

**Florin Lungu  
- Coordinator -**

# **Proceedings**

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**7<sup>th</sup> Review of Management and Economic Engineering  
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## **Management Challenges Within Globalization**

**Special Edition in Memoriam Professor Ioan Abrudan**

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Romania**

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# **Challenges of globalization and companies' reaction**

# PROCESS MANAGEMENT IN AN ORGANIZATION IN THE AEROSPACE INDUSTRY IN TERMS OF THEIR VERTICAL INTEGRATION

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## Abstract

**Purpose** – The scientific paper focuses on a pragmatic study regarding the existing processes in an organization and how to integrate them into an efficient quality management system.

**Methodology/approach** - A process map was conceived in its own vision, analyzed and subsequently argued in an organization with a field of activity in the aerospace industry. The subject of manufacturing processes in such an organization has been reported to process and inspection standards.

**Findings** – Operational processes, namely process improvement, are a key priority in the business environment. Support processes contribute to supporting business processes through methods, techniques and software applications in order to design, adopt, control and analyze operational processes that primarily involve people, organizations, applications, documents and other sources of information. The importance of establishing a process map in the management area and then the manufacturing one in an organization in the aerospace industry is an extremely important step in solving problems and implicitly non-conformities.

**Research limitations/implications** – A properly prepared process map can certainly lead to efficiency and effectiveness. This aspect can lead to favorable results related to the quality management of the processes, there being a correct functionality of all the management activities as well as of the technical ones.

**Practical implications** – The scientific paper presents a serious documentation regarding the possibilities of operationalization of the operational processes and the support processes in an organization in the aerospace field in order to manufacture some structural components.

**Originality/value** – The contributions we promote are of a conceptual, applied and technical nature. At the same time, the management is not neglected at all, so that an important and essential contribution is the way in which the authors impose their point of view on the concrete way in the organizational management at company level.

**Key words:** process map, aerospace industry, process management.

## Introduction

Within an industrial organization, operational processes are those production processes with the role of making products. As for the production processes, they represent the activities carried out with the help of natural equipment and processes, organized and led by people in an organized way in order to obtain some products.

From a systemic point of view, the objectives of the production process involve the transformation of inputs (materials, labor, energy, etc.) into outputs in the form of semi-finished products, finished products or services.

For years, process improvement has been a major business priority. Companies have been using a value-based management approach since the 1990s in a constant effort to increase its value. The principles of value-based business process management have been introduced in business process management. Existing analyzes of this problem operate at a high level (i.e., corporate), preventing the use of value-based business process management at the operational process level, both in research and in practice. Authors such as (Buhl, Roglinger, Stockl, and Braunwarth, 2015), (Bolsinger, 2015), (Rotaru, Wilkin, Churilov, Neiger, and Ceglowski, 2011), have approached this issue through the prism of an evaluation that brings business process management. based on value at the operational process level, showing how the estimated net present value adjusted for the risk of a process can be determined. The evaluation calculations performed in these researches provide information about the theoretical foundations of the processes and help to improve the computing capabilities of some existing process modeling tools.

In any company there are main processes, management processes and support processes. Specifically, for example:

- the main processes relate to production and services provided;
- the management processes aim at establishing the company's policies and objectives, the analysis performed by the management, analyzes and decisions regarding the resources and
- support processes take into account human resources, infrastructure, work environment, supply, transport, logistics, internal audit, improvement, etc.

Supporting business processes through methods, techniques and software applications is done in order to design, adopt, control and analyze operational processes involving people, organizations, applications, documents and other sources of information (Weske, van der Aalst, and Verbeek, 2004).

### **Map of management processes in an industrial organization**

Process maps are adopted by organizations as the foundation of business process management initiatives. They play an important role in providing an overview of all processes, so that the basic operation of a company can be understood without necessarily going into details, which are usually presented in the single model of the management process (Malinova and Mendling, The Effect Of Process Map Design Quality On Process Management Success, 2013)

Instead, the process map focuses on the representation of classifications, relationships, and dependencies between single processes. These aspects are usually illustrated as a visual representation, serving as a basic means of communication and for a better understanding of business processes (Kesari and Chang, 2003). Based on the process map design, the next steps of the business management process life cycle could follow successively (Dumas, La Rosa, Mendling, and Reijers, 2013). Given this, the quality of the process map is essential for the success of process management. Numerous research efforts have been made regarding the design and redesign of process models (Kock, 2006). Recently, new navigation techniques through large collections of process models have been the focus of research (Radulescu, 2006).

One way to handle a large number of models is by using a process architecture. A process architecture is a collection of process models organized systematically within an organization (Malinova, Leopold, and Mendling, An Empirical Investigation on the Design of Process Architectures, 2003)

Usually, a process map is the input to the different levels of a process architecture, where the detailed modeling of the process takes place. Different approaches to process architecture design have been defined (Dijkman, Vanderfeesten, and Reijers, 2011), (Malinova, Leopold, and Mendling, An Empirical Investigation on the Design of Process Architectures, 2003). Also, the importance of process architecture for the success of business management processes was highlighted (Sedera, Gable, Rosemann, and Smyth, 2004), (Bandara, Gable, and Rosemann, 2005), (Rosemann, 2006). Regardless of its obvious importance, the design of the process map was hardly subject to research. Practitioners seem to approach this challenge rather as an art based on their own creativity and a broadly defined set of concepts in designing a process map. As a result, a variety of process map models are used in practice, despite the fact that most aim for the same goal. Many of them are obvious cases of mastery,

where the concepts used for their design are not based on generally accepted engineering principles for the design of visual notations (Moody, 2009).

Given this diversity, there is a strong demand for research into the concepts used and represented in a process map (Recker, Rosemann, Green, and Indulska, 2011).

### The importance of mapping management and manufacturing processes in an industrial organization

W. Edwards Deming stated that "If you can't describe what you're doing as a process, you don't know what you're doing."

Any organization can improve its quality management system. The conformity of the processes, products and quality management system in the organization can be demonstrated, even if the standard does not explicitly require it, by preparing documents, such as (Mendes, 2013): process map (matrix); product specifications; production programs; list of approved suppliers; test and inspection plans; installation, operation and service manuals; rules and procedures.

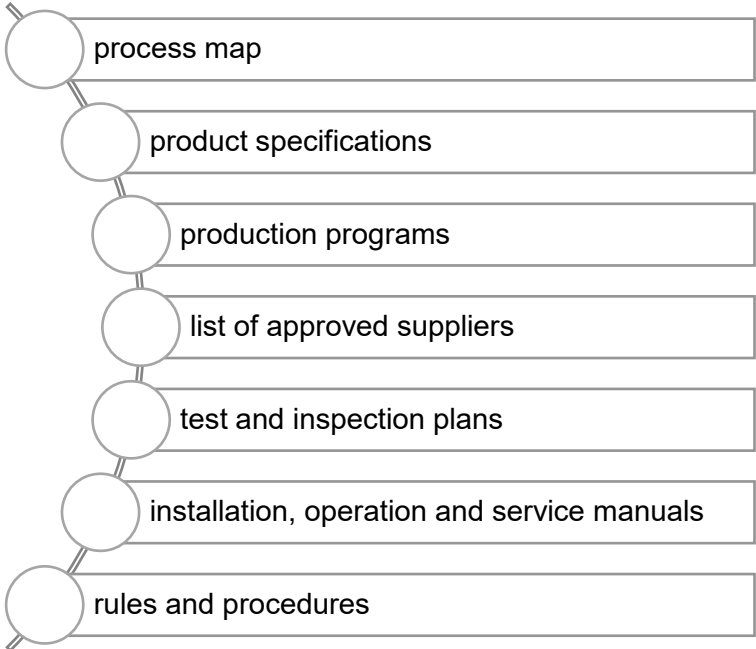


Figure 1. Documents to demonstrate compliance

The process map is a graphical representation of all the processes identified within the organization. This map illustrates the process flows that influence quality. A map (matrix) of a process represents the process as a whole, from beginning to end (www.ro.wikipedia.org, 2020), (Gotz, 2012). Figure 2 shows the components of the process map.

Any quality management system process can be divided into sub-processes that are clearly defined in a quality management system process matrix. The requirements are set out in documents called specifications. They are unique to the process, product or organization, and for this reason are not detailed in the quality standard (www.improvement-skills.co.uk, 2020).

In making the process map, the same importance is given to the performance of all component processes. This performance is established on the basis of the specific objectives for each process or through performance indicators.

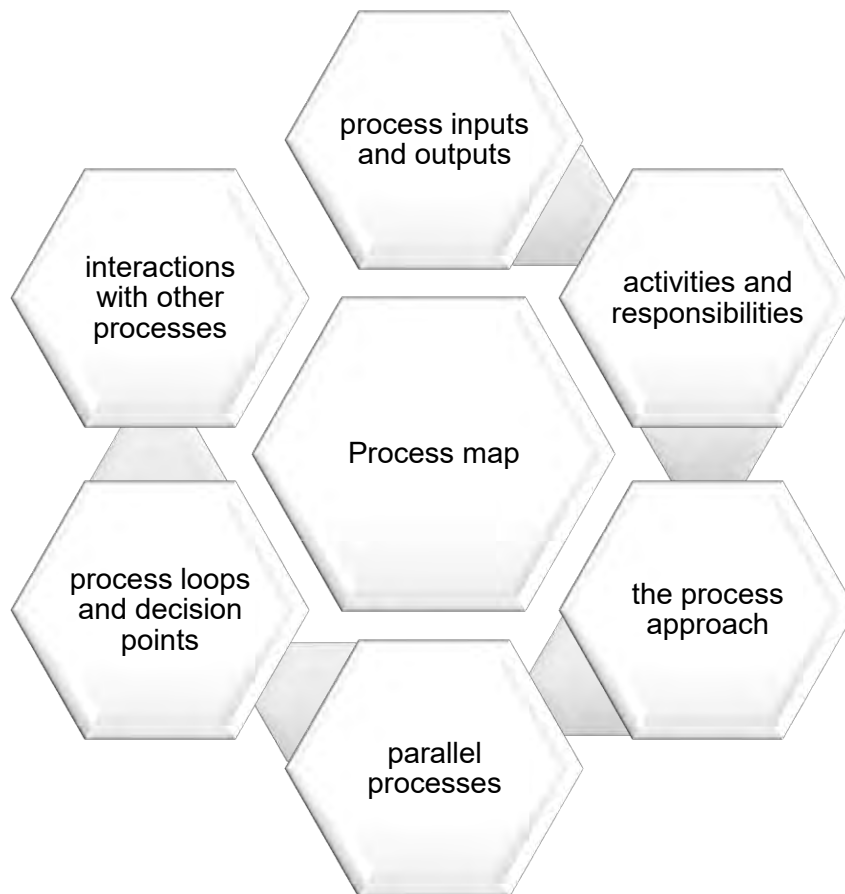


Figure 2. Process map components

The usefulness of a correctly made process map is felt when there are changes in the organization or when it is intended to explain the principle of operation of the company. According to Figure 3 on the process map can be indicated: system procedures (PS); operational procedures (OP); quality plans (PC); work instructions (I); technologies (T); standards (S); contracts (outsourcing processes); formulation; any other documents that are used in defining and carrying out the processes.

Procedures are documents that show how the activities are carried out, so that anyone can work without mistakes, even if there is no maximum number of procedures, for the implementation of a quality management system according to ISO 9001, 6 system procedures are absolutely necessary, and all other procedures are operational.

An organization can write a number of procedures equal to the number of processes within it. However, the possibility of performing only one procedure related to several processes of the same type, or the reverse situation in which a single process can be described in several documents is not excluded.

The 6 mandatory procedures specified in ISO 9001 are with reference to processes, more precisely to:

- how documents in the organization are kept under control;
- how the organization's records are kept under control;
- how the product found to be non-compliant is kept under control;
- how to perform the internal audit;
- how corrective actions are controlled;
- the way in which preventive actions are controlled.

It is recommended that the names of the procedures be associated with the chapters in the ISO 9001 standard that refer to the analyzed process.

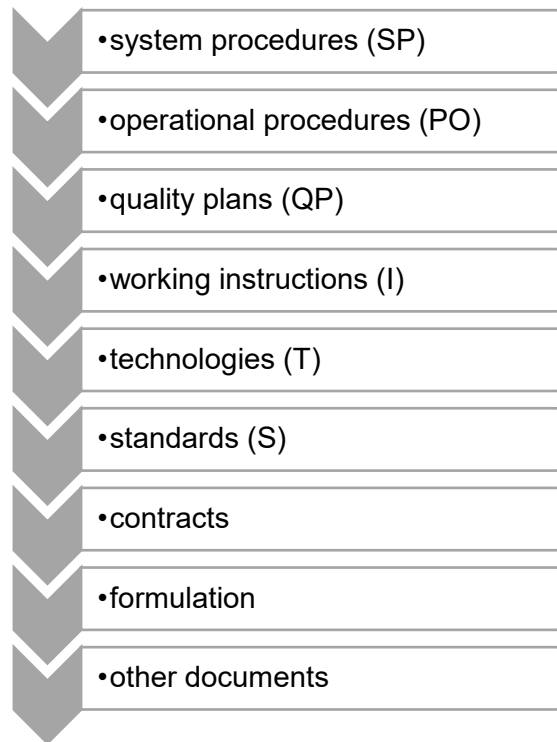


Figure 3. Aspects indicated in the process map

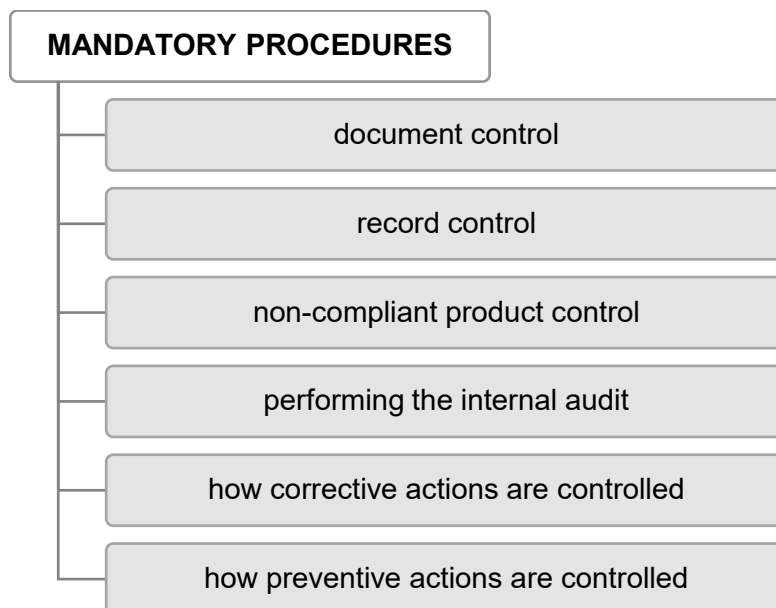


Figure 4. Mandatory procedures according to ISO 9001

### **The processes and their integration in the quality management system in an organization in the aeronautical field**

Figure 5 shows how certification organizations structure the requirements of the quality management system in the aeronautical industry.





Figure 5. The main processes of the Quality management system

Industrial organizations in the aeronautical field must be AS 9100 certified, so they must have a quality management system implemented according to its requirements.

Management, support and operational processes are included in the requirements of the AS 9100 standard to the same extent as in ISO 9001.

The integration of management processes, Figure 5, from the perspective of the standard, is approached by integrating leadership requirements in all processes and equally by controlling management decisions, by thinking based on probable risk.

Also, the approach of all processes through a continuous improvement, makes the management processes to be integrated in all processes and under the system processes.

Figure 6 represents the distribution and connections of processes in an industrial organization in the aeronautical field, specifically on the manufacture of metal structural components.

The processes are distributed according to the purpose they have within the organization. Thus we can identify:

- Management processes;
- Operational processes;
- Support processes.

As can be seen in Figure 6, customer requirements are the main entry into the organizational system. These requirements are transformed by the organization, through the prism of the organizational context. Outputs, resulting products, verified by the customer, in addition to financial benefits, are also measured by the degree of customer satisfaction that have a direct impact on the evaluation of the organization's performance and also on the process of continuous improvement.

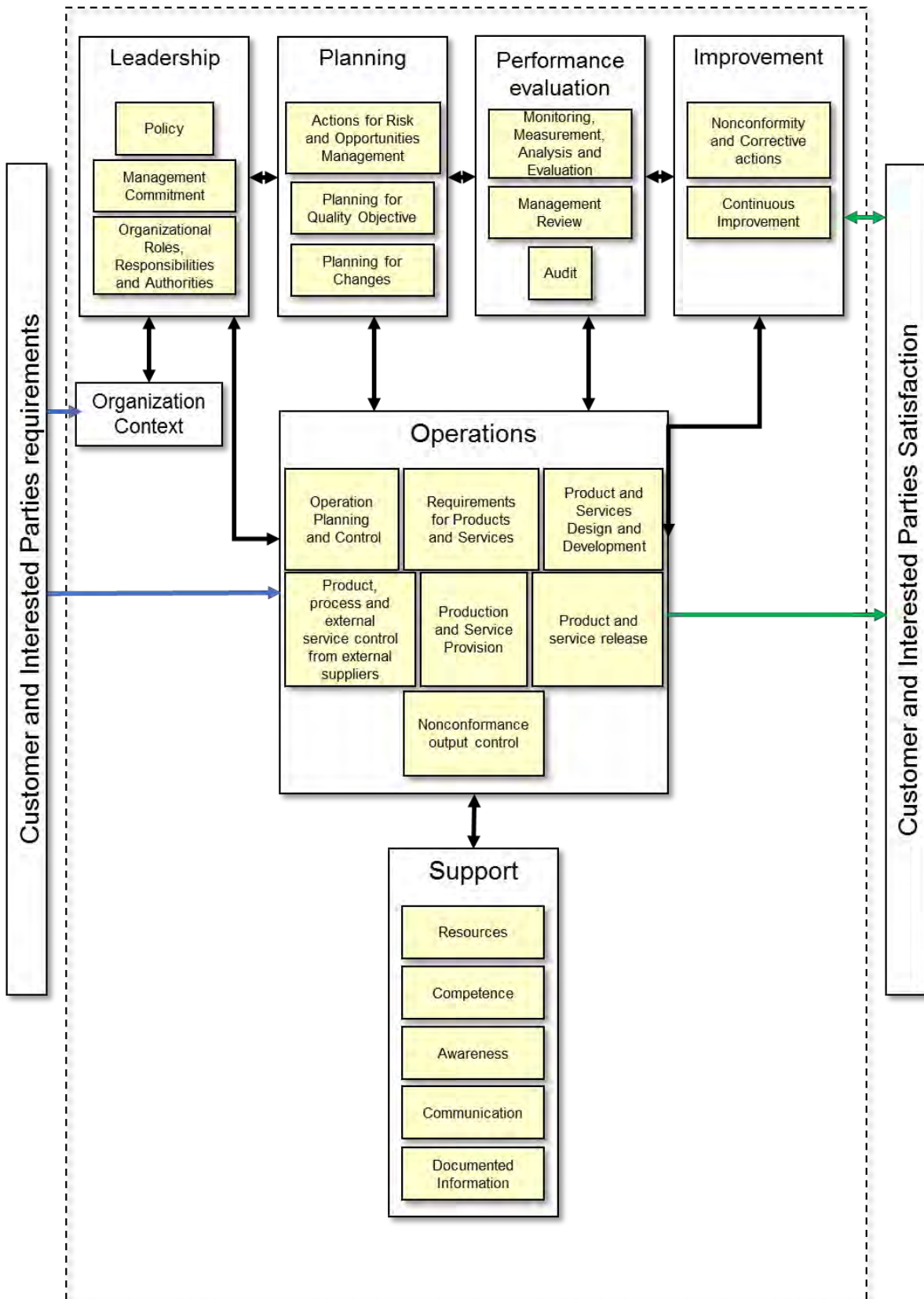


Figure 6. Process map in an industrial organization in the aeronautical industry

The leadership process (position 5 Figure 6) is a management process with a major impact in the organization, which is why these organizations emphasize the commitment of senior management and their level of involvement in processes. The activity of the management process is carried out in relation to the context of the organization.

The ways in which this commitment is met are:

- Assuming responsibility for the effectiveness of the quality management system;
- Involvement in the development of quality objectives so that they are correlated with the context of the organization;
- Involvement in the process of integrating the requirements of the quality management system in the processes of the organization;
- Allocation of the necessary resources for maintaining the quality management system;
- Promoting continuous improvement;
- Supporting other relevant management positions to demonstrate their leadership, as applicable to their area of responsibility;

The management commitment and its principles are formalized within the quality management system by defining the quality policy of the organization.

The aeronautical quality policy contains generally applicable directives, such as:

- Compliance with laws and regulations specific to the aeronautical field applicable to the activity sector;
- Clear definition of the objectives and targets of the quality level in all hierarchical structures within the organization and their periodic analysis;
- Decision making using objective data;
- Promoting thinking based on risk analysis;
- Promoting and developing a culture of aviation safety;
- Active monitoring of the process of improving the quality management system.

Management activities, in addition to making a commitment and defining the context of the organization and its objectives, have the role of defining the organizational structure of the organization. Thus, the definition of roles, responsibilities and authority closes the functions of this process of management, leadership. Role allocation is based on the processes of organizations and their interaction.

Achieving the objectives generated by the strategic plan of any company is the goal of the entire management, and the way it is done is planning (position 6 Figure 6).

Planning is the key to the success of any organization regardless of the field of activity. Thus, the planning of the organization's objectives will be found at all hierarchical levels. Planning can be accomplished by carrying out development projects, long-term or short-term production projects or improvement projects.

Also, planning to achieve quality goals requires a well-established plan, integrated into all processes within the organization. Also, each process must be identified with a quality target correlated with that of the organization.

The coordination of the planned activities is achieved by analyzing the impact and influence of each process in the entire organizational system, in other words, by organization.

It is considered that the level and quality of the influence and impact analysis has a major effect in the allocation and management of resources.

The control process by measuring and evaluating the activities within the organization is represented by the processes in box 9 and 10 (Figure 6). Thus, the process of evaluating the performance of the organization is performed through management analysis and audits of all processes.

In addition, the improvement process helps to evaluate the activities and at the same time becomes a major input in the improvement planning process. The process of analyzing the non-conformities of the product, technological process and system, represent important inputs in the evaluation process, also used as input in the realization of improvement plans.

Customer satisfaction is used by organizations as a marketing tool. The level of customer satisfaction indirectly determines the quality of the products.

Customer satisfaction has a major impact in the improvement process, being considered a factor with high influence in the improvement processes.

Support processes (heading 7 Figure 6) are the processes that deal mainly with human resources management, in particular:

- The process of hiring human resources;
- Competence assessment process;
- The process of awareness of human resources at all hierarchical levels;
- The communication process inside and outside the organization.

The quality of the output of this process - especially the quality of human resources knowledge - has an impact on the entire organization. This knowledge plays a special role in management processes, and also in processes based on human resources knowledge.

Operational Processes (position 8 Figure 6) are the "engine" of the organization. Thus, the processes within this group of processes are very important and they are given special attention.

Under the operational planning and control process is that process that develops and monitors operational plans including all others under operational processes.

The process of managing requirements and services is the process of entering the operational plan. This process has as input the requirements of the products directly from the customer. It is considered that the level and manner of interpretation of the requirements may lead to the success of the operational plan or its failure. This process is considered a critical process, due to the impact it can have on the organization, both on other processes and on products. In other words, incorrect or incomplete interpretation of product requirements may result in the production of non-compliant products.

Within the operational processes it is also found under the process of design and development of products and services, which also has a major impact on the fulfillment of the operational plan.

## **Conclusions**

The structure of the quality management system in industrial organizations in the aeronautical field is based on the AS 9100 standard. However, the challenge for companies is to comply with the requirements of this standard and the requirements of customers at the same time in product manufacturing processes.

The complexity of product requirements in the field of aeronautics requires management processes an approach based on risk analysis. Thus, management decisions are influenced both by the knowledge of managers in the field in which they operate, and by the available information of related processes, which they can use.

In an industrial manufacturing organization, the interaction between the processes of the management system is achieved through human resources, coordinated by process managers (Figure 7).

Each process manager must know very well the processes of the entire quality management system, so as to align the process he coordinates with the requirements of the system and equally necessary to know everything under the processes, activities, inputs and outputs of the process. which he coordinates. In order for the system to work, process managers must also know the processes they intersect with, according to the quality management system, but the large volume of information and

knowledge specific to each process makes the management activity considerably more difficult. Sorting and analyzing all this information consume a long time, which is not available in management decisions.

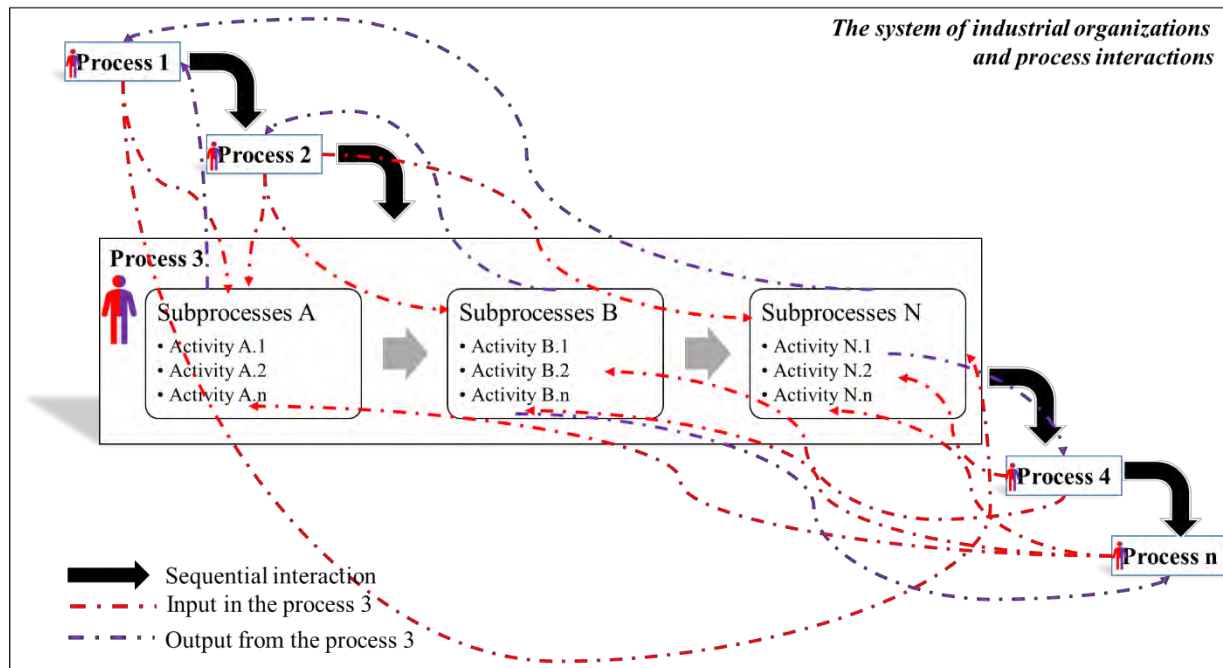


Figure 7. The interaction of processes within a system

The industrial organization operates using the knowledge of human resources and the capacity and capability of the equipment.

The organization achieves its functional role, the target of quality and financial level, only because management decisions and processes are managed in relation to the strategic vision.

The analysis of the efficiency of each process is related to the other processes, regardless of its complexity. Thus, it is necessary to develop a model for analyzing the efficiency of the processes, in relation to the own resources of the process and to the interactions of the other processes.

Analyzing the processes of the organization's system in terms of interactions and the impact on product quality, the process of preparing the launch documentation in manufacturing was chosen for conducting the study.

In manufacturing, and not only, the efficiency of each process is influenced by management functions and the volume and quality of human resources knowledge. At the same time, the multitude of parameters that can influence the process, makes the management activity to be seen as a function controlled by all parameters simultaneously.

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# COST OPTIMIZATION FOR DESIGNING SUSTAINABLE, INTELLIGENT AND INCLUSIVE BUILDINGS USING TRIZ

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## Abstract

**Purpose** – To formulate a methodology for handling qualitative optimization of buildings when several target-functions are considered, such as smartness, green design and inclusiveness.

**Methodology/approach** - Concurrent Multi-Function Deployment method is used to study a multitude of criteria that give the performance of a building. Performance criteria such as costs, health and comfort of the inhabitants are weighted. They are in relation with target functions, such as sustainability, intelligence and inclusivity. TRIZ is included to solve several conflicts in relation with these target functions.

**Findings** – It is possible to formulate a balanced solution in designing a building where several target functions, such as sustainability, inclusiveness and intelligence, are taken into account.

**Research limitations/implications** – The methodology was tested only on three target functions and on a relatively simple building. We do not have yet a clear understanding about its reliability on complex civil engineering projects, where the entropy is very high.

**Practical implications** – The proposed methodology is applicable in any civil engineering project, where we need to tackle design from multiple angles.

**Originality/value** – Originality is defined both in terms of the methodology we have proposed to solve the design problem and in its domain of applicability. Usually, qualitative optimization of buildings has been reduced to one or maximum two target functions (e.g. inclusiveness, smartness, sustainability or a mix of two of them). By our knowledge, there is no treatment of design from an aggregated perspective of all three dimensions.

**Key words:** sustainability, intelligent house, cost management.

## Introduction

A need has developed since the 20th century to create buildings that can function to its full potential for the purpose for which they were created. New technologies with a decisive role in their sustainability, aesthetics, efficiency, accessibility and health but also in cost reduction have been implemented in these buildings (Building Regulations, 2010).

In the approach to the design and construction of buildings as a whole, the concept of high-performance building has been introduced and must include features such as: accessibility, aesthetics, cost efficiency, functionality, productivity, inhabitants' health, safety and security, sustainability (enil.eu, 2020).

Figure 1 illustrates the characteristics of a sustainable, intelligent and inclusive building: advanced engineering, low cost, safe, competitive, open, practical, elegant and high-security building.





Figure 1. Sustainable, intelligent and inclusive building with high performance - characteristics

At the point when we talk about sustainability, we consider various qualities and materials that a structure must have. These incorporate (FOBRP,2020): recyclable materials from which the building is built and recyclable furniture, economical household appliances, economical electrical equipment, water purification system etc.

When stating that a building is intelligent, there are certain elements to be considered: flexible design, energy efficient design, Wi-Fi networks, VOIP net-works (voice over internet protocol), video monitoring, building access monitoring, automatic fire suppression, built-in support (for lighting, signaling, smoke control, etc.), integration of all building systems, energy management systems, thermal water and energy monitoring etc. (Edgar, 2016).

An inclusive building has certain features: wide doors access roads, spacious toilets, supporting railings, good natural lighting, the use of eye-pleasing colors with a guiding role inside the building, vertical traffic with ramps or elevators, communication systems, emergency exits accessible to all, fire alarms, inclusive furniture etc.

### Methodology and testing

Concurrent Multi-Function Deployment (CMFD) was adopted for multi-criteria performance planning (Brad,2009). This method permits the synchronous approach of multiple objective functions and the inclusion of structured innovation in the design process of the solution. The CMFD algorithm must have a certain sequence (Brad, 2009): define the objective set of functions, identify and classify requirements related to the objective and business functions in general, analyze the objective functions in relation to the investment plans, determine and classify the value characteristics that define each objective function, generate local solutions for the entire system, plan and generate a solution by innovating and aggregating, compare the general solution to the value characteristics, define the parts that form the whole solution, execute the plan.

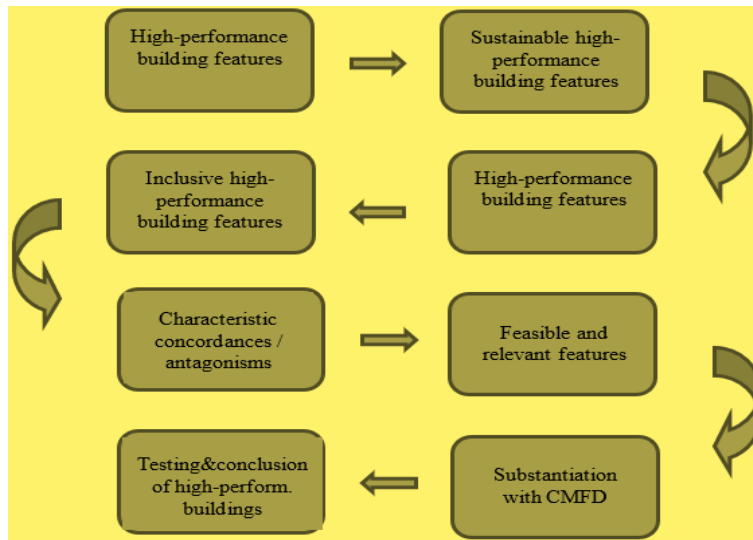


Figure 2. CMFD - route and associated methods

For testing the method, objective functions of a sustainable, intelligent and inclusive building (FO) and their requirement-functions (FR) were decided upon by the client/owner of the house: FO = {sustainability, intelligence, inclusiveness}, FR = {costs, health and comfort of the inhabitants}. His perspective is that the initial investment will need a maximum of 130,000 euros (FR1) with an importance of I = 25 percent, the maximum total investment cost will be 400,000 euros (FR2) with an importance I = 25 percent, the house's floors will have a surface of maximum 250 m<sup>2</sup> (FR3) with an importance I = 10 percent, the ease of operation (FR4) has an importance I = 10 percent, health protection of the inhabitants (FR5) has an importance I = 15 percent, and the protection of the environment (FR6) has an importance I = 15 percent.

Table 1. Objects / materials / equipment of objective functions

Objective function	Code	Objects / materials / equipment that meet the objective	Importance percentage (%)
Sustainability	OP <sub>11</sub>	Do not pollute the environment	GI <sub>11</sub> =9%
	OP <sub>12</sub>	Have low energy costs	GI <sub>12</sub> =23%
	OP <sub>13</sub>	Use as little water as possible	GI <sub>13</sub> =20%
	OP <sub>14</sub>	No major repairs are needed	GI <sub>14</sub> =10%
	OP <sub>15</sub>	Recyclable building materials	GI <sub>15</sub> =17%
	OP <sub>16</sub>	Furniture made of recyclable materials	GI <sub>16</sub> =5%
	OP <sub>17</sub>	To protect the health of the inhabitants	GI <sub>17</sub> =16%
Intelligence	OP <sub>21</sub>	Windows open / close automatically	GI <sub>21</sub> =11%
	OP <sub>22</sub>	The blinds open / close automatically	GI <sub>22</sub> =11%
	OP <sub>23</sub>	The front door opens / closes automatically	GI <sub>23</sub> =7%
	OP <sub>24</sub>	Heating monitoring system	GI <sub>24</sub> =20%
	OP <sub>25</sub>	Light monitoring system	GI <sub>25</sub> =19%
	OP <sub>26</sub>	Danger warning alarm	GI <sub>26</sub> =9%
	OP <sub>27</sub>	The light turns on / off automatically	GI <sub>27</sub> =7%
	OP <sub>28</sub>	Integrated audio system	GI <sub>28</sub> =4%
	OP <sub>29</sub>	Building security and protection system	GI <sub>29</sub> =12%
Inclusivity	OP <sub>31</sub>	Large rooms	GI <sub>31</sub> =13%
	OP <sub>32</sub>	Large hallways	GI <sub>32</sub> =13%
	OP <sub>33</sub>	Large bathrooms	GI <sub>33</sub> =13%
	OP <sub>34</sub>	Non-slippery floor	GI <sub>34</sub> =12%
	OP <sub>35</sub>	Lights open easily	GI <sub>35</sub> =7%
	OP <sub>36</sub>	Doors open easily	GI <sub>36</sub> =9%
	OP <sub>37</sub>	No level differences	GI <sub>37</sub> =4%
	OP <sub>38</sub>	Easily accessible alarm system	GI <sub>38</sub> =12%
	OP <sub>39</sub>	Warning signs	GI <sub>39</sub> =10%
	OP <sub>310</sub>	Well-lit rooms	GI <sub>310</sub> =7%

Table 1 reveals that sustainability has the highest importance, of 45.12 percent, followed by intelligence with 31.71 percent and inclusiveness with 23.17 percent. The value characteristics related to sustainability, inclusivity and intelligence are displayed in table 2.

Table 2. Objective function planning

Sustainability				
Intelligence				+
Inclusivity			+	-
Optimization trends		↑	↑	↑
Links: ● powerful link ⊙ medium link ⊕ possible link + positive correlation - negative correlation ↑ positive trend ↓ negative trend	Importance	Inclusivity	Intelligence	Sustainability
Initial investment max 130.000 euro	25%	⊕	●	●
Total investment max 400.000 euro	25%	⊕	●	●
House floors max 250 m <sup>2</sup>	10%	●	⊕	⊕
Easy to operate	10%	●	⊙	⊕
Protects residents' health	15%	●	⊕	●
Protects the environment	15%	⊕	⊕	●
Value share (PV)		23.17%	31.71%	45.12%

After applying the CMFD method, a hybridization of the three concepts follows. Based on the algorithm and data, the first two buildings are merged - the sustainable building and the smart building - a hybrid building is emerging.

The designed hybrid building in Figure 3 has the following features: is covered with 15 cm thermal insulation made of recyclable materials, the windows' glass reflects sunlight, it has a ventilation and air purification plant doubled by natural ventilation, the house's heating is done with a geothermal pump, there are solar panels on the roof of the terrace, the windows have a system of embedded blinds. Furthermore, this house can be controlled remotely in terms of: heating, lighting, safety, monitoring, energy and water consumption.

Considering the relative weight of each subcomponent in association with the degree of importance of each objective function: sustainability, intelligence and inclusion, windows have the highest value of 15.29 percent, doors of 12.37 percent and HVAC monitoring system of 9.96 percent. The light monitoring system has a percentage of 8.01 percent, the walls of 7.95 percent, the thermal power supply system of 6.97 percent, the danger monitoring/warning system of 6.22 percent, the furniture of 6 .03 percent and the building surveillance system of 5.78 percent. At the end of the ranking one can find: vertical circulation with 1.91 percent, bathroom with 1.68 percent and water supply system with 1.27 percent.

Afterwards, the hybrid solution fuses with the inclusive building. When fusing, a series of conflicts appear, as seen in Figure 4. TRIZ methodology was used, a method based on logical deductions following the analysis of existing information in order to resolve these conflicts (Brad et al, 2006), (Russo and Carrara, 2019).



Figure 3. Hybrid building

For solving the first conflict: “widest possible access routes” versus “the smallest possible surface for exposing the exterior walls”, in TRIZ we have found the following generic parameters: “surface of stationary objects” and “energy loss”. Hence, the following inventive principles result for solving the problem: 1. The nest-in-nest principle, 2. The transfer principle in another dimension (multi-level arrangement, object reorientation, moving to 3D spaces) and 3. The principle of flexible walls or thin walls (innovation in the structure of the walls). In this case, of the three, the nest-in-nest principle was chosen. All rooms will be structured around a central hall, inhabitants will enter these rooms through it. A large exposure area of the exterior walls is therefore avoided.

For the second conflict: “as easy as possible access to any point in the building” and “as little footprint as possible” the following generic TRIZ parameters were selected: “surface of stationary objects” and “convenience in use”. Using TRIZ for solving this conflict, the proposed principles are: 1. The principle of partial or excessive actions and 2. The principle of asymmetry (building the building on two levels, but asymmetric). A combination of the two principles was chosen: the principle of asymmetry and the principle of “excessive actions”. The upper floor has a smaller surface than the ground floor, ensuring the regulations for buildings used by persons with disabilities. A platform hydraulic lift was also placed, ensuring the access of all residents of the building to the upper floor. The costs with this platform lift are much lower than what would have been the costs of foundations and earthworks if the building would have been constructed on a single level.

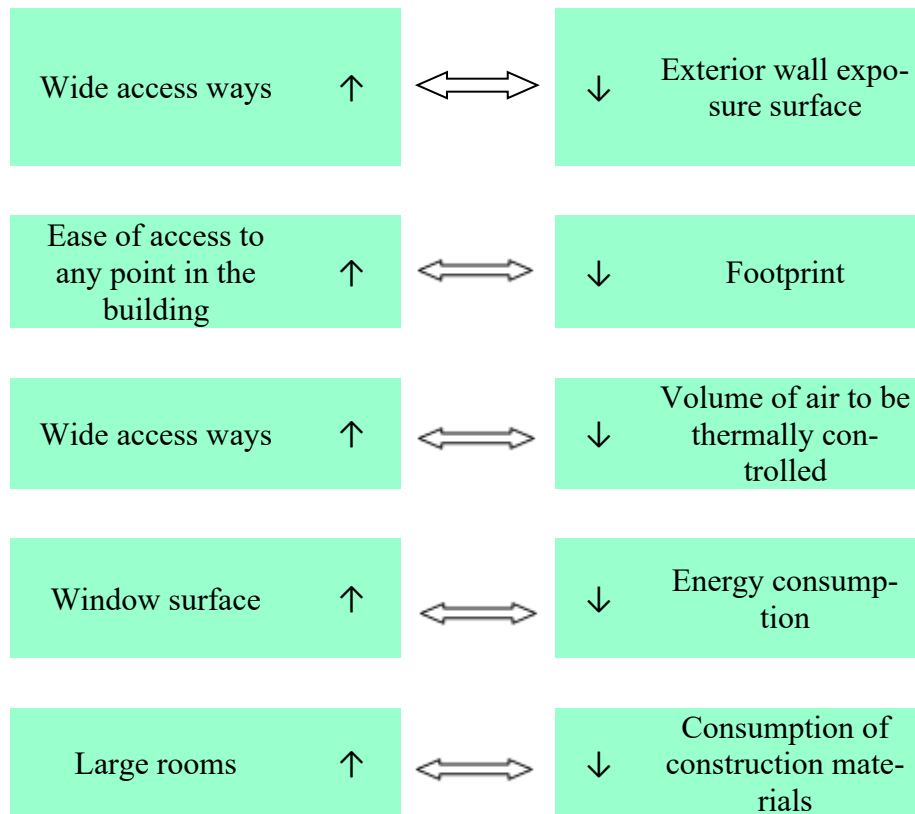


Figure 4. Inclusive building vs. hybrid building – emerging conflicts

Coveting to have the widest possible access routes and a volume of air that must be thermally controlled as small as possible, is at the basis of the third conflict. TRIZ method, identifies a series of parameters: “convenience in use” and “volume of a stationary object”. These inventive principles were brought about by TRIZ: 1. The principle of asymmetry (when heating / cooling spaces), 2. The principle of “mechanical” vibration (elevator or other easier access to the upper level), 3. The principle of use of porous materials (facilitating the movement of people inside the building) and 4. The principle of inert media (incorporation of vacuum tubes to heat several rooms). The principle of asymmetry in space heating/cooling was decided upon: both the heating and ventilation system is operated by residents on a certain daily schedule, duplicated with an intelligent system that functions when spontaneously using rooms, outside the pre-set schedule.

A large surface area of the windows and a low energy consumption is the fourth conflict, with the following TRIZ parameters: “the surface of a stationary object” and “energy loss”. The principles offered by TRIZ for solving the conflict are: 1. The nest-in-nest principle, 2. The transfer principle in another dimension (multi-level arrangement, object reorientation, moving to 3D spaces) and 3. The flexible materials principle or the thin materials principle. Using the the object reorientation principle, transfer of indoor and outdoor heat energy is aided by the automatically operated roller system. The blinds are automatically lowered if natural light is in excess and the room does not require natural lighting.

The desire to have the widest possible access routes (high mobility) and the lowest possible material consumption is what inflicted the last conflict. “Moves inside a stationary object” and “amount of material” are the parameters chosen by TRIZ with solving principles as follows: 1. The principle of local quality (choice of differentiated materials for different spaces), 2. The principle of changing parameters and 3. The principle of composite materials (use of recyclable materials, waste, etc.). Recycled materials are utilized when building: recycled brick, recycled wood, thermal system made of recyclable material, recycled parquet, furniture made of recycled materials, etc., thus using the principle of composite materials.

As a result of all the information mentioned above, the sustainable, intelligent and inclusive building was designed, as seen in figure 5.



Figure 5. Sustainable, intelligent and inclusive building

This house was developed on two floors, the ground floor 50 percent larger than the first floor, coated with 15 cm thermal insulation made of recyclable materials, exterior finishes made of recycled brick from demolition and recycled and treated plywood, cooling floor heating done with a geothermal pump. Hot water is produced with a bivalent boiler, solar panels exist on the roof's terrace. The windows have masked roller shutters with automatic operation from a switch/telephone. The house is remotely controlled regarding: heating, lighting, safety, monitoring, energy, lighting and water consumption. The building has accessible sized flows, access ramps to the main entrance and on the terrace, warning signs at the beginning and end of the ramps, the main ramp is covered and has non-slippery floors, halls and rooms allow the simultaneous passage of two wheelchairs, switches and sockets are accessible by persons in wheelchairs.

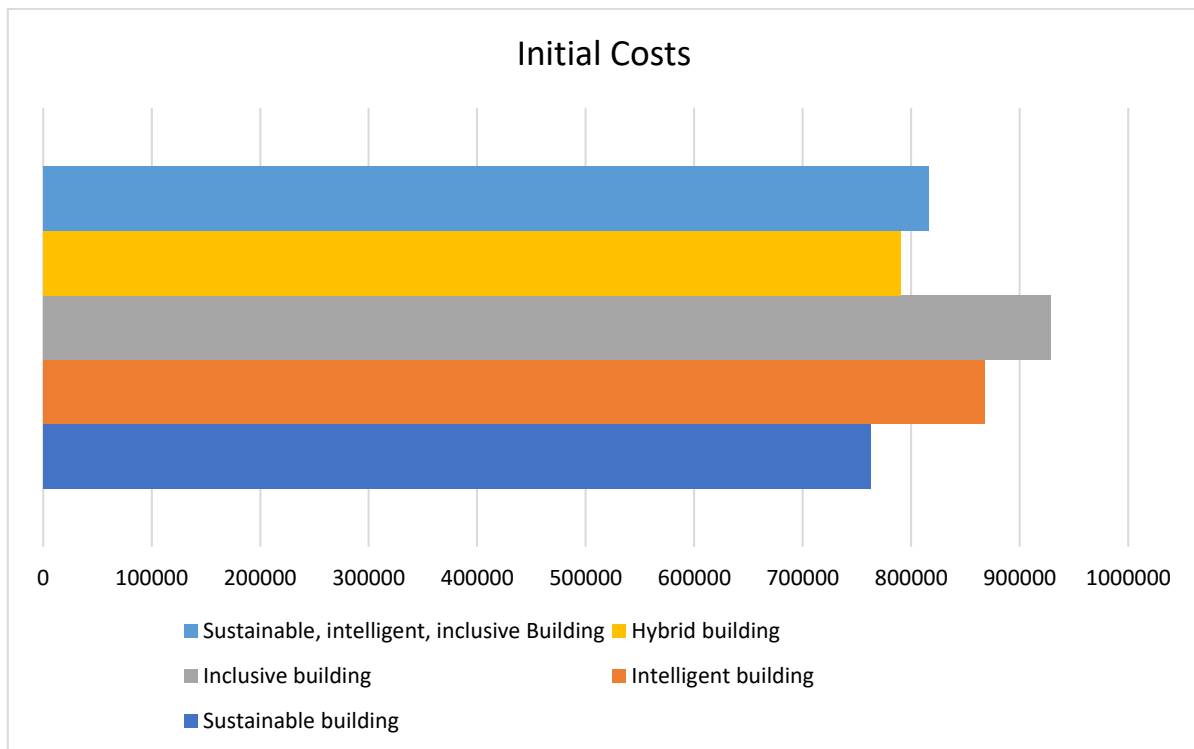


Figure 6. Initial material costs for the 5 types of buildings

Figure 6 exemplifies the initial costs for the 5 variants of houses, houses with approximately equal surfaces, of 250 m<sup>2</sup>. Of these, the most expensive is the inclusive building, followed by the smart one. The cheapest building is the sustainable one, while the sustainable, smart and inclusive building is in the middle of the ranking.

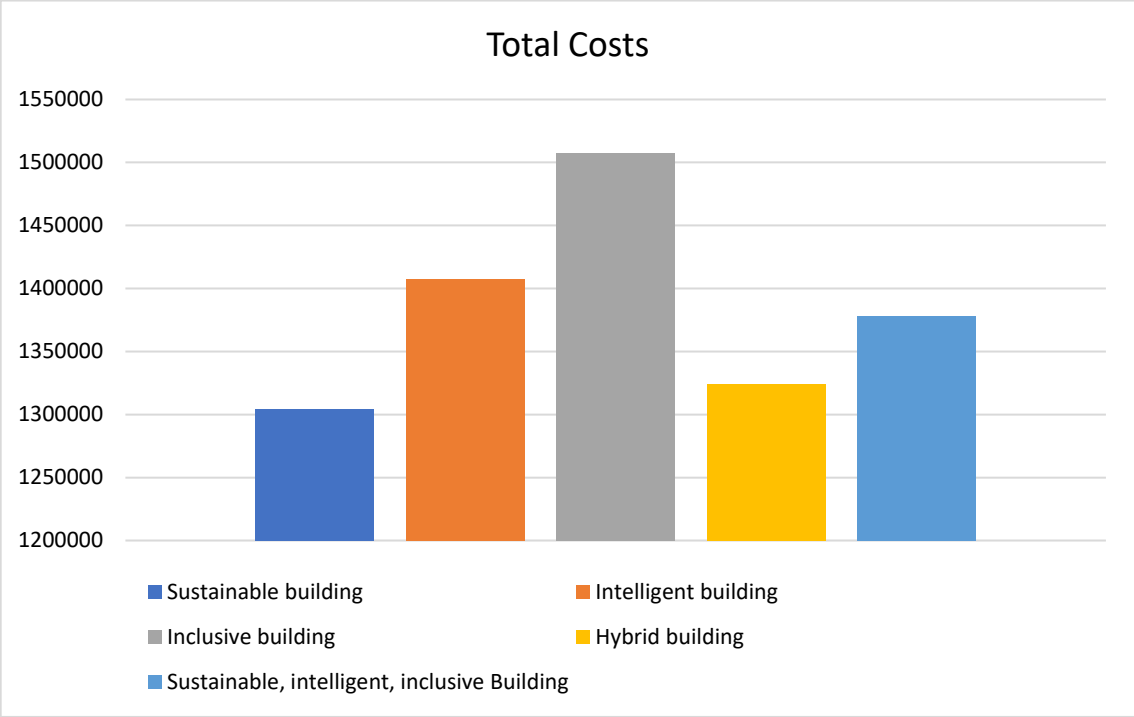


Figure 7. Total costs for the 5 types of buildings

Figure 7 compares the total costs over a period of 50 years (the entire life of a construction). The comparison makes sense because all 5 buildings are variants of the same building, desired by the same beneficiary, a building with an area of about 250 m<sup>2</sup>, with a predetermined initial and final budget. After analyzing the figure, we notice that the cheapest of them is the sustainable building, followed by the sustainable and intelligent one. In the middle of the ranking is the sustainable, intelligent and inclusive building. The most expensive of the buildings is the inclusive one.

### Conclusions

In the sense of global developments in seeking sustainable approaches to energy and climate problems, as well as to more inclusive societies, this work offers insights into how building construction issues can be addressed.

This paper attempts to formulate a framework for managing qualitative building optimization while considering multiple goal functions, such as smartness, green design and inclusiveness.

This paper shows that a holistic approach can be designed when designing a building that takes into account several target functions, such as sustainability, inclusiveness and smartness. The approach proposed is applicable to any civil engineering project where we have to tackle design from several angles.

The drawback of this analysis, however, is that the methodology was only tested on three target functions and on a fairly simple design. On complex civil engineering ventures, where entropy is very high, we do not yet have a good understanding of its reliability. Our future efforts will be channeled into this deficiency.

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# THE EFFECTS OF GLOBALIZATION ON HUMAN RESOURCE MANAGEMENT

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## Abstract

**Purpose** *In the current world that we are living, events and changes follow one another with astonishing rapidity, and as far as the business world is concerned, these rapid changes are beginning to become part of the normal activity of companies. In this situation, the human resources need to show multiple professional skills, creativity and ability to adapt to different changes.*

**Methodology/approach** *In the current context of multiple changes, people are a vital resource, able to ensure the survival, development and success of the organizations they belong to. In these conditions, it is absolutely natural for organizations to be more and more concerned with selecting the most competent candidates, "the right people in the right place", even if the costs of recruitment and selection are not negligible, especially if these processes are organized by specialized companies. The paper aims to conduct a study on the methods applied by staff recruitment companies in the current context of globalization.*

**Findings** *The study was conducted at a staff recruitment and selection company, whose field of activity extend to three essential aspects in terms of human resources, namely: staff recruitment, staff leasing and professional evaluation projects.*

**Research limitations/implications** *The proposed research method of human resource selection, to meet the requirements and wishes of any manager, ensuring the expected results both for him/her and the selected staff, starting from the current context of the economy.*

**Practical implications** *Over the time, but especially during this period, there are essential changes that raise a number of problems related to the world economy, which has led to an explosive rise in unemployment, but also a number of problems related to technological changes, an uncontrolled rise in inflation, budgetary problems. The liberalization of the international financial circuit has led to an intensification of international trade. Over time, multi-national companies have taken a representative place in the progress of the global economy. This aspect has been and is being studied by various specialists who have stated that their existence brings positive aspects to the global economy.*

**Originality/value** *Over the time, organizations are developing and dealing more and more with a number of key aspects in human resource management. Managers are increasingly aware of the importance of creating a plan to attract and retain for as long as possible people who have the skills the organization needs. The implementation of that involves both the recruitment, selection, integration, training of candidates/ employees, but also their reward choosing the most appropriate and attractive benefits at the same time. A fair and motivating reward system for employees also involves the implementation of a plan for periodic evaluations of their performance, performance that is also reflected in achieving organizational objectives. The purpose of this paper is to study the ways that organizations can apply in streamlining the selection, selection and improvement of the workforce in the current context.*

**Key words:** *human resources, globalization, recruitment, organization.*

## Introduction

In the last years, there has been an increase in international competition, as a result of the amplification of the globalization process. Globalization is a moment in the process of globalization, whose main

actors are companies, especially multinationals (Bică and Constantinescu, 2007). Most authors consider that multinational corporations are companies that have expanded their production and marketing activities beyond the borders of the countries where they were established (Constantinescu-Băeșu, 2006).

A defining feature of the multinational company is the expansion of economic and financial activity outside the country where the company was established, resulting in a vast international scale composed of a parent company, called the parent company and a variable number of subsidiaries, opened in various countries and who are in a dependent relationship with the parent company (Albescu, 2012).

Besides the social, political and economic effects, globalization has also impacted the field of human resources and in the context of intensified competition between multinational corporations, the role of human resources management cannot be ignored, it is in fact one of the most important factors which ensures success (Ștefan and Roman, 2012).

Traditionally, human resources management has a dual purpose, namely, to integrate social objectives into the general objectives of the enterprise as well as to coordinate the different aspects of the actual management of human resources (Lefter et al., 2008). Despite that, under the influence of globalization, companies become the actors of a competitive framework with an increasingly strong and wide international tone where company managers are forced to rethink the role that human resources departments have, giving special importance to the following factors:

- the ability to react on a highly competitive market, within the global business structures;
- close connections with the company's strategic plans;
- involvement of both managers and employees in the definition and implementation of objectives;
- orientation towards quality, productivity, teamwork and workforce flexibility (Ștefan and Roman, 2012).

As a result, companies in various fields of activity have intensified their efforts in identifying and continuously training their employees. Companies around the world are working hard to keep up with the competition. Human resources are an important factor, which ensure the continuity and continuous development of the company's activity.

The emergence and development of the globalization process brings advantages and disadvantages. Certainly, one of the advantages is attracting the capital needed for growth and development as well as much more new developed technology that cannot be generated locally. Another positive aspect would be the managerial experience and the substantial development of jobs which entails revenues to the state budget. Among the negative effects, we can mention the fact that the opening to the worldwide markets attracts quickly also all the external negative effects.

The registration and development of multinational companies on the Romanian market has had over the time an upward evolution, that can be seen in the data published by the Romanian National Institute of Statistics, press, 2017 – figure 1 and figure 2.

Companies around the world are aware that they have to face stiff competition in order to survive. In many cases, when expanding into a foreign country, multinational companies choose to send their managers and specialists to focus on opening branches specific to the parent company but prefer to recruit their employees from the local workforce.

Manolescu (2004) said in a paper that “managerial styles at the level of different multinational companies have proven their efficiency and effectiveness internally but most of the time externally they have led to frustrations and achievements below the expected level. That is why in order to ensure its international success, a company must take into account not only the financial and marketing considerations according to which many of the decisions are made, but especially the aspects related to the labor force”.

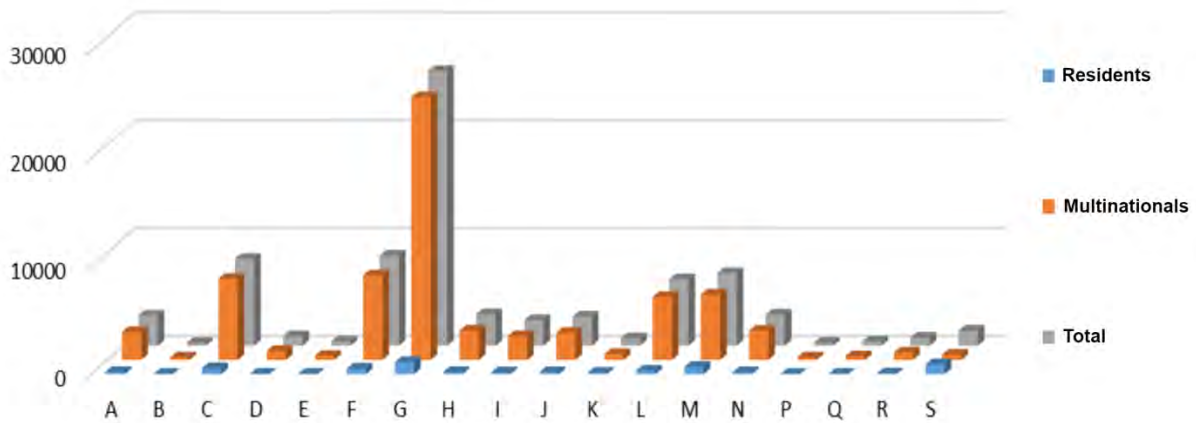


Figure 1: Distribution of the number of enterprise groups by CAEN Rev.2 activities sections and types of groups (Romanian National Institute of Statistics, press, 2017)

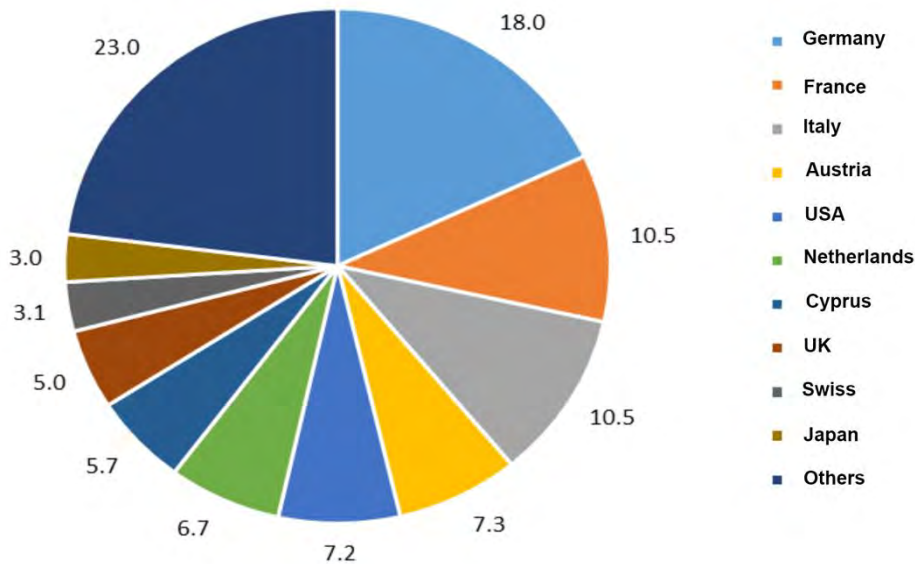


Figure 2: Structure of enterprise subgroups in Romania, by share of number of employees (%) (Romanian National Institute of Statistics, press, 2017)

The labor force is the one that ensures the survival development and success of a company on the market. Insurance costs and labor development are rising for companies but this investment in people is considered the safest way to ensure the company's survival and development. The active human resources of the organization are able to reproduce and develop the other resources necessary for a company to increase its efficiency and effectiveness.

Managerial decisions in the field of human resources are difficult and must be very responsible. Each employee must be treated differently, depending on past activities taking into account also what is expected of them in the future.

Inside and outside the company, staff training can be achieved through very diverse methods and techniques. To ensure their effectiveness it is preferable that they be integrated into the general policy of the company and be followed by an analysis of job openings and the evaluation of people.

## A Case Study in staff recruitment

The case study was conducted at a consulting company in the field of human resources with considerable experience in the market. The company is part of a group with 100% Romanian capital being formed by a consulting and a training company.

As an area of expertise, the company focuses in three directions: namely personnel recruitment, personnel leasing and professional evaluation with the main purpose of offering consulting. In order to achieve this goal, it has at its disposal an important number of HR consultants with backgrounds in different fields of activity which contribute to an improvement of the services offered in accordance with the feedback received from the client and the candidates.

The responsibilities of the company's employees are similar, in other words all team members deal with the research part related to open positions and client companies, the sourcing part, strategy preparation, maintaining contact with clients and candidates throughout the entire recruitment process and recruitment part, interviews reports and statuses.

The management of the company is a well-organized having established certain rules regarding the behavioral, physical and technical part. The approach of inactive clients on the labor market supposes keeping up to date the information regarding the actuality of the job.

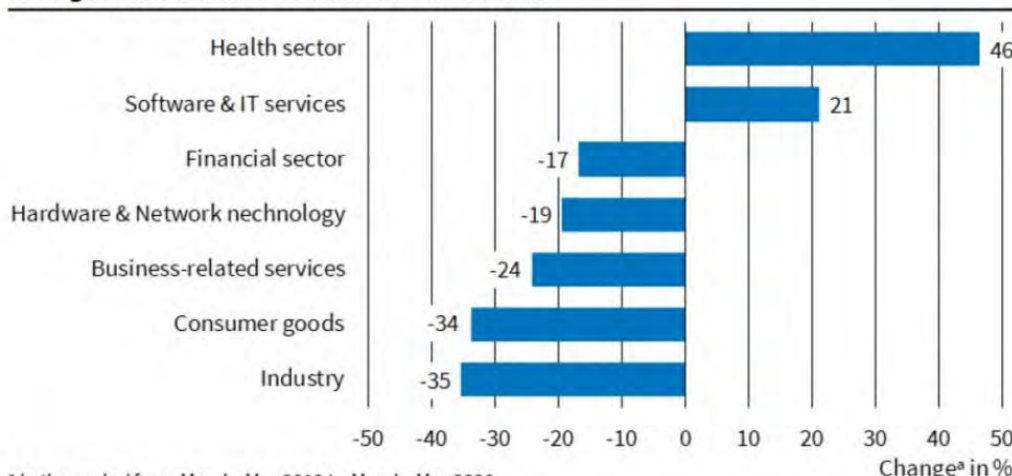
The services offered by the company are varied and are aimed at recruitment, selection, assessment and consulting. The recruitment and selection part involve a strategy that follows the direct search, networking, use of the database available at the company level, candidates file, but also recruitment online or through advertisements.

This direct search refers to an identification of candidates who are not active in their search for a job. Networking is another essential method that aims to help transform local projects in national or even international projects. Its main purpose is to form relationships with other people and to maintain them over time in order to stimulate the evolution of the business.

Considering the current context and the continuous development of the globalization process, we can say that an intense activity can be observed within the professional networks which can increase the visibility in the professional area of activity.



Change in the Number of Job Advertisements<sup>a</sup>



<sup>a</sup> In the period from March–May 2019 to March–May 2020, measured as a proportion of all job ads on LinkedIn. Source: LinkedIn 2020; calculations by the ifo Institute.

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Figure 3: Change in the number of job advertisements (IFO institute, press, 2020)

The chart in figure 3 presented by the Info Institute shows a substantial increase in published posts in the field of health and software and a serious reduction in those in other fields, a situation due to the problems facing humanity globally.

Recruiting candidates online involves an active search through various specialized recruitment sites but does not exclude situations in which the company publishes ads for open positions, a context in which there are a number of candidates eager to make a career change or to find a new job.

A way of assessing the development needs and highlighting leadership, coordination and communication skills is done through the assessment center. In the case of companies that want to recruit specialized personnel in certain field of activity a contract is made between the client company and the recruitment company.

Although recruitment seems a relatively simple situation organizing the process at the level of recruitment companies is quite complex. The staff of the companies is organized in teams led by a project manager who has the role of ensuring that the wishes of the clients are satisfied at the highest level. The process is a very complex one materializing in regular information meetings with the client. During the first discussion with the client, the work strategy is elaborated, and all the details are gathered, while the client is making available to the team all the information considered relevant in order to be able to make the most appropriate and responsible choice relative to client's needs. The involvement of the client is particularly important because the entire recruitment process is done in agreement with him. The meeting ends by setting a deadline.

The next step is to inform the client about:

- the context of the job opening;
- requirements and responsibilities;
- the level of experience required;
- foreign languages that must be known by the candidates;
- the tests that may or may not be applied in the selection process;
- the requested recommendations
- the start date of the recruitment;
- the allocated budget;
- the strategy that will be followed by the team to achieve the goal.

In order to avoid stagnation, the applied strategy must be designed in such a way to cover a wide range of candidates as possible. The way of promoting the open position is essential since it needs to attract the interest of as many applicants as possible, therefore it must be both specific and attractive.

Determining how to contact candidates is another key aspect. The approach must be friendly, and the information must be short and to the point if we are talking about entry level roles or in the IT industry. It is essential that the approach be personalized but also equally attractive.

How to conduct the selection interview is another important aspect. The success of an interview depends to a large extent on the skills and experience of the interviewer, who needs to know how to start the discussion, possibly through friendly discussion, ice-breaking discussions. This preliminary phase of the interview is followed by discussions on how the candidate understood the requirements and responsibilities of the position in question. A good interviewer knows how to communicate with a candidate, providing him/her with additional information about the company and the position for which he/she applied and obtaining from him/her all the information needed in order to ensure that the best candidate for the job is selected. The presentation of the client company needs to be as attractive as possible to the candidate and as well as the presentation of the position the candidate applied for. A consultant who presents some information mechanically and rigidly will not be able to make an attractive presentation for the candidate. Also, at this stage the aspects relating to the holding of possible technical tests are discussed. The interview ends with discussions regarding the notice period and financial expectations. Completion of the recruitment process involves reporting all the data to the team manager who will inform the client. Even after the completion of the process and the hiring of the candidate the recruitment company will keep in touch with the candidate to find out if he/she is satisfied with the new job.

The analyzed recruitment company is a long-standing company which stands out through:

- a good organization of the activity with a set rules established and in place;
- it has diversified projects that allow employees a way of professional development with positive effects in reducing recruitment time;
- open way of working through discussions with both: clients and candidates;
- development plan for consultants.

But there are also weak points that the company makes every effort to correct like: a system that does not allow the centralization of data to achieve a simplified workflow, IT equipment that needs updating and a small number of consultants. All these issues are being taken care by the management.

## Conclusions

In conclusion we note that the company analyzed in the case study is a mediator between client and candidates, this requires careful documentation of consultants on the history, products and processes of the client, on the vision, mission and values promoted which need to correspond to those of the candidates, that the company will recruit for the client. Candidates are identified not only by classical methods but also by an active search. This approach aims to increase the pool of potential candidates suitable for the job recruited and thus streamline the recruitment process.

A first positive aspect that we recall is the fact that the company's management is very well organized which ensures good communication and effective feedback between manager and employees, a very important aspect for the success of any company but also for employee satisfaction. The good development of the company activity also implies and the existence of clear procedures and rules regarding the behavioral, physical and technical part of the organization. A plus for the company is the fact that these consultants have backgrounds in various field of activity thus being more versatile, ready to respond to requests from customers who each consider different profiles of candidates depending on the domain of activity.

As in any company here are aspects that can be improved and that once optimized can increase the quality and efficiency of the recruitment process. Among the aspects that need to be remedied we mention: the improvement of the IT system, the acquisition of new and high-performance equipment that will make consultants' work more efficient and easier, internal trainings, brainstorming sessions.

We believe that the involvement of consultants in the process of improving or reviewing applicable procedures may also be recommended as the information they provide may be valuable. This involvement would also give employees a sense of professional satisfaction and deepen their loyalty relationship with the company. We also consider that it would be a good thing to implement/improve a feedback system from the clients they serve but also from the candidates' subject to recruitment.

A famous quote from Richard Branson says: "Clients do not come first. Employees come first. If you care of your employees, they will take care of your clients."

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# CHALLENGES IN THE PROJECT MANAGEMENT PRACTICES OF REMOTE TEAMS

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## Abstract

**Purpose** – Given how the number of remote teams has increased, and how these types of teams face a set of particular issues on top of the common issues that regular teams face, a need for a set of tools and techniques to help address these issues emerge. That constitutes the central point of the paper.

**Methodology/approach** – The research was conducted by examining the particularities of remote and software remote teams, their project management practices and the particularities of remote agile implications. Based on this, a set of tools and techniques that remote teams can use has been proposed.

**Findings** – The research indicates that there are a set of project management practices from agile methodologies and lessons learned from software remote teams that could benefit remote teams.

**Research limitations/implications** – Lack of research in the field of remote teams from various fields.

**Practical implications** – The inability to reach out and test the proposed set of tools and techniques on various remote teams working in different fields.

**Originality/value** – Proposing a set of tools and techniques that remote teams can use in order to address the most pressing issues that they face.

**Key words:** project management, remote, agile

## Introduction

In today's socio-economic context where most of the businesses aim for globalization and are encouraged to do so, and furthermore, where the needs of various companies are met with the help of remote teams, the requirement for an adequate project management approach emerges. The number of companies turning to remote or virtual teams has increased significantly in recent years (Ásólfisdóttir, 2012) (Ford, Piccolo, & Ford, 2016), with research showing that approximately 66 percent of multinational organizations use virtual teams (Gilson, et al. 2015).

An important aspect to consider regarding the popularity of remote teams is that it has been noted that although these were predominantly used in fields such as software development, we can now witness companies from various occupational fields such as: accounting, applied psychology, business management, communication, education, and engineering (Gilson, et al. 2015) taking advantage of the benefits that remote teams bring. Furthermore, world events such as the COVID-19 pandemic has pushed even more teams to become remote (Zimmermann 2020), thus reiterating the necessity of understanding how remote teams work and what can be done to increase their productivity and the overall wellbeing of remote workers.

A large number of definitions exist to describe the terms remote team and virtual team (Ásólfisdóttir 2012) (Ford, Piccolo and Ford 2016) (Ravi, Drake and Liang 2016) (Gilson, et al. 2015), their common point being that remote teams are made of individuals working together towards a common goal, even if they are not clustered together in the same building, or often cities, and even countries.

This dispersion can in turn impact the way the work is organized and targets are met. Research has focused on identifying the key factors that influence the efficiency and the way in which remote teams



work together and has found that among others, the most prominent factors are: management ability, culture (especially significant amongst teams distributed across multiple countries), the time zones, the team cohesion, the set of project management tools used and the quality management practices (Ásólfisdóttir 2012).

Even so, the benefits of remote teams outweigh the issues that arise. These benefits include: reduce costs for sourcing talent regardless of geography, increased diversity and flexibility, maintain a workflow across different time zone (Choi, 2018), reduced time to market and the possibility of following critical-path tasks around the clock (Vallon, Estácioc, Prikladnicki, & Grechenig, 2018).

Lately, a trend in the way that remote software development teams are organizing their workflow has been observed and it relates to the implementation of agile principles and practices (Shrivastava and Date 2010) (Collins, et al. 2012) (Sharp, et al. 2016) (Sepulveda 2003) (Keeling, Clements-Croome and Roesch 2015) (Phalnikar, Deshpande and Joshi 2009) (Vallon, et al. 2018) in order to increase productivity and alleviate some of the issues that arise from working remotely. At the same time, the trend of implementing agile practices has been noted in other occupational fields as well (Serrador and Pinto 2015) (Paasivaara, Durasiewicz and Lassenius 2009).

In this paper, we analyze the difficulties encountered by remote teams along with the possibility of using some of the techniques used by software remote teams and principles of agile development for addressing some of these issues.

## Research problem

Remote teams are becoming an essential aspect of the way that work is conducted worldwide, and this trend has shown a significant increase in the past couple of months due to the situation created as a consequence of the COVID-19 pandemic. These remote teams have proven to be a viable alternative when there's an impossibility of teams working together in the same space, this alternative being already more thoroughly explored by teams working in the software industry.

Although remote teams can be highly effective and bring about a set of particular benefits that regular teams do not, research shows that they are also prone to encountering more issues than regular teams and requiring more management involvement in order to be efficient.

Furthermore, an interesting trend emerged among remote teams and that is the implementation of agile methodologies and principles for their project management. Agile practices emphasize the importance of fast prototyping and delivery, adaptability to changes in customer requirements and self-organizing teams.

Given how remote teams are becoming a necessity and how these teams face a set of particular issues along with the common issues that regular teams face, manifests the need for a set of tools and techniques to help address these issues.

In our research, we have focused on addressing the following research questions:

*RQ1: Are there differences in the way that remote teams and regular teams organize their work?*

*RQ2: Are there differences in the way these types of teams address the issues that arise before or during the development process?*

*RQ3: Are there differences when using a traditional project management approach and an agile development approach in the case of remote teams?*

## Methodology

The research was conducted by first examining the particularities of remote teams, and observing their plusses and minuses, along with their project management practices. The literature was consulted in regard to this matter. Similarly, the literature was consulted in order to observe and draw conclusions

on software remote teams project management practices and agile methodologies, and their proven effectiveness. From here, based on the results obtained after analyzing the data, a set of tools and techniques that remote teams can use in order to address the most pressing issues that they face was proposed.

The research articles that were reviewed in the paper were selected from Google Scholar and Researchgate by searching for key terms such as: “remote teams”, “remote agile”, “agile teams”, “distributed teams”, “virtual teams”, “globalized teams”, in the 2012 – 2020 interval. After this initial step, the most relevant articles have been selected by reading the abstract and conclusions. The next step involved the in-depth reading of the articles and their findings in order to help answer the research questions.

A second round of searching and reviewing relevant research articles took place, based on the bibliography and suggestions from the previously reviewed scientific articles. Similarly, articles were first checked for relevancy by reading the abstract and conclusions, then were read and their findings were analyzed.

Based on the findings, suggestions and observations of the reviewed scientific articles, the conclusions were formed in order to answer the research questions. Furthermore, suggestions were formed in order to help propose a set of tools and techniques that can be used by remote teams to address some of the issues that they face.

## Findings

The first significant aspect discovered through the analysis of scientific articles in the field was related to the definition of remote teams, and understanding the various forms that they can take. Figure 1 shows the three main types of remote teams that have been identified in literature (Sharp, et al. 2016) and their particularities.

Remote teams		
<b>Distributed</b> <ul style="list-style-type: none"> <li>Overall team is split between locations but everyone in the sub-team is co-located with others in the sub-team</li> </ul>	<b>Dispersed</b> <ul style="list-style-type: none"> <li>Each team member is located in a different place, and is on their own</li> </ul>	<b>Hybrid</b> <ul style="list-style-type: none"> <li>A small number of team members are located elsewhere separately, but there is a co-located team</li> </ul>

Fig. 1. Types of remote teams

Based on these descriptions of types of remote teams, the authors identified that for the articles reviewed in the current paper, the majority of the case studies examined remote work in hybrid teams. Knowing the various types of remote teams and their particularities is helpful in understanding how teams work in these different scenarios and which tools are best fit for each case.

The identified challenges that arise from managing and working with and within a remote team are presented in Figure 2 and they relate not only to the technical issues that team encounter but also take into account the social aspects. The types of issues that remote teams deal with can be grouped into four main categories as follows: issues raised by the tools used, knowledge management issues, project management issues and communication issues. It can be observed that the project management and communication categories are the ones with most entries, showing that these are an essential aspect

of ensuring effectiveness of remote teams. If, in the case of ordinary teams, communication tools do not pose that much importance, as most of the communication takes place in face-to-face setups that are easily accessible at any time during the workday, in the case of remote teams, proper communication is vital as these teams might even be working in different time zones and could go on for weeks at times without speaking to one another. Besides these, it has been noted that trust is even harder to build among remote teams (Ford, Piccolo and Ford 2016), and that less importance is given to team building activities in these teams (Sharp, et al. 2016), even though communication and trust is one of the major issues in remote teams (Du, et al. 2018).

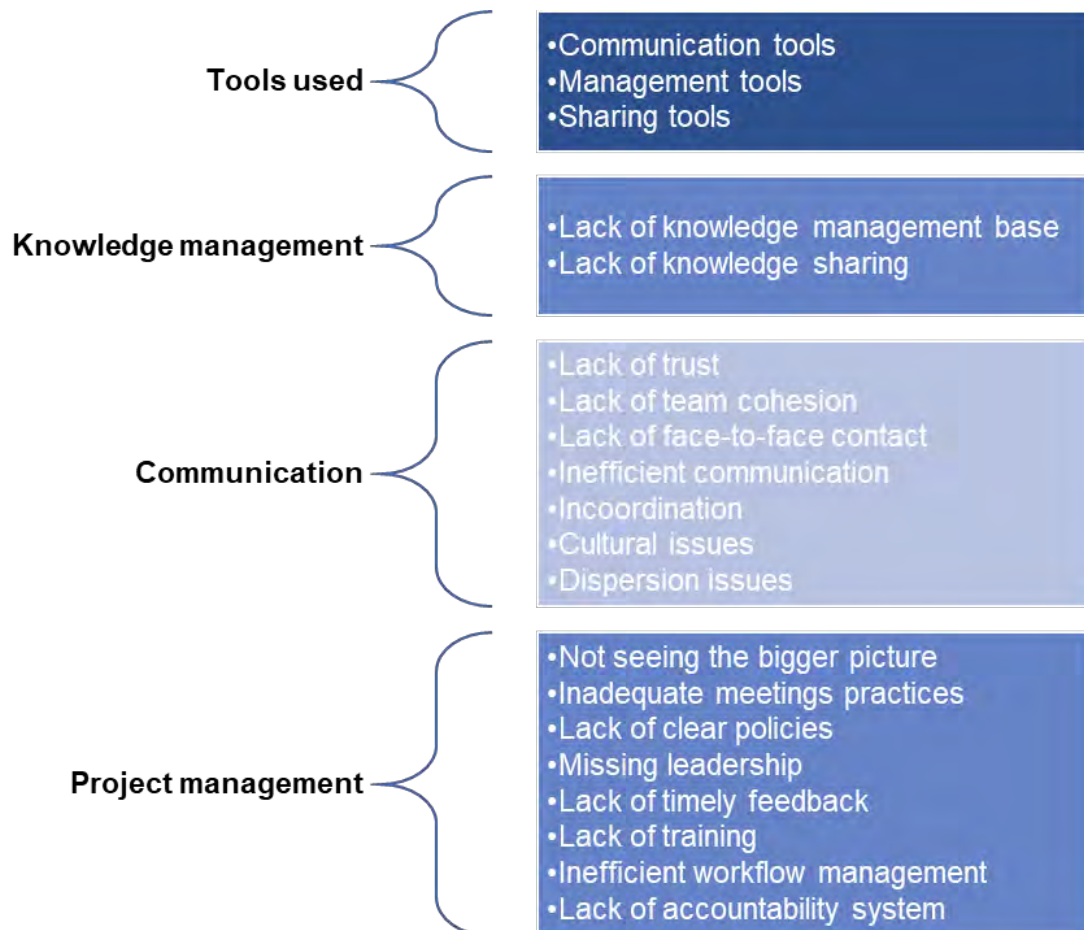


Fig. 2. Issues encountered by remote teams

Regarding the importance of communication and team cohesion, it has been shown that collaboration has a significant impact on building team trust and the overall effectiveness of the team, and that knowledge sharing is one of the factors that has a positive influence on collaboration (Alsharo, Gregg și Ramirez 2017). In order to address the communication issues that remote teams face, most research focused on identifying the tools that can mediate the communication process of remote teams, from using dedicated software tools (Ravi, Drake and Liang 2016) (Giuffrida and Dittrich 2015) (Paasivaara, Durasiewicz and Lassenius 2009) (Costa, Lemos and Beck 2018) to developing VR headsets (Du, et al. 2018). At the same time, authors have noted that for remote teams, building trust can be somewhat easily achieved, and even more important issue regarding the enduring quality of trust emerges. This in turn has been linked to an effective coordination (Ravi, Drake and Liang 2016).

Agile methodologies have been implemented in the case of remote teams in order to increase project quality and performance, create trust between team members (Shrivastava and Date 2010), increase stakeholder satisfaction and manage projects (Serrador and Pinto 2015) but also due to their suitability for high uncertainty projects (Paasivaara, Durasiewicz and Lassenius 2009). Furthermore, it has been shown that the application of Agile in projects has a statistically significant impact on all three dimensions of project success (Serrador and Pinto 2015).

As a result of the implementation and usage of Agile methodologies in the case of remote teams, but also thanks to the added experience of remote teams from the software development field, a series of lessons learned and advice has been provided by the available literature. Therefore, in the case of remote teams, the most important aspect to be taken into account is clarity of objectives and making sure that everyone from the development team understands what is required of them and what the overall goal of the project is (Ásólfisdóttir 2012) (Ravi, Drake and Liang 2016) (Lindsjörn, et al. 2016), closely followed by team communication and collaboration and usage of appropriate management and communication tools.

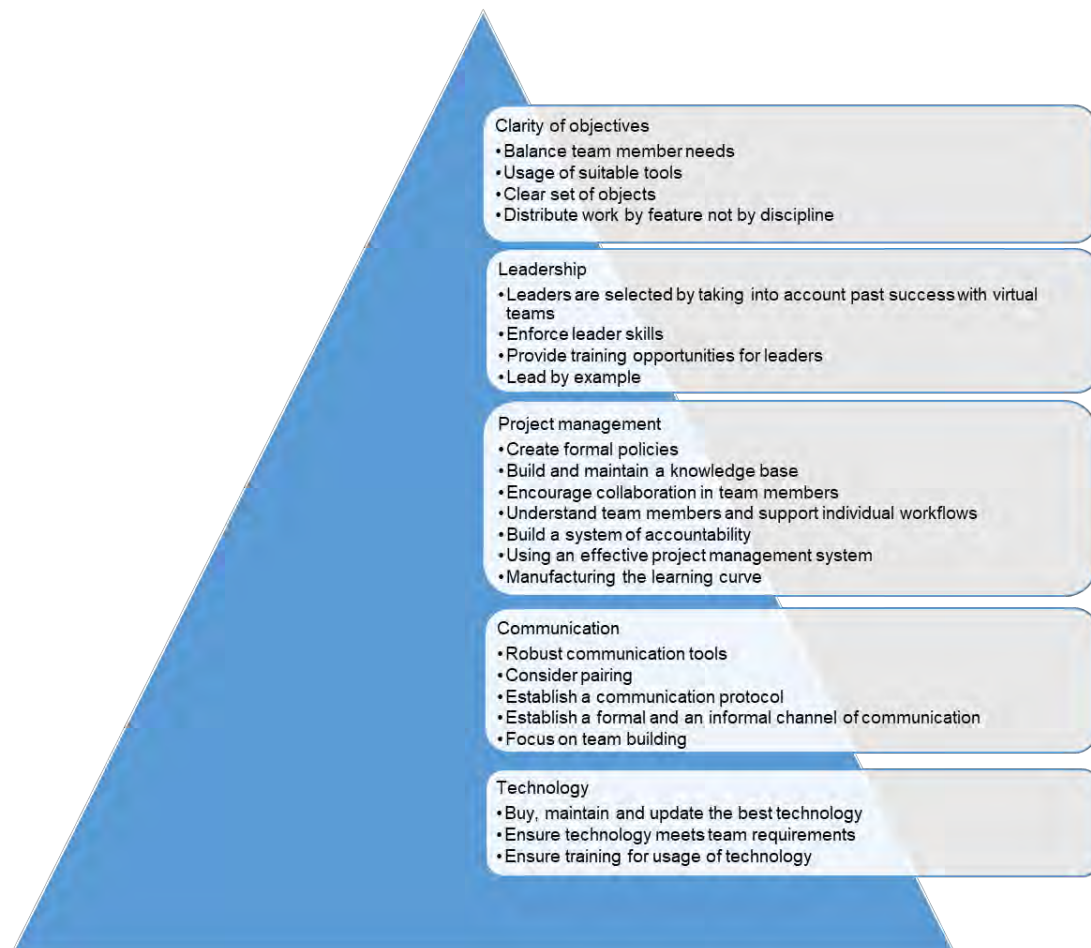


Fig. 3. Issues encountered by remote teams

Figure 3 shows an overview of the recommendations formed by the research which was analyzed in the current paper. It can therefore be observed that the five major areas of importance when managing a remote team are: clarity of objectives, leadership, project management, communication and technology.

Answering *RQ1*, the research has shown that there are differences in the way that remote and regular teams organize their work, and these are mainly linked to the way objectives are established and team work is managed.

Furthermore, research revealed that there are differences in the way issues are dealt with by remote teams and regular teams (*RQ2*). The most significant differences are caused by communication channels and lack of policies and face-to-face interaction between team members of remote teams. More so, a lack of clear objectives and adequate project management tools leads to even more issues for remote teams.

Lastly, when addressing *RQ3: Are there differences when using a traditional project management approach and an agile development approach in the case of remote teams?* It has been noted that agile practices, particularly the Scrum methodology of the agile approach, can greatly benefit remote teams, with case studies showing an increase in efficiency and overall deliverables quality.

## Discussion and conclusions

The aim of the paper was to analyze various research studies conducted in the field of remote teams and the problems that they encounter, with the purpose of proposing a set of tools and techniques that remote teams from various fields can use in order to address the most pressing issues that they face. The set is built from lessons learned by remote software teams and remote teams using agile methodologies.

The research indicates that there is a set of project management practices from agile methodologies that could benefit remote teams. Furthermore, a set of lessons learned from software teams can be applied to remote teams in order to improve their efficiency and ensure success. Figure 4 presents the main ideas drawn from lessons learned when dealing with remote teams and remote teams using one or more agile development methodologies.

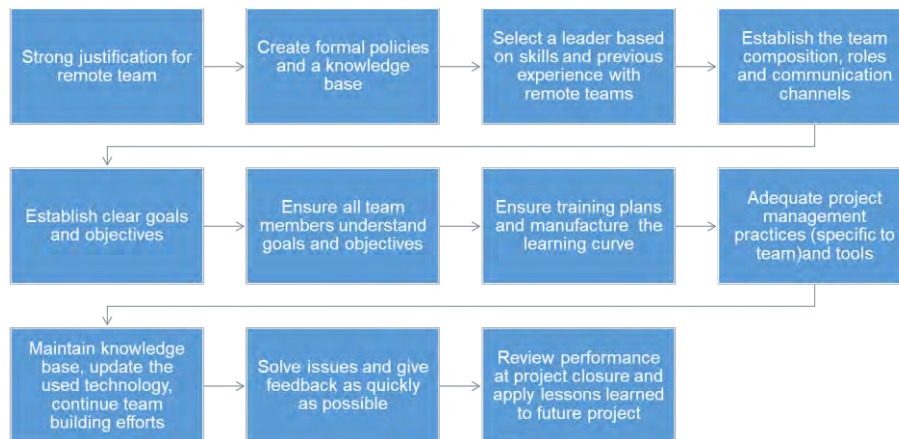


Fig. 4 Recommendations for building and managing remote teams

Further research endeavors are based on the following two main directions:

1. testing the assumptions made with the help of an empirical study targeting preferably both software remote teams and remote teams from a different field of study.
2. examining the possibility of using specific quality management tools and practices in the project management of remote teams to help address some of the issues that they are faced with.

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# IDENTIFICATION OF KNOWLEDGE LEVEL AIMED TO IMPROVE PRODUCTION PROCESSES AND UP-GRADE VALUE ADDED WITHIN COMPANIES

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## Abstract

**Introduction** Importance of process improvement is over two centuries continuous research challenge but in Romania national issues & global approach can rise new problems.

**Research problem** Nobody evaluated training needs in the field of process improvement. With respect to this problem, we've expressed the **Purpose**: Identification of training needs in automotive field concerning improvements since these are not easy to find if you are not part of the niche and market voice is subsequently hidden.

**Methodology/approach** Going back to on-site assessment means **face-to-face** interviews, covering the field of automotive producers - parts, components, assemblies and performing National inquiry on almost all Regions and all fields of processes and technologies.

**Findings** – For training and coaching it isn't enough to ask for Human Resources to find out needs but also Purchasing and other Operational departments. Knowledge management maturity was found not reliable; process improvement projects are not really effective; waste is present and subsequently organization's productivity is not appropriate.

**Research limitations/implications** – New approach in Romania, time consuming and logistically heavy to perform, complete state-of-the-art level.

**Practical implications** – Hands-on inquiry, interviews performed on over 2/two Years;

**Originality/value** – \*Complex multidisciplinary assessment, performed on-site; \*Holistic approach; \*Paradigm change; \*Process approach reviewed and changed into Project approach for Lean & QC Story appliances aimed to improve efficiency; agile base was considered as support.

**Key words**: training needs, processes improvement.

## 1. Introduction

Survey was conducted over a 2-year period in SMEs and large companies, facing major challenges. Identification of targets in order to improve performance in the area of process improvement was assumed. Risk was that changes in methodological approaches could bring with them changes in mentality and cleavages; the importance of transferring new methods to production of modernized process methodologies is to be noted. A general objective is the development of managerial capacities in Romanian companies, through training, consulting and transfer of skills based on professional assistance in order to improve the competitive position of companies, increase the quality and effectiveness and through them the development of managerial capacities in Romanian companies.

This report presents the results of quantitative research, with qualitative interpretations. The results of the study serve to identify specific training needs of the group considered and to define their improvement actions and adapt the training and assistance activities on line with re-design of production processes.

This will result into identification of differences between the actual level of training of employees and what is desired in terms of performance for employees – this can contribute – if properly managed – to up-grade performance of the company in which they operate.

For the differences identified between expectations and reality, one possible solution is staff training and coaching, especially where there are gaps to fill - identified on the basis of this "gap analysis".

## 2. Research problem

To carry out a process of training needs identification it is mandatory to gather information to support the decision to choose training programs that (can) solve existing problems. This activity is designed and conducted as a research - collection and analysis of the information received - from key people within Companies: answers provided to questions contained in questionnaires.

The survey is a practical, face-to-face approach to interview decision-makers. We totally avoided internet surveys, to which the responsible factors answer with great reluctance and therefore results in a low participation involvement and lower reliability factor.

Objectives raised from problem research of the survey-based research:

1. Identify actual situation of training in a particular – automotive – field: what employees already know; have they necessary knowledge in order to carry out activities? Is it correlated with the HR training requirements for achieving operational objectives?
2. Identifying need for training - what employees need to know in order to improve their performance - (Erick Jones, 2014, pag. 627) "knowledge management"; perception also covers the maturity level of the QMS;
3. Identify the perception of key people within the company on operational issues;
4. Identify the types of training that will help improve performance;
5. Identify ways to test the growth of knowledge and skills or adapted techniques.

## 3. Methodology including sampling/population

The sampled **population** included employees with managerial missions and responsibilities in production management field, on process improvement projects and process engineering.

**Methods & techniques** included the appropriate resources planning, the approach, the methodology and subsequent tools

The research was carried out through both **organizational and functional analysis**, as the problems considered to be important were those of performance in the field of process improvement. The organizational analysis consists of organization as a whole diagnosis in order to find out malfunctions. Elements such as strategic axes, key indicators and organizational culture have been taken into account.

**Prospective field visits** were made, during which we met leading people from general management, human resources, production or quality. They provided useful information for identifying specific training level, training needs and the will of transfer of new knowledge, skills and attitudes. A purpose was to research the company's potential management's interest in a training and assistance program proposed by an international team, as well as to identify the company's own, specific training and assistance needs.

The amount of data needed to carry out diagnosis were **obtained by interviews**. Obtained information & data, creates-on a degree of correlation between the operational objectives of marketing, design, production, quality and human resources departments. This correlation had to draw a pattern concerning the level of performance and the overall profile of employees with managerial duties in management and production improvement, using next formats:

- Identification sheets of potential customer requirements and expectations;



- Answer grid for "customer requirements and expectations identification sheet";
- Visit report documenting company key person attendance list answering to inquiry

A questionnaire "Customer Requirements and Expectations Identification Sheet" was conducted – administered directly by the Coordinator/first author and operated, discussed and completed. The questionnaire contains a number of questions, 80% being open **questions** - and 20% being closed **questions** – in order to facilitate the dialogue with deciders.

In terms of Companies, **the sample** was selected between Automotive Organizations. Use of questionnaires attached to the customer's requirements and expectations identification sheets were answered **by a number >80 companies\***, all from manufacturing domain. After the survey, many companies were interested in applying into training/coaching projects.

Interviews were conducted on **more than 120\* persons** – a representative sample.

(\*) NOTE: 80 Companies represents 25% of the Automotive Companies out of a total between 360-380: statistically reliable with a 95 % indices of confidence, and a +/- 3% error margins.

## 4. Findings

### 4.1 Data analysis and interpretation

Data gathered have been reported into graphs and figures in such a way that interpretation could become as reliable as possible. **Pie chart** graphs prevailed, especially where the answers had to show the comparative factorial aspects. Comments were not neglected: verbatims provided by interviewees were included in(to) the analysis; we've included comments where answers didn't prove to be reliable.

It should be pointed out that certain comments are not available in case of online surveys, hence the quality of this study, which is **pushed** towards confession and, possibly, factual, based on objective indicators or evidence – is not quite possible for online surveys.

### 4.2 Efficiency of production flows - DMAIC re-engineering needs

The scope of the firms was the manufacturing industry mainly automotive industry and the level of interest of companies in acquiring DMAIC techniques, process improvement projects and/or reducing non-quality costs was focused. It was explained to the companies participating in the questionnaire that participation in projects aimed at improving **competences** of participants, target being defined: managers, process engineers, technicians. 14 firms of those surveyed did not participate in fulfillment of the questionnaire but accepted open discussions and authors recorded their requirements and expectations; we can expect that in case of online inquiries these people could just deny answer. Following the interview, the following analyses were found for each situation:

**Question 1.: Have you defined within your organization the function responsible for improving processes or redesigning existing processes? - see Figure 1.**

For 76.5% of the companies surveyed, the appointment of a person responsible for process improvement RIP-Responsible for Process Improvement is a priority but unpractically defined and not factual implemented. Directors Boards have made them aware of this way of increasing market competitiveness and are looking to implement improvement projects. Additionally, it appeared in nomenclatures on trades approaches of the type Responsible improvement processes. They are not currently missioned (no link to requirements of Lean Manufacturing or LSS) as they try to set principles and objectives for trainings. Companies proved to have some doubts about the proper understanding of such a Responsible role.

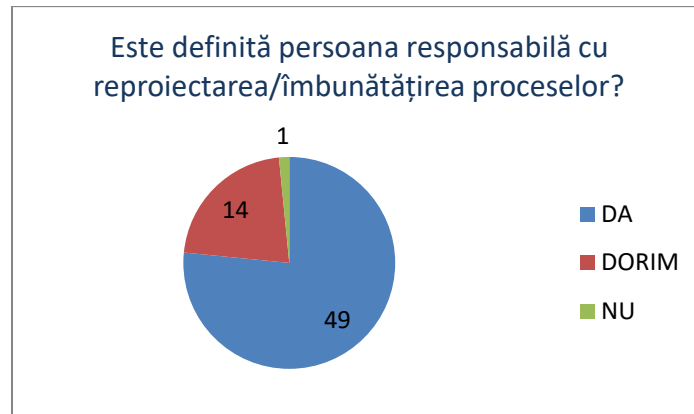


Figure 1. Definition of people responsible for process redesign

**Question 2: Do you encounter difficulties in redesigning appropriate process flows ? - see Figure 2.**

At (re)designing production flows after a period of activity it was found that in some respects the flows do not correspond to planned expectations. According to the firms surveyed, most of them had difficulties. In this situation, the survey responses were quite reliable. The appearance was considered gratifying, because the respondents were aware of some efforts but knew that the efforts were either not successful or were partially winning and would have liked to consider factual/effective methods of resolution. Often the lack of vision of FLM - front line managers (Ortiz, 2016) has worked starting since the basics - production cell / work cell. It has been noted that *work cell* is not considered relevant (did not attempted goals).

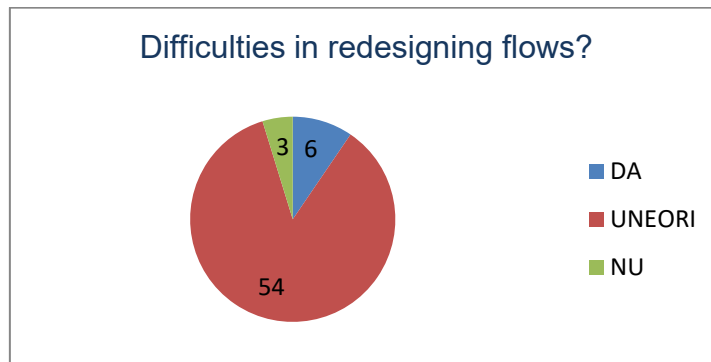


Figure 2. The level of difficulties encountered in redesigning process flows.

**Question 3: Difficulties encountered relate to - see Figure 3, a), b), c), d):**

**a) Planning of development stages, taking into account customer requirements?**

The first step in re-designing some production flows is the Planning of the Development of a Process. This planning is often difficult, say over 50% of managers surveyed. Although it seems quite a lot, the imbalance is much more obvious if you take into account the notes contained in the YES answer, it **is difficult** leading the weight towards >70%.

**b) The flow design and/or redesign?**

Designing and redesigning a stream must be a well-thought-out step involving risks. A significant 37.5 percent of the firms surveyed say they have encountered no problems so far. This may be due to the fact that they have benefice from Head Office consulting or advice from specialized teams since multinationals already have supported them with redesigned plans.

**c) Framing in the final deadlines / planning stages?**

Planning to perform a redesigned process should not affect the fixed delivery deadlines. The redesigned process needs to be well planned and its implementation to fall within deadlines and not into bottlenecks. RIB must assess all risks that may occur during the process of redesigning and implementing new process, establishing Critical Path within the target time. Of the firms surveyed >50 experienced difficulties, representing >80%.

If we question that re-planning is done from the office in order to save time but applied in the field, it becomes quite clear that there are more 20% of over scheduling cases due to **office work without process knowledge** but is possible % to be even worst due to specific conditions (please follow the trace into the next stage, related to human factor and working in teams). Many aspects prove that flow designer doesn't know or practically cannot take into account processes related risks.

**d) Ensuring functioning and communication in multidisciplinary teams?**

The RIP has to take into account both objective factors - facilities (equipment, locations, logistic flow) and subjective factors - people (motivation, lack of competence) at the level required within interdisciplinary teams – or, finally the absence of Leadership. Problems related to human factors, communication problems, facilitation and negotiation problems or conflicts of interest are usually felt within the teams designated to carry out a project. This can be improved only if members are meeting each other and work on project or share with other teams designated for various projects. 82.8% of companies experience this kind of problem.

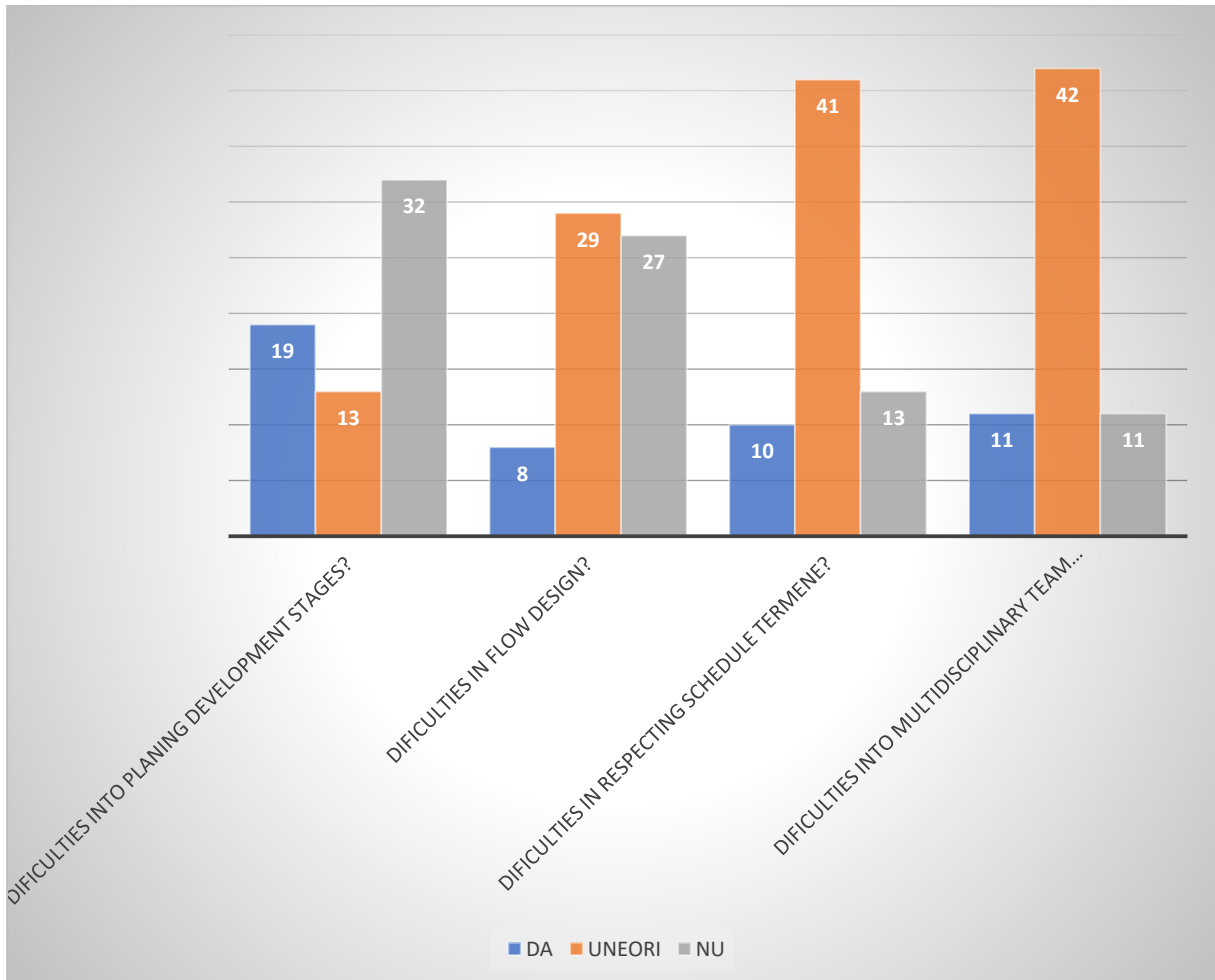


Figure 3.

- a) – Share of difficulties in the planning of development stages
- b) – Share of difficulties in designing and redesigning the flow
- c) – Share of difficulties in relation to compliance with planned deadlines
- d) – Share of difficulties in relation to the functioning of interdisciplinary teams

#### Question 4. Feasibility of producing under conditions of synchronous streams? - see Figure 4

In this approach in the questionnaire there are actually caught two main aspects: the first is the **feasibility of the project aimed to improve the flow**, which implies the existence of all resources for the planned risks, the second is the analysis of the indicators before the **redesign of the flow**. From the point of view of implementation, resources are the basis, but from the point of view of synchronization there are still not all the prerequisites, therefore a sufficiently crystal-clear YES is possible in < 15% of cases. When designing a synchronous flow, it is necessary to take into account that process capacity, balance and capability must be obtained on all sub-flows. To design a synchronous flow capable of meeting the customer's requirement for a T/T - takt time, each sub-flow requires a pre-defined C/T – cycle time, to lead to a correct capacitive response.

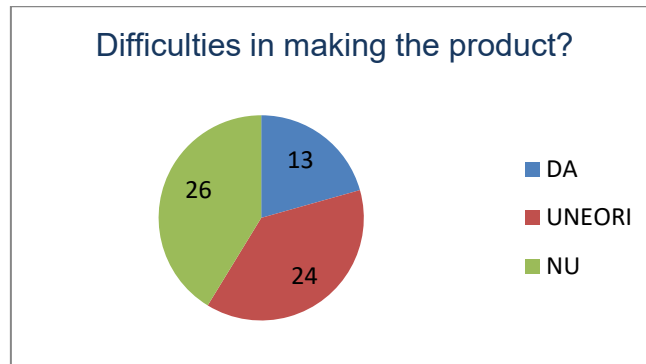


Figure 4. Share of difficulties in assuming the feasibility of synchronous flows

#### Question 5 Effective use of resources allocated to re-planning? - see Figure 5

Resources are in any project planning a huge problem (mainly in re-planning). Resources within a re-planning action must be adequate and based on records of resources previously used in planning. Before submitting any data and figures, the basis is the analysis of what was right and/or what was wrong with the previous planning: see TGG & TGW - things gone good/wrong. When we refer to resources we understand: time resources, allocated budgets, material resources: equipment may already exist, only site configuration is to be changed, human resources - here you can list both people involved in dismantling-reassembly, and personnel for logistics – transport or handling. Reasons for the above results are obvious (Klaus Altendorfer, 2014) and are confirmed by the results of the survey and the reasons why 92.1% of the companies surveyed say they had problems.

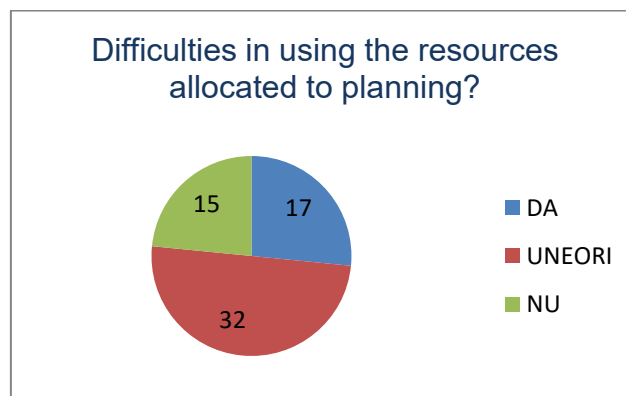


Figure 5. Share of difficulties in the use of resources allocated (re)planning

#### Question 6 Competence of staff involved in (re)planning? - see Figure 6

Staff involved in re-planning are often at the beginning of the road (if not for other reasons, at least because these aspects are not displayed in theory at the level of university degree). Many of the RIP are self-taught, with the necessary costs of training considered quite substantial. Such a RIP that has

not worked with KPIs – key process indicators: L/T – lead time, C/T, T/T, Cmk – machine capability, Cpk – process capability, Ppk – process performance, Cgk measuring equipment capability, with machine usage times, operating times, with effectiveness analysis – OEE – overall equipment effectiveness, will not understand their involvement into reaching appropriate targets.

Processes such as those that carry out production VA - value added, but also support processes: quality, logistics, maintenance, purchases, human resources, are in direct re-planning involvement. Out of the firms surveyed, 36 said they had encountered problems in terms of staff competence ≈50%.

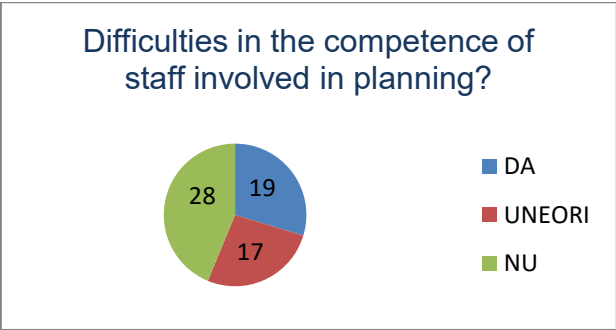


Figure 6. Share of difficulties in the competence of involved staff in case of (re)planning

**Question 7: Do you use Risk Analysis in flow planning/development? - see Figure 7**

Risk analyses in flow planning/development are essential preventive activities for smooth running of processes. This analysis is not cost-effective when the series are not very large. Moving over this stage is traditionally done so positive responses were often preceded by empirically fire fighter style actions that proved their inefficiency. As is also apparent from the questionnaire, there are companies that apply risk analyses in flow re-planning. Here the sample is not representative at national level since companies in the automotive area have been approached into this survey, those practicing PFMEA – process risk analyses. They acknowledged that, to a large extent, the results are formal and that they want to improve their performance.

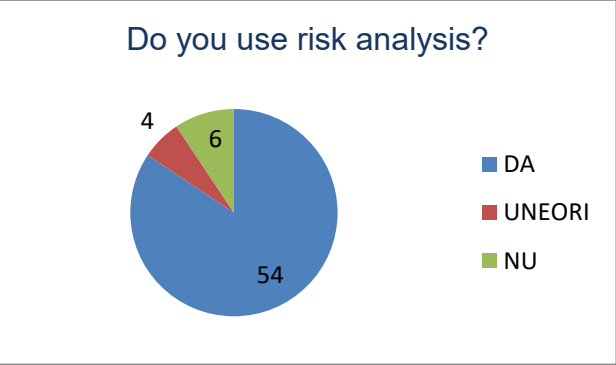


Figure 7. Call for risk analyses on flow schedules

**5. Survey conclusions**

It was found that of the total of enterprises surveyed a significant percentage would like to include in the course(s) scopes concerning teamwork skills (soft skills). This aspect is much more pronounced when it comes to approach team development of the couple product/process, which is a team built-up of staff from several departments and who do not carry out all their daily work together.

With regard to the willingness to engage in a training programme for the development of skills relating to the use of tools that reduce product release times or the number of non-conformities at the design stage, the results indicate favourable attitudes of the majority of companies.

Participants - some of - wish only to develop skills related to understanding and using their Risk Analyses, others would like to develop working skills in multidisciplinary teams and techniques for product development. There are also enterprises that have chosen both aspects: product development, re-planning production processes, but nominating different people, depending on their role within the organization. Thus, in most enterprises, employees are willing to participate for a period of 3 to 10 days in the training program. For the courses with a duration of 10 days, however, it is necessary to divide into 2 sessions of 5 days each, and between them a period of coaching is required to be intercalated.

Another important aspect is that of adapting the training programme to the specific requirements of clients - Companies that have been established as beneficiaries - with regard to the presentation of examples related to their own products and processes, and in some cases also the use of own documents of the organisation to be understood equally by all participants.

## 6. Contributions of integrated trainings & coaching

In this survey, authors are recommending as a matter of priority the following:

- Design of learning activities should be guided by the specific principles of adult training, including strategy of: teaching – learning through games and plays, assessment, coaching.
- Design of practical guides (Patel, 2016) approaches for an effective implementation of Lean/Agile.
- Inclusion of chapters that address different aspects of teamwork – from the definition of concept to its exemplification through role-playing or exercise.
- Performing training activities in such a way as to achieve a homogenization of the knowledge of all participants, without letting those who possess more knowledge get bored.
- Lecturers take into account that the vast majority of people assessed upon entry into the training program have a level of skills. By managing the initial test results, the actual level can be better observed. It is the starting point in the development of skills.
- The use of AGILE methods (Rothman, 2016) taken from the automotive field, not (of) those out of the IT field, here is imposed QC Story, used by two major OEM companies, a methodology that provides theoretical knowledge of the type lean manufacturing for managers of the level Heads of Teams, representing the recruitment base of the support staff for projects.

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# THE DEVELOPMENT OF QUALITY MANAGEMENT SYSTEM USED IN THE PRODUCTION OF REFERENCE MATERIALS

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## Abstract

**Purpose** – This paper presents the development of Quality Management System (QMS) used in the production of Reference Materials (RM), specific to food engineering.

**Methodology/approach** - The authors performed a documentary study on the legislation applied in the accreditation of manufacturers of RM. In order to develop the QMS, the procedures specific to the certified RM field were identified.

**Findings** – This paper presents the specific procedures for the development of the QMS necessary for the accreditation of the manufacturers of reference materials according to the clauses of the ISO 17034 standard.

**Research limitations/implications** – This research paper presents the requirements of ISO standards in the area of production of reference materials and synthesis of management procedures in the field of quality development of reference materials in the sector of food engineering.

**Practical implications** – The documentary study allowed the National Institute of Research and Development for Food Bioresources – IBA Bucharest, to elaborate the documentation needed to create the QMS for the development of RM.

**Originality/value** – The paper shows that in addition to the necessary infrastructure, for the development of the quality system in the production of RM, at least 30 specific procedures and 20 work instructions are required, and over 40 standard forms.

**Key words:** quality management system; production of reference material; ISO 17034:2017 standard

## 1. Introduction

Major incidents of food frauds reported at European Union member states level led to the elaboration in 2013 of the European Parliament Resolution, which called the European Commission to pay all the needed attention to food fraud and to take all necessary measures such as the prevention and battle against food fraud in order to become an integrated part of the EU policy (Committee on the Environment, 2013).

At the same time, given the scale of food fraud, its consequences on human health and the economic climate, the European Commission has set up a Center for Food Fraud and Quality, starting March 13, 2018, operating within the Joint Research Center (JRC). The newly created entity supports innovation in the field of testing techniques, by developing/standardizing new methods and increasing the measurement performance.

The quality of measurements plays a key role in technological and socio-economic development, thus supporting the development of trade and monitoring the quality of products and services and allows the optimization of decisions in monitoring food safety (Rychlik et al., 2018).

The quality of the test results is monitored both internally and externally by using certified reference materials (MRC). Consequently, the development of MRC is a vital area in the quality control of the test result and implicitly of food safety.

The reference material (RM) is the generic name used to refer to that material that is sufficiently homogeneous and stable related to one or more of the specified characteristics and determined to be suitable for the intended use in a measurement process. The specified characteristics can be quantitative or qualitative, and the uses could include calibration of the measurement system, evaluation of the measurement procedure, allocation of values of other materials and quality control. The nutritional value of the products is of particular importance for the labeling of foods for the international trade in goods and the support schemes of the common agricultural policy.

William Cunningham defines in Chapter 3, related to RMs, from the book of reference material producers, published under the U.S. Food and Drug Administration, three types of reference materials namely: RM, certified reference materials (CRM) and reference materials produced by an internal laboratory (IRM) (C. & G., 2014).

If during the '80s the requirements regarding the competence of the reference material producers were not standardized, with the intensification of the quality of test monitoring, the ISO Guide 34:2009 was elaborated, which laid-down "General requirements for the competence of the producers of RMs"(International Organization for Standardization (ISO), 2009).

In 2016, the International Organization for Standardization published the ISO 17034:2016 standard on general requirements regarding the competence of reference material producers (RMP), replacing ISO Guide 34:2009. The need for an international standard arose because several accreditation bodies could not accredit against the guide, while in other countries ISO Guide 34 was accepted in accreditation only in combination with ISO 17025, the RMP being obliged to accredit also in compliance with the requirements of ISO 17025 (International Standard Organization, 2005).

In addition, at European level, the legislation establishes the requirements for accreditation and market surveillance and Regulation (EC) no. 765/2008 (European Parliament, 2008) requires that the accreditation should be based on harmonized international standards. Therefore, accreditation according to a guide is only accepted for a transitional period and is not possible in the long term, therefore, ISO Guide 34:2009 is no longer applicable.

The testing laboratories use RMs for calibrating the measuring instruments, validating the methods, evaluating the test procedures and for controlling the quality of the results.

## **2. Materials and Methods**

This paper presents the specific procedures for the development of the quality management system necessary for the accreditation of the manufacturers of reference materials according to the clauses of the ISO 17034 standard.

In this sense, the authors performed a documentary study on the legislation applied in the accreditation of manufacturers of reference materials. Also, in order to develop the quality system management, the procedures specific to the MRC field were identified.

ISO 17034 standard contains requirements for Reference Material Producers (PRMs) required for accreditation (International Organization for Standardization, 2016). PRMs that meet the requirements of ISO 17034 are considered competent. At the same time, reference materials that meet the requirements of this Standard must be accompanied by a certificate with mentions about the homogeneity and stability of the specified properties. Also, the certified reference material (CRMs) are accompanied with the certified value, the associated measurement uncertainty and metrological traceability.

The European Union has been supporting the development/production of RMs for more than four decades, with the establishment of the European Community Reference Office (BCR) in 1980. For



example, BCR produces wheat flour certified as RM (BCR-563 and BCR-396) for the parameters presented in Table 1 (Steger, 1983) (European Commission, 2016) (European Commission, 2019).

Table 1. Certified quality parameters for BCR-563 wheat flour

No.	Name	Parameter/technique
1	Physical properties	- weight per hectoliter/ water content, ash content
2	Presence of proteins	- protein and / or gluten content/ protein composition and amino acids
3	Rheological properties	- test farinograph or valorigraph/ value alveograph/ -test extensograph
4	Enzyme properties	- Hagberg drop number/ amilograph
5	Other examinations	- Mycotoxin content/ pesticide and insecticide residues

Table 2. ISO standards applicable in the production or use of reference materials

Standard	Standard title
ISO/CEI 17025	General requirements for the competence of testing and calibration laboratories
ISO 17034	General requirements for the competence of the reference material manufacturers
ISO Guide 30	Terms and definitions used in the reference standards (www.iso.org)
Guide ISO 31	Reference materials. Content of certificates of reference materials
ISO Guide 32	Calibration of chemical analyzes / use of reference materials certificates
ISO Guide 33	Good practice in using reference materials
ISO Guide 35	Guidance for characterization and assessment of homogeneity and stability
ISO 17034	General requirements for the competence of the reference material manufacturers
ISO Guide 80	Guidance for the in-house preparation of quality control materials (QCMs)
ISO/TR 79	Reference materials - Examples of reference materials for qualitative properties
ISO/TR 10989	Reference materials - Guidance on, and keywords used for, RM categorization
NIST 260-100	User's Manual for Reference Materials

The documentation for accreditation of reference material producers based on SR EN ISO 17034:2017 standard. The SR EN ISO 17034:2017 documents are presented in table 3.

Table 3. The SR ISO CEN 17034:2016 documents for accreditation system of reference material producers

No.	Name	Description	Number
1	ISO 17034 Quality Manual	-the requirements for accreditation of reference material producers	1
2	Procedures	-all the specific practice areas	29
3	Work instructions	-establishing a good quality control environment	20
4	Forms	-standard forms	40
5	Audit	-audit questions for internal auditing system SR EN ISO 17034	200

### 3. Results and discussions

In Romania, the National Institute of Research and Development for Food Bioresources – IBA Bucharest (Romania) benefits from national funding for increasing the expertise in production of RMs, specific to food engineering, in accordance with the European Commission recommendations. Thus, National Plan for Research, Development and Innovation 2015-2020 funded the projects PN 19 02 04 01 "Research on the development of skills in the development of reference materials and inter laboratory comparisons". The documents elaborated for the implementation of the quality management in the laboratory for the production of reference materials are presented in table 4.

Table 4. Document matrix SR EN ISO 17034:2017 (QM=Quality Manual; P=Procedure; F=Form)

No.	Reference ISO 17034	Abbreviation	Title
1	4	P	Procedure for Request, tender and contract reviews
2	4.2	P	Procedure for impartiality or operational integrity
3	4.3	P	Procedure for protection of customer's confidential information
4	6.1	P	Procedure for personnel and training
5	6.1	F	Training Calendar/ Training report/ Job Description
6	6.2	P	Procedure for subcontracting
7	6.3	P	Procedure for procurement of equipment and services
8	6.3	F	Registration/ Inspection report
9	6.4	P	Procedure for accommodation and environment
10	6.4	F	Environment condition monitoring report
11	7.2	P	Procedure for production planning and implementation
12	7.2	F	Production plan
13	7.3	P	Procedure for production control
14	7.4	P	Procedure for labeling and packaging
15	7.4	F	Packing report/ Deliver challan
16	7.5	P	Procedure for material processing
17	7.6	P	Procedure for Measurement procedures
18	7.7	P	Procedure for equipment
19	7.7	F	Preventive Maintenance
20	7.8	P	Procedure for protecting the integrity of data
21	7.9	P	Procedure for metrological traceability
22	7.1	P	Procedure for assessment of homogeneity
23	7.11	P	Procedure for assessment of stability
24	7.11	F	Stability study report
25	7.12	P	Procedures for characterization
26	7.13	P	Procedure for assignment of property values
27	7.13	F	Uncertainty calculation report
28	7.14	QM	Description of documents and labels
29	7.15	QM	Method followed for distribution
30	7.16	P	Procedure for control of records
31	7.17	P	Procedure for Control of non-conforming reference materials
32	7.17	F	Non-conforming work report
33	7.18	P	Procedure for complaint handling
34	8.2	F	Quality objective monitoring report
35	8.3	QM	Structure of management system documetation
36	8.4	P	Procedure for control on management system documents
37	8.4	F	Distribution list of documents
38	8.5	P	Procedure for control of records
39	8.6	P	Procedure for management review
40	8.7	P	Procedure for internal audit
41	8.7	F	Audit plan/ Internal audit non-conformity report/ Audit programme
42	8.8	QM	Risk and opportunities
43	8.9	P	Procedure for corrective action
44	8.9	F	Corrective action report
45	8.1	QM	Methods followed for improvements
46	8.11	F	Customer feedback report

In 2018, the SR ISO 17025 standard was revised and, thus, the possibility of its integration in the quality system certified according to the SR ISO 9001 standard was introduced.

In direction with the new trend in the field of quality testing of agri-food products, the integrated standards are presented in Figure 1 as follows: the standards EN ISO 17034 "General requirements for competence of manufacturers of reference materials" and ISO 17043 "General requirements for tests of competence", suppliers of conformities in the EN ISO / IEC 17025 standard are implemented in an ISO 9001 certified quality system.

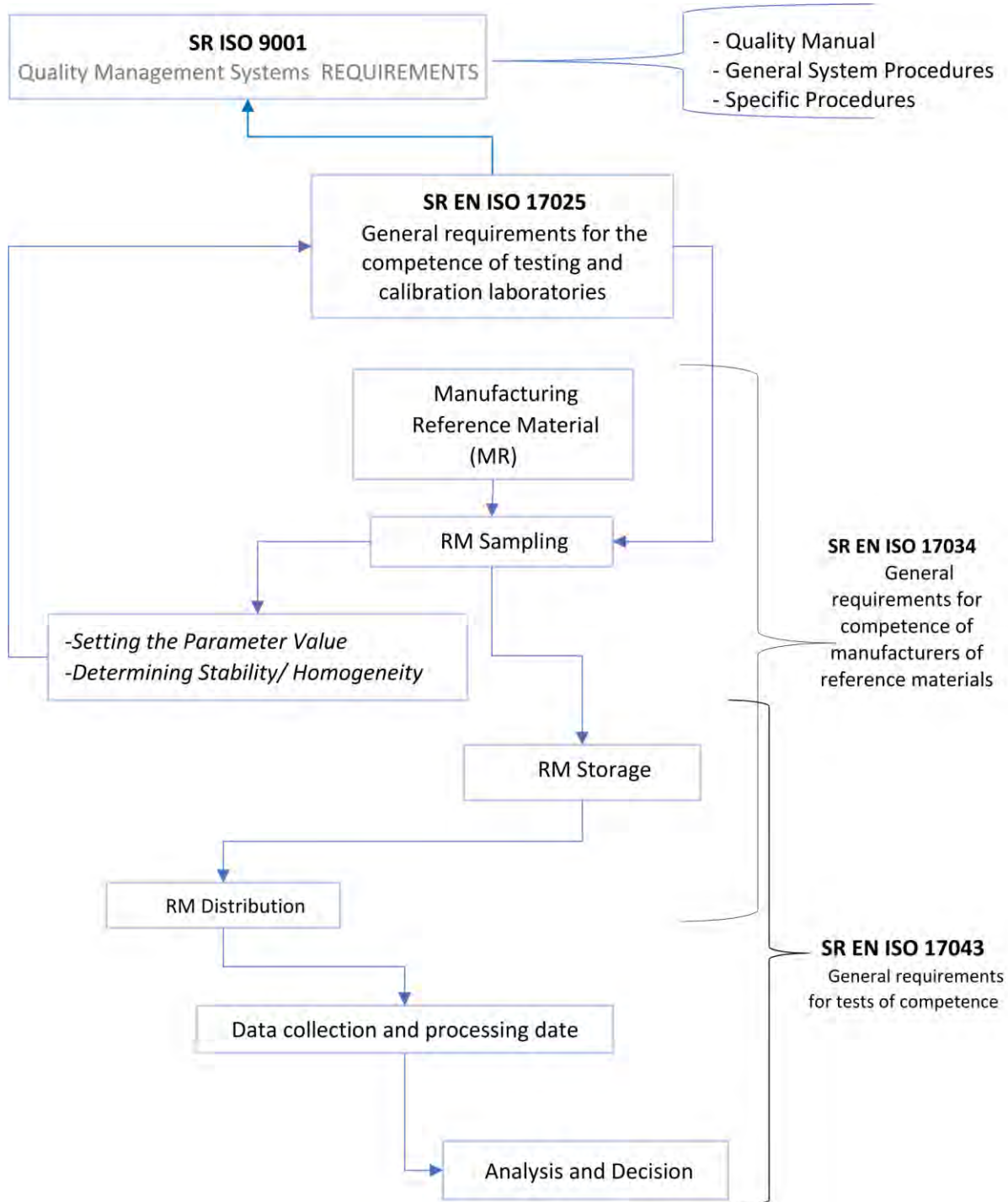


Figura 1. Scheme of integrated quality system used in the manufacturing of Reference Materials and organizing of interlaboratory comparison schemes

Underlying the need to develop the international standard was the impossibility of independent accreditation of the ISO 34: 2009 Guide, without forcing the manufacturer of reference materials to be accredited according to ISO 17025. The transformation allowed alignment with recent editions of conformity assessment standards in the series ISO 17000, mainly: ISO 17025 (general laboratory quality) and ISO 17043 (proficiency testing). This is considered an advantage for manufacturers of reference materials who perform analytical measurements and organize proficiency tests.

## Conclusions

Regarding the quality of RM, the ISO 17034 standard establishes requirements for assessing their homogeneity and stability because they have a major influence on defining RM characteristics. Thus, the homogeneity test is required for all the characterization schemes of the RM, because it provides information on possible variations of inhomogeneity, the presence of impurities or deficiencies in the production of granular reference materials.

In addition to the necessary infrastructure, for the development of the quality system in the production of reference materials, at least 30 specific procedures and 20 work instructions are required, and over 40 standard forms.

## Acknowledgments

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# LEAN MANUFACTURING METHODOLOGY FOR IMPROVING PRODUCTION FLOWS ON AN ASSEMBLY LINE

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## Abstract

**Purpose** – The article presents another stage of development of the methodology for improving production flows on an assembly line in the automotive industry.

**Approach** – The Lean Manufacturing methodology was developed to present in a logical chaining way the methods specific to this concept of production management, and as to allow efficient analysis and continuous increase of the performance of an assembly line. This chaining requires that, according to the results of each method application, specific paths/ methods will be followed/ applied.

**Findings** – This methodology was experimented and validated in the laboratory which integrates an experimental demonstrator (an assembly line of an experimental product), software (to analyse, improve or optimize different layouts of the workstations or line production and production flows) and specific concepts (learning, experimenting and research platforms) of the Lean Learning Factory. Along with the “Lean cubes” platforms, for each Lean method (5S, VSM, DOJO, Poka-Yoke etc.), flowcharts and tables specific to their application were made.

**Research limitations/implications** – The developed methodology allowed the increase, during the project/ research, of the TRL level (technological training level) of the experimental demonstrator from 2 to 4. The platforms specific to Lean methods can be used for other production systems, being able to be used successfully in any Lean learning factory, but the experimental demonstrator is intended only for assembly lines.

**Practical implications** – The lean manufacturing methodology presented in this paper can be used successfully in the “Lean learning factory” type laboratory for the education and training of students and employees of companies in the automotive industry.

**Originality/value** – The study is part of a research project of the authors, which has as aim the development of a methodology of improvement of production flows in the automotive industry, by integrating modern techniques and instruments of production management.

**Key words:** lean manufacturing, learning factory, assembly line

## Introduction

Around the 1950s, at the Toyota plants in Japan, the Toyota Production System (TPS) was created, with the aim of increasing production by using as few resources as possible, reducing physical effort, efficient use of equipment, time, movement and space and adding value to the final product. Starting from the TPS system, Womack first introduced the concept of Lean production (Womack et al., 1990). Thus, Lean Production or Lean Manufacturing are names currently adopted for TPS-based systems, and these are frequently found in the literature.

To achieve the main objectives of Lean manufacturing, several methods and techniques have been proposed, as highlighted by Ohno (Ohno, 1988) and Pascal (Pascal, 2007):

- Objective: Maximum Availability of Resources:  
TPM (Total Productive Maintenance) – OEE (Overall Equipment Effectiveness)
- Objective: Maximum Quality (Zero Defect):  
TQM (Total Quality Management)
- Objective: Minimum Productive Flow/Maximum Speed  
Cellular Manufacturing, SMED Systems and Error Proof (Poka-Yoke) Systems
- Objective: Minimum Inventory (Zero Inventory)  
JIT/Kanban Systems

Also, to support decision-making, several tools have been developed, such as: Value Stream Mapping (VSM - to evaluate the company and generate a map of all information flow processes), Kaizen (a continuous improvement program implemented within the company), 5S (tool intended to organize and clean the workplace), Visual Management (displaying the company's activities so that the whole team involved in the work has easy access) etc.

Throughout time, Lean methods and techniques have already proven their efficacy in various sectors, firstly in the automotive industry. Their use in the context of globalization of production and strong competition in the automotive industry, allows manufacturers to offer customers a wide range of good quality products at lower prices, by continuously improving the production system. This is possible by adapting production systems, especially assembly lines, to mass customization so that they can offer the variety demanded by customers, while limiting their costs and maintaining profitability (Limere, 2012).

On the other hand, to develop and transfer fundamental knowledge, e.g. about methods for process improvement (Lean manufacturing), to students or seminar participants from industry, a novel concept was developed: Learning Factory (Kreimeier et al., 2014). A Learning factory includes elements of learning or teaching, as well as a real manufacturing environment (Wagner et al., 2012), which allow the analysis, simulation and optimization of various aspects of production systems and, thus, their easier and faster application in industry by the students or participants.

### **Research problem**

This study is part of a research project of the authors that has as aim to develop new methodologies of improvement for the production flows of automotive industry, by integrating modern methods, techniques and tools of production management. The starting conceptual model is appreciated as having Technology Readiness Level 2 - TRL2 (DOE G 413.3-4, 2009) and was presented in (Gavriluta et al., 2018).

The proposed model has 3 interrelated investigations areas - layout design, modelling and simulation flows, Lean manufacturing – and, until now, the project team developed several studies in these areas: methodology for designing the layout for an assembly line to the automotive industry using the Lean concept (Gavriluta et al., 2018), methodology of learning to use simulation in the analysis of production system performances production system (Gavriluta et al., 2019), ergonomics study on an assembly line used in the automotive industry (Anghel et al., 2019), approach with genetic algorithms to improve the workstation space planning (Belu et al., 2019), SixSigma application (Belu, 2018) and implementation of Kanban using indoor location based on RFID (Belu et al., 2018). All these studies were integrated into general *Methodology for improving production flows on an assembly line*, fig. 1 (Nitu et al., 2020).

This paper presents another step of this methodology, *Lean manufacturing application*, which is applied in the exploitation stage of the assembly line. This methodology was experimented and validated in the laboratory which integrates an experimental demonstrator, software and specific concepts of the Lean Learning Factory (Nitu et al., 2019).

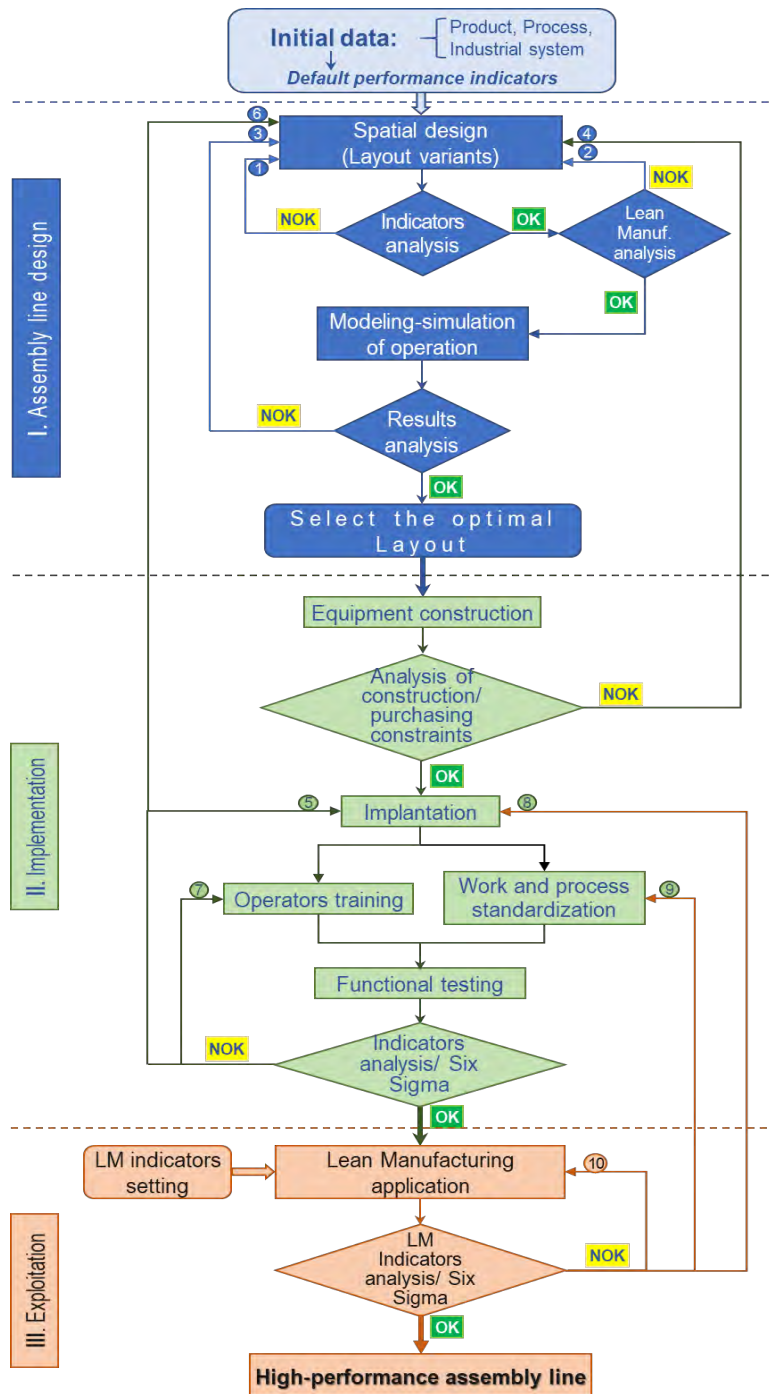


Fig.1 Methodology for improving production flows on an assembly line

### Approach

The application methodology of Lean Manufacturing was developed in order to present in a logical chaining way the set of methods specific to this modern concept of production management, so as to allow efficient analysis and continuous increase of the performance of an assembly line. The performance of the assembly line is assessed by Lean indicators (whose value is to be achieved / increased), such as:

- Productivity – number of products assembled per hour;
- Quality – number of products without defects;
- Cost – cost per unit for the process of the assembly on the assembly line;



- Delivery time – the time between the moment of clients product demand and the moment when the product is available to the client;
- Safety and environment protection– possible situations of risk for the environment, with ways to prevent them, actions to collect and constant monitor the wastes (to surpass possible danger situations and to guaranty the safety conditions);
- Human capital – teamwork or the optimal use of the available human resources knowledge. The purpose is to increase the abilities of each team member (of teamwork, of team leading, of logical and clear thinking, of problem solving) and to increase the confidence of the team members in the own competences.

To obtain the LEAN performance indicators is needed to analyze and to do a successive evaluation of the stability and standardization of the process, its efficiency, “Just in Time” delivery of products, of the quality management system, of the working team, and followed with the use of specific methods that lead to improvements in the assembly lines functioning, fig. 2.

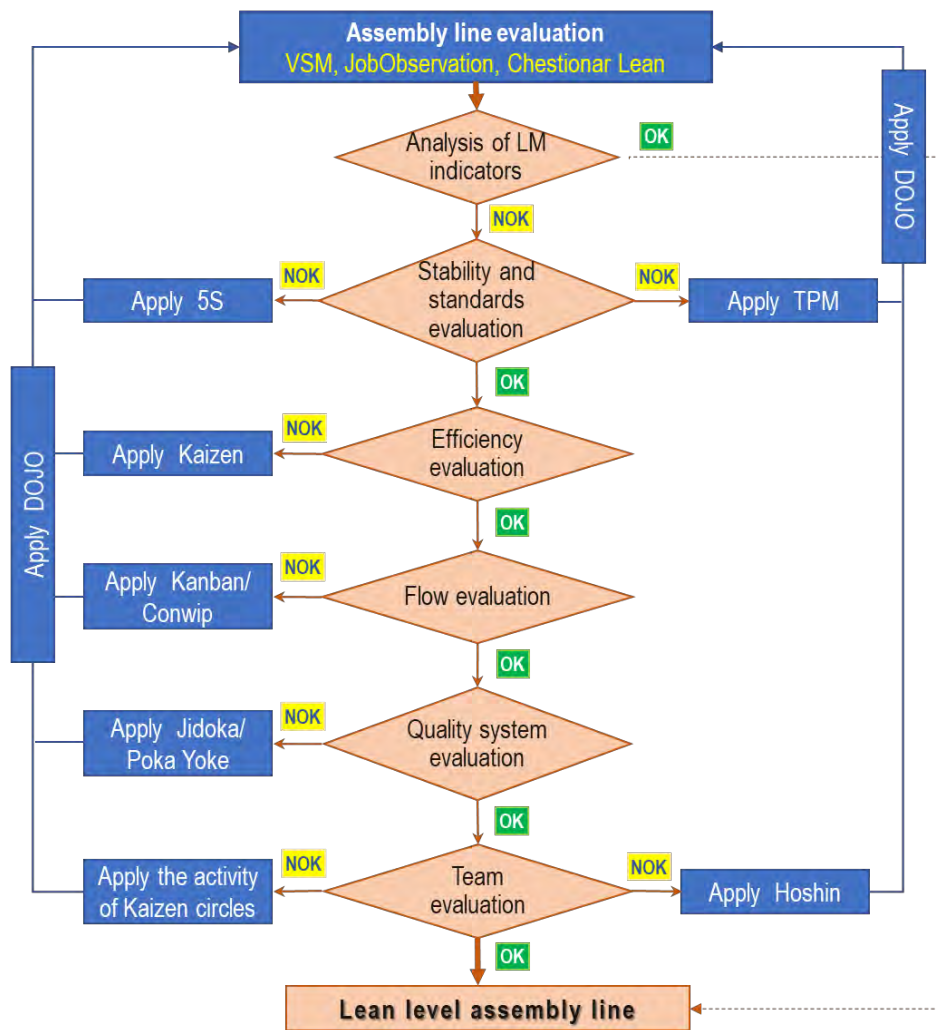


Fig. 2 Lean Manufacturing application methodology

**“Assembly line evaluation”** consists in the use of some methods to define, measure and analyze the flow of “things that are transformed”, whether we talk about stocks, products or documents. These methods are: Value Stream Mapping – VSM, JobObservation and Lean Manufacturing Questionnaire. Value Stream Mapping – VSM is one of the most important methods of analysis of a production system, that helps to identify the current state and the improvement opportunities. JobObservation is a method of analysis of the activities that take place in a production system, with its help are confirmed the existence of standards and can be easily identified solutions of improvement. The method is based on the observation of the activities and on discussions with the operators. The Lean Questionnaire is a form

that highlights the current status of the system by comparing it to the targeted Lean level. The evaluation focuses on:

- Philosophy – the long term thinking to an excellence vision;
- Process – stability, the consistent delivery of what the client wants, when he wants it;
- People – respected and guided to become process developers, to reach challenging objectives;
- Problem solving – with the help of Plan-Do-Check-Act model, using innovation to reach the excellence vision.

The results obtained after the implementation of these methods are analyzed in the step “**Analysis of LM indicators**”. If the LM indicators resulted after the evaluation are in the range of established limits, is concluded that the assembly line has the needed performance, and the improvement of its performance implies the change of the Lean Manufacturing indicators. In the situation when the LM indicators resulted after the evaluation are not satisfactory, the team passes to the next stage, “**Stability and standards evaluation**”, that consists in the analysis of stability and process standardization of the assembly line.

The most frequent causes of process instability in an assembly line are:

- The problems of quality of parts that are supplied from the external suppliers;
- The stocks of parts that are undersized in the workstations;
- Problems of equipment, tools, conveyers and other transport systems;
- The waiting time of the operators without activity;
- Safety issues caused by the design/ not ergonomic placing, sliding, tripping, falls of the operators.

A standard must give a clear image of the working way for the operator/ process in the targeted area, must be simple, clear and visible. With its help the abnormalities of the process are seen faster, making possible a quick implementation of the needed actions of improvement.

To evaluate the stability and the standardization of process in an assembly line can be used the following tools:

- Table/ chart of production capacity: documents the functioning time of machinery and operators and allows to quickly identify the bottlenecks in the system;
- The conjunct table of standardized work: highlights the steps to make the activities and their sequence, the duration of each activity, the working time for each operator and of each machinery and the interaction between operators or between operator and machinery;
- The analysis chart of standardized work: helps the rationalization of placing and training the workers. This includes the spatial organization of the workplace, the steps of the process and the durations for each activity, important articles for quality and safety, the standard work in process;
- Job Elements Sheet (JES), that contains: operations/ activities needed to make the product; the reason, motive to make the activities; images and photos that show the important key points; control records.

To increase the performances of a production line is absolutely necessary to stabilize and standardize the processes specific to the 4M:

- Man: team members;
- Machine: machinery, devices, conveyers and other transport devices, etc.;
- Methods: the used processes;
- Material: raw materials and the details given by the supplier.

The stability and standardization impose the use of specific methods and techniques of visual management/ 5S (the 5S method is the backbone of standardize work and Just In Time production) and Total Productive Maintenance (TPM, that is the way to stabilize and standardize the methods and

machinery). Therefore, if after the evaluation of stability and standardization it is concluded that the assembly line does not meet the requirements, the next steps are organized “**Apply 5S**” and/or “**Apply TPM**”, in parallel with the step “**Apply DOJO**”. The use of these methods is restarted until the assembly line is completely stabilized and standardized, moment when the team can pass to the next steps.

After the stabilization and standardization of production process, the team can start the improvement activities. The production processes contain, in most cases, waste (muda). The stabilized and standardized work supply the initial information to improve the activities of the operators, by identifying the added value and the wastes in the process. The efficiency can be defined by:

$$\text{Efficiency} = \text{Total achieved production} / \text{Involved work force}$$

Therefore, Lean Manufacturing highlights that one of the ways to increase the efficiency consists in decreasing the workforce involved in the process. In this context, in the next step “**Efficiency evaluation**” the purpose is to evaluate the efficiency of operators use in the assembly line. The tools used in this stage are:

- The chart of operators workload;
- The analysis of Cycle Time vs Takt Time;
- The combined table of standardized work;
- The analysis of operators movements;
- Ergonomic analysis of the workplace etc.

If, after the evaluation it is concluded that the assembly line is not efficient, the team passes to the next step “**Apply Kaizen**”, in parallel with the step “**Apply DOJO**”. The use of these methods is resumed until the assembly line reaches the needed efficiency level.

In the step “**Flow evaluation**” it is checked if the assembly line works in a pull flow, in a continuous way and in small production lots, preferable part by part (one-piece flow), characteristic of Just In Time production (JIT). If it is concluded that the line works in a push flow manner, the team will apply methods to reach pull flow by using Kanban or Conwip. This is done in the step “**Apply Kanban/ Conwip**”. Kanban and Conwip are visual methods to manage the production, that synchronize and give information for the suppliers and the clients, intern and extern of the production system. This step is done in parallel with the step “**Apply DOJO**”, until a pull flow is reached.

The implementation of Lean Manufacturing imposes also the implementation of a continuous improvement long term strategy. Therefore, in the step “**Quality System Evaluation**” it is evaluated the assembly line capacity to prevent, discover and reduce the errors that can lead to defects. If the obtained results are not satisfactory the team will pass to the step “**Apply JIDOKA/ POKA YOKE**” and, in parallel the step “**Apply DOJO**”. The JIDOKA method consists in a fundamental rethinking of the quality management methods, different from the statistical methods, it leads to 100% inspections and use of POKA YOKE tools. A POKA YOKE is a simple and robust, inexpensive, device that allows 100% inspections of parts, identification of errors that can lead to defects and helps to find fast solutions to implement.

The involvement of team members is the heart of LEAN production. The involvement develops abilities for the team members and improves the long-term perspective, by eliminating wastes caused by the inefficient use of team members knowledge (that are, probably, the most obvious type of waste). Therefore, in the step “**Team Evaluation**” the management team evaluates the degree of involvement of the team members in solving problems and the capitalization of their knowledge. The activities of Kaizen circles (KCA) are, probably, the best way to encourage the involvement of the team members in the solving of identified problems. The involvement must be planned and controlled as good as the production and quality, and the most adequate method to do that is HOSHIN. If the answered obtained is unsatisfactory the team will pass to the steps “**Apply the activity of KAIZEN circles**” and “**Apply HOSHIN**”.

## Findings

In order to experiment and validate the developed methodologies, an experimental demonstrator (TRL4 level) – fig.3 was developed in the laboratory (Gavriluta et al., 2018). In fact, this experimental demonstrator is an assembly line of an experimental product (steering wheel) that can be made in several variants, through manual assembly activities. The assembly line was designed to integrate Lean principles: high flexibility for the workstations, one-piece flow, minimizing the activities with non-added value and, also, some concepts specific to Industry 4.0: a digital structure for one of the workstations.

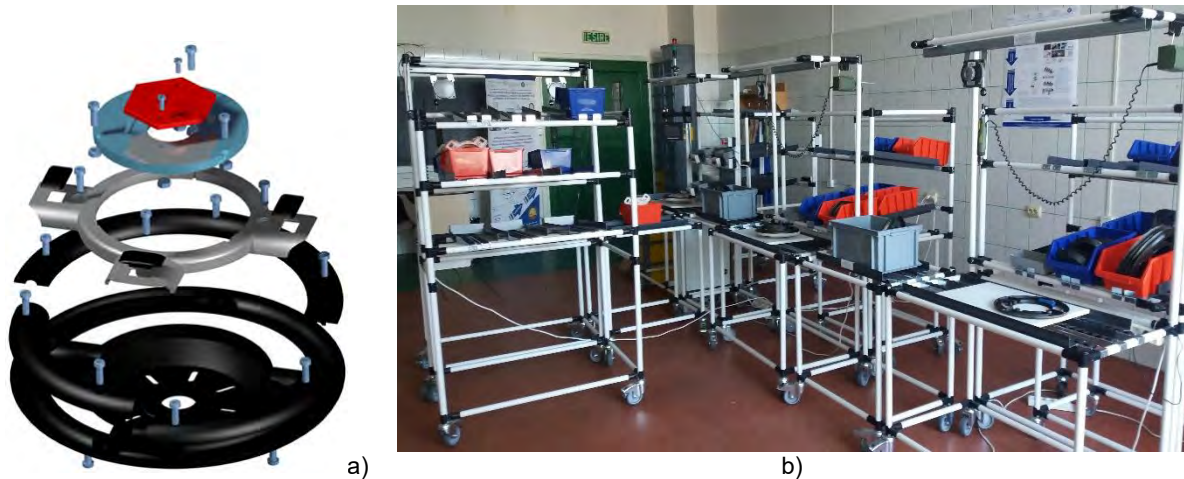


Figure 3. Experimental product (a) and experimental demonstrator (b) used in Lean Learning Factory laboratory.

Also, this laboratory integrates along with the experimental demonstrator, software and specific concepts of the Lean Learning Factory (Nitu et al., 2019). Software as IMPACT, TECNOMATIX (FactoryCad, FactoryFlow, Jack, Plant Simulation) and ARENA SIMULATION are used in order to analyse, improve or optimize different layouts of the workstations or line production and production flows.

To facilitate the understanding of the Lean manufacturing methodology on the assembly line (on the experimental demonstrator), its use and experimentation, a lot of methodologies and platforms specific to lean methods (5S, VSM, DOJO, Poka-Yoke etc.) were developed and tested in the laboratory. The platforms were made into “Lean cubes” from modular aluminium tubes, which are display systems that mix a white board with Lean display concept, providing a compact teaching solution, information display and visual management. Along with these platforms, for each Lean method, flowcharts and tables specific to their application were made, using the “Learning Factory” concept. Some of these methods and methodologies, together with their instruments are summarized below.

**Value Stream Mapping – VSM** is a method that allows the analysis with the help of a simple figure of the whole process of product making, from the moment when the client places the order to the moment when the products reach him. The VSM shows the flow of materials and the flow of information, as they go from a stage to another all along the process. The use of VSM to study the flow of production for a product consists in following the steps is presented in fig. 4. To apply this method in the analysis of an assembly line, using “Learning Factory” tools, was made a “VSM platform”, fig. 5.

**The 5S method** is a way to organize the workspace, that intends to make a clean, stable and efficient workspace. The use of 5S method to improve the workspace consists in following the steps shown in fig. 6. To apply this method on the assembly line, was made a “5S platform”, fig. 7, using a tool named “Lean Cube”, each side corresponding to a step (Wilson, 2010).

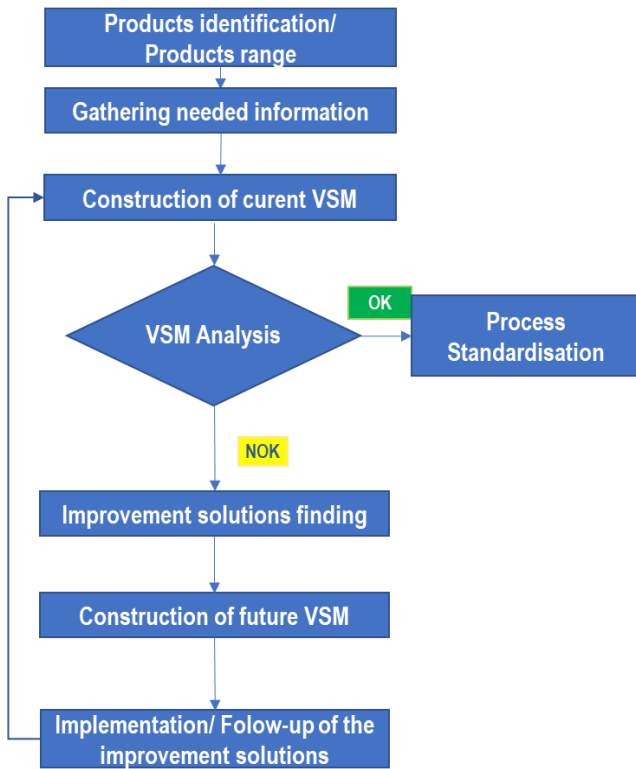


Figure 4. VSM application methodology



Figure 6. 5S application methodology



Figure 5. VSM Platform

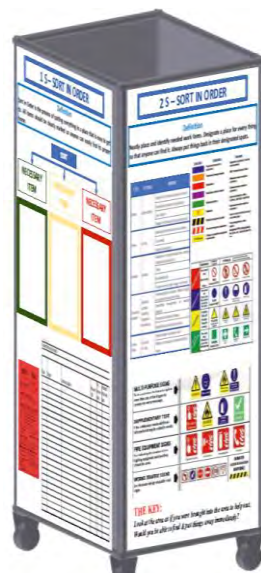


Figure 7. 5S Platform



Kaizen is a method of continuous improvement, which is done step by step involving everyone, managers and workers alike (Imai, 1989). Kaizen is Japanese word composed of two terms: “Kai”, which

means continuous and “Zen” which means improvement (Newitt, 1996). The stages and activities specific to the Kaizen methodology are based on the application of a PDCA (Plan–Do–Check–Act) cycle, which is also called the Deming cycle and are presented in fig. 8. In order to facilitate the use of this methodology, a lot of predefined tables and documents / instruments are proposed, fig. 9.

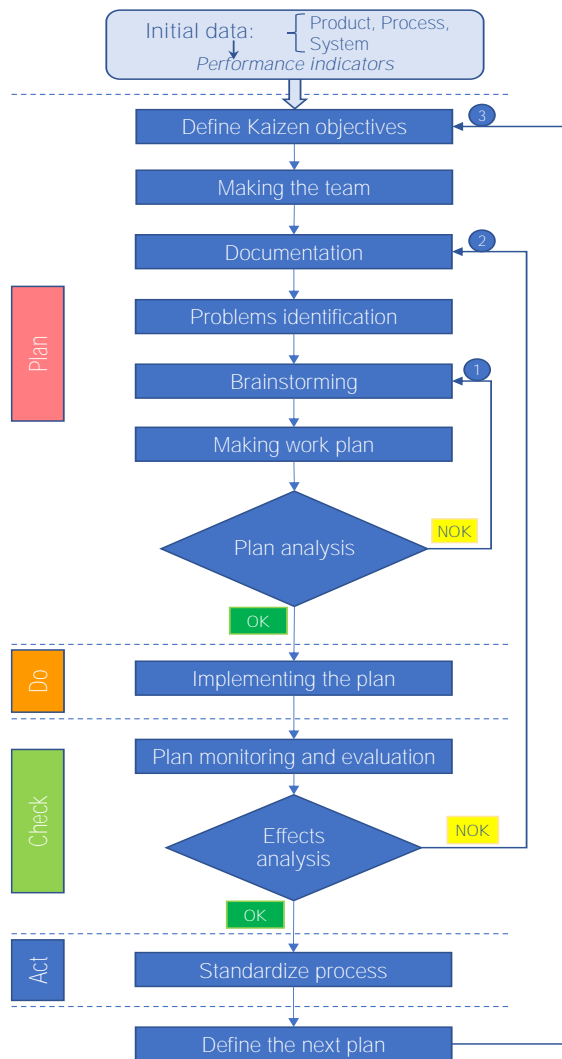


Figure 8. Kaizen application methodology

Date of completion:	KAIZEN ACTION PLAN			Ending date:
Task	Responsible	Duc	Status	Remarks

Kaizen Report	
Location	Department
Initial Condition (What was the problem?)	Solution Proposed (What was implemented, changed or improved?)
Before (Include pictures, diagrams, etc.)	After (Include pictures, diagrams, etc.)
Benefits Category <input type="checkbox"/> Quality <input type="checkbox"/> Safety / Health <input type="checkbox"/> Cost <input type="checkbox"/> Environment / Energy <input type="checkbox"/> Delivery <input type="checkbox"/> Customer responsiveness <input type="checkbox"/> Efficiency <input type="checkbox"/> Morale <input type="checkbox"/> Waste <input type="checkbox"/> Other	Benefits Description (results, cost benefit analysis, cost savings etc.)
Originated By	Validated By
Approved By	Contact Details
Team Members	
Implementation Date	Date of Completion
Remarks	

KAIZEN BOARD			
IDEAS	TO DO	DOING	DONE

Fig. 9 Tables specific to the application of the Kaizen method

**Poka-Yoke** is a quality tool invented and implemented by the Japanese engineer Shingo Shigeo (Shigeo and Dillon, 1989). By translating the two Japanese words "Poka" - mistake and "Yoke" - to escape, one arrives at the translation of the "Poka-Yoke" method (Shimbun, 1989). The purpose of this tool is to eliminate the defects of a product by preventing and correcting the errors as quickly as possible.

Poka-Yoke is a simple method of identifying defects, it is robust and easy to implement. Therefore, this method is also called „ZQC” (Zero Quality Control), „error proofing” or „mistake proofing”, and its application stages are shown in the figure fig. 10. The fig. 11 shows a simple Poka-Yoke device used on an assembly line workstation.

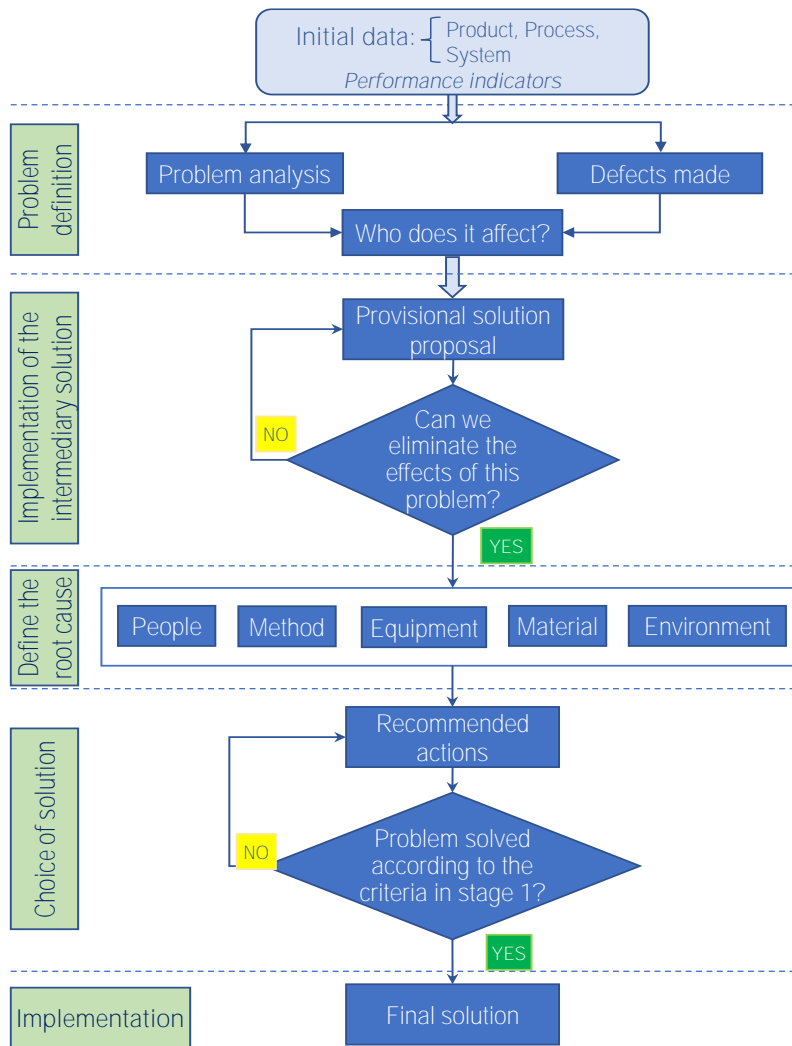


Figure 10. Poka-Yoke methodology

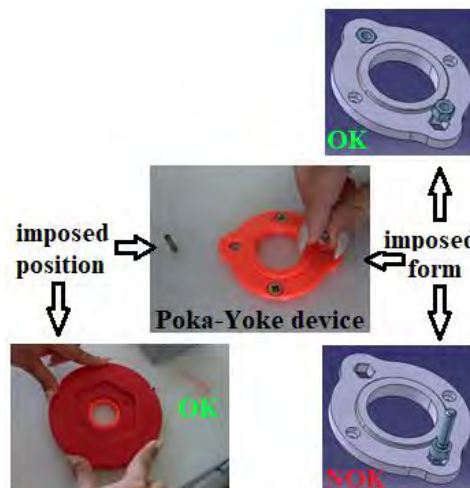


Figure 11. Poka-Yoke device used on an assembly line workstation

The **Hoshin Kanri** method is a tool for effective strategic that makes it easy to identify critical targets, evaluate restrictions, establish performance measurements, develop implementation plans and conduct to periodic review meetings used to carry out the alignment (Lagarda-Leyva et al., 2014). This is a technique that helps organizations to focus their efforts and analyse their activities and results. It

translates the vision and mission of an institution in an understandable arrangement of tactical objectives, which defined performance indicators and transforms them into a framework of project-based work (Jimenez, P. et al., 2016). The proposed steps for applying this method are shown in the fig. 12. The most popular way of implementing this method is applying the Hoshin Kanri matrix that includes goals, strategies, strategic projects (initiatives) and owners, fig.13.

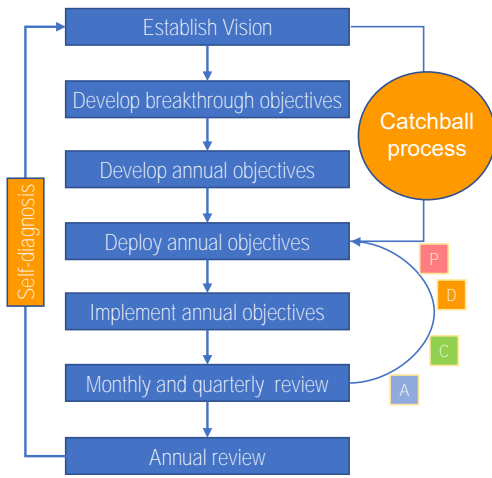


Figure 12. Hoshin Kanri methodology

			Activity 1:								
			Activity 2:								
			Activity ...:								
			<b>Priorities and Activities</b> <b>Annual Objectives</b> <b>Key Performance Indicators</b> <b>Long-time objectives</b>								
Annual objective 1:											
Annual objective 2:											
Annual objective ...:											
				KPI 01:							
				KPI 02:							
				KPI 03:							
				KPI 04:							
				KPI 05:							
				KPI ...:							
				Owner 1:							
				Owner 2:							
				Owner 5:							
			Long-term objective 1:	Correlations/ contributions			Resources:				
			Long-term objective 2:	● Direct / primary							
			Long-term objective ...:	○ Complementary							

Figure 13. Hoshin Kanri Planning matrix

Kaizen circles encourage employees to improve service activities through their own proposals in order to increase productivity. These are held consistently on a regular basis comprising six to eight employees usually led by a team leader and circle consultant instigated to resolve work related issues, typically chronic quality or productivity issues (Damrath, 2012). Structural problem-solving algorithms, fig. 14, are conducted through these meetings ending up with a delivery in form of a report, as shown in the fig. 15.

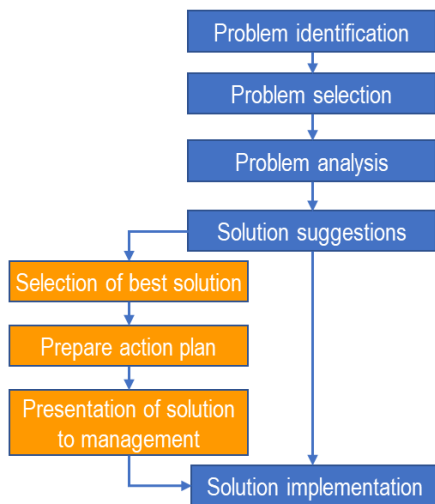


Figure 14. Kaizen circles methodology

Start day		Scheduled finish day	
1. Problem Identification	Circle area	Circle theme	
2. Circle consultant.....		5. Countermeasures (Development and implementation)	
Circle leader .....			
Circle members	4.....		
1.....	5.....		
2.....	6.....		
3.....	7.....	6. Countermeasures check	
	8.....		
Name of the team			
3. Problem selection	Problem		
Purpose			
Activities plan			
4. Cause problems analysis			

Figure 15. Kaizen circles reporting form

Dojo is a management method which allows the managing and continuous improvement of a grand diversity of problems by training to achieve the best performances in the workstations. In a Lean environment, a Dojo is a place and method for structured knowledge sharing by employees through other employees, encouraging their multi-skill capabilities, with the idea of "what our best resources know, can benefit the rest" (Damrath, 2012). The main idea of the concept is sharing of best practices how to execute tasks. The proposed steps for applying this method are shown in the fig. 16. A DOJO workstation used for wiring assembly was developed in our laboratory, fig. 17.



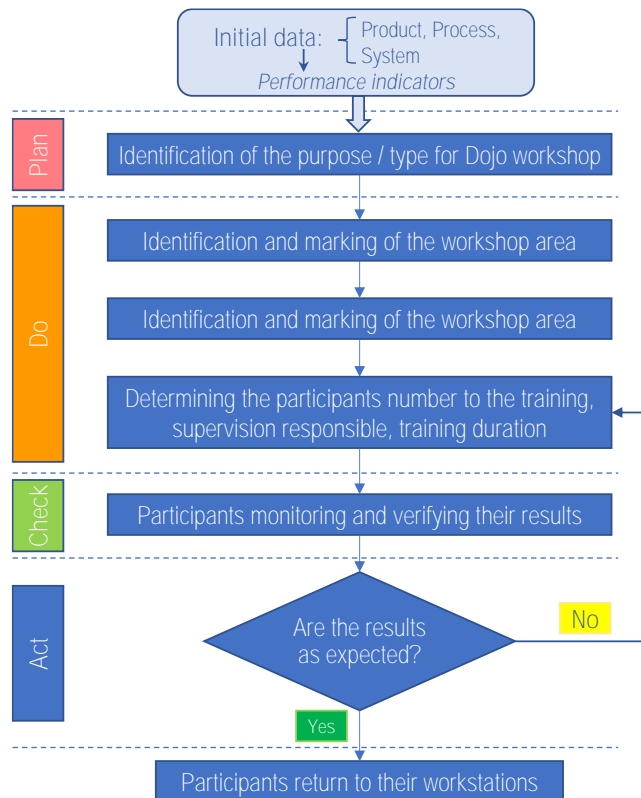


Figure 16. DOJO methodology



Figure 17. DOJO workstation for wiring assembly

## Conclusions

In this paper is presented a methodology to use Lean manufacturing methods and techniques in order to improve an assembly line performance. The Lean Manufacturing methodology was developed as a logical chaining way the methods specific to this concept of production management, and according to the results of each method application, specific paths / techniques be followed / applied. This methodology was experimented and validated in a "Lean Learning Factory" type laboratory and, along with the "Lean cubes" platforms, for each Lean method (VSM, 5S, DOJO, Poka-Yoke etc.), flowcharts and tables specific to their application were made

The Lean manufacturing methodology allowed the increase, during the project/ research, of the TRL level (technological training level) of the experimental demonstrator from 2 to 4. The platforms specific to Lean methods can be used for other production systems, being able to be used successfully in any Lean learning factory, but the experimental demonstrator is intended only for assembly lines.

The Lean manufacturing methodology can be used successfully in the "Lean learning factory" type laboratory for the education and training of students and employees of companies in the automotive industry. Future work will focus on developing and integrating Lean - Industry 4.0 platforms and integrating the developed methodologies into the generally methodology for improving production flows on an assembly line.

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# THE ORGANIZATION READINESS INDEX, AS A DECISION SUPPORT TOOL FOR CONSIGNMENT STOCK PROGRAM ADOPTION IN A “LEAGILE” SUPPLY CHAIN

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## Abstract

**Purpose** – The study proposes a decision support tool (DST) that takes into account the readiness of an organization to accept and implement a consignment stock program (CSP) adoption in a ‘leagile’ supply chain.

**Methodology/approach** - The paper includes a brief overview on multi-criteria decision making (MCDM) methods and uses Fuzzy logic theory to capture the uncertainty that usually occur in a decision process.

**Findings** – A correct and realistic decision, which is well accepted by the organization team is easier to implement and creates a sooner positive outcome.

**Research limitations/implications** – The proposed decisional model has a degree of limitation in the meaning that it must be adjusted according to the specific criteria of each business environment.

**Practical implications** – The seven steps DST was designed to assist the practitioners, in their decision making processes, and to encourage them to use multi-criteria mathematical programming in their basic activities, as it is proved to increase their efficiency.

**Originality/value** – The present research integrates the voices of the internal functions into a decisional process matrix. An organization readiness index is defined, to reflect the degree to which a business unit is prepared to adopt and implement a CSP.

**Key words:** Decision support tool, organization readiness, consignment stock

## Introduction

Globalization phenomenon continues to have a growing impact on business organizations, especially on their strategies and practices. Increased competition puts more pressure on managers, forcing them to perform at higher levels and making correct decisions at the right moments. The present study represents a part of a wider research, focused on CSP adoption and implementation in a supply chain governed by lean and agile strategies.

Most of the industry players seek to improve their supply chains performance by implementing lean and agile concepts and practices, either separately, or simultaneous as a ‘leagile’ hybrid system (Faur & Bungău, 2018). Lean management is the provision of maximum customer satisfaction by reducing waste through optimum utilization of resources (Womack & Jones, 2003; Gherghea & Bungău, 2018; Gherghea, Bungău & Negrău, 2019), while agile concept requires provisional sources of supplies and employment, immediately available, to accommodate the inherent variations on the market (Faur & Bungău, 2019b).

An effective supply chain management, by adopting the most appropriate strategies in a knowledge-based society, determines new approaches of conducting the business. (Abrudan & Candea, 2002; Drăghici, 2007; Avasilcăi & Rusu, 2015). These might include taking advantage of already tested models, useful programs, or best practices, along with changing the organizational culture and listening to the

voices of business functions, in order to ensure a successful implementation. Thus, having an efficient DST, pre-designed for different business models or policies is at great help and sometimes crucial. Making the good choice is of the essence when it comes to performance improvement. Under these circumstances, the present paper aims to develop a DST, with application in CSP, considering the readiness of the organization to accept the model.

### **Problem definition**

In both, literature and practice, CSP is known as an appropriate solution towards reducing inventory cost, as well as eliminating shortages, forecast accuracy issues and bringing procurement lead-times to zero, all of these being essential objectives in supply chain management. The consigned materials are legally owned by the supplier, but held by the buyer, so there are no financial implications for the buyer until the materials are consumed. The fundamentals of CSP are explained in Valentini & Zavanella, (2003). However, it is important for the organization to be ready to adopt such initiatives. A research and a case study presented by Faur & Bungău, (2019a) demonstrated that a 'leagile' company, already having in place streamline processes, clearly defined and allocated responsibilities, along with a robust ERP software solution (e.g. SAP), is more prepared to adapt to this kind of changes and has a higher rate of a success in implementation than a common firm. Nevertheless, this is not a sufficient condition, as the same authors showed that a positive result is not warranted for another subsidiary of the same company, acting under the same rules and strategies, but where the idea of adopting the CSP generated mass resistance and real barriers to the project implementation. The problems have been addressed by investigating and assessing the risks associated with the challenges, and a solution framework has been proposed, in order to overcome the barriers towards achieving the benefits of the CSP (Faur et al, 2020). The result demonstrated that people perception can be changed when the issues are properly addressed, information is shared and specific solutions are provided. Based on these insights, the present study intends to continue the research in this area by developing a decision model which integrates among the decision criteria the voices of the internal functions, making them allies in the process of change, instead of generating conflicts.

### **Research methodology**

The study includes a brief overview on MCDM methods and proposes a DSP for CSP adoption in a 'leagile' supply chain. Fuzzy logic theory is used to capture the uncertainty and doubt that usually occur in a decisional process. The objective is to enhance the effectiveness of a decision making process and consequently to identify the appropriate criteria, rank them according to their level of importance, to the priorities and interrelations, then obtain the most suitable combination, in alignment with the real situation. Numerical examples are considered to validate the proposed model and further, an index of organization readiness is defined, in accordance with the result obtained for the focal company.

### **Overview of various multi-criteria decision making methods**

There are multiple studies and surveys concerning fuzzy MCDM, which classify the contributions in the field depending on the theoretical basis used for the modeling. Chen & Hwan, (1992) consider that there are fuzzy ranking methods (e.g. fuzzy mean and spread, centroid index, linguistic ranking methods) and fuzzy multiple attribute decision making methods, including fuzzy simple additive weighting methods, analytic hierarchy process (AHP), fuzzy outranking methods, or maximin methods (Carlsson & Fuller, 1996). There are also main contributions in fuzzy mathematical programming, subject that is in detail presented by Inuiguchi, Ichihashi & Tanaka, (1990) in their survey.

Fuzzy MCDM models are meant to sort different options according to predetermined criteria with a single decision-maker or through group decision-making (Sofuoglu, 2019). Initially, MCDM methods assumed that all the criteria were independent, then, gradually, conflicts were introduced due to the necessity to represent antagonist interests of the decision-making group members and new methods have been developed to consider interdependent criteria (Yager, 1994).

In order to enhance precision in the results, several researchers used in their studies combinations of different methods. For example, Hsu, (2003) suggested a multi-criteria approach to integrate different opinions into an AHP, combined with the utilization of fuzzy numbers (Hsu et al, 2003), while Zhu, (2015) proposed to use evidential reasoning rules, which is another multi-criteria approach, in order to overcome the limitations of simple additive methods (Zhu et al, 2015).

Mamdani and Tagaki-Sugeno Fuzzy Inference Systems (FIS) are two widely-applied MCDM methods. The key difference between these two FIS techniques is the manner in which they calculate their crisp output values. The Mamdani-type FIS requires defuzzification, whereas the Tagaki-Sugeno-type FIS applies a constant weighted-average technique avoiding defuzzification (Khosravanian et al, 2016). Table 1 presents a number of differences among Fuzzy Mamdani and Fuzzy Tagaki-Sugeno.

Table 1. Differences among Fuzzy Mamdani and Tagaki-Sugeno (adapted from Khosravanian et al, 2016)

FIS Type	Mamdani	Tagaki -Sugeno
Fuzzification	Singleton	Singleton
Inference process	Min-max	Min-product; Order 0
Defuzzification	Center of gravity	Weighted average
Rule format	IF x and/or y, rule strength, THEN z	F x is A and y is B THEN Z = f(x,y)

### Developing the DST

As mentioned in the 'Problem definition' section, the present study is based on the insights from a couple of other previous exploratory cases of CSP implementation, one of them being successful and the other one having a negative outcome in the first attempt. Mamdani-type FIS, introduced in 1975 by Ebrahim Mamdani, was chosen to develop the DST. The decision criteria and the membership rules are set with the involvement of the stakeholders impacted by the CSP, who are included in the decision process along with the project team. The criteria include the benefits and costs along with organizational capabilities, suppliers' reliability, constraints and perceived risks. The latter criteria act like perturbation factors in the decision making process, increasing the uncertainty and level of fuzziness. Scores among the criteria were obtained based on expert interviews and a survey addressed to the stakeholders. The decision input and output variables are detailed in table 2, along with the assigned weighting for each criterion, the allocated ranges, linguistic degrees and inference rules that have been agreed.

Table 2. Decision input and output variables, weighting, rules, and linguistic degrees

Main criteria groups (set as output variables)	Crit. No.	Notations	Decision criteria (set as input variables)	Crit. Weight (%)	Input variable - range	Rules and linguistic degrees	Output variable - range [0-1]
Benefits and costs	1	Benefits	Lower average monthly inventory value (AMIV) for the consigned materials versus actual with 10%-50%	35	[10%-50%]	AMIV=50%decrease= Very High=>Decision=Yes [0.8-1] AMIV=40%decrease= High =>D=Probably Yes [0.6-0.8] AMIV=30%decrease=Med=>D=Almost Yes[0.4-0.6] AMIV=20%decrease=Low=>D=Almost No[0.2-0.4] AMIV=10%decrease=Very Low=>D=N [0-0.2]	Very low Low Medium High Very high

Main criteria groups (set as output variables)	Crit. No.	Notations	Decision criteria (set as input variables)	Crit. Weight (%)	Input variable - range	Rules and linguistic degrees	Output variable - range [0-1]
	2	Costs	Costs related to extra FTE full-time equivalent), training for new competences, new SAP CS module & extra storage space	15	[3000-10000] Eur	very low <=3000; D=Yes[0.8-1] low-3001-5000 [0.6-0.8] medium-5001-7000 [0.4-0.6] High-7001-8500 [0.2-0.4] Very High-8501-10000 [0-0.2]	
Organization capabilities & suppliers' reliability	3	SSC	Storage space capacity for the consigned materials (SSC) Actual = 400sqm - CSP optimum=700sqm	15	[400-700] sqm	Equal actual=400sqm=> D=No[0-0.4] Acceptable=500sqm=>D= Probably Yes [0.4-0.5] Required=600sqm=> D=Almost Yes[0.4-0.7] Optimum=700sqm; D=Yes[0.7-1]	Less good Acceptable Good Very good Almost perfect
	4	IIS	Integrated information systems with suppliers; SAP compatible systems	5	[1-10]	Very less compatible; No[0-0.2] Less compatible; Probably Yes [0.1-0.3] Relative compatible; Yes [0.2-0.5] Compatible; Ye [0.4-0.7] Very compatible; Yes[0.7-1]	
	5	RS	Reliable suppliers (RS), upon an internal evaluation of the embedded suppliers	10	[1-10]	Very Less reliable; No[0-0.2] Less reliable; Probably Yes [0.1-0.3] Relative reliable; Yes [0.2-0.5] Reliable; Yes [0.4-0.7] Very reliable; Yes[0.7-1]	
Functions voices integration: acceptance level of perceived risks (ALPR)	6	PR	Perceived risks (PR)	12	[10-100]	PR=Very low => D=Yes[0.8-1] PR=Low; D=Almost Yes[0.7-0.8] PR=Medium=>D=Probably Yes [0.6-0.7] PR=High=>D= Probably No [0.3-0.5] PR=Very High=>D=No [0-0.3]	Very low Low Medium High Very High
	7	IC	Implementation complexity (IC)	8	[1-10]	IC=Low=>D=Yes[0.8-1] IC=Medium=>D= Probably Yes [0.4-0.9] IC=High=>D=No [0-0.5]	
				100			

The Mamdani inference process is developed in five stages: fuzzification of crisp input values, application of logical operators in the antecedent of each rule, implication to the consequent of each rule, aggregation of the consequents of all the rules and defuzzification of the final aggregate (Chen and Klein, 1997). The result, a number, is a centroid of area, or in other words a center-of-gravity, reflecting the combination of all the input variables according to the given set of rules. Based on the FIS principles and the key actions that have to be performed, a seven steps DST proposal is developed by the authors (figure 1).

The DST refers to the action plan, namely the successive steps which are aligned with the supporting Mamdani FIS and which are compulsory to follow, in order to evaluate the organization readiness to adopt CSP and get a final decision. Upon defining relevant criteria, they are organized in pairs or triad groups, and then a process of mapping the input data sets into outputs is carried out, using fuzzy logic approach. Then, by concatenating the partial results and using the weighted arithmetic mean, the organization readiness index (IOR) is determined.

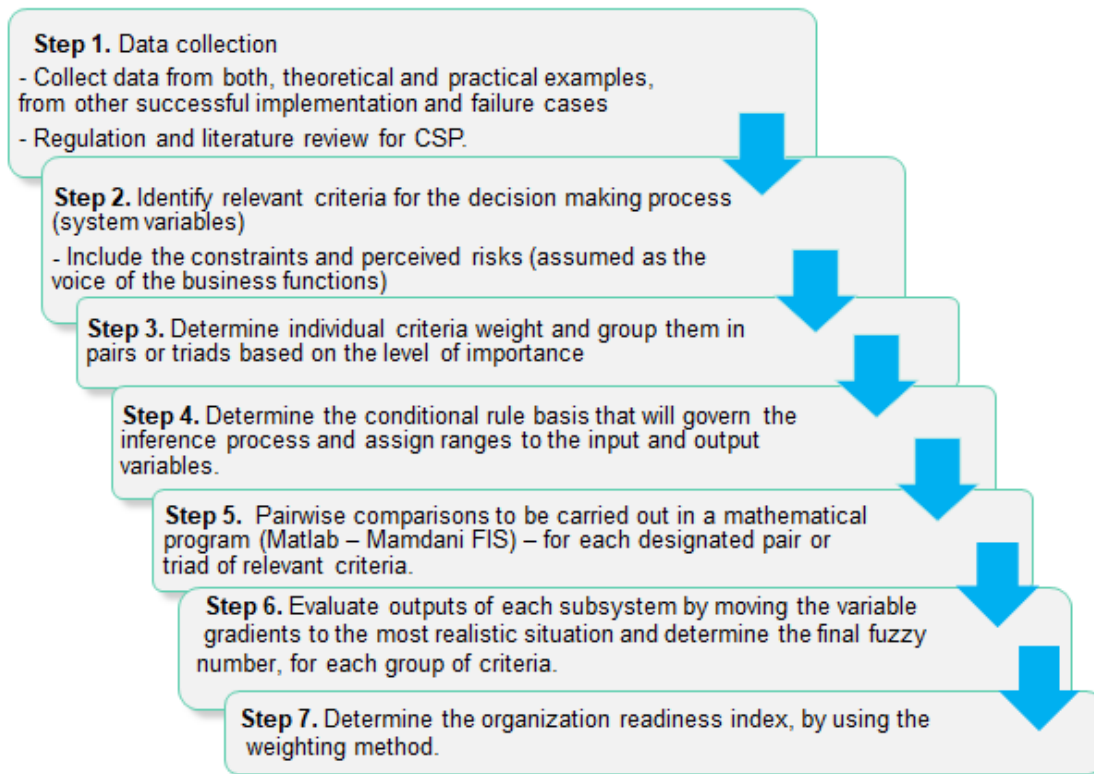


Figure 1. The proposed DST in seven steps

## Results and discussions

The inference system or the decision-making unit performs the inference operations on the rules and in the way the rules are combined, expressing the potential assessment of the constituent subsystems. Once the consensus is reached on the definition of variables and the decision rules, the inference process can be initiated for each criteria group. The implementation was developed with the “Fuzzy” toolbox of MATLAB software. Some of the sequential results are presented in figures 2-5.

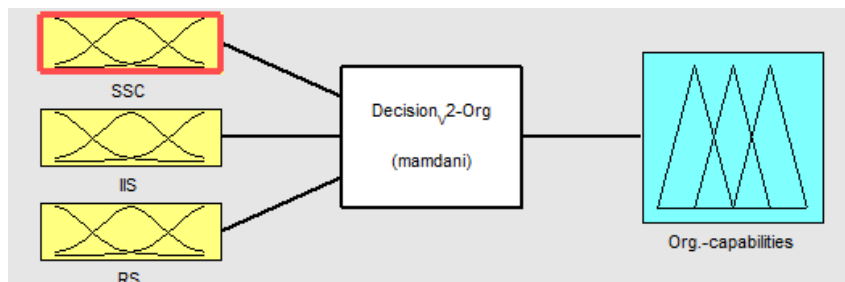


Figure 2. Input and output members for group ‘Organizational capabilities & suppliers’ reliability’

Decision-making with interdependent multiple criteria is a quite difficult task using traditional means. In case of conflicting objectives there normally is no optimal solution which would simultaneously satisfy all the criteria. On the flip side, if we have pairwise supportive parameters, that positively influence one another, then this attribute should be maximized to find the synergistic effect and Mamdani FIS has the ability to integrate such circumstances.



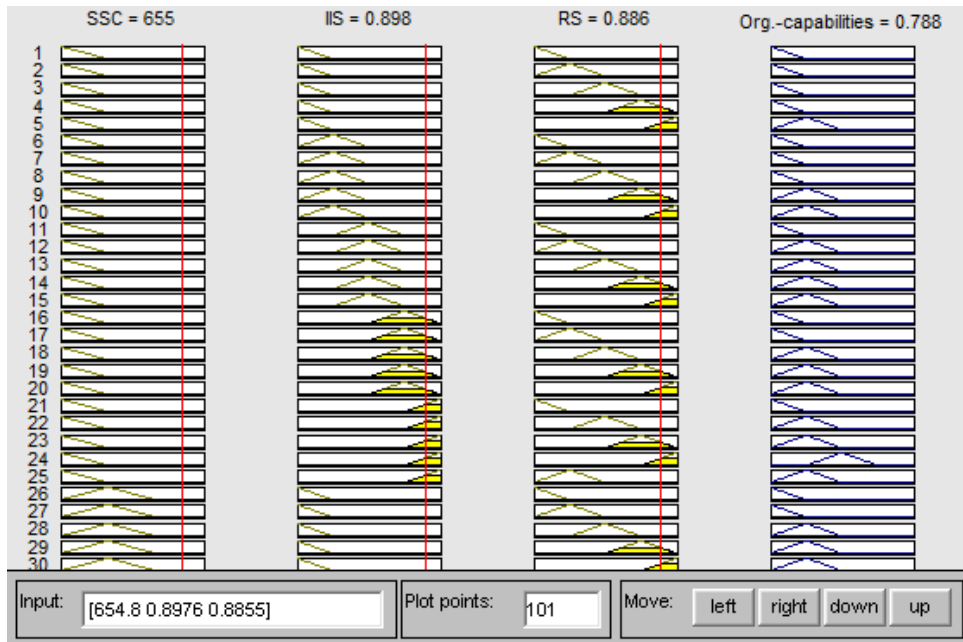


Figure 3. Rule viewer for Organizational capabilities: a suitable output value = 0.788

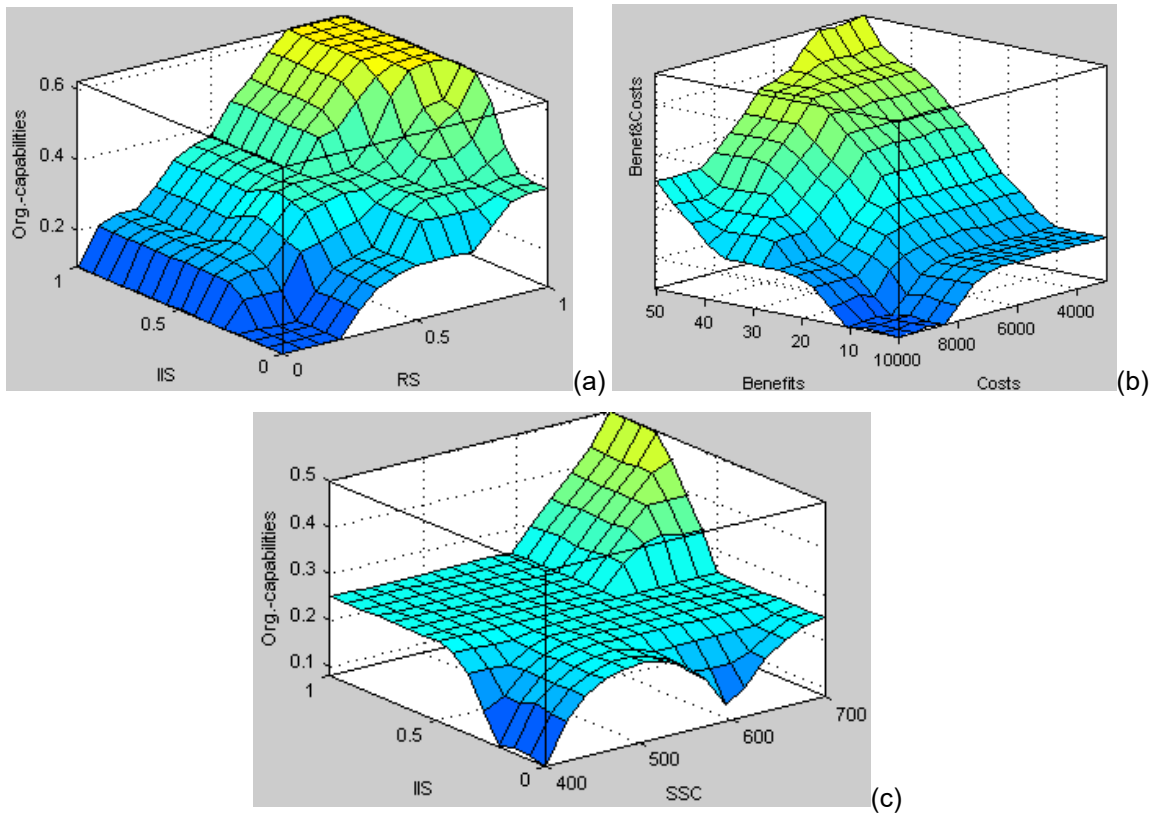


Figure 4. Inference maps for different criteria combinations: (a) supportive criteria; (b) conflicting; (c) – quite equivalent

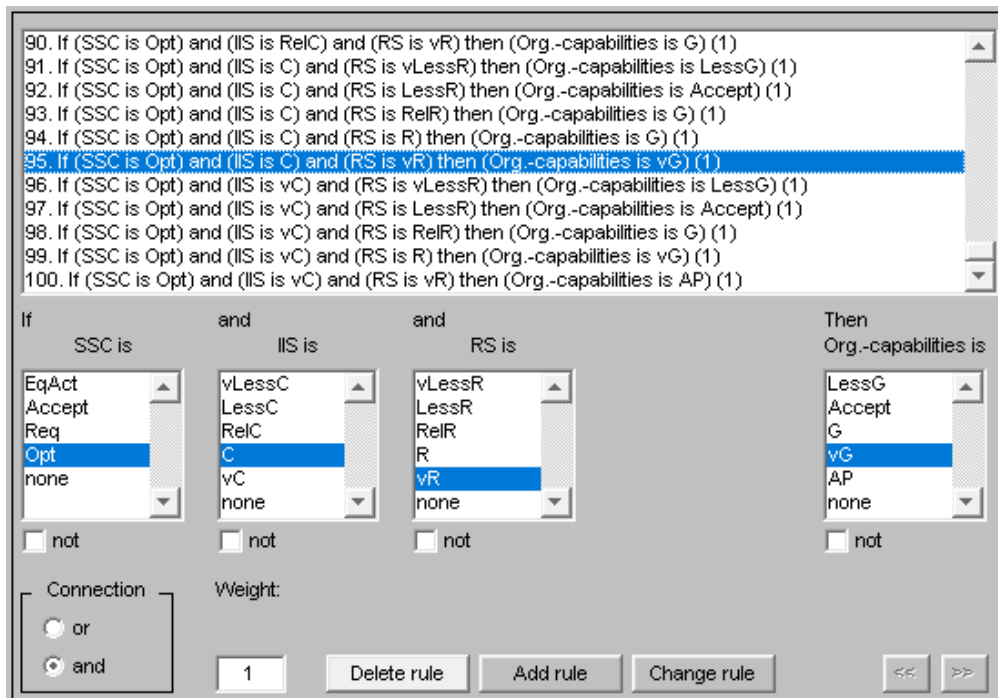


Figure 5. Agreed rules for 'Organizational capabilities' group of criteria

The developed model was tested in order to verify if it simulates the real situations described by dataset. The results indicate that the selected variables provide suitable values in the direction of adopting CSP. It also provides clear guidance in respect of what parameters have to be improved, or which of them can act as limitations, just by a simple movement of a gridline. The final results are obtained after several iterations and adjustments of variables ranges in order to get a suitable scenario. Figure 6 shows the final IOR, together with the output results per groups, and their weighting in the decisional process.

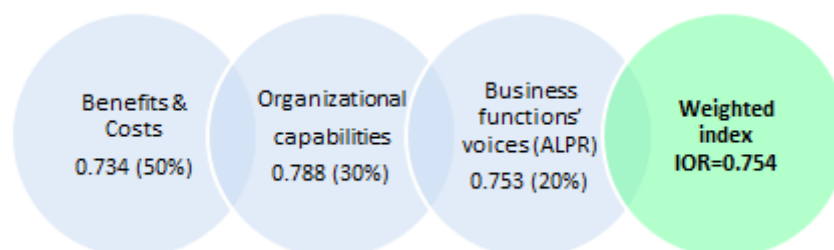


Figure 6. Weighted index IOR

## Conclusions

In several cases the decisions taken by the top management are only considered from the perspective of business performance, but often the projects fail upon or during implementation, because they are difficult to be accepted by the stakeholders. The present research takes into account as a decision input variable, the voices of the internal functions, through their perceived risks, and as an output, the accepted level of the perceived risks. This approach will lead to a correct decision, which might be well accepted by the organization team, and consequently generating a sooner positive outcome upon implementation.

The seven steps DST proposal is designed to assist the practitioners in their decision making process, while it also contributes to the existing literature in the field of CSP adoption.

Mamdani FIS was a useful approach to determine the IOR, which reflects the degree to which an organization is prepared to adopt and implement a new project.

Future research objectives might focus on using other fuzzy logic MCDM, or combination of different methods to find an enhanced alternative to our DST, in terms of precision and efficiency.

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# SURVEY ON SOCIAL RESPONSIBILITY PRACTICES AND SUSTAINABLE DEVELOPMENT REQUIREMENTS IN ROMANIAN FIRMS

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## Abstract

**Purpose** – the paper raises awareness on corporate social responsibility (CSR) and investigates the linkages between the company profile and their practices and the employee profile and their involvement.

**Methodology/approach** – the study has been performed by surveying 88 individuals working in Romanian firms. The linkages have been discovered using regression analysis.

**Findings** – the results explained the linkages and outlined the main CSR strategic objectives that companies should have and to raise awareness between employees.

**Research limitations/implications** – the study is limited by the respondents' opinions related to their knowledge.

**Practical implications** – this study provides an updated view on the CSR practices in Romanian firms. It discovers any linkage between women integration programs after a career break, recent graduates' integration and environment protection programs and the company size and if the sector influences the adoption of environmental programs. It also analyzes if employees' gender and seniority level is linked to their involvement in CSR activities.

**Originality/value** – this study contributes towards the CSR view in Romania, enabling companies to adapt their programs using GRI (Global Reporting Initiative) standard with economic, social and ecological pillars and to raise awareness about the importance of such practices.

**Key words:** sustainable development, corporate social responsibility, globalization.

## Introduction

Nowadays, globalization is an important concern. It has brought economic gains, such as international trade and services, improved transport, enabling movement of people and goods across the globe. In terms of culture and governance, globalization has led to transparency, providing greater access to press, telephones, computers and the Internet. On the other hand, globalization is perceived as creating threats to communities and environment, as it brings growth. Thus, it increases the gap between developed and undeveloped nations, it increases products consumption, it enables people migration and urbanization, ultimately leading to more emissions. Globalization processes are complex and to address the concerns, nations should have an integrated approach, combining all sustainability pillars (Martens and Raza, 2010).

To help companies report their sustainability performance, the GRI global knowledge database has been developed, providing reporting guidelines under the following pillars: ecological, social and economic. According to the report on GRI contribution towards the sustainable development goals (SGDs), GRI influences sustainable practices on the following themes: climate change, human rights, anti-corruption, market regulators, SMEs, trade and gender equality (GRI, 2020).

In the context of globalization, companies have now the opportunity and challenge to address sustainability themes at global and local level. Their impact on the community is significant and, to

ensure differentiation on the market, brand image and increased business profits, companies should adapt their sustainability practices. The global trend is to go beyond business as usual and to address global and local socially-responsible challenges.

Thus, firms should adapt their practices to ensure employee wellbeing, to contribute towards the community and to reduce their impact on the environment.

This paper addresses the concern for corporate social responsibility (CSR) and sustainable development (SD), identifies and analyzes the practices related to the requirements of sustainable development of companies operating in Romania.

### **Research problem**

In Romanian scientific literature, the concepts have been introduced in 2011, demonstrating that the most common CSR actions are philanthropic, ecological and social (Ciulu, Onea and Tatarusanu, 2015).

A micro-level survey on conducted in 2014 demonstrated that CSR has three main benefits: improves company reputation, notoriety and organizational culture (Mitra and Borza, 2015).

The National Strategy for Promoting National Responsibility outlines that CSR has a legal, ethical and volunteer grounds, not only increasing profits (Ciulu, Onea and Tatarusanu, 2015).

On the other hand, CSR leads to a higher financial effort, time and logistics, and the efforts are not justified by the benefits obtained (Mitra and Borza, 2015).

A major threat to the CSR implementation in Romanian companies is the lack of knowledge and awareness, public policies and budgetary funds. An Ernst & Young research demonstrated that companies focus their efforts in educational (79%), social (68%), health (56%) and environmental programs (58%) (Popa, 2015).

However, a study on 80 Romanian companies demonstrated that, on average, companies are not concerned about implementing CSR programs (Gherghina and Vintila, 2016). According to another study, multinational companies' presence in Romania has increased the awareness in CSR activities (Dura and Imola, 2017).

Another study emphasized a clear connection between corporate CSR communication and reporting, whether it is a CSR report or a dedicated section on the annual or financial report (Iamandi, 2012).

Although there is plenty of literature on Romanian's CSR, there are some gaps on the market analysis investigating the relationships between the company profile, the employees' profile and socially-responsible practices.

Thus, this paper aims to provide an insight on the sustainable development practices in Romanian firms by conducting a survey among employees and by using regression to identify the links between company profile and their practices, to provide an overview of the firms in the context of globalization. This paper analyzes the sustainable practices in the Romanian firms, aims to outline the state and propose indications for the future.

### **Research methodology**

The aim of this paper is to identify and analyze the correlations between the company profile and their sustainable practices.

The paper methodological approach consisted in designing a survey to interview contributing individuals and managers on their view on the CSR practices developed in the companies they work for. The data collection consisted on a questionnaire filled by 88 individuals from different sectors (IT, consumer-facing sector, energy, other) and sizes (large, medium, small companies).

To analyze their view on CSR practices developed by their companies, multiple choice questions have been addressed and the authors have applied linear or multiple regression and ANOVA methods using SPSS.

Linear regression is a method to predict the value of a variable (dependent) based on the value of another variable (independent or predictor). It has the following formula:

$$Y = a + bX$$

where  $X$  is the predictor variable,  $Y$  is the dependent variable,  $b$  is the slope of the line, and  $a$  is the intercept (Laerd Statistics, 2018).

The following variables have been used interpret the outcome of the linear regression:

- Pearson correlation – to measure the association between two variables
- $R^2$  - how much of the total variation in the dependent variable
- $F$  and  $Sig.$  - statistical significance of the regression model and  $Sig.$  has to be less than 0.05 (Laerd Statistics, 2018).

## Results and findings

The demographic structure of the sample is based on 35,2% of individuals working in other industries, 33% working in ICT (IT, telecommunications, professional services), 27,3% working in consumer-facing sectors (retail, food, tourism) and 4,5% working in the energy and infrastructure (extractives, transport, heavy manufacturing, power and utilities).

Mostly women have responded to the questionnaire, 76,1%, and 23,9% men. The majority had between 20 and 30 years old (69,3%), followed by 21,6% between 30 and 40 years old and 9,1% over 40 years old, the majority being contributing individuals (81,8%).

The study covered 39,8% individuals working in large enterprises (+499 employees), 38,6% in small enterprises (1-49 employees) and 21,6% in medium enterprises (50-499 employees).

The majority of the companies provide flexible working time for both women (71,6%) and recent graduates (53,4%). Recent graduates are also offered internships and junior programs (47,7%), job fairs (35,2%) and open doors programs (19,3%).

The most popular actions undertaken by the companies for environment protection are: reducing their energy usage (56,8%) and their general waste (53,4%).

To discover some liaisons between the company profile and their sustainable practices, the authors have applied linear or multiple regression.

The following section presents the correlation analysis between the research variables.

### *A1: Correlation between company size and practices on supporting women after a career break.*

According to a study, multinational companies are aware that CSR enhances the company's reputation and consolidates its employer's brand, which might engage employees and create a better organizational environment and culture (Obrad and Gherhes, 2018).

A good organizational culture implies sustaining inclusion, diversity and integrating women and recent graduates in the workforce. A study outlined that in United Kingdom, women after a career break wishing to enter the ICT workforce face challenges like the lack of flexi-time schemes or part-time work and are not trained properly (Panteli, 2013).

In Romania, the current survey revealed that the majority of the companies provide a flexible working time (71,6%), a work from home option (44,6%) and only 17% mentioned that they have programs to recruit women after a career break.

To discover if the company size influences practices on supporting women after a career break, authors performed linear regression.

There is a slight correlation between the variables (Pearson = 0.273). The company size accounts for only 7.4% of the variance in integrating women after a career break ( $R^2 = 0.074$ ). As ANOVA shows, the F value is 6.907 and the statistical significance Sig. is 0.01, hence the predictor is significant.

*A2: Correlation between company size and practices on integrating recent graduates in the workplace.*

Integrating recent graduates into the workforce is beneficial for both parties: the right internship program enables graduates to practice their theory and the companies to provide a job for those skilled interns (Coco, 2000). Companies can integrate recent graduates into workforce through internships, apprenticeships, graduate programs and entry-level jobs. They can get in touch with students through job fairs and provide open doors programs, seminars on different subjects and company presentations to advertise their opportunities.

In Romania, this survey revealed that the majority of the companies provide a flexible working time (53,4%), followed by internships and junior programs (47,7%), participation to job fairs (35,2%) and work from home option (31,8%).

To discover if the company size influences practices on integrating recent graduates in the workplace, authors performed linear regression.

There is a slight correlation between the variables (Pearson = 0.204). The company size accounts for only 4.2% of the variance in graduate's integration programs ( $R^2 = 0.042$ ). As ANOVA shows, the F value is 3.732 and the statistical significance Sig. is 0.05, hence the predictor is significant.

*A3: Correlation between company size and practices on environmental protection.*

A study performed in 2015 revealed that large companies developed environmental programs (Popa, 2015).

Reducing energy usage (56,8%) and general waste (53,4%) were the most common environmental protection approaches undertaken by Romanian companies.

To discover if the company size influences practices on environmental protection, authors performed linear regression.

There is a slight correlation between variables (Pearson = 0.206). The company size accounts for only 4.2% of the variance in environmental protection programs ( $R^2 = 0.042$ ). As ANOVA shows, the F value is 3.801 and the statistical significance Sig. is 0.05, hence the predictor is significant.

*A4: Correlation between company sector and the development of energy efficiency programs.*

According to a study, the companies that developed CSR programs for the environment are in the energy and infrastructure sectors (Popa, 2015).

To discover if the company sector influences the development of energy efficiency programs, authors performed linear regression. Pearson correlation is 0, therefore there is no correlation between the company sector and environment protection programs. The ANOVA test reveals the statistical significance Sig. as 0.467, hence the predictor is not significant.

From 88 responses received, only one company activated in the energy and infrastructure sector, hence the results of this test are not concluding and a deeper study must be conducted.

*A5: Correlation between the gender and seniority level and the employee's involvement in CSR programs.*

A 2018 study on a multinational company in Romania demonstrated that more than half (56%) of the employees didn't participate on any kind of CSR activity, whereas 34% participated sometimes (Rosca, Badulescu and Bac, 2018).



Another study containing 84 surveys from Bihor County employees, revealed that their age didn't have any impact on their CSR actions (Badulescu, Badulescu, Saveanu and Hatos, 2018).

This current study performed on 88 individuals from different company sectors aims to understand if the employee's involvement in CSR programs are influenced by the gender and seniority level.

To discover the linkages, the authors performed a multiple regression, where the dependent variable is employee's involvement and the independent variables are: gender and seniority level (contributing individual or manager).

Pearson correlation is 0.012 for gender and 0.276 for job level, hence there is a slight correlation between the job level and employees' involvement. Taking as a set, the predictors account only for 7.6% of the variance in the employees' involvement in CSR activities ( $R^2=0.076$ ).

The ANOVA and Coefficients analysis reveal that the regression model is significant (Sig.=0.035) and only the job level (Sig.=0.010) is a significant predictor.

Table 1. Summary of findings for this study

Company / Employee profile	Supporting women	Integrating graduates	Environmental protection	CSR involvement
Company size	Pearson = 0.273 $R^2 = 0.074$ F = 6.907 Sig. = 0.01	Pearson = 0.204 $R^2 = 0.042$ F = 3.732 Sig. = 0.05	Pearson = 0.206 $R^2 = 0.042$ F = 3.801 Sig. = 0.05	-
Company sector	-	-	Pearson = 0 Sig. = 0.467	-
Gender	-	-	-	Pearson = 0.012 Sig.=0.972
Seniority level	-	-	-	Pearson = 0.276 Sig.=0.010  <b>Set:</b> $R^2 = 0.076$ Sig.=0.035

By summing up the findings, these results explore the links between the company characteristics and their CSR practices, as well as the employee profile and their CSR involvement.

This study reveals that on average, companies provide one program to integrate women after a career break and two programs for recent graduates, the company size having a slight influence on these. The company sector doesn't influence company's environmental protection programs.

The seniority level (contributing individual or manager) influences the level of involvement in CSR activities, and looking at the survey results, managers are more active.

As strategic plan, to implement corporate social responsibility practices, companies can work with specialized agencies and create a CSR department under marketing or HR to be in charge with their implementation. Visibility on this practice is necessary for the employees to get involved. CSR practices enable companies to build a stronger organizational culture, an enhanced brand image and competitive advantage.

To encourage employees into CSR activities, companies should provide the grounds. They can organize team buildings for environmental and social clauses such as: planting trees, cleaning forests, donating money to a cause, teaching, training or providing successful career stories to young people or future high school graduates. To report their CSR activities, companies can use GRI guidelines on social, environmental and economic contributions.

## Conclusions

This paper is grounded on several previous studies conducted in the Romanian market on the issues of correlation between CSR and relevant involvement in social initiatives. They suggested some connections between social responsibility communication and involvement in social initiatives, as well as the links between the CSR practices and the firm value.

This paper provided an up-to-date view on the CSR practices in Romanian firms, showing if there is a clear liaison between the company size or sector and sustainable practices and if the employees' gender and seniority level influence their involvement in CSR activities.

By knowing these liaisons, companies can adapt their practices in order to enhance their sustainable development strategies.

The limitations of current research emerge from the sample population, only 88 responses have been received from contributing individuals and managers from 3 major sectors (ICT, energy and infrastructure, consumer-facing goods), whereas the energy and infrastructure sector has been poorly represented.

As future research avenues, authors purpose is to extend the research sample and to provide more links between the company's characteristics and their social responsibility and sustainable development involvement.

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# HUMAN RESOURCES PLANNING MANAGEMENT ON CONSTRUCTION SITES

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## Abstract

**Purpose** – One of the main objectives of a manager must be to study the ways of applying different technologies, so that by applying them the company is successful. When the objectives are met and the company is successful, it can expand both its production and the market for its products.

**Methodology/approach** – The rapid access to the results of various researches and their implementation in a large number of countries is the result of the phenomenon of globalization. Increasing productivity, modernizing technological flows, reducing the execution time in making a product while improving its quality, are basic priorities of any manager.

**Findings** – Achieving the goals of the organization and increasing performance within the company can be achieved by applying efficient management. If the manager has access to information, both in the country and abroad, the success of the company is possible. The theories studied must be able to be put into practice and be appropriate to the specifics of the field in which they are applied.

**Research limitations/implications** – The paper presents the results of the research, which aims to study the work teams in a process in the field of construction. This study was carried out in order to be able to effectively form work formations in the case of construction works. Different working conditions and the composition of the work formations are taken into account.

**Practical implications** – Managers must decide within the company to apply those procedures that lead to its success. After establishing the objectives and the methods by which they can be achieved, the managers must find ways in which the techniques can be successfully applied within the company and then the globalization of these solutions at the widest possible level.

**Originality/value** – The study analyzed different factors that can influence the composition of a work formation, within a construction process. The study is based on the use of the multi-criteria method. This study aims at compiling an optimal work team and formulating conclusions regarding the most rational and efficient use of work teams in the construction activity.

**Key words:** Management, globalization, constructions,

## Introduction

The creation of new products, the implementation of an improved technology, the application of efficient organizational procedures, the use of operational management methods, etc., are just some of the results of human activity and which are entirely attributed to him. In the activity of creating products and services, highlighting the importance of human, it should not be seen as an under estimation of other resources such as material, financial or information. Achieving the objectives in a productive activity can be achieved only when the human factor is considered in close connection with all other resources. Carrying out the activity under normal conditions, developing the production, increasing the market of products, globalizing the production, respectively making a profit, are just some of the main objectives of a company, which can be achieved only when, among all the resources involved in productive activity, a dynamic balance can be achieved.

## Initial data

Studies show that multicriteria analysis can be used successfully in various fields of activity. Since 1960, this method has been applied as a way of making a decision. Today, it is frequently used in project management. [Beria et al., 2011]

The purpose of the method is to determine an order of results, by comparative estimates, applied to different possible alternatives. It is used when the people involved in making a decision face a certain problem. The analysis is useful in situations where, in order to make a decision, in solving a problem, a single criterion cannot lead to the determination of a satisfactory result. The role of the method is to systematize and combine several analyzed variants, which are necessary and useful in order to make a decision. The decision will be influenced by how these variants each contribute to the final result. The multicriteria analysis highlights the arguments and subjective opinions of the participants regarding all the analyzed situations; summarizes the opinions presented in order to obtain a succession according to the importance of the analyzed elements; identifies possible contradictory states; makes recommendations and proposes operational advice. [Roman, M., 2012]

## Case Study

### Establishing the decision-making context

We will take for analysis, several variants of composing a team of workers, in the field of construction. The composition of the team will be made according to certain characteristics (age, qualification, seniority, etc.). We will analyze the composition of the teams, and the most favorable combination will be determined, which will be as close as possible to the current requirements and needs of a company.

### Criteria and value range

- *Age of employees.* This characteristic can underline the appearance of the aging process and the need to hire young staff within the company;
- *Performance - seniority in work.* The young staff will have more work power and, implicitly, they will be eager to perform. More experienced workers can perform better jobs, from a qualitative point of view, but they can also have certain salary or social advantages that the company must take into account;
- *Based on this analysis,* it will be possible to highlight the existence of a plus or minus of workers of a certain specialization in the company, which will obviously be transferred or requalified, possibly hiring where appropriate. [Hossu et.al., 2001].

Table no. 1. Criteria and value ranges

Criteria	Indicators	Value ranges	
C <sub>1</sub>	Performance	Seniority in work - experience gained at work	1- 5
C <sub>2</sub>	Age	Average age of the team	25 - 50 years
C <sub>3</sub>	Specialization	One or more specializations within the team	1- 5
C <sub>4</sub>	Cooperation within the team	Balance between team members	1- 5
C <sub>5</sub>	Composition of work formations	Depending on the number of workers who can perform an activity	1- 5

- The composition of the work formations will be done so that the respective team can carry out a productive activity. Too many workers in the team means waste, too few workers will lead to the impossibility of carrying out that activity safely. Manufacturing companies make up their work teams so that they are able to perform certain well-established tasks.

- Cooperation. In order for team members to be able to carry out their duties in optimal working conditions, they must be productive and perform well. Team members must work together with the main goal of achieving the set objectives.

## Performance matrix

On the lines of the matrix there are represented the options taken into account in the analysis and on the columns the performances of the options related to the chosen criteria are represented. The value assessment of the performance of each option can be done numerically, or using any other form of evaluation that allows clear highlighting of results.

Table no. 2. Performance matrix

Criteria \ Alternatives	C <sub>1</sub>	C <sub>2</sub>	...C <sub>j</sub>	C <sub>n</sub>
A <sub>1</sub>	a <sub>11</sub>	a <sub>12</sub>	a <sub>13</sub>	a <sub>1n</sub>
A <sub>2</sub>	a <sub>21</sub>	a <sub>22</sub>	a <sub>23</sub>	a <sub>2n</sub>
...A <sub>i</sub> ...	...	...	a <sub>ij</sub>	...
A <sub>n</sub>	a <sub>m1</sub>	a <sub>m2</sub>	a <sub>m3</sub>	a <sub>mn</sub>

General representation of the performance matrix, with  $m$  rows and  $n$  columns [Roman, M., 2012]

In the process of creating products, especially in the field of construction, the organization of production and work has an essential role, as they study a series of technical, organizational and economic regulations that make the workforce and technological processes to be used as appropriate and efficient as possible. Thus, through the process of globalization of productive activities, positive results can be obtained in many fields of activity, by extending processes or products from the company level, to the level of a country and then worldwide.

Human is considered by specialists as the only component within a company, who can create value for use. [Nicolescu, O., 1997]

## Estimated values of the alternatives for criteria

The options express the way in which the variants of proposals meet the proposed objectives. The most favorable option will be chosen from those options that will be considered the closest to the proposed objectives. [Mircea, A.T., 2016] The criterion expresses the value according to which the evaluations are made and the options are compared, in order to determine to what extent the options lead to the achievement of the established objectives. [Dobre et al, 2000]

Taking into account some basic criteria, we can analyze the organization of work and teams, within the productive activities specific to the construction field. We can mention the following criteria:

- specialization of workers in work teams;
- collaboration between team members;
- ensuring the necessary climate for collaboration between teams;
- ensuring a work front for each team, as well as the organization corresponding to the activity carried out (appropriate work space, material storage, circulation, etc.);
- creating the necessary conditions (development) for the execution of the technological process;
- ensuring the continuity of the workforce force activity, during the production process; [Popa, A., 2006]
- the use of work norms, for as many of the activities carried out on the site as possible;
- stimulation and motivation of the work submitted by employees (awards, bonuses, individual or group incentives, facilities, social protection programs, etc.);

- ensuring the necessary support for the continuous improvement of the staff, corresponding to the qualification and the activity carried out;
- the composition of the teams of workers to be realized according to the current requirements of the market;
- continuous training and improvement of the workforce in the field where it operates.

The study analyzes four teams of workers, taking into account different criteria's that we considered relevant. Four of these criteria are evaluated qualitatively, one of the criteria is numerical.

Table no. 3. Estimated values of the alternatives for criteria

Alternatives	C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>	C <sub>4</sub>	C <sub>5</sub>
Team A <sub>1</sub>	5	20	5	4	4
Team A <sub>2</sub>	3	30	4	5	5
Team A <sub>3</sub>	3	40	3	2	3
Team A <sub>4</sub>	4	50	2	3	2

Criteria considered in the analysis:

1 - unimportant; 2 – less unimportant; 3 – a bit important; 4 - important; 5 - very important

### Scores and weights

The data in the basic matrix are, in most cases, transformed into numerical values. This is done in two phases.

- Scores: for all the variants considered in the analysis, a score is established, depending on the importance and which is applied to each criterion.
- Weights: determines, for all criteria, the relative evaluation between the highest and lowest value of the size chosen for comparisons. [AMC, manual, 2009]

### Weights estimated directly

In the example, we will use direct estimation to determine the relative importance of the weights for each analyzed criterion. A criterion with a higher weight is more important. The determination of direct estimation is generally done by qualified persons, who take into account the wishes of the companies regarding the elements according to which the decisions are made, but they must be prepared to translate these wishes into relative weights. [Roman, M., 2012]

In this case, we considered: for criterion C<sub>1</sub> - performance and C<sub>3</sub> - specialization, which are the most important elements, we allocated a weight of 30%, the other criteria have a lower importance, with a weight of 20% for criterion C<sub>2</sub> - age, respectively 10% being allocated to criterion C<sub>4</sub> - cooperation within the team and C<sub>5</sub> - composition of work teams.

Table no. 4. Weights estimated directly

Criteria	C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>	C <sub>4</sub>	C <sub>5</sub>
Weight	0.30	0.20	0.30	0.10	0.10

## Normalized performance matrix

In order to be able to compare the results of the analyzed elements, the scores of the criteria must be transformed so that they are represented by the same units of measurement. This is done by normalization. Through this activity we aim to obtain, for the determined values of the criteria, a common unit of measurement so that we can compare the obtained results.

Normalization will be achieved by the method of linear transformation:

$$r_{ij} = \frac{a_{ij}}{a_j^{max}} \quad a_j^{max} = \max_i\{a_{ij}\} \text{ for maximum effect}$$

$$r_{ij} = 1 - \frac{a_{ij}}{a_j^{max}} = \frac{a_j^{max} - a_{ij}}{a_j^{max}} \text{ - for minimum effect [Dobre et al, 2007]}$$

The nominal values will result from applying the linear transformation method. We will calculate the standardized value for each alternative and for each criterion.

Table no. 5. Normalized performance matrix

Alternatives	C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>	C <sub>4</sub>	C <sub>5</sub>
Team A <sub>1</sub>	0.00	0.60	0.00	0.20	0.20
Team A <sub>2</sub>	0.40	0.40	0.20	0.00	0.00
Team A <sub>3</sub>	0.40	0.20	0.40	0.60	0.40
Team A <sub>4</sub>	0.20	0.00	0.60	0.40	0.60

## Multicriteria evaluation – results by summing the weights

$$A_{Si} = \sum_{j=1}^n W_j r_{ij} \quad [\text{Dobre et al, 2007}]$$

$r_{ij}$  – standardized scores, related to the criteria;

$W_j$  – the weight of each criterion;

$A_{Si}$  – total score for each alternative.

Table no. 6. Results by summing the weights

Alternatives	C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>	C <sub>4</sub>	C <sub>5</sub>	A <sub>Si</sub>
Team A <sub>1</sub>	0.00	0.60	0.00	0.20	0.20	0.16
Team A <sub>2</sub>	0.40	0.40	0.20	0.40	0.00	0.30
Team A <sub>3</sub>	0.40	0.20	0.40	0.40	0.60	0.38
Team A <sub>4</sub>	0.20	0.00	0.60	0.00	0.40	0.28
Weight	0.30	0.20	0.30	0.10	0.10	

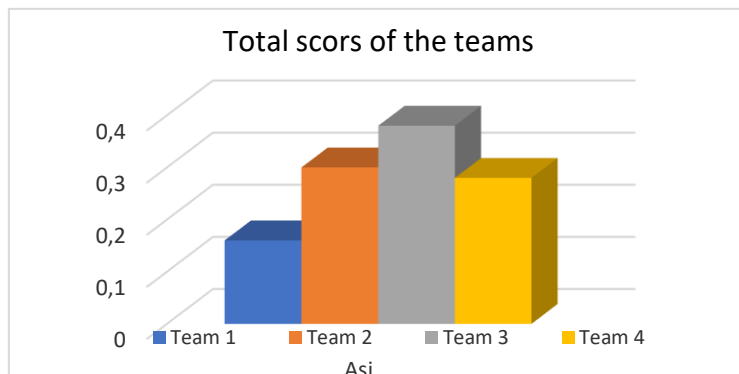


Fig. no. 1. The total score of the teams



## Hierarchy of weights

Using this method in decision making can provide important data and the results obtained can be a real help in making a decision related to a certain issue.

## Discussion and conclusions

The following conclusions were based on the study:

- the best alternative was for Team A3, where a score of 0.38 was achieved, for the criteria of the greatest importance: the performance and specialization of the team;
- for Team A2 a score of 0.30 resulted;
- for the A4 team a score of 0.28 resulted;
- respectively for Team A1 a score of 0.16.

It can be seen that the maximum efficiency is achieved by the A3 team made up of experienced workers, whose goal is to achieve the work tasks, have work power, the average age being 40 years. For inexperienced young teams it is more difficult to mobilize to work together and be productive. There is also the possibility that some tasks may not be performed without sufficient knowledge. At an older age, there may be problems with salary increases, various salary or social benefits. It also highlights the phenomenon of aging and the need to hire young staff.

Teams fail to perform their work tasks when one or more of the following causes occurs:

- they are assigned activities for which they do not have the necessary qualification;
- the teams are not made up so that they can perform a certain activity;
- they are not provided with the necessary conditions to perform the tasks;
- there is no good collaboration between the members, within the team;
- conflicts occur within the team;
- workers do not have the same interests or common concerns;
- communication between team members in performing tasks is not very well done;
- the transmission of information between the team and the higher levels is interrupted.

Each worker must have a well-established role in the team, and the distribution of tasks must be done according to their qualification. The composition of the teams should be done as rationally as possible with a clear specification of the level of responsibility for each member of the team and the members with decision-making rights. Responsibilities and decisions must be in accordance with the knowledge and training of each worker. On-the-job training, qualification and continuous improvement, according to the requirements of the workplace, are important for improving the employee's performance.

When the composition of the work formations is done in accordance with the activity carried out, then a larger amount of work will be performed per unit of time. In the construction activity, there are many activities for the realization of which, workers with a different degree of qualification are needed. Some operations are performed by unskilled workers, other operations require higher qualification. The number of workers in the teams depends on the type of process performed. When an adequate team is determined to carry out a construction process, with increased productivity in carrying out tasks, it can be used through the process of globalization, both at the level of several companies within the country and at a more extensive level.

On construction sites, there are still many activities that are performed manually or semi-mechanized. In this sense, the study of the efficient organization of the productive activity is considered important. The rational use of workforce, equipment and materials and other resources, in order to determine the shortest possible time for a construction, is an important goal for companies. Increasing workforce productivity, the quality of products made, while reducing the total cost are also permanent concerns for running a company.

For this purpose, the following is continuously pursued: the rational use of the workforce force, the diminution of the manually performed activities, the mechanization, the automation, as well as the use of an execution technology adequate to the work processes.

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# CONSIDERATIONS ON THE CHALLENGES OF PLANNING AND MANAGING GREY SWAN EVENTS

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## Abstract

**Purpose** – analyzing some of the challenges faced by decision makers in planning and managing the effects of grey swan events and proposing a set of recommendations

**Methodology/approach** - mixed methods - qualitative methods (mainly interviews with planners and decision makers in the areas of defense, security and public sector), the analysis to the existing literature and quantitative methods (a questionnaire).

**Findings** – some of the challenges identified stem from difficulties related to planning under uncertainty, while others derive from organizational issues and psychological considerations

**Research limitations/implications** – research limitations have derived from the lack of awareness from the decision makers interviewed of the concept of grey swan events and its implications on the organizations

**Practical implications** – increasing the awareness of the decision makers on the challenges posed by dealing with grey swan events and the importance of planning and preparedness

**Originality/value** – the authors propose some recommendations in order to improve the management of grey swan events and to mitigate their effects on the public and private organizations

**Key words:** *planning, grey swan.*

## Introduction

The perception of increased uncertainty in the contemporary world has generated a lack of trust in the benefits of planning and the usefulness of tools such as modelling, in private but especially public sectors. Still, uncertainty does not mean that the world is full of “black swan events”, often, events are part of a system of interconnected factors and there are always warning signs regarding the change in the current environment.

The focus of this paper are the planning/management issues faced in relation to grey swan events by public sector organizations and large private organizations, as medium to small organizations seldom plan for these type of events, due to their limited planning resources (including lack of personnel, tools, time and information).

### Are all black swans really black?

The concept of black swan event [Taleb, 2007] is an event with three main attributes: a very low probability of occurring, an extreme impact and impossible to predict in advance. The concept is appealing, but many of the events presented as black swan are at best grey swans, light grey swans, if not downright bleached, almost white swans, to use the same color-related metaphor, as many are not that rare/unpredictable. The 2008 financial crisis was “predicted” by reputable economists [Roubini,2008][Baker,2006][Keen,2007], long before it occurred. The 9/11 events had numerous

precursor signs that were ignored. Brexit was not such a big surprise considering the amount of disinformation, the increased distrust in the British political class, anti-European propaganda fueled by the tabloid media, the rising popularity of the populist and nationalist parties.

Consequently, in today's globalized world, an organization will be more likely confronted with grey swan events, meaning an event that has a low to medium probability of occurring, that may have a big impact on the organization, that can be anticipated if one looks for the precursor signs, which are not taken in consideration by managers/decision makers due to the perceived low probability, despite their potential systemic impact.

### **Planning related problems deriving from “grey swan events”**

Planning and managing grey swan events is difficult even in ideal circumstances, but the task is made even more difficult by a series of specific issues and problems, that shall be discussed in the following section.

The process of planning is not supposed to function as a crystal ball, meant to accurately predict the future before it occurs. Instead, its purpose is to explore potential “alternative realities” in order to help managers make decisions and outline courses of action and their consequences. In this respect, *mathematical models and simulations have sometimes been misunderstood by managers. Instead of considering them a tool to help decision making, there is a tendency to act solely based on a model's outputs, without a proper analysis of all the factors involved and a proper decision making process.* There are unfortunately numerous examples [Sample, 2020] of over-reliance on models/ simulations for public sector decision making.

The problems may derive from improper modelling, but also from the lack of decision makers understanding of what modelling means and from the tendency to politicize decision making, by choosing models that advise a course of action fitting the decision makers' political convictions, interests or values. Lack of time (often deriving improper planning) tempts decision makers to consider modelling as a form of crystal ball that can accurately predict the future and can provide rapid answers, ignoring that models may be based on faulty input data (insufficient or low quality) and assumptions.

Strategic plans are by definition aimed at the achievement of medium/long term results, but this may lead to an over-generalization of their contents and a tendency to focus exclusively on formulating goals and objectives. A common issue derives from the *lack of correlation between the strategic plans and operational plans in terms of level of detail, assigning the responsibilities, the chain of reports, command and authority and the allocation of financial resources.*

Strategic plans are meant to provide the context for the development of operational plans, while they should depend on the inputs from the latter in order to remain realistic. Sometimes managers (especially when constrained by time, lack of personnel or financial resources) tend to underestimate the importance of a good strategic plan and build one that is too generic, while at the same time include in operational plans only on the pressing, short term issues. This has the potential to cause an almost permanent state of perceived emergency, leading to a crisis management (“fire-fighting”) approach even for events that were perfectly foreseeable and plannable.

On the other hand, the operational plans are not the place to clearly identify goals and objectives. When strategic plans are not clear and specific enough, the entire planning process will be flawed. Brilliantly formulated policies, concepts, well-chosen words, positive thinking and good intentions do not make a good foundation for realistic planning. Strategic managers may avoid giving clear directions and making strategic decisions as an attempt to avoid responsibility for difficult decisions and may be tempted to push the problems down the line, towards the operational managers. In turn, the latter may not perform to the best of their abilities faced with a lack of clear and achievable objectives and they may be forced to make decisions under pressure. The result of this permanent shifting of responsibility between strategic planning and operational planning may generate mediocre results at best and serious problems at worst.

The example on how the French authorities dealt with the face masks stocks required by a possible pandemic is representative. France went from a stock of 1 billion surgical masks, 700 million FFP2

masks in 2009 to only 150 million surgical masks and no stocks of FFP2 masks in 2020 [Stanghellini, 2020], based on cost reduction considerations [Delattre, 2015].

There was a clear lack of correlation between the doctrines, strategic plans and the operational plans. The strategic decisions were taken at ministry of health/government level, without clearly establishing the way they were going to be translated into operational plans at the levels of hospitals (especially private ones), without assigning clear responsibilities and authority.

Changes in strategy, with no prior analysis regarding the potential scenarios that may occur, can also hamper effective planning. The reasons this situation occurs are varied: resource scarcity, distrust/lack of understanding from the decision makers related to the importance of such planning tools, ideological considerations that influence decision making and financial reasons. Unfortunately, resources planned for grey-swan events are the first to be cut, as they are perceived as a waste of public money allocated for events that may never happen, as opposed to “real and pressing” issues.

Another issue that may lead to the managerial inability to deal effectively with gray swan events derives from psychological considerations related to the perception that *plans are a static, rigid, time consuming tool, useful perhaps in stable, low uncertainty times, but less suited to rapidly changing environments*.

There is a natural (albeit ineffective) tendency for managers to avoid changes and to stick to already existing plans, as a sort of reassurance that if something happens, they will be prepared. Together with overreliance on models, a rigid approach to planning is a coping mechanism that allows the avoidance of a difficult decision making process and of having to choose a course of action, with its associated risks and opportunity costs.

The “end states” in Lykke’s model [Lykke, 1989] of developing a strategy are often understood by managers as a final destination, when they should be viewed as a set of desirable future conditions that are going to evolve together with the changes in the input data, the environment, the decisions made and even the decision makers themselves. Strategies are just meant to provide a structured framework for measures that need to be taken during the normal functioning of an organization.

Flexible planning does not mean drastic changes in doctrines, strategies and plans without a careful analysis of the environment, potential scenarios and their implications and probabilities. In the case of French mask stocks, the strategy was changed drastically and suddenly, based on short term financial considerations. The probability of a pandemic occurring was the same, the mask requirements for effectively dealing with the effects of the disease were the same, what had changed was the political orientation and the short term financial priorities.

*The issue of responsibility* is yet another area of potential problems in planning and managing grey swan events. Government officials and CEO’s share the tendency to focus on the present, and to postpone/avoid measures for medium term, especially related to medium or low probability events.

The tendency is enhanced in situations where the decision makers do not keep their position for long and when the accountability is low. This is especially true for the public sector, if decision makers are appointed and then replaced, strategies are not translated into operational plans, measures initiated are not finalized, as each decision maker is more interested in imposing their own vision than continuing to put in practice the previous decision maker’s one. In the public sector, decision makers are inclined to make decisions based on short term considerations, as they are going to be held responsible by their electoral base the latest on the next elections, not after 10 years, when the results of some measures may become visible. Planning experts may come with analyses and recommendations, but they may be overlooked if they don’t fit with the current priorities and it is easy to blame the predecessors for the current problems and decision.

In the private sector, this tendency derives from the need to provide good financial results at the end of the year, so there are few ways of incentivizing managers to prioritize medium term decisions related to low probability grey swan events over short term considerations.

Another important issue related to translating planning into concrete measures derives from the fact that *many strategic plans ignore the financial aspects of implementing the objectives identified*, as these considerations are postponed to the operational planning phase or are dealt with in the annual budget.

Resource planning suffers from inertia and the budgeting process (especially in the public sector) is a lengthy and complicated process that allows limited flexibility for adjustment in case precursors of trouble are identified. Managers have to deal each month with prioritizing scarce resource on short term and giving precedence for urgent, current resource needs compared to allocating resources for hypothetical future events seems like a rational choice.

In the case of French authorities' decision to reduce costs by dismantling the stocks of face masks and assigning the responsibility to keep stocks to the hospitals was based solely on the desire to reduce budgetary expenses, without further analysis on the issue if the hospitals (public and private) have the financial resources to ensure such stocks.

Often decision makers view strategic decisions as separated from their costs implications – after all, they are about the future, and they have to deal with budgets and resources now, in the present. There is a natural tendency to postpone the cost estimations of potential courses of action for the time when they are due to be implemented and included in the annual budgetary plans, or to leave such “details” for the middle-level decision makers. The result is that medium or long term strategic decisions can easily become unrealistic in relation to the resources they require, leading to problems in implementing them fully, when the time comes, as the amount of resources they require each year has not been planned.

Estimating resources for medium to long term is of course a difficult task and the margin of error is significant, but the point of estimating the resource requirements of strategic decisions is not to make a detailed budget for the next 20 years – which of course it would be impossible, or to make a resource driven plan. The purpose should be to give managers a better idea about the financial sustainability of a decision, about the potential implications of the various courses of action, about the benefits and drawbacks of each of them, and to help them make the best decision possible with the information available at that point.

In the public sector especially, with yearly budgetary allocations, managers have little choice in regard to the time-frame for estimating the resource implications of the strategic decisions. The decisions for the next three years have to keep into account the estimated budget envelope for maximum that time-frame, and there is little time, resources or sometimes interest, to make simulations of the financial implications of decisions for a longer time-frame.

The result is that public sector managers often have a narrow, budget driven approach to management, and there is little incentive for them to use planning tools such as planning scenarios, modelling and simulations (with some exceptions such as the military and civil emergency agencies).

### **Potential solutions for mitigating the impact of planning related problems deriving from “grey swan events**

Based on the issues identified above, this section proposes some recommendations in order to improve the management process:

- Clearly defining the responsibilities for the plans development and execution, the reporting process and the evaluation of the results, followed by corrective actions. The more the responsibility is blurred within the organizational structure, the bigger the lack of effectiveness in managing grey swan events.
- Assigning clear accountability for strategic decisions and changes in strategy (from the highest level down to the lower levels), even if the effects of strategic decisions will only become visible after some time.
- Implementing a system of incentives to encourage a medium term approach to management instead of a short term, budget driven one.
- Strategic plans should be financially sustainable, and strategic decisions should not be taken without considering the financial implications. The objectives established should be correlated with the level of available/allocated resources beforehand, in the planning phase, to avoid the situation where the manager is forced to take short term actions to free those resources from other activities, after the budget is approved.

- Multi-annual resource planning can help managers be aware of the implications in time of various decisions (from financial implications to the number of required personnel, the investment requirements, the operating and maintenance requirements etc) and of the life cycle costs involved by specific courses of action.
- Strategic decisions should be based on cost-benefit analysis of various courses of action, to allow decision makers to be aware of other possible solutions and to understand in more detail the possible systemic and longer term implications of their decisions.
- Using planning scenarios and other similar planning tools to help decision making, including Artificial Intelligence. A better understanding of the meaning of grey swan events, probability, role of modeling, simulation is required for effectively mitigating the effects of grey swan effects.
- Greater flexibility in changing and adapting plans to the current realities, as grey swans do not come un-announced. There usually are clear warning signs, but they are often easy to ignore if complacency sets in regarding the existing plans (considered too good to change). Should plans be viewed as static and rigid and should the managers be reluctant to change them until the schedule time for a new plan, grey swan events may not wait that long and may be perceived as black swans, with huge effects on the organization.
- Integrated planning throughout the organization and the correlation of plans between different levels of the organization (from the ministry/headquarter level down to the component units) and between agencies (for the public sector), including the resource area.
- An honest assessment and acknowledgment of the various organizational factors and individual psychological biases that may increase the likelihood of faulty decisions and judgement errors.
- Applying the concept of lessons-identified and lessons-learned. The analysis of past situations and problems can provide useful insights into problems and how they could potentially be solved, that should be translating into Standard Operating Procedures, protocols and regulations, set up in advance, to be activated when a particular scenario becomes reality. They should be understood, accepted and implemented throughout the organization, following a top down approach (from the strategic planning department/ministry down the hierarchy chain), but should be developed following a bottom up approach, by taking advantage of the inputs (experiences, the problems identified and the solutions found) at all levels of the organization.

## Conclusions

In today's globalized environment, that fact that grey swan events can be anticipated if warning signals are heeded, does not mean their effects are not serious or that dealing with them is easy. An effective response to grey swan events requires a complex combinations of factors and measures that should be taken, but the first step is recognizing the need to plan for such events. Even though the probability of a grey swan event is not very high, managers from both public and private organizations should take the necessary steps to plan for them in advance, as dealing with their effects when they happen entails high costs.

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# STUDY OF A FOUR-DIMENSIONAL TRANSPORTATION PROBLEM

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## Abstract

**Purpose** – Solving and analyzing a four-dimensional Transportation Problem is the purpose of this paper.

**Methodology/approach** – The theoretical study of the paper contains the development of the mathematical model of the studied problem and a proposed methodology for solving and analyzing it. A numerical case study is treated based on the methodology to demonstrate its applicability.

**Findings** – The mathematical model and the methodology for solving and analyzing a four-dimensional Transportation Problem are proposed. The sensitivity analysis of the solution, the parametric analyze of some coefficients, the solving of the problem in cases of additional imposed constraints are also possible.

**Research limitations/implications** – The proposed methodology is applicable to a variety of cases of a four-dimensional Transportation Problem.

**Practical implications** – The paper offers the practical possibility to treat a class of real four-index Transportation Problem, for which the methods of solving the classical two-index Transportation Problem are not applicable. It can also performs sensitivity and parametric analyzes, as well as the solving, by means of software WinQSB.

**Originality/value** – The proposed method represents a very useful tool for managers to ensure an efficient leading for transporting heterogeneous commodities with the lowest possible cost involved.

**Key words:** Transportation Problem, optimal solution, WinQSB.

## Introduction

Over the past two decades, the globalization has defined the business landscape by growing cross-border interconnectedness, reflected in the global flows of people, capital, products, services, knowledge, information, technologies and culture. New communication technologies correlated with the decreasing transportation costs increase the opportunity to connect with anyone from anywhere and to discover new business opportunities.

This paper addresses the issue of transport of goods and services across the global marketplace, an indispensable economic factor, which contributes to the successful operation of management in the globalized economy. At the same time, this paper aims to emphasize the increasing need for global managers operating in business to respond effectively to the challenges of globalization and to provide responses and training for managers.

Transportation Problem is one of the most important applications of quantitative analysis due to its spreading in real life (Hillier and Lieberman, 2015). The classical Transportation Problem is a two-dimensional problem in which a single commodity (homogeneous product) is directly shipped from a set of source centers to a set of destination centers (Hitchcock, 1941). The sum of the amounts available at the sources is equal to the sum of the demands at the various destinations. The goal is to determine the amounts of the commodity to be transported over all routes so that the total transportation cost is minimized.

Many researchers have extensively studied such cost-time transportation problems: discussing variants of the Transportation Problem (Appa, 1973); transportation with mixed constraints (Brigden, 1974); a specialized method of the Transportation Problem with additional linear constraints (Klingman and Russel, 1975); the branching method for fixed-charge Transportation Problem (Adlakha et al., 2010); solving transportation problem with the various method of linear programming problem (Sharma et al., 2012).

When planning transportation, a situation occurs when the commodity is delivered to consumers not directly but through intermediate centers (warehouses, secondary processing enterprises, etc.), called a three-dimensional Transportation Problem with intermediate centers (Raskin et al., 2017).

Recently, the Transportation Problem with sources, destinations and various commodities, so another three-dimensional Transportation Problem, is treated by a few researches (Pudasaini and Shrestha, 2019).

In this paper, a four-dimensional Transportation Problem with source availabilities, destination demands, intermediate centers and several types of commodities is analyzed and solved. Subsequently, other additional constraints are added to the initial considered problem: the restricting access on certain transport routes; minimum shipping guarantees from certain specified routes. The approach of such situations is included in the numerical case studied in the paper.

### Mathematical model of a four-dimensional Transportation Problem

In a four-dimensional Transportation Problem it is considered that several types of products,  $P_l, l \in \overline{1, q}$ , must be transported from the producer centers,  $A_i, i \in \overline{1, m}$ , for the consumer centers  $B_j, j \in \overline{1, n}$ . In addition, it is assumed that each type of product  $P_l$  will pass through one of the intermediate centers  $D_k, k \in \overline{1, p}$ , before reaching a consumer center.

Let us introduce the following notations for the known data of the considered problem:

$a_i$  - the total quantity of products intended for transportation from the  $i$ -th production center,  $a_i > 0, i \in \overline{1, m}$ ;

$b_j$  - the demanded total quantity of products at  $j$ -th consumer center,  $b_j > 0, j \in \overline{1, n}$ ;

$d_k$  - the permissible total quantity of products transported through the  $k$ -th intermediate center,  $d_k > 0, k \in \overline{1, p}$ ;

$f_l$  - the transported enter quantity of the  $l$ -th product,  $f_l > 0, l \in \overline{1, q}$ ;

$c_{ijkl}$  - the transportation cost of one unit of the  $l$ -th product, from the  $i$ -th producer center, to the  $j$ -th consumer center, through the  $k$ -th intermediate center,  $c_{ijkl} > 0$ .

The objective of the problem is to determine the amounts shipped from each production center to each consumer center to minimize the total transportation cost.

Let  $x_{ijkl}$  ( $i \in \overline{1, m}, j \in \overline{1, n}, k \in \overline{1, p}, l \in \overline{1, q}$ ) be the variables, i.e. the quantity of product  $P_l$  shipped from the center  $A_i$  to center  $B_j$  through the center  $D_k$ .

Using the notations introduced above and the linear programming approach, the mathematical model of this four-dimensional Transportation Problem can be formulated as follows:

$$\text{Minimize: } z = \sum_{i=1}^m \sum_{j=1}^n \sum_{k=1}^p \sum_{l=1}^q c_{ijkl} x_{ijkl} \quad (1)$$

$$\text{Subject to: } \sum_{j=1}^n \sum_{k=1}^p \sum_{l=1}^q x_{ijkl} = a_i, \quad i \in \overline{1, m} \quad (2)$$

$$\sum_{i=1}^m \sum_{k=1}^p \sum_{l=1}^q x_{ijkl} = b_j, \quad j \in \overline{1, n} \quad (3)$$

$$\sum_{i=1}^m \sum_{j=1}^n \sum_{l=1}^q x_{ijkl} = d_k, \quad k \in \overline{1, p} \quad (4)$$

$$\sum_{i=1}^m \sum_{j=1}^n \sum_{k=1}^p x_{ijkl} = f_l, \quad l \in \overline{1, q} \quad (5)$$

$$x_{ijkl} \geq 0, \quad i \in \overline{1, m}, \quad j \in \overline{1, n}, \quad k \in \overline{1, p}, \quad l \in \overline{1, q} \quad (6)$$

where:  $a_i > 0, i \in \overline{1, m}; b_j > 0, j \in \overline{1, n}; d_k > 0, k \in \overline{1, p}; f_l > 0, l \in \overline{1, q}$ .

The necessary and sufficient condition for the existence of a feasible solution to the above model is:

$$\sum_{i=1}^m a_i = \sum_{j=1}^n b_j = \sum_{k=1}^p d_k = \sum_{l=1}^q f_l \quad (7)$$

The objective function (1) is to minimize the total logistics cost for shipping all products. The constraints (2) define the supply restrictions at the producer centers. The constraints (3) define the demand restrictions at the consumer centers. The constraints (4) refer to the capacities of the intermediate centers, and the constraints (5) specify the quantity of each type of product.

The obtained four-index mathematical model contains a system of  $m + n + p + q$  constraints of which  $m + n + p + q - 3$  are independent, and  $m \cdot n \cdot p \cdot q$  unknowns. In the model, both the objective function (1) and the constraints (2)-(5) have a linear relationship, so it is a linear programming model.

Particular cases of the above model are the following:

a) In this case,  $c_{ijkl} > 0, a_i > 0, b_j > 0, d_k > 0, i \in \overline{1, m}, j \in \overline{1, n}, k \in \overline{1, p}, l \in \overline{1, q}$  are known.

The mathematical model contains only three categories of restrictions; it obtains:

$$\text{Minimize: } z = \sum_{i=1}^m \sum_{j=1}^n \sum_{k=1}^p \sum_{l=1}^q c_{ijkl} x_{ijkl}$$

$$\text{Subject to: } \sum_{j=1}^n \sum_{k=1}^p \sum_{l=1}^q x_{ijkl} = a_i, \quad i \in \overline{1, m}$$

$$\sum_{i=1}^m \sum_{k=1}^p \sum_{l=1}^q x_{ijkl} = b_j, \quad j \in \overline{1, n}$$

$$\sum_{i=1}^m \sum_{j=1}^n \sum_{l=1}^q x_{ijkl} = d_k, \quad k \in \overline{1, p}$$

$$x_{ijkl} \geq 0, i \in \overline{1, m}, j \in \overline{1, n}, k \in \overline{1, p}, l \in \overline{1, q}$$

with the necessary and sufficient condition:

$$\sum_{i=1}^m a_i = \sum_{j=1}^n b_j = \sum_{k=1}^p d_k \quad (8)$$

There are  $C_4^3 = 4$  variants.

b) In this case,  $c_{ijkl} > 0, a_i > 0, b_j > 0, i \in \overline{1, m}, j \in \overline{1, n}, k \in \overline{1, p}, l \in \overline{1, q}$  are known.

The mathematical model contains only two categories of restrictions; it obtains:

$$\text{Minimize: } z = \sum_{i=1}^m \sum_{j=1}^n \sum_{k=1}^p \sum_{l=1}^q c_{ijkl} x_{ijkl}$$

$$\text{Subject to: } \sum_{j=1}^n \sum_{k=1}^p \sum_{l=1}^q x_{ijkl} = a_i, i \in \overline{1, m}$$

$$\sum_{i=1}^m \sum_{k=1}^p \sum_{l=1}^q x_{ijkl} = b_j, j \in \overline{1, n}$$

$$x_{ijkl} \geq 0, i \in \overline{1, m}, j \in \overline{1, n}, k \in \overline{1, p}, l \in \overline{1, q}$$

with the necessary and sufficient condition:

$$\sum_{i=1}^m a_i = \sum_{j=1}^n b_j \quad (9)$$

There are  $C_4^2 = 6$  variants.

### Methodology for solving and analyzing a four-dimensional Transportation Problem

Due to the large number of variables and constraints, the mathematical model (1)-(6) is more complex than the two-index mathematical model of the typical Transportation Problem. For this reason, unlike the typical Transport Problem, only the simplex algorithm can be used to solve this studied model.

The proposed methodology for solving and analyzing a four-dimensional Transportation Problem includes the following steps:

1. Define the objective function to be minimized with the constraints imposed on the problem.
2. Testing the necessary and sufficient condition for the existence of a feasible solution to the problem.
3. Finding the optimal solution and the optimal value of the objective function.
4. Perform the sensitivity analysis of the solution and develop the economic interpretation of the results.
5. Perform the parametric analysis relative to some different coefficients of the model and develop the economic interpretation of the results.
6. Finding the optimal solution in case of restricting access on certain transport routes from the problem.

7. Finding the solution in case of imposing certain conditions regarding the quantities transported on some routes from the problem.

Therefore, the four-dimensional Transportation Problem, formalized by the mathematical model (1)-(6), represents a multi-product Transportation Problem with intermediate centers. If we keep the notations, except for  $k \in \overline{1, p}$ , with which we will denote different means of transport for which the cost of transporting a unit of product is different (i.e. the transportation cost for a unit of product and over the same distance, it is assumed that it depends so much on the nature of product and the type of used means of transport), then the optimal solution of the problem allows the determination of a transport plan with a minimum total cost.

### Numerical case study

Consider the following four-dimensional Transportation Problem involving: two producer centers ( $A_1, A_2$ ), three consumer centers ( $B_1, B_2, B_3$ ), two intermediate centers ( $D_1, D_2$ ), two products ( $P_1, P_2$ ).

The known numerical data of the problem are the following (with the abbreviations: u. for units; m.u. for monetary units):  $a_1 = 500$  u.,  $a_2 = 400$  u.,  $b_1 = 250$  u.,  $b_3 = 300$  u.,  $d_1 = 420$  u.,  $d_2 = 480$  u.,  $f_1 = 470$  u.,  $f_2 = 430$  u.,  $c_{1111} = 3$  m.u.,  $c_{1112} = 5$  m.u.,  $c_{1121} = 4,5$  m.u.,  $c_{1122} = 4$  m.u. ,  $c_{1211} = 3,5$  m.u. ,  $c_{1212} = 6$  m.u. ,  $c_{1221} = 5,5$  m.u. ,  $c_{1222} = 6,5$  m.u. ,  $c_{1311} = 6$  m.u. ,  $c_{1312} = 5$  m.u. ,  $c_{1321} = 5$  m.u. ,  $c_{1322} = 4$  m.u. ,  $c_{2111} = 4,5$  m.u. ,  $c_{2112} = 4$  m.u. ,  $c_{2121} = 3,5$  m.u. ,  $c_{2122} = 3$  m.u. ,  $c_{2211} = 7$  m.u. ,  $c_{2212} = 5$  m.u. ,  $c_{2221} = 7$  m.u. ,  $c_{2222} = 5,5$  m.u. ,  $c_{2311} = 4$  m.u. ,  $c_{2312} = 4,5$  m.u. ,  $c_{2321} = 6$  m.u. ,  $c_{2322} = 5$  m.u.

- Determining the optimum mode of transport to minimize the total cost of distributing the quantities of products.
- Performing the sensitivity analysis of the solution.
- Performing the parametric analysis relative to the unit transportation cost  $c_{2122}$ .
- Solving the problem in case of blocking the access on the route between the center  $A_2$  and the center  $B_3$ .
- Solving the problem provided that a total quantity of products greater than or equal to 210 u. is transported on the route between the center  $A_1$  and the center  $D_2$ .

The detailed literary mathematical model of this problem is:

$$\begin{aligned} \text{Minimize : } z = & c_{1111}x_{1111} + c_{1112}x_{1112} + c_{1121}x_{1121} + c_{1122}x_{1122} + \\ & + c_{1211}x_{1211} + c_{1212}x_{1212} + c_{1221}x_{1221} + c_{1222}x_{1222} + \\ & + c_{1311}x_{1311} + c_{1312}x_{1312} + c_{1321}x_{1321} + c_{1322}x_{1322} + \\ & + c_{2111}x_{2111} + c_{2112}x_{2112} + c_{2121}x_{2121} + c_{2122}x_{2122} + \\ & + c_{2211}x_{2211} + c_{2212}x_{2212} + c_{2221}x_{2221} + c_{2222}x_{2222} + \\ & + c_{2311}x_{2311} + c_{2312}x_{2312} + c_{2321}x_{2321} + c_{2322}x_{2322} \end{aligned}$$

Subject to :

$$\begin{aligned}
 &x_{1111} + x_{1112} + x_{1121} + x_{1122} + x_{1211} + x_{1212} + x_{1221} + x_{1222} + \\
 &\quad + x_{1311} + x_{1312} + x_{1321} + x_{1322} = a_1 \\
 &x_{2111} + x_{2112} + x_{2121} + x_{2122} + x_{2211} + x_{2212} + x_{2221} + x_{2222} + \\
 &\quad + x_{2311} + x_{2312} + x_{2321} + x_{2322} = a_2 \\
 &x_{1111} + x_{1112} + x_{1121} + x_{1122} + x_{2111} + x_{2112} + x_{2121} + x_{2122} = b_1 \\
 &x_{1211} + x_{1212} + x_{1221} + x_{1222} + x_{2211} + x_{2212} + x_{2221} + x_{2222} = b_2 \\
 &x_{1311} + x_{1312} + x_{1321} + x_{1322} + x_{2311} + x_{2312} + x_{2321} + x_{2322} = b_3 \\
 &x_{1111} + x_{1112} + x_{1211} + x_{1212} + x_{1311} + x_{1312} + x_{2111} + x_{2112} + \\
 &\quad + x_{2211} + x_{2212} + x_{2311} + x_{2312} = d_1 \\
 &x_{1121} + x_{1122} + x_{1221} + x_{1222} + x_{1321} + x_{1322} + x_{2121} + x_{2122} + \\
 &\quad + x_{2221} + x_{2222} + x_{2321} + x_{2322} = d_2 \\
 &x_{1111} + x_{1121} + x_{1211} + x_{1221} + x_{1311} + x_{1321} + x_{2111} + x_{2121} + \\
 &\quad + x_{2211} + x_{2221} + x_{2311} + x_{2321} = f_1 \\
 &x_{1112} + x_{1122} + x_{1212} + x_{1222} + x_{1312} + x_{1322} + x_{2112} + x_{2122} + \\
 &\quad + x_{2212} + x_{2222} + x_{2312} + x_{2322} = f_2 \\
 &x_{ijkl} \geq 0, \quad i \in 1, 2, j \in 1, 3, k \in 1, 2, l \in 1, 2
 \end{aligned}$$

It is a linear programming mathematical model with 24 variables nonnegative continuous and 9 constraints.

a) Because  $\sum_{i=1}^2 a_i = \sum_{j=1}^3 b_j = \sum_{k=1}^2 d_k = \sum_{l=1}^2 f_l = 900 \text{ u.}$ , the necessary and sufficient condition for the existence of a feasible solution is fulfilled.

Further, the problem is resolved using WinQSB software, the module *Linear and Integer Programming*, with the simplex algorithm.

The numerical data of the problem in matrix form, from the initial working window of the module, are presented in Fig.1.

Variable	X1111	X1112	X1121	X1122	X1211	X1212	X1221	X1222	X1311	X1312	X1321	X1322
Minimize	3	5	4.5	4	3.5	6	5.5	6.5	6	5	5	4
C1	1	1	1	1	1	1	1	1	1	1	1	1
C2												
C3	1	1	1	1								
C4					1	1	1	1				
C5									1	1	1	1
C6	1	1			1	1			1	1		
C7			1	1			1	1			1	1
C8	1		1		1		1		1		1	
C9		1		1		1	1	1	1	1		1
LowerBound	0	0	0	0	0	0	0	0	0	0	0	0
UpperBound	M	M	M	M	M	M	M	M	M	M	M	M
VariableType	Continuous	Continuous	Continuous	Continuous	Continuous	Continuous	Continuous	Continuous	Continuous	Continuous	Continuous	Continuous

X2111	X2112	X2121	X2122	X2211	X2212	X2221	X2222	X2311	X2312	X2321	X2322	Direction	R. H. S.
4.5	4	3.5	3	7	5	7	5.5	4	4.5	6	5	=	500
1	1	1	1	1	1	1	1	1	1	1	1	=	400
1	1	1	1									=	250
				1	1	1	1					=	350
1	1			1	1			1	1	1	1	=	300
1	1			1	1			1	1			=	420
1		1	1			1	1			1	1	=	480
1		1		1		1		1		1		=	470
	1		1		1		1		1		1	=	430
0	0	0	0	0	0	0	0	0	0	0	0		0
M	M	M	M	M	M	M	M	M	M	M	M		
Continuous	Continuous	Continuous	Continuous	Continuous	Continuous	Continuous	Continuous	Continuous	Continuous	Continuous	Continuous		

Figure 1. The data of the initial problem in matrix form

With the command *Solve the Problem*, from the menu *Solve and Analyze*, the combined report is obtained in the results window (Fig.2,a). The optimal solution of the problem is displayed in the column *Solution Value* of the report. Table representation of this solution is presented in Table 1.

Table 1. Table representation of the optimal solution from the Fig.2,a

		$B_1$	$B_2$	$B_3$
$A_1$	$D_1$	-	310 u. $P_1$	-
	$D_2$	-	-	190 u. $P_2$
$A_2$	$D_1$	-	-	110 u. $P_1$
	$D_2$	50 u. $P_1$ 200 u. $P_2$	40 u. $P_2$	-

The minimum total cost of the transport corresponding to this solution is  $z_{\min} = 3280$  m.u.

But the initial problem also admits a second optimal alternative solution. Its corresponding combined report is obtained with the command *Obtain Alternate Optimal* from the menu *Results* (Fig.2,b).

22:24:02		Wednesday		June		24		2020	
Decision Variable	Solution Value	Unit Cost or Profit c(j)	Total Contribution	Reduced Cost	Basis Status	Allowable Min. c(j)	Allowable Max. c(j)		
1	X1111	0	3.0000	0	2.0000	at bound	1.0000	M	
2	X1112	0	5.0000	0	4.5000	at bound	0.5000	M	
3	X1121	0	4.5000	0	2.0000	at bound	2.5000	M	
4	X1122	0	4.0000	0	2.0000	at bound	2.0000	M	
5	X1211	310.0000	3.5000	1.085.0000	0	basic	3.5000	4.5000	
6	X1212	0	6.0000	0	3.0000	at bound	3.0000	M	
7	X1221	0	5.5000	0	0.5000	at bound	5.0000	M	
8	X1222	0	6.5000	0	2.0000	at bound	4.5000	M	
9	X1311	0	6.0000	0	3.0000	at bound	3.0000	M	
10	X1312	0	5.0000	0	2.5000	at bound	2.5000	M	
11	X1321	0	5.0000	0	0.5000	at bound	4.5000	M	
12	X1322	190.0000	4.0000	760.0000	0	basic	2.0000	4.0000	
13	X2111	0	4.5000	0	2.5000	at bound	2.0000	M	
14	X2112	0	4.0000	0	2.5000	at bound	1.5000	M	
15	X2121	50.0000	3.5000	175.0000	0	basic	2.5000	4.0000	
16	X2122	200.0000	3.0000	600.0000	0	basic	2.5000	4.0000	
17	X2211	0	7.0000	0	2.5000	at bound	4.5000	M	
18	X2212	0	5.0000	0	1.0000	at bound	4.0000	M	
19	X2221	0	7.0000	0	1.0000	at bound	6.0000	M	
20	X2222	40.0000	5.5000	220.0000	0	basic	4.5000	5.5000	
21	X2311	110.0000	4.0000	440.0000	0	basic	3.0000	4.0000	
22	X2312	0	4.5000	0	1.0000	at bound	3.5000	M	
23	X2321	0	6.0000	0	0.5000	at bound	5.5000	M	
24	X2322	0	5.0000	0	0	at bound	5.0000	M	
Objective	Function	(Min.) =	3.280.0000	(Note: Alternate Solution Exists!!)					
Constraint	Left Hand Side	Direction	Right Hand Side	Slack or Surplus	Shadow Price	Allowable Min. RHS	Allowable Max. RHS		
1	C1	=	500.0000	0	-1.0000	500.0000	580.0000		
2	C2	=	400.0000	0	0	400.0000	M		
3	C3	=	250.0000	0	-2.5000	250.0000	290.0000		
4	C4	=	350.0000	0	0	350.0000	M		
5	C5	=	300.0000	0	-0.5000	300.0000	380.0000		
6	C6	=	420.0000	0	-1.5000	420.0000	470.0000		
7	C7	=	480.0000	0	0	480.0000	M		
8	C8	=	470.0000	0	6.0000	430.0000	470.0000		
9	C9	=	430.0000	0	5.5000	390.0000	430.0000		

a)

22:26:33		Wednesday		June		24		2020	
Decision Variable	Solution Value	Unit Cost or Profit c(j)	Total Contribution	Reduced Cost	Basis Status	Allowable Min. c(j)	Allowable Max. c(j)		
1	X1111	0	3.0000	0	2.0000	at bound	1.0000	M	
2	X1112	0	5.0000	0	4.5000	at bound	0.5000	M	
3	X1121	0	4.5000	0	2.0000	at bound	2.5000	M	
4	X1122	0	4.0000	0	2.0000	at bound	2.0000	M	
5	X1211	350.0000	3.5000	1.225.0000	0	basic	3.0000	3.5000	
6	X1212	0	6.0000	0	3.0000	at bound	3.0000	M	
7	X1221	0	5.5000	0	0.5000	at bound	5.0000	M	
8	X1222	0	6.5000	0	2.0000	at bound	4.5000	M	
9	X1311	0	6.0000	0	3.0000	at bound	3.0000	M	
10	X1312	0	5.0000	0	2.5000	at bound	2.5000	M	
11	X1321	0	5.0000	0	0.5000	at bound	4.5000	M	
12	X1322	150.0000	4.0000	600.0000	0	basic	4.0000	4.5000	
13	X2111	0	4.5000	0	2.5000	at bound	2.0000	M	
14	X2112	0	4.0000	0	2.5000	at bound	1.5000	M	
15	X2121	50.0000	3.5000	175.0000	0	basic	2.5000	4.0000	
16	X2122	200.0000	3.0000	600.0000	0	basic	2.5000	4.0000	
17	X2211	0	7.0000	0	2.5000	at bound	4.5000	M	
18	X2212	0	5.0000	0	1.0000	at bound	4.0000	M	
19	X2221	0	7.0000	0	1.0000	at bound	6.0000	M	
20	X2222	0	5.5000	0	0	at bound	5.5000	M	
21	X2311	70.0000	4.0000	280.0000	0	basic	4.0000	4.5000	
22	X2312	0	4.5000	0	1.0000	at bound	3.5000	M	
23	X2321	0	6.0000	0	0.5000	at bound	5.5000	M	
24	X2322	80.0000	5.0000	400.0000	0	basic	4.5000	5.0000	
Objective	Function	(Min.) =	3.280.0000	(Note: Alternate Solution Exists!!)					
Constraint	Left Hand Side	Direction	Right Hand Side	Slack or Surplus	Shadow Price	Allowable Min. RHS	Allowable Max. RHS		
1	C1	=	500.0000	0	-1.0000	500.0000	580.0000		
2	C2	=	400.0000	0	0	400.0000	M		
3	C3	=	250.0000	0	-2.5000	250.0000	290.0000		
4	C4	=	350.0000	0	0	350.0000	M		
5	C5	=	300.0000	0	-0.5000	300.0000	380.0000		
6	C6	=	420.0000	0	-1.5000	420.0000	470.0000		
7	C7	=	480.0000	0	0	480.0000	M		
8	C8	=	470.0000	0	6.0000	430.0000	470.0000		
9	C9	=	430.0000	0	5.5000	390.0000	430.0000		

b)

Figure 2. Combined reports of the initial problem

Table representation of this second optimal solution is presented in Table 2.

Table 2. Table representation of the optimal solution from the Fig.2,b

		$B_1$	$B_2$	$B_3$
$A_1$	$D_1$	-	350 u. $P_1$	-
	$D_2$	-	-	150 u. $P_2$
$A_2$	$D_1$	-	-	70 u. $P_1$
	$D_2$	50 u. $P_1$ 200 u. $P_2$	-	80 u. $P_2$

The existence of two basic optimal solutions shows that the initial problem admits the following general optimal solution:

$$x = (0, 0, 0, 0, 310\lambda_1 + 350\lambda_2, 0, 0, 0, 0, 0, 0, 190\lambda_1 + 150\lambda_2, 0, 0, 50, 200, 0, 0, 0, 40\lambda_1, 110\lambda_1 + 70\lambda_2, 0, 0, 80\lambda_2), \text{ with } \lambda_1, \lambda_2 \geq 0, \lambda_1 + \lambda_2 = 1.$$

Table representation of this general optimal solution is presented in Table 3 and a network representation is illustrated in Fig.3

Table 3. Table representation of the general optimal solution

		$B_1$	$B_2$	$B_3$
$A_1$	$D_1$	-	$310 \cdot \lambda_1 + 350 \cdot \lambda_2 \text{ u. } P_1$	-
	$D_2$	-	-	$190 \cdot \lambda_1 + 150 \cdot \lambda_2 \text{ u. } P_2$
$A_2$	$D_1$	-	-	$110 \cdot \lambda_1 + 70 \cdot \lambda_2 \text{ u. } P_1$
	$D_2$	$50 \text{ u. } P_1$ $200 \text{ u. } P_2$	$40 \cdot \lambda_1 \text{ u. } P_2$	$80 \cdot \lambda_2 \text{ u. } P_2$

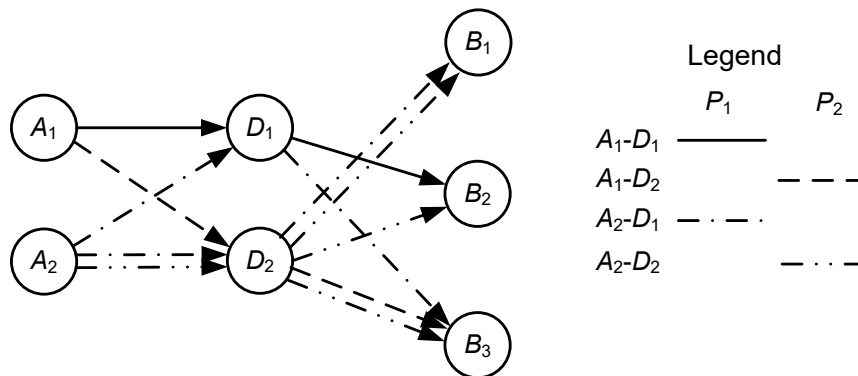


Figure 3. A network representation of the general optimal solution

b) For a certain optimal solution of the problem, the columns *Allowable Min  $c[i]$*  and *Allowable Max  $c[i]$* , from the corresponding combined report (see Fig.2), contain, for each variable  $x_{ijkl}$ , the extremities of an interval in which the coefficient  $c_{ijkl}$  can take values so that the optimal solution of the problem remains unchanged.

Thus for the solution from the combined report, presented in Fig.2,a, it obtains:

$$c_{1111} \in [1, \infty), c_{1112} \in [0,5; \infty), c_{1121} \in [2,5; \infty), c_{1122} \in [2, \infty), c_{1211} \in [3,5; 4,5] \text{ and so on.}$$

c) For the parametric analysis relative to the values of the unit transportation cost, respectively, to the corresponding coefficient from the objective function, the command *Perform Parametric Analysis*, from the menu *Solve and Analyze*, is called. It displays the dialog box *Parametric Analysis*, in which the selections shown in Fig.4 are performed. A click on the *OK* command button displays in the results window the table with the parametric analysis in relation to the unit cost  $c_{2122}$  (Fig.5).

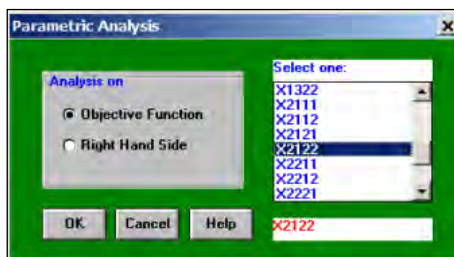


Figure 4. The dialog box Parametric Analysis



Range	From Coeff. of X2122	To Coeff. of X2122	From Obj Value	To Obj Value	Slope	Leaving Variable	Entering Variable
1	3.0000	4.0000	3.280.0000	3.480.0000	200.0000	X2222	X2212
2	4.0000	4.0000	3.480.0000	3.480.0000	120.0000	X2311	X2312
3	4.0000	4.2500	3.480.0000	3.492.5000	50.0000	X2122	X2112
4	4.2500	M	3.492.5000	3.492.5000	0		
5	3.0000	2.5000	3.280.0000	3.180.0000	200.0000	X2121	X1221
6	2.5000	-M	3.180.0000	-M	250.0000		

Figure 5. Table with parametric analysis in relation to the unit cost  $c_{2122}$

It is found that for  $c_{2122} \geq 4,25$  m.u. the transport of product  $P_2$  from  $A_2$  to  $B_1$  through  $D_2$  is no longer performed. With the command *Graphic Parametric Analysis*, from the menu *Results*, it is obtained the graph of the variation of the total cost depending on the value of the parameter (Fig.6).

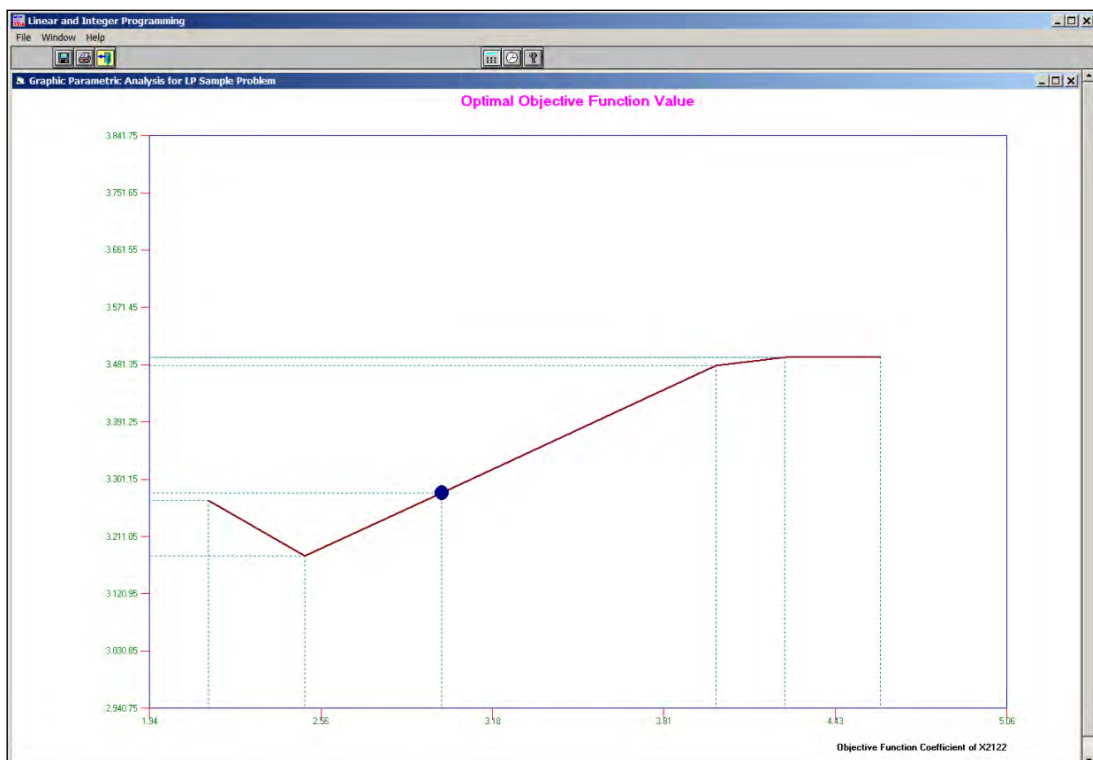


Figure 6. The graph of the parametric analysis in relation to the unit cost  $c_{2122}$

d) The blocking of the access on the route between the centers  $A_2$  and  $B_3$  implies the disappearance of four variables ( $X_{2311}$ ,  $X_{2312}$ ,  $X_{2321}$ ,  $X_{2322}$ ) from the mathematical model of the problem. For this purpose, for each of these four variables, it can use the command *Delete a Variable* from the menu *Edit* in *WinQSB*, as in the Fig.7.

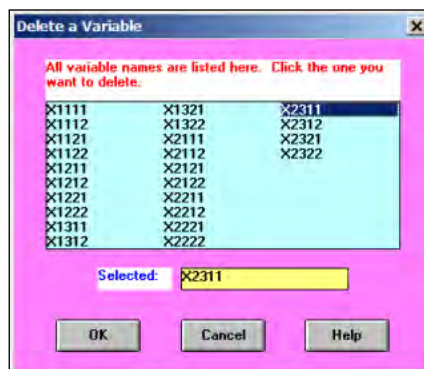


Figure 7. The dialog box *Delete a Variable*

In this case, two combined reports (Fig.8) are also obtained.

22:58:27		Thursday		June		25		2020			
Decision Variable	Solution Value	Unit Cost or Profit c(j)	Total Contribution	Reduced Cost	Basis Status	Allowable Min. c(j)	Allowable Max. c(j)				
1	X1111	0	3.0000	0	1.0000	at bound	2.0000	M			
2	X1112	0	5.0000	0	4.0000	at bound	1.0000	M			
3	X1121	0	4.5000	0	3.5000	at bound	1.0000	M			
4	X1122	0	4.0000	0	4.0000	at bound	0	M			
5	X1211	200.0000	3.5000	700.0000	0	basic	-M	4.5000			
6	X1212	0	6.0000	0	3.5000	at bound	2.5000	M			
7	X1221	0	5.5000	0	3.0000	at bound	2.5000	M			
8	X1222	0	6.5000	0	5.0000	at bound	1.5000	M			
9	X1311	20.0000	6.0000	120.0000	0	basic	5.5000	6.0000			
10	X1312	50.0000	5.0000	250.0000	0	basic	5.0000	5.0000			
11	X1321	0	5.0000	0	0	at bound	5.0000	M			
12	X1322	230.0000	4.0000	920.0000	0	basic	4.0000	4.0000			
13	X2111	0	4.5000	0	0	at bound	4.5000	M			
14	X2112	0	4.0000	0	0.5000	at bound	3.5000	M			
15	X2121	250.0000	3.5000	875.0000	0	basic	-M	3.5000			
16	X2122	0	3.0000	0	0.5000	at bound	2.5000	M			
17	X2211	0	7.0000	0	1.0000	at bound	6.0000	M			
18	X2212	150.0000	5.0000	750.0000	0	basic	4.0000	6.0000			
19	X2221	0	7.0000	0	2.0000	at bound	5.0000	M			
20	X2222	0	5.5000	0	1.5000	at bound	4.0000	M			
Objective Function		(Min.) = 3.615.0000		(Note: Alternate Solution Exist!)							
Constraint	Left Hand Side	Direction	Right Hand Side	Slack or Surplus	Shadow Price	Allowable Min. RHS	Allowable Max. RHS				
1	C1	500.0000	=	500.0000	0	-2.5000	500.0000	520.0000			
2	C2	400.0000	=	400.0000	0	0	400.0000	M			
3	C3	250.0000	=	250.0000	0	-4.0000	250.0000	260.0000			
4	C4	350.0000	=	350.0000	0	-2.5000	350.0000	370.0000			
5	C5	300.0000	=	300.0000	0	0	300.0000	M			
6	C6	420.0000	=	420.0000	0	0	420.0000	M			
7	C7	480.0000	=	480.0000	0	-1.0000	480.0000	530.0000			
8	C8	470.0000	=	470.0000	0	8.5000	460.0000	470.0000			
9	C9	430.0000	=	430.0000	0	7.5000	410.0000	430.0000			

21:49:46		Thursday		June		25		2020			
Decision Variable	Solution Value	Unit Cost or Profit c(j)	Total Contribution	Reduced Cost	Basis Status	Allowable Min. c(j)	Allowable Max. c(j)				
1	X1111	0	3.0000	0	1.0000	at bound	2.0000	M			
2	X1112	0	5.0000	0	4.0000	at bound	1.0000	M			
3	X1121	0	4.5000	0	3.5000	at bound	1.0000	M			
4	X1122	0	4.0000	0	4.0000	at bound	0	M			
5	X1211	200.0000	3.5000	700.0000	0	basic	-M	4.5000			
6	X1212	0	6.0000	0	3.5000	at bound	2.5000	M			
7	X1221	0	5.5000	0	3.0000	at bound	2.5000	M			
8	X1222	0	6.5000	0	5.0000	at bound	1.5000	M			
9	X1311	0	6.0000	0	0	at bound	6.0000	M			
10	X1312	70.0000	5.0000	350.0000	0	basic	4.0000	5.0000			
11	X1321	20.0000	5.0000	100.0000	0	basic	4.5000	5.0000			
12	X1322	210.0000	4.0000	840.0000	0	basic	4.0000	4.5000			
13	X2111	0	4.5000	0	0	at bound	4.5000	M			
14	X2112	0	4.0000	0	0.5000	at bound	3.5000	M			
15	X2121	250.0000	3.5000	875.0000	0	basic	-M	3.5000			
16	X2122	0	3.0000	0	0.5000	at bound	2.5000	M			
17	X2211	0	7.0000	0	1.0000	at bound	6.0000	M			
18	X2212	150.0000	5.0000	750.0000	0	basic	4.0000	6.0000			
19	X2221	0	7.0000	0	2.0000	at bound	5.0000	M			
20	X2222	0	5.5000	0	1.5000	at bound	4.0000	M			
Objective Function		(Min.) = 3.615.0000		(Note: Alternate Solution Exist!)							
Constraint	Left Hand Side	Direction	Right Hand Side	Slack or Surplus	Shadow Price	Allowable Min. RHS	Allowable Max. RHS				
1	C1	500.0000	=	500.0000	0	-2.5000	500.0000	520.0000			
2	C2	400.0000	=	400.0000	0	0	400.0000	M			
3	C3	250.0000	=	250.0000	0	-4.0000	250.0000	260.0000			
4	C4	350.0000	=	350.0000	0	-2.5000	350.0000	370.0000			
5	C5	300.0000	=	300.0000	0	0	300.0000	M			
6	C6	420.0000	=	420.0000	0	0	420.0000	M			
7	C7	480.0000	=	480.0000	0	-1.0000	480.0000	550.0000			
8	C8	470.0000	=	470.0000	0	8.5000	460.0000	470.0000			
9	C9	430.0000	=	430.0000	0	7.5000	410.0000	430.0000			

a) b)  
Figure 8. Combined reports of the problem in case of blocking access

Based on them, the general optimal solution of the problem in case of blocking access can be written:

$$x = (0, 0, 0, 0, 200, 0, 0, 0, 20\lambda_1, 50\lambda_1 + 70\lambda_2, 20\lambda_2, 230\lambda_1 + 210\lambda_2, 0, 0, 250, 0, 0, 150, 0, 0), \text{ with } \lambda_1, \lambda_2 \geq 0, \lambda_1 + \lambda_2 = 1.$$

The minimum total cost of the transport corresponding to this solution is  $z_{\min} = 3615$  m.u.

Table representation of the above solution is presented in Table 4 and a network representation is illustrated in Fig.9.

Table 4. Table representation of the general optimal solution of the problem in case of blocking access

		$B_1$	$B_2$	$B_3$
$A_1$	$D_1$	-	$310 \cdot \lambda_1 + 350 \cdot \lambda_2$ u. $P_1$	-
	$D_2$	-	-	$190 \cdot \lambda_1 + 150 \cdot \lambda_2$ u. $P_2$
$A_2$	$D_1$	-	-	$110 \cdot \lambda_1 + 70 \cdot \lambda_2$ u. $P_1$
	$D_2$	$50$ u. $P_1$ $200$ u. $P_2$	$40 \cdot \lambda_1$ u. $P_2$	$80 \cdot \lambda_2$ u. $P_2$

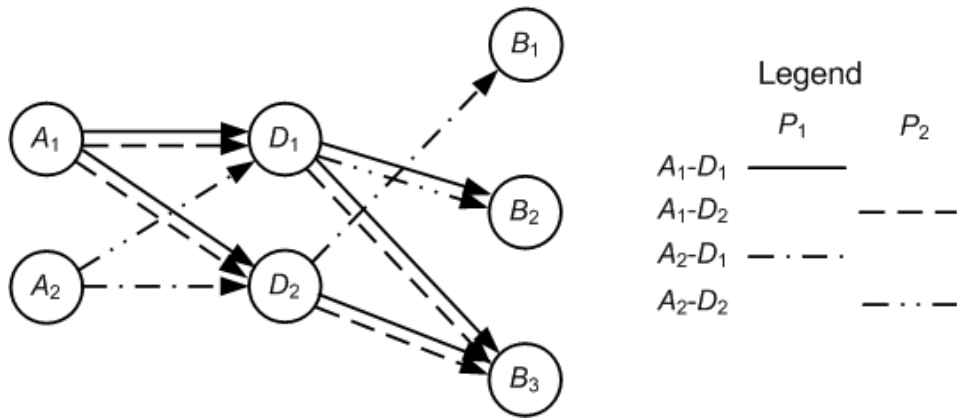


Figure 9. A network representation of the general optimal solution of the problem in case of blocking access

e) Imposing the restriction as on the route between the center  $A_1$  and the center  $D_2$ , a total quantity of products greater than or equal to 210 u. to be transported, implies the addition of a new constraint, in the initial mathematical model of the problem, having the form:

$$X_{1121} + X_{1122} + X_{1221} + X_{1222} + X_{1321} + X_{1322} \geq 210$$

For this purpose it can use the command *Insert a Constraint* from *WinQSB* and it obtains the numerical model in matrix form, presented in Fig.10.

Variable ->	X1111	X1112	X1121	X1122	X1211	X1212	X1221	X1222	X1311	X1312	X1321	X1322
Minimize	3	5	4.5	4	3.5	6	5.5	6.5	6	5	5	4
C1	1	1	1	1	1	1	1	1	1	1	1	1
C2												
C3	1	1	1	1								
C4					1	1	1	1				
C5									1	1	1	1
C6	1	1			1	1			1	1		
C7			1	1			1	1			1	1
C8	1		1	1	1		1	1	1		1	1
C9		1		1		1		1		1		1
C10			1	1			1	1			1	1
LowerBound	0	0	0	0	0	0	0	0	0	0	0	0
UpperBound	M	M	M	M	M	M	M	M	M	M	M	M
VariableType	Continuous	Continuous	Continuous	Continuous	Continuous	Continuous	Continuous	Continuous	Continuous	Continuous	Continuous	Continuous

X2111	X2112	X2121	X2122	X2211	X2212	X2221	X2222	X2311	X2312	X2321	X2322	X2322	Direction	R. H. S.
4.5	4	3.5	3										=	500
1	1	1	1	1	1	1	1	1	1	1	1	1	=	400
1	1	1	1										=	250
				1	1	1	1						=	350
								1	1	1	1	1	=	300
1	1			1	1			1	1				=	420
		1	1			1	1			1	1	1	=	480
1		1		1		1		1		1			=	470
	1		1			1		1		1	1	1	=	430
													>=	210
0	0	0	0	0	0	0	0	0	0	0	0	0		
M	M	M	M	M	M	M	M	M	M	M	M	M		

Figure 10. The data of the problem in matrix form

The obtained combined report (Fig.11) indicates a unique optimal solution:

$$x = (0, 0, 0, 0, 290, 0, 40, 0, 0, 0, 0, 170, 0, 0, 10, 240, 0, 0, 0, 20, 130, 0, 0, 0)$$

23:06:09		Thursday	June	25	2020			
Decision Variable	Solution Value	Unit Cost or Profit c[i]	Total Contribution	Reduced Cost	Basis Status	Allowable Min. c[i]	Allowable Max. c[i]	
1	X1111	0	3.0000	0	2.0000	at bound	1.0000	M
2	X1112	0	5.0000	0	4.5000	at bound	0.5000	M
3	X1121	0	4.5000	0	1.5000	at bound	3.0000	M
4	X1122	0	4.0000	0	1.5000	at bound	2.5000	M
5	X1211	290.0000	3.5000	1.015.0000	0	basic	-M	4.5000
6	X1212	0	6.0000	0	3.0000	at bound	3.0000	M
7	X1221	40.0000	5.5000	220.0000	0	basic	5.0000	6.0000
8	X1222	0	6.5000	0	1.5000	at bound	5.0000	M
9	X1311	0	6.0000	0	3.5000	at bound	2.5000	M
10	X1312	0	5.0000	0	3.0000	at bound	2.0000	M
11	X1321	0	5.0000	0	0.5000	at bound	4.5000	M
12	X1322	170.0000	4.0000	680.0000	0	basic	3.5000	4.5000
13	X2111	0	4.5000	0	2.0000	at bound	2.5000	M
14	X2112	0	4.0000	0	2.0000	at bound	2.0000	M
15	X2121	10.0000	3.5000	35.0000	0	basic	3.2500	4.0000
16	X2122	240.0000	3.0000	720.0000	0	basic	2.5000	3.2500
17	X2211	0	7.0000	0	2.0000	at bound	5.0000	M
18	X2212	0	5.0000	0	0.5000	at bound	4.5000	M
19	X2221	0	7.0000	0	1.0000	at bound	6.0000	M
20	X2222	20.0000	5.5000	110.0000	0	basic	4.5000	6.0000
21	X2311	130.0000	4.0000	520.0000	0	basic	3.0000	4.5000
22	X2312	0	4.5000	0	1.0000	at bound	3.5000	M
23	X2321	0	6.0000	0	1.0000	at bound	5.0000	M
24	X2322	0	5.0000	0	0.5000	at bound	4.5000	M
Objective Function		[Min.] =		3.300.0000				
Constraint	Left Hand Side	Direction	Right Hand Side	Slack or Surplus	Shadow Price	Allowable Min. RHS	Allowable Max. RHS	
1	C1	=	500.0000	0	-1.5000	500.0000	540.0000	
2	C2	=	400.0000	0	0	400.0000	M	
3	C3	=	250.0000	0	-2.5000	250.0000	270.0000	
4	C4	=	350.0000	0	0	350.0000	M	
5	C5	=	300.0000	0	-1.0000	300.0000	340.0000	
6	C6	=	420.0000	0	-1.0000	420.0000	425.0000	
7	C7	=	480.0000	0	0	480.0000	M	
8	C8	=	470.0000	0	6.0000	460.0000	470.0000	
9	C9	=	430.0000	0	5.5000	410.0000	430.0000	
10	C10	>=	210.0000	0	1.0000	190.0000	215.0000	

Figure 11. Combined reports of the initial problem

The minimum total cost of the transport corresponding to this solution is  $z_{\min} = 3300$  m.u.

Table representation of this solution is presented in Table 5 and a network representation is illustrated in Fig.12.

Table 5. Table representation of the optimal solution from the Fig.11

		$B_1$	$B_2$	$B_3$
$A_1$	$D_1$	-	290 u. $P_1$	-
	$D_2$	-	40 u. $P_1$	170 u. $P_2$
$A_2$	$D_1$	-	-	130 u. $P_1$
	$D_2$	10 u. $P_1$ 240 u. $P_2$	20 u. $P_2$	-

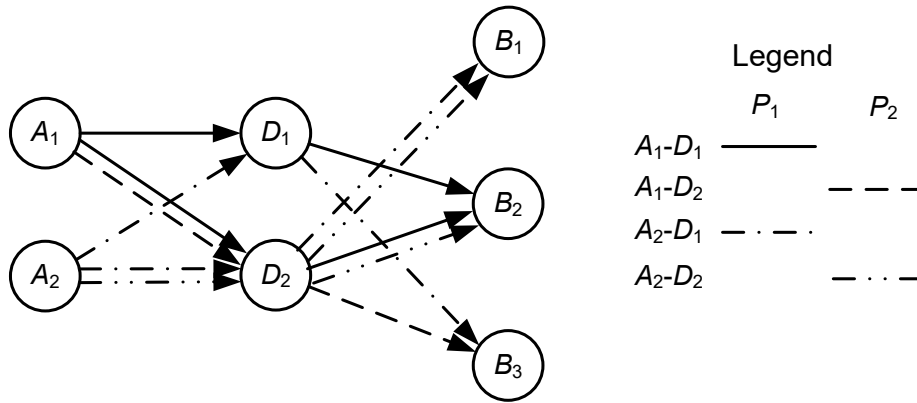


Figure 12. A network representation of the optimal solution from the Fig.11

### Discussion and conclusions

Most of the models formulated for transportation problems have concentrated on shipping a single product or commodity to optimize the distribution network. Cases arise when multiple products have to be transported along similar routes.

This paper aims to be a guide to understand mathematical formalization, resolving and analyze of a four-dimensional Transportation Problem. The extension to four dimensions of the Transportation Problem is very important in the practice of the real-world, where the heterogeneous commodities shipping and more than two categories of centers involve a very large number of variables and constraints.

In the paper it is elaborated the mathematical model of the studied problem; it is formulated the necessary and sufficient condition for the existence of a feasible solution; it is proposed a methodology for solving and analyzing this problem. Finally, a numerical case study is treated in detail, based on the methodology, to demonstrate its applicability to a variety of cases.

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# THE ROLE OF VALUES IN ECONOMIC SLOWDOWN TIMES

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## Abstract

**Purpose** – *This paper highlights the role of the professional values in reiterating the business units' strategy in the current pandemic times.*

**Findings** - *The literature studies values' role and culture in rooting the business idea, in choosing the customers, partners, suppliers, teams, business model, in the employees' lifecycle, in the organization's success or depression, in the behavior in front of the external factors, but unfortunately it is not offering a sufficient share of practical examples on managing in VUCA times.*

**Practical implications** – *How successful organizations handle the meltdown, looking into the global companies' approach can be interpreted in a weighted way, and the measures are a good source of inspiration for other business units.*

**Value** – *The paper analyzes the companies' strategic measures of adapting to the current times, with the main focus on People. What is the role of a value driven professional mindset in adapting, sometimes spontaneously, to the economic environment? If the first thought relates to having the right set up so that the employees can easily achieve excellence in functional capabilities, one must not ignore the nurturing and preservation of personal and professional values, which are the basis of one's motivation and commitment.*

**Key words:** *Change, Strategy, Values*

## Introduction

The literature offers countless fundamental studies on the importance of the organizational culture, of the so-called company DNA that employees are sharing, or not. People's values are being lived in the working environment too and they are in fact the engine, the main drive in achieving the professional goals, along with, of course, the functional capabilities.

Day in day out, all being out and about and caught into the rush of duty, business life, success even, where the external factors leave too much place into guiding our leaders' measures, followed by the employees' actions, the professional values often remain posters hanging on the office walls, motivational notes in the printed agendas or screensavers on the desktops and unfortunately, they are not always used and perceived as they should, as driving one's professional activity.

The objective of this paper is to highlight the role of the professional values in reiterating the strategy of economic agents in the current pandemic times.

The literature is flowing with strategic models helping out companies recovering, same as there is state support in place for life after the sudden downturn. Consulting agencies are ready to offer their service on the topic, forecasting a financial boom, same as other industries and clever minds can benefit upon the current economic depression.

While the impact of the global recession stays insignificant compared to the human loss, one can see how the economic crisis is not just about the meltdown or stagnation of production, investment or services.

The negative growth of the Gross Domestic Product, the social impact created by the pandemic and economic crisis affects the population (and the unemployment rate is only one of the indicators). Certainly, the emphasis is, where possible, on maintaining the employment relations, in the view of resuming work as soon as possible.

The literature studies the role of the values and culture in rooting the business idea, in bringing it to life, in choosing the customers, partners, suppliers, teams, business model, in the employees' lifecycle, in the organization's success or depression, in the behavior in front of the external factors (political, economic, social), but unfortunately it is not offering a sufficient share of practical examples on recovering after the pandemic.

Although already convinced of the importance of a value driven mindset in the professional environment, I would not have thought that the completion of my doctoral thesis. *The implications of Human Resource Management in the Development of Family Business in Romania* will happen in the midst of a pandemic and economic crisis. Because travelling and the use of classical research methods are not possible, the paper aims to complete by accessing these main fronts: the professional, educational and life experience of the researcher and the online bibliographic sources.

### **Organizational Values and their Role in the People Strategy**

A correct business strategy will always include a correct people strategy, in which employees are offered levers for their professional development. Just as the strategy involves measures to meet its goals in the short, medium and long term, so a good personnel strategy aims to prepare the workforce in such a way that it meets the future needs of the labor market. What is the role of a value driven professional mindset in adapting, sometimes spontaneously, to the economic environment? If the first thought relates to having the right set up so that the employees can easily achieve excellence in functional capabilities, one must not ignore the nurturing and preservation of the importance of personal and professional values, which are the basis of one's motivation and commitment.

This paper intends to embed the findings from one of the studies carried out within the doctoral thesis *The implications of Human Resource Management in the Development of Family Business in Romania* and to interpret them given the current situation. If the majority of the corporations have already defined their Mission, Vision and Values, small family businesses lack this part in the content of their website. Thus, I interviewed a sample of 12 entrepreneurs running small businesses, but with high potential, especially in the service industry and HORECA, Romania, 2018. To the question *What are the values that underlie the business?*, entrepreneurs had difficulty answering concretely. Why? Naturally, at the beginning of the road, the business idea should be immediately followed by action. Intrinsic motivation is present as an engine, without being able to be consciously assigned words and values.

I thus applied an exercise of awareness of the personal values, because they are, each time, the basis of motivation. Entrepreneurs were offered a list of values, and the exercise consisted in choosing a top of 15, 10 and then 5 values which they identify with. The interview ended with the 3 questions, in order to urge the founders to reflect. The same survey was applied on 24 employees.

*Why do you think you identify yourself with the 5 chosen values?/ How do you live these values daily?/ How do you think that you can translate these values into expected behaviors at work?*

Below, the values included in the survey, in an alphabetical order: adventure, authority, belonging, challenge, community, creativity, culture, dependency, efficiency, empathy, engagement, equality, freedom, friendship, health, honesty, inner harmony, innovation, integrity, job security, money, material well-being, nature, passion, politeness, prestige, professional development, professionalism, relationship, respect, respect for traditions, responsibility, returning favors, self-awareness, sense of life, social power, social recognition, spiritual life, stability, success, sustainability, teamwork, wisdom.

In the graphic below the top values of the employers are listed, followed by the employees' top and the, on the third graphic, a correlation of both groups can be easily observed.



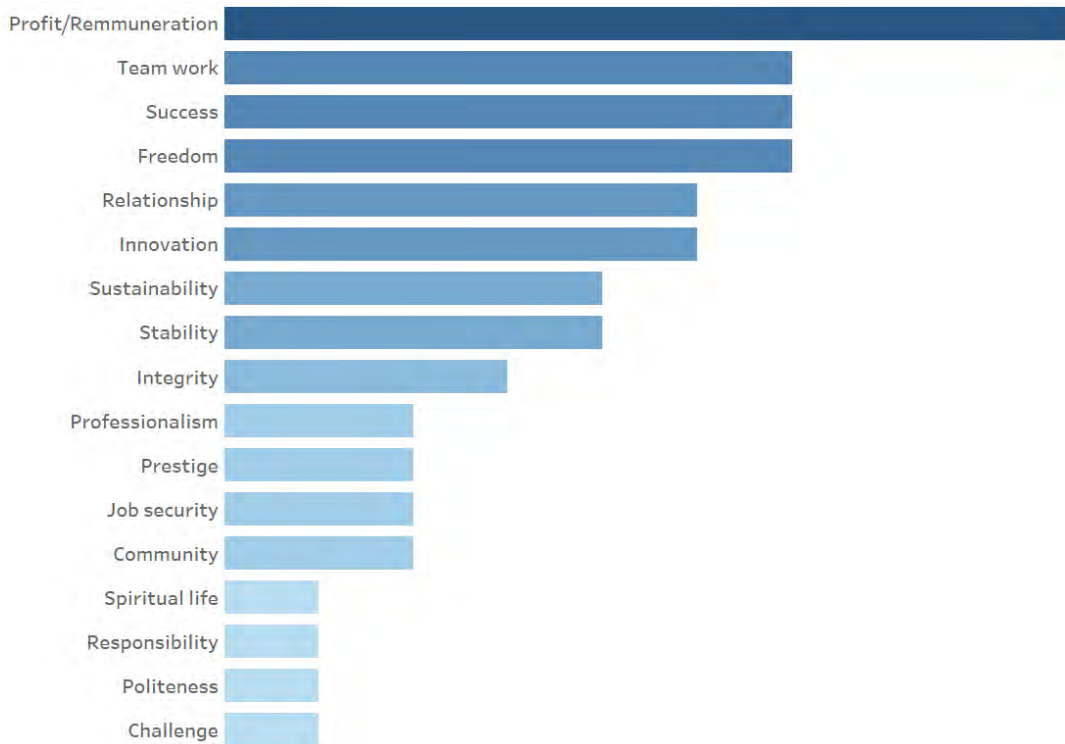


Figure 1. Top Values Employers

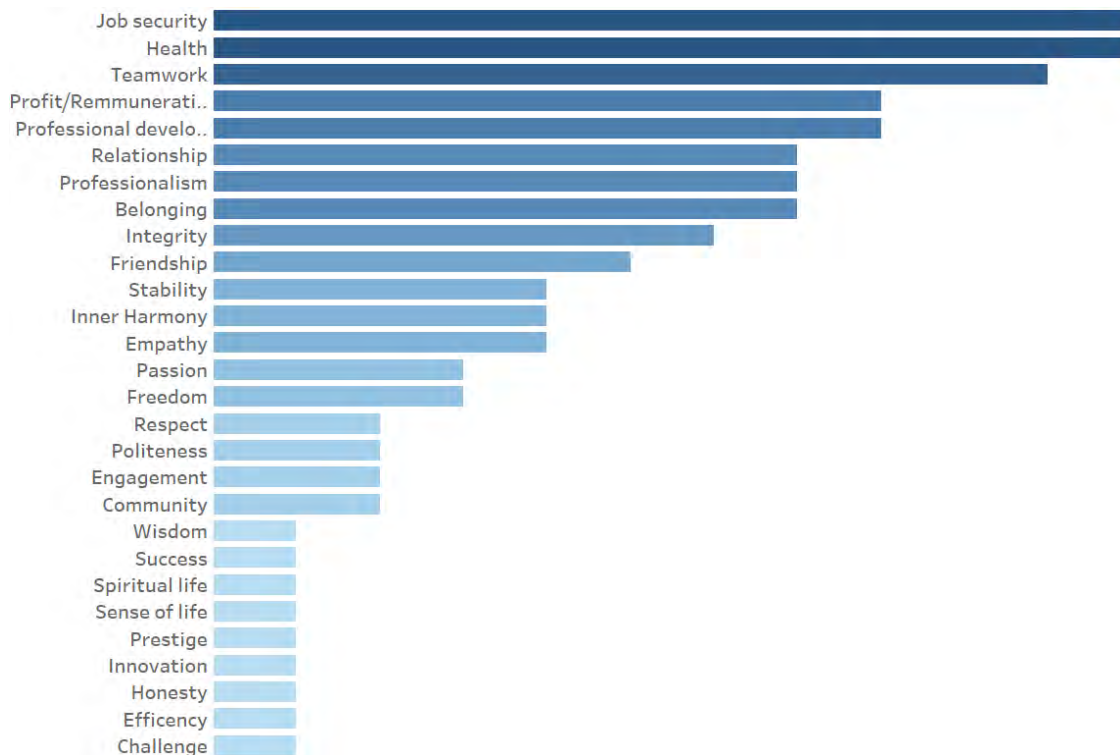


Figure 2. Top Values Employees

Teamwork is the value that is in the top three for both employees and the employers. Teamwork and a good collaboration at work becomes essential, especially for a family business but not only, where without the community, could the business not exist. The synergy between the members is the source of reaching together, through a joint effort, achievements and results. The team, for employees, responds to an important social need, strongly expressed in the questionnaire by choosing values such

as quality of relationships, friendship, sense of belonging, community, in the top five of the most important values, thus this aspect cannot be subject to compromise.

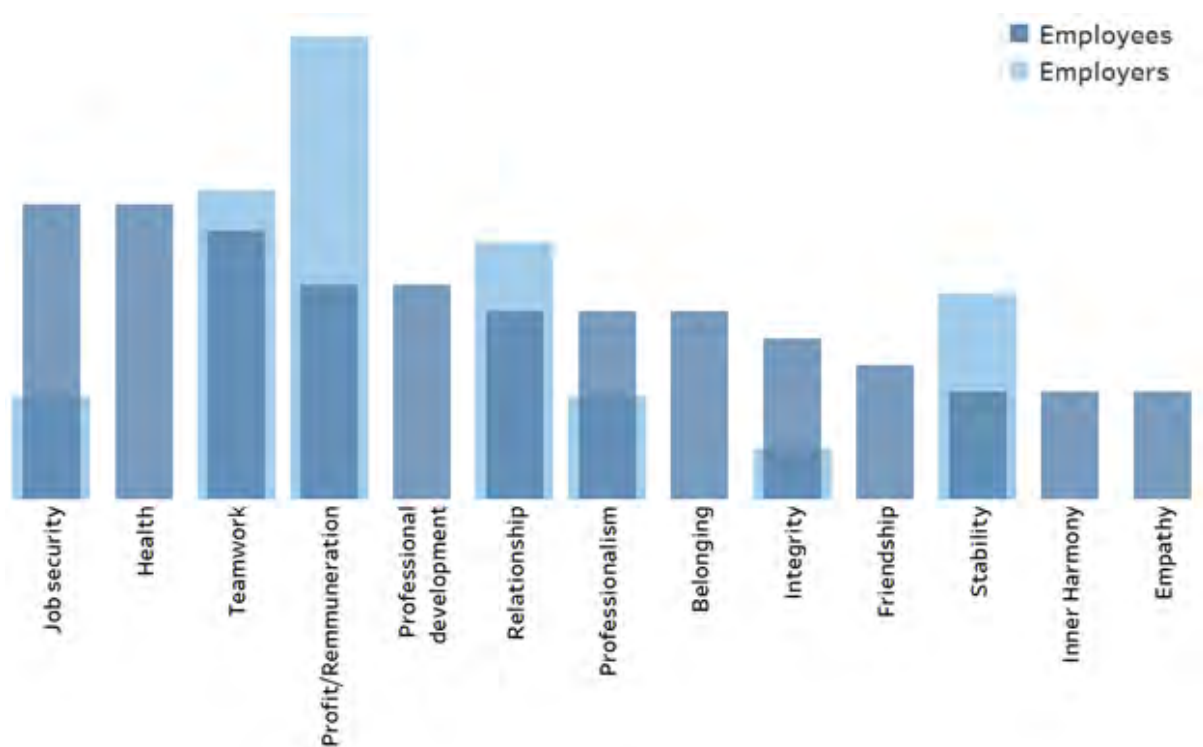


Figure 3. Top Values Employees and Employers

Profit or remuneration are to be found in the top 5 selected values for the both groups. The financial aspect presents a contradiction between the interests of employees and the interests of employers. For employers it means profit, business development, and for employees it means the remuneration and benefits received for the work they perform. Job safety and health are among the top values of employees, but not in the top values of employers. A greater trust and involvement of employees in finding solutions and problem solving at the company level will increase the entrepreneurial spirit and attachment to the company's results and evolution. Increasing job satisfaction will strengthen the feeling of having job security as well as a general state of harmony, health, with a substantial reduction of the motivational sick leave. Professional development is another value that is in the top four for employees and not in the top 10 for employers. If the company does not provide career plans for its employees, especially due to economic and market conditions, I recommend granting autonomy to employees to develop their creativity and personal skills through organic and natural means. A learning organization is the ideal environment for professional development and a great method of increasing the employees' engagement.

### The Role of Values in Economic Slowdown Times

We have noticed that values play a particularly important role in shaping the organizational culture and commitment in the workplace. What happens when, in unfavorable and unforeseen conditions, everyday life is marked by a global change and everything is subject to coming into question? Unfortunately, organizations do not have the capacity to be proactively prepared for all risk levels. Therefore, agile work methodology and the so called agile organizations have the chance to adapt to crisis situations and even to transform these risks from threats into opportunities, in some situations or areas of activity.

A lot of the operating business models overcame structural changes and a big amount of them decided to temporarily suspend their activity or even to suspend it. There are countries, regions, organizations that will still be able to manage more effectively, if not favorably, the adverse effects of the depression. In my study I dive deep into how successful organizations handle the meltdown, looking into the global

companies' approach. Of course, the data, the measures, the strategies cannot be the same globally, but the overall impact can be interpreted in a weighted way, and the measures are a good source of inspiration for other economic agents.

## **A Successful Response to the Current Situation**

Without any intention of showing thankfulness for the current situation worldwide, part of coping with it means adapting to it. Care for People is and should remain top priority. How do some companies manage to succeed in VUCA (Volatility, Uncertainty, Complexity and Ambiguity) times? The VUCA environment takes issue in finding a customized way to the present condition. While at times, companies find themselves in challenging situations, now the entire world can be described as so. Developing an empathic behavior, being even more concerned about the People's needs would altogether put purpose and meaning in the center of attention. Most agile teams practiced such foundational agile elements before the pandemic, so they could continue their work almost seamlessly under lockdown. This is one the sort of a successful response of adapting to the current situation in which agile organizations manage to outperform. Satya Nadella's statement, Microsoft CEO, stays memorable, yet so true: "The COVID-19 pandemic has driven two years' worth of transformation in two months."

Although the VUCA concept might be considered as old, dating from 1987, it is as valid as it could be. Combining vision, understanding, clarity and agility, it offers the right mindset to counter the unwanted results of volatility, uncertainty, complexity and ambiguity, at a company, team, individual level, in a strategic approach.

- Vision – a shared vision which is worth striving for
- Understanding – for each other and listening
- Clarity – internally and externally, combined with transparency in communication
- Agility – in mindset, behavior and actions

Turning to default to transparency in uncertain situations becomes a must and creates psychological safety (or the opposite) in moments of insights, leading to connection and understanding, ultimately to having a shared feeling of meaning and purpose. This will give people a clear focus and help them to react quickly to change.

Therefore, companies should follow two main focuses: people and business. While they are interconnected, as they depend on each other, expressing clear work streams or strategies will fight ambiguity and give people a clear direction or expectation.

1. Protecting the employees by keeping them safe from harm, protecting the business unit by keeping it operational at all times, while contributing to the society goal of slowing down the spread if the virus
2. Managing impact on the business and calibrating appropriate measures to protect the financial health in the economic slowdown times

While COVID-19 surprised us all, the slowdown that followed was expected. Many companies switched to a zero-based recruitment approach and tried the most to keep their own workforce committed. At a people level (1), holding onto staff should stay a top business priority, hence ensuring business growth after the meltdown and ultimately, raising loyalty and engagement of both employees and customers. Besides the social implications, "Companies that lay off too much of their workforce and reduce headcount in their sales departments, in particular, will struggle to capture new businesses when the economy picks up. Thinking beyond the downturn is imperative." (John Wilson, WilsonHCG, 2020).

*Recruitment.* Unfortunately with more people looking for jobs, the number of successful candidates remained a fixed one whereas rejected applications raise at an exponential rate. More than ever, on the way to recovery, customers are important. The connection between profitability and employer branding is not any longer a secret. A study published by Careerarc shows that 65 percent of the jobseekers say that a poor candidate experience would make them less likely to purchase goods and services from that particular employer. This means that unsuccessful candidates need to have a positive experience too.

*Remote working* became another hot topic and suddenly companies needed to provide the necessary equipment and frame to make this new working style that once was perceived as a benefit, possible.

While co-location has often been seen as a prerequisite for the agile way of working, the pandemic has shown that agile teams can be highly effective in a remote setting. The critical success factors have been a stringent adherence to the agile cadence, efficient use of remote-collaboration tools, and the creation of a virtual co-location. Many organizations reported that being remote helped them to be virtually co-located and become more effective.

*Diversity and inclusion*, together with bias, stayed as important as they were before, only that the new context brought the topics to more light. Diversity and inclusion is inherently linked with innovation, strong company cultures and psychologically secure environments and teams. In an inclusive culture, belonging signals team members feel valued, respected and accepted as individuals — which helps them to participate and contribute uniquely and authentically.

*Job rotation, job assignments.* Temporary assignments, commonly also known as secondments, became common practices for agile organizations. Staying adaptable means also encouraging people to learn new skills, stimulate debate and embrace creativity. Besides the big learning benefit at an individual level, altogether with keeping the occupational level, secondments have the main benefits into balancing idle capacity with high business critical demands, helping other teams in urgent need to run the business, supporting agility of internal mobility, therefore increasing cross functional and transferable learning. Below, an excerpt from my own testimonial, initially published in the internal newsletter:

*Taking over my current assignment did not only allow me the opportunity to adapt to the dynamics of another team, their requirements and leadership styles, but also to celebrate and learn in collaboration with my new team, while still being part of the recruitment team. A great way to learn, discover and apply new skills! While I am sincerely hoping life will soon get back to normal, I have to admit I am also longing to have the chance to implement and test the new designed solutions. This assignment was one of the best challenges I took part in so far, encouraging my development into an area I haven't really planned before. How will this impact my future work? I am also curious to see. The sky is the limit!*

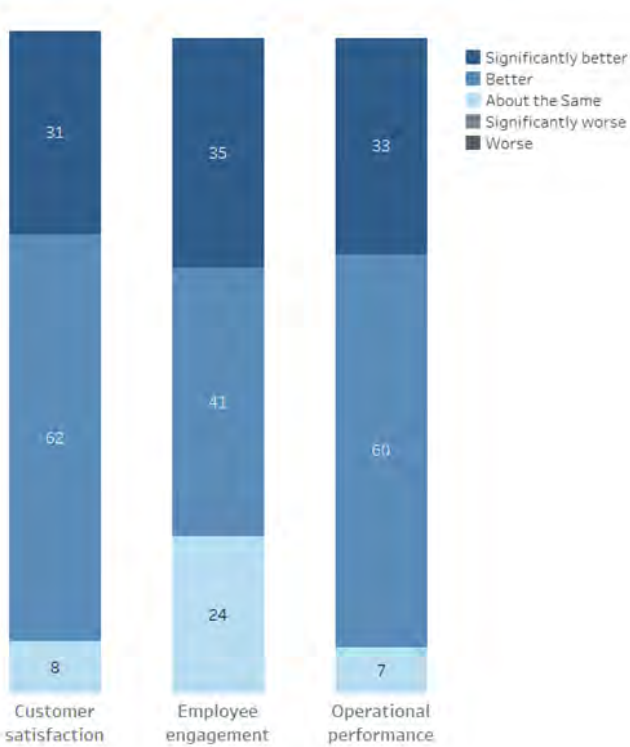


Figure 4. Performance self assessment of agile business units relative to nonagile units in same organisation

At a company level (2), a top work stream is managing impact on the business and calibrating appropriate measures to protect the financial health in the economic slowdown times. Keeping the

business running is not only business beneficial but also people targeted, therefore continuing to work in an agile way fitting the VUCA environment is essential. Reprioritization is the key, together with always staying in the know to anticipate threads or take advantage of the new opportunities.

An article published by a study (25 companies across seven sectors), conducted by McKinsey shows the practical impact of agile companies, equipped with methodologies and practices that ensure fast, resilient, adaptable, reactions to shock. Companies with a strong orientation towards change, especially agile ones, are given as successful examples not for exiting slowdown access, but for adapting on the fly to the unfavorable global decline. According to their self-assessments, almost all of their agile business units responded better than their nonagile units to the shocks associated with the COVID-19 pandemic by measures of customer satisfaction, employee engagement, or operational performance.

The study emphasized how the agile teams pursued their work almost seamlessly, having an assertive reaction to the shock, without mentioning important setbacks. On the other hand, transition through and after the shock for non-agile organizations represented a struggle.

### Discussion and conclusions

Interested would be to have the survey described and applied in 2018 also now. I believe foreseeable changes would be noted in the area of Health, Safety, Job security, Profit/ remuneration, as these suddenly became stringent, while values like teamwork, professional development, relationships, professionalism, belonging would still continue to stay on top, as they are intrinsic values that People have. Keeping employees motivated and committed, means making sure to respond to their needs and expectations in terms of sharing these values and playing the company's values. Organizational culture, that DNA that connects people, stays the engine, the main drive in achieving the professional goals, along with, of course, the functional capabilities, even working remotely, if not especially in the absence of a co-located working environment.

The correlation of personal values with the professional ones is possible and natural, as seen in the table below as well as the harmony between meeting the daily needs, aspirations or goals at work and outside of it, combined with the purpose of the organization. A good match between the two areas is highly beneficial for both the company and the employees.

Table 1. Harmony between the interests of the organization and the individual ones

Conditions for staying competitive	People's inner needs
Learning	Learning and exploring
Agility	Experimentation
Creativity and innovation	Creativity and innovation
Partnership	Relationship
Continuous learning	Discovering
Teamwork	People connection
Dialogue	Communication
Participation	Involvement
Risk taking	Permission to err
Proactivity	Empowerment
Informal assessment/ feedback	Solidarity and friendship
Mentoring	Closeness
Vision	Purpose
Context	Complexity and depth
Alternative roles	Experience
Inventions	Possibilities
Imagination	Reflection
Communication	Communication
Integration	Accomplishment
Expansion	Widening the horizon
People development	Growth
Common self-awareness	Attachment
Team	Community
Interest representation	Family

As stated earlier, as the strategy involves measures to meet its goals in the short, medium and long term, a good personnel strategy aims to prepare the workforce in such a way that it meets the future needs of the labor market, and this stays relevant in all times. Ensuring a good combination of team and company elements would lead to a more transparent approach, which is expected especially in uncertain situations, as feeling a shared meaning and purpose creates psychological safety (or the opposite).

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# SPECIFIC ASPECTS OF PROCESS QUALITY MANAGEMENT IN THE AEROSPACE INDUSTRY

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## Abstract

**Purpose** – *The scientific paper addresses in its own way the specific aspects of process quality management in an organization in the aerospace industry by first streamlining the quality of products and services offered.*

**Methodology/approach** – *The research methodology was a standard methodology where the life cycle of the management processes is insisted on, as well as the improvement of the management processes in a concrete way in order to increase and achieve the proposed goals. The optimal results in order to significantly reduce the non-conformities are foreshadowed in order to improve the quality management system and subsequently of the integrated quality management system.*

**Findings** – *The total quality and the zero defects strategy can be correlated with the continuous improvement in order to increase the quality of products and services in the specific water industry that the authors chose to analyze. The aerospace field is a spearhead in terms of current spectrum worldwide. The process approach through a specific method of continuous improvement can lead to an important benefit in terms of management quality, product quality, efficiency and effectiveness and then the market position of the organization.*

**Research limitations/implications** – *The presented research deals with the issue of improving the quality of process management in a specific industry organization. Planning and making decisions in order to implement efficient management correlated with a good manufacturing organization can lead to increased efficiency and high efficiency.*

**Practical implications** – *It presents its own point of view on how the efficiency and effectiveness of the processes can be estimated in order to improve the quality of the products promoted on the profile market.*

**Originality/value** – *All the above have led to a scientific research based primarily on rigorous documentation, on an important qualitative contribution to the efficiency of manufacturing and management itself within an industrial organization in the aerospace field. The processes within the analysis were carefully selected and led to a modeling made so that in the end the authors managed to present solutions to improve the quality of process management and reduce non-conformities in the specific industry.*

**Key words:** *quality and quality management, process management, aerospace industry.*

## Introduction

Akhil Kumar (Kumar, 2018) in his paper, defines the process as a vital element of an organization.

Michael Hammer and James Champy (Hammer and Champy, 1993) and (Buhl, Roglinger, Stockl, and Braunwarth, 2015) argued in the early 1990s that by redesigning business processes, organizations could achieve major productivity improvements. These improvements represent faster deliveries to customers in business - shorter order-to-cash cycles and labor savings needed to work in processes.

Many organizations do not yet have formal processes for how things are done. People need to "know" how things are done and follow the routine.

However, unless a description of the process is explicitly noted, it is not possible to analyze this description, nor to identify inefficiencies or even make improvements.

Many organizations have continued to perform unnecessary tasks for decades, but without analyzing their purpose. In these cases there is a risk that additional copies of a document will be sent to more people than necessary, and therefore additional approvals are required. When a person in an organization is asked why he or she is doing this, the answer he or she will receive will be "I've always done that." Is this due to organizational inertia, and often no one has thought about why things are done the way they are done?

In other words, Akhil Kumar, Rosemann (2006), Rotaru (2011) and Sedera (2004) state that:

- a process is a way of carrying out activities to achieve a goal;
- a process model is a formal representation of a series of related activities that are carried out in a specific order to achieve a clear objective;
- a business process is a collection of activities that require one or more types of inputs and create an output that has value for the customer;
- a business process is defined as a chain of activities whose ultimate goal is the production of a specific product for a particular customer or market.

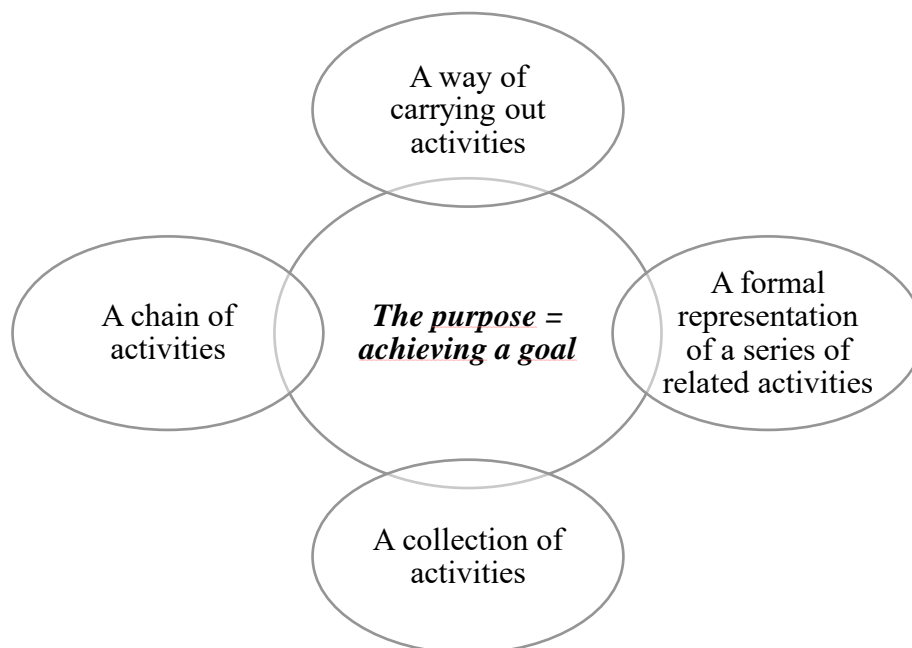


Figure 1. Defining the process

### **Management processes. General information about processes in the aeronautical industry**

Dumas and his collaborators proposed six stages of the life cycle of management processes (Dumas, La Rosa, Mendling, and Reijers, 2013), (Dijkman, Vanderfeesten, and Reijers, 2011):

- process identification;
- process discovery;
- process analysis;
- process redesign;



- implementation of processes;
- process monitoring and control.

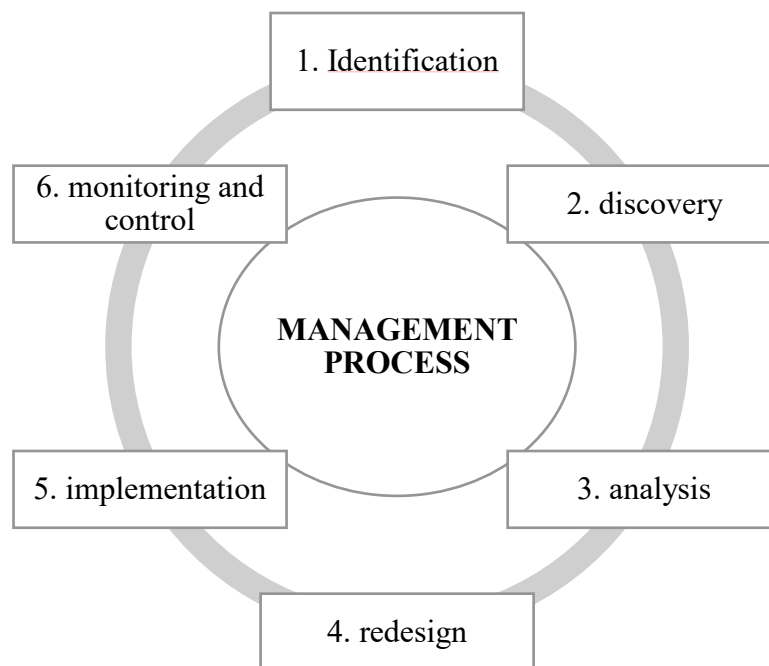


Figure 2. Stages of the life cycle of management processes

Leadership functions are a systematic way of doing things. Management is a process that highlights the fact that all managers, regardless of their aptitude or ability, engage in some interconnected functions to achieve their desired goals.

Planning, organization, coordination and control are the 4 functions of management, which function as a continuous process. In the planning phase, managers must establish a plan, then organize resources according to the plan, then coordinate employees to work according to the plan and finally control everything by monitoring and measuring the effectiveness of the plan.

### **The basic activities of the management process. Own interpretations**

The management process / functions involve 4 basic activities. These are (www.iedunote.com, 2020):

- Planning and decision making - determining actions;
- Organization - coordination of activities and resources;
- Leadership - managing, motivating and guiding people;
- Control - monitoring and evaluation activities.

### **Planning and decision making - determining the course of action**

Looking ahead and anticipating possible trends or events that could influence the work is of major importance, similar to the manager's position.

Planning involves setting the goal of an organization and deciding how best to accomplish it. Planning involves making decisions about goals and setting the course of future actions from a set of alternatives to achieving goals.

The plan facilitates the maintenance of managerial effectiveness, as it functions as a guide for future activities dedicated to staff. The selection of objectives, as well as the ways to achieve them is what planning entails.

Planning involves selecting missions and objectives as well as actions to achieve them. Planning requires making decisions or choosing future courses of action from alternatives.

In short, planning means determining what the organization's position is and what the situation should be at some point in the future and deciding how best to make it happen.

Planning helps maintain managerial effectiveness by guiding future activities.

For a manager, planning and decision making requires the ability to predict, visualize, and deliberate anticipation.

### **Organization - coordination of activities and resources**

Organization can be defined as the process by which established plans are close to realization. Once a manager sets his goals and develops his plans, his next managerial function is to organize human resources and other resources identified as necessary by the plan to achieve the goal. The organization involves determining how activities and resources should be combined and coordinated.

The organization can also be defined as a structure intentionally formalized by positions or roles for people to complete an organization.

The organization produces a structure of relationships in an organization and through these structured relationships the plans are followed.

Indeed, organization is that part of management that involves: establishing an intentional role structure for people to complete the organization. Intentionally, to ensure that all the tasks necessary to achieve the objectives are assigned to those who can do their best.

The purpose of an organizational structure is to create an environment for the best human performance. The structure must define the task to be performed. The rules thus established must also be designed according to the abilities and motivations of the people available.

The staff is related to the organization and involves filling and maintaining busy positions in the structure of the organization.

This can be done by determining the positions to be filled, identifying the workforce requirement, filling vacancies and training employees so that the assigned tasks can be performed effectively and efficiently.

Managerial functions of promotion, demotion, dismissal, transfer, etc. they are also included in the broad task of "staff (human resources)". The staff ensures that the right person is placed in the correct position.

The organization assumes where exactly the decisions will be made, who will work and what tasks it will have to perform, for whom and how the resources will be gathered.

### **Leadership - Managing, motivating and guiding people**

The third basic managerial function is Leadership, which involves having the ability to influence people for a certain purpose or for a certain reason. Leadership is considered to be the most important and challenging of all managerial activities.

Leadership influences or determines the human resource in the organization to work in its interest.

Leadership involves creating a positive attitude of the organization's members towards work and the organization's objectives. It is necessary because it helps to achieve the objectives in an effective and efficient way by changing the behavior of the employees.

Leadership is key to leadership. Most authors do not consider coordination as a separate function of management. Rather, it considers coordination to be the essence of leadership for achieving harmony between individual efforts to achieve group goals.

Motivation is an essential quality for a leader. Motivation is the function of the management process to influence people's behavior based on knowing the cause and the channels that support human behavior in a certain direction.

Effective managers must be effective leaders.

Because leadership involves fellowship, and people tend to follow those who clearly provide a means of meeting their own needs, hopes, and aspirations, leadership involves styles of approaches, communication, and motivational leadership.

### **Control - Monitoring and evaluation of activities**

Monitoring organizational progress toward meeting goals is called control. Monitoring progress is essential to ensure that organizational goals are met.

Control means measuring, comparing, finding deviations and correcting organizational activities performed to achieve the goal or objectives. Control consists of activities such as: measuring performance, comparing with the existing standard and finding and correcting deviations.

Control activities are generally concerned with measuring the achievements and results of actions taken to achieve the goal.

Some means of control, such as the budget for expenditure, the record of inspections and the recording of lost working hours, are generally familiar. Each means of control also shows whether the plans are being met.

If deviations persist, correction is indicated. Whenever the results differ from the planned action, the responsible persons must be identified and the necessary measures taken to improve performance.

Thus, the results are pursued by controlling what people do. Control as a function of the management process, even if it is the last, does not mean that it is the least important.

The statement "planning without control is useless" is as correct as possible. In short, we can say that the control function allows the fulfillment of the plan.

All the functions of the management process are interconnected and cannot be ignored.

The management process designs and maintains an environment in which staff, working together in groups, meet selected objectives effectively.

### **Manufacturing subprocess of structural components in the aeronautical industry**

The manufacturing thread brings direct value to the organization. In the organization chosen for the research project, the manufacturing processes represent the complete technological flow of manufacturing the structural components.

Manufacturing processes require direct or indirect control. In the aeronautical industry, manufacturing processes are controlled by major aircraft manufacturers, by defining manufacturing process and inspection standards that suppliers must comply with in the technological component manufacturing process.

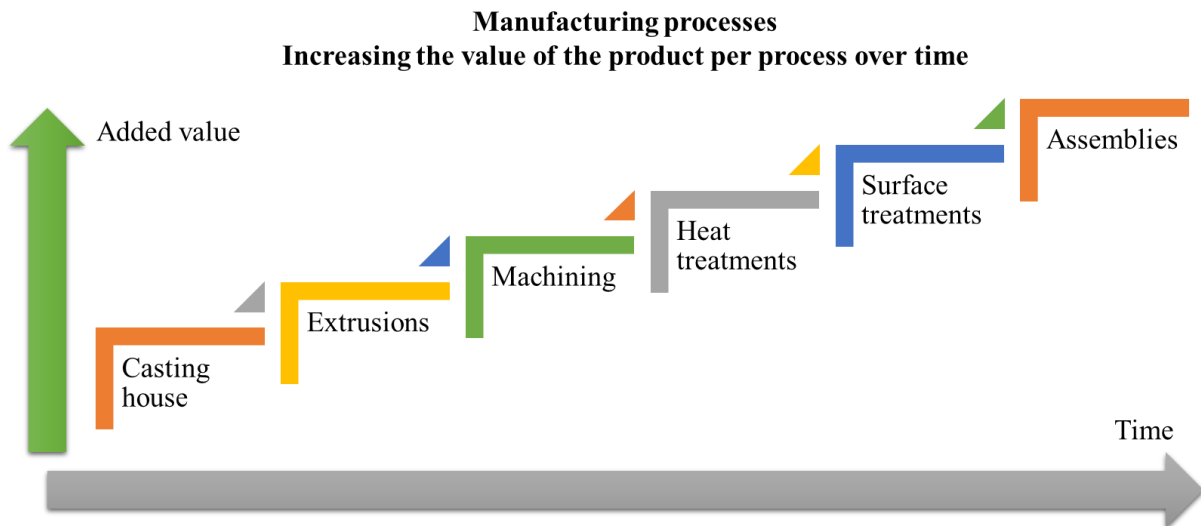


Figure 3. Manufacturing processes in the industrial organization

These process and inspection standards are called: process specifications and have the role of establishing for all suppliers in the field, the same manufacturing process parameters as well as their limits. In this way, they manage to design and plan the manufacturing process for the entire supply chain, in order to obtain quality products. The control of process parameters, through various methods, is a direct control of the manufacturing process. In other words, the values of the parameters resulting from the process within the predetermined limits are followed directly.

Process control can also be performed indirectly by following certain characteristics of the products, resulting from the analyzed process.

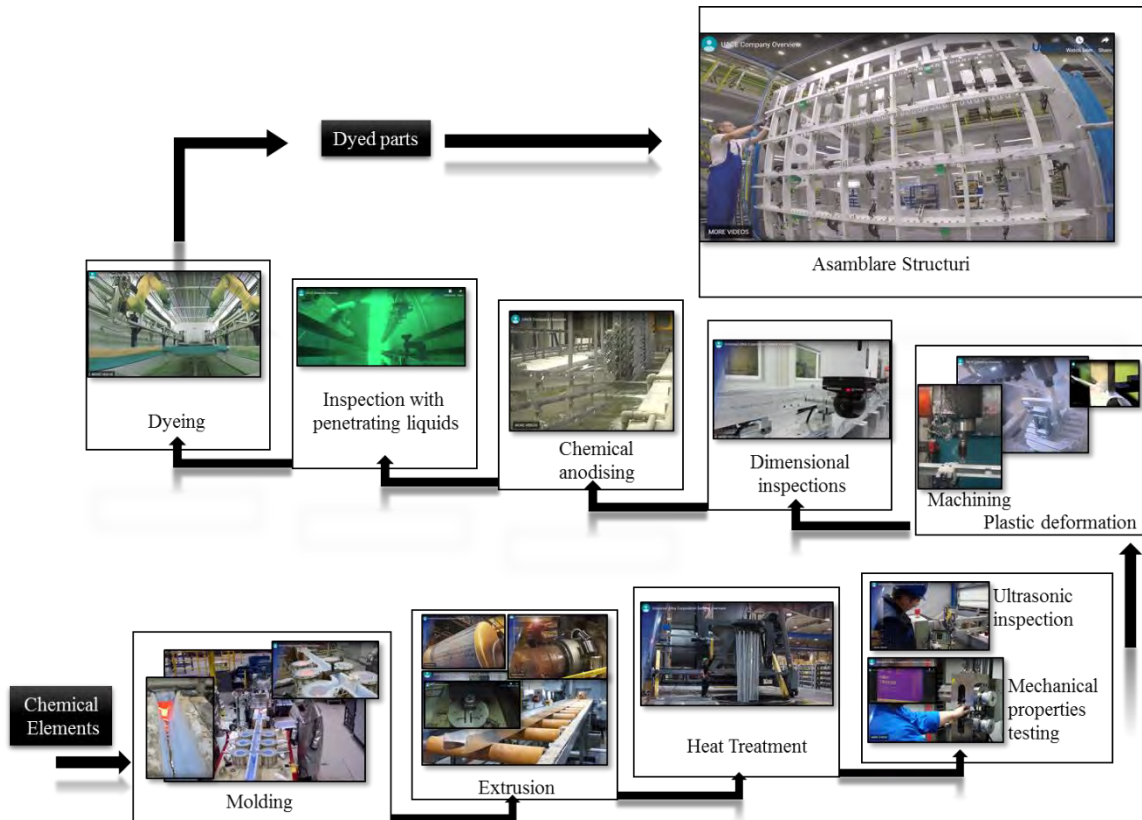


Figure 4. Technological process of achieving structural landmarks in the aeronautical industry (www.universalalloy.com, 2020)

In the field of aeronautics, certain manufacturing or inspection processes have a more special character being considered processes with a major impact on products. Reason why aircraft manufacturers are involved in qualifying suppliers by conducting qualification audits and process evaluation

Thus, it is considered as special processes, processes of realization of materials / semi-finished products, processes of heat treatments and inspection of materials / semi-finished products, certain processes of mechanical processing, chemical processes of surface treatment, non-destructive inspections, assembly processes and inspection of assembly elements.

It is considered that the control of products (Figure 5) can be performed similarly to that of processes, directly or indirectly. The direct control of the product is performed by comparing the designed requirements with values or attributes measured directly on the product. Indirect control arises from the control of process parameters applied to the product in question

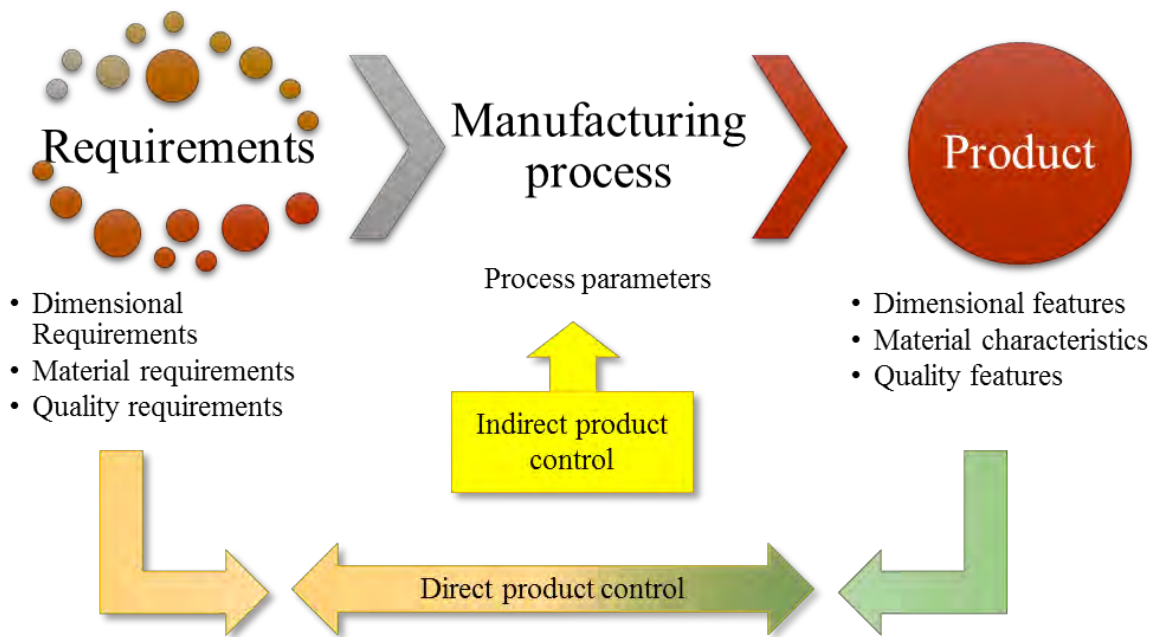


Figure 5. Direct or indirect control of the product

The process of controlling the resulting non-conformities is critical, and is applied at all hierarchical levels, due to the impact they can have. Impact in terms of safety, which is critical in aeronautics and of course costs. Thus, most organizations in the field of aeronautics have policies for managing non-compliant products under special conditions by their very clear identification and segregation from products in production. Also, products declared scrap are destroyed immediately.

The aeronautical field, as it is also covered in the media, is based on large chains of suppliers and their control. For these reasons, the supplier control process is a process of very high importance being a process audited by each certification authority.

The importance of controlling the requirements and their interpretation is generated by the fact that at the end of the aircraft manufacturing process, each structure made by different suppliers must fit.

In the aeronautical industry, the supplier control process is focused on:

- Control of requirements to the supplier, both product and process;
- Process control and process qualification at suppliers:
- Control of products made by suppliers:
- Control of product documentation.

All these processes are audited and certified by both certification authorities and major aircraft manufacturers.

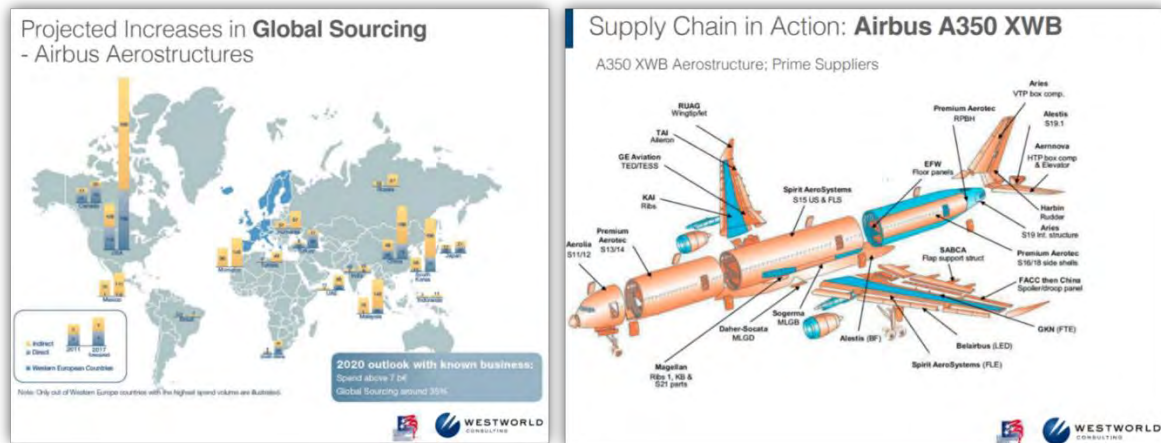


Figure 6. Distribution of A350 Airbus aircraft structure suppliers worldwide (www.westworldconsulting.com, 2020)

## Conclusions

All the input elements in the process are transformed, within an “N” process, by carrying out coordinated activities in relation to a management thinking, resulting in output elements with added value. Each influencing factor has a greater or lesser impact on the outputs.

Each process within the organization has an efficiency calculated in relation to the quality and quantity of outputs from that process, without taking into account the quality and quantity of information at the entry into the process.

The influence of management activities (M-Figure 7) within the processes is achieved by organizing the activities within the processes, using procedures and work instructions (P-Figure 7).

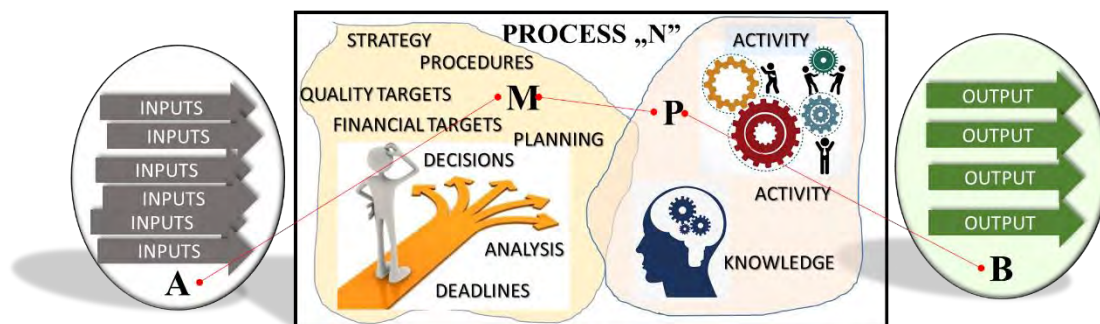


Figure 7. Influencing factors in a process

These instructional procedures are developed using as the structure of the quality management system, the context of the organization and the knowledge of the process manager. Thus the activities within each process are influenced by the quality management system. The level of influence on the process also shows the level of integration of the process in the organization's system.

At this moment, in all organizations the evaluation of the integration of processes in the quality management system is done by performing process audits using as a criterion the standard of the quality management system.

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# HUMAN RESOURCES MANAGEMENT - AXIOLOGICAL FIELD OF INCREASING MANAGEMENT EFFICIENCY

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## Abstract

**Purpose** – is to define the concept of human resources management and quality management, to identify methods to create managerial efficiency

**Methodology/approach** - The methodological plan of the paper consists in consulting the specialized literature and, based on the bibliographic study.

**Findings** – Following the bibliographic study, in each direction of research, it was observed that the literature has some limitations in the direction of empirical studies on measuring labor productivity in public administration, the object of research being treated only theoretically.

**Research limitations/implications** – Limitations for research consist in creating a research methodology, based on bibliographic studies, care will be based on subsequent qualitative and quantitative analysis.

**Practical implications** – *In the future, the application of the methodology will serve to create a management model that will successfully contribute to the administrative reform process. The pragmatic goal is to determine the methods of increasing labor productivity in public administration.*

**Originality/value** – The novelty consists in the fact that it can provide the managers of some preschool educational institutions, but also of some political decision-makers, the necessary information and knowledge regarding the human resources practices and their applicability in the management of the activities at the workplace.

**Key words:** *management, quality, education*

## Introduction

Due to the fact that the staff resource, its profile and quality represent a true *primum movens* of the activity, the inherent competitive framework determines a real "battle" for attracting true professionals in the field of education, through managerial methods that include offering an activity environment that stimulates and ensures pro-performance means and behaviors, up to concrete motivational attitudes, usually quantified financially. Pursuing the achievement of performance criteria, the quality growth policy must stimulate not only the fulfillment of the benchmarks in the individual specifications, but it also must focus on the creative, innovative, individual and collective effort, reflected on the employee-institution-manager relationship or motivation and performance-management. Education and its management, viewed from the perspective of increasing the quality of teaching, were and remain open to interdisciplinary study, imposed not only by the emergence, but also by their evolution and subsequent implications at the social level. There are aspects that dynamically pigmented the surprising fresco of the historical evolution of research related to personnel management at different levels, being the object and concomitant subject of research for: E. B Filippo (1976) D. Farnham (2000 and 1986), J Storey (1995), PMWright & GC McMahan (1992), T. Keenoy (1990), M. Armstrong (1987).



## **Conceptualization of a syntagm: M.R.U**

In order for all organizational development efforts to increase managerial efficiency through procedures that increase the staff quality and its success, managers must consider the fact that human resources are the most valuable asset of an institution, regardless of type or field of activity, that is why, through a semiotic mediation, the phrase human capital was established, together with the financial capital. Its management has often been able to ensure the difference between success and failure, between performance and mediocrity, from overcoming the stage in which the workforce had only an accounting relevance, expressing employment, pay and possible dismissal.

Emphasizing the importance of the structure and professional level of human resources, William H. Newman, since 1964, in *Process of Management: Strategy, Action, Results*, defined management as "an important social technique, that directing, leading and controlling efforts a group of individuals, in order to achieve a certain common goal. " In 1969, in the November-December issue of the famous American publication *Harvard Business Review*, Alec MacKenssie defined the concept of management in a three-dimensional internal architecture: ideas, things and people. In France, in 1966, Octave Gélinier's work entitled *The Secret of Competitive Structures* appeared, in which the French researcher considers that management designates, both, leadership and organization, but at the same time requires a conscious methodical and scientific effort to study and achieve the conditions. optimal activity of the organization's staff.

Peter Drucker (1985) states in the same direction that the main task of the manager is to mobilize the energies of the economic unit to fulfill known and defined tasks.

Unlike the traditional approach, on this category of resources, the postmodern interpretation focuses on highlighting the implications that human resources can manifest in achieving the managerial target. The research of the complex issue of personnel resources, through the work signed by Rosalind H. Searle & Denise Skinner (2011) is positioned in a psychoanalytic perspective which emphasizes the phenomenology of mutual trust as a link between the staff of an organization.

## **The art of internal resource management**

Internal resources are those characteristics of an organization that can be used to achieve a certain managerial strategy. These include not only tangible features such as buildings, staff and finances, but also intangible features such as reputation as an expression of the team's professionalism. The analysis should cover not only the presence of these resources, but also how they are used or exploited. Thus, a school could have untapped potential, for example, in its buildings or the quality of its staff or it may have additional potential in its relations with potential financiers. Therefore, a realistic assessment of all opportunities must be made, as this will be part of any assessment of possible future strategies to increase the quality of work generated by increasing the level of professionalism of human resources. It is essential not only that all possibilities be assessed, but also to eliminate overly optimistic assumptions, as this would jeopardize the viability of any strategy. The strengths and weaknesses of the school's current operations should result from the audit of resources.

As it is natural, organizational performance must be evaluated. Such an assessment must use clear comparative data. How well does the organization work compared to similar institutions and especially local competing institutions? For schools, kindergartens, this means an analysis of test and exam results and other results at different levels of schooling. Surveys on the opinions of staff, parents and alumni can thus provide data on the strengths and weaknesses they perceive about the institution. Such information is essential for the formation of the educational strategy but also in tracing the design of the professional portrait of teachers.

### **How the personnel policy influences the establishment of the qualitative parameters of the activity**

If according to Peter F. Drucker's (1993) definition, built around the concept of "human resources", "management means organizing resources to achieve satisfactory performance and economic activity based on material and human resources", newer studies show that the issue of the quality of education has become significant for the social environment because all aspects and fundamental activities of

civilization begin and are dependent on the level of education and as an expression of it, the quality of human resources involved in this activity. Among the important directions which depend on the personnel resource, orient the managerial activity here some of them can be mentioned:

- combining leadership and personal responsibility;
- promoting staff on the basis of competence and professionalism, efficiency and effectiveness.

These are not negligible aspects, especially when the level of staff training is obviously reflected in a deficient managerial act. In this regard, in the field of educational management, the following principles are activated to increase quality: 1- the principle of efficiency involves the use of managerial methods and techniques to ensure the achievement of the institution's objectives with maximum efficiency; 2- the principle of motivation can be achieved by establishing and using moral and material stimuli by senior managers to interest the organizational behavior of all to achieve the proposed objectives; 3- the principle of participatory management, refers to the employment of employees in solving processes and management relations, regardless of their complexity (it was found that this involvement increases the degree of loyalty, motivation, participation in system functionality and increases efficiency); 4 - the principle of correlation between possibilities and requirements expresses the need to adapt the management system to the demands of external factors by increasing quality.

Therefore, we can consider that the director of educational institutions and by extension, any person engaged in a reform process, must have a behavior similar to that described by Harvard Professor Chris Argyris (1985) who declares as effective behavior of the manager , in the process of improving the quality of staff, everything that "beings use to deal with these problems."

The aspects presented by the scheme elaborated by Robbins and Coulter are deepened in specialized studies (see: James C. Craig & Robert M. Grant, Strategic Management, Kogan Page, 1993; Julia Balogun & Veronica Hope-Hailey, Exploring Strategic Change, Prentice-Hall Europe, 1999; Adrian Haberberg & Alison Rieple, The Strategic Management of Organizations, Prentice-Hall, 2001; Andrew Campbell & Kathleen Sommers Luchs (eds.), Core Competency-Based Strategy, International Thomson, 1997; Paul Joyce & Adrian Woods, Essential Strategic Management - from modernism to pragmatism, Heinemann, 1996; Robert Paton & James McCalman, Change Management - A guide to effective implementation, 2nd Edition, Sage, 2000; Gary Hamel & CK Prahalad, Competing for the Future, Harvard Business School Press, 1994), constituting a set of extremely important criteria that must be taken into account in the design and construction of the institution's strategy regarding the quality of staff and the possibilities increasing its level. Scientific management is revealed as a consistent remedy compared to empirical-chaotic leadership, because science has its say. The practical finality is imposed and due to these characteristics, the research projects that target the human resource of a preschool education institution (and not only) have at hand a series of landmarks to follow.

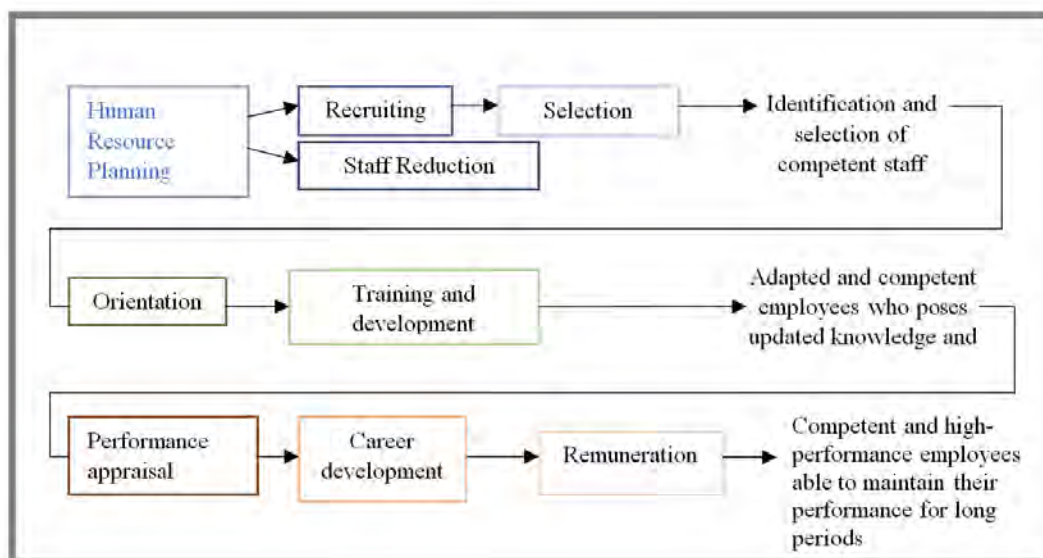


Figure 1 Scheme qualitative increase process factors

## Discussion and conclusions

Increasing the quality of the entire educational process by raising the professional level involves a set of measures related to the natural desire to modernize, to continue the professional training of newly hired graduates through competition, because the accumulation of knowledge involves the accumulation of teaching experience and hence the increase professional competence (teaching).

Starting with the recruitment of staff with great potential, according to well-developed selective criteria (following the steps provided by current legislation - CVs, tests, references) (GA Cole, 2000) for vacant positions, it is an intrinsic responsibility of the manager to ensure a favorable climate for professional development, because, says Bernard Gazier (2003), the triad: general training - vocational training - accumulation of experience, ensures the preservation and development of the qualitative heritage of the institution.

Relatively recent studies by researchers Ch. Hoy, C. Bayne-Jardine and M. Wood (1999), Boxall P. & Purcell J, (2000) mention among the organizational indicators not only the efficiency of school management, but especially the professionalism of staff that determine the investment of trust of parents and students in the management team and in the team of teachers and non-teaching staff. Educational managers must know the methods, the specific techniques of management, in order to be able to solve the wide problems they face and which require in-depth knowledge in the field. Therefore, in order to increase the quality of teaching and non-teaching staff, the diagnostic procedure is required, so that all those involved know and recognize their level of competence, implicitly their position in the staff structure.

The analytical procedure maximizes its efficiency when it offers teachers the opportunity to understand, explain and interpret the importance of this benchmark, on the one hand in the particular situation of the effects on the group of children / class of students, and on the other hand when it is seen as level reached / or to be reached of the degree of preparation, cohesion, homogeneity, autonomy and efficiency in the educational act, etc. For these reasons, quality and the process of increasing quality itself represent and must represent ab initio a permanent constant of any educational institution, regardless of level.

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# RISK MATRIX – AN INNOVATIVE MANAGEMENT TOOL FOR SME`S

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## Abstract

**Purpose** – increasing the survival rate of SMEs.

**Methodology/approach** – an analysis of the socio-economic framework for the North-West development region of Romania using a mixed research, both qualitatively and quantitatively through the survey method – questionnaire and the analysis and the interpretation of information from the National Office of the Trade Register.

**Findings** – there are signs that the total number of SMEs in the North-West development region of Romania will decrease. In addition, half of the SMEs that participated in the survey do not use management tools to meet the company's objectives.

**Research limitations/implications** – the risk matrix do not eliminate risk, but rather prioritizes the appropriate use of resources and time and facilitate the decision-making.

**Practical implications** – SMEs do not have an entire arsenal of strategic weapons and are often led by the owner-manager who runs the risk of failure following their own ideologies and practices.

**Originality/value** – the use of a risk matrix – an innovative management tool for SMEs with which the management (entrepreneur) will identify and quantify the risks to which the company is exposed, will increase the survival chance of SMEs.

**Key words:** Risk Matrix.

## Introduction

In Romania, from December 1990 until March 2017, over two point eight million businesses were set up, of which one point thirty-two million were closed in the meantime; the survival rate of a business is fifty-two point seven, meaning only one out of two businesses manage to remain on the market, according to data (ONRC 2019) for the last 25 years.

The latest analysis on the demography of enterprises conducted by the National Institute of Statistics in Romania, was conducted for the period 2010 - 2014 and reveals that approximately only fifty point nine percent of newly created enterprises in Romania are active four years after establishment, given that at the EU level, the highest four-year survival rate is in Finland, where over seventy percent of start-ups in 2010 were active in 2014 as well.

According to Welsh, White and Dowell (1981), small and medium-sized enterprises (SMEs) contribute to economic growth - the positive correlation between the level of development of the small and medium-sized enterprise sector and the gross domestic product (GDP) of an economy, contributes to reducing unemployment and increasing living standards - provides jobs, and last but not least according to Nicolescu (2008), it plays the role of stabilizer on the market due to their prompt reaction to change – prompt reaction due to the flexible structure that gives them adaptability.

The role that small and medium-sized enterprises play in both developing and developed countries cannot be ignored and, therefore, their existence and survival it is a matter of major interest for both policy makers and researchers; countless SMEs cease to operate within a year of their establishment.

## Theoretical background

Most people want to avoid risk however, the economy encourages businesses to take risks. Business operations, the activities of extracting capital from one source to another, literally mean taking risks for higher profits. Moreover, taking risks in one way or another brings competition and innovation.

Leopoulos, Kirytopoulos and Malandrakis (2006) warn managers - owners of SMEs, to be aware of potential risks, to be familiar with risk identification and risk mitigation, or may suffer catastrophic consequences. Moreover, St-Pierre and Bahri (2006) states that SMEs face difficulties in obtaining financing due to the high level of risk and the insufficient level of profitability associated with them.

In every enterprise we are dealing with risk management, but not always in a completely transparent, repeatable or permanent way that supports the decision-making process.

There are several important ERM (Enterprise Risk Management) models, each of which describes an approach to identifying, analyzing, responding to and monitoring the risks and opportunities, both internally and externally, that the company faces.

Starting from the analysis of COSO ERM and ISO 31000 models - being the most widespread and debated in the literature - I believe that the use of a functional matrix - an innovative management tool for SMEs can be the solution that will increase survival rates of SMEs.

Risk matrices have two main applications. First, when used in making decisions about accepting risk; secondly, to prioritize risks - which risk must be addressed first.

At the same time, the risk matrix will ensure the following:

- prompt reaction - must be easy to apply by the management (manager - employer)
- low costs - not to represent a financial burden
- friendly interface - data entry without requiring extensive specialized knowledge (economic - financial, computer systems, etc.).

## Methodology

In order to collect the information needed for the study which will identify the need and reliability of using the risk matrix in SMEs, a mixed research was conducted, both qualitatively and quantitatively by the method of the Questionnaire and the analysis and interpretation of information from the National Trade Register Office.

Firstly, the socio-economic framework of the functioning of SMEs was analyzed - the analysis and interpretation of the situation of SMEs in the North West Region of Romania for the period 2017-2019, for the 6 counties that make up the region: Bihor, Bistrița – Năsăud, Cluj, Maramureș, Satu Mare and Sălaj.

The following statistical data for the North-West region, which are of interest for the topic addressed, were analyzed and interpreted:

- active professionals – all enterprises registered in the Trade Register and which are not in any of the states that may cause the loss of legal personality,
- new registrations – the total number of enterprises that were set up at the Trade Register during the analyzed period
- closures – all the companies disbanded for the analyzed period,

for the years 2017-2019, in order to present the evolution and situation of the last three years.

Secondly, the data collected using the questionnaire - *Improving management tools for SMEs* - applied to owners (entrepreneurs) or staff involved in the day-to-day management activities of the enterprise with a minimum of 3 years from the establishment were interpreted. The questionnaire was chosen as

the survey method, it is considered according to de Singly, Blanchet, Gotman and Kaufmann (1998) and Jemna (2018) the basic tool of the opinion poll.

The questionnaire includes questions on the profile of the entrepreneur and the activity carried out within the SMEs, product and market identification, business management, labor force and last but not least, the evolution of the business in terms of decisions and factors that influenced the business.

From the searching techniques, Şandor (2013) the following variants were selected:

- face to face - the interaction between the operator and the respondent - the operator reads the questions and notes the answers of the subjects
- self-administered questionnaire - the researcher distributes the questions and the subjects answer them and then the researcher then collects the answers.

In the introductory part of the questionnaire the purpose of the research was specified, the subjects are assured of data confidentiality, the enterprise is identified, the category (medium, small or micro) and the quality of the respondent (owner, involved in daily management activities of the enterprise).

The questions in the questionnaire were formulated using accessible and clear language.

The answer options were formulated and presented to be as clear and complete as possible, avoiding multiple variants as much as possible.

The extracted qualitative and quantitative data were analyzed with the statistical data analysis programs SPSS 20 and EXCEL.

## Results and discussion

First, I analyzed the following indicators: new registrations, closures, active professionals and dynamics of the socio-economic environment of SMEs in the North-West region of Romania for the period 2017-2019.

The analysis for the period 2017-2019 for the North-West region regarding the registrations, closures and the total of active professionals, was performed for the following categories of enterprises: Joint Stock Company (SA), Limited Liability Company (SRL), Authorized Individual (PFA), Debutant Limited Liability Company (SRL-D), Individual Enterprise (II), Family Enterprise (IF) and Limited Partnership (SC). The mentioned categories were selected because they represent over 99% of the total registrations for the selected period.

Legally active professionals are professionals registered in the Trade Register who have not declared their suspension of activity and are not in any of the conditions that can cause the loss of legal personality, Armanu (2018). This eliminates the enterprises in bankruptcy, dissolution, liquidation, insolvency, judicial reorganization, with temporary suspension of activity.

Analyzing the data collected from the National Office of the Trade Register, a synthetic statistical situation was prepared regarding the evolution of enterprises for the analyzed period, 2017 - 2019, North - West region of Romania, table no. 12. The summary situation is presented in table one.

Table 1. SME's evolution 2017- 2019 N-V

	<b>2017</b>	<b>2018</b>	<b>2019</b>
New registrations	23155	23193	20478
Closures	11314	12188	15780
Active professionals	193348	204387	209961
Dynamics (new registrations - closures)	11841	11005	4698

The chart regarding the evolution and dynamics (new registrations – closures – total active professionals) of enterprises for the period 2017 - 2019, North - West region of Romania is presented chart one.

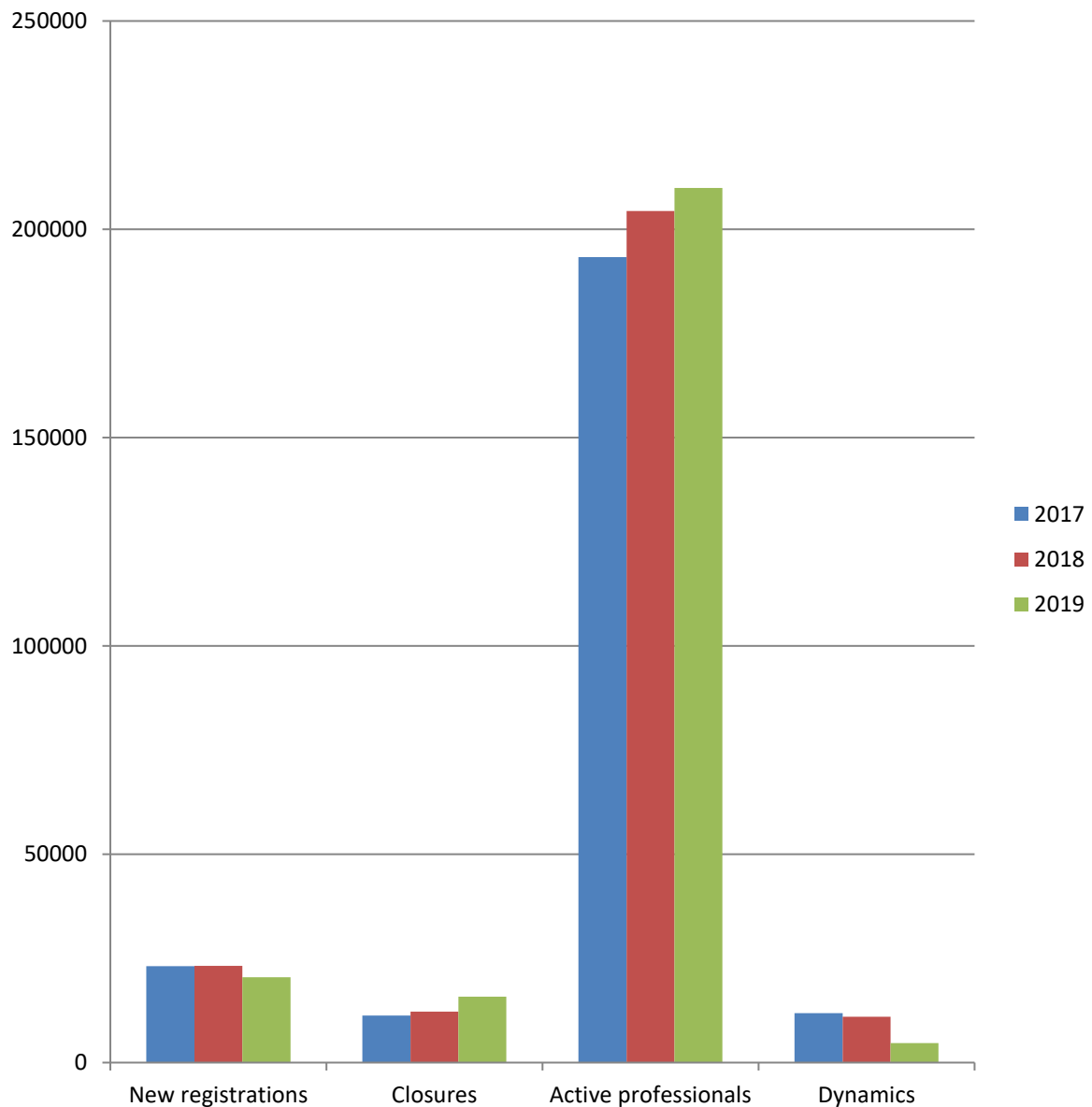


Chart one - the evolution of enterprises, N-V region period 2017-2019

The total number of professionals active during 2017-2019 for the development region of North-West of Romania has been increasing, but there are signs that the maximum number has been reached, and a period of decline is foreseen due to the fact that the number of closures was increasing from year to year and the number of registrations for the same period was decreasing. Moreover, in 2020 we face what Taleb (2018) has developed, namely the black swan theory; in this case it is the SARS-CoV-2 pandemic, i.e. difficulties in specifying the consequences and possibly in the full specification of the event itself and how small and medium-sized enterprises will be affected.

Secondly, I resorted to interpreting the data collected from the total number of SMEs that completed the questionnaire. The main findings will be presented below.

About three quarters of entrepreneurs - staff involved in daily management activities are with higher education.



Of the respondents, half stated that they do not use management tools to achieve the company's objectives. This is also because eighty percent of enterprises (respondents) are represented by micro or small enterprises. While large firms have a whole arsenal of strategic weapons and even seek external advice on the risks facing the enterprise, micro and small enterprises need to manage their resources much more limited. Therefore, they cannot afford to allocate funds or hire specialized personnel in the field of risk management.

Another element that should be mentioned is the fact that seventy percent of those who participated in completing the questionnaire stated that they are not registered in an association or confederation in their field of activity.

Training in SMEs is oriented towards increasing income, most courses taken by entrepreneurs or employees being focused on the following areas: marketing, management and manufacturing - production. Very rarely do we have to deal with a management approach that aims at courses dedicated to risk management in the company. Moreover, eighty percent of respondents stated that they do not carry out risk management planning activities.

Of the total respondents to the questionnaire applied, in terms of the degree of readiness to deal with the risks faced by the company, and covering the following elements: identification, analysis, assessment, management and monitoring of risks, all stated that they identify risks but only sixty percent monitor them.

Half of SMEs do not use management tools to meet the company's objectives, but seventy percent of them said they would be willing to try.

## **Conclusion**

There are several factors that could have a negative effect on the profitability, security and stability of the business. One of the main goals of every entrepreneur-owner is to identify these risks and prevent them before they become a major problem. Therefore, it is necessary to design a general picture that gives the management (entrepreneur - employer) a synthetic picture of the vulnerabilities of the company.

Regarding the feasibility of the proposed instrument – risk matrix, the following should be clarified: seventy percent of respondents have higher education as their educational training, which can be translated into their possibility and ability to develop their risk rankings according to the matrix, to identify the risks that represent the higher general (and therefore priority) threats.

The format of the matrix is given by the environment in conjunction with contextual elements (financial, human resources, marketing, quality, information systems, performance, etc.) in order to obtain a ranking of the level of risk for small and medium enterprises. Along with the proposed matrix, a response strategy template was developed for the identified and analyzed risks, which may include avoidance, reduction, alternative actions, acceptance, transfer, risk sharing, etc.

The management tool - risk matrix - will not give assurances that adverse events will not happen but provides the warning to ensure business continuity.

I believe that the results of the study justify the need for the management tool for SMEs, functional matrix - innovative management tool for understanding internal and external risks so that they are properly assumed and it will lead to profit maximization - the fundamental objective of the company.

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### Risk matrix

		CONSEQUENCES				
		INSIGNIFICANT  does not pose a significant threat	MINOR  potential negative consequences, insignificant impact	MODERATE  considerable negative consequences, significant impact	CRITICAL  substantial negative consequences and significant impact	DEZASTUOS  extreme negative consequences, top priority
<b>PROBABILITY</b>	<b>UNLIKELY</b>  extremely rare, almost no probability of occurrence	<b>LOW</b>  1 - 1	<b>LOW</b>  1 - 2	<b>LOW</b>  1 - 3	<b>MEDIUM</b>  1 - 4	<b>MEDIUM</b>  1 - 5
	<b>RARE</b>  unusual, but with a small chance of manifestation	<b>LOW</b>  2 - 1	<b>LOW</b>  2 - 2	<b>MEDIUM</b>  2 - 3	<b>HIGH</b>  2 - 4	<b>HIGH</b>  2 - 5
	<b>OCCASIONAL</b>  typical, with a chance of occurrence of 50/50	<b>LOW</b>  3 - 1	<b>MEDIUM</b>  3 - 2	<b>HIGH</b>  3 - 3	<b>HIGH</b>  3 - 4	<b>EXTREME MELY</b>  3 - 5
	<b>PROBABLE</b>  likely to occur	<b>MEDIUM</b>  4 - 1	<b>HIGH</b>  4 - 2	<b>HIGH</b>  4 - 3	<b>EXTREME MELY</b>  4 - 4	<b>EXTREME MELY</b>  4 - 5
	<b>DEFINITELY</b>  it is almost certain	<b>MEDIUM</b>  5 - 1	<b>HIGH</b>  5 - 2	<b>EXTREME MELY</b>  5 - 3	<b>EXTREME MELY</b>  5 - 4	<b>EXTREME MELY</b>  5 - 5

### Strategy template response

<b>NAME</b>		<b>Objective</b>	
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REF/ID	PRE-MITIGATION				DEPARTMENT / LOCATION	MITIGATIONS / WARNINGS / REMEDIES	POST-MITIGATION			
	RISK	THE SEVERITY OF THE RISK	RISK PROBABILITY	RISK LEVEL			THE SEVERITY OF THE RISK	RISK PROBABILITY	RISK LEVEL	ACCEPTABLE?
		MINOR	RAR	MEDIUM			INSIGNIFICANT	LESS PROBABLE	LOW	GA
		MODERATE	OCCASIONAL	MIDDLE			MINOR	RAR	LOW	GA
		CRITICAL	PROBABLE	HIGH			MODERATE	OCCASIONAL	MEDIUM	R
		DEZASTUOS	DEFINITE	EXTREMELY			CRITICAL	PROBABLE	HIGH	GU

GA - generally acceptable  
R - reasonably  
GU - generally unacceptable

# RESEARCH REGARDING TELEWORK AND ITS IMPACT ON THE EMPLOYEE AND THE ORGANIZATION

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## Abstract

**Purpose** – *The paper aims to present arguments for considering telework as a support process for sustainable business globalization.*

**Methodology/approach** – *A questionnaire-based research study was conducted on a sample of 268 Romanian people between 4 - 29 May 2020, in order to identify some aspects regarding respondents' opinion on telework and its impact on the employee and the organization.*

**Findings** – *Hypotheses regarding telework comparison to work performed at the employer's premises and changes occurred in the relationship with the organization were tested using SPSS. Our main results show that more than 50% of the respondents consider the changes involved by working remotely as being positive.*

**Research limitations/implications** – *The research was non-random, based on both judgment and accessibility, the results being valid at the sample level.*

**Practical implications** – *The main conclusion shows a positive perception of the respondents regarding telework impact. Employees may accept to work remotely, and this form of work organization can be considered in some fields of activity as a solution for business continuity in case of crisis.*

**Originality/value** – *The paper gives arguments for including the telework risk analysis among the company's processes risk analysis. The organizations' management must be prepared to manage telework implementation and to consider it as a part of Business Continuity Plan.*

**Key words:** *questionnaire, human resources, business continuity plan.*

## Introduction

Globalization, as the process of interaction and integration among employees and companies worldwide, has grown because of communication technology and new technologies development. As a result, more employees were able to work from home or remote locations, using online networking for communication and work.

In the context of the European Employment Strategy, the European Framework Agreement on Telework was negotiated and signed in 2002 (EurWORK, 2010). Since then, many countries including Romania have developed the legislative aspects regarding telework and acted in the direction of increasing the number of employees working remotely. As far as Romania is concerned, the Parliament issued the "Law regarding the regulation of the telework activity" in 2018. According to it, the definition of telework emphasizes a few mandatory aspects of this form of work organization, related to: frequency and initiative (regularly and willingly), location (other than the one organized by the employer), the responsibilities of the employees working remotely (it fulfills the responsibilities specific to its position, occupation or job), repetitiveness (at least once a month) and the mandatory condition of using technology (using information and communication technology). (The Romanian parliament, 2018)

Telework was used to a small extent in Romania before March 2020 and few studies of its impact on the employee and the organization have been performed. A report regarding the use of telework in European Union (EurWORK, 2010) shows less than 3% level of telework in Romania. However, since

the beginning of the current COVID-19 sanitary crisis, this way of working has been and is used more and more in many fields of activity.

### **Research problem**

Regarding the advantages and disadvantages of telework, there have been very few studies performed. Gajendran and Harrison (2007) performed “a meta-analysis of 46 studies in natural settings involving 12883 employees” and concluded that “telecommuting is likely better than bad for individuals”. The authors mention among the positive effects and telework advantages: “perceived autonomy, work–family conflict, job satisfaction, performance, turnover intent, and stress”, pointing out that “telecommuting also has no straightforward, damaging effects on the quality of workplace relationships or perceived career prospects”. The disadvantage mentioned by the authors, regarding telework, refers to the relations between coworkers, which can be deteriorated.

Quoting a series of psychological research, Abrams (2019) mentions that both employees and organizations may have benefits from using telework: “when it’s done right, telework can improve employee productivity, creativity and morale”. The article also mentions the fact that leadership may want to avoid telework because employees are less monitored, and performance may decrease. This could be understandable, as Sava and Bacali (2013) mention: “performance “fever” has developed globally in recent times; from individual level to business entities, everybody seems to improve performance”.

New abilities are needed in the present context in order to work remotely and both employees and organizations must be prepared for changes. It is also necessary that all aspects related to the impact of telework on the employee and the organization be analyzed by the organizations’ leadership and management, so that the best decisions are taken regarding the use of telework, especially in crisis situations, such as the pandemics generated by COVID- 19.

### **Applied research**

The applied research was carried out during a research project together with the economic environment supported by De KLAUSEN company. The project aimed to perform some theoretical and practical research related to the impact of the human capital – through behavior, through value generating work or through its opposite – on the organizational results. One of the project’s activities consisted of performing a telework (remote work) and influence of technology related survey. The research instrument used was the questionnaire.

The criteria established for estimating the value of the information obtained through research were accuracy (the extent to which the information obtained would correctly describe the reality) and availability (the extent to which information could be obtained). The two criteria were considered for the decision on the implementation of the applied research (the investigated population and the research period for conducting the study). Considering the period of the research and the conditions in the external environment drastically marked by the COVID-19 sanitary crisis, which imposed the partial or total cessation of business activity and the use of telework, it was decided to perform the research as it follows:

- the investigated population – employed persons from Romania, preferably with telework experience
- the period of the study – one month, including the last two weeks of the emergency state period, established to reduce the effects of the COVID-19 sanitary crisis (period in which regular work was drastically limited in Romania, by law) and the first two weeks of the alert state instituted in Romania as a continuation of the emergency state.

At the end, 363 respondents took part in the research. 268 out of them declared that they used telework (remote work) and they were asked to answer the questions from the questionnaire related to the theme of this paper. Their responses will be presented below.

All participants to the telework and its impact related study, presented in this paper, experienced teleworking as students (27%), managers or employees (63%). According to the participants' profile presented below, all participants have telework experience, about 70 percent of them haven't had experience in using telework before COVID-19 sanitary crisis, more than 65 percent are female (66.42%), and over half of them (52.99%) are between 20 and 35 years old (figure 1). The respondents were students (about 25%) and employees (64%) working in education – teachers (14%), IT industry (9,5%), manufacturing and other industries (14%), public administration and defense (5,5%) and other fields of activity. About 11% of respondents did not agree to provide data related to gender, age group and field of activity.

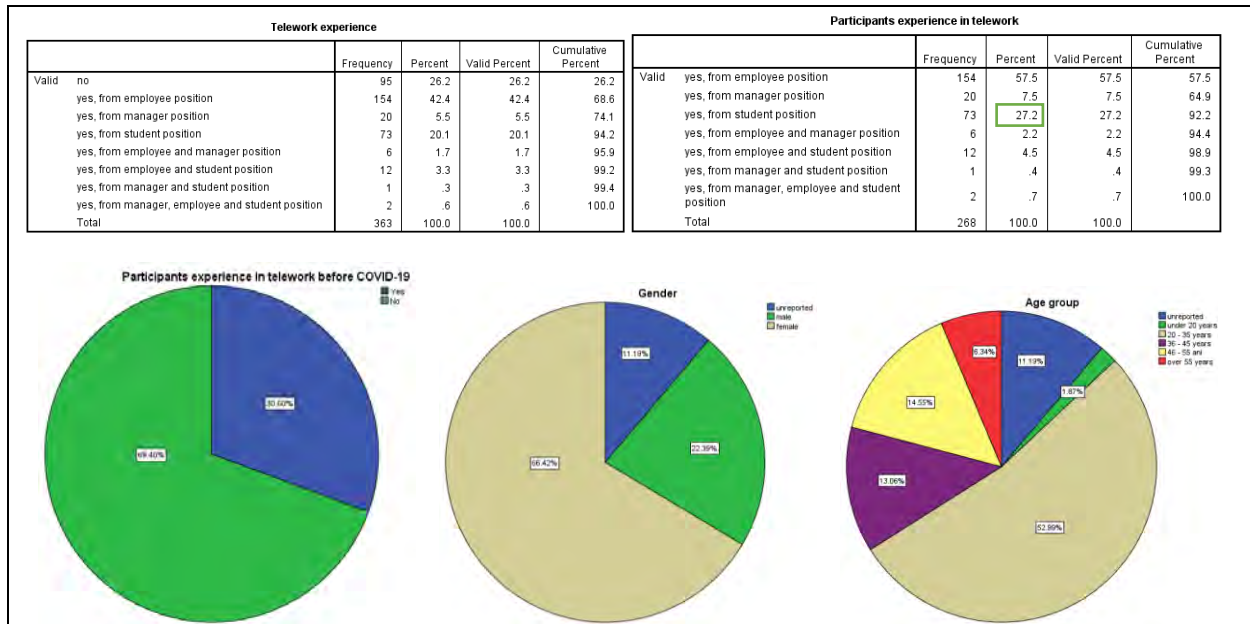


Figure 1. Participants' profile

## Findings

The research presented in this paper was performed from a double perspective: (1) telework comparison to work performed at the employer's premises and (2) the changes brought by telework in the employee's relationship with the organization. Therefore, the following part of the paper is structured according to the double assessment that was performed, as it follows:

(1) The first part presents the results regarding telework comparison to work performed at the employer's premises. The participants had the opportunity to express their opinion on telework, as they were asked to fill out one question that contained five items, developed around various aspects of telework comparison to work performed at the employer's premises, such as: Work performance, Work efficiency, Physical fatigue, Mental fatigue and Commitment to the organization. The participants' opinion regarding these aspects were captured using five-point comparison scales, ranging from: 1 – 'much lower' to 5 – 'much higher'.

(2) The second part presents the results regarding the changes brought by telework in the employee's relationship with the organization. The participants had the opportunity to express their opinions, as they were asked to fill out one question that contained five items, developed around various aspects, such as: Work climate, Collaboration and acceptance of ideas, Problem solving and decision making, Work organization and Work appreciation. The participants' opinion regarding the five mentioned aspects were captured using five-point scales, ranging from 1 – 'very negative (unacceptable)' to 5 – 'very positive (acceptable)'.

The data collected through the research instrument were analyzed using SPSS and the main results are presented as it follows.

## Part 1 – Telework comparison to work performed at the employer’s premises

The research hypotheses have been tested using the SPSS statistical analysis and the results are summarized in Table 1. The main conclusion shows that, according to the participants in the survey, physical fatigue is lower in the case of telework as compared to ordinary work, while the commitment towards the organization is generally the same. The study does not confirm, at a sample level, a negative impact of telework on the employee, through the increase of psychological stress or on the organization through lower performance and work rate. Teleworking may have a positive impact on the employee, by a lower physical stress and a neutral impact on the organization.

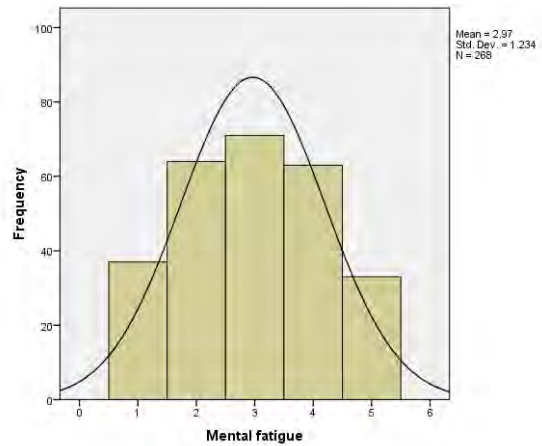
Table 1. Results regarding telework comparison to work performed at the employer’s premises

<p>H<sub>01</sub>: More than 40% of the respondents consider that Performance and Efficiency are lower through telework, than through ordinary work.  <b>H<sub>11</sub>: Not more than 40% of the respondents consider that Performance and Efficiency are lower through telework than through ordinary work. – It’s confirmed</b></p>											
<b>Work performance</b>					<b>Work efficiency</b>						
		Frequency	Percent	Valid Percent	Cumulative Percent			Frequency	Percent	Valid Percent	Cumulative Percent
Valid	much lower	17	6.3	6.3	6.3	Valid	much lower	25	9.3	9.3	9.3
	lower	79	29.5	29.5	35.8		lower	82	30.6	30.6	39.9
	about the same	115	42.9	42.9	78.7		about the same	97	36.2	36.2	76.1
	higher	45	16.8	16.8	95.5		higher	50	18.7	18.7	94.8
	much higher	12	4.5	4.5	100.0		much higher	14	5.2	5.2	100.0
	Total	268	100.0	100.0			Total	268	100.0	100.0	
<p>H<sub>02</sub>: Less than 50% of the respondents consider that Physical Fatigue is lower through telework than through ordinary work.  <b>H<sub>12</sub>: At least 50% of the respondents consider that Physical Fatigue is lower through telework than through ordinary work. – It’s confirmed</b></p>											
<b>Physical fatigue</b>											
		Frequency	Percent	Valid Percent	Cumulative Percent			Frequency	Percent	Valid Percent	Cumulative Percent
Valid	much lower	49	18.3	18.3	18.3						
	lower	107	39.9	39.9	58.2						
	about the same	69	25.7	25.7	84.0						
	higher	34	12.7	12.7	96.6						
	much higher	9	3.4	3.4	100.0						
	Total	268	100.0	100.0							
<p>H<sub>03</sub>: More than 40% of the respondents consider that Mental Fatigue is greater through telework than through ordinary work.</p>											



**H13: Not more than 40% of the respondents consider that Mental Fatigue is greater through telework than through ordinary work. – It's confirmed**

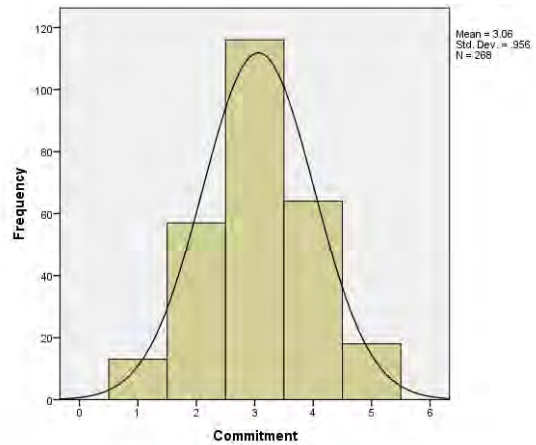
	Frequency	Percent	Valid Percent	Cumulative Percent
Valid much lower	37	13.8	13.8	13.8
lower	64	23.9	23.9	37.7
about the same	71	26.5	26.5	64.2
higher	63	23.5	23.5	87.7
much higher	33	12.3	12.3	100.0
Total	268	100.0	100.0	



**H04: Less than 30% of the respondents consider that Commitment is higher through telework than through ordinary work.**

**H14: At least 30% of the respondents consider that Commitment is higher through telework than through ordinary work. – It's confirmed**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid much lower	13	4.9	4.9	4.9
lower	57	21.3	21.3	26.1
about the same	116	43.3	43.3	69.4
higher	64	23.9	23.9	93.3
much higher	18	6.7	6.7	100.0
Total	268	100.0	100.0	



**H05: Performance and Efficiency are generally lower through telework than through ordinary work. – It's denied**

**H06: Physical Fatigue is generally lower through telework than through ordinary work. – It's confirmed**

**H07: Mental Fatigue is generally higher through telework than through ordinary work. – It's denied**

**H08: Commitment is generally approximately the same through telework than through ordinary work. – It's confirmed**

Descriptive Statistics				Test Value = 3					
	N	Mean	Std. Deviation	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Work performance	268	2.84	.934	-2.879	267	.004	-.164	-.28	-.05
Work efficiency	268	2.80	1.019	-3.238	267	.001	-.201	-.32	-.08
Physical fatigue	268	2.43	1.034	-9.036	267	.000	-.571	-.70	-.45
Mental fatigue	268	2.97	1.234	-.445	267	.656	-.034	-.18	.11
Commitment	268	3.06	.956	1.086	267	.278	.063	-.05	.18
Valid N (listwise)	268								

The superior and inferior limits of the confidence interval for testing the H05 - H08 hypotheses have been checked using the Explore option in SPSS. It can be seen that we can state with 95% confidence that:

- The averages obtained from the respondents' assesment regarding Performance and Efficiency are between 2,72 – 2,95 and respectively 2,68 – 2,92. In conclusion **H05 is denied**.

Descriptives				Descriptives			
		Statistic	Std. Error			Statistic	Std. Error
Work performance	Mean	2.84	.057	Work efficiency	Mean	2.80	.062
	95% Confidence Interval for Mean	Lower Bound	2.72		95% Confidence Interval for Mean	Lower Bound	2.68
		Upper Bound	2.95			Upper Bound	2.92
	5% Trimmed Mean	2.82	5% Trimmed Mean		2.78		
	Median	3.00	Median		3.00		
	Variance	.872	Variance		1.038		
	Std. Deviation	.934	Std. Deviation		1.019		
	Minimum	1	Minimum		1		
	Maximum	5	Maximum		5		
	Range	4	Range		4		
	Interquartile Range	1	Interquartile Range		1		
	Skewness	.194	.149		Skewness	.177	.149
	Kurtosis	-.123	.297		Kurtosis	-.445	.297

- The averages obtained from the respondents' assesment regarding Physical Fatigue are between 2,30 – 2,55. In conclusion **H<sub>06</sub> is confirmed**.
- The averages obtained from the respondents' assesment regarding Mental Fatigue are between 2,82 – 3,18. In conclusion **H<sub>07</sub> is denied**.

Descriptives				Descriptives			
		Statistic	Std. Error			Statistic	Std. Error
Physical fatigue	Mean	2.43	.063	Mental fatigue	Mean	2.97	.075
	95% Confidence Interval for Mean	Lower Bound	2.30		95% Confidence Interval for Mean	Lower Bound	2.82
		Upper Bound	2.55			Upper Bound	3.11
	5% Trimmed Mean	2.38	5% Trimmed Mean		2.96		
	Median	2.00	Median		3.00		
	Variance	1.070	Variance		1.523		
	Std. Deviation	1.034	Std. Deviation		1.234		
	Minimum	1	Minimum		1		
	Maximum	5	Maximum		5		
	Range	4	Range		4		
	Interquartile Range	1	Interquartile Range		2		
	Skewness	.498	.149		Skewness	.016	.149
	Kurtosis	-.305	.297		Kurtosis	-.978	.297

- The averages obtained from the respondents' assesment regarding Commitment are 2,95 – 3,18. In conclusion **H<sub>08</sub> is confirmed**.

Descriptives			
		Statistic	Std. Error
Commitment	Mean	3.06	.058
	95% Confidence Interval for Mean	Lower Bound	2.95
		Upper Bound	3.18
	5% Trimmed Mean	3.07	
	Median	3.00	
	Variance	.914	
	Std. Deviation	.956	
	Minimum	1	
	Maximum	5	
	Range	4	
	Interquartile Range	2	
	Skewness	.002	.149
	Kurtosis	-.230	.297

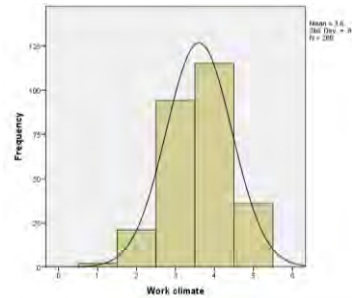
## Part 2 – Changes brought by telework in the employee – organization relationship

The research hypotheses have been tested using the SPSS statistical analysis and the results are summerized in Table 2. The main conclusion shows that changes in the Work climate, Colaboration, Problem solving and decision making, Work organization and Work appreciation are perceived as positive ones when working remotely.

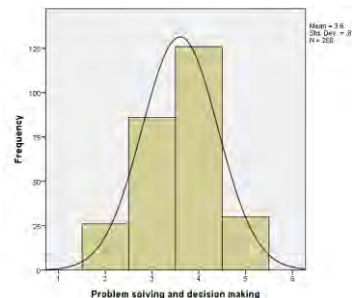
Table 2. Changes brought by telework in the employee – organization relationship

**H<sub>09</sub>: More than 50% of the respondents appreciate the changes related to Work climate, Problem solving, Work appreciation as being positive and acceptable when working remotely. – It's confirmed**  
 H<sub>19</sub>: Not more than 50% of the respondents appreciate the changes related to Work climate, Problem solving, Work assesment as being positive and acceptable when working remotely.

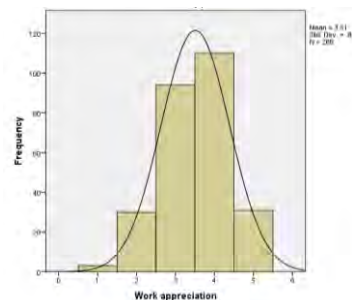
Work climate				
	Frequency	Percent	Valid Percent	Cumulative Percent
Valid very negative (unacceptable)	2	.7	.7	.7
negative	21	7.8	7.8	8.6
neutral	94	35.1	35.1	43.7
pozitive	115	42.9	42.9	86.6
very positive (acceptable)	36	13.4	13.4	100.0
Total	268	100.0	100.0	



Problem solving and decision making				
	Frequency	Percent	Valid Percent	Cumulative Percent
Valid negative	26	9.7	9.7	9.7
neutral	86	32.1	32.1	41.8
pozitive	126	47.0	47.0	88.8
very positive (acceptable)	30	11.2	11.2	100.0
Total	268	100.0	100.0	

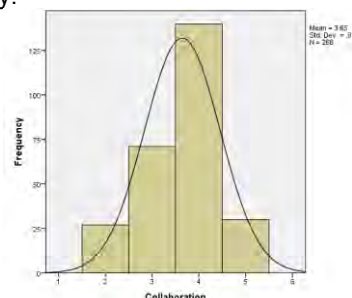


Work appreciation				
	Frequency	Percent	Valid Percent	Cumulative Percent
Valid very negative (unacceptable)	3	1.1	1.1	1.1
negative	30	11.2	11.2	12.3
neutral	94	35.1	35.1	47.4
pozitive	110	41.0	41.0	88.4
very positive (acceptable)	31	11.6	11.6	100.0
Total	268	100.0	100.0	

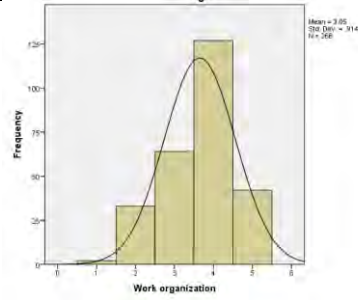


**H<sub>010</sub>: More than 60% of the respondents appreciate the changes related to Collaboration and Work organization as being positive and acceptable when working remotely. – It's confirmed**  
 H<sub>110</sub>: Not more than 60% of the respondents appreciate the changes related to Collaboration and Work organization as being positive and acceptable when working remotely.

Collaboration				
	Frequency	Percent	Valid Percent	Cumulative Percent
Valid negative	27	10.1	10.1	10.1
neutral	71	26.5	26.5	36.6
pozitive	140	52.2	52.2	88.8
very positive (acceptable)	30	11.2	11.2	100.0
Total	268	100.0	100.0	



Work organization				
	Frequency	Percent	Valid Percent	Cumulative Percent
Valid very negative (unacceptable)	2	.7	.7	.7
negative	33	12.3	12.3	13.1
neutral	64	23.9	23.9	36.9
positive	127	47.4	47.4	84.3
very positive (acceptable)	42	15.7	15.7	100.0
Total	268	100.0	100.0	



**H011: The changes related to Work climate, Collaboration, Problem solving and decision making, Work organization and Work appreciation are generally appreciated as being positive when working remotely.**

One-Sample test was used to test the hypothesis. The inferior and superior limits of the confidence interval have been verified by using the Explore option in SPSS.

One-Sample Statistics					One-Sample Test					
	N	Mean	Std. Deviation	Std. Error Mean	Test Value = 3					
					t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Work climate	268	3.60	.844	.052	11.728	267	.000	.604	.50	.71
Collaboration	268	3.65	.810	.049	13.041	267	.000	.646	.55	.74
Problem solving and decision making	268	3.60	.813	.050	12.022	267	.000	.597	.50	.69
Work organization	268	3.65	.914	.056	11.629	267	.000	.649	.54	.76
Work appreciation	268	3.51	.880	.054	9.435	267	.000	.507	.40	.61

One-Sample Test						
	Test Value = 4					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Work climate	-7.674	267	.000	-.396	-.50	-.29
Collaboration	-7.161	267	.000	-.354	-.45	-.26
Problem solving and decision making	-8.115	267	.000	-.403	-.50	-.31
Work organization	-6.283	267	.000	-.351	-.46	-.24
Work appreciation	-9.158	267	.000	-.493	-.60	-.39

Descriptives			
	Statistic	Std. Error	
Work climate	Mean	3.60	.052
95% Confidence Interval for Mean	Lower Bound	3.50	
	Upper Bound	3.71	
5% Trimmed Mean	3.62		
Median	4.00		
Variance	.712		
Std. Deviation	.844		
Minimum	1		
Maximum	5		
Range	4		
Interquartile Range	1		
Skewness	-.238	.149	
Kurtosis	-.138	.297	

Descriptives			
	Statistic	Std. Error	
Collaboration	Mean	3.65	.049
95% Confidence Interval for Mean	Lower Bound	3.55	
	Upper Bound	3.74	
5% Trimmed Mean	3.66		
Median	4.00		
Variance	.657		
Std. Deviation	.810		
Minimum	2		
Maximum	5		
Range	3		
Interquartile Range	1		
Skewness	-.416	.149	
Kurtosis	-.249	.297	

Descriptives			
	Statistic	Std. Error	
Problem solving and decision making	Mean	3.60	.050
95% Confidence Interval for Mean	Lower Bound	3.50	
	Upper Bound	3.69	
5% Trimmed Mean	3.61		
Median	4.00		
Variance	.661		
Std. Deviation	.813		
Minimum	2		
Maximum	5		
Range	3		
Interquartile Range	1		
Skewness	-.232	.149	
Kurtosis	-.407	.297	

Descriptives			
	Statistic	Std. Error	
Work organization	Mean	3.65	.056
95% Confidence Interval for Mean	Lower Bound	3.54	
	Upper Bound	3.76	
5% Trimmed Mean	3.67		
Median	4.00		
Variance	.835		
Std. Deviation	.914		
Minimum	1		
Maximum	5		
Range	4		
Interquartile Range	1		
Skewness	-.463	.149	
Kurtosis	-.312	.297	

**Descriptives**

		Statistic	Std. Error	
Work appreciation	Mean	3.51	.054	
	95% Confidence Interval for Mean	Lower Bound	3.40	
		Upper Bound	3.61	
	5% Trimmed Mean	3.52		
	Median	4.00		
	Variance	.775		
	Std. Deviation	.880		
	Minimum	1		
	Maximum	5		
	Range	4		
	Interquartile Range	1		
	Skewness	-.255	.149	
	Kurtosis	-.229	.297	

It can be seen that we can state with 95% confidence that the averages obtained from the respondents' assessment regarding changes in the previously mentioned aspects are between: 3,50 – 3,71 (work climate); 3,55 – 3,74 (collaboration); 3,50 – 3,69 (problem solving and decision making); 3,54 – 3,76 (work organization) and respectively 3,40 – 3,61 (work appreciation). In conclusion **H<sub>011</sub> is confirmed.**

**Comparative analysis on telework assessment, by fields of activity**

To perform the comparative analysis by fields of activity, the investigated sample was divided using the Select Cases option in SPSS, into layers represented by the field of activity. The average values for all the 10 investigated aspects related to telework have been calculated, for the fields of activity represented by a number of more than 25 respondents: education – student (65), education – teacher (38), IT industry (25) and other industries (30). Table 3 presents the results of the statistical analyses and Figure 2 a few observations regarding the identified differences.

Table 3. Comparative analysis on telework assessment by fields of activity

Statistics											
		Work performance	Work efficiency	Physical fatigue	Mental fatigue	Commitment	Work climate	Collaboration	Problem solving and decision making	Work organization	Work appreciation
N	Valid	268	268	268	268	268	268	268	268	268	268
	Missing	0	0	0	0	0	0	0	0	0	0
Mean		2.84	2.80	2.43	2.97	3.06	3.60	3.65	3.60	3.65	3.51

Field of activity					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unreported	30	11.2	11.2	11.2
	education - student	65	24.3	24.3	35.4
	education - teacher	38	14.2	14.2	49.6
	IT industry	25	9.3	9.3	59.0
	manufacturing	7	2.6	2.6	61.6
	other industries	30	11.2	11.2	72.8

**IF Field of activity = Education – student**

Statistics						Statistics					
		Work performance	Work efficiency	Physical fatigue	Mental fatigue	Commitment	Work climate	Collaboration	Problem solving and decision making	Work organization	Work appreciation
N	Valid	65	65	65	65	65	65	65	65	65	65
	Missing	0	0	0	0	0	0	0	0	0	0
Mean		2.63	2.51	2.40	3.26	2.82	3.46	3.49	3.40	3.54	3.46
Skewness		.011	.129	.599	-.102	.234	-.043	-.556	.026	-.643	-.271
Std. Error of Skewness		.297	.297	.297	.297	.297	.297	.297	.297	.297	.297
Kurtosis		-.414	-.555	-.442	-1.318	-.562	-.498	-.389	-.308	.100	.189
Std. Error of Kurtosis		.586	.586	.586	.586	.586	.586	.586	.586	.586	.586

**IF Field of activity = Education – teacher**

Statistics						Statistics					
		Work performance	Work efficiency	Physical fatigue	Mental fatigue	Commitment	Work climate	Collaboration	Problem solving and decision making	Work organization	Work appreciation
N	Valid	38	38	38	38	38	38	38	38	38	38
	Missing	0	0	0	0	0	0	0	0	0	0
Mean		2.61	2.45	3.00	3.58	3.58	3.61	3.66	3.63	3.68	3.42
Skewness		-.159	.352	-.109	-.418	-.266	-.622	-.839	-.882	-.844	-.526
Std. Error of Skewness		.383	.383	.383	.383	.383	.383	.383	.383	.383	.383
Kurtosis		-.035	-.215	-.927	-.572	-.322	.267	.681	.455	.529	.110
Std. Error of Kurtosis		.750	.750	.750	.750	.750	.750	.750	.750	.750	.750

IF Field of activity = IT industry													
Statistics						Statistics							
		Work performance	Work efficiency	Physical fatigue	Mental fatigue	Commitment			Work climate	Collaboration	Problem solving and decision making	Work organization	Work appreciation
N	Valid	25	25	25	25	25	N	Valid	25	25	25	25	25
	Missing	0	0	0	0	0		Missing	0	0	0	0	0
Mean		3.44	3.56	2.20	2.80	3.16	Mean		3.52	3.64	3.72	3.76	3.52
Skewness		.199	-.015	.854	.193	.754	Skewness		-.667	-.942	-.461	-.312	-.667
Std. Error of Skewness		.464	.464	.464	.464	.464	Std. Error of Skewness		.464	.464	.464	.464	.464
Kurtosis		-.436	-.670	1.128	-.653	.789	Kurtosis		-.060	.857	.656	.312	-.060
Std. Error of Kurtosis		.902	.902	.902	.902	.902	Std. Error of Kurtosis		.902	.902	.902	.902	.902

IF Field of activity = other industries													
Statistics						Statistics							
		Work performance	Work efficiency	Physical fatigue	Mental fatigue	Commitment			Work climate	Collaboration	Problem solving and decision making	Work organization	Work appreciation
N	Valid	30	30	30	30	30	N	Valid	30	30	30	30	30
	Missing	0	0	0	0	0		Missing	0	0	0	0	0
Mean		2.87	2.83	2.23	2.60	2.93	Mean		3.97	3.77	3.53	3.77	3.63
Skewness		-.028	-.163	.037	.116	.731	Skewness		-1.040	-.214	-.284	-.704	-.046
Std. Error of Skewness		.427	.427	.427	.427	.427	Std. Error of Skewness		.427	.427	.427	.427	.427
Kurtosis		.368	.211	-.403	-1.139	-.124	Kurtosis		1.300	-.484	-.443	-.304	-.343
Std. Error of Kurtosis		.833	.833	.833	.833	.833	Std. Error of Kurtosis		.833	.833	.833	.833	.833

### Regarding telework comparison to work performed at the employer s premises:



- The group of investigated students and the group of investigated teachers consider work performance and work efficiency lower – below average (2,63 and 2,51 respectively – for students and 2,61 and 2,45 respectively – for teachers).
- The group of IT industry investigated respondents consider work performance and work efficiency as being higher – above average (3,44 and 3,56 respectively).
- The group of investigated teachers appreciate physical fatigue approximately the same –at an average (3).
- The group of investigated students and the group of investigated teachers consider mental fatigue higher – above average (3,26, 3,58 respectively)
- The group of IT industry and other industries investigated respondents consider mental fatigue a little lower– below average (2,80, 2,60 respectively).
- The group of investigated teachers consider the commitment towards the organization as being higher – above average (3,58).

### Changes brought by telework in the employee – organization relationship

- The group of investigated teachers consider work appreciation approximately the same – a little above average (3,42).

Figure 2. Differences in the respondents' assesment of telework

## Discussion and conclusions

The results of the study presented in this paper show that telework may have a positive impact on the employee by lowering the physical stress and a neutral impact on the organization. The study does not confirm, at a sample level, a negative impact of telework on the employee through higher physical stress or on the organization through lower work performance and efficiency.

According to the activity field, work performance and efficiency are seen differently when working remotely: a possible negative impact of telework can be identified in education through a lower work performance and work efficiency and a positive impact in IT. Taking into consideration the number of respondents in the previously mentioned fields and the fact that the sample was non-randomly chosen, there is further research necessary to be performed in order to confirm some activity field related conclusions.

The paper aimed to find arguments for considering telework as a support process for sustainable business globalization. Being a work process performed according to the conditions specified by the legislation in force, this form of work organization may be taken into consideration as a solution for business continuity, in particular areas of activity, in case of crisis, such as epidemics, pandemics, calamities, etc. For the situations that require financial investments such as alocation of funds or

auctions, besides respecting the ISO 9001:2015 and ISO 14001:2015 specifications, Romania also asks, more and more frequently, that organizations prove that they have a procedure for business continuity, according to ISO 22301:2019 specifications. According to the standard's requirements, the organization is obligated to evaluate business continuity risks, to establish and periodically test a Business Continuity Plan in order to provide a response to disturbances and possible resuming of activity as soon as possible.

As a conclusion, the organizations' management must be prepared to manage telework implementation and to consider it as a part of Business Continuity Plan. The paper gives arguments for neutral or positive impact of telework, for using this form of work organization and for including the telework risk analysis among the company's processes risk analysis.

### **Acknowledgments**

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# A POKA YOKE MECHANISM, AS A CONTINUOUS IMPROVEMENT ACTION IN A MANUFACTURING PROCESS

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## Abstract

**Purpose** – the paper presents a solution to eliminating waste, following some issues identified in the manufacturing process. The solution consists in a Poka yoke (mistake proofing) mechanism, which is a specific Lean manufacturing tool.

**Methodology/approach** - the research methodology includes a literature review on the application of poka yoke mechanisms in different operational processes, followed by a case study in which the main errors are identified. After identifying those problems in the manufacturing process, a poka yoke mechanism is designed, with the outcome of preventing those errors in the future operational process.

**Findings** – The proposed solution contributes to the safety during product operation, due to the assigned protection function, the reduction of operational and non-operational times, product quality increase, elimination of costs and profit increase.

**Research limitations/implications** – the study focuses on identifying an optimal solution to eliminate human errors. This adopted solution has contributed not only to the elimination of human errors in the manufacturing process, but also to the reduction of operational times, product quality increase and the enhanced safety at work.

**Practical implications** – The provided solution is meant to help the company to eliminate human errors, while increasing its production capacity.

**Originality/value** – The paper represents a part of the authors' research project, with the scope of developing a methodology for continuous improvement in the manufacturing process, by integrating poka yoke mechanisms in manufacturing on CNC machining centers.

**Key words:** poka yoke, Lean manufacturing, waste.

## Introduction

Manufacturing is a complex process, in which new challenges often arise and the involved human factor must find the best solution, in the shortest possible time, at the lowest possible costs and gaining long-term benefits. Even if the design process and production planning are carefully conducted, and potential interruptions / failures are considered, they will appear sooner or later, either in a lower or a higher frequency.

Lean manufacturing is a concept developed by Toyota and its fundamental goal is to eliminate waste through continuous improvement. For this purpose, different Lean manufacturing techniques and methods of continuous improvement are used. (Faur and Bungau 2019), (Faur and Bungau 2018).

The aim of Lean production is to increase production efficiency by identifying and eliminating waste (Bungau et al 2012), (Bungau et al 2014), (Gherghea et al 2019). Often, these losses occur due to human error. To avoid and eliminate these errors, a mechanism called Poka yoke has been developed within Lean manufacturing (Pascal 2015). This mechanism is often designed in the production process to prevent or detect errors, and once these errors are identified, the process is stopped in order to fix the identified error (Sundar et al 2014).



This concept was invented by Shigeo Shingo in the mid-1960s, who was invited to Toyota by Taichi Ohno, the founder of the Toyota Production System (Rajan et al, 2016).

In the literature, poka yoke has several names, such as: foolproof systems (Anholon and Sano 2016), mistake proofing (Bhaskaran 2012), error proofing (Gupta and Kundra 2012), fool proof (Masai et al 2015), false proofing (Sundar et al 2014).

Poka yoke is a mechanism that prevents the occurrence of human errors in the manufacturing process, thus avoiding the occurrence of various types of losses, according to those identified in Lean production (Choomlucksana et al 2015). Also poka yoke can be applied to any type of process. According to Gherghea and Bungau (2018), the main waste caused by human errors are defects, ergonomic working conditions and unnecessary movements (Gherghea and Bungau 2018).

There is a strong link between the poka yoke mechanism and six sigma, because by implementing a poka yoke mechanism in a process, the defects are reduced, which leads to the process improvement, according to one of the benefits of the six sigma system (Singh 2019).

According to Rajan et al (2016), poka yoke is a mechanism that is part of the quality management system, being considered the most important TQM tool, significantly contributing to the process of continuous improvement within a Lean organization (Rajan et al 2016).

In the same paper the author presents the poka yoke mechanism (along with other TQM tools - Total Quality Management such as: Kaizen, 6 Sigma, JIT, jidco, FMS, etc.) as an important component in terms of developing a culture of quality within a company (Rajan et al, 2016).

Three types of poka yoke mechanisms have been identified: shutdown poka yoke, control poka yoke and warning poka yoke (Rajan et al, 2016).

The construction of such a mechanism within operational processes has significantly contributed to increasing product quality, eliminating waste, reducing operational and non-operational times, reducing costs and increasing customer satisfaction (Gherghea and Bungau 2018).

In any operational activity performed by a human operator, at some point an error may occur, due to several factors that may influence the activity of the operator. These errors can occur due to the lack of experience of the operator, unfavorable working conditions (dirt, unfavorable ergonomic position), insufficient information, insufficient preparation and training of the operator, fatigue, high stress etc (Li et al. 2016), (Cirjaliu and Draghici 2016).

In order to prevent and reduce these types of human errors, the careful analysis of the product is considered, but also the process in which the developed product is involved, taking measures (from the design phase) to prevent possible human errors (Wasim et al. 2013). After the main possible errors are identified, the poka yoke mechanism is designed to prevent the occurrence of those errors (Gherghea and Bungau 2018).

## **Research problem**

The purpose of this paper is to present a practical solution that will eliminate a human error in an operational process. Following the identification of the problem, a poka yoke mechanism was developed, which eliminated this human error.

Therefore, in the case study, a poka yoke plate was designed (according to figure 1) on which the piece is placed, which has the role of simultaneously cutting the two radii of the cast piece (according to figure 2). At the same time, the role of the poka yoke plate is to position the cut piece in the correct cutting position, according to figure 3.

Before this device was designed, the part was cut by hand by the operators, which led to the appearance of scrap caused by improper cutting (due to human error).

The introduction of the poka yoke mechanism has significantly contributed to improving the operational process.

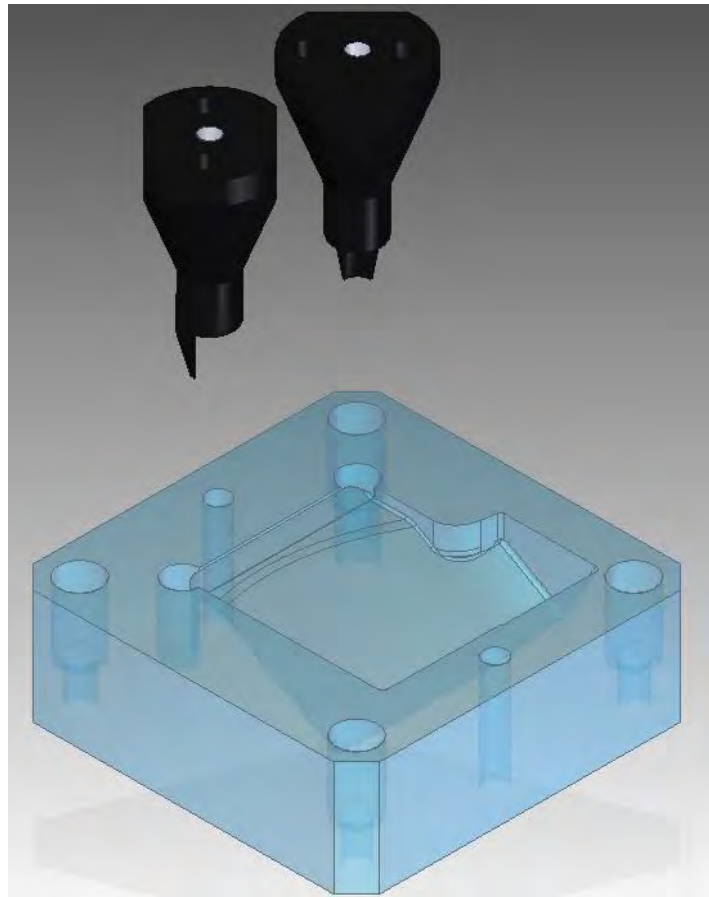


Figure 1. Poka yoke plate

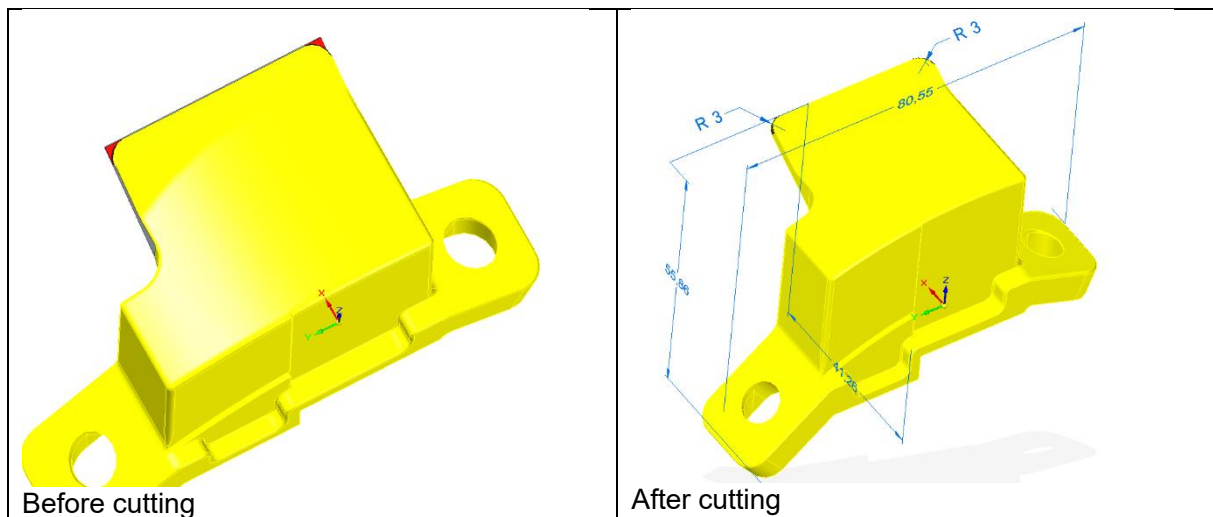


Figure 2. Casting, simultaneous cutting of the two rays

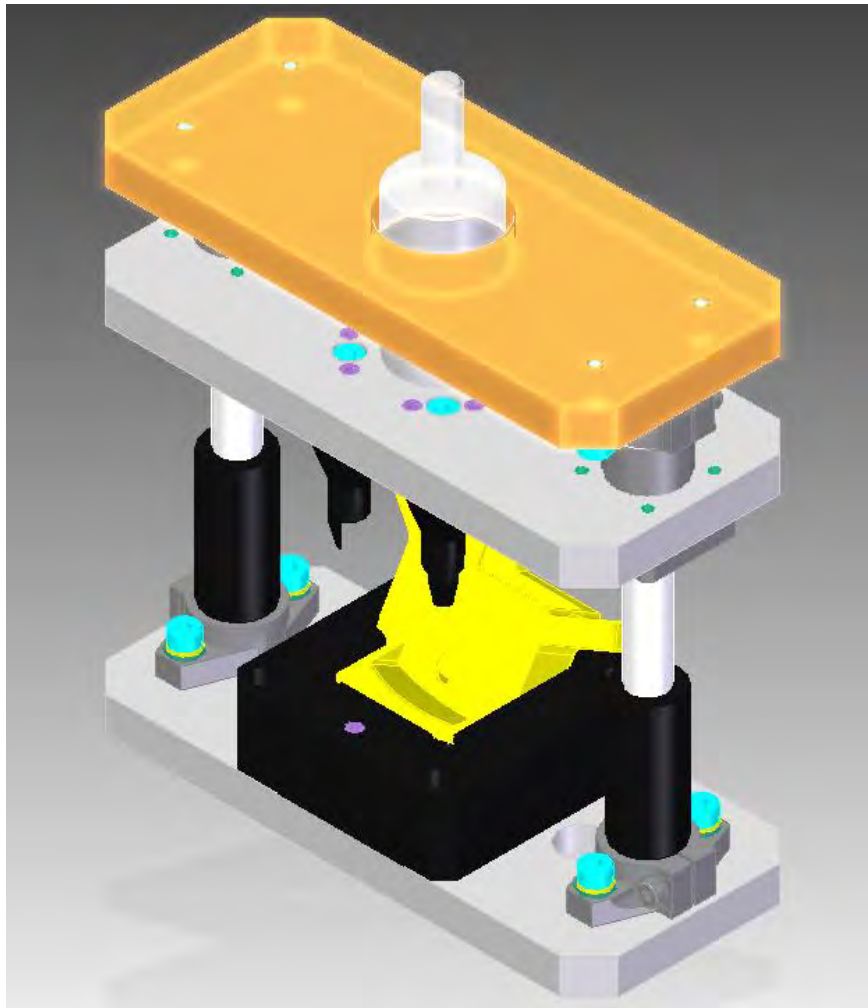


Figure 3. Poka yoke plate

### **Research methodology**

The research methodology is based on the analysis of the literature on the poka yoke mechanism, followed by case study where a poka yoke mechanism is implemented to avoid human errors, and in the same time having significant contribution to the elimination of other waste.

### **Discussion and conclusions**

Following the identification of the problem, the cutting fixture rounds device was built, according to figure 2. The cut is made by the 2 profiled knives, heat treated, being made of C120 material (tool steel), designed and manufactured according to the two radii. With the design and implementation of the poka yoke mechanism, human error was eliminated, but it also had a significant impact on operational times, production cost and product quality (radius cutting quality), because due to the poka yoke mechanism the positioning of the part is much faster and also prevents incorrect positioning of the part.

The required time to manually cut for both rays was 45 seconds, and using the poka yoke mechanism is 5 seconds, which represents an increase in productivity by 88.88%. Considering 7.5 hours of work per day, the production capacity using the poka yoke mechanism is 5400 pieces processed per day, while for their manual processing, the production capacity is 600 pieces per day.

Also, the number of workers and cutting tools was reduced, from 2 workers to 1, and the risk of injuries due to manual cutting and the ergonomic position of the worker decreased.

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# IoT TECHNOLOGY AND SUPPLY CHAIN MANAGEMENT

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## Abstract

**Purpose** - This article presents the supply chain management applications in economics but especially in the transportation industry.

**Methodology / approach** - The methodology proposed in this article is based on the use of ledger technology for the integration of transport sensor systems. Ledger technology integration methods are applied, and their results contribute to measuring performance in traffic management.

**Findings** - Based on the development of the processes realized by the authors, a methodology - was developed within the Department of Intelligent Transport Systems of UPB, for the integration of sensors from ITS.

**Research limitations / implications** - The paper offers a concrete solution obtained at the department level. This solution based on the implementation of the ledger technology algorithm represents a new approach for monitoring and transport planning in accordance with ITS requirements.

**Practical implications** - The practical aspects approached by the authors are related to the identification of the obstacles encountered in the implementation of urban transport planning management using ledger technology.

**Originality / value** - Methodology based on the supply chain management algorithms approach for monitoring and predicting traffic planning using IoT networks in ITS.

**Key words:** supply chain management, IoT, ledger technology.

## Introduction

The Internet of Things (IoT) initially established itself as a generous concept of direct (human) interconnection, via the Internet, of a multitude of devices, tools, equipment - eg household appliances, mobile vehicle systems ("Connected cars") that communicate with each other but also with the fixed infrastructure, ( Barbu and all, 2015). In the the Romanian translation, by extension, "Internet of Objects" can include not only objects hardware (hardware) but also software objects (including in the sense of object-oriented programming) and, also, virtual objects - even going as far as "avatars" of things – models behavioral that are (transactional) representatives of physical objects, etc. Embedded with electronic components. By connecting IoT sensors to the Internet of the future through ledger technology, they can be monitored and controlled remotely in complete safety because ledger technology ensures data security through its particularity, namely the division of data segments into chained blocks. The structure and implementation of the Internet of Things (IoT) has evolved due to the development of new technologies, thus allowing the realization of integrated sensor systems, real-time monitoring and last but not least the implementation of the concept of supervised Machine Learning.

In the industrial field, the Internet of Things architecture is based on sensors, instruments and other electronic devices connected to industrial software applications (SCADA), including electricity production and transmission systems (Ziegler S, 2017).

This connection structure allows the acquisition, bidirectional data exchange and real-time data analysis, aiming at improving the parameters of productivity and efficiency in obtaining a superior management. The IoT concept has been criticized in particular for its privacy and data security issues. In recent years, IoT architecture has begun to be used in many directions of development, the most relevant being the concepts of Smart Home, Smart City and Smart Country (Ziegler S, 2015).

The main vulnerability in IoT is that access to software applications and sensors are brought together in a unified architecture. In this sense, ensuring an optimized and secure solution for users, regardless of the device with which they connect in the system, is a major goal for designers. For example, a user could access an online recipe through the screen of a smart home appliance and then transmit the information obtained to another user who is in traffic, to make purchases on the way home (Singh S, 2015). Currently, for IoT, a new concept called environmental intelligence and autonomous control appears, a concept that was not part of the incipient architecture of IoT. Due to the emergence of these new IoT concepts, correlated with the development of ledger technology (the first applicability being blockchain networks for cryptocurrency generation), there was a change in research (conducted by companies like Intel) to integrate IoT concepts, automatic control and ledger technology, taking considering that sensors become the engine of an autonomous ledger Internet (Narang S, 2018).

In this context, a new approach to machine learning appears, namely the use of Deep Learning neural networks, which will allow sensors in IoT networks to learn on their own, thus providing a dynamic development environment.

## **Blockchain technology and the Supply Chain Management**

In this article we will analyze how one of the most prominent existing technologies - ledger technology (blockchain), can change the transport industry.

While the most widely used application of this technology is in cryptocurrencies, such as Bitcoin and Ethereum, the applications of ledger technology go beyond this use.

Blockchain, is a digital register of transactions; which contains a widely distributed database and stores all historical data in chronological order (traceability). The data is stored in blocks and can be viewed by all network users, without being able to make changes.

As an architecture, the Blockchain network must meet the following basic requirements: security, accessibility, traceability and transparency - and the blockchain is built to bring all these benefits and add something extra to industrial developments. The advantages for the transport industry (road, naval, air) are the following: it reduces bureaucracy (documentation), reduces costs and human administration of the process, facilitates the establishment and planning of routes and automates the tasks of drivers.

Blockchain can also be used to simplify the supply chain, reducing human interaction, increasing the speed of supply management and allowing communication between vehicles.

Starting from document management and transport tracking, ledger technology can act as a communications network for the Internet of Things (IoT) and will facilitate the use of radio frequency identification (RFID), rapid response codes (QR) and tags, blocks will allow storage large amounts of data, in a secure and decentralized way, ensuring fast data processing in a short time. Security is another important feature of blockchain technology. Currently, cryptocurrency trading information is stored in blocks that cannot be modified and immutable, which means that it is impossible to change it without the consent of the smart contract partner, because the calculations needed to make informational changes in blocks require a lot of processing power. great because they are stored centrally.

In addition, even if certain users want to make changes, they become visible to all members of the network, because the blocks but also the transaction history can be viewed by the participants in the transactions. The combination of ledger technology (Blockchain) and the IoT network can be achieved on three levels: IoT devices, Edge nodes and Cloud servers. The control and intelligent decision of the IoT network depends on the performance of software applications that use artificial intelligence algorithms. For example, the autonomous vehicle camera must detect obstacles in real time to avoid an accident. Smart decision making cannot be done without transferring data from the vehicle to the Cloud

servers / nodes and resending the resulting predictions back to the vehicle. Instead, the entire operation must be performed locally in the vehicle. The integration of advanced machine learning algorithms, especially deep learning in IoT devices, is a research direction in order to bring smart sensors as close as possible to the reality of human thinking.

In addition, an innovative element in the structure of IoT networks will be their ability to extract information and predict / anticipate events, so that the human factor can make control decisions in a short time (Jara J, 2014) .

### **Internet of multimedia objects (IoMT) and Ledger Tehnology**

Currently, due to the demand-driven economy, the supply chain model has had to undergo transformations. At this point, the supply chain is not just a chain, and the supply management system has evolved through an IoT interconnection with a multitude of websites that can be accessed permanently.

"Internet of Things" Multimedia (IoMT) is a new development direction in which different sensors of intelligent multimedia type and can interact and collaborate with each other, but can exchange information and other devices within IoT networks, so they can quickly exchange information multimedia from around the world. Based on this concept, IoMT networks are integrated worldwide. Today, over 9 billion multimedia network devices are connected to the Internet, contributing to the development and management of communication services (e-mail, social networks, chat, blog), forums, entertainment activities (games, books), shopping, exchange knowledge (education, geographic information, encyclopedias) for over 2.5 billion people worldwide (Frustaci M, 2017). In an IoT-based multimedia system, intelligence and decision-making are embedded in sensors. Similarly, a Cloud server has the ability to develop, maintain and execute various services, providing large scalable computing and data storage resources, using Artificial Intelligence algorithms. This approach allows users to monitor and control devices in any corner of the world. However, the currently existing Cloud services (ThingSpeak, Xively, ioBridge, Carriots, Axeda) are limited to managing the user's device and recording data from sensors. Existing Cloud servers have been implemented only for the processing of data received from IoT, which transmit information asynchronously and at long intervals (Iglesias M, 2017). The role of IoMT networks is defined by two user services as follows: wireless multimedia systems, which are used to monitor the quality of the environment, and detection sensors can receive feedback based on applications that use intelligent agents; procurement process control systems; and Wireless networks for multimedia sensors (WMSN), but these devices have a limited ability to receive feedback. In traditional multimedia networks, multimedia devices only transmit multimedia information purchased near them. Multimedia content can be transmitted to the user or stored on Cloud servers for further data processing at the request of users. In general, the architecture of multimedia devices is designed for communication with other multimedia devices with similar technical characteristics (homogeneity), in the future it will be possible to integrate inhomogeneous devices.

Today, IoMT communication allows multimedia devices, such as cameras or mobile phones, to be accessed globally via a single IP address, as can connectors or other devices connected to the Internet. Due to the technological progress of miniaturizing the size and costs of multimedia devices, connected in IoMT networks will be widely used, and these devices will be able to create ad-hoc connections with all devices in the network using ledger technology. Thus, IoMT networks with communication on ledger technology will become globally interconnected networks, which will be uniquely identifiable and addressable to obtain multimedia data or to predict the development of actions, having the ability to communicate and exchange information with other devices. and multimedia services, with or without human intervention. In this new configuration, the traffic monitoring systems will move to a new level, and based on deep learning software applications for object detection and recognition, they will be able to predict traffic flows, transmitting to the network the traffic flow control commands and travel.



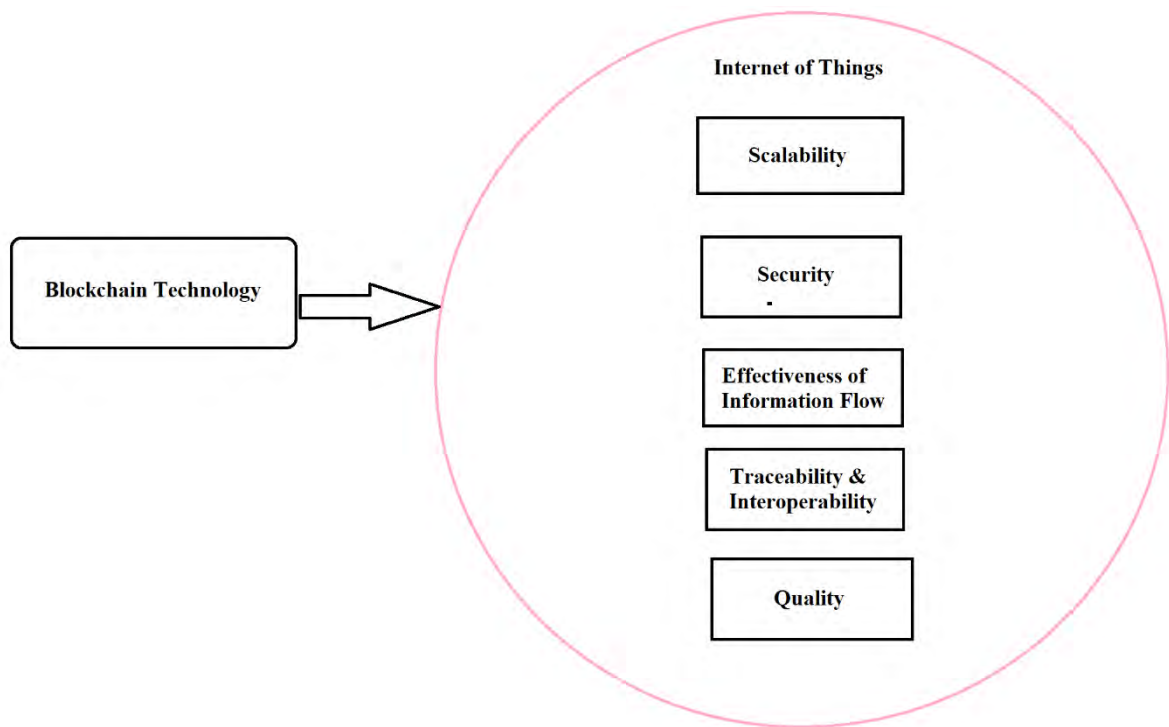


Figure 1. IoT interconnection with Blockchain technology

Large amounts of multimedia data (Big Data) are subjected to different data processing procedures in order to reduce the volume of data to be transmitted on the multimedia device - transformation, quantification, estimation, entropy encoding, vectorization, so that the data content can be tablet to comply with the available bandwidth during transmission. This problem will be solved by implementing 5G mobile communications worldwide. The previously mentioned processing processes are complex in terms of computing resources, consuming a large amount of energy. Currently, various solutions are being tested for streamlining multimedia communications, including compressive detection, distributed video encoding based on blockchain technology, which will be used to facilitate the acquisition and processing of multimedia devices on IoMT networks.

Based on the functional requirements of IoMT networks, video encoding techniques can be classified into three categories:

- Conventional video encoding
- Distributed video encoding
- Acquisition with statistical compression rate ("compressive sensing / compressive sampling")

Challenges in IoMT development. The transmission of multimedia content from the sensor to the Cloud server with processing and storage applications, can generate traffic management restrictions, which are essential for real-time transmission of continuous video streams, which can introduce acquisition delays or breakages, aspects that for a video traffic monitoring system in ITS networks can cause major inconveniences. These inconveniences can cause a malfunction of software applications developed with Artificial Intelligence algorithms for object detection and recognition (cars, pedestrians, face detection and recognition, tracking a car). For example, users may be allowed to ubiquitously access data from remote sensors and sets of rules may be implemented to control the automatic operation of actuators in the Cloud ("sensor and actuation as a service" - Sensing and Actuation as a Service , SAaaS), to control Identity and Policy Management as a Service (IPMAaaS), allowing processing to real-time analysis for video surveillance streaming (VSaaS) and so on The desired goal is to reduce human involvement in IoMT to a viable minimum - including in detecting objects and movements, facial recognition, identification of license plates, situational and acoustic awareness, forensic analysis, detection of theft or prohibited access, etc. In conclusion, some new possible uses of IoMT are:

telemedicine, intelligent social interaction, intelligent business management (eBusiness), automatic public security.

### **Research Methodology: IoT integration in the Cloud through real-time web ledger technology communications (Web-RTC)**

WebRTC (short for Web Real-Time Communications) is a collection of communication protocols and application programming interfaces (APIs) that allow real-time communication (with a latency that has fallen far below the time constants of human perception; or of industrial processes) using peer-to-peer (P2P) connections (Mardan A, 2014). This allows web browsers to send and receive information in real time, from and to other users' browsers - the premise for this is the new speed and capacity performance of IP communications.

Traditional web models are developed on the client-server architecture in which the communication is performed unidirectional (from server to client). The WebRTC architecture develops the client-server model by incorporating the notion of P2P communication ("peer-to-peer") between web browsers (Kelleher J, 2016). The most widely used WebRTC architecture is the triangular model in which the two web browsers access an application on a server (located "at the top of the triangle") - through this application, signaling messages are transmitted via HTTP protocol or Ledger technologies (Wen Y, 2010). Validation and consensus for Ledger technology was achieved by Proof-of-Work. The blockchain using a procedure Proof-of-Work (PoW) to validate transactions and create new blocks. The original purpose of PoW was achieved as an economical measure to discourage distributed service (DDoS) attacks and the generation of spam in the network. This function is performed by requesting "validations" by the service provider. For example, on the blockchain "validation" consists in calculating a double hash function of type SHA256. Usually all blockchain networks are based on validation and a certain consensus (Peters & Panayi, 2016).

```
% Copyright 2019 The DCM&MathWorks, Inc
classdef Blockchain < handle

    properties
        blockchain
    end

    methods
        function obj = Blockchain()
            obj.blockchain = bc.Blockchain.genesis_block();
        end

        function block = add_block(obj, data, nonce)
            assert(isa(nonce, 'uint32'));
            index = numel(obj.blockchain) + 1;
            prev_hash = obj.blockchain(end).hash;
            timestamp = char(datetime);
            hash = bc.Blockchain.calculate_hash(index, prev_hash,
timestamp, nonce, data);
            block = bc.Block(index, prev_hash, timestamp, data, nonce,
hash);
        end

        function added = add_mined_block(obj, block)
            assert(isa(block, 'bc.Block'));

            valid = bc.Blockchain.validate_block(block,
obj.blockchain(end));
```

```

        if valid
            obj.blockchain(end+1) = block;
            added = true;
        else
            added = false;
        end
    end
end

function rv = replace_blockchain(obj, new_blockchain)
    valid = bc.Blockchain.validate_chain(new_blockchain);
    if ~valid
        rv = p2p.MessageType.DO_NOTHING;
        return;
    end
    if numel(new_blockchain) > numel(obj.blockchain)
        obj.blockchain = new_blockchain;
        rv = p2p.MessageType.BROADCAST_LATEST;
    end
end

function print(obj)
    fprintf('\n=====');
    for idx=1:numel(obj.blockchain)
        fprintf('index: %d\n', obj.blockchain(idx).index);
        fprintf('timestamp: %s\n', obj.blockchain(idx).timestamp);
        fprintf('data: %s\n', obj.blockchain(idx).data);
        fprintf('nonce: %d\n', obj.blockchain(idx).nonce);
        fprintf('hash: %s\n', obj.blockchain(idx).hash);
        fprintf('previous_hash: %s\n\n',
obj.blockchain(idx).previous_hash);
    end
    fprintf('=====');
end

function rv = handle_blockchain_response(obj, mess)
    % Convert incoming message of struct or array of struct
    % to array of blocks
    received_blockchain = bc.Block(mess(1));
    if numel(mess) > 1
        for idx = 2:numel(mess)
            received_blockchain(end+1) = bc.Block(mess(idx));
        end
    end

    latest_block_received = received_blockchain(end);
    latest_block_held = obj.blockchain(end);
    rv = p2p.MessageType.DO_NOTHING;

    % If received latest block is not later than the local, do
    % nothing.
    if latest_block_received.index > latest_block_held.index
        if latest_block_held.hash ==
latest_block_received.previous_hash
            % We can append the received block to our chain
            % FIXME validate block
            valid =
bc.Blockchain.validate_block(latest_block_received, latest_block_held);
            if valid
                obj.blockchain(end+1) = latest_block_received;
                rv = p2p.MessageType.BROADCAST_LATEST;
            end
        end
    end
end

```

```

        end
    elseif numel(received_blockchain) == 1
        % We have to query the chain from our peer
        rv = p2p.MessageType.QUERY_ALL;
    else
        % Received blockchain is longer than current blockchain
        rv = obj.replace_blockchain(received_blockchain);
    end
    % Above only works if only one block or entire chain is
    % sent, which should be the case.
end
end
end
end

methods (Static = true)

function gen = genesis_block()
    % FIXME mine the block for correct hash
    % Create genesis block
    index = 1; % Yes it is MATLAB
    prev_hash = char(0);
    timestamp = '07-Dec-2017 01:19:33';
    data = 'The origin';
    nonce = uint32(0);
    hash = char(uint8([159 253 165 212 162 203 121 5 144 7 7 212 3
29 209 119 128 39 5 152 71 69 214 107 142 245 155 146 123 159 164 236]));
    gen = bc.Block(index, prev_hash, timestamp, data, nonce, hash);
end

function valid = check_if_genesis(block)
    assert(isa(block, 'bc.Block'));
    gen_str = ['1', char(0), '07-Dec-2017 01:19:33The origin0',
char(uint8([159 253 165 212 162 203 121 5 144 7 7 212 3 29 209 119 128 39 5
152 71 69 214 107 142 245 155 146 123 159 164 236]))];
    blk_str = [num2str(block.index), block.previous_hash,
block.timestamp, block.data, num2str(block.nonce) , block.hash];
    if strcmp(gen_str, blk_str)
        valid = true;
        return;
    end
    valid = false;
end

function [sha256, uint8_sha256] = calculate_hash(index, prev_hash,
timestamp, nonce, data)
    string = [num2str(index), prev_hash, timestamp, num2str(nonce),
data];
    sha256hasher = System.Security.Cryptography.SHA256Managed;
    uint8_sha256 = uint8(sha256hasher.ComputeHash(uint8(string)));
    sha256 = char(uint8_sha256); %consider the string as 8-bit
characters
end

function valid = validate_chain(blockchain)
    valid_genesis = bc.Blockchain.check_if_genesis(blockchain(1));
    if ~valid_genesis
        valid = false;
        return;
    end
end

```

```

temp_blockchain = blockchain(1);

for idx=2:numel(blockchain)
    valid_blk = bc.Blockchain.validate_block(blockchain(idx),
temp_blockchain(idx-1));
    if valid_blk
        temp_blockchain(end+1) = blockchain(idx);
    else
        valid = false;
        return;
    end
end
valid = true;
end

function valid = validate_block(new_block, prev_block)
assert(isa(new_block, 'bc.Block'));
assert(isa(prev_block, 'bc.Block'));

% FIXME check for correct hash (with 0s)
if ~(new_block.hash(1:2) == char(zeros(1,2)))
    valid = false;
    return;
end

if (prev_block.index+1) ~= new_block.index
    valid = false;
    return;
end

if ~strcmp(prev_block.hash, new_block.previous_hash)
    valid = false;
    return;
end

new_block_hash = bc.Blockchain.calculate_hash(new_block.index,
...
        new_block.previous_hash, new_block.timestamp,
new_block.nonce, new_block.data);
if ~strcmp(new_block.hash, new_block_hash)
    valid = false;
    return;
end
valid = true;
end
end
end
end

```

Figure 2. Proposed communication algorithm between IoMT and Ledger technology

#### Workflow approach on neural networks

LabVIEW and Matlab are software development environments for object recognition and classifications solution uses neural networks and Deep Learning algorithms (Wen Y, 2010).

LabVIEW workflow overview:

1. Object recognition and classifications using a trained model.
2. Cars and pedestrian data transformation for neural networks analysis.
3. Representation of the object on a 128-dimensional data using deep neural networks.

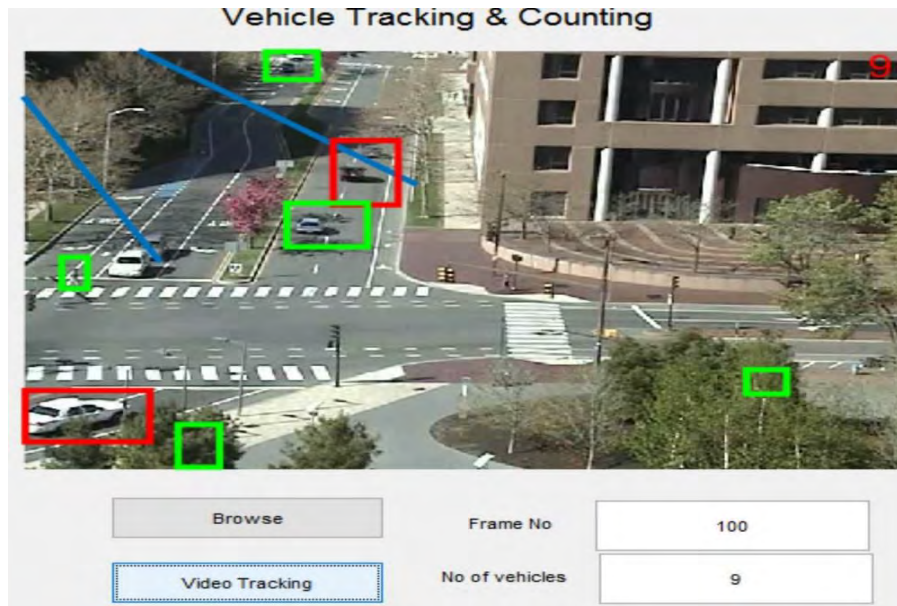


Figure 3. Cars and person recognition using Deep Learning Neuronal Networks

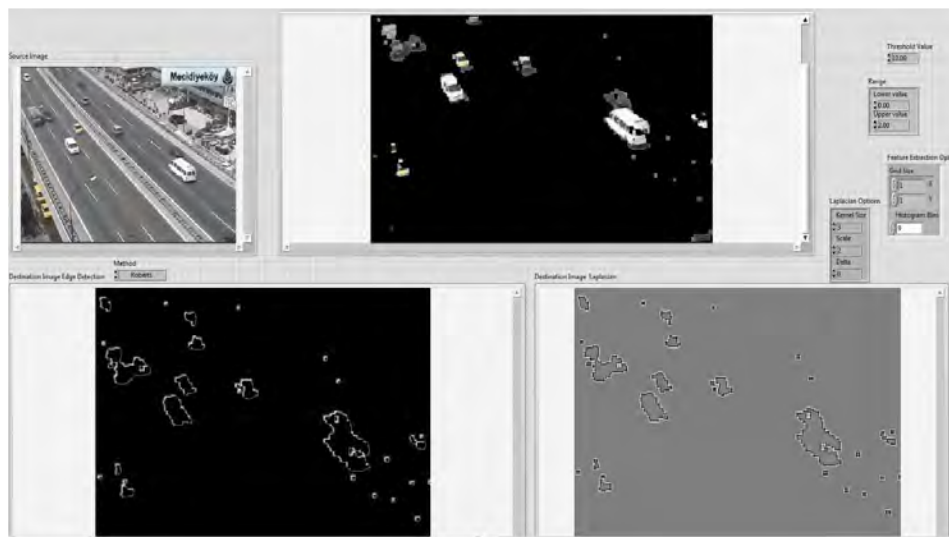


Figure 4. Vehicle motion detection from highway detection and analyze using IoMT

One of the main advantages of using LabVIEW in the development of software applications with neural networks is the possibility of importing extensive libraries of objects. The training database for object recognition and classification will be installed on Cloud servers and can be accessed and used in data processing and object recognition using software applications developed within the department.

### Conclusions

The supply chain industry is the backbone of any country's economy. The modern supply chain ecosystem is quite complex, with many entities involved in the process, which leads to lower efficiency and higher operating costs. Currently we can see that the management of the supply chain used in the field of transport has developed significantly, starting from manual operations that generated prediction risks, reaching automatic management, in real time, which is not a risk generator. The use of IoT and blockchain technology (ledger) together with applications developed for supply chain management has a major impact on road, sea and air traffic management, in tracking goods and supply (efficient inventory management and reducing supply chain losses) . This has contributed to the achievement of economic benefits for companies and has helped to expand the supply chain over large geographical areas (eg Amazon). Starting with the use of simple goods identification devices and arriving at a complex

architecture that works in an intelligent system, IoT has revolutionized the transportation and supply chain industry, starting with supply, product selection and delivery to users.

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# TRADE RECEIVABLES AND / OR PAYABLES? EVIDENCE OF THEIR IMPACT ON FINANCIAL PERFORMANCE

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## Abstract

**Purpose** – The main objective of the research was to identify the impact of trade receivables and payables on financial performance for a sample of car parts companies.

**Methodology/approach** – Since most of the companies in the sample are medium-sized (unlisted) companies, we used accounting measures. The dependent variable was return on assets and return on equity; the independent variable was trade receivables, trade payables and net trade credit, firm size and growth rate. Eviews 9 software was used to formulate econometric models.

**Findings** – The results of this study are in line with previous research results and confirm that trade receivables and payables have a negative impact on financial performance.

**Research limitations/implications** – Empirical research was conducted on a sample of companies selected based on several criteria. The extension of the sample and the grouping of companies (according to the size criterion) can increase the degree of representativeness of the research results.

**Practical implications** – The research is useful because it provides empirical evidence; managers can capitalize on research results for a proper substantiation of funding and performance strategies.

**Originality/value** – Research results are valuable contributions towards the improvement of Romanian companies' performance.

**Key words:** performance, trade receivables, trade payables.

## Introduction

Integrated in the field of performance management, measuring financial performance is one of the longest-lived preoccupation for academia and business. In this study we will consider financial performance as an artefact based on which the success of an organization is appreciated, in the context of a globalized market. Maintaining or increasing a company's performance requires careful management of trade receivables and payables to identify the extent to which they balance. Research conducted in the US and Europe has shown that trade receivables granted by companies accounted for 9% of total sales revenue, and 94% of these receivables were financed from trade payables (Afrifa and Gyapong, 2017).

The research on this field has expanded in recent decades. However, things are not completely clear. The diversity of data and indicators analysed, the diversity of samples but also of the methodologies used made the research results mixed, and difficult to generalize. For these reasons, but also to ensure the representativeness of the results, the main objective of the research is to identify the impact of trade receivables and payables on financial performance for a sample of companies producing car exchange parts for vehicles, for a period of 10 years. To achieve this objective, we structured the work as follows. The first section presents a review of the literature on performance and trade receivables and payables; the second section details the research methodology; the next section presents the research results; the last section summarizes discussion and conclusions.



## Review of the literature on financial performance, trade receivables and payables

Financial performance appraisal systems have been developed in several stages (Rajnoha, Lesníková and Korauš, 2016). In the first stage (until 1980), the financial indicators underlying the evaluations were profit and profitability (assets, capital, investments). Over the next ten years, performance management systems focused on creating value for stakeholders, and the indicators used were economic added value (for the company and stakeholders). In this context, financial performance has been defined as the ability of a company to create economic value (Orozco Vargas and Galindo-Dorado, 2018), to maximize the wealth of its shareholders or founders (Baker, Veit and Powell, 2001), to attract and generate profits for investors (Suhadak et al., 2019; Al-Sa'eed, 2018). Then, as an effect of the intensification of globalization, the evaluation of financial performance was performed in an integrated framework, along with other facets of performance, based on methods such as business excellence, balance score card, service profit chain, integrated performance measurement. Against the background of divergences on the indicators used to measure performance, new methods have been proposed, called multi-criteria methods that operate either with a single synthesis indicator or with a multiple combination of partial indicators (Peleckis, Krutinis and Slavinskaitė, 2013).

Recently, new performance measurement systems have been developed: dynamic multi-dimensional performance framework; integrated performance measurement framework; holistic performance management framework. Some authors (Batrancea et al, 2018) showed that the studies regarding performance link five major categories of causality: growth and performance; working capital and performance; capital market and profitability; cash flow and earnings; capital structure and profitability. In this study we focus on the link between working capital and performance. As a consequence of sales-purchase relationships, companies simultaneously generate trade receivables and payables. The issue of trade receivables and payables is integrated into research regarding the impact of short-term financing on financial performance.

Debt-based financing theory admits that a company that holds receivables from its customer relationships can improve profitability but also overall performance by virtue of favourable customer relationships, which can guarantee future sales. As the period of receivables increases, the supplier has more control over customers and can cause them to buy more than necessary (Afrifa and Padachi, 2016), especially when there are a small number of suppliers on the market (Garcia-Teruel and Martinez-Solano, 2010). On the other hand, trade receivables restrict the possibilities of financing the current activity, which is why some researchers have opined that their volume must be minimal or even zero (Afrifa and Gyapong, 2017). The arguments invoked were: companies with higher liquidity may be more profitable (Goddard, Tavakoli and Wilson, 2005); the volume of trade receivables must be assessed according to the size of the company (Petersen and Rajan, 1997) and to the possibilities of access to the capital market (Hill, Kelly and Highfield, 2010; Banos-Caballero et al., 2010).

Liquidity theory explains why companies use supplier credit as a source of financing. Treated as a substitute for institutional financing (from banks), the credit provider can improve the financial performance of the beneficiary companies provided with the condition that to be a cheaper source of financing. Research has shown that companies with financing difficulties register an increase in trade payables (Atanasova, 2007; Molina and Preve, 2012). On the other hand, companies that meet the conditions for bank lending will use the supplier credit to a lesser extent. Bank financing is considered to be cheaper than supplier credit (Huyghebaert et al. 2007).

Empirical research based on these theories has analysed separately or correlated the impact of trade receivables and payables on financial performance. As long as receivables generate temporary cash deficits, it is accepted that there is a negative relationship between the volume of receivables and financial performance. In other words, shortening cash conversion cycles generates higher profitability (Knauer and Wohrmann, 2013; Muscettola, 2015; Öner, 2016; Otuya and Eginiwin, 2017). Without denying these results, Batrancea et al. (2018) also argued that an increase in receivables positively influences financial performance only in conditions of accelerated sales, in which the growth rate of turnover is higher, shortening the cash conversion cycle.

Admitting that a company manages both assets (trade receivables) and liabilities (trade payables) simultaneously, other authors have shown that shorter business cycles are associated with higher profitability and vice versa (Muscettola, 2015). In other words, there is a negative relationship between the net business cycle and profitability (Soenen, 1993; Öner, 2016; Hill, Kelly and Highfield, 2010; Afrifa

and Gyapong, 2017), which requires a reduction in the number of days for trade receivables and an increase in the number of days for trade payables.

## Research methodology

In order to ensure the representativeness of the data, we selected only companies producing spare parts for vehicles. The construction of the sample was based on three criteria: sales volume (turnover), size of profits and number of employees. After collecting the data (accessing secondary sources), we eliminated companies that were established after 2009, that recorded losses for more than three consecutive years (in the period 2009-2018) or did not submit financial statements for all 10 years of the period analysed. The final sample consist of 44 companies (of which 3% large companies, organized as joint stock companies, and 97% small and medium enterprises, organized as limited liability companies). The selected companies represent 14.6% of the total companies in the stated fields and generate 60% of the turnover of these fields.

Since most of the companies in the sample are medium-sized companies (unlisted), we turned to ROA (return on assets) and ROE (return on equity) accounting measures. Regarding the independent variables, we included in the analysis *trade receivables*, *trade payables*, and *net trade credit*. Due to the differences in the size of the companies in the sample, we used two control variables: *firm size* and *growth rate*. The variables and the methodology for determining them are presented in Table 1.

Table 1. Variables defining

Variables	Cod	Measuring
Return on assets	ROA	Gross profit / Total assets
Return on equity	ROE	Net profit / Shareholder's Equity
Share of receivables in turnover	SR	Trade receivables / Turnover = TR / T
Share of payables in turnover	SP	Trade payables / Turnover = TP / T
Net trade credit	NTC	(TR/Total assets) – (TP/Total assets)
Growth rate	G	Turnover <sub>n</sub> / Turnover <sub>2009</sub> (2009 is the base year)
Firm size	S	The natural logarithm of assets

Empirical research is based on the following hypotheses:

H 1. Trade receivables and payables have a negative impact on the financial performance assessed by the ROA and respectively ROE.

H 2. There exists a negative association between net trade credit and financial performance assessed by ROA and respectively ROE.

## Results

The analysis at the level of descriptive statistics indicated that ROA and ROE for the sampled companies vary between a negative minimum and a maximum with very high values (73.2% for ROA and 361.7% for ROE). The average level of profitability indicators indicates a very important aspect. The ROE (20.6%) is higher than the ROA (12.0%), which means that the companies in the sample use borrowed funds whose cost is lower than the internal rate of return. The average share of receivables in turnover (SR = 29.6) is lower than the average share of trade payables in turnover (SP = 47.4). Analysis from the perspective of net assets held indicated a negative average NTC, which confirms that, at the sample level, the volume of trade payables is higher than the volume of trade receivables (see Table 2).

Table 2. Descriptive statistics of the independent and dependent variables

	Mean	Maximum	Minimum	Std. Dev.	Observations
ROA	12.083	73.200	-27.900	13.494	440
ROE	20.665	361.400	-100.100	27.729	440
SR	29.602	691.700	1.600	44.951	440
SP	47.403	1321.600	3.000	83.472	440
NTC	-16.147	63.694	-93.533	23.932	440
G	742.982	25058.00	0.100	2724.298	440
First difference of growth rate	157.413	8688.100	-3061.900	783.675	396
Firm size = S	2.94E+08	3.06E+09	716559.0	4.97E+08	440
Logarithm of firm size	17.591	21.841	13.482	2.321	440

Source: processed by the author

In terms of growth rates, the standard deviation indicates a large variation in values, which means that, at the sample level, companies have experienced (over the 10 years) very different growth rates. Regarding the size of the companies in the sample (estimated by logarithmic average annual number of employees), the value spread rate is relatively low which means that they are comparable in size. First difference of growth rate was determined to solve the stationarity problem.

Eviews 9 software was used to perform statistical analyses for econometric models that estimate the impact on ROA and ROE. The analyses are based on the panel data method (OLS adapted to panel data), which is a specific method of generating equations for data containing both time series and cross sections. By determining the correlation matrix of the variables (table 3) we showed that there are no significant correlations (greater than 0.7) between the independent and control variables, which strengthens the fact that they can be used together in the same econometric model.

Table 3. Correlation matrix of the variables considered in the analysis

Variables	ROA	ROE	SR	SP	NTC	G	S
ROA	1.000						
ROE	0.625 (0.000)	1.000					
SR	-0.201 (0.000)	-0.042 (0.376)	1.000				
SP	-0.294 (0.000)	-0.106 (0.025)	0.615 (0.000)	1.000			
NTC	0.374 (0.000)	0.041 (0.379)	0.180 (0.000)	-0.322 (0.000)	1.000		
G	0.091 (0.055)	0.109 (0.021)	-0.058 (0.221)	-0.030 (0.517)	-0.053 (0.260)	1.000	
S	-0.036 (0.450)	-0.024 (0.601)	-0.147 (0.002)	-0.055 (0.247)	-0.125 (0.008)	0.246 (0.000)	1.000

Note: probability in parenthesis  
Source: processed by the author

The regression results are summarized in Table 4. The two multiple regression models are statistically significant (R-squared for ROA and ROE is 0.713, respectively, 0.431), and F-statistic probability higher than 0.01 (meaning that the predictors are related significant with the dependent variable). R-square adjusted indicates that 66.6% of the ROA variation is explained by the variation of the independent variables. The second regression model explains the ROE variation only in proportion of 33.7%.

Table 4. Regression analysis

Indicators	Model 1 - ROA	Model 2 -ROE
	Coefficient (Std. error)	Coefficient (Std. error)
Share of receivables in turnover	<b>-0.127***</b> (0.024)	-0.062 (0.068)
Share of payables in turnover	<b>-0.091***</b> (0.029)	<b>-0.187**</b> (0.081)
Net trade credit	0.048 (0.041)	<b>-0.386***</b> (0.116)
First difference of growth rate	<b>0.001*</b> (0.001)	<b>0.005**</b> (0.001)
Logarithm of firm size	0.961 (1.507)	1.147 (4.193)
R-squared	0.713	0.431
Adjusted R-squared	0.666	0.337
F-statistic	15.071***	4.596***

Note: Standard error in parenthesis;

Note: \*, \*\* and \*\*\* represents significant values at 1%, 5% respectively 10%

Source: processed by the author

The regression estimate reveals that (in the case of the first model) there is a significant negative relationship between SR, SP and ROA. The second model indicates that there is a significant negative relationship between SP, NTC and ROE. For both models, the turnover growth rate is positively and significantly correlated with the financial performance appreciated by ROA and ROE.

## Discussion and conclusions

In the context of intensifying globalization, performance management has taken on the task of ensuring business flexibility and increasing/maintaining competitive advantage. Therefore, trade policy is gaining importance in the context of value creation for both the company and the interested parties. However, a commercial policy focused on attracting/retaining customers (by postponing the payment of invoices) generates an imbalance in the company's cash flow. To the extent that managers effectively manage the receivables and liabilities generated by sales and supply operations (aiming to maintain a short-term financial balance), they can minimize the negative impact on financial performance.

The study aimed to determine the impact of trade receivables and payables on the financial performance assessed by ROA and ROE. Different from previous research (Padachi, 2006; Batrancea et al., 2018), which separately assesses the impact of trade receivables and payables on financial performance, in this study we included a third variable (net trade credit - according to Afrifa and Gyapong, 2017), which indicates the net financial statement resulting from the purchasing and sales operations. Then, in order to ensure the representativeness of the results, we performed an analysis on a relatively homogeneous sample (both in terms of field of activity and in terms of business size).

The results of the statistical analysis partially confirmed two hypotheses: trade receivables and payables have a negative impact on the financial performance assessed by ROA; net trade credit has a significant and negative impact only on ROE. Our results confirm the results of previous research (Hill, Kelly and Highfield, 2010; Muscettola, 2014; Afrifa and Gyapong, 2017), including those conducted on the example of Romanian companies (Batrancea et al, 2018). To increase the efficiency of asset use, managers need to reduce trade receivables and payables. To increase the efficiency of using equity, managers must reduce net trade credit.

Research is useful from at least two points of view: theoretically, because it performs an evaluation of the literature both from the perspective of performance management and from the perspective of theories on company financing; practical, as it provides empirical evidence on the impact of trade

receivables and payables on performance; managers can capitalize the research results to achieve a sound rationale for funding and performance strategies.

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# EVALUATION OF THE PERFORMANCE OF ROBOTIC WELDING CELLS BY MODELING WITH TIMED PETRI NETS. CASE STUDY

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## Abstract

**Purpose** – The subject is to develop a model with timed Petri nets of a robotic welding cell.

**Methodology/approach** - The information used in the construction of the model (s) with timed Petri nets were: the sequence of sequences specific to the welding process within the robotic cell; duration of sequences; number and type of parts that are assembled by welding; cell layout. With this information, three model variants with timed Petri nets were built

**Findings** – The paper presents how generalized timed Petri nets can be used to model and simulate robotic welding cells.

The modeling and simulation process is an iterative process several varieties of models with generalized timed Petri nets have been developed.

**Research limitations/implications** – The subject is to develop a model with timed Petri nets of a robotic welding cell. Using this model, by simulation, the performance of the cell will be evaluated and the problems that appear in the manufacturing process will be highlighted

**Practical implications** Using the model, by simulation, the performance of the cell will be evaluated and the problems that appear in the manufacturing process will be highlighted.

**Originality/value** – Models with generalized timed Petri nets, the final version, have several attributes: takes into account the actual welding sequences within the cell; also models the supply processes with parts; integrates the cell within a manufacturing line.

**Key words:** Modeling, simulation, Petri nets, robotic cell.

## Introduction

Welding is a very common technological process used in the automotive industry, especially in assembling car bodies. Modern assembly lines are characterized by the fact that they have complex devices in their component and in most cases are robotic.

Car bodies are complex assemblies which, in turn, are obtained using subassemblies such as: lower floor, side faces, front assembly, engine compartment, doors and bonnets. These subassemblies are obtained, several times, by joining by welding some pieces of deep drawing and bent sheet (Figure 1).

In the process of welding the sheets, spot welding without filler material or continuous welding with filler material is used by the process with fusible electrode in protective inert gas (MIG) medium. Regardless of the welding method chosen, it is preferable that the assembly of the body elements be done mechanized or automated with the help of industrial robots (Figure 2). The use of industrial robots leads to: increasing productivity and quality, reducing energy costs, material costs and labor.

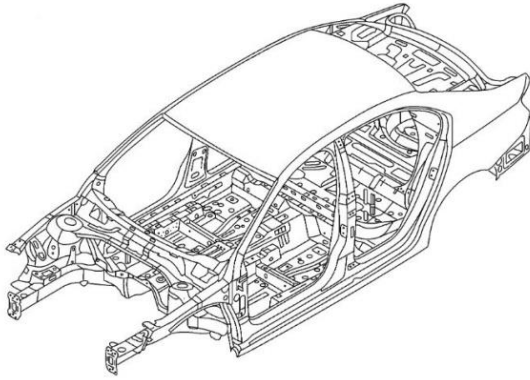


Figure 1. Car body assembly



Figure 2. Industrial welding robot

These robots are equipped with weld guns. The mobile welding pliers are manipulated together with their actuator by the robot. These can be of 3 types:

Type C - performs a translational movement, its actuating cylinder being connected directly to the moving electrode (Figure 3);

Type X - are the most common, they perform a rotational movement (Figure 4);

Type D - performs a translational movement and is used for vertical welding (Figure 5).

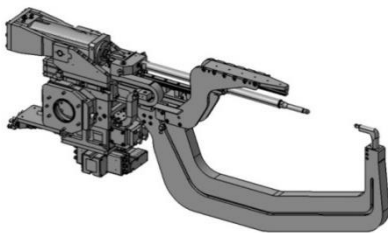


Figure 3. Type C Welding gun

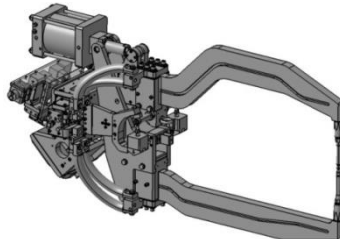


Figure 4. Type X Welding gun



Figure 5. Type D Welding gun

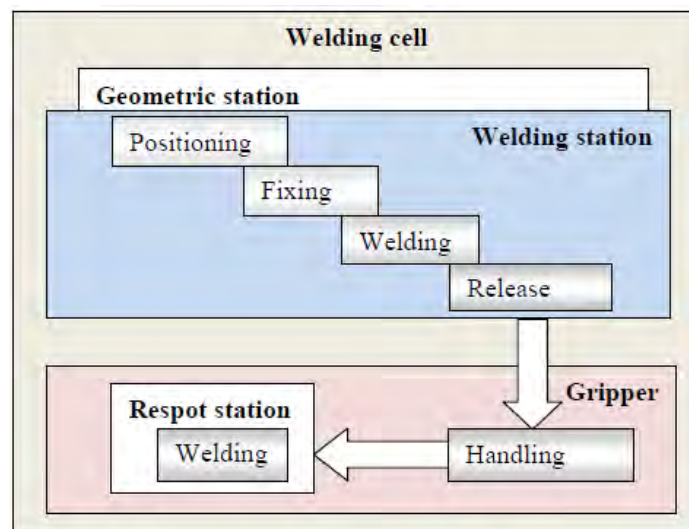


Figure 6. Welding cell

A robotic welding cell may contain a geometric station in which the assembly is done through the welding points and, as the case may be, a respot station in which the assembly will be done through those



welding points that could not be done in the geometry station. Figure 6 shows the scheme of the working process in such a cell. In the geometric station, the body elements are first positioned in the devices and then fixed with pneumatic clamps to hold the parts in place. The next step is welding at the geometry points after which the assembly is released by the clamps. After that, the subassembly can be managed by a clamping device which is taken from the geometric station and holds it until the respite phase lasts. In the respot station, the remaining welding points, also called respot points, will also be welded. The welding procedure is described in figure 6.

**Description of the subassembly to be welded and of the welding station**

The welding cell is intended for assembling the structure *Central lower floor subassembly*. This subassembly has three components: sheet 1, welded subassembly and sheet 2 (Figure 7)

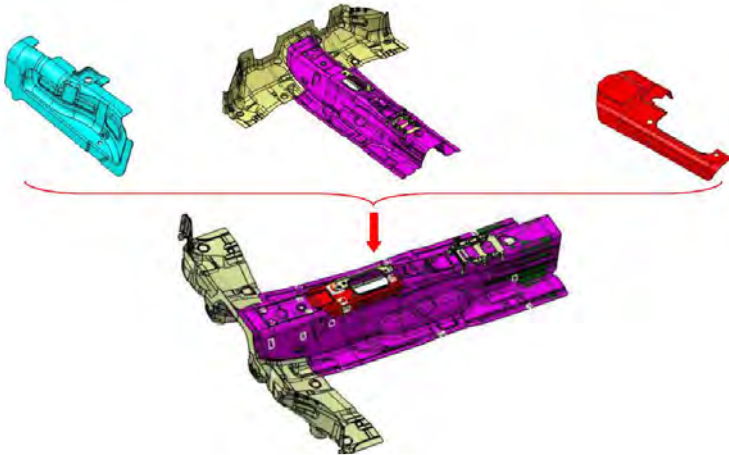


Figure 7. Central lower floor subassembly components

The automated welding cell is of human-robot type and works sequentially, ie first, the operator loads the sheet elements to be welded after which the robot performs the welding operation. The body elements to be assembled are oriented by means of the pins and fixed with the help of pneumatic clamps in the geometric welding station. Figure 8 shows the components to be welded positioned and fixed in the welding station. Welding is performed with the help of welding pliers. All welding points defined on the road elements can be accessed by the welding pliers, so there will be no need for respot points. Welding a point takes 4 sec. Welding is done successively, only one welding point at each step until all welding points are executed. The robot starts spot welding with type X guns, and then with type C guns (Figure 9). Figure 10 shows the station and the numbering of the component units. A complete cell operating cycle is composed of a sequence of sequences. These sequences and their durations are presented in Table 1.

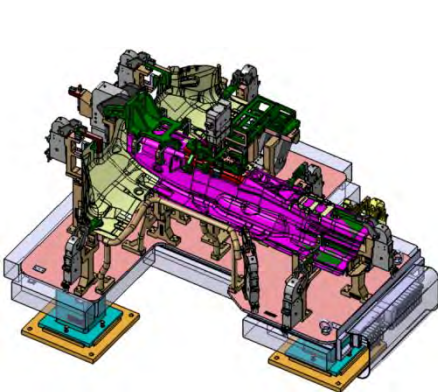


Figure 8. The components to be welded are positioned and fixed

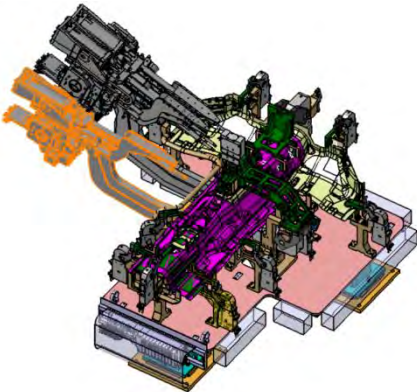


Figure 9. Type C gun welding

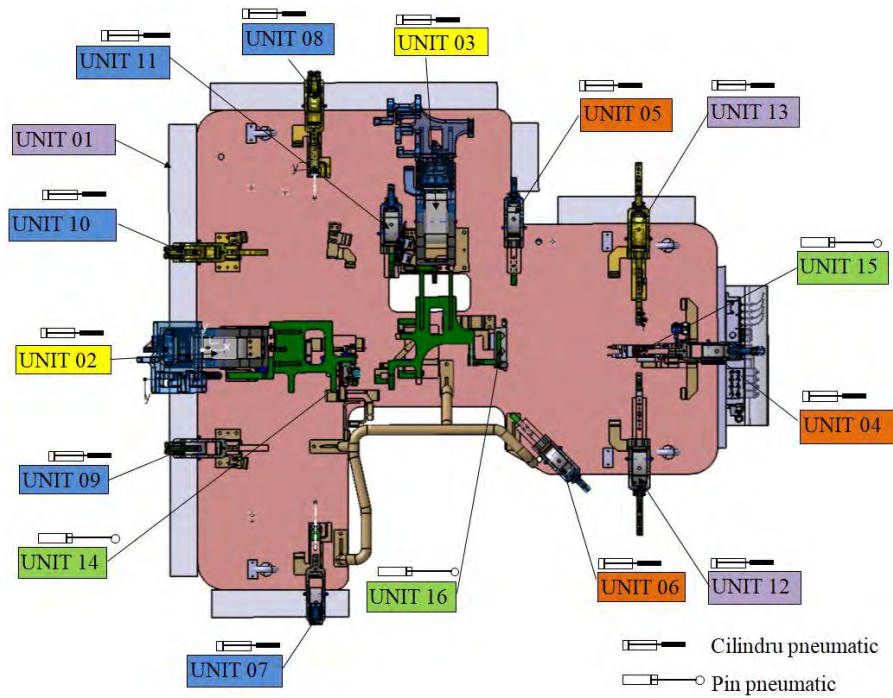


Figure 10. The units within the station

Table 1. Process sequences

No	Description	Operator/ Robot/ No. Unit	Quantity	Operation time
Loading of the sheets by the operator / approximately 65-70 sec				
1	Manual sheet loading 1		1	10.5
2	Manual loading of the blank	With the help of a handling device	1	39
3	Manual sheet loading 2		1	19
Welding station				
4	Closing the pneumatic clamps	Unit 02,03	1	3
5	Closing the pneumatic clamps	Unit 04.,05,06,07,08, 10,12,13	1	1.5
6	The robot turns 90 °	Towards the geometric station	1	1.7
7	Spot welding with the robot	Welding with X-type welding pliers	12	48
8	The robot turns 180 °		1	2.7
9	Changing the pliers (the pliers are on the support)	Lifting type C welding pliers	1	15
10	The robot turns 180 °		1	2.7
11	Spot welding with the robot	Welding with type C welding pliers	10	40
12	Opening the pneumatic clamps	Unit 02,03	1	3
13	Opening the pneumatic clamps	Unit 04.,05,06,07,08, 10,12,13	1	1
14	Pine cylinders retract	Unit 14,15,16	1	2
15	The robot turns 180 °		1	2.7
16	Changing the pliers (the pliers are on the support)	Lifting the gripper with the robot	1	15
17	The robot turns 180 °		1	2.7
18	The robot unloads the large blank	From the GEO station	1	8
19	Pine cylinders rise	Unit 14, 15, 16	1	2

## Evaluation of welding cell performance by modeling and simulation with timed Petri nets

To evaluate the performance of the welding cell and to identify possible blockages, a model with Petri nets was developed. The models were made in the Visual Object Net ++ program. The activities performed by the human operator (loading the sheet 1, the welded semi-finished product and the sheet 2) are modeled by transitions to which timings have been associated, equal to the real times in which the human operator performs the respective actions. Also, the closing / opening sequences of the pneumatic clamps, the retraction and lifting of the pin cylinders were modeled with transitions. In the process that takes place in the welding cell, the robots perform complex sequences, such as: positioning (turning), performing welding points, changing the welding pliers, replacing the welding pliers with the gripper, evacuating the lower lower floor subassembly. All these sequences were modeled with timed transitions. Execution of a transition (realization of a real sequence) is possible if some conditions are met. These conditions are modeled in the Petri net through the positions. The transitions and positions of the three model variants are presented in table 2

Table 2. Petri net positions and transitions

No.	Symbol	Type	Description	Characteristics		
				Version 1	Version 2	Version 3
1	P1	Position	The operator is free	$m_0(P1)=1$	$m_0(P1)=1$	$m_0(P1)=1$
2	P2	Position	Stock of type 1 sheets	$m_0(P2)=150$	$m_0(P2)=160$	$m_0(P2)=20$
3	T1	Transition	Loading the sheet 1	$d_1=10,5$ sec	$d_1=10,5$ sec	$d_1=10,5$ sec
4	P3	Position	Table 1 is on the station	$m_0(P4)=0$	$m_0(P4)=0$	$m_0(P4)=0$
...	...	...	...	...	...	...
19	P11	Position	The robot is in position	$m_0(P11)=0$	$m_0(P11)=0$	$m_0(P11)=0$
20	T7	Transition	Welding the 12 (8) points with X-type welding pliers	$d_7=48$ sec	$d_7=32$ sec	$d_7=32$ sec
21	P12	Position	All 8 points are welded	$m_0(P12)=0$	$m_0(P12)=0$	$m_0(P12)=0$
22	T8	Transition	The robot rotates 180 °	$d_8=2,7$ sec	$d_8=2,7$ sec	$d_8=2,7$ sec
23	P13	Position	The robot is in position	$m_0(P13)=0$	$m_0(P13)=0$	$m_0(P13)=0$
24	T9	Transition	Replacing the welding pliers X with the tee type C	$d_9=15$ sec	$d_9=15$ sec	$d_9=15$ sec
25	P14	Position	Type C welding pliers are on the robot	$m_0(P14)=0$	$m_0(P14)=0$	$m_0(P14)=0$
26	T10	Transition	The robot rotates 180 °	$d_{10}=2,7$ sec	$d_{10}=2,7$ sec	$d_{10}=2,7$ sec
27	P15	Position	The robot is in position	$m_0(P15)=0$	$m_0(P15)=0$	$m_0(P15)=0$
28	T11	Transition	Welding the 10 (6) points with type C welding pliers	$d_{11}=40$ sec	$d_{11}=24$ sec	$d_{11}=24$ sec
...	...	...	...	...	...	...
44	T19	Transition	The pin cylinders rise	$T_{19}=2$ sec	$T_{19}=2$ sec	$T=2$ sec
45	P25	Position	The pin cylinders are raised	$m_0(P25)=0$	$m_0(P25)=0$	$m_0(P25)=0$
46	P26	Position	Consumption table 1	-	-	$m_0(P26)=0$
47	T20	Transition	Supply of sheet metal stock 1	-	-	-
48	P27	Position	Sheet stock reload number counter 1	-	-	$m_0(P27)=0$
49	P28	Position	Blank consumption counter	-	-	$m_0(P28)=0$
50	T21	Transition	Supply of blank stock	-	-	-
51	P29	Position	Counter number of reloads of the blanks stock	-	-	$m_0(P29)=0$
52	P30	Position	Consumption counter table 2	-	-	$m_0(P30)=0$
53	T22	Transition	Supply of sheet metal stock 2	-	-	-
54	P31	Position	Sheet stock reload number 2	-	-	$m_0(P31)=0$
55	P32	Position	Confirmation of completion of sheet metal assembly	-	-	$m_0(P32)=0$
56	T23	Transition	The waiting time of the station until the operator is free	-	-	-

In the first model version (Figure 11) it was considered that welding with pliers type X is done in 12 points and lasts 48 seconds (transition T7 has timing 48). It is also welded in 10 points with type C pliers. This sequence lasts 40 seconds (transition T11 has a timing of 40). Using the model with Petri nets, the simulation of the cell functioning during an 8-hour work shift was performed. The simulation result indicates that 133 *Central lower floor subassemblies* can be obtained.

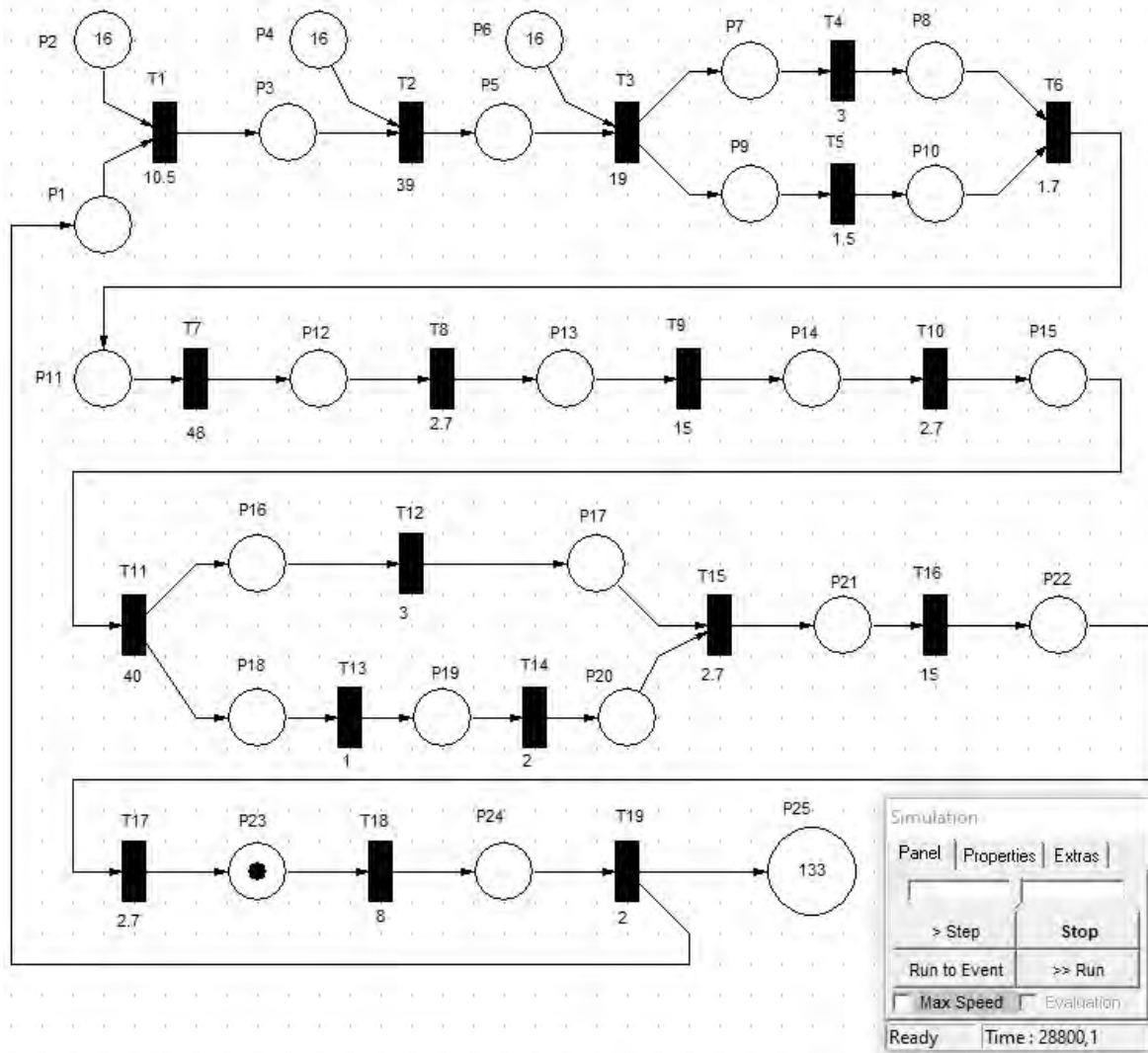


Figure 11. Model with timed Petri nets. Version 1

Analyzing, together with the beneficiary (client) the results of the simulation and, at the proposal of the designer, it was decided to reduce the number of welding points from 22 to 14. Thus, with type X pliers the welding will be done in 8 points. The duration of this sequence is 32 seconds. With type C pliers, 6 points will be welded in 24 seconds. With these data, variant 2 of the model with timed Petri nets was built, the variant in which transition T7 has timing 32 and transition T11 has timing 24. Simulation of cell operation, in version 2 of the model, highlighted the possibility of achieving 157 of *Central lower floor subassemblies*.

In version 3 of the model (Figure 12) other aspects of the cell operation are taken into account, so that the model is as close as possible to the real system. Thus, it is considered that the storage space of the sheets, respectively of the subassemblies, which are welded, is not enough to store the necessary for 8 hours. Consequently, the stocks, modeled with positions P2 (Table 1), P4 (welded semi-finished product) and P6 (Table 2), will be replenished periodically during the 8 hours. Items P26, P28 and P30 count the number of Tables 1, Welded Subassemblies, Tables 2 consumed from stock. When the number of tokens in these positions (the number of components used) is equal to the capacity of the stocks, their replenishment is done. Stock replenishment is modeled, through transitions T20, T21 and

T22. The transition T20 is executable when in position P26 there are 20 tokens, the arc P26 → T20 has the load 20 (in the real system 20 pieces of sheet 1 were used). Transition T21 is executable when in position P28 there are 2 tokens, arc P28 → T21 has load 2 (in the real system 2 pieces of welded subassembly were used). Transition T22 is executable when in position P30 there are 20 tokens, arc P20 → T22 has a load of 20 (in the real system 2 pieces of sheet 2 were used). Given that arches appear in the model whose loads are greater than 1, the model is a generalized timed Petri net. Positions P27, P29 and P31 count stock replenishment cycles.

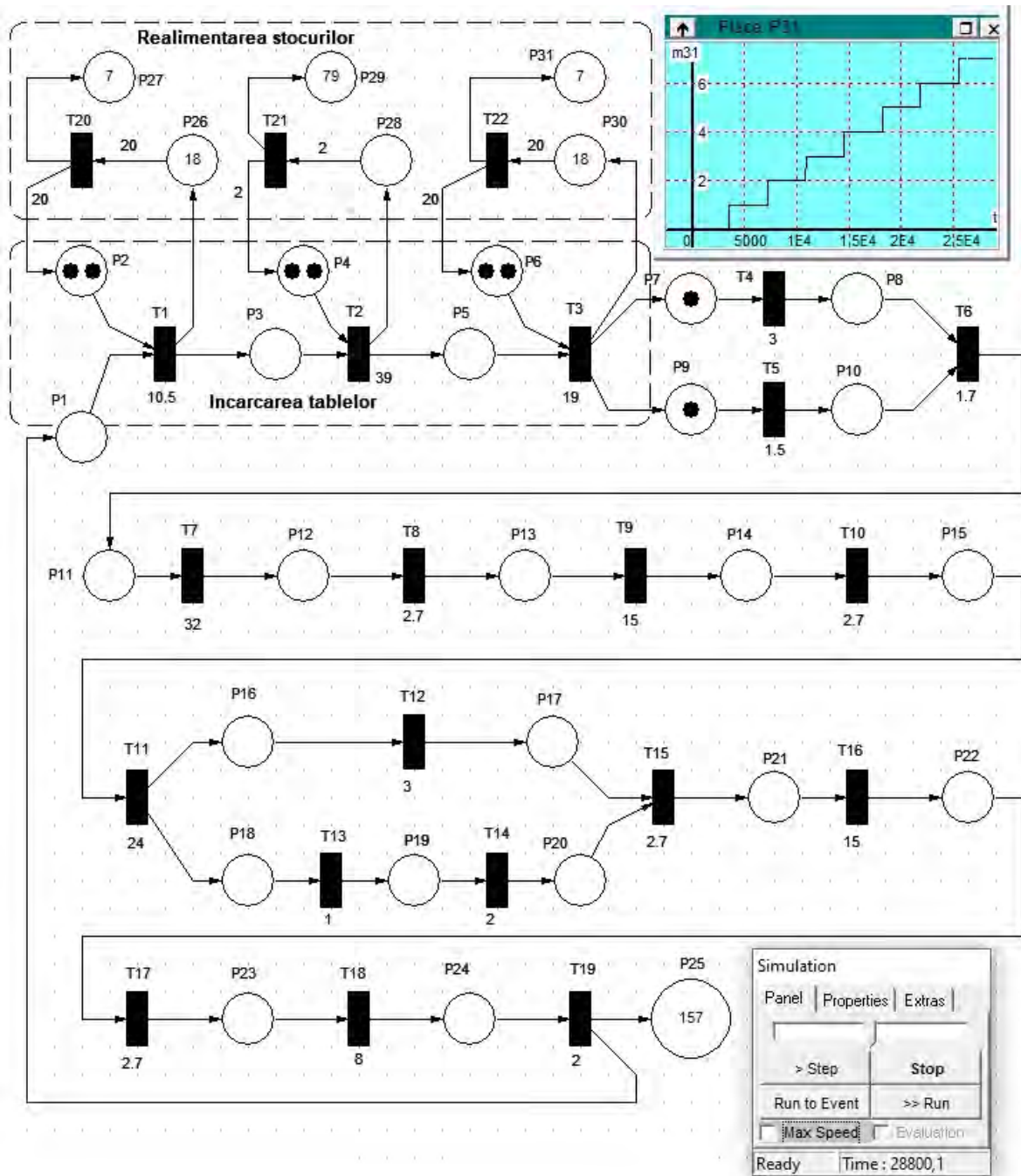


Figure 12. Model with timed Petri nets. Variant 3

After simulating the operation of the cell for 8 hours, the number of replenish sequences for each of the three stocks can be highlighted. Thus, the stocks for Sheet 1 and Table 2 landmarks were replenished 7 times (in positions P26 and P31 there are 7 tokens each - Figure 12). Replenish moments can be highlighted by the graphs associated with the positions. Figure 11 shows the graph associated with

position 31. Also, the 79 tokens in position P29 indicate that the stock corresponding to the *Welded subassembly* must be replenished 79 times during an exchange.

## Conclusions

The paper presented how using modeling with timed Petri nets can evaluate the performance of a welding cell served by a human operator and a robot. The models were gradually developed. Thus, in the first variant the number of welding points was 22, having a cell cycle duration of 215 sec, and after simulating the operation of the station for 8 hours, it was found that 133 pieces were welded to the lower central floor subassemblies. The number of welding points was reduced from 22 to 14, and the cycle time decreased to 183 sec, ie by 32 sec. After simulating the operation of the 8h station, it was found that 157 pieces of *Central lower floor subassemblies* were welded.

Version 3 included in the model with timed Petri nets and stock refueling sequences with components that are welded. The model becoming a generalized timed Petri net.

Therefore, modeling and simulation with Petri nets provides important information about the dynamic behavior of the modeled system. Modeling and simulation also offer the possibility to evaluate the performance of the modeled system and to suggest improvements or changes.

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# LIMITATIONS OF ORGANIZATIONAL AND RISK MANAGEMENT PERFORMANCE IN AIR TRANSPORT DUE TO TECHNOLOGY AND THE DYNAMICS AND UNPREDICTABILITY OF THE GLOBAL ENVIRONMENT

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## Abstract

**Purpose** – *The paper highlights specific challenges in relation to inter-organizational communication and cooperation and analyzes safety management limitations due to lack of predictability which can lead to cascading events.*

**Methodology/approach** – *The research method combines a thorough literature review, analysis of the means of control used in safety management worldwide for keeping risk at an acceptable level and evaluation of monitoring methods which must ensure functionality.*

**Findings** – *The study identifies what kind of decisions affect the probability of an event to develop cascading effects and what are the influencing factors for decision failure.*

**Research limitations/implications** – *The paper researches the drawbacks of management processes and strategies in achieving operational performance while dealing with technological complexity and the unpredictability of the global environment due to research and development dynamics, economic instability, or even pandemics.*

**Practical implications** – *The outcome of different managerial decisions is identified and the connections between the initiator system and the dependent system when an intervention can prevent an event from having cascade effects are established.*

**Originality/value** – *After reviewing the limitations of safety performances and organizational management success, the authors propose that the framework for safety risk assessment must be outlined by a network-type combinatorial structure comprising elements of knowledge.*

**Key words:** *cascading effects, safety risk management, technological complexity.*

## Introduction

In a global environment, dealing with the technological complexity of the system must be supported by effective risk management as a foundation for strategic decisions which must be made long before cascading events occur. Many aeronautical organizations provide safety performance indicators based on generic categories and specific programs because they are easier to measure and by doing this, it offers a false sense of comfort that risks are being managed. While these indicators are important in the context of organizational culture and leadership, they are very rarely used in the initiation phase of a safety event.

Safety risks associated with high-impact events that are less likely to occur represent the trigger for the analysis of specific management challenges related to the dynamics and lack of predictability of aviation environment. The authors study the interdependence of modern aviation systems and their implications on risk management. Although these interdependencies make the systems more efficient during normal operations, they contribute to cascading effects in times of crisis. The research method analysis primary and secondary data; thus, after reviewing different studies, surveys and reports, indicators related to safety performance are assessed and the limitations of management performance are outlined.

The drawbacks of poor managerial decisions in aviation regarding safety are outlined in the context of global instability, pandemics outbreak and the development of complex technologies that on one hand have had a decisive impact in reducing accident rates, but on the other hand, affected decision making due to additional information, influenced the attitude towards risk in a negative way and generated a series of errors that led to accidents.

### **Technological complexity in the aeronautical system - a network of knowledge**

In aviation, technologies have reached high levels of complementarity that require multi-technological activities, an additional aspect to complexity due to the development and application in the operational environment (Fai & Von Tunzelmann, 2001). The pattern that technological complexity has provided over time reflects in the detail, intricacy and difficulty of the measures applied.

Technological complexity is seen as an explanatory dimension of technological success and development (Romer, 1990; Dalmazzo, 2002). Hidalgo and Hausmann (2009) state that the success of a system depends on the ability to manage complex technologies and economic activities, while Fleming and Sorenson (2001) offer an approach to technological complexity by conceptualizing technological advances as a research process for combining knowledge. Knowledge can be outlined by a network of combinations in which nodes represent individual pieces of cognition, and their combinations represent the links between them. Surely, an aircraft can be represented as a combined knowledge network, with directly and indirectly linked elements. As a measure of aircraft technological complexity, a combinatorial structure of the network type can be used, comprising elements of knowledge. Nevertheless, the difficulty of combining elements of knowledge can be determined by a precise structure in which technological elements are integrated, giving rise to innovation processes.

Progress in technical systems development and manufacturing processes leads to modes of complex failures and reliability issues in the product life cycle. In the spectrum of capital/industrial goods, the consequences of concessions can be directly related to safety issues affecting people - in the event of incidents or accidents. This represents major challenges for engineering reliability processes in the final product life cycle. Reliability methods/techniques need to be improved and adapted in order to ensure product reliability and production capacity (Bracke et al. 2017).

In order to identify safety issues and characterize initiating events, the connections, dependencies between different systems, past incidents with cascading effects must be studied and understood - their knowledge and understanding is the basis for development of appropriate response algorithms. A cascading event showing recent technological vulnerabilities is reflected in the two Boeing 737 MAX accidents from Indonesia (Lion Air Flight 610) and Etiopia (Ethiopian Airlines Flight 302) from 2018, respectively 2019, having one thing in common: they were not equipped with safety features that could have prevented accidents. The initiating event (a sensor calibration error) led to automatic actuation of the trimmer control located on the horizontal rudder. Due to the way MCAS (Maneuvering Characteristics Augmentation System) was conceived, there was unlimited number of flight control actuations which led to an unbalance of the aircraft (excessive trimming) which exceeded the crew's ability to control the depth control (cascading events), thus forcing the aircraft into uncontrolled dive.

The lacking elements of knowledge consist of an operational problem: the fact that Boeing did not provide any information to the pilots about the existence and operation of the system in the preparation phase - to make the transition on the 737 MAX aircraft, nor were they registered information in the Operating Manuals for 737 MAX or in the QHR (Quick Reference Book). Therefore, the crew could not identify the cause of the in-flight control problems of the aircraft, failing to reach a solution, thus failing to provide a network of knowledge.

In the context of events with (or with a high risk of producing) cascading effects as presented above, human activities and decision can play a significant role in unfolding events and cascading effects. The specifics of aircraft systems must be known in order to solve unforeseen situations regardless of the context and phase of the flight. Aeronautical systems undergo technological changes in a staged manner; the biggest problem is the impact of that technology on the operation of the whole system; and in this particular case, the new features and characteristics, restrictions and limitations of operation should have been taken into account. A new, modern technological system has an impact on the entire



system in which it is implemented; given the multitude of organizations involved in aeronautics this impact is a connected one.

### **Barrier strategies and management limitations in achieving operational performance**

Safety control does not imply only barriers of a physical nature, such as protective equipments and systems; but also administrative processes and critical safety activities that are carried out by the organization's staff. The need to understand interaction between technical, organizational and operational elements that play a role in performing safety barrier functions is important in order to be successful in implementation of risk assessment process. Of course, the knowledge on defining performance requirements for organizational and operational elements and how to achieve their inclusion in the specific barrier strategy is also very important.

In general, management is important as an influencing factor for performance, but it is not a barrier element; it helps to ensure that routine and resources are adequate for setting and maintaining barriers. The limitations of management performance are given by the lack of predictability of the aviation safety environment. Lordache et al. (2018) show that predictability is narrowed not only during concept phase, but also in operational processes due to performance variability – which should not be counted as a negative aspect like performance deviation.

However, specific roles in management and the functions they may perform can represent barriers of organizational or operational nature. The contribution of the human factor is extremely important in barrier functions. The performance requirements are intended to verify that each individual barrier is effective; performance requirements must be clear and verifiable both organizationally and operationally (Lauridsen et al. 2016).

Significant concerns have risen in current challenging circumstances for the aviation industry due to Covid-19 global health emergency. In aviation, this infectious disease represents a high-impact event unlikely to occur; however, this initiating event (the pandemics) has led to unexpected safety related cascading effects. Safety occurrence has been reported lately, including real hazards such as tail strikes and exceeding the assigned altitude due to a lower take-off weight of the aircraft caused by a small load factor, or even the inability to maintain cabin pressure (Pallini, 2020). On top of this, pilots losing their skills and abilities after a long period in which they no longer practiced, require refresher training or even medical help to deal with fear or stress as responses to perceived safety threats. This has led to severe cascading effects and quickly became very difficult to manage by using pre-established response measures. The more vulnerable the system is due to the environment, the greater the risk of cascading effects.

In this case, technical barriers are not suitable, but organizational measures can be applied for achieving operational performance again. According to Kilskar et al. (2017), operational barrier elements represent information that provides assistance in carrying out a specific task. The spectrum in which they provide support is broad; so it can be a benefit in distinguishing different categories of safety critical procedures. Operational barrier elements can only be considered those that are critical to activating the barrier function after an event occurs and those that are important in order to prevent initiation of the unwanted event. These procedures are required in order to activate the barrier function. Also, performance requirements must be set to follow these organizational barriers. From an organizational point of view, the barrier elements are represented by the staff with well-defined roles or specific functions and skills; which helps to achieve the barrier role (Lauridsen et al. 2016). Withal, maintaining and ensuring barriers integrity across operational spectrum, including verification and evaluation of performance barriers is needed (Hauge et al., 2016) (see fig 1).

From the management standpoint, the response to such situations must be as effective as possible and built on recent and verifiable information - this information comes in support of decision making processes. Surely, in aviation, keeping risks to a minimum it's compulsory, thus the role of predictive analysis is imperative; but this is achieved by collecting large amounts of data to make predictions. In the real or perceived hazard cases related to ongoing pandemic, this was not possible or feasible. This situation highlights the importance of a safety knowledge network. It must be acknowledged that decision making is a collaborative effort that unites several groups with different visions of situations, decisions and actions (Bram et al., 2016). This creates the need for a common ground and shared

mental models for decision making. The possibility of achieving this, during an event involving cascading effects, increases with the understanding of how it works and the knowledge of equipment and tools available and understanding the characteristics of members/team/organization including their knowledge of skills, beliefs and efforts of others (Lönnermark and Lange, 2017).

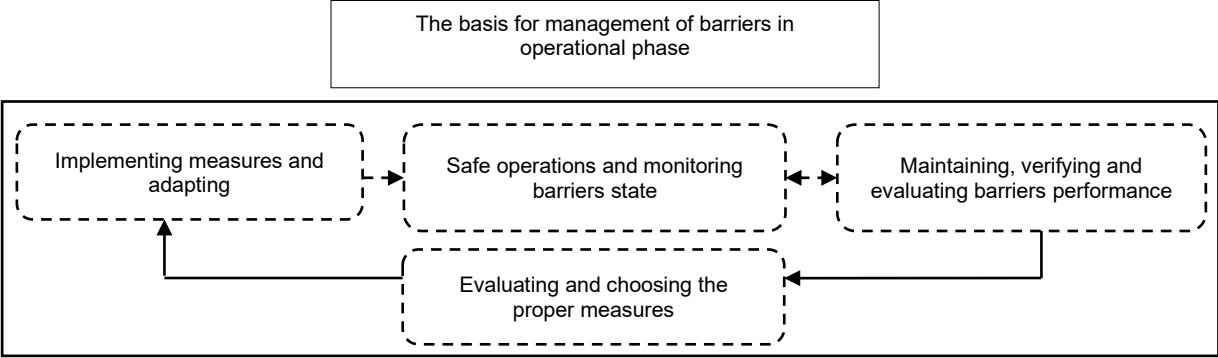


Figure 1. The process of barrier management in operation (adapted after Kilskar et al., 2016)

An important aspect is to identify the effects of different decisions, in order to find key decision points; for example, opportunities to affect connections between the initiator system and the dependent system when an intervention can prevent a cascading event. The aim is not to fully analyze how decisions are made, as it can be very difficult to determine, but to find out what kind of decisions affect development during a cascading incident. How an incident is considered to be complex, stressful, or difficult to understand depends on both the experience of receiver and the ability to understand information received. From the point of view of the decision-maker and possible success, influencing factors can be considered the following: system capacity and ability, interface, stress, workload, motivation, complexity, training, experience, culture, social dynamics such as group effects, how to carry out processes and organizations structures.

**Discussion and conclusions**

Without sufficient investment in modern aviation technologies, catastrophes can occur, although the goal of research and development of new technologies was to represent a benefit. Understanding escalation processes requires knowledge of initiation elements and the dependencies between systems, physical phenomenon and key decision points in crisis situations. New strategies, structures and methodologies are needed to withstand and manage evolving challenges, including inter-institutional or inter-organizational cooperation in conducting operations and providing or receiving support regardless of the operational environment.

Mapping existing performance standards or a logical model that presents the relationships between barrier elements within a barrier function is important. In the situation of identifying organizational barrier elements, it is preferable to differentiate between the normal operational organization and the organization of the emergency response. The inter-organizational situation, the way it is managed, and the level at which decisions are taken and communicated, may differ depending on the country and regions; even if there is international standardization, the impact of regional/national culture is reflected in organizational management processes.

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# APPLICATION OF ARTIFICIAL INTELLIGENCE SYSTEMS IN THE MANAGEMENT OF INTELLIGENT TRANSPORT SYSTEMS

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## Abstract

**Purpose** – This article presents the applications of Artificial Intelligence in the development of Intelligent Transport Systems.

**Methodology / approach** – The methodology proposed in this article is based on the analysis of Artificial Intelligence algorithms for road traffic control and prediction. Image processing methods and polynomial prediction analyzes are applied, and their results contribute to the measurement of performance in road traffic prediction.

**Findings** – Based on the measurements of the processes undertaken by the authors, a methodology - was applied within the Traffic Management Center in Bucharest, to increase traffic management.

**Research limitations / implications** – The paper offers some concrete solutions obtained at a department level. These solutions based on a new approach to performance measures are developed in accordance with ITS requirements.

**Practical implications** – The practical aspects approached by the authors are related to the identification of the most problematic obstacles encountered in the implementation of performance management in ITS using a new methodology based on Artificial Intelligence.

**Originality / value** – The methodology based on the AI-oriented approach to classification and prediction can be implemented for measuring, evaluating and improving traffic using ITS strategies.

**Key words:** artificial intelligence system, expert system, intelligent management model.

## Introduction

We live in such a complex world, in which human reason can hardly respond to the challenges posed by the rapid and permanent changes that are taking place in the economy. In the context of the knowledge-based economy, the use of information systems determines not only the development of companies, but also, in many cases, their survival, which depends on making the right decisions at the right time. For these reasons, artificial intelligence is increasingly present in economic activity and for Intelligent Transport Systems (ITS).

### Conceptual approaches to artificial intelligence

The term "artificial intelligence" was introduced by John McCarthy in 1956, being defined as "the science and engineering of producing intelligent machines." Artificial Intelligence is a vast field that deals with the use of computers to solve problems / tasks that require human intelligence. It is known that there are many problems that require intelligence, but that can be solved very easily with the help of a computer, for example complex arithmetic. On the other hand, there are a few problems that people can easily solve without much thought, such as facial recognition, but which are extremely difficult to automate. Artificial intelligence deals with solving such difficult tasks, which require a complex and

sophisticated reasoning process. People may be interested in automating human intelligence for several reasons. One reason would be a better understanding of human intelligence. In this context, theories of human intelligence can be tested and developed by creating programs (software) that simulate aspects of human behavior. Another reason would be to have computers and smart programs. Even if it were making such computers, we cannot be sure that these programs accurately simulate human reasoning, but by studying human reasoning can be developed useful techniques for solving difficult problems specific to people. All this contributes in different ways to our understanding of how we can act and communicate intelligently and effectively. Understanding these areas helps us use computers to perform tasks and solve tasks issues that require intelligence. According to Ioniță Silviu (2015), it can be said that the year 1981 is the beginning of a promising stage for the evolution of artificial intelligence.

The development of artificial intelligence is reflected in complex and multidisciplinary practical algorithms: knowledge-based systems, cognitive systems, intelligent machines, intelligent agents. According to Raymond Kurzweil (2013), the concept of artificial intelligence refers to "the art of creating machines that perform functions that would require intelligence if they were performed by humans." Horia Pop (2018) reveals that artificial intelligence is a field of research whose purpose is to study and model intelligence, by creating systems capable of performing intelligent activities. Currently, Artificial Intelligence System (AIS) systems are widely used to automate decision-making in various economic fields.

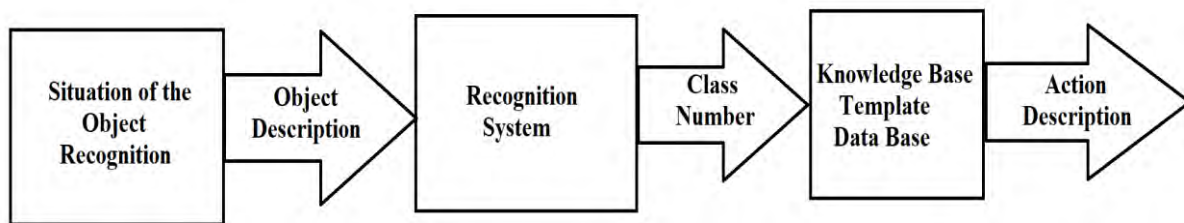


Figure 1. Artificial Intelligence System (AIS) architecture.

### AIS methodological basis

The activity of economic entities requires a very large number of decisions in the process of attracting and using the factors of production. The formalization of the decision-making process is possible due to the principles of recognition of the situation or objects of activity (Thorisson K, 2007). Each situation can be characterized by the description presented by a certain set of values of the indicators or properties regarding the introduction of AIS, as well as by a complete description of the subsequent actions at the exit (Fig.1). Thus, the AIS provides for the recognition of the situation and the decision on other actions, the implementation of the functions of the expert system (OECD, 2019).

Artificial intelligence systems can be entrusted with such tasks: choosing the investment project, investor, carrier, supplier, choosing product distribution options, evaluating product quality, forming transport tariffs according to product characteristics, etc. AIS can be used both in tactical operational activity and in strategic planning activities for optimal decision making.

The task of recognizing objects, such as identifying the economic situation at the macroeconomic level or the loading time of means of transport at the microeconomic level, requires a gradual solution of many theoretical tasks. In the first stage it is taken into account that each object is defined by the values of many properties, or signs, that form the indicative space. Thus, it is impossible to determine an a priori information content of the individual characters, from the point of view of the separability of the object classes, as well as the necessary number of the most informative features.

The *first phase* of AIS construction for each set of object classes is required to solve the problem of choosing the working characteristics of the system, which describe the recognition of the most informative object. In economic activity, the task of choosing the working characteristics of the system can also be focused on selecting the indicators of superior quality performance in the economic system, or the so-called KPI indicators.

Solving the task of choosing operating systems includes the following steps:

1. *Determining an a priori vocabulary of indicators*, i.e. choosing the range of indicators that characterize the recognition of objects, to classify them. Usually, an a priori dictionary includes all the significant features available for quantification.
2. *Choosing the way of coding the meaning of the indicators* and the way of describing the object in the form of a code - the indicative word, convenient for the computer system. Thus, it is necessary to take into account the fact that some indicators are quantitatively characterized by numbers, and some indicators may be of a qualitative or structural nature.
3. *Determining the values of the intervals of the range of changes of each indicator* in order to codify it according to the principle of adaptive quantification. This involves setting thresholds for these meanings of the indicators, above and below which the corresponding object recognition classes differ.
4. *The comparative evaluation of the informativeness* of the a priori vocabulary indicators in relation to the recognition target, taking into account the selected coding method and the established intervals. Zero informativeness means the total absence of the contribution of this indicator to the recognition of the object, and the singular informational content corresponds to the case when according to the values of an indicator a complete classification (recognition) of the objects can be achieved.
5. *Selection of the working system* of the necessary and sufficient indicators for the full recognition of all objects. This step is accomplished by sequential addition to the most informative indicators, which provide the broadest (informational) pairs of properties. Then the index that forms the most informative triplet, etc. is selected, until the combination of indices that provide a unique information content is identified, namely: those that ensure full recognition of the object. The selection of the working system of the indexes minimizes the length of the indicative words, the introduction of the object recognition algorithm.

During the *second phase* of construction of the AIS it is necessary to form an object recognition algorithm, obtained in the first phase of the indicative space. During AIS work, objects or work situations appear at the entrance, the description of which is different from those of the initial stage. This determines the need to develop procedures for studying the recognition algorithm.

The recognition subsystem can use the learning algorithm, built on the theory of image recognition and using the adaptive weighting coefficients, established according to the category of the indicative word formed in the first stage.

The recognition process consists in calculating the values of the decisive function of the classified object according to all possible membership categories. The decision is made in favor of the class, for which the value of the decisive function is maximum. In case of recognition error, the learning process takes place; thus, the weighting coefficients are adjusted.

As a model of intelligent strategic management can be proposed a model with adaptive structure, which takes into account the factors of the external environment and the internal strategic tasks chosen on the basis of competition.

The intelligent control scheme includes the following units (Gallieres R, 1998):

1. *Preliminary assessment unit* (analysis of the political, technological, economic and social dimensions of the environment, PEST):

- 1.1. Determining the objectives of the system.
- 1.2. Choice of strategy.
- 1.3. Determining internal opportunities and environmental threats.
- 1.4. Identifying the advantages of the system (considering the size, distribution of resources, strengths and weaknesses of the company (SWOT)).

The results of the work of the preliminary assessment unit are coded according to the mechanism of formation of the indicative words for estimating the situation.

2. *Selection unit* (guaranteeing the choice of the optimal strategy):

- 2.1. Examining alternatives.
- 2.2. Choice of strategy.

The selection unit is implemented using a situation recognition algorithm, which extracts the necessary strategic decisions from the economic knowledge database.

3. *Implementation unit* (formation of the organizational structure, adequate strategy, allocation of human, material, financial and intellectual resources, in accordance with the requirements of the strategy):

- 3.1. Elaboration of the structure and climate of the organization.
- 3.2. Development of medium- and short-term policies, plans and programs.

The implementation unit is included in the information system and integrated with the knowledge base at the level of the expert operational management system.

4. *Evaluation unit* (ensuring the achievement of strategic goals):

- 4.1. Strategy evaluation.
- 4.2. Transition to unit 1 for changes in strategy and repetition of the management cycle.

This model requires a change in the internal structure of the information system, in line with current perspective and tasks. An indispensable condition for this is the existence of a strategic center, the formation of strategy in a continuous way.

AIS is integrated into the planned economic information system, based on the analytical information center (Liebowitz J, 1998) and can be used by participants in regional economic activities for their own purposes. At the level of individual organizations, the mechanism for classifying situations that require strategic decision making is their information base (Morabito J, 1999).

### AI techniques in Intelligent Transportation System

Intelligent transport systems are applications of electronics, IT and communications in the field of transport whose major objectives are to reduce the negative effects of the transport activity (accidents, material losses, additional costs, pollution) and increase the efficiency of this activity. The term Intelligent Transportation Systems (ITS) originated in the United States and was originally used in road transportation to define traffic light and traffic management equipment and facilities. "Intelligence" at that time was given using electronics in the field of transport and was more a term imposed by marketing and not a term imposed by technology.

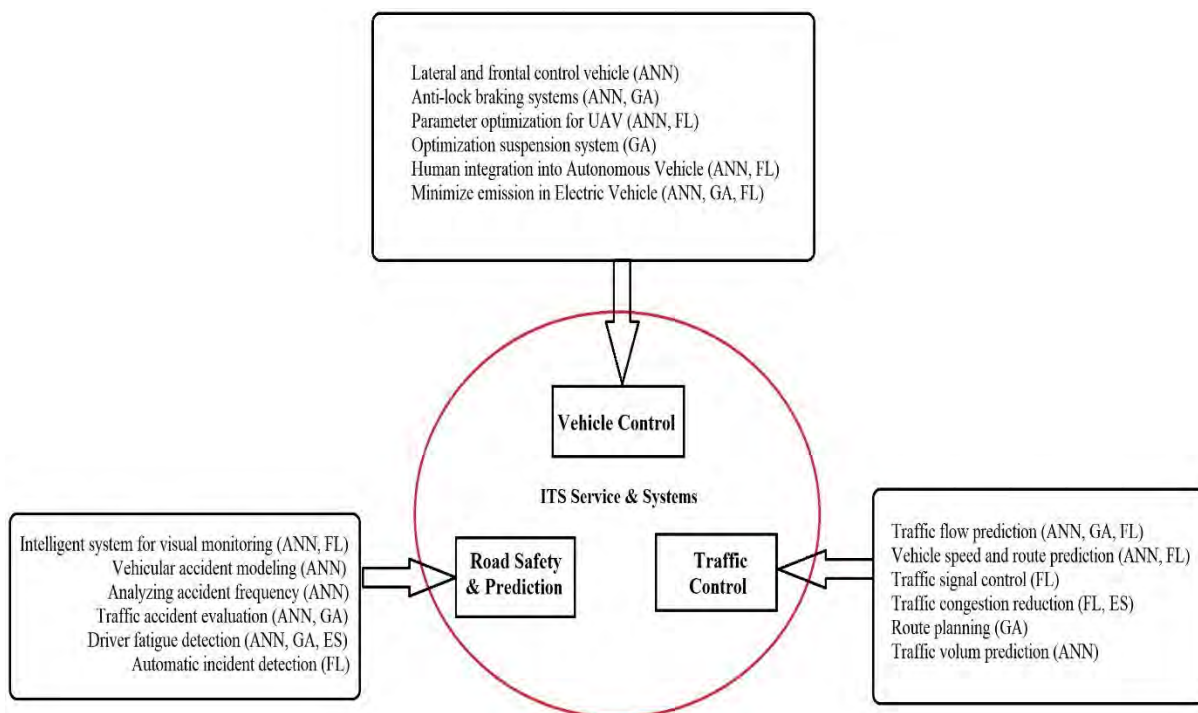


Figure 2. Chart of ITS services and AI systems.

Many ITS applications now use solutions based on artificial intelligence (AI - Artificial Intelligence), Data Mining, Big Data and so-called smart technologies. This means that the term Intelligent Transport Systems is defined by the technologies used and not by marketing tools. Figure 2 shows a Chart of ITS services and systems, as found in the studied works.

**Research Methodology: Developing a traffic control application (the values generated by the Count Objects)**

Semantic segmentation is the task of labeling images with semantic classes at the pixel level. It provides a high-level representation and can play an important role in the semantic perception and understanding of the environment. The main objective is to obtain a solution of high accuracy and precision at a low calculation cost, which would allow running in real time. This can be done using robust and time-efficient features and classification schemes. Cars, pedestrians and objects in traffic environments are limited by spatial and geometric constraints. We define such constraints and incorporate them into perception solutions in the form of additional context channels in addition to the filtered feature channels. In this way we can allow classifiers to learn the context for different types of objects or semantic classes. Context features can also speed up the prediction process. In the case of soft-cascade decision trees, the prediction is stopped if the intermediate prediction score falls below a certain threshold (L. Zhu, 2014). Context features can stop prediction at an early stage if the context is not appropriate for a semantic class. In our experiments for semantic segmentation we used the following contexts:

- 2D spatial: vertical and horizontal position in the image
- Spatial 3D: 3D position x, y, z, dense interpolated representation from stereo video cameras
- 3D size: the height and width in 3D of the groups of super-pixels

To generate semantic segmentation, we train an individual binary pixel classifier for each semantic class. We propose the use of multi-radius classification features, extracted from the feature channels. We classify individual pixels using the values of the surrounding pixels in the feature channels. The nearest points capture the local structure, while the distant ones capture the context. To capture the features at different radii, we extract them with a grid using different sampling rates. We use a 13 x 13 grid around the pixel of interest and apply sampling using a step rate of one, two, four and eight pixels, resulting in 676 points from each individual channel. Four grids with different sampling rates cover a region of 13 x 13, up to 104 x 104 pixels in the input image. To obtain powerful classifiers, train 2048 7-level decision trees for each semantic class. After training the classifiers we can generate semantic segmentations (GAs, Li et al. 2016). The results of the mathematical simulations are shown in Figures 3 (a) and (b). Figure 4 shows the results obtained for real-time video analysis for the counting object and traffic flow.

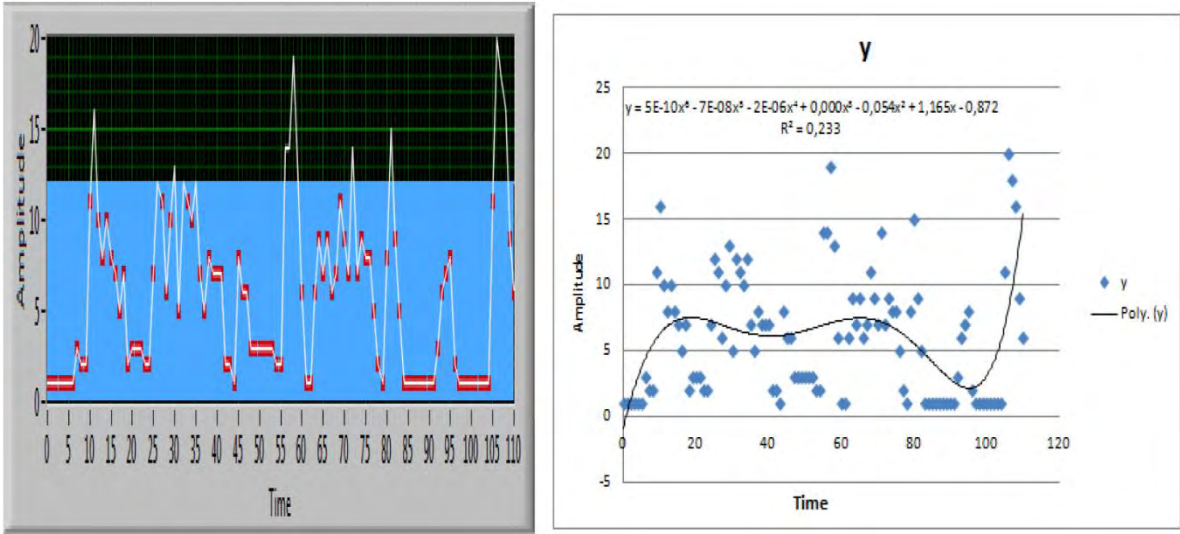


Figure 3. mathematical simulations. (a) The values generated by the “count objects” and (b) Fitting a 6-degree polynomial decomposition.



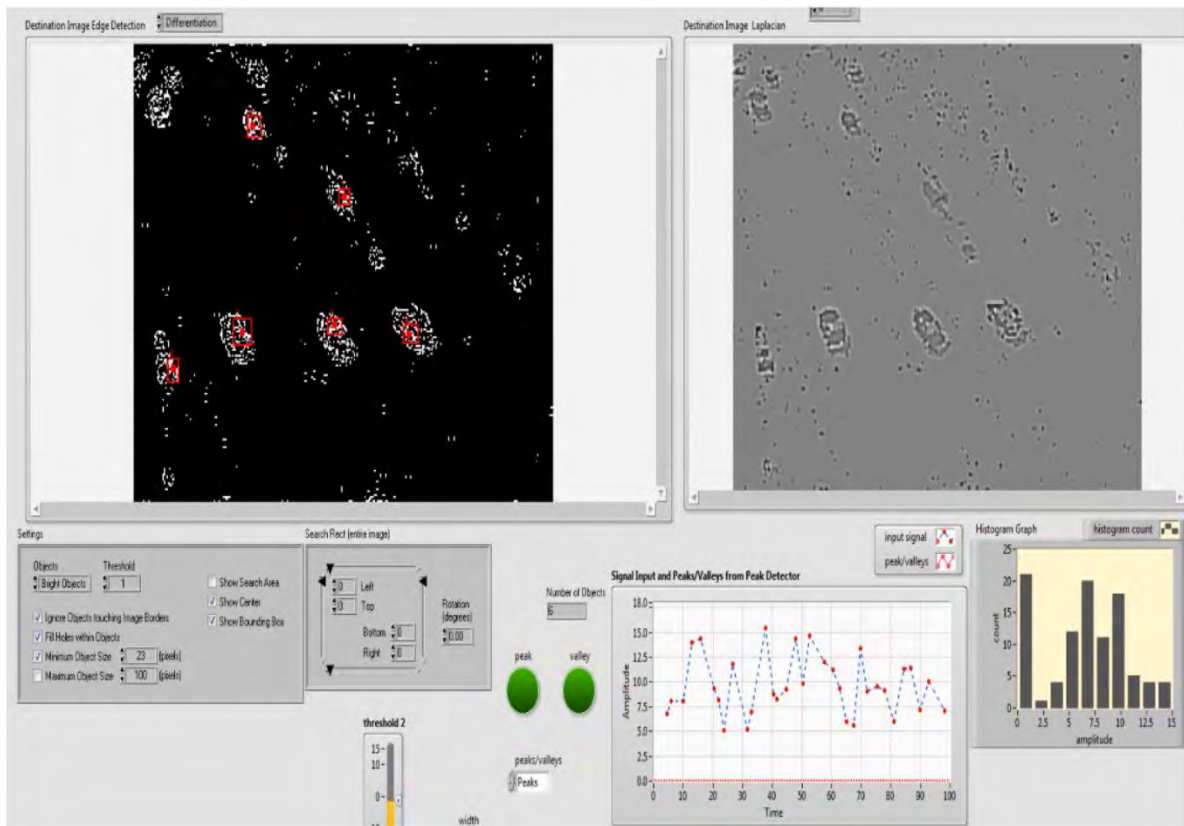


Figure 4. Count Object & Traffic Flow Detection from highway.

## Conclusions

The sharp evolution of information technologies has led to the emergence of technical systems that tend to fundamentally change the way people live and even offer new models of economic activities. Intelligent systems can generate conclusions based on built-in or externally provided knowledge. The design and development of smart systems for optimal decision making are indispensable for the efficiency of economic activity. Artificial intelligence is no longer just a game of imagination or a simulated software paradigm, but an opposition to boosting economic efficiency. The clear trend of super-technology will lead human society to cooperate with increasingly intelligent systems, as intelligent as man, maybe even super-intelligent. In this article we have studied the applications of artificial intelligence with applicability in ITS management and we have proposed a solution for traffic prediction based on AI algorithms. Modern transport systems include a wide and constantly evolving suite of technologies and applications: from real-time traffic information, electronic tickets, to automatic passenger counting and traffic forecasts based on artificial intelligence. Transforming a city's transportation network into a smart system offers benefits on multiple levels: revenue growth, active contribution to raising the standard of living in the municipality and citizens' perception of the authority's concern for good governance, catalyst for a healthy economic life of the municipality, improving the efficiency and operational performance of the transmission network, in particular due to reduced costs, increasing passenger mobility and comfort, increasing the use of the transport system.

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# ASSESSING THE EFFICIENCY OF THE ROMANIAN CONSTRUCTION INDUSTRY COMPANIES BASED ON DATA ENVELOPMENT ANALYSIS

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## Abstract

**Purpose** – *The purpose of the study presented in this paper is to investigate the financial performance of the Romanian companies from construction industry using data envelopment analysis.*

**Methodology/approach** - *The present paper is using data obtained from companies belonging to construction industry listed on the Bucharest Stock Exchange for 2019. The input variables from data envelopment analysis model are materials, fixed assets and labor, whilst the output variable is represented by the operating revenues.*

**Findings** – *The results point out that among the investigated companies within the construction industry listed on the Bucharest Stock Exchange, ten are assessed as being fully efficient. The findings reveal that data envelopment analysis can be successfully employed for evaluating the efficiency of companies from construction industry.*

**Research limitations/implications** – *The limitation of this investigation is that it analyzes only the companies from one industrial sector, respectively in our case the ones belonging to the construction industry listed on the Romanian capital market. Notwithstanding, this paper provides useful information for decision makers from Romanian construction industry, enhancing the literature in the field.*

**Practical implications** – *The findings of this paper provide gainful insights concerning the development and efficiency of Romanian construction industry companies. Such findings can be useful for the managers from the companies identified as inefficient to enhance their business performance.*

**Originality/value** – *This paper, to the best of our knowledge, represents the first study that assesses the efficiency of the Romanian construction industry companies using data envelopment analysis.*

**Key words:** *data envelopment analysis, performance measurement, construction industry.*

## Introduction

The construction industry represents a major pillar of economy for many countries worldwide (Yu and Yang, 2018). Construction is one of the most important industries in Romania, playing a major role in the national economy. The construction industry contributed about seven percent of the Romanian total gross added value in 2019 (National Institute of Statistics, 2020). Construction industry is one of the most significant industrial employers in Romania, providing about nine percent of the total employment in 2018 (National Institute of Statistics, 2020). Due to the economic importance of construction industry, the performance assessment of the companies that perform in this industry represents a major issue for ensuring its sustainability and the overall economy development.

Assessing the efficiency of companies from construction industry represents a major issue, being a permanent concern for investors, managers, shareholders. The efficiency assessment of companies indicates how effective their resources are used and objectives achieved (Perez-Gomez, Arbelo-Perez

and Arbelo, 2018). A company is less efficient if it uses more inputs to obtain smaller or equal amount of outputs, or if it processes less outputs by using more or equal inputs in comparison with similar firms (Yang, Shi and Yan, 2016).

One of the most suitable methods for evaluating the efficiency of a company is data envelopment analysis (DEA). Due to the fact that it can integrate multiple inputs and outputs for assessing the relative efficiency, this method has been employed in different sectors. Lin, Liu and Chu (2005) evaluated the relative efficiency of shipping firms in Taiwan based on DEA. The results indicated that less than a third were efficient, and also was determined a high level of overall efficiency in the sector. Soetanto and Fun (2014) assessed the performance of Indonesian property and real estate firms using DEA and found that only one company was technically efficient. Mantalis et al. (2016) examined the efficiency per vessel class of Greek-owned shipping firms listed on the New York stock markets based on DEA. They found that companies that operate most efficiently are those with dry bulk carriers. Haridasan and Venkatesh (2011) evaluated the effectiveness of Customer Relationship Management for a set of Indian mobile service providers using DEA. Hoe et al. (2018) studied the Malaysian construction companies' efficiency based on DEA. The results indicated that only ten percent of the listed firms were relatively efficient. Henning et al. (2013) examined the financial performance of South African agricultural producers based on a DEA model. The results revealed that DEA can be a useful tool for benchmarking the agricultural producers. In Italy, Agasisti and Dal Bianco (2006) investigated the efficiency of public universities using DEA, revealing that the most efficient are those located in the Northern part of the country.

In this paper, it was investigated the performance of companies from the construction industry listed on the Bucharest Stock Exchange for 2019 using DEA. No study, to the best of our knowledge, has evaluated the efficiency of the Romanian construction industry firms based on a DEA model.

The rest of the study is structured as follows: in the second section the methodology is presented, the results are exposed in the third section and, at the end, the conclusions are pointed out.

## Methodology

The financial data used for this investigation were obtained from the financial statements and annual reports of the 36 companies operating in the construction industry listed on the Bucharest Stock Exchange.

DEA is a non-parametric linear programming technique that, based on various inputs and outputs, is used to evaluate a set of Decision-Making Unit (DMU)'s relative efficiency (Charnes, Cooper and Rhodes, 1978). In this study, the input oriented CCR (Charnes, Cooper and Rhodes) model is used. The relative efficiency of DMUs can be computed as follows (Charnes, Cooper and Rhodes, 1978):

$$\max h_k = \frac{\sum_{r=1}^s u_r \cdot y_{rk}}{\sum_{i=1}^m v_i \cdot x_{ik}} \quad (1)$$

where:

$h_k$  – DMU<sub>j</sub>'s technical efficiency;

$u_r$  – weights given to each output  $r$ ;

$v_i$  – weights given to each input  $i$ ;

$x$  – inputs;

$y$  – outputs.

Subject to:

$$\sum_{r=1}^s u_r \cdot y_{rj} \leq \sum_{i=1}^m v_i \cdot x_{ij}, j = 1, \dots, n \quad (2)$$

$$u_r \geq 0, r = 1, \dots, s \quad (3)$$

$$v_i \geq 0, i = 1, \dots, m \quad (4)$$

The input variables taken into account in the data envelopment analysis model are materials, fixed assets and labor. The operating revenues represent the output variable. If the relative efficiency of DMU is equal to unity, then it is considered efficient. When the relative efficiency of DMU is less than unity, then it is determined to be inefficient.

## Results

The description of the summary statistics concerning the input and output variables from this investigation are presented in Table 1. The statistical means and standard deviation are shown in the table below.

Table 1. Descriptive statistics of variables (in RON)

	Mean	Std. Deviation
Fixed assets	44855232	89831475.42
Labor	4796561	5868077.21
Materials	7462559	9852546.24
Operating revenues	30346934	51829792.05

The DEA efficiency scores for the analyzed companies operating in the construction industry listed on the Bucharest Stock Exchange are presented in Table 2.

Table 2. Efficiency scores for construction industry companies

DMU	Company name	Efficiency	Rank
CEON	Cemacon	0.859	13
CMCM	Constanța Construction-field Assembly Company	0.155	33
COMI	Condmag	1	1
ENP	Energopetrol Company	0.775	15
IMP	Impact Developer & Contractor	1	1
PREH	Prefab	0.419	29
COTR	Transilvania Construction Company	0.922	12
PREB	Prebet Aiud	0.61	24
NAPO	Napoca Construction Company	0.606	25
ELEL	Electroconstrucția Elco Suceava	0.974	11
ICSI	Icsim București	1	1
COKJ	Concivia Brăila	0.76	16
SCBC	Scut Bacău	0.467	28
ICMR	ICMRS Galați	0.721	17
ARCV	Imotrust Arad	1	1
CPLB	Buzău Complex Construction	0.669	19
MACO	Macofil Târgu Jiu	0.646	21
COBJ	Bihor Oradea Construction Company	0.856	14
CORO	Galați Railway Construction	1	1
CFED	Craiova Railway Construction	0.069	36
HEAL	Helios Astileu	0.574	27
LCSI	LCS Imobiliar Cluj-Napoca	0.612	23
SIOB	Simbeton Oradea	0.642	22
CHIA	Iași Hydro-technical Construction	0.384	30
EEAI	Elco Electro Construction Alba Iulia	0.706	18
ELJA	Electromontaj Carpați Sibiu	0.665	20
AUXI	ATM Construction Ploiești	1	1
CODG	Comtram Sibiu	1	1
DUPX	Duplex Făgăraș	0.583	26
CONJ	Crîșeni Construction-field Assembly	0.089	35
ADMY	Admet Galați	0.191	32
PCTM	Prima Construct Timișoara	0.241	31
MINO	Mindo Dorohoi	1	1
SIEP	Sinter Ref Azuga	0.124	34
CONK	Concas Buzău	1	1
COLK	Conex Prahova București	1	1

The companies that obtained an efficiency score less than unitary are regarded as being inefficient. It can be noticed that a total amount of ten firms are assessed fully efficient, meaning that these companies are on the optimum production scale. The number of Romanian construction companies that registered a relative efficiency equal to unity is two half the number in comparison with the Malaysian construction companies (Hoe et al., 2018).

The average efficiency score of the construction companies listed on the Romanian equity capital market is 0.676, a value almost 63 percent better than that of the Malaysian construction firms (Hoe et al., 2018).

The efficiency scores of inefficient Romanian construction companies range between 0.069 and 0.974. Thus, the companies have to decrease the inputs consumption by up to 93.1 percent, while preserving the identical output level.

## Conclusions

The efficiency assessment of companies operating in the construction industry represents a significant challenge for the industry managers. This study evaluates the efficiency of the Romanian construction companies listed on the equity capital market using DEA. The results indicate that less than one third of the investigated companies were determined to be fully efficient, highlighting the fact that there is a significant potential for efficiency enhancement in the field. The findings of this investigation provide useful information for the management of the firms, supporting them to enhance the resource efficiency, as well as for shareholders, analysts and investors.

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# UNMANNED AERIAL VEHICLE (UAV) IN CONSTRUCTION MANAGEMENT: A LITERATURE REVIEW, APPLICATIONS AND CHALLENGES

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## Abstract

**Purpose** – The aim of the article is to analyze the current directions of UAV application areas in the management of processes in construction, limitations and development opportunities, considering the fusion between academic publications and practical ones.

**Methodology/approach** – This research puts forward a bibliographic synthesis to summarize the results of 20 research papers published in 2012-2020 and highlights the growing trend of using UAVs in the construction sector.

**Findings** – The UAV is widely used in structural condition assessment, occupational health and safety, quantity survey and logistics activities. Cost and time efficiency are the primary benefits for using UAV in construction processes. Multi-rotor is the most common structure of UAV and a multitude of sensors can be attached to the UAV such as digital camera, thermal and infrared sensor. The control of the UAVs can be manual or a pre-programmed flight.

**Research limitations/implications** – The research limitations are related to the methodological approach which consists of identifying the scientific papers based on keywords in academic databases.

**Originality/value** – This paper outlines the classification of UAV applications in construction research and pleads the use of applications in construction quality control along the project implementation.

**Key words:** UAV, construction quality management.

## Introduction

The current breakthrough in the construction field makes use of the integration of data digitization, robotization and the application of modern technologies on quality controlling of the structures and on checking the project implementation.

In the field of aeronautics, unmanned aircraft vehicles (UAVs), also known as "drones", are considered a modern and innovative technology in both military and civilian fields.

By analogy with other industries, the application of UAV technology is to be found in the field of Architecture Engineering and Construction (AEC) and generates a considerable potential of use in various fields such as:

- structural condition assessment,
- management of logistics activities,
- occupational health and safety management,
- assembly of construction elements,
- verifying the progress of the works, and etc.



## Research methodology

The multitude of the UAV technology applications in the field of construction has been of relatively high interest since 2012. Therefore, it is necessary to analyze the current directions of application areas, limitations and development opportunities, considering the fusion of academic publications with practical ones, and also of legislative regulations in force.

### The objectives of the bibliographic synthesis

This paper aims at the following:

1. to identify the State-of-the-Art of UAV technology applications in the AEC,
2. to acknowledge methodologies applied in the management of construction projects,
3. to identify limitations and research opportunities in the management of construction projects.

### Identifying the academic sources

Identifying academic sources was based on keywords, such as "UAV", "drone", "unmanned aerial vehicle", "quality management", in academic database Scopus.

Following the collection of scientific articles in individual publisher databases such as Elsevier, their summary and keywords were analyzed individually. The large number of publications required the creation of a complex database, containing data on the journal and year of publication, keywords used and the rate of citations, which points out their relevance.

### The current stage of the application of UAV technology in AEC

The bibliographic synthesis consists of 20 scientific articles published in 2012-2020, represented in graphic form in Figure 1.

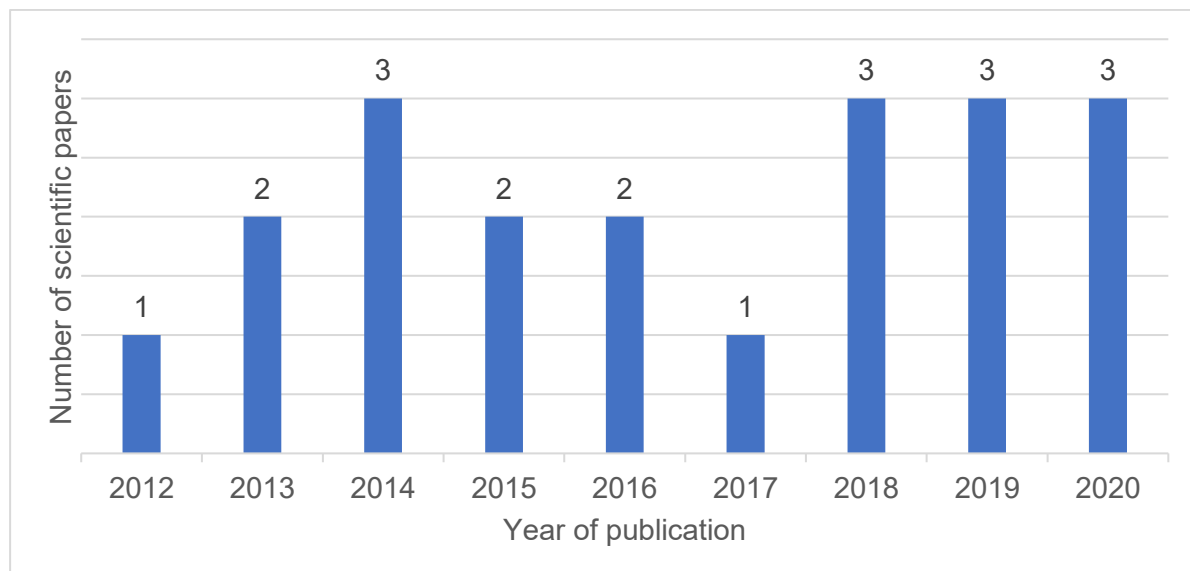


Figure 1: Frequency of publication of scientific articles in the period 2012-2020 with regard to UAV application

Of the 20 academic sources studied, 18 articles present UAV applications in the field of AEC and two present the State-of-the-Art of UAV application.

The applications in AEC are made up of a multitude of subdomains. The distribution by categories of the 18 scientific publications is represented in Table 1.

Table 1: Applicability of UAV technology in AEC

<b>Applications of UAV technology</b>	<b>Reference</b>
Topography	(Agüera-Vega et al., 2018)
Logistics management of construction sites	(Guo et al., 2020)
Progress management of construction processes	(Zollmann et al., 2014; Braun & Borrmann, 2019)
Quantity survey	(Siebert & Teizer, 2014; Jeong et al., 2020)
Risk management of construction sites	(Melo et al., 2017; Kim et al., 2019; Liu et al., 2019)
Structural condition assessment	(Dobson et al., 2013; Hallermann & Morgenthal, 2013; Hallermann et al., 2014; Sankarasrinivasan et al., 2015; Ellenberg et al., 2016; Hallermann & Morgenthal, 2016; Seo et al., 2018)
Natural hazards	(D'Oleire-Oltmanns et al., 2012; Wang et al., 2020)

Seo et al. (2018) presented the efficiency of structural flaw inspection, analyzing images taken by UAV and compared the results with a technical report prepared by the US Department of Transportation that considers manual (traditional) inspection of the same objective.

Hallermann and Morgenthal (2016) put forward the computerized processing of the images taken after the inspection and the generation of the 3D georeferenced digital model with the accuracy of approximately five millimeters.

Real-time investigation of cracks detection and assessment of surface degradation by integrating image processing algorithms following the UAV inspection is presented in the study by Sankarasrinivasan et al. (2015).

The study by Hallermann et al. (2014) highlighted the efficiency of the UAV inspection which aimed to detect the relative displacements of a 180-m-long retaining wall section in less than eight minutes.

Melo et al. (2017) identified the potential of UAV inspection to improve human resource pattern of behavior and reduce the risk associated with occupational health and safety. Processing images by the means of artificial intelligence offered the chance to identify the risk in the vicinity of construction equipment (Kim et al., 2019).

Methods of verifying the progress of construction activities are presented in the study by Zollmann et al. (2014), which supported the application of augmented reality and digital reconstruction, by processing images taken by a drone. In a recent study, Guo et al. (2020) showed the possibility to identify construction equipment, such as excavators, trucks, concrete mixers, concrete cranes, in different locations on the site.

The complex analysis of large excavation volumes by processing UAV recorded images of high-speed railway infrastructure construction project, generated low costs compared to alternative scanning methods and facilitated the decision-making process of the project manager (Siebert and Teizer, 2014).

The current synthesis of the exclusive application of UAV in construction processes and structural condition assessment are presented in Table 2 and Table 3.

Table 2: Uses of UAVs in construction processes

Domain of applicability	Method	Reference
Logistics management on site	Automatic image processing by deep learning algorithms	(Guo et al., 2020)
Occupational health and safety management	Visual analysis	(Melo et al., 2017)
	Merger of UAV inspection with dynamic BIM	(Liu et al., 2019)
Dimensional measurements	Image processing by artificial intelligence	(Kim et al., 2019)
	Generating a high-resolution 3D model	(Jeong et al., 2020)
Three-dimensional measurements	Generating high-resolution 3D model	(Siebert & Teizer, 2014)
Topography	Generating cross sections by applying an automatic algorithm to the point clouds	(Agüera-Vega et al., 2018)
Checking the progress of the works	The fusion of digital reconstruction and augmented reality	(Zollmann et al., 2014)
	The fusion of BIM and inverse photogrammetry process	(Braun & Borrmann, 2019)

Table 3: Uses of UAVs structural condition assessment

Domain of applicability	Method	Reference
Structural condition assessment	• displacement detection	• generating a high-resolution 3D model (Hallermann et al., 2014)
	• cracks detection	• combining methods hat and HSV (Sankarasrinivasan et al., 2015)
		• generating a high-resolution 3D model (Hallermann & Morgenthal, 2016)
	• infrastructure (roads)	• generating a high-resolution 3D model (Dobson et al., 2013)
	• infrastructure (bridges)	• automatically detection of the position and the structural non-conformities (Ellenberg et al., 2016)
Natural hazard	• landslides	• generating the digital elevation model (DEM) (Wang et al., 2020)
	• river erosion	• generating the digital terrain model (DTM) and orthophotographs (D'Oleire-Oltmanns et al., 2012)

### Methodologies applied in the management of construction processes

The UAV inspection methodology consists of the following stages 1) defining the flight parameters of the drone, 2) data acquisition, and 3) data processing.

#### UAV types, sensors, and flight parameters

The studied scientific articles present two types of UAV structure: fixed wing and multi-rotor. A multitude of sensors can be attached to the UAV such as digital camera, thermal and infrared sensor.

Another important parameter is the flying height or distance from the object of interest.

## **Data acquisition**

The main component of the UAV is the Flight Control Unit (FCU). This hardware component processes and implements not only the commands transmitted by the pilot but also the pre-programmed flight via GPS way points.

## **Data processing**

A major topic of interest in research is the improvement and development of efficient image processing techniques. The studied articles present four categories of image processing in construction management, based on the time of data processing. Three of them (the visual analysis, the photogrammetric methods, and the methods of the artificial vision algorithms) are validated in the post-inspection processing of the images taken by UAV, while the computed algorithms may be used for real-time results.

## **Possibilities of UAV integration in construction quality management**

Following the undertaken research, the authors advocate for the application of UAV in construction quality management, during the design, construction and operating stages.

### **Design stage**

The environmental factors that may affect the mechanical strength and structural stability of the construction project can be evaluated by using the high-resolution 3D model and geotechnical studies. The integration of the digital terrain model, resulted after UAV images processing, in Building Information Modeling (BIM) models can contribute to the improvement of the geospatial visualization and complement the information on the construction surrounding environment. The UAV inspection can facilitate decision-making with regard to the interdisciplinary coordination and optimization of the technical design solutions.

### **Construction stage**

The quality control during the construction stage requires daily records, which are extremely time-consuming and a lot of human resource is needed. Usually, the quality control of the activities is completed by various types of reports or protocols and the traceability is performed manually. In this context, data traceability leads to difficult identification of the history and low precision in pinpointing activities.

The UAV inspection presents high applicability in the quality control of construction activities, due to time and economic efficiency compared to conventional tools, high precision of the collected data and the possibility to store it in an integrated digital platform.

The authors propose the use of BIM models when performing quality control. The process involves comparing the 3D model with the digital reconstruction resulted from the UAV inspection, in activities such as verifying:

- The geometric parameters of earthworks and foundation works;
- The alignment of formworks and the position of reinforcements in concrete elements;
- The structural non-conformities inside concrete elements (local gaps, reinforcements position);
- The joints of precast concrete elements;

Furthermore, the UAV can improve the documentation of works that become hidden.

### **Operating stage**

Conventional inspections involve complex and expensive procedures such as the use of access platforms or special scaffolding. The main advantage of drone inspection is the flexibility to record data related to structures located in hard-to-reach areas as well as high altitudes such as dams, bridges, or wind turbines.

Structural health monitoring and extension of a structure's life span through periodic inspections are of economic, social, and environmental protection interest.

### **Limitations and research opportunities**

The increase in the applicability of large-scale UAV in the civil field is conditioned by preliminary considerations: technological limitations for the ability to maneuver autonomously, in safe conditions and the adaptation of the legal requirements for operation and surveillance during the flight (Floreato and Wood, 2015).

#### **UAV endurance, autonomy and maneuverability**

The study by Otto et al. (2018) identified the influencing factors of drone endurance: 1) drone structure, 2) flight altitude, 3) take-off speed, 4) payload, 5) meteorological conditions.

A large part of inspection applications considers pre-programming the flight path using GPS waypoints but in the case of inspections inside buildings, pre-programming of the trajectory is not possible due to the limitations of the GPS signal.

#### **Legislative norms and regulations**

The socio-economic potential of using UAV in the civil field requires both technological advances and the framework of legal regulations to allow functionality in conditions of safety, confidentiality, and security.

The study by Dobson et al. (2013) indicated the need to facilitate the obtaining of the flying license. Hallermann and Morgenthal (2013) specified the adaptation of the regulations regarding the autonomous control of the UAV in Germany. Taking into account the safety conditions, the authors indicated that the pilot must maintain the Visual Line of Sight Operation throughout the inspection.

### **Conclusions**

The article is a synthesis of 20 bibliographic sources related to the applicability of UAV in AEC and highlights the growing trend of using this technology in construction quality management, occupational health and safety management, and progress monitoring of construction activities. Although UAV does not tend to replace current technologies, their usefulness can supplement and complement the existing ones.

The topic of a new research is monitoring an excavation of roughly 28 meters in depth, executed for building a multi-storey commercial complex which was abandoned after the basement completion. The construction site forms a rectangle of approximately 10,000 square meters.

The new research is conducted within the framework of the project "*Monitoring the construction site located at 62B Traian Street*", County of Constanta, Romania and involves long term (numerous years) assessment of the soil displacements using UAV.

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# THE ROLE OF EUROPEAN UNION POLICIES ON THE MANAGEMENT OF REFERENCE MATERIALS SPECIFIC TO FOOD ENGINEERING

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## Abstract

**Purpose** – This paper presents the decisive role of the European Commission (EC) policy in the development of reference materials (RM), specific to food engineering.

**Methodology/approach** - The authors of this paper carried out a documentary study on the dynamics of the EC policy in the field of RM production and the implementation of these policies beyond 2014.

**Findings** – By analyzing the regulations issued by the European Union we can observe a significant increase in the financing of projects on the development of reference materials used to evaluate the performance of testing the quality of agri-food products.

**Research limitations/implications** – Since 2014, the fight against food fraud is included into the EC's food safety policy. The policies in the field of food safety have expanded their regulatory area by including provisions regarding food fraud. The authors performed a research on the dynamics of the EC policy in the field of RM production and the implementation of these policies beyond 2014.

**Practical implications** – Relevance of testing performance in evaluating product quality in order to reduce food fraud.

**Originality/value** – This research paper identifies and indicates how European Union regulations influence the increase of quality testing performance and the need to develop reference materials used in agri-food engineering.

**Key words:** EU policies; food safety; quality management

## 1. Introduction

This paper assesses the impact of European Commission (EC) policies on increasing testing performance and developing RMs, specific, to food engineering. In this view, the authors carried out a documentary study on the dynamics of the EC policy in the field of RM production and the implementation of these policies beyond 2014. The year 2014 was chosen as a landmark because the policies in the field of food safety have expanded their regulatory area by including provisions regarding food fraud. Thus, the European Parliament recommends to the EC and Member States to stimulate research programs to develop technologies for food fraud detection. The EC proposes a financial support for the strategy developed by the European Strategy Forum on Research Infrastructures (ESFRI) and for the justified initiatives to increase the quality of agri-food products. EU Member States



transpose the EC regulations and finance at national level projects to increase the testing performance of agri-food products.

Renée Johnson, agricultural policy specialist at the Congressional Research Service (CRS), noted in the report "Food Fraud and Economically Motivated Adulteration" about the economic consequences of food frauds and substantiated the need for food fraud to be included into food safety policy (Elliott, 2013).

On the other hand, Elliott's report on "Integrity and assurance of food supply networks" elaborated for United Kingdom Government, supports the periodic review of the methodologies used. Recommendation 4 (Laboratory Services) mentions that those involved in the food chain audit and inspection should have access to sustainable laboratory services and the Government should facilitate the standardization of the methods used by the laboratories (C. Elliott, 2014), the need for new RMs being closely linked to the development of these new analytical methods.

European Parliament also called on the EC legislation review in this area, in order to reduce the risk of food fraud. Legislative proposals were also requested in accordance with Regulation (EU) no. 1151/2012 regarding quality schemes for agri-food products. In the same context, the European Parliament recommends to the EC and the Member States to stimulate research programs to develop the technologies and methods used to detect food fraud.

Federal Ministry for Economic Affairs and Energy in Germany, in partnership with National Physical Laboratory (NPL) in UK and Laboratoire National d'Essais in France coordinate the international database named COMAR, Code d'Indexation des Matériaux de Référence, developed in 1970 by Laboratoire National d'Essais (LNE) and approved by the ISO Committee for Reference Materials (ISO-REMCO) (COMAR, 2017).

## **2. Materials and Methods**

The authors of the paper conducted a documentary study in order to present the decisive role of the European Commission's policy in developing the RMs specific to food engineering. It involved a documentary study consisting in EU regulations and reports, research strategies and projects, national legislation and scientific articles, as well as international standards. The instruments for the implementation of EC policies at EU level in the field of testing of agri-food products have been also identified.

Both the increase of the quality of life and the smooth functioning of international trade depend on reliable measurements, which eliminates the errors of testing results and the need for re-testing of food that are coming with additional costs. Certified reference materials (CRMs) are used for the reliability of the measurements.

Certified reference material (CRM) is a reference material for which it can be found the traceability of specified characteristics in a certificate (International Organization for Standardization (ISO), 2007).

### **2.1. EU regulations**

The quality of agri-food products is a priority at European level, so by issuing regulations targeting the food sector, the European Union draws guidelines regarding quality management for testing and monitoring these products.

On the agenda of the European Council, the existing legislative package on animal and plant health focusses on modernizing and simplifying the existing rules, while strengthening compliance with health and safety standards throughout the agri-food chain. The package is consisting in five legislative proposals submitted by the Commission, the fourth proposal foreseeing the creation of a single framework for all official control actions along the agri-food chain. The negotiations between the European Parliament and the Council on the proposal for a regulation on animal health were completed in June 2015, and the regulation was adopted on March 9 and published on March 31, 2016 (European Council, n.d.). It will be applied from April 21, 2021.

In the last two decades, the European Union has carried out an intense activity for developing the specific tools for implementing food safety, including the mitigation against food fraud. From 2000 until now, the

European Union has issued regulations in this field, one of the first being Regulation 178/2002, the regulation establishing the general principles and requirements of the food law, establishing the European Food Safety Authority (EFSA) and establishing procedures in the field of food safety (European Parliament, 2002).

## **2.2. Research Infrastructures**

The Joint Research Center (JRC) is the European Commission's internal scientific service, with the mission to provide scientific support and identify key issues in the agri-food field. In order to achieve its objectives, JRC has laboratories and facilities for the development and production of RMs at international level. JRC Institute of Reference Materials and Measurements (IRMM) in Geel, Belgium has pilot plants for the processing of unique multi-parameter reference materials.

In the context where bio-terrorism is a risk factor for food safety, class 3 bio-safety laboratories are under construction within the JRC to provide the European Commission internal access to laboratory facilities where human pathogens (bacteria and viruses) can be used to develop new CRMs (European Commission, n.d.-a).

JRC develops MRs according to the requirements generated by the European policies in the field of food safety, in particular, supporting the emerging fields, such as nanotechnology, biotechnology and personalized medicine. Moreover, in 2018 JRC provided through public calls, access to the nanobiotechnology pilot station (Braskem, 2017), and support in the development of RMs (Joint Research Center, n.d.).

Taking into consideration the importance of the quality of the results obtained from food testing, for risk assessment/management in the field of laboratory analysis, the European Commission, has selected at EU level, EU reference laboratories (EURL) that support the activities of the European Commission in implementing food safety policies.

EURLs are responsible for providing national reference laboratories (LNR) with analytical methods and diagnostic techniques, RMs and testing schemes for laboratory competencies, to train LNR staff, but also to provide the European Commission with scientific and technical expertise, in terms of laboratory analysis. The activity of EURL groups ensures better implementation of EU legislation, for example, by assessing legislative limits and reducing the need for repeat testing which it means time and money consuming. As a result, the functioning of the EU internal market is strengthened and consumers benefit from safer foods on the market. Information on the competence of the EURL can be found on the European Commission's website (European Commission, n.d.-d).

## **2.3. Research projects**

Knowing the importance of food testing in monitoring food safety and the not sufficient existing testing methodologies, Giovana Zappa (Zappa & Zoani, 2015) proposed in 2015 to include the project "Infrastructure for promoting metrology in food and nutrition" with the acronym METROFOOD in the Roadmap agenda prepared by ESFRI, a project funded by the European Commission, in 2017. An important objective of the project is the realization of the scientific research infrastructure necessary to evaluate the quality of food products and, thus, to provide adequate tools for identifying the food frauds (Zoani, 2016).

METROFOOD is coordinated by the National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA) and currently involves 48 European research organizations and one international (FAO) from 18 European countries (MetroFood, 2020).

## **2.4. International standards**

Quality management, as defined by international standards, is the administration of all functions and activities necessary to determine and achieve quality. At the same time, it is a part of total management, including the definition, organization and implementation of quality policy in order to ensure and control the quality of all processes, products or services. (Sitnikov, 2014)

An important role in the standardization of the food field was played by the Food and Agriculture Organization (FAO), established in 1945 by the Organization of the United Nations. Under FAO coordination, following the Codex Alimentarius Austriacus a model, Codex Alimentarius (Codex) and

the first collection of international product standards, was developed. Although not mandatory, Codex standards are a source of information on technical specifications, composition and quality parameters, labeling, and methods of analysis and sampling.

Standardization of the specific requirements is necessary in establishing the degree of conformity of the product. The International Organization for Standardization (ISO) plays the decisive role in the development and promotion of international standards. It carries out an intense activity in standardizing the quality requirements of the products and the analytical methods, afterwards the standardization has extended to other important elements in increasing the confidence in the quality of the products: among them, the labeling is intensely regulated in the context in which it was found that the label is the vector to the consumer of all the food legislation.

The international (ISO/IEC) and European (CEN/CENELEC) standardization bodies, through the elaborated standards, provide technical support for performing procedures used in mutual recognition of the results of conformity testing with the standards.

## 2.5. Financing tools

The main objective of Regulation (EU) no. 652/2014 (for expenditure on the food chain, for the health of animals and plants) (European Commission, 2014) is to contribute to ensuring a high level of health for humans, animals and plants. Costs related to food fraud for the global food industry have been estimated at around € 30 billion each year, posing a real threat to the proper functioning of the Common Market 18 (European Commission, n.d.-b).

## 3. Results and discussions

The legislative requirements in the field of food safety and the testing of the quality of agri-food products increase the demand for specific products and services. Thus, the test laboratories accredited according to ISO 17025 are required to prove their competence by declaring the degree of measurement uncertainty performed on RMs and through inter-laboratory tests.

In this context, the Elliott Report (C. T. Elliott, 2014) prepared for the Government of the United Kingdom emphasizes that some adulterants are undetectable by existing techniques and, therefore, a special role lies in the scientific research in identifying new markers, analysis techniques and periodically reviewing the methodologies used, the need RM being closely linked to the development of these new methods of analysis.

For RMs producers, the information regarding the regulation of food quality represents opportunities to diversify RMs producing that support the implementation of the new regulations. Thus, the EC regulation regarding the declaration of the country of origin of the main ingredient (raw material) generates the elaboration of test standards regarding and the need for RMs.

The European Union regulations with impact on the activity of the RMs are presented in table 1.

Table 1. EC regulations governing food safety (selection) Subsection

Regulation number	Description
Regulation 1829/2003	on genetically modified food and feed
Regulation 853/2004	on food hygiene
Regulation 2073/2005	on microbiological criteria for foodstuffs
Regulation 1881/2006	establishing the maximum levels for certain contaminants in food products
Regulation 2158/ 2017	establishing mitigation measures and reference levels for reducing the presence of acrylamide in foodstuffs
Regulation 1169/2011	on informing consumers about food products

The European Strategy Forum on Research Infrastructures plays an essential role in the development of policies on research infrastructure in Europe.

Through its policies, the European Commission supports research to increase the quality of food testing results applicable within the EC. In this context, the EC has been supporting the development/production of RMs for more than four decades, with the establishment of the European Community Reference Office (BCR) in 1980. Joint Research Center is one of the world's leading developers and producers of RMs. Currently it offers over 760 RMs and distributes around 20,000 units per year to laboratories worldwide. The certified RMs produced and distributed by the JRC provide the measurement laboratories with means to validate the analytical methods and to evaluate the accuracy of their measurement results. The JRC also develops RMs based on the requirements generated by European food safety policies, especially in emerging fields, such as nanotechnology, biotechnology and personalized medicine. To achieve its objectives, JRC has laboratories and processing facilities for the development and production of unique RMs in the world.

Regarding the RMs for food matrices in Romania, there is no RM/ CRM producer, the only option for national laboratories being the purchase of CRMs from external producers.

The implementation of the METROFOOD project will generate knowledge in two closely related areas, metrology and food quality. The implementation stages of the METROFOOD project are presented in table 2 (European Strategy Forum on Research Infrastructures, 2018).

Table 2. METROFOOD project execution stages

Phase	Period	Objective	Financing
PRO-METROFOOD	2016-2017	Preparation of the project for inclusion in ESFRI	Horizon 2020 No 739568
METROFOOD-RI	2015-2017	Design and feasibility phase	H2020 INFRADEV-02-2019, CSA
METROFOOD-PP (GA 871083)	2018-2021	Creation of pan-European research infrastructures ESFRI	ESFRI
	2021-2024	Project implementation	

Following the completion of the FoodIntegrity project, FERA represents the United Kingdom in key European and international regulatory committees (e.g. EFSA, CEN, CODEX and ILSI) and is a national reference laboratory designated for a number of food contaminants and residues in food (Food Integrity, 2020).

European Program for the establishment of validated procedures for the detection and identification of biological toxins, EuroBioTox, is a project funded by the EC with the budget of 7,998,747 euros through the program "Fight crime, illegal trafficking and terrorism, including understanding and tackling terrorist ideas and beliefs (H2020-EU.3.7.1.)". The project is being implemented during 5 years, 2017-2022, and the 14 partners in 7 countries (Germany, France, Belgium, Switzerland, Finland, Great Britain and Sweden) are developing microbiological methods for determining pathogens in food products used as crime vectors (*Project "EuroBioTox,"* n.d.).

Official controls from Member States are an essential tool for verifying and monitoring the implementation and compliance with the relevant requirements of the European Union. The effectiveness and efficiency of the official control systems are vital to maintaining a high level of safety for humans, animals and plants along the food chain, while ensuring a high level of environmental protection. Financial support from the European Union should be available for such control measures. In particular, a financial contribution should be made to the Union reference laboratories to help them to cover the costs resulting from the implementation of work programs approved by the Commission, in accordance with Appendix 20 of Regulation (EU) NO. 652/2014 of the European Parliament and of the Council of 15 May 2014 and Appendix 22 of the same Regulation specifying that the EU should allocate funds for the technical, scientific, coordination and communication activities that are necessary to ensure the correct implementation of EU law and to ensure the adaptation of the right to scientific, technological and societal developments (European Commission, 2014).

The general budget of the European Commission for the period 2014-2020 is € 1,891,936 million and is intended to finance food safety programs. From table 6 it can be seen that the budgetary allocation has had an upward trend, the value of the investment in the field of food security increasing steadily from year to year.

Table 3. General budget of the European Commission for the period 2014-2020

Year	2014	2015	2016	2017	2018	2019	2020	TOTAL 2014-2020
<b>Mi. Euros</b>	253.39	258.53	264.07	270.23	276.69	282.69	286.33	1.891.936

For the implementation of food safety policies EC has allocated EUR 1.68 billion for the financial cycle for the period 2021-2027 (European Commission, n.d.-c).

As a result of the implementation of EC policies at the international level, there is an increase in the number of laboratories accredited in accordance with the ISO 17025 standard (figure 1).

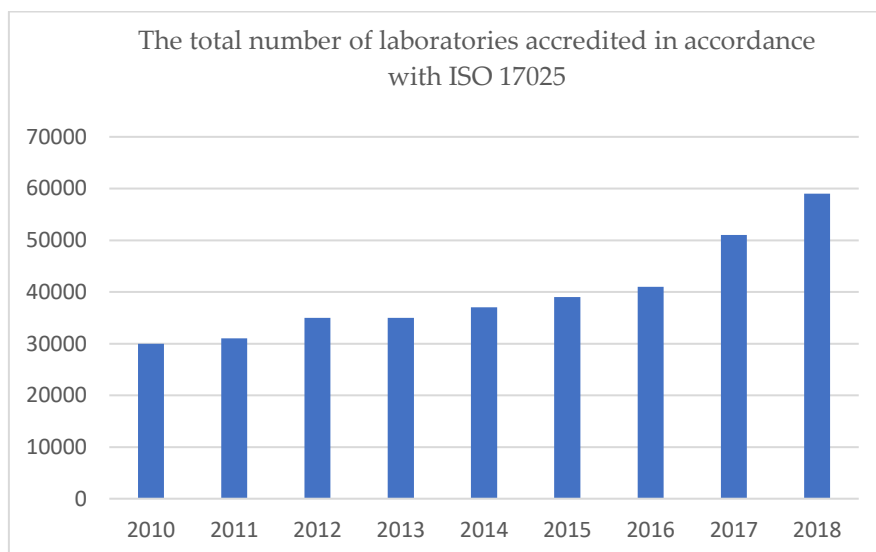


Figure 1. The total number of laboratories accredited in accordance with ISO 17025

Also, according to the National Institute of Standards and Technology (NIST), there is an increase in the production of RMs. 10,000 RMs are registered in COMAR database, which reflects the interest of laboratories in developing them (Figure 2).

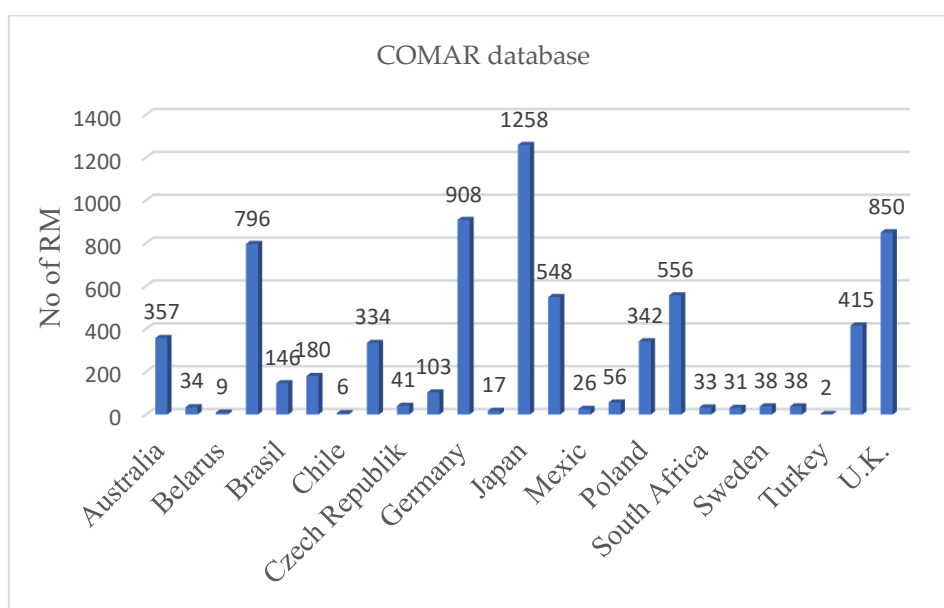


Figure 2. Number of RMs registered in COMAR database (situation in 2019)

As noted, 17% of the RMs registered in COMAR database are produced in Japan, followed by Germany with a percentage of 13% (Figure 3).

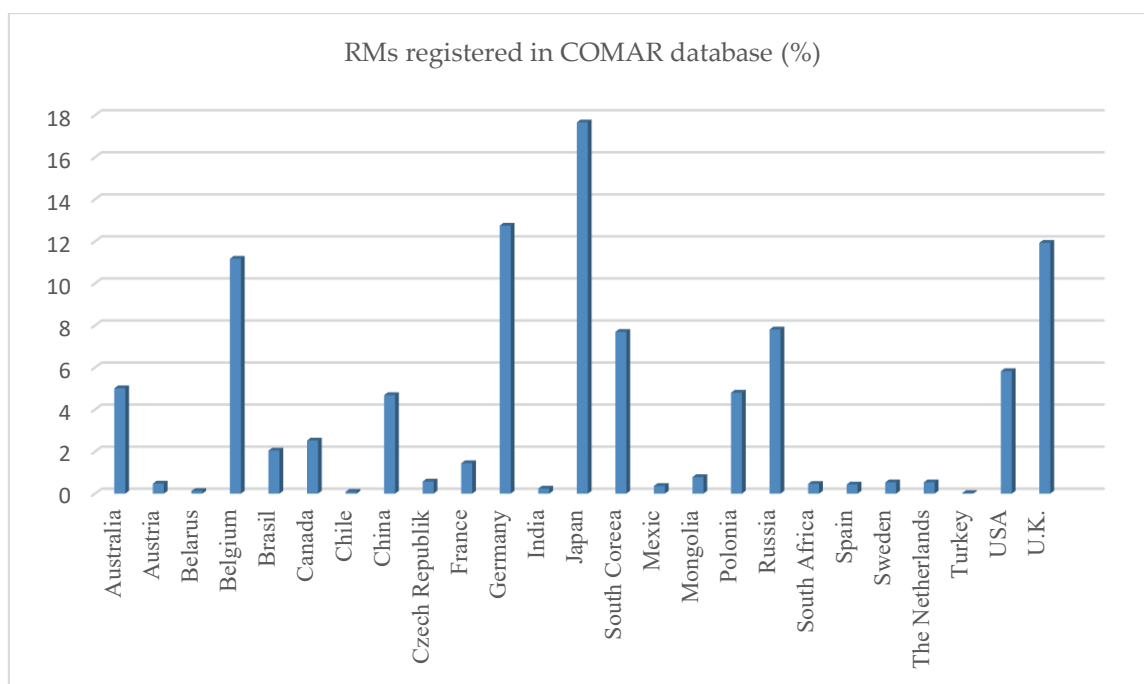


Figure 3. % RMS registered in the COMAR data base

## Conclusions

As a priority for the European Union, food safety is intensely regulated and monitored. Through its policies, the European Commission addresses food safety in an integrated way, by offering both specific regulations and the appropriate tools for their implementation at European level. In this context, there is an intensive activity of harmonizing the instruments for assessing the quality of foodstuffs in the EU member states, increasing the analytical performance and developing new food matrices used as CRMs. The RMs have a wide applicability in the testing activity regulated by the international standard ISO 17025, but also in the quality evaluation of the results obtained from the analytical tests, the calibration of the analysis equipment, the validation of the methods and the estimation of the measurement uncertainty.

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# THE CUSTOMER RELATIONSHIP MANAGEMENT AND THE EXEMPLIFICATION OF THE IMPLEMENTATION IN THE ORGANIZATIONAL CUSTOMER RELATIONSHIP

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## Abstract

**Purpose** - is to exemplify the way in which an industrial company responds to customer complaints, based on the application of the principles of customer relationship management.

**Methodology/approach** - applied research and development

**Findings** - implementing customer relationship management can generate organizational customer loyalty and involves researches, tests, redesign and implementations for new or improved products

**Research limitations/implications** - depending on the profile of industrial companies and of their customers, customizations of the implementation of customer relationship management are required.

**Practical implications** - the implementation at SC Niob Fluid s.r.o., Ostrožská, Czech Republic was analyzed, resulting in a case of good practice.

**Originality/value** - the approach to customer relationship management from the perspective of organizational customer orientation.

**Key words:** customer relationship management, loyalty, rotary spray head

## Customer Relationship Management

The importance that customers have in the activity of companies is widely recognized, even in practice. This was highlighted in the management theory by Peter F. Drucker who spoke of the fact that the customer is at the heart of any company's strategy. Along with the economic, technical, technological, social evolution etc. specific to the last century, the customer-oriented management elements have also been conceptually developed, generating a new scientific field, that is the customer relationship management (CRM).

The customer relationship management is defined as a global process of creating and maintaining profitable customer relationships by ensuring a higher level of value and satisfaction for the customer, but which results in customer loyalty. At the same time, the levers of customer relationship management ensure the most efficient use of each contact/ customer, of each interaction between the company and the consumer to obtain direct mutual benefits from both parties. In its initial phase, the customer relationship management was defined as the activity of managing customer databases. Gradually, CRM evolved, and in addition to the activity of managing databases with customers, it extended its concerns to the management of detailed information about customers, in order to know their needs, preferences, desires etc. and, by fulfilling them, it is aimed at maximizing their fidelity and maintaining long-term profitable relationships.

Globalization, digitalization and current computerization have created the challenge for companies to manage numerous and very different customers, customers whom the company is interested to study and keep close by offering the right products and services and an adapted sales mode. But, globalization and digitalization have created great premises for development and companies that manage organizational customer relationships. For these customers, an optimal customer relationship

management implies a deeper, more detailed and more complex direct relationship with them. The following principles can be used to optimize these relationships:

- permanent provision (24 hours a day) of information related to products and services as well as about their use, with the provision of specialized technical assistance;
- identifying the way in which each client defines its quality and then creating service packages adapted to each client, oriented to their requirements and expectations;
- quick estimation and identification of potential problems (regardless of their nature) that may occur in the relationship with the client, this being recommendable even before they happen, as well as the way to treat them;
- creating a friendly mechanism for managing and resolving customer complaints as soon as possible.

In order to implement these principles and create a coherent and efficient CRM project, employees of the departments of Design, Production, Sales, Marketing, Financial-Accounting etc. are mobilized that is, all those who can generate value in the relationship with each customer.

### **The Description of the Organizational Context**

Niob Fluid s.r.o. Company, based in Ostrožská, Hluk, Czech Republic (The Czech Republic also known by its short-form name, Czechia) is a manufacturer of stainless-steel fittings and valves (X5CrNi 18-10) for the food, pharmaceutical and chemical industry.

Niob Fluid s.r.o. was established in 1992 and since then the company has become a major manufacturer of hand, pneumatic or electric-operated three-way direct shut-off valves, of input fittings, ball valves, globe valves, check valves, filters, vacuum valves, limiting valves and other products made of stainless steel. The company also supplies manholes designed especially for tanks used in the food industry. Since 2014, it has also been a manufacturer of heating elements for the food industry.

The company's production is also oriented towards the manufacture of customized products. The company Niob Fluid s.r.o. produces customized accessories and equipment, which are not intended exclusively for the food industry.

The atypical products, which are most commonly ordered, include variants of valves with different connections, as well as special welded pipe assemblies.

The company is included in the category of small enterprises in the Czech Republic and currently has 52 employees. Niob Fluid s.r.o. is a limited liability company being managed by a general manager. A large part of Niob Fluid production, about 80% of exports are directed to Russia and Ukraine and about 20% of them are delivered to Poland, Romania and Italy.

The geographical location of the most important customers of Niob Fluid s.r.o. are presented in Figure 1.

One of the important customers of the company is company X whose object of activity is the filtration of beer, wine and other beverages. For that company, Niob Fluid s.r.o. produces the 360° spray head used for washing and disinfecting the tanks needed in the brewing process. All over the world, the legislation obliges food industry producers to strictly comply with rules and regulations that directly affect the health of consumers, as well as the quality of products. In this idea, strict procedures that aim at washing and disinfecting the necessary volumes in this industry are regulated. Before the appearance of these procedures for washing the tanks, specialized personnel disassembled the machine and then penetrated inside the tanks. The washing thus performed was of low efficiency, using numerous human and material resources and large amounts of washing solutions. In addition to these drawbacks, the risk of infestation caused by improper washing and the introduction of other pathogens into tanks has led to the elimination of this technology and its replacement by modern technologies based on computerization and automation.



Figure 1. Important customers of the company

### The Description of the Cleaning - Disinfection Cycle of Liquid Food Products Tanks

The cleaning - disinfection cycle for the tanks in the food industry is performed with the help of a fluid jet spray head which is directed (360°) under pressure on their entire inner surface. The method is very efficient and allows compliance with quality, hygiene and food safety standards, while ensuring low cycle costs.

The spray head uses relatively small amounts of cleaning fluid, the working pressures being low (1-3 bar). The method can be used for washing tanks with a volume between 5 m<sup>3</sup> and 50 m<sup>3</sup> and due to the rotational movement of the fluid jet it is ensured a washing of the entire inner surface of the tank in a very short time.

The spray cycle begins by inserting the device through the tank inspection window and positioning it in the tank. The device must be connected to a centrifugal pump with adequate power and flow rate correlated with the dimensions of the tank. The washing system can be also connected to a reducer that impresses a rotational movement and thus distributes the washing solution on the tank ceiling, on the side walls and on its bottom. The presentation of an application that contains spray heads is shown in Figure 2.

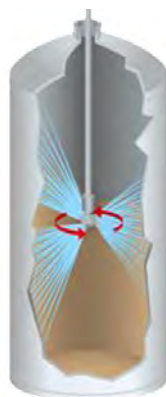


Figure 2. 360° spray heads in the process of cleaning – disinfection

All the components of the spray head must be made of stainless steel. The nozzle in the cleaning head is a compact device that rotates axially, being driven in this movement by the cleaning agent due to the

arrangement of the slots through which the cleaning agent exits, as shown in Figure 2. The entire cleaning system - disinfection from a dairy using this method to sanitize milk cooling tanks / tanks is shown in Figure 3.

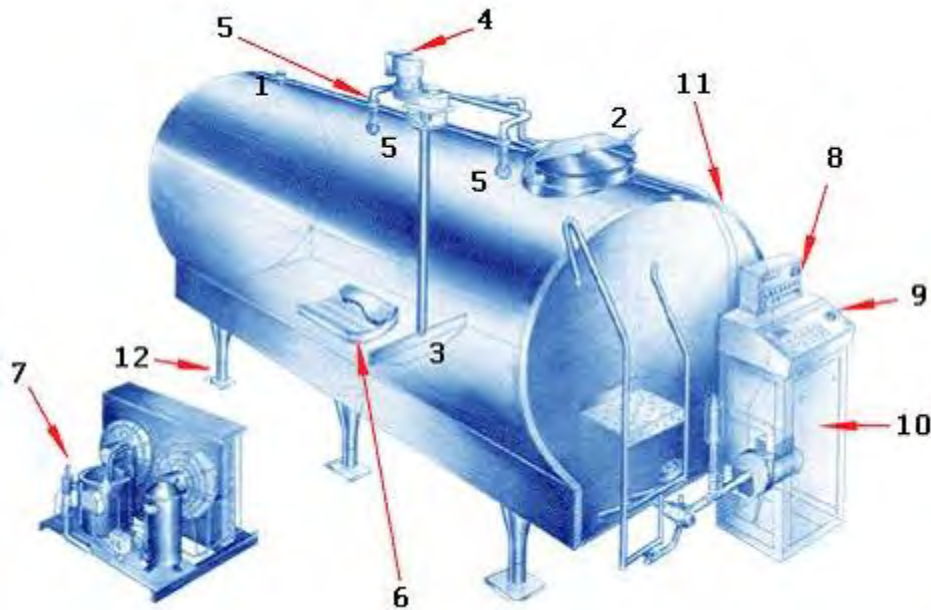


Figure 3. Milk cooling tank/tank with automatic washing system

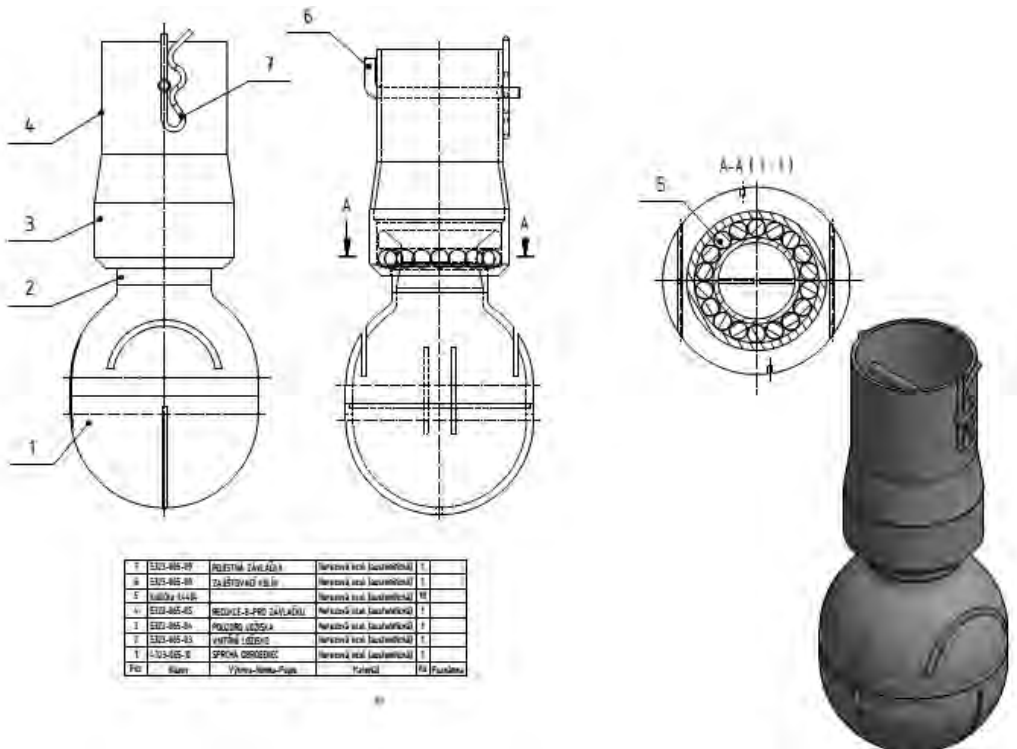
The meaning of the notations in figure 4 is the following: 1 - ventilation system; 2 - visiting cover; 3 - stirring system; 4 - agitator gear motor; 5 – 360° spray head; 6 - evaporator in construction; 7 - compression unit; 8 - control console for agitator temperature and speed; 9 and 10 - automatic washing system; 11 - tank body; 12 - adjustable legs.

In a first constructive variant, the 360° rotary spray head (Figure 2) was designed, manufactured and tested at Niob Fluid s.r.o. The components of the 360° spray head are made of stainless steel and are shown in Figure 4.

1. the lower part of the nozzle system;
2. the upper part of the nozzle system;
3. special bearing;
4. connecting piece through which the washing system is supplied and which is connected to a pump;
5. special bearing balls;
6. pin;
7. assurance element.

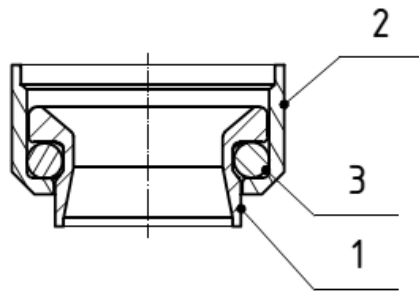
A longitudinal section through the special bearing (component 3 of Figure 5) is shown in Figure 5.

The body of the nozzle system consists of two components called the lower part (component 1 in Figure 4 and in Figure 6) and the upper part (position 2 in Figure 4 and in Figure 6) which are assembled by welding.



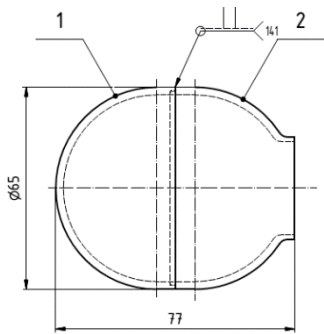
1	5323-065-01	POUŠTĚNÁ ZÁVLÁČKA	Nerezová ocel (austenitická)	1	
2	5323-065-02	ZÁKRYVNÝ KOLÍČEK	Nerezová ocel (austenitická)	1	
3	Kulička 1.4404		Nerezová ocel (austenitická)	18	
4	5323-065-03	POUŠTĚNÍ S-PRO ZÁVLÁČKOU	Nerezová ocel (austenitická)	1	
5	5323-065-04	POUZDRO LOŽISKA	Nerezová ocel (austenitická)	1	
6	5323-065-05	VNITŘNÍ LOŽISKO	Nerezová ocel (austenitická)	1	
7	5323-065-06	SPRCHA ORBIDEK	Nerezová ocel (austenitická)	1	
Poz	Název	Výkres-Norma-Popis	Materiál	Ks	Poznámka

Figure 4. 360° Rotary spray head for pin assembly



3	Kulička 1.4404		Nerezová ocel (austenitická)	18	
2	5323-065-04	POUZDRO LOŽISKA	Nerezová ocel (austenitická)	1	
1	5323-065-03	VNITŘNÍ LOŽISKO	Nerezová ocel (austenitická)	1	
Poz	Název	Výkres-Norma-Popis	Materiál	Ks	Poznámka

Figure 5. Longitudinal section through the special bearing



2	5323-poletovar-065-02	HORNÍ POKLOUPE	Nerezová ocel (austenitická)	1	
1	5323/065/02	SPONNÍ SPRCHA	Nerezová ocel (austenitická)	1	
Poz	Název	Výkres-Norma-Popis	Materiál	Ks	Poznámka



Figure 6. Body of the nozzle system without machined slots

The slots, with a different inclination and positioning, are obtained by milling at dimensions that are in accordance with those in Figure 7.

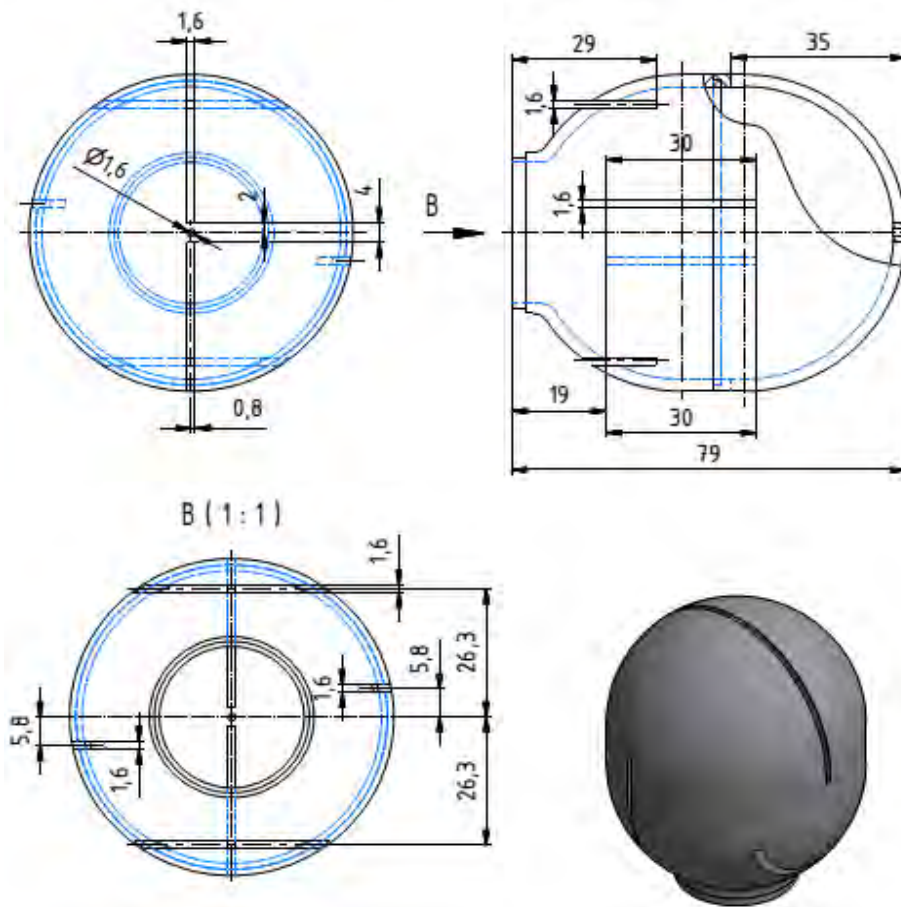


Figure 7. Dimensions and position of the slots for the nozzle system body

### Implementing the Principles of Customer Relationship Management

Niob Fluid s.r.o. is attentive to customer relationship management and actively implements the principles defined by customer relationship management. In this sense, for its products, the company provides technical assistance permanently specialized to its customers, tries to adapt its products according to their requirements, estimates problems of any kind that may arise in relation to them, manages and quickly resolves any complaints.

Also, Niob Fluid s.r.o. cultivates a relationship based on trust with its customers that results from the open interaction with them, an effective partnership in making the products they need, an effective communication etc.

With all the simulations and tests performed by Niob Fluid on the entire manufacturing flow of the products, even in the design stage, some problems may sometimes arise in their operation, aspects that are noticed by customers. These problems can be noticed by watching, for a longer time, the way in which the products behave in operation. This situation also occurred in the case of the partnership with company X.

### Presentation of a Technical Problem Identified by the Customer

For this first constructive variant of the 360° spray head, notifications and complaints were received from the customer Niob, company X, the first to use the 360° spray head for washing and disinfecting the tanks/tanks used in their own production processes. The problem was stopping the spray head from

rotating during the washing cycle, which had as consequences: the remaining of uncleaned residues in tanks, the existence of non-hygienic surfaces and the possibility of microbial infestation of newly stored or processed products. It was also claimed that the washing radius of 1.5 - 2 meters, described in the technical documentation of the spray head, is not reached during the washing process, which led to poor cleaning on the side surfaces of the tanks. These problems arose although the customers complied with the requirements of the technical data sheet of operation of the spray head where it was specified to ensure a working pressure of 1 to 3 bar, in which case the manufacturer guarantees to obtain a washing radius of 1.5 to 2 meters.

Thus, based on the received notifications, the company Niob Fluid started a process of analysing the causes of these phenomena and numerous tests were made (images from the 360° spray head tests are shown in Figure 8). The result of the carried out tests led to a first conclusion, namely that at an inclination of less than 2° (degrees) of the spray head during the washing process this is locked and in this way the nozzle system does not rotate. The locking takes place because the ball sleigh (of the special bearing) touches the outer wall and thus a sliding friction occurs between them which causes the balls of the special bearing to no longer fulfil their functional role.



Figure 8 - Images from the 360° spray head test

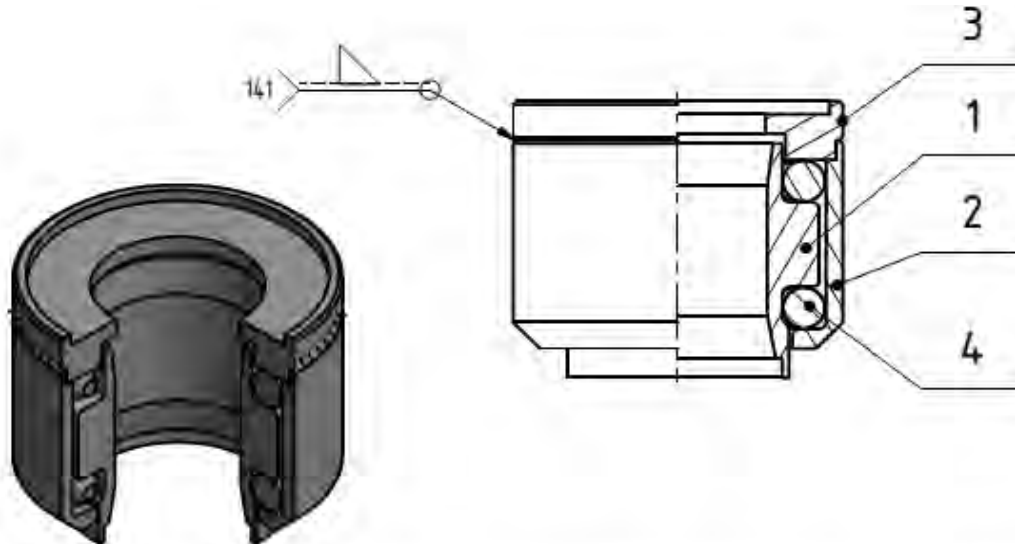
Also, another conclusion resulting from the tests performed, which could determine or contribute to blocking the rotation of the nozzle system body, was related to the section of the channel through which the washing device is fed.

In fluid dynamics, Bernoulli's Law states that an increase in the velocity of a liquid occurs simultaneously with a decrease in pressure or a decrease in the potential energy of the fluid.

Following the findings of the tests, it was concluded that a 360° spray head redesign is needed to eliminate the reported drawbacks.

## The Results Obtained by Redesign and Feedback from the Company's Client

The first redesigned component was the special bearing which in the new version was designed as having two rows of balls, which will determine a better stability of the spray head during the process and, thus, the influence of its angles of tilt during operation will be reduced. The resulting variant is shown in figure 9.



4	5324P-6,35	Kulička 6,35mm	Nerezová ocel (austenitická)	36	
3	5323P-065-05	HORNÍ KRYT LOŽISKA	Nerezová ocel (austenitická)	1	
2	5323P-065-04	SPODNÍ KRYT LOŽISKA	Nerezová ocel (austenitická)	1	
1	5323P-065-03	TĚLESO LOŽISEK	Nerezová ocel (austenitická)	1	
Poz	Název	Výkres-Norma-Popis	Materiál	Ks	Poznámka

Figure 9. Special redesigned bearing with two rows of balls

Another change made was that by which a variation of the section of the washing liquid circulation channel was made, as shown in Figure 10.

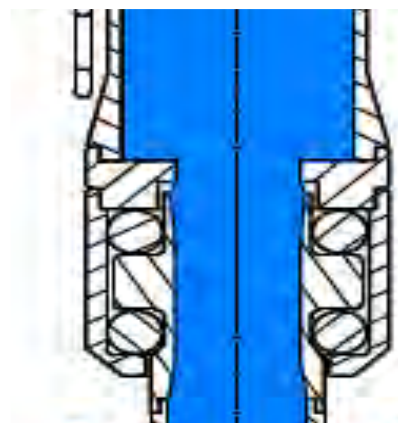


Figure 10. Change of section through the body of the spray head to the redesigned version of the 360° spray head

The redesign of the special bearing, which in this constructive variant has two rows of balls, so a larger axial gauge, also determined the need to redesign the connecting parts in order to maintain the total height of the spray head. The redesign was made for all types of assembly of 360° spray head components: pin assembly, welding assembly and thread assembly. These are shown in Figures 11 (Pin Assembly), 12 (Weld Assembly) and 13 (Thread Assembly).



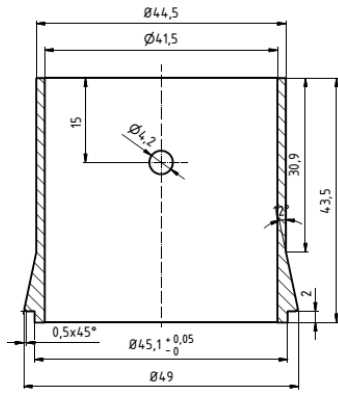


Figure 11. Pin assembly

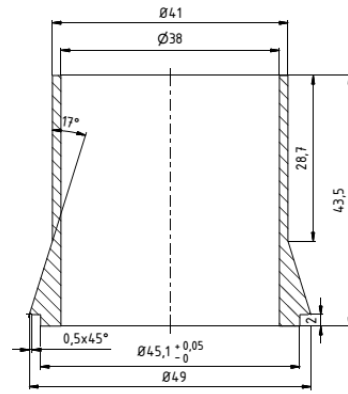


Figure 12. Weld assembly

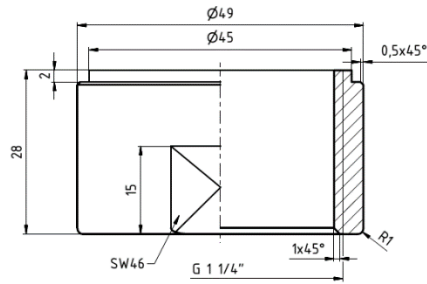


Figure 13. Thread assembly

The final results of redesigning the special bearing (the new constructive solutions, corresponding to the three types of assembly) are presented in figures 14 - 16.

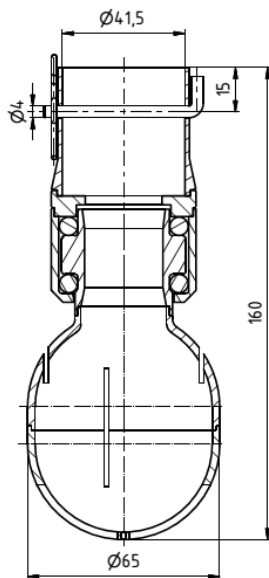


Figure 14. Head assembled with pins

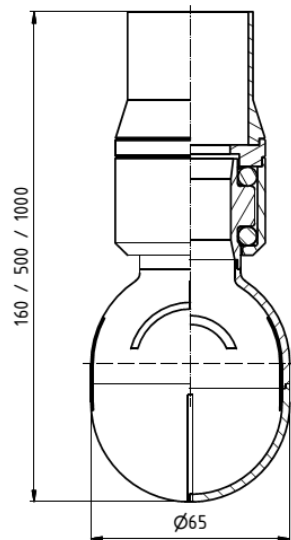


Figure 15. Head assembled by welding

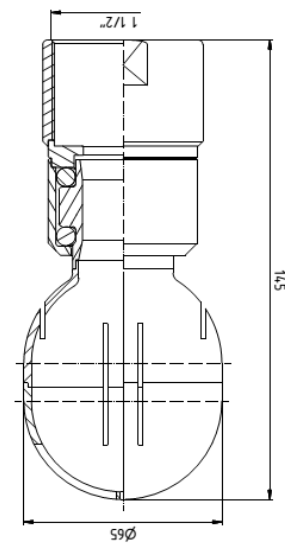


Figure 16. Head assembled with thread

After redesigning, there were performed tests by which the redesigned 360° spray heads were tested in several operating positions, for this purpose a special tank being used, as shown in figure 17. These tests have shown that the improvements have solved all the problems noticed, the redesigned 360° spray heads working properly in any position in which they are inserted into the tank.

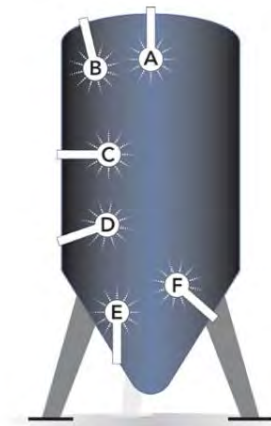


Figure 17. Tank for final testing of redesigned 360° spray heads

## Conclusions

For companies that make products or provide services for organizational customers, customer relationship management becomes a mandatory element to ensure market success. This is accentuated by the fact that the development of a company is no longer necessarily given by the acquisition of new customers but by obtaining the loyalty of the existing ones. Implementing the principles of customer relations is a long-term process that starts from simple customer complaints to the inclusion in the organizational culture of respect for customers and treating them as collaborators to obtain the most appropriate products for their work.

Also, the customer relationship management must be approached as part of the company's business strategy because it is relevant and profitable for the company only insofar as it contributes to achieving the company's objectives and generating value both for it and the customer. This overlaps with the attitude of collaboration and partnership existing between the manufacturer and the customer with maximizing long-term customer satisfaction and loyalty.

For Niob Fluid s.r.o., the implementation of the principles of customer relationship management is already performing and has led to its success and development on the market.

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# IMPLEMENTATION OF LEAN METHODOLOGY IN SALES

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## Abstract

**Purpose** – *The aim of this work is to investigate the possibility to implement the lean methodology in sales.*

**Methodology/approach** – *The main concepts of lean manufacturing were examined: types of waste, lean principles, 5 s. The sales process/cycle were described from the point of view of creating added value instead of waste. The lean concepts were transposed at the level of sales process and sales cycle. The manner how theoretical aspects are implemented in the sales were investigated for six companies which sell doors. The companies are located in Cluj Napoca and Alba Iulia and some of them have more selling points. The investigation took place in june – august 2020.*

**Findings** – *All eight types of waste can be found in sales. They generate supplementary costs, time delay and the possibility of not closing the deal. It was revealed a gap between what means added value for customer and what perceives the sales force.*

**Research limitations/implications** – *The main limitation was generated by the actual situation regarding social distancing. It was not possible to cover a higher number of sellers or to discuss with managers at top level. The persons involved in the study were executives in sales. The study must be extended for the sales of other products and services.*

**Practical implications** – *The work provides to the sales businesses a direction to increase their competitiveness by implementing lean methodology in sales.*

**Originality/value** – *The results provide managerial information for organizing better sales processes and for developing lean sales cycles.*

**Key words:** *lean methodology, performance, sales*

## Introduction

Increasing the sales performance is one of the main goals of a competitive organization. The central idea of the majority implemented methods is to evaluate and increase the performance at the salesforce level. A better approach is to consider the entire organization as a system and to apply the lean principles. A continuous improvement of sales is obtained by finding and decrease or eliminate the causes that affect the results.

### Trends in the management of sales

The development of the markets and the increased competition determined new trends in management of sales. Some of the changes at the process level are related with the shift from transaction to relationship, from individual person to the team level, from volume of sales to the productivity of sales, from management to leadership and from local approach to a global approach. (Baker, 2008)

At the managerial level, in the past, the managers were focused to command and control the activities. Nowadays, the importance of the knowledge at company level become more important than the physical resources. The delegation of responsibility is very often used as leading method. The change was necessary because the clients have less patience in the sales process, it is much easier to sell for all

companies and the success is determined by partnership and long-term relations. The manager is more and more a facilitator in the sales process.

The role of the sales team was transferred to the sales centers. The sales team has a permanent character, the salesforce is stable in the team and has a strategic mission from organizational point of view. The sales center is temporary. Its advantage is to exploit better the sales opportunities, to have a variable membership of the sales force and to be transaction oriented. The center mission is a tactical one.

### **Lean elements**

Lean manufacturing is not a general receipt for goal accomplishment. Many organizations implement lean principles, but this is not a guarantee of achieving all purposed targets from the point of view of content and time constrain. The elimination of non-value added elements from processes is the central idea of lean. The company will have competitive advantage by eliminating the waste at all levels and stages. The sales process can be continuously improved in this manner.

### **Lean types of waste**

Taiichi Ohno (1988) and Shigeo Shingo (1981) established the Toyota famous production systems. Ohno proposed the framework of lean manufacturing. The central idea was to obtain higher results with less resources and effort. The value was defined through the eyes of customers. The concept of waste means everything which does not bring value for the customer. Seven types of waste were defined at the beginning, latter on an eighth one was added. The eighth type of waste is related with the capacity of management to correctly use the human potential of personnel. The first seven types are related with production process.

DOWNTIME is the acronym for the lean types of waste. Their meaning is the following: defects, overproduction, waiting, not utilizing the human talent, transportation, inventory in excess, motion waste and excess processing. Defects are generated by lack or low standards, bad processes, weak documentation or low-quality control. Overproduction has as reasons a wrong understanding of customer needs, a bad forecasting of demand, unreliable processes, long set-up time. Waiting is related with persons and materials. Not utilizing the human talent appears because of poor management, lack of training, assignment of wrong task to the wrong employee and unproper communication process.

The transportation is connected more with the manufacturing plant and is determined by a wrong layout and the existence of multiple storage facilities. It can produce damages of the transported goods and a cost increase. The excess of inventory appears because of overproduction, a wrong connection between purchasing and production, wrong done inventories. The wrong motion of raw materials, equipment and persons have as results non added value time and additional unwanted costs. The supply chain has a moderate capacity to absorb the risks in a traditional organization. (Parthipan, 2015) Last but not least, the excess processing can appear because of insufficient standards, human errors, communications and over reporting.

### **Lean principles**

There are five lean principles. They were proposed by Womak and Jones. These principles are: define and identify the value, map the value stream, create the flow after eliminating the waste from the value stream, establish pull, seek perfection and make lean a part of the organizational culture. The value must be expressed in terms of a specific product or service. The flow has to be continuous for products, services and information.

### **Lean Sales**

The most important aspect which one need to determine is if the sales process creates added value or waste. This is necessary because value and waste are key concepts in lean. The elements which can generate waste mentioned for the sales process are the following (Nissila, 2013):

1. Degree of customization: different customers have different needs and desires. The correctness of market segmentation is very important for an efficient sales process. Some clients can ask for customized products and services. These maybe do not produce so much disturbance for the salesforce, but the effects are much greater at manufacturing and delivery level. The

salesman must try to discover why the client asks for a specific customization and try to avoid it if it is not mandatory for the client.

2. Work partially done: there are too many tasks in progress and nothing to be delivered. The sales process requires many contacts with the customers, many reports, meetings and emails. All of them involve time and energy and generate costs. The unfinished tasks will influence and create other unfinished jobs.
3. Re-Learn: in a sales team there are persons who already know how to accomplish some tasks, but these tasks are assigned to other persons less qualified in that topic. The time necessary to learn and the mistakes that can appear lower the added value of the sales process.
4. Task switching: the team leader must ask a person to do just one thing at one time and not to switch that person from a task to another one. Confusion and mistakes can be generated. Work partially done and re-learning are associated with task switching.
5. Delays: the customers can postpone some tasks because of other priorities they have in their company. This will affect the sales team and the sales process without being possible to avoid it.
6. Defects: the defects which occurs in the sales process are dangerous because very often the client will choose another provider and the company will not have the opportunity to correct the problem.

The five lean principles have correspondence for the sales process. To identify the value for the customer means to do market segmentation and identify the target market. To map the value stream means to attempt a value stream mapping having in mind the potential opportunities. To create the flow is to have a non-disruptive flow for the offer. Establish pull is obtained by delivering only what the client required. To acquire the customer is equal with seek perfection.

### **Sales Cycle**

All activities which are related with closing a sale are included in the sales cycle. There are many definitions of sales cycle. It can be defined as the time from the moment of first approach until the moment of selling. Other definition says the sales cycle is a sequence of predictable stages in order to sell a product. The length of the sales process is very important. A more effective sales department will obtain shorter length of sales cycle than the average of competitors. A longer time to close a sale is very bad because the customer can change his mind or can close the deal with a competitor.

There are seven phases of a sales cycle: prospecting for customers, contact the potential customers, qualify the customer in order to see if he has decision power, presentation of the products and services provided by the company, facing the clients' objections, closing the sale and obtain referrals. The management of sales cycles has as goal the decrease of its time. The literature review mentions the length of a conventional sales cycle as four to six months. A short cycle means less than a month and a long one covers more than twelve months. (Each phase of the cycle must be analyzed. The conversion rate helps us to calculate which stage is the longest. The conversion rate is defined as the ratio between the number of opportunities in one stage and the number in the following stage. It is measured in percentages. (Bean, 2019)

### **Lean Approach of Sales Cycle**

An analysis from the lean point of view, regarding the sales cycle, revealed that the representatives spend only 37% of their time selling. The rest of the time is covered by the administrative and other tasks which generate more types of lean waste in the sales process. Eighty percent of the salesman declared that they need about five meetings in order to close a deal but 44% of them give up after the first appointment. These figures indicate a requirement for increasing the number of representatives who can follow all steps of sales cycle.

A lean approach of sales cycle group the above mentioned seven phases in three stages: the pre-sales activity, the direct selling activity and the post-sales engagement. The sales force and the marketing department work together in the pre-sales activity. Their goals are to increase the customization level and to deliver a standard approach for as many as possible activities. On the other hand, the tasks for each person are correlated with the knowledge and experience of each salesmen, decreasing in this way the non-utilizing the human talent. The main result will be the decrease of time for each step. Decreasing time and waste means implementation of lean in pre-sales activity. To map the selling

process and to create the flow are the main concerns in the direct selling activity. Each salesman who had good result could design standard work and to implement best practices in their activity. Another important aspect for this stage is to monitor the performance of each person and/or team according with the standard key performance indices. The post sales engagement is mandatory after closing the deal. It is not enough to provide automatic order confirmation to the customer. The marketing team must keep on the contact with the client for loyalty programs and referrals. The communication process will consider the lean aspect by eliminating the time and multiple contacts with the same person for the same reasons. (Eisenhart, 2016)

## **Discussion and conclusions**

A study was done in order to investigate if and at which level, the elements of lean methodology are used in sales process of doors. Five companies located in Cluj Napoca and one from Alba Iulia were analyzed. Some of the selected companies have more selling point. It was expected to have the same approach in all selling points, but the results were very different. The selling doors process was selected because the construction sector registers a significant growth. The names of the companies and of the salesmen are not revealed due to confidentiality reasons. They will be called Company A – the one from Alba Iulia, Company B, C, D, E and F – the ones from Cluj Napoca. The letters were assigned according with the alphabetical real name. Company B is a small one, companies C, D and E are big companies and F is a medium size company. E and F firms have more selling points. The discussions took place with salesmen after observing their behavior with the clients and the customer approach manner.

All the salesmen mentioned the existence of in-process waste because they are doing tasks which donot bring added value to their goal. A low efficiency and the existence of mistakes was recognized in four companies. Very often, many of the same sales process stages are not done in the same way each time. A medium to high degree of inconsistency was discovered. Only the company A offers a high degree of customization for the customers, fact providing great added value. The company offers different sizes, different colors or glass type and design. The customer is not obliged to reconstruct the wall area for the door. The re-learn waste was not observed for the big companies but it was revealed in the small and medium firms. Task-switching was very common for the big companies because the salesmen were not enough and when a potential buyer came, the direct manager tried to take over the negotiation and sent the salesmen to the new comer. Another common mentioned problem, was the delay generated by the customers due to the delays occurred in their workshops. Partially done work was also found in all companies. The defects are rare, majority of them are related with broken delivered products.

The analysis of 5S means sorting, setting in order, shining, standardization and sustainability. Sorting was not enough done. Many necessary things were out of the workspace, while unnecessary ones remained, especially in the small company. Setting in order was better for physical objects but not enough done for electronic devices. The salesmen from big companies could provide only standard products and the website of their supplier, without be able to present online catalogs or their own portfolio. Shining was satisfactory in all companies, the process of cleaning and organizing the workspace was quite well done. The weak point was the level of charging the electronic devices in order to show files to the potential buyer or to check previous orders. The standardization was done in theory because all salesmen from the same company had the same training, but in practice the situation was unsatisfactory. The employees from the company F provided different and wrong information. The younger person gave the worst information and when the potential buyer wanted to leave, the older salesman interferes. Instead of recognizing the bad quality of information, the first guy became very impolitely. Unfortunately was not possible a conversation with his manager to see if it is a minus in organization or a wrong person in a wrong job. Sustainability means to create a smooth workflow.

From the point of view of sales cycle, the weak aspect was at pre-sale activity. Majority of interviewed salesmen recognized that they do not put much effort in searching potential customers. They are more involved in passive sales, just waiting for the clients. There are no financial incentives in the big companies. There are some additional money in the medium company, but the salesman declared that are not enough in order to try more.

All the studied companies reach the sales goals and maybe for this reason they do not make more. All companies provided sales training modules but none of them in the lean manufacturing. None of the employees knew about what means lean or lean methodology, in spite of the fact that all the workers

from small and medium firms have university degree. This confirm the hypothesis that the concept is unknown at sales team level. None of the firms calculate the conversion rate.

The main recommendation is to include lean manufacturing trainings for the sales team. The lean methodology can be implemented in all size companies from various types of industries. Eliminating the waste in all stages of sales cycle will help organizations to become more competitive. The continuous improvement at sales process is a must. It is required to define performance indices and correlate them with lean methodology. A starting point can be the calculation of conversion rate for sales stages and the increase of it. Another recommendation is to have regular audit activity performed by supervisors in order to do things according with the standards. To create added value for the customers must remain a central aspect in the sales process. It is required to identify as much as possible the types of waste and implement plans for it in terms of quality, time and costs. The company has to learn which are the gaps between where they are and where they want to be.

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# STUDY REGARDING THE INCREASE OF LEAN COMPETENCE IN AN ORGANIZATION

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## Abstract

**Purpose** – *The aim of this work is to investigate the theoretical and practical aspect regarding lean competence. An analysis was done for soft assets.*

**Methodology/approach** – *The lean competence of the soft assets was evaluated using the skills matrix. The matrix was implemented in June 2020 for a team which work in production, in automotive industry. The desired skills are elimination of wastes, calculation of takt time and lead time, using Poka Yoke instruments, identification of bottlenecks, knowing the push and pull approach. The matrix will be updated at every two months.*

**Findings** – *Three out of the six desired skills are at good level. At the individual level, the manager and the supervisor had good scores, above 20 points. Only two workers had a score higher than the ten points threshold specified for persons. The workers with the score less than ten points will attend lean trainings. The threshold for the skills was three. It is required training for two skills out of six.*

**Research limitations/implications** – *The skill matrix could not be implemented to other teams because of the new comers. They do not have yet the basic trainings and the minimum work experience.*

**Practical implications** – *The skills matrix provided information regarding which skills and which persons need additional training.*

**Originality/value** – *The instrument can be implemented for other teams in order to help the organization to increase its lean competence. The matrix will be updated when the composition of the team is changed or when new competences*

**Key words:** *competence, lean, skills matrix*

## Introduction

The paper should be between 1500 and 3000 words (including references). Type all paper, except tables, single-spaced in 11-point type Arial font. Type in block form, with an extra double-space between paragraphs. Use footnotes sparingly. Organize the manuscript by using primary, secondary, and tertiary headings rather than numbered headings.

## Lean approach

The lean approach has its roots on the shop floors of Japanese Toyota Motor Corporation. The first publications in the field belonged to Ohno (1988) and to Womak and Jones (1990). The word lean describes all activities done to improve the process, to increase the added value and to decrease the wastes and the non-added value. The final customer defines the value, which is the starting point for each lean approach. The set of activities which convert a product is the value stream. The next step is to make the value flow. Products are produced and delivered only when the customer asks for them, according with the fourth lean principle. To follow the perfection must be developed through the company. The interest was focused for quantifying the effects of a lean tool on performance. Later on, the researchers were interested about organizational capabilities to create a lean company.



The continuous improvement is conditioned by establishing the importance of the people. (Emiliani, 2011). Companies putted many resources and much effort in order to train and empower the workforce. The soft assets of the firm become more important. The workers are multifunctional and are able to perform more types of jobs.

According with Russel and Taylor, among the lean benefits are listed the following: the increase of productivity, lower stocks, reduced costs, reduce the space required for activities and a shorter lead time. The company flexibility is greater and has a bigger variety of products. In addition, it has a superior relation with the suppliers. It is noticed a better use of human potential.

### **Resources, Capabilities and Competence**

Each company has different resources, capabilities and competencies. The resources consist of all type of assets which are used by the company for implementing the strategies. The capabilities are the attributes that enable the company to exploit its resources and implement the strategies. (Barney and Arikan, 2001). So, the main difference between resource and capability is that capability is related with the capacity of the management to build a means to distribute and manage resources for a goal. The capability is the aptitude to do something. It is specific for each company. Wu stated that a capability is not perceived by the customers and / or the organization (Wu et al, 2010). Capabilities can be developed and improved. They cannot be purchased and have to be developed inside the company.

The competence was defined as a set of skills which allow to a company to perform better than its competition (Coats and McDermot, 2002). The competence is considered also as a combination of resources and capabilities, improved by the synergy effect between them. It provides a higher competitive advantage at a faster speed than competitors can copy. The competence is perceived by the market and shows the organization performs at high level. The abstract character of the competence concept made it difficult to be applied in practice. The most important starting point is to provide a good definition of competence.

The literature review revealed different descriptions of competence. One approach was related with the financial results on shareholder value based on market return. The other approach didn't target financial result, using internal management sources. The next level of conceptualization was to link the competence and capabilities with financial flows (Kothari and Lakner, 2006). The theoretical definitions were not good enough for the usage of employees. There were added elements as value delivered, the attitude of workers or skills used within the organization. Some of the competences lost their importance in time because the competitors developed competing capabilities.

### **Lean Competence**

Nowadays, many organizations shift forward to a lean approach, trying to minimize the waste, to increase the added value and improve the competitiveness. Miller proposed a four level model for the lean competence of a company. The four levels of competence are:

- Unconscious incompetence: companies which did not hear about lean
- Unconscious competence: firms which did not hear about lean but they have some lean behavior.
- Conscious incompetence: companies where lean was studied fail in practicing lean behavior.
- Conscious competence: employees learn about lean and are able to perform lean processes and lean activities. (Miller, 2017)

It is mandatory for a company which want to reach lean competence to address questions at the following levels: company purpose, aspects regarding people, problem solving and management process. The firm has to decide if is interested in better financial results for short term or in long run sustainability.

Soft assets of a company are an important lean competence source. Competence means more than knowledge and skills. Michalicki et al, illustrated the steps from information to the competence. The possession of information and the capacity of cross-linking information generate knowledge. The knowledge and the ability to apply the knowledge provide skills for the workforce. The skills supported by the correct doing through experience offer competence. The competence generates competitiveness.

## **Skills matrix – theoretical aspects**

The skills matrix is related with the value stream and shows how internal assets deliver value. It is an instrument which allows to illustrate and evaluate the workforce skills and the knowledge of managers and executives. It is created in two steps: identification of competences and filling the matrix. A periodical update of it is required. The following steps are required for a skills matrix:

- To identify the mandatory skills and add them in a row
- List the names of the team members in a column
- Each team member tells what skills posses
- The identification of risks and knowledge gap
- Formulate a knowledge sharing program.

A simple type of skills matrix indicates the knowledge possession with a symbol, for example x mark. The knowledge/ skill level is scored in the more evaluated matrixes. There are four levels: basic understanding, able to achieve a task with somebody supervision, able to perform a task alone, capable to train other persons. The matrix shows the knowledge and skills needs. Another information which is provided is if the team members are able to transfer knowledge within the team or it is necessary to have an external trainer.

The skills matrix can be improved by adding information regarding the interest of the team members in further development of a skill. It also provides hints about workers ambition level in the field. This can be done by adding a second column for a second score. The first score reflects the actual level of the skill and the second score indicates the desired level of that skill. The second column can be view as a mirror of ambition.

The matrix can be developed further by introducing peer reviews or team review. This is done by adding a third column for the score given by the team. This approach is indicated more for mature teams. If the team is immature the third column is not recommended because the team members will waste more time and effort in checking what are doing their colleagues instead of their own development.

### **Skill Matrix Case study**

The goal of this study was to do an analysis from the point of view of soft assets for a team from an automotive Romanian company. Due to the confidentiality reasons, the name of the company and the production department are not revealed. The company has implemented many of the lean methodology elements. It is a great interest in developing in this direction. The analyzed team is a young one. Not all the members had trainings in the lean field. Part of their knowledge is more theoretical and obtained from university. The team has five members under the coordination of a project manager for a specific product and client.

The skill matrix was done in June 2020 and must be revised every two months. The matrix was realized in the simple form, having just one column for each skill. This column indicates the level of skill evaluated by each worker. The desired skills are elimination of wastes, calculation of takt time and lead time, using Poka Yoke instruments, identification of bottlenecks, knowing the push and pull approach. The skill matrix was practically done using the free version of the continuously improvement toolkit in online version.

The skills matrix is presented below.

Skills Matrix									
Leader: Name Surname		Department: Production		Date: June 2020		Legend: 4 3 2 1 0			
				Team other to perform		Perform effectively		Perform	
				Trainer level		Expert		Moderate experience	
				Basic awareness		Not familiar			
ID	Name	Job title	Calculation and use of Lead Time	Identification of bottleneck	Knows push and pull approach	Calculation of takt time	Using Poka Yoke instruments	Elimination of 7th types of waste	Score
1	Worker 1	Project Manager	4	4	4	4	3	3	22
2	Worker2	Supervisor	4	4	2	4	4	2	20
3	Worker 3	Operator	1	3	0	1	2	2	9
4	Worker 4	Operator	2	2	1	0	3	3	11
5	Worker 5	Operator	0	2	0	0	2	2	6
6	Worker 6	Operator	2	2	1	2	3	4	14
Score per skill:			13	17	8	11	17	16	
3	Threshold	Training required?	2	0	4	3	0	0	

Figure 1: Skills matrix for a production team

Three out of the six desired skills are at good level, obtaining the scores 16- elimination of waste and 17 for identification of bottleneck and usage of Poka Yoke instruments. The maximum possible score to be obtained is 24. The worst skills are related with the push and pull approach. It gained only 8 points. Skills about calculation and usage of lead time and takt time are at an average level, obtaining 13 and 11 points. At the individual level, the manager and the supervisor had good scores, above 20 points. Only two workers had a score higher than the ten points threshold specified for persons. One is close to the threshold, having nine point, but the last worker has poor result with six points. They will attend lean trainings. The threshold for the skills was three. It is required training for takt time calculation and for push and pull approach.

The company must improve the skills of this team. The study has to be extended to the other teams. The matrix can be improved by adding the second column for desired level of skill for each person. The version with three columns can be implemented only for mature teams. The matrix will be updated when the composition of the team is changed or when new competences are required.

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# STUDIES AND RESEARCH REGARDING THE ONLINE MARKETING AND THE RELATED CONSUMER BEHAVIOR

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## Abstract

**Purpose** – *This paper aims at highlighting the importance of online marketing in the Internet and e-commerce age, providing, at the same time, a basic understanding of the main techniques that can help a business stand out organically (for free) in the online environment.*

**Methodology/approach** – *This paperwork comprises a marketing study on the consumer behavior in relation to online marketing. This marketing research is a quantitative one, the survey being the method used, while the questionnaire is its research instrument. The sampling method used is a random one, based on accessibility. A sample of 331 natural persons has been surveyed.*

**Keywords:** *Marketing research, consumer behavior, SEO (Search Engine Optimization), blog and social media.*

## Introduction

Nowadays, the companies can no longer ignore the importance of online marketing in their effort to be always one step ahead of their competition. The digital age has brought the access to an unlimited variety of products, which, in its turn, has radically changed consumer behavior.

In order to be able to choose from among all these products, nowadays consumers turn to the online environment, searching for useful information and advice, instead of commercials. Likewise, they are choosing more and more online shopping, for convenience. Moreover, the Z Generation, the new demographic group that will represent future customers, expect everything to be done online. Thus, it will become extremely difficult for the companies which do not yet exist online to attract them.

In this context, this paperwork is meant to be an online marketing introductory guide, useful to any manager or entrepreneur interested in this matter. Therefore, this work features the three main instruments used in order to bring organic traffic (free of charge) to any website: SEO, blog and social media.

SEO, the search engine optimization, represents all the actions taken to get a web page appear among the first pages, as a search engine result. SEO includes both technical aspects and content-related aspects. The company's blog can be used as a valuable source of information and as an efficient way to communicate with the customers. The external links to the blog articles contribute, to a large extent, to the SEO efforts. Since it is getting more and more popular, social media is a good way to build a name for the company's brand and to create a community around the company's products. The attention received by social media also contributes to the SEO.

The applicability of all these theoretical concepts is practically proven by using a study on the consumer behavior in relation to online marketing.

## Methodology

This marketing research is a quantitative one, the survey being the method used, while the questionnaire is its research instrument.

The purpose of the marketing research is that of studying the consumer behavior in relation to the online marketing.

The data sources are primary sources, since the information comes directly from the people surveyed. For the distribution of the questionnaire, the Google Forms online platform has been used.

For the questionnaire, we have used: dichotomous questions, frequency scale questions (always, often, sometimes, rarely, never) and importance scale questions (very important, important, neutral, less important, not at all important) and identification questions. The questionnaire has 25 questions, six of which are demographic questions.

The pretesting of the questionnaire has been done on a number of five subjects and the results have not been included in the final data. Following the pretesting, certain questions have been amended, some questions have been removed and others have been added. The final survey has been conducted on 331 natural persons, their selection being carried out according to a random sampling, based on accessibility.

## Results

Based on the results, we can say that 91% of the surveyed people shop online regularly, as compared to only 9%, who do not.

Among the people who have answered „Yes” to the first question, most of them use to buy products online once every 2 or 3 months (37%), followed by several times per month (24%) and once per month (20%).

The overwhelming majority of 98% of the people surveyed use internet to look for information about certain products they are interested in. We can say that it is important for a company to make the details, information and advice about its products available online.

The answers received show that the mobile phone is the most often used device for searching online information (59%), followed by the PC or the laptop (39%). Only a small percentage of the subjects surveyed use the tablet for such a thing (2%).

Although, as expected, most of the consumers who look for online information, also buy the products through the Internet (65%), a significant percentage of the people surveyed would rather make the final purchase in a physical store, when possible (35%). Therefore, a strategy that combines online presence with „brick-and-mortar” type shops is the most advantageous strategy for a company these days.

Most people in the group surveyed, namely 83%, believe that the assertion „The more expensive a product is, the more I look up information about it before purchasing it.” Is a true one. It is a good thing for the companies to provide as much information as possible about such products, as reviews, tutorials, blog articles etc.

The most important factors in the consumers’ decision to buy certain products are, in the following order: de reviews/other consumer opinions (274 votes), comparison between product specifications (230), video tutorials or articles featuring how the product can be used (121), pictures of the product (74), reviews/opinions of public figures/influencers (31), the commercial of the product (13). Thus, the commercials have considerably less impact upon the consumers as compared to the reviews, tutorials and online articles.

89% of the people surveyed look for a company, a product or a restaurant they have just heard of or which is new for them online, proving the importance of a company’s presence on the web, especially at the beginning, when it is trying hard to build a name and be renown.

Most of the answers to this question have constantly fluctuated during the questionnaire, so as, in the end, the assertion „Nowadays, if a company does not have a website, it is not to be trusted.” is generally

considered as being true, (51% vs. 49%). Although the difference is a small one, the companies who still want to remain competitive should seriously consider the fact that they could lose half of the potential clients by ignoring this basic online marketing aspect, namely the company's website.

83% of the people taking part in this study confirm that when looking for something on Google, if they do not find relevant information on the first two pages, they change the search words and try again.

A fairly large number of subjects read the online articles completely, always or often (142). Nevertheless, in order to maximize the number of readers and online articles on the company's blog, it would be a good idea for the company to take into consideration also those people who do not do this regularly (189), by creating articles that are easy to scan according to the methods presented in chapter III.

The clickbait-type articles are seen with distrust by the readers and are a good way to attract them. Besides the 86% of the subjects surveyed, who believe that such articles "seem to try to trick you," 11% have filled in: "They drive me crazy." „Are horrible!" „I'm sure they're useless." etc.

202 of the 331 people taking part in the study believe that optimizing a website for the mobile phone is very important, strengthening the results obtained at question number 4. For a pleasant experience of a website's user, it is not enough for the website to be well done exclusively for the desktop version.

As we all know, most of the of the Romanian consumers use social media. 96% of the people surveyed do it regularly, as compared to only 4%, who do not use social media.

It is not surprising that the most used social media are Facebook (274 votes) and Instagram (170). The utilization rate of Twitter, LinkedIn or Snapchat cannot yet be compared to that of the first two, although in other countries these are much more popular (for instance, Twitter is used extensively in the United States).

Most of the people taking part in this study said that their interest in certain products increases when the said products are shown in pictures, videos, stories or other posts on social media (64%). The relationships with the influencers or the customer promotion crowdsourcing are those that help the most, so as the content in these posts is as natural as possible.

The targeted/customized online commercials rarely (77 votes) or even very rarely (165) attract visits on the product presentation pages. Therefore, online promotion should be done organically and as natural as possible.

In the end, a few coordinates related to the profile of the studied sample will also be presented.

65% of the people surveyed have been females and the remaining 35% have been males.

Most of the subjects, 59%, were aged between 24 and 39 years when the study has been conducted, being part of the Millennial generation. The following age categories, according to the number of participants to the study, are: the Z Generation (28%), the X Generation (11%) and the Baby Boomers Generation (2%).

Most of the (92%) investigated people come from an urban environment.

The three main occupations of the people surveyed are, in order: salaried employee (67%), pupil or student (25%) and entrepreneur/freelancer (4%). The emergence of the third category shows the fact that entrepreneurship and freelancing also get a running start in our country.

Most of the subjects have Bachelor studies (47%). A pretty significant percentage is represented also by those people who have completed the master studies (33%).

The main fields of practice of the subjects surveyed, when the study has been conducted, are, in order: IT (22%), engineering (17%), marketing (15%), healthcare (11%) and economic (10%). The remaining percentages have other practice fields, such as: education, architecture, psychology, design, law.

From the point of view of the net monthly income per each family member of the people surveyed, it has been noted that 29% fall within the 3.001 – 5.000 RON category and a quarter fall within the 2.001 – 3.000 RON categories and within the 5.000 RON category respectively. Likewise, it is important to

mention the fact that the question being optional, only 299 of the overall number of 331 have answered these questions.

## Conclusions

With the advent of the Internet, the world has radically changed. The abundance age, brought by the fact that the Internet makes any kind of product available to anyone and anywhere, had a significant influence upon the consumers' behavior. They no longer trust as much as before the traditional commercials; instead, they look for useful information and advice, which would help them making decisions about the products they want to purchase. Furthermore, the consumers turn their attention, more and more, towards online shops. All these make the companies turn to online marketing, even more so if we consider the fact that the Z Generation, the future clients, expect everything to be done in a digital environment. Any company ignoring these aspects will have problems in keeping up with its competition.

SEO (Search Engine Optimization) is the most important aspect when it comes to online visibility of a business. Regardless of how good the content of a company's website is, it cannot be appreciated if it cannot be found. SEO refers to all the efforts that make a webpage appear on the first pages with results for a certain Google search. The technical aspects are equally important as using the key words searched by the users or as obtaining the external links.

The company's blog is a very powerful online marketing instrument, contributing both to the SEO and to the direct communication with the customers of the potential clients. In order for it to be efficient, one must take into consideration certain article editing rules, based on the fact that people read the online content in a different manner as compared to the content of a book or a magazine. Due to the fact that the users look for usefulness and, many times, they make their search in a hurry, their attention in an online environment is limited. This is why an online optimized article is easier to read, providing exactly the information that the readers are looking for, in a format that they can easily scan with their own eyes.

Social media are increasingly being used, both worldwide and in Romania, being an excellent way to increase a company's online visibility and a brand's fame. The choice of the best social media for the promotion of a business is done depending on the consumers the said business wants to attract, the most popular being Facebook and Instagram. In order to avoid getting the opposite effect, social media promotion must comply with a certain format the users are used to and expect to see. A content as natural as possible, coming from other users or from trustworthy people has a great impact upon consumers. Therefore, the collaboration with influencers or the use of the content created by the clients are efficient social media promotion techniques.

The relevance of all these theoretical aspects has been proven in practice by using a 25 question questionnaire, for which, 331 answers have been received. 91% of the people surveyed shop online regularly, while 98% look for the online information they are interested in. Most of the subjects, 83%, do not get pass the second page of results when they are looking for something on Google, proving the importance of the SEO. The traditional commercials have a much less influence upon the consumer decisions as compared to the video tutorials or articles that show the way in which the product can be used (15 vs. 121 votes). Moreover, 96% of those taking part in the study use social media and 64% of them say that it is very likely for them to be interested in a product they have seen in a picture, in a video or in a post on these social media.

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**Globalization and  
internationalization in education  
and medical services: Theoretical,  
strategic and management  
perspectives**

# STUDY ON THE GLOBALIZATION OF INFORMATION IN THE ONLINE EDUCATIONAL ENVIRONMENT DURING THE COVID-19 PANDEMIC

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## Abstract

**Purpose** – The paper aims to study the globalization of information in the online educational environment during the Covid-19 pandemic.

**Methodology/approach** - The online teaching activity during the emergency period focused on the realization of projects by students and their online presentation. The project was presented online and after that the authors proposed to colleagues a game through which to fix their knowledge or to develop their skills / competencies.

**Findings** – The results of the study focus on the following directions: Globalization of information; Flexibility of information; Ability to use information; Motivating students through information.

**Research limitations/implications** – The research results refer strictly to the statistical population mentioned in the article. A larger statistical group is needed to generalize the results.

**Practical implications** – The research results can be used to establish educational strategies for the online environment at the university level.

**Originality/value** – The research is innovative and can support new educational policies for the pandemic period.

**Key words:** Globalization of information, e-learning, blended learning platforms

## Introduction

Globalization is a phenomenon of transforming the world into a unit, which manifests itself on a global scale through the creation of supranational political institutions and bodies, through a common economic and security policy, etc. (DEX, 2016).

Information is power at the moment in the context of the technical-scientific revolution. The channels of information propagation are represented by net networks, specific programs and applications on a global scale (Diaconu, 2014). The globalization of information is manifested by the promotion of information strategies, beyond what we define classical borders of the national state, aiming at prioritizing information and developing information culture on a global scale (Diaconu, 2014).

In the field of sustainable management and quality (Bratu, 2019a; Enescu, 2018), the principle of open source solutions is already widely used (Bratu, 2016; Bratu, 2019b). In education we find such examples, but face-to-face learning predominates.

The online educational environment includes blended learning platforms for educational institutions and is an alternative to simplify the teaching-learning process (UMFCD, 2020). Adapting teaching-learning strategies in the online environment involves adapting the managerial style of teachers, to model learning behaviors and increase the quality of teaching through creativity and ability to use online resources (Bratu, 2019; Bratu, 2018a; Bratu, 2018b; Cioca, 2020).

Given the local, national and global context, being declared a COVID-19 pandemic by the OMS (Javelot, 2020), the educational process took place online in the next period. The Google Classroom platform has been designed so that teachers and students can communicate and collaborate effectively in the online environment. Thus, along with the face-to-face meetings, the students carry out their individual study, accessing the course materials available in eLearning format.

## **Methodology**

The study on the globalization of information in the online educational environment during the Covid-19 pandemic aims at analyzing students' activities in the online environment and offers teachers some benchmarks on classroom management strategies to optimize learning.

The research problem presented by the paper is the analysis of students' activity in the online environment.

The target population of the research was a number of 69 students - bachelor and master, in the field of Economic Engineering and European Project Management, who studied the disciplines Human Resource Management and Project Team Management. The students were organized into three classes on Google Classroom.

The tasks of the students during the classes on the Google Classroom platform are the following:

- Perform tasks at each seminar;
- Post comments on each topic;
- Present projects online;
- Explain to colleagues the tasks to be performed;
- Develops interactive games with colleagues that aim to apply theoretical information.

Playing games with students is a trend in e-learning, for consolidating information, acquiring skills and developing personality (Stevenson, 2018; Alsharif, 2018).

Each team carried out a project on a topic in the field of human resources management and the project team.

Were analyzed the resources used by students to organize games / applications for colleagues during the presentation of projects. The following items were followed:

- Variability of applications used by students.
- Content of applications:
  - o Assess knowledge;
  - o Apply concepts;
  - o Evaluate the personality.
- Student involvement:
  - o Emotional;
  - o Cognitive;
  - o Physics (online presence at the right time).
- Results obtained in applications / games.
- Feedback provided by students regarding games / applications.
- The impact of Covid-19 and social isolation on learning activity.

## **Results**

Out of a total of 69 students, 68% are female and 22% are male; 81% are students in the first cycle of studies - bachelor, and 19% are students in the second cycle - master.

The notes from the project reflect the quality of the scientific content, the use of technology, innovation, organization of applications. The marks were between 7 and 10, 72% obtaining marks of 9 and 10. The average mark obtained was 9.04.

The grading of the seminar activity was done according to the involvement and solving of the tasks given by colleagues, communication with the group, compliance of the deadlines for applying the games. The grading range was between 1 and 10, 12% had grades between 1 - 4, 12% between 5 - 7, and 76% greater than or equal to 8. The average grade at the seminar activity was 8.28, and standard deviation of 2,468.

The final score obtained by the students, after summing up all the items tracked, was between 13 and 31, with an average of 25.94 and a standard deviation of 3,650. It should be noted that the maximum expected grade was 27, for the maximum standard of 100% of tasks, but the expected level of average was 26.

The use of online platforms by students was assessed in order to monitor the extent to which they have access to information and how they take it. Excluding the use of the Microsoft Office - Power Point package, students use between 1 and 4 platforms, according to the figure below.

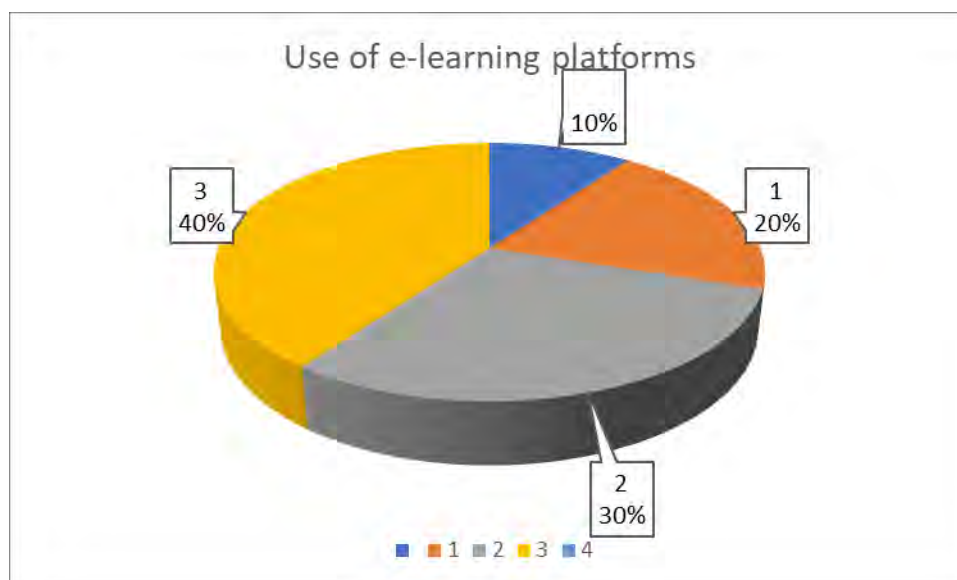


Figure 1. Use of e-learning platforms

The applications made by the students evaluate the knowledge transmitted in proportion of 46%, evaluate the personality 67% and apply concepts 61%. The applications implied students at the cognitive level in proportion of 99%, emotionally 77% and physically 99%.

96% of students communicated easily with colleagues, passed on clear tasks and responded to colleagues. The feedback provided by colleagues was 100% positive.

Following the statistical analysis it is observed that the following data are correlated at a moderately positive level:

- Field of study with the application of concepts and personality assessment. The higher the level of study of students and implicitly their age, the more complex the applications made by them and target the personality as a whole.
- Use of e-learning platforms with the application of concepts and personality assessment. Students who use multiple learning platforms tend to view learning as a whole, as a process not only of reproduction but of personality formation and development.

- Personality assessment and emotional involvement of students. Applications that require the development of students' personality require an emotional response from them, so the degree of emotional involvement also increases.

There was a strong correlation between the final score of the students and the evaluation of the seminar, according to the chart below.

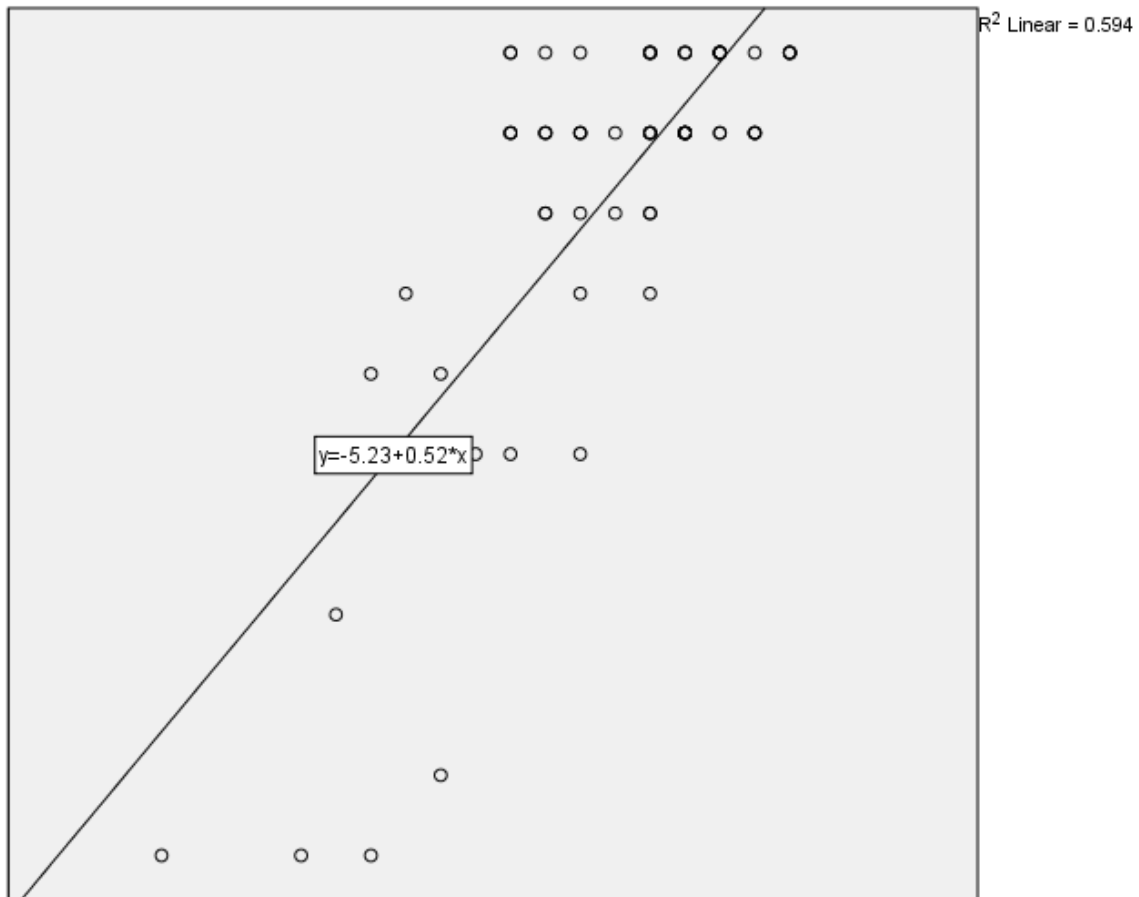


Figure 2. Correlation between the final score of the students and the evaluation of the seminar.

Students who were involved throughout the online learning phase by solving tasks, communication and feedback provided, used most e-learning platforms and developed the most complex applications, which led to superior final results.

In conclusion, online learning is more successful if it is staggered over time, is supported by constant interest and desire for knowledge.

### Discussion and conclusions

The globalization of information in the online environment has the following effects at the level of students:

- Browse and download more information from the online environment;
- Use several online applications;
- Uses technology at higher level than in the first semester;
- The open access system motivates them in the study.

Another interesting element to note is that the projects bibliography included only online links, even the cited books were in electronic format.

Following the analysis of the activities carried out in the online educational environment, the following management strategies from the perspective of information globalization are recommended to the teachers:

- Punctuality to scheduled activities.
- Composing an informal environment in the situation of teleconferences, characterized by simplicity, non-protocol, including clothing.
- Indulgence of disturbing factors that may occur in communication (problems with technology, meeting primary needs - food, food).
- Clear conceptualization of the problem, clear setting of learning goals and objectives.
- Use of negotiation strategies, moral support, as well as ritual and routine.
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# VIRTUAL EDUCATION, A CHALLENGE FOR THE MANAGEMENT OF THE ROMANIAN UNIVERSITIES

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## Abstract

**Purpose** – The authors tried to analyze eLearning, because the 2020 pandemic crisis showed an old weakness of the Romanian education system. The analysis was seen as a social phenomenon in the entire Romanian education system, in which the need for eLearning became evident after March 15, 2020, the date that affected many elements of society, including education.

**Methodology/approach** – 19 questions, through an electronic questionnaire, to which 200 respondents answered, formed the basis of the research methodology and was applied to a group of 200 respondents between April 29, 2020 at 1 pm and April 30, 2020 at 1 pm. It is specified that the respondents are students at the University of Petroșani for undergraduate and master's studies in the academic year 2019-2020.

**Findings** – The lack of an eLearning platform led to the sending of courses to students by email in pdf format. The lack of teacher training was limited to 50% of the effective percentage of online courses and only to 30% in videoconferencing. The students being more adaptable participated in a higher proportion in the courses from March to May 2020, counting 87%. It should be noted that 42% used the phone for this activity.

**Research limitations/implications** – Even if the respondents, as mentioned, are only from the University of Petroșani, the study can be extrapolated to provide an image for the Romanian education system.

**Practical implications** – The demonstration of the representativeness of the University of Petroșani in relation to a national education system for the implementation of eLearning in crisis situations leads to the important conclusion of this short research. This conclusion says that Covid19 has changed education in Romania, and classical education is likely to undergo significant changes because of these three months of exclusive online education.

**Originality/value** – Romania did in two months what it has not done in years, so at the beginning of May, most schools and universities migrated to an online education system.

**Key words:** eLearning, teaching process, digital tools, education platform, virtual classroom

## 1. eLearning in Romanian Education System

### 1.1. An Overview of the Educational Platforms in the Romanian Education System

The analysis of the stage of implementation of eLearning in the primary and secondary education system in Romania was a necessity for evaluating the impact of eLearning for Romanian education during COVID-19. In Romania, the eLearning software market has been dominated since 2000 by the company SIVECO, which developed the AeL solution. This solution has been implemented in the primary and pre-university system. There are implementations of this solution in other fields as well, including at the University of Petroșani through the implementation in the period 2010-2013 of a European project PODSDRU 59676, focused on eLearning in partnership with SIVECO Romania SA. In recent years, Ascedia SA has appeared on the Romanian eLearning market, providing the LMS LIVRESQ solution, delivered together with the use of free licenses for education offered by Google and Microsoft (G Suite and Microsoft 365 A1). The Ascedia solution is aimed at the pre-university environment. It should be

noted that both companies have formed a partnership with the Romanian Ministry of Education and Research (MER).

The analysis cannot be limited to the pre-university system. For example, the history of eLearning in the university system begin with Spiru Haret University (SHU), that has used a Learning Management System (LMS) platform called Blackboard Learn for teaching, collaborative work, testing and student management since 2006. This platform has increased the number of SHU students 10 times in 4 years, starting with 2004.

In the years since the appearance of distance learning (DL) in Romania, in 1995, 58% of universities stated to use eLearning solutions. Currently, all Romanian universities use eLearning platforms, the most popular being Moodle. There are also platforms from Google and Microsoft.

Because the study analyzes the University of Petroșani, the authors analyzed the evolution of eLearning at this university. The University of Petroșani started in 1998 the first study programs focused on a DL structure. In 2011, a LMS (Learning Management System) eLearning platform called CourseMill was implemented. (Lupu, Edelhauser, Ionica, 2010), (CourseMill, 2020) Currently there is a small eLearning platform based on Moodle, insufficiently customized, without virtual classes, without content, without test modules, which places the University of Petroșani at the bottom of the ranking of Romanian universities in terms of virtual education. This situation is abnormal because at UPET there has been a collaborative educational platform from Microsoft-Office 365 A1 since 2013. (Edelhauser, Ionica, Lupu, 2010 b).

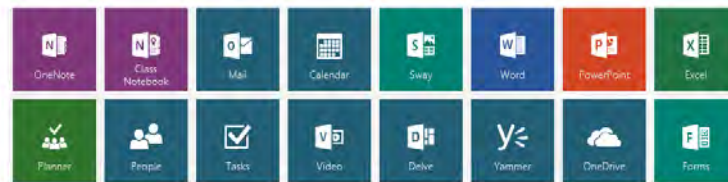
Overall, the technical or administrative details, the main topic was the ability of eLearning to replace classical education or their combination. Everything starts from meeting the quality criteria from a pedagogical, academic, administrative and technical point of view. Research to date reveals eLearning capabilities if it has a proper design. Criteria to be met, with decisive value in an eLearning system are the quality criteria to which each element is equally important - Institutional support, Teaching and learning, Course development, Support for faculty members, Course structure and Evaluation.

Google and Microsoft have developed digital education platforms. Google's G Suite for Education contains tools that integrate new technologies into teaching and improve teaching, learning, and collaboration in schools (Figure 1). Microsoft for Education offers similar tools so that each student can achieve better learning outcomes. Teachers receive tools for organizing virtual classes, by planning lessons, until maintaining a constant connection with colleagues (Figure 2). In Romania, any educational institution can activate for free the free version of G Suite for Education and Microsoft 365 A1. (Edu365, 2020)



Îmbunătățește predarea, învățarea și colaborarea în școala ta

Figure 1. School 365 Platform for Education G-Suite for Education



### Caracteristicile platformei Școala365

Principalele caracteristici ale platformei Școala365 sunt instrumentele inovatoare necesare pentru gestionarea fiecărei instituții de învățământ. Acestea facilitează sistemul de management al școlii, catalogul electronic, predarea, învățarea, comunicarea profesor-elev-părinte și multe altele.



#### Catalog Electronic

Catalogul școlar electronic asigură comunicarea directă părinți - profesori - elevi, trimite notificări în timp real despre note, absențe, ședințe, teme.



#### School Management

Cu sistemul de School Management (Secretariat365), administrația școlii are o imagine de 360° a activității școlare.



#### Integrări365

Platforma Școala365 are potențialul de a transforma clasa tradițională într-o experiență unică și inovatoare de învățare pentru toți elevii.



#### Social365

Este un instrument digital de comunicare, conceput și dezvoltat special pentru școli.

Figure 2. School 365 Platform for Education Microsoft for Education

The strategy of a mix of platforms was the path followed by Romanian universities, to be able to support distance learning or part-time learning. The University of Oradea and the Transilvania University of Brașov use Moodle. Politehnica Timișoara has its own version of a virtual campus. The Technical University of Cluj Napoca and Politehnica București use the Microsoft Microsoft 365 A1 platform. Lucian Blaga University of Sibiu and the University of Craiova use Google G Suite. Gheorghe Asachi University of Iasi uses Microsoft Microsoft 365 A1 and Google G Suite.

## 1.2. Designing an eLearning Platform at the University of Petroșani, using Microsoft 365 A1 Licence

The success of an educational process is offered by the collaborative work and the continuous communication, fact accomplished by the complete use of the resources of the Microsoft 365 platform. This platform allows the centering on the student needs, as it happens in the traditional education (Figure 3).

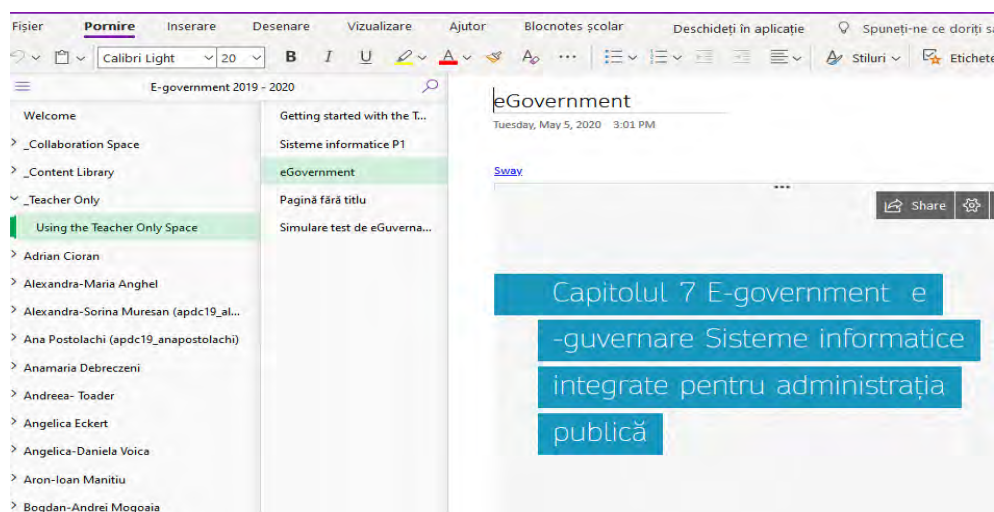


Figure 3. The structure of a virtual class in OneNote Class Notebook.

The authors' experience in using the platform, allows the exemplification of the way of working in mixed regime. In the classroom, students access their resources, assigned to their own account, in order to be able to present their work. (Edelhauser, Lupu, 2012), (Edelhauser, Ionica, Lupu, 2010 a)

Also, in class, students load all their activity individually, in the specified sections, thus giving the student the opportunity to continue their study at home. This method also provides information security and compliance. (Edelhauser, Ionica, Lupu, 2010 b)

## 2. eLearning during the COVID-19 Pandemic at the University of Petroșani

### 2.1. Methodology

"Is Romania ready for eLearning in the period of the coronavirus pandemic 2019-2020?" is the question around which the study carried out at the University of Petroșani revolved. To collect the information, the authors used an online questionnaire, with 19 questions, the respondents being students of the University of Petroșani, of the academic year 2019-2020.

### 2.2. Respondents

The questionnaire was completed by over 200 students from the University of Petroșani, and the data were collected for 24 hours, starting with April 29, 2020 at 1 p.m. the data collected allowed the authors to ascertain the existence of trends in online education. The analysis of these tendencies allows the proposal of useful measures for decision makers in the university or in the education system.

### 2.3. Findings and discussions. Graphical results

There have been opinions that the pandemic has increased the level of importance of eLearning. This explains question Q1 (Figure 4).

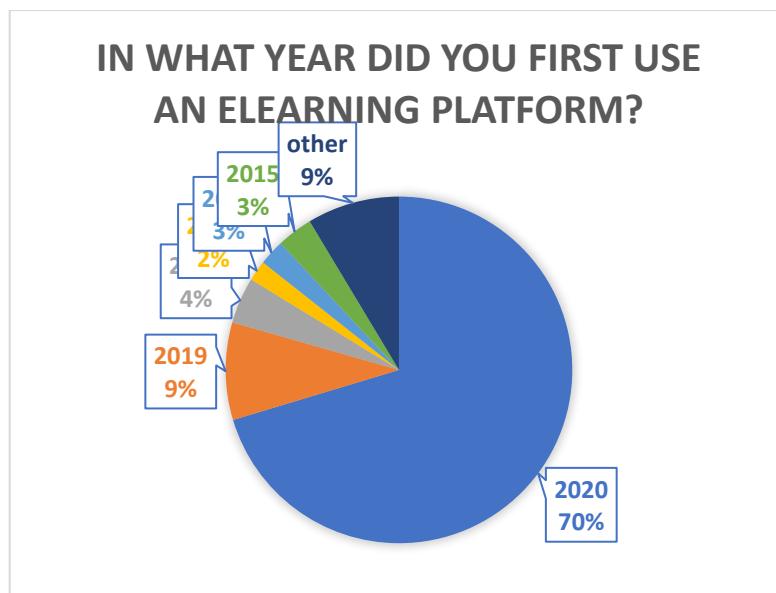


Figure 4. Q1, "In what year did you first use an eLearning platform or did you go through an education-focused video conferencing session?"

The answers provided show the great ability of students to adapt, so they quickly migrated to online courses (Figure 5).

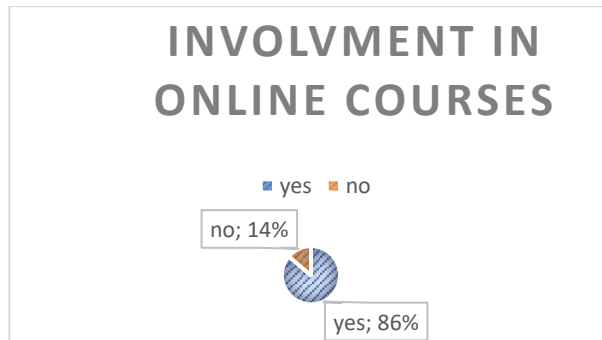


Figure 5. Q2, “Did you attend online courses between 16th March 2020 and 30th April 2020?”

Because the way students perceive eLearning is diverse (for some students WhatsApp is an eLearning platform), it is difficult to assess their level of involvement in online courses. The answers to questions Q11, Q12 and Q13 show that 86% is too high compared to reality.

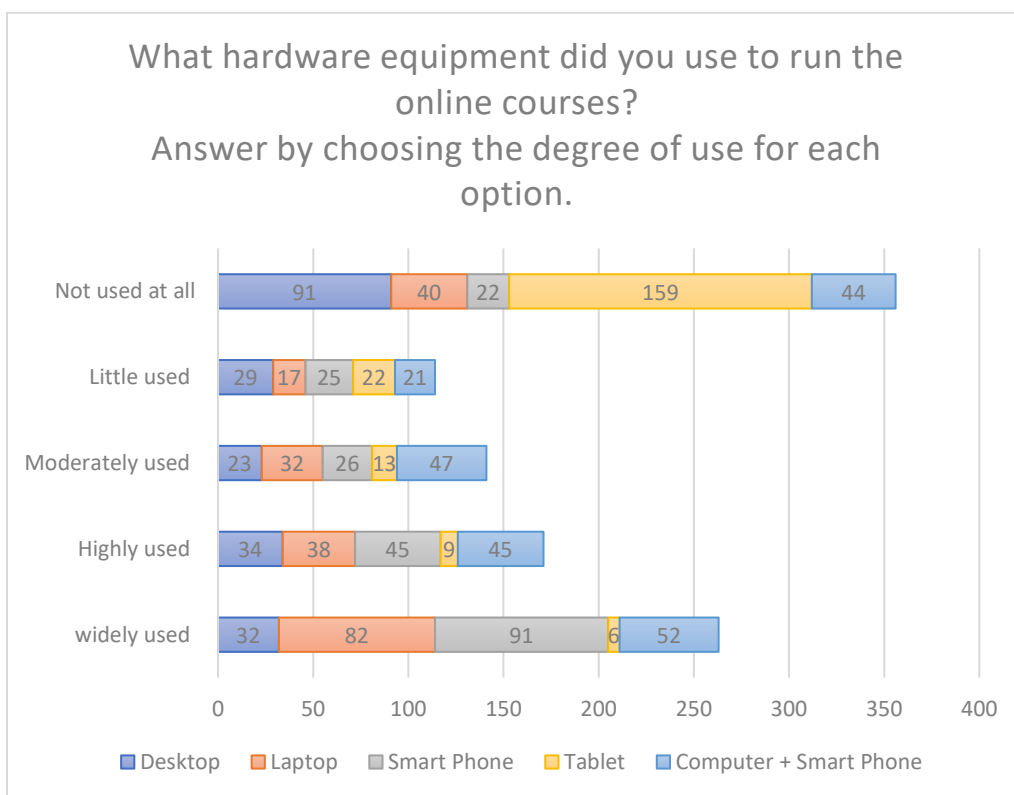


Figure 6. Q3, “What hardware equipment did you use to attend the online courses? Answer by choosing the degree of use for each option (number of students).”

Table 1. Student attendance for classic or online classes by hours per day

Hours of Courses/Day	Online	Classic
0	9	16
1	54	34
2	83	39
3	22	18
4	23	25
5	5	12
6	8	44
More Than 6	5	21

Analyzing the collected data, we can see an increase in the number of students in online courses for those who participate up to 2 hours a day. These students are the ones who participate in 5 or 6 hours in the classical system, and the courses were probably not taken. The authors appreciate that the presence is lower and the dropout rate is higher in eLearning classes (Table 1).

The analysis shows a lower average number of hours online, 2.43, compared to the classic, 3.70. The graph in the figure shows that the high density is for 2 hours a day, while in the classic it is 6 hours a day (Figure 7).

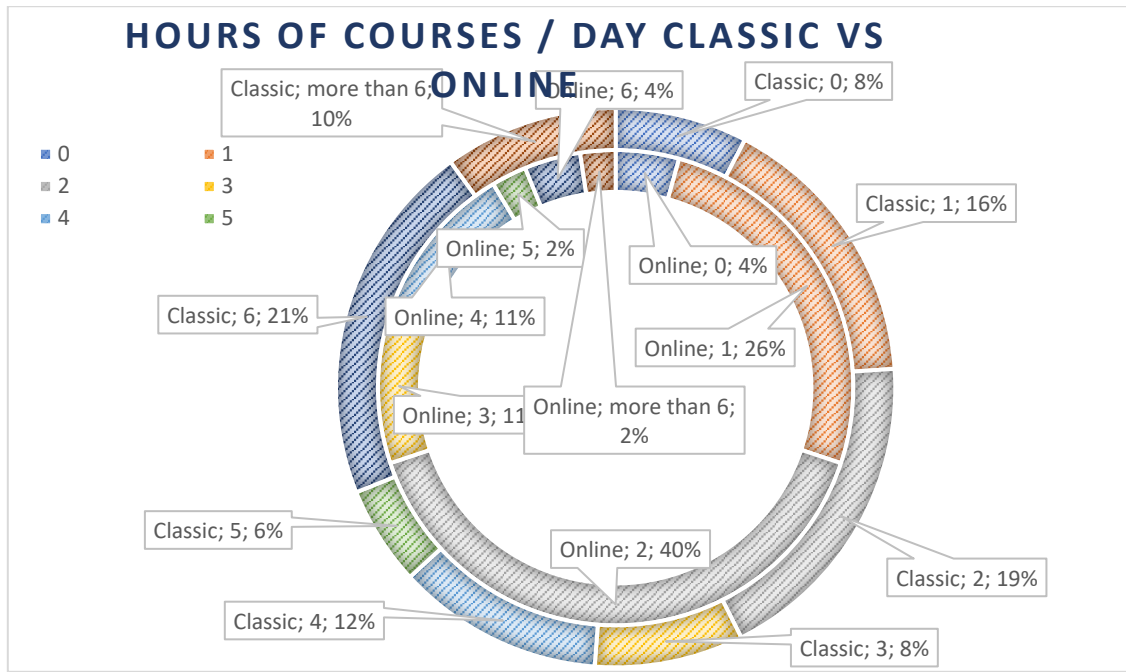


Figure 7. Q6, “What was the number of hours per day dedicated to your online courses during the state of emergency?”, and Q7, “What was the number of hours per day dedicated to conducting the courses in the classic format by you in the period prior to the declaration of the state of emergency?”.

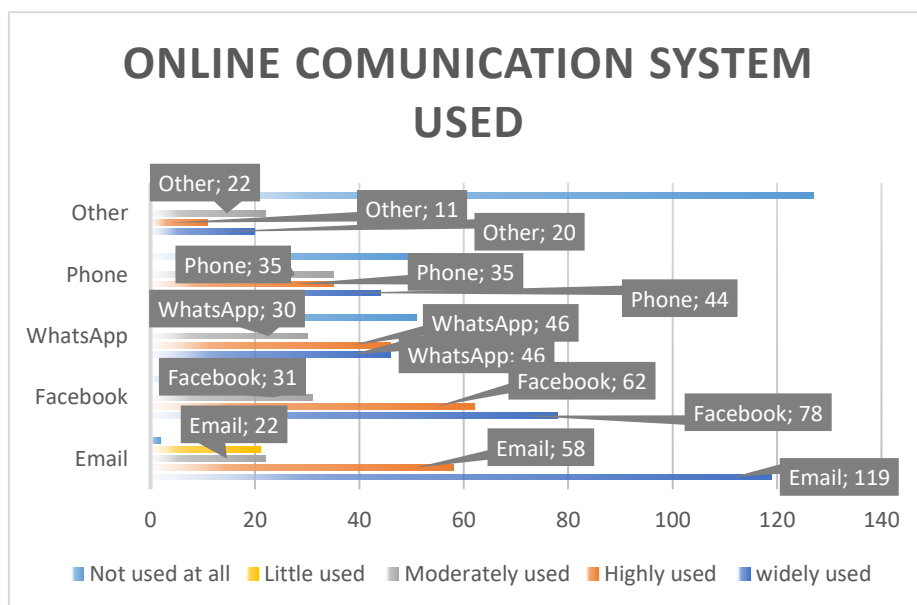


Figure 8. Q8, “What online communication system did you mainly use to communicate with the teacher? Answer by choosing the degree of use for each option (number of students).”

The lack of implementation of an eLearning system is proved by the collected data. 119 students stated that email is the main communication. The second option is a social networking platform, Facebook (Figure 8).

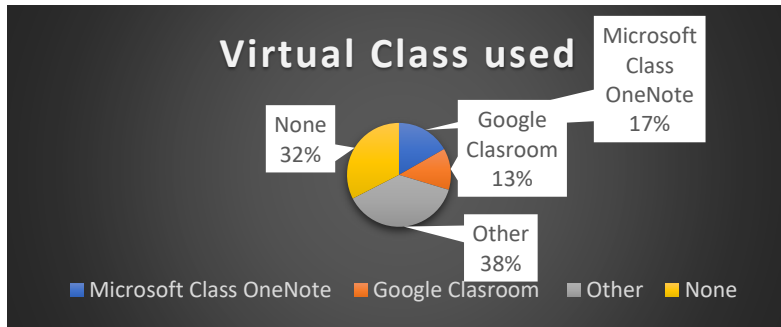


Figure 9. Q11, “Were the virtual classes used for the seminar or project classes? If so, specify which.”

The virtual classroom is the tool that allows eLearning a good development of activities. 30% of the students stated that they used a virtual class Google or Microsoft (Figure 9), which contradicts the rest of the information collected by the authors from the Dean's Office of two faculties of the three, which indicates a degree of use of only 14% of virtual classes.

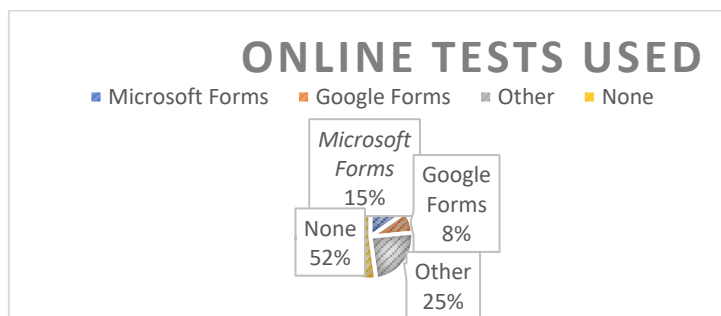


Figure 10. Q12, “Were predefined online tests used for online testing? If so, specify which.”

Another important aspect of the second semester was the use of online tests. 48% of students stated that they used the online tests between April and May 2020 (Figure 10). The data was confirmed by new information collected from the Faculty of Science and the Faculty of Mining, which showed levels of 43% and 48% for the use of online tests.

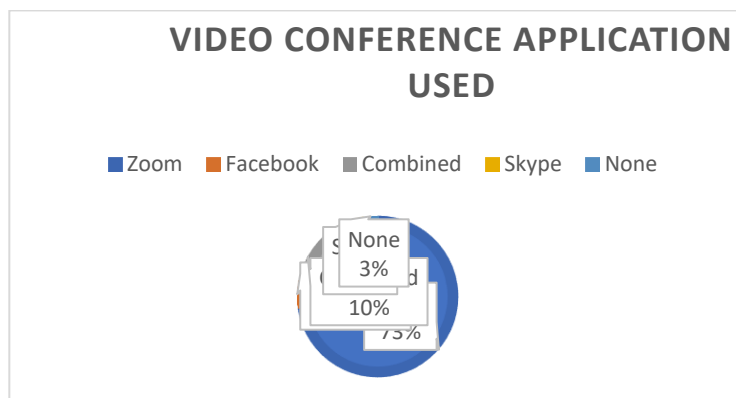


Figure 11. Q13, “What program did you use during the video conferencing courses?”.



Because the video interaction had an important component, this aspect was also investigated. The data showed that during the COVID-19 crisis no specialized platforms were used, the favorite tool being Zoom, which is free and easy (Figure 11).

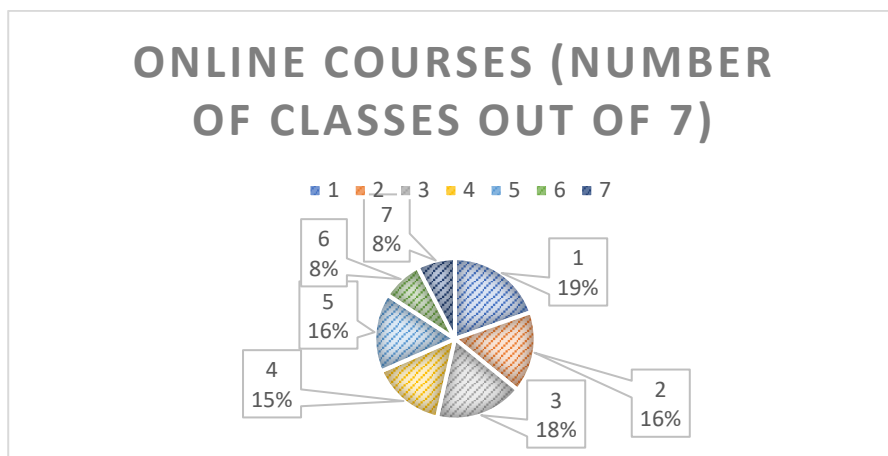


Figure 12. Q14, “Out of the total of 5–7 study disciplines allocated to the 2nd semester of the academic year 2019–2020, for how many of them did you use online courses?”

The proof that the university did not have a preoccupation for the training of teachers for working online is provided by the percentage of 50% of the courses that take place online. It is concluded that three out of seven teachers (1, 2 and 3 - blue, orange and gray) used the online course effectively, and the students participated in 3.45 out of seven courses (Q14) (Figure 12).

### 3. Discussion and conclusions

The COVID-19 pandemic has made eLearning a necessity. This statement refers to the whole world, including Romania. The migration from classic to eLearning has been easy for strong universities. The same challenges were faced by all levels of education. The actual study of authors went to small schools and universities, because they had a level of similarity offered by the fact that they used very little eLearning.

Another important aspect of the choice of authors was the importance of small universities, which are relevant at regional level. They have a supporting role in education in less developed areas. This explains the relevance of the University of Petrosani, considered by the authors to be representative for the three-month period in which all education was online.

According to the authors, immediately after Romania declared, on March 15, 2020, the state of emergency, conducting such a study became unavoidable. The importance of this major change in the education system has been identified by the authors, who have almost 10 years of experience in the field of eLearning. The experience in the field of authors' management is not to be ignored. The lack of preparation for such a change in small universities is also a reality at the University of Petrosani.

Using the Microsoft 365 A1 platform, the authors developed their own tools for online education in the first 45 days of the state of emergency. This fact was presented in Chapter 1 of this work. Other teachers, due to a low level of training in eLearning, have adapted with difficulty.

The lack of adaptation to the new conditions made the authors take an extra step in the second part of the state of emergency. They tried to provide advice to other teachers and started a questionnaire-based investigation, benefiting from the involvement of a very large number of students. These students were involved by authors in online courses and projects, as well as webinars. An explanation of the good data collection from students in such a short period of time is provided by the fact that in the period 2016-2020, Eduard Edelhauser was the vice-rector of the university for student issues and, in February 2020, he was the candidate to the position of rector at the University of Petroșani, being one of the most important figures for the students from the academic community from Petroșani.

Using the data collected in this study, the authors with good expertise in the field, identified a few relevant results:

- The high degree of student participation in online courses, 87% between March and May 2020 shows the adaptability of students to virtual education;
- A communication tool, email, was used as a testing tool in a proportion of 33-40%;
- Another communication tool, WhatsApp, was used as a testing tool in a proportion of 6 to 12%;
- The percentage of online testing varied between 45% and 52%;
- 42% of students participated in online courses using a smartphone, which became the most used equipment;
- The number of online courses was only 50%;
- The number of courses held online with video conferencing was only 30%.

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# GLOBALIZATION AND THE TOTAL QUALITY MANAGEMENT IN DEVELOPING SOFTWARE SOLUTION FOR APPAREL INDUSTRY

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## Abstract

**Purpose** – The objective of the paper is to highlight the importance of Total Quality Management (TQM) in software development in the context of globalization of the apparel industry sector.

**Prior Work:** Analysis of existing reports for apparel industry status and trends, analysis of the existing software solutions developed dedicated to apparel sector, study of the literature specialized literature and articles that develops the subject of TQM.

**Design/Methodology/Approach:** Brief literature review with focus on TQM model and its successful implementations, context analysis in European Union (EU) and worldwide developed by specialized institutions with respect to apparel industry status and trends, and a research on the websites of the top 10 CAD suppliers of software products dedicate for apparel industrial segment.

**Findings/Results:** The paper shows that the software solutions suppliers should involve customers and local distributors in the development process to ensure their relevance and to remain successful on the market.

It is also highlighting the importance of total employee commitment in the product development process.

**Practical Implications:** The study helps to understand the relevance of applying the TQM model in the process of developing software products for industrial domains such as apparel industry.

**Originality/Value:** There are relatively few studies focusing on the development of dedicated software solutions for the apparel industry and on the particularities of the sector that are influencing the software development trends.

Thus, the value of this article comes from the interpretation of the TQM model applied to software solution development for apparel industry.

**Keywords:** product development, globalization, customization, emerging markets, new business model, total management

## Introduction

Almost fifty years of data available made possible comparisons between the performance of countries under a liberalized versus a non-liberalized regime. According to Stanford University researchers Wacziarg and Welch (2003), in 1960, „just 22 percent of all countries, representing just 21 percent of the global population, had open trade policies, in the sense defined by Sachs and Warner (1995). By 2000, some 73 percent of countries, representing 46 percent of the world’s population, were open to international trade”. Same authors concluded that trade liberalization has, on average, robust positive effects on growth, openness and investment rates within countries. “The removal of trade barriers such as import tariffs, export duties and quantitative restrictions stimulated the growth of exports and imports” (Kassim, 2015).

In 2001, Werner Stengg - an official of the Enterprise Directorate-General of the European Commission, anticipated that „the removal of all quantitative import restrictions in 2005 will have major implications on global trade flows in T/C (textile and clothing) products”. Offshoring and outsourcing models that

emerged with trade liberalization after 2005 produced important growth in the textile industry in Asian countries and other parts of the developing world.

Trade liberalization came together with the liberalization of international capital markets, of the migration of the workforce. international agreements and conventions for the protection of property rights (including intellectual property rights related to proprietary knowledge). The outcome of these liberalizing and integrating processes is known as globalization (Hillman, 2008).

According to the International Labor Office (2019) "technological advances, climate change, globalization and changing demographics" are the four elements that "will shape industries in the future".

The positive, and particularly the negative implications brought by globalization were never entirely foreseeable. In the textile industry all these changes lead to the flooding of the clothing market, and to its saturation with cheap and inferior quality products. Consumers became more critical when accepting a product, preoccupied with details that are not related to the quality or the pricing of the actual product - such as the supply chain that had been involved into the manufacturing process of the article - all before deciding to make the purchase. They also started expecting the product to represent their personality and to make them feel unique. Recent studies (International Labor Office, 2019) confirm that the production and trade of clothing is decelerating in terms of volumes and directing attention to quality and customization.

Climate change is expected to have wide-ranging effects throughout textiles, clothing, leather and footwear (TCLF) global supply chains (ILO, 2019). "While the effects of a changing climate are beginning to affect the industries, it is arguably governments' green growth policies, consumers' demands for sustainability, and civil society organizations' concerns about the environmental footprint of the industries that have so far spurred the greatest action among brands, manufacturers, and producers of raw materials to adopt new technologies, business models and production processes to protect the environment and limit the industries' contribution to global warming and its related effects (...) Nevertheless, these approaches and production processes can be costly to develop and implement, especially for developing countries and for small and medium-sized enterprises(SMEs), which is reflected in the relatively slow uptake of green and clean technology and business models in the industries to date (...) and while these have shown promise and potential, they have yet to be brought to scale. At the current rate, it will take many years before the TCLF industries move to a circular economy approach and become truly sustainable", the ILO report mentions.

With regards to demography, ILO believes that" shifting demographics will continue to drive changes in the industries in the future. This includes but is not limited to: a growth in the global population, an increase in the number of female and male middle-class consumers, a transformation in the age structure across regions and countries, and changes in consumer preferences and demand."

With the development of new technologies and the endless potential of robotics and automation to increase productivity, a process of re- or nearshoring of production is likely. „In the past few years, however, the debate has increasingly shifted to the potentially much greater impact that digitalization will have across TCLF supply chains, with critical implications for a range of occupations and tasks in the industries, not only in manufacturing but also in design, marketing, finance, logistics, and retail." (ILO, 2019, p. 2).

The producers of new technologies need to understand the world is at a major crossroads, to drive change instead of merely react, and to develop new products that are relevant and effective. And, not the least, to develop solutions that meet both the needs and the interests of customers.

### **Success Factors for New Product Development**

There are many models which attempt to describe the factors which influence the development of successful products. One such model is that of Cooper et al. (1995) which establishes that the factors for new product performance are: the NPD process, the NPD strategy, the organization, the culture and the management commitment. The model proposed by Cooper however was criticized for failing" to acknowledge the role of knowledge and other non-technical components of innovation" (Leonard et al, 1998 apud Joubert&VanBelle, 2012).

Marketing researchers Montoya-Weiss and Calantone (1994) propose a different categorization of success factors: strategic factors, market factors, development process factors and organizational factors.

Strategic factors include:

- Product advantage (customer's perception of product superiority with regards to quality, cost-benefit ratio or function) relative to competitors.
- Marketing synergy (how well the needs of the project and the firm's resources and skills fit together, with respect to salesforce, distribution, advertising, promotion, market research and customer service);
- Technological synergy (the coherence between the needs of the project and the firm's resources and skills in the area of product development, engineering and production);
- Strategy (the original impulse for the development of a project - defensive, reactive, proactive, imitative; how well does the new product fit with the firm's strategy);
- Company resources (the compatibility of resources of the firm with the requirement of the project - capital, manufacturing facilities, manpower);

Market factors are:

- Market potential (size and growth of the market, customer need for the product type - the importance of the product to the customer);
- Market competitiveness (the intensity of the competition in the marketplace - in general or with regards to price, quality, service, salesforce or distribution);
- Environment (the general operating environment in which the firm operates - risks, legal framework etc.)

Development process factors are:

- Protocol (the firm's knowledge and understanding of the market they operate in, technical conditions to be met prior to product development - customer needs, interests, product concept, specifications and requirements etc.);
- Proficiency of predevelopment activities (initial market analysis, technical assessment, business and financial analysis);
- Proficiency of market-related activities (marketing research, customer tests of prototypes/samples, service, advertising, market launch);
- Proficiency of technological activities (proficiency of product development, in-house testing, pilot production, production start-up and obtaining necessary technology)
- Top management support, control and skills (the top management's commitment to the project, day-to-day involvement, guidance/direction, control over the project development, product champions/key individuals);
- Speed to market (the speed of the development/launch effort, launch timing, development timing cycle, first or second market effects);
- Costs (project development costs, measures of production, research and development, marketing costs overruns, measures related to insufficient project funds);
- Financial/business analysis (the proficiency of ongoing financial and business analysis during development, prior to commercialization and full-scale launch, measures of go/no go decisions);

Organizational factors include:

- Internal/external communication (coordination and cooperation within the firm and with other firms);
- Organizational factors (organizational structure of the firm, by project - teams, new venture, organizational climate, size, centralization, reward structure, job design).

## Trends in apparel industry: mass customization

Inherently, trends in apparel industry are also influenced by the global megatrends: globalization, climate change, demographics and technology advances. The producers of cloths are forced to rethink the way the garments have been created until now and many of them are already looking to reorient their production to emerging markets.

In 2017, the EC (European Commission) JRC (Joint Research Center) organized an event with the purpose of facilitating the understanding of the long-term needs and challenges faced by European textile and clothing industry, based on case-studies. According to the *Textiles and Clothing Manufacturing: Vision for 2025 and Actions Needed* Report, “the European textile sector still represents 2.4% of EU manufacturing employment and 1.4% of EU manufacturing value added. It is also mostly made up of SMEs (Small and medium sized enterprises) widely distributed across many Member States.” (2017). The key conclusion of the event was that by 2025, this industry sector will “operate according to a globalized and efficient circular economic model that maximizes the use of local resources, exploits advanced manufacturing techniques and engages in cross-sectorial collaborations and strategic clusters”. Four clusters have been identified: Innovation - in this area the focus has been pointed to emerging markets, especially to customized production; Resources - focus on reusing the textiles, traceability of materials and total support for recycling; Trade and Skills.

Corroborating the conclusions from the EC JRC Report with the situation described by ILO (2019) which highlights the fact that there is “a general slowdown of trade in manufactured goods, world textile and apparel trade is decelerating” we can conclude that the feature in the clothing and apparel industry belongs to a different type of product manufacturing which will replace or at least balance the mass production.

The alternative to mass production is mass customization. According to Pan (2012), there are six levels of customization: the ‘Basic Customizer’, the ‘Alteration Customizer’, the ‘Cosmetic Customizer’, the ‘Transparent Customizer’, the ‘Self-Adaptive Customizer’ and the ‘Collaborative Customizer’. Each of these levels of customization treats a different segment of customization, and their complexity is in direct relation with the level of relationship engagement between Producers and customers. As the level of customization increases, customers’s involvement moves further upstream of the supply chain (Lampel & Mintzberg, 1996; Blecker & Abdekafit, 2006).”

## TQM Concept and benefits

In the context of an industry with an upward and unpredictable shifting trend, the technology suppliers must remain constantly connected to market trends so that they can offer solutions that respond to the new needs.

Total Quality Management (TQM) is a customer-oriented management approach that held up very well over time. In his book *Total Quality Management Key Concepts and Case studies*, Kiran (2017) explains that all definitions given to TQM by quality organizations such as British Standard Institution Standard BS7850-1:1992, the American Society of Quality, ISO (International Organization of Standardization) 9000 etc. or by acknowledged authors such Deming, Juran and Crosbi “focus on the efforts put in by organizations to fulfill customer requirements” (Kiran, 2017).

Looking into the way the ISO defines the TQM, we can identify the following elements as being involved in the process from the TQM specific paradigms:

**TOTAL:** all functions (design, production, marketing, purchase, maintenance, quality control, HR); all levels (Chairman and Managing Director, General Manager, Supervision, Operator); all persons having a stake (Factory personnel, Corporate office, Shareholders, Suppliers).

**QUALITY:** customer satisfaction, customer driven, functional requirement of the product, product specifications, process parameters.

**MANAGEMENT:** effective direction, monitoring and control; continuous improvements, effective utilization of resources, executive commitment, well-planned and effective decision making, employee empowerment.

TQM is basically a change of state of mind from product oriented (result-oriented) to customer centricity.

According to Besterfield et al. (2012) TQM relies on six basic concepts:

- A committed and involved management to provide long-term top-to-bottom organizational support.
- An unwavering focus on the customer, both internally and externally.
- Effective involvement and utilization of the entire workforce.
- Continuous improvement of the business and production process.
- Treating suppliers as partners.
- Establish performance measures for the processes.

The benefits of the TQM derive from its concepts and principles. Following the list of basic concepts listed above we can easily deduct at list four major benefits of TQM: improved product quality due to committed and involved management, customer satisfaction and profitability due to focus on customer needs, business sustainability due to continuous improvement and constant utilization of the entire workforce and employee motivation.

The core technology that is expected to be widely implemented for improving and optimizing the textile and clothing industry sector as the Textiles and Clothing Manufacturing: Vision for 2025 and Actions Needed report developed by European Commission shows is the software technology. Moheel et al. (2019) have made a review of CSFs (Critical Success Factors) of TQM in software development articles published between 1989 -2017, based on a list of relevant selected keywords. They have found a list of twenty different CFSs. The first three most relevant TQM CFSs for software development have been proved to be: Top Management Commitment and Leadership; Human Resource Management and Employee Empowerment; customer focus and process quality management. This finding from their research can prove that TQM should be considered as one of the best forms of management for software development in the current textile market.

## **Conclusions**

Industries are shaped by “technological advances, climate change, globalization and changing demographics” (ILO, 2019), factors which influence each other as well. Technology developers need to adopt new technologies, business models and production processes to protect the environment, which in turn (particularly digitalization) will have critical implications for a range of occupations and tasks in the industries.

Mass customization – seen as the opposite of mass production - is a model which plays well in the global, yet so personally defined world. Mass customization production uses the benefits of globalization while alleviating the negative outcomes. The long-term effects of the new trend in the apparel industry of shifting from mass production to mass customization means that garments manufacturers need to rethink strategic factors, market factors, development process and organizational factors and to start looking for alternative solutions and for new technologies that fits better for the customized products market, as globalization influences supply chains of TCLF.

Total Quality Management is an opportune and successful management approach aligned to current industry trends. TQM takes into account all of the product development success factors, while producing the needed change of state of mind from product oriented (result-oriented) to customer centricity.

As far as it concerns the technology suppliers for this sector, they have to remain in constant connection with the manufacturers for quickly identifying the new “jobs to be done” (Ulwick, 2016) and for bringing adapted solutions for the new manufacturing production needs. This interconnection and communication relation type must be a “continuous game” (Carse, 1986).

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# MEASURING THE PERFORMANCE OF THE NONPROFIT ORGANIZATION: THE MANAGERIAL RELEVANCE OF THE SOCIAL RETURN ON INVESTMENT FOR MULTI-PROJECT ENVIRONMENTS

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## Abstract

**Purpose** – *The aim of the paper is to investigate the capacity of the Social Return on Investment (SROI) for supplying managerial informational needs in multi-project contexts and the means to integrate the SROI in project management tools for decision-making processes.*

**Methodology/approach** - *Drawing upon the specifics of SROI from relevant literature, compared with other financial tools, we construe a systematic integration of the SROI methodology into the project management tools.*

**Findings** – *the proposal to integrate the SROI with the project management, by mediating between the key performance indicators and SROI outcomes; the identification of a SROI-based assessment of project intake decisions; pointing the need to integrate a time factor in SROI estimates.*

**Research limitations/implications** – *The approach is mainly theoretical requiring practical application through project management procedures.*

**Practical implications** – *The paper points to practical ways to embed the SROI methodology in project management instruments and to the need for incorporating time constraints into the SROI estimates.*

**Originality/value** – *The value of the paper consists in the proposal to link the project performance indicators to a SROI sensitivity analysis, reflected by the integration of SROI in the project management tools, and the case for including time factors in the SROI estimates.*

**Key words:** *Social Return on Investment, Project Management.*

## Introduction

The old dictum “there are only costs inside [the organization]” was reflected by the different stages of the measurement “revolution” (Eccles, 1991). In economic sectors with a strong competitive rivalry, the marketing indicators became more significant for the survival of the entities than the financial ones. The category of stakeholders vital to the survival of companies were the customers, hence information about their constituency and preferences became highly relevant. A second wave of the measurement revolution was represented by the system of quality indicators that aimed at defining the products and services through the lenses of the customer’s appraisal (Eccles, 1991).

The diversification of the range for performance indicators has led to the possibility of their ranking and customization according to the organizational strategic objectives. This consequence exhibits a bi-univocal relationship between what is measured and what results are obtained. For nonprofits, managerial strategies are often formulated in terms for which either performance measurement is not possible (in a strategically meaningful fashion) or there are no specific organizational functions able to achieve the measuring.

In the context of this paper, a nonprofit is an organization characterized by a restriction of non-distribution of profits (through dividends or managerial wages) (Anheier and Salamon, 2006). This definition captures various organizational settings under the same umbrella, encompassing the charitable/voluntary sector, non-governmental organizations and civil society organisms. By multi-

project contexts, we mean organizations that supply all their outputs by means of inter-related projects. Hence, multi-project context refers to project based-organizations, portfolios or programs, which cannot be explained in terms of an aggregation of disparate projects.

Financial performance indicators present information that is mainly intended for current or potential capital holders. Even for the shareholders, the financial information is retrospective in nature, allowing for relevant inter-temporal comparisons within the past performance of the same entity or with the current performance of entities (having a similar economic profile of production structure and beneficiaries). For project-based nonprofits, the financial performance indicators the financial results for projects would not represent a profit, but rather a time lag between the accrual accounting imputation of incomes/expense and their cash flows influence. Also, the interests of the donors of a nonprofit are distinct from those that could be captured in financial accounting informing donors requires a different approach, "for if there is no pay check, achievement is the sole reward" (Drucker, 2005).

Unable to benefit from the uniformity of performance information, nonprofits are searching for metrics and communities of practice that will make the results of nonprofit efforts comparable, both in time and space, for various categories of stakeholders. Donors in particular are interested in those entities that can substantiate their results, even though in nonprofits there will always be a tension between moral results (specified in the mission) and allocative or economic results (specified by indicators) (Drucker, 2005). Finding suitable performance indicators would also allow comparing nonprofits in terms of microfinance, assessing organizational and managerial capacity.

The managerial difficulty of measuring the performance of nonprofit organizations is among the peculiarities of these entities. This difficulty influences decision-making practices - from strategy development to current decision-making processes. The fact that, in principle, managerial activity cannot be rewarded in relation to financial performance makes finding adequate indicators even more difficult. This informational need is addressed by creating tools and techniques, by producing a vocabulary and a "grammar" for communities of practitioners, being able to evaluate the results of nonprofits.

Lately, a number of instruments for assessing the social impact of nonprofits and businesses were proposed. These approaches propose an extended organizational ontology that internalizes the outcomes experienced by a multitude of stakeholders (Nichols et al. 2012; PWC, 2013; KPMG, 2014). By capturing outcomes covering social and environmental concerns, these approaches indicate a conceptual transition from organizations depicted as owned by shareholders to entities depicted as owned by communities, as long as the latter are stakeholders in the well-being (or failure) of the entities. In economic language, the performance indicators aim at integrating results, previously seen as externalities.

In multi-project contexts, performance appraisal involves connecting key indicators of achieving project goals with the organization's global performance indicators. When a multi-project nonprofit chooses to implement a methodology for measuring strategic alignment, a rule for deriving indicators from the project-level outputs to the organizational social impact must be in place. Hence, the indicators for work packages must reflect the influence of a certain package on indicators of organizational performance. This implies the judicious alignment of the project objectives with the strategic ones to make possible a methodologically consistent, and spatially comprehensive, measurement of the results.

The aim of this paper consists in exposing the capacity of the Social Return on Investment (SROI) approach to serve the managerial informational needs in multi-project contexts. This relevance is expressed through the suitability of SROI for grounding strategic decisions and current project management issues. One of the claims of the SROI guidance methodology is that it might be used as a managerial instrument. The research question is hence: How can the SROI approach be integrated and embedded in project management tools and practices for sustaining decision-making processes?

The paper analyses the SROI approach through the lenses of project management practices. Drawing upon an inventory of SROI challenges from relevant literature, on the specifics of SROI methodology, compared with other financial tools, we construe a systematic integration (through analogy of different common notions and tools) of the SROI methodology into the project management tools - proposing various means and insights of integration.

## The Social Return on Investment – prospects and challenges

The Social Return on Investment (SROI) is a framework for measuring social impact, aiming to achieve a language shared in communities of practice, led by the consistent application of a set of principles. The application of the principles within the SROI may lead to different results, depending on the context of the pursuits whose value is under examination. SROI has its roots in the theory of change, stakeholder theory and cost-benefit analysis. It is aiming at determining a value of social impact, mediated by financial proxies, in order to capture as accurately as possible the net outcome of nonprofit activities. The fundamental difference between the SROI approach and the cost-benefit analysis is given by the explicit integration of as many (relevant) stakeholders as possible in the outcome estimates, this difference in approach being due to the influence of sustainability standards (Nichols, 2017).

While SROI claims to represent an informational device for managerial and stakeholder interests, the authors of the guide do not recommend a direct comparison of nonprofit activities, by using the value of SROI. However, we consider that if a SROI report of comparable activities contains the methodological details and counterfactual assumptions used therein, then, with due professional caution, the SROI values might be compared. To suggest that this is not recommended, would inevitably lead to a tendency for donors not to use it as a tool for benchmarking organizations or selecting projects for available funding. From the SROI perspective, the comparability of outcomes implies the standardization of the conceptual framework and the existence of independent audit bodies for SROI implementation.

SROI could be a retrospective tool, for assessing the outcomes of completed activities, or a forecast tool, predicting the amount of created social value, were the nonprofit activities to meet their intended outcomes. As a performance indicator, SROI determination involves reporting effects to efforts, the stages of SROI implementation seeks from the outset to understand social change from the perspective of stakeholders, in order to obtain elements leading to the financial assessment of effects or outputs (value created) and efforts or inputs (costs). Using a tool called Value Map - embodied in a spreadsheet (Nichols et al. 2012), allows the calculation of the SROI. The completion of this instrument indicates that SROI is determined as a ratio between the present value of outcomes and the present value of the inputs needed to obtain the social impact, as in the equation below (1).

$$SROI = \frac{\text{Present value of outcomes}}{\text{Present value of inputs}} = \frac{\sum_{i=1}^n \frac{O_i}{(1+r)^i}}{\sum_{i=1}^n \frac{I_i}{(1+r)^i}} \quad (1)$$

Where: - O – financial value of the outcomes; - I – financial value of inputs; - i – year of reference; - r - discounting rate.

This formula is mathematically identical to the financial return on investment, but the means to calculate the financial values of the outputs and inputs differ radically from the financial-accounting way of determining the return on investment. Since for some of the inputs and outcomes (such as - changing the live style of beneficiaries, providing volunteering opportunities etc.) there is no marketable value and financial proxies are to be used as a value substitute. These financial proxies are a reflection of the practitioners' assessment of counterfactual scenarios linked with a certain social outcome.

Another major distinction between SROI and the return on investment for economic projects consists in that the latter can be marketed and sold as investment opportunities (Weber, 2013). Still, on a deeper level, there is a funding market for nonprofit projects, even if the donors do not request the calculation of a forecast SROI for the selection of projects. It can be speculated whether the value of financing represents the price of the project as a process, or the project represents only a mean to obtain the deliverables, which are evaluated through financing.

There are some managerial difficulties in applying the SROI framework in a systematic way – such as (Millar and Hall, 2012; Arvidson et al. 2013): lack of fidelity in rendering the heterogeneity of entities and projects; the need for an organizational data collection system; the precarious nature of the counterfactual estimates necessary for the calculation of the SROI; the expensiveness in terms of dedicated time and trained staff. There are also difficulties of estimation: determining the fixed cost part of the value attributed to the outcomes; choosing a discounting rate; determining the value of voluntary work and its nature as input / output; arbitrariness in decisions on the counterfactual future – through deadweight, dislocation and attribution (Arvidson et al., 2013).

The fact that the volunteers of nonprofits can be seen as both beneficiaries (of trainings) and inputs is also challenging. For some volunteers, volunteering is not equivalent to work, but to spending spare time. When it comes to the difficulty of value attribution, it seems that more is required of SROI than is required from financial indicators, since those also based (in the forecast calculation) on counterfactual assumptions based on professional reasoning alone.

### The relevance of the Social Return on Investment in multi-project environments

The position held by the management of nonprofits, as mediators between beneficiaries and donors might be seen from the perspective of the agent theory. Considering the multiple informational asymmetries between these parties, it is necessary to implement a methodology for evaluating social outcomes in a way that could be translated into reports understandable with minimal effort.

In multi-project organizations, the performance indicators associated with the project objectives are usually metrics describing the efficiency of a project from the perspective of a strategic grid - key performance indicators – KPIs. These metrics are required by donors as a way to assess organizational performance. Being required by donors, these indicators reflect the social perspective and interests of these stakeholders. What constitutes significant social change for the donor may appear to have minor social influence from the strategic perspective of the organization’s intent. However, if the requested KPIs are decisive for the social impact of the project in a SROI approach, the degree of compliance with the donors’ requirements will influence the SROI value. At times, the KPIs required by donors show that the beneficiaries were exposed to some factors of social change, rather than indicating a measure of the impact these factors might have.

Trying to integrate the project management approach with the SROI theory of change, we begin with grouping sets of deliverables in work packages having associated indicators. This approach is supplemented, at the work package level, with their impact on the SROI value, as suggested in Figure 1.

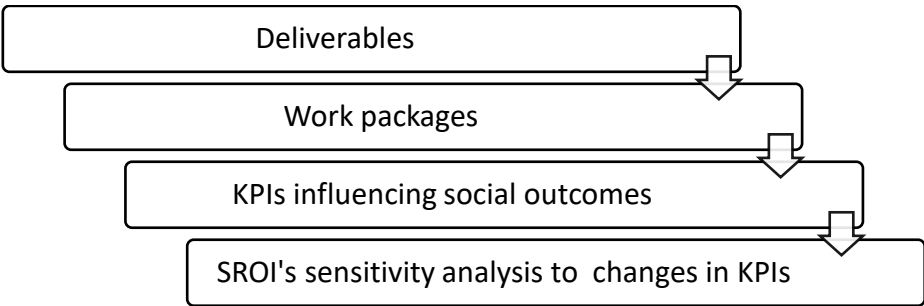


Figure 1. Integrating project KPIs with the SROI

The requirements traceability matrix can be extended with information on the KPIs and the SROI sensitivity to KPI’s variance (the sensitivity can be expressed by a factor applied to the attributed value of the outcomes). This correlation shall also be present in the Value Map to draw a formal link between the project requirements and their influence on the SROI. Figure 2. presents the inclusion of these factors in the two aforementioned documents.

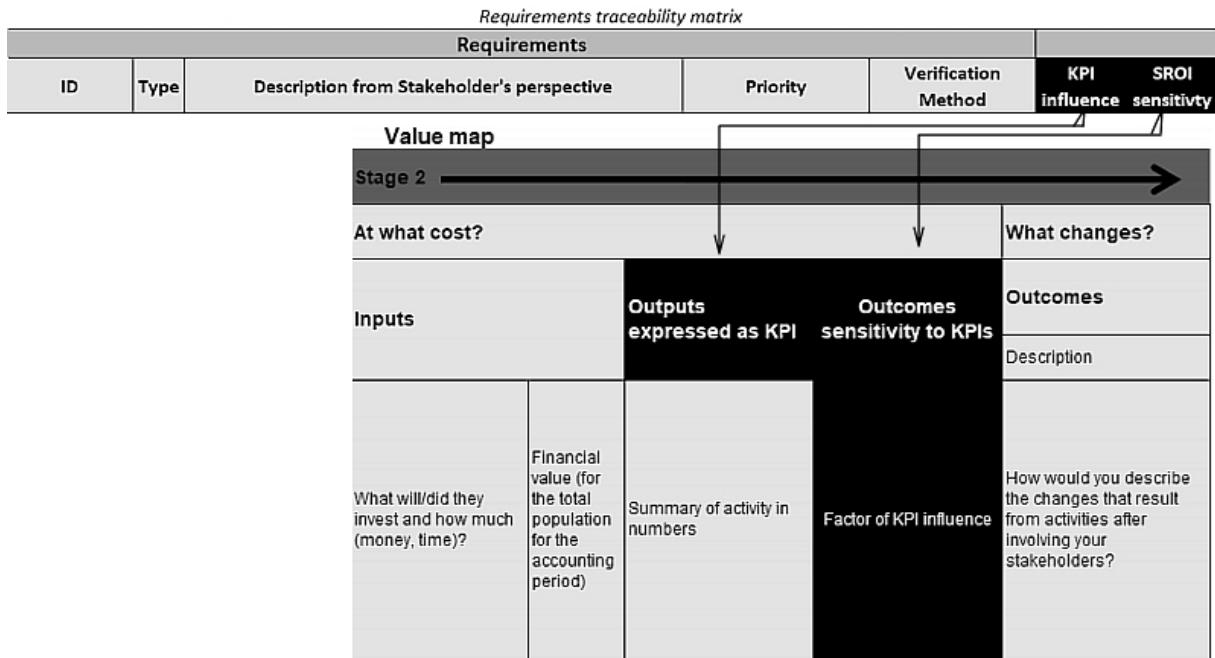


Figure 2. Embedding KPI's influence on SROI from the Requirements Traceability Matrix to the Value Map

From the perspective of the project network, the contribution of each project's deliverables to the organizational SROI can be depicted as in Figure 3. where projects denoted A and B, lead to a respective measure of SROI, contributing to the organizational impact - denoted SROI<sub>o</sub>.

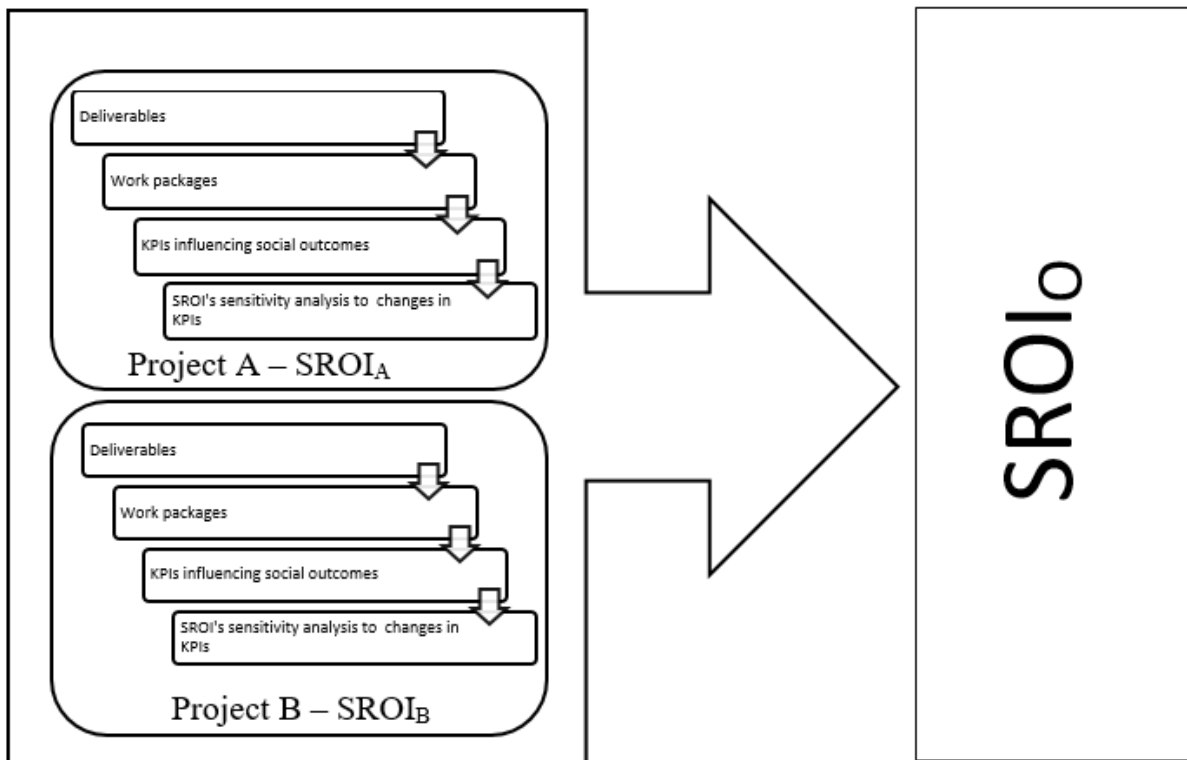


Figure 3. The contribution of project KPIs to the organizational value of SROI

At operational level, project managers can appreciate the alignment with the project requirements either using a dashboard (reflecting also the donor's requirements amidst the strategic landscape) or a project health form, which specifies the status of the project in terms of costs, deliverables, risks etc. At the project level, it becomes visible that the role of SROI methodology, as a decision-making tool for managers, prioritizes the management among stakeholders in a manner inconsistent with the apparent neutrality of SROI in terms of stakeholder ranking.

Using a SROI forecast as a strategic tool in multi-project organizations involves: a uniform inter-project procedure for SROI instruments at project level, the construction of a common database for financial proxies, *i.e.* assignment of identical values for identical outcomes; the possibility for weighted aggregation of SROI to obtain a value of organizational SROI, as in relation (2) – already suggested by Figure 3; a sensitivity analysis of SROI at the organizational and project level for KPIs affecting various stakeholders and their associated deliverables.

$$SROI_O = \sum_{p=1}^n k_p SROI_P \quad (2)$$

Where: p - indicative of the project;  $k_p$  – the specific strategic weight of SROI for project P

The only influence of time made explicit in SROI consists in discounting the outcomes for multi-annual projects. However, a homogeneous discounting rate does not show a very diverse time preference of the stakeholders. It is challenging to balance an increased time preference for beneficiaries with a fixed short-term productive capacity and time constraints on the available of funding. The efficiency of deadlines in projects implies an increased SROI in multi-project environments. For these reasons the SROI analysis should be done as a function of time (3).

$$SROI = f(t) \quad (3)$$

The financial position will also be affected in time by the acquisition of non-current assets of project restricted usage and their ongoing depreciation. All these time-related issues need to be reflected in the SROI by inclusion in the Value Map.

## Conclusions

The aim of the paper was to expose SROI's ability to meet managerial information needs in multi-project contexts. This capacity is shown by the adequacy of the SROI to substantiate strategic decisions and current project management issues. Starting from an inventory of the specifics and limitations of SROI in the relevant literature, on this basis we described a possibility of systematic integration of the SROI methodology in project management tools - proposing means and indicating peculiar difficulties of this endeavor.

The main contributions of the paper are: the proposal to integrate the SROI methodology with the project management tools, by mediating between the key performance indicators (KPIs) and the SROI outcomes indicators, through ongoing stakeholder consultations; the identification of a SROI-based assessment of strategic project-intake decisions; pointing to the need to integrate a time factor in the SROI estimates - for a better expression of the project duration efficiency, the usage of restricted assets and variances in the stakeholders' time preferences.

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# THEORETICAL RESEARCH ON THE EVOLUTION OF JOB EVALUATION METHODS

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## Abstract

**Purpose** – *The paper aims to make an x-ray of the ways of approaching the job evaluation process during the last century. Job evaluation is an essential component of human resource management, but at the same time it is responsible for determining the value of a job in an organization. Job evaluation is based on the types of activities necessary to perform the tasks of a job or by extrapolating, the work/labor type and work/labor value associated with a job.*

**Methodology/approach** – *The paper starting point consists in the review of the main types of job evaluation methods, as currently defined and accepted. Once the current concepts are established, we will move on to the second stage of the paper, which will consist of analyzing the original approaches to work/labor management in the meanings defined by Taylor and Bedeaux. This analysis aims to identify concepts similar to those used in job evaluation.*

**Findings** – *The paper has two objectives: a) to draw similarities between the methods of work/labor evaluation proposed by Taylor and Bedeaux and the methods of job evaluation; b) applicability verification of the working hypothesis based on the use of work/labor evaluation as a reference for selecting the most objective methods of job evaluation.*

**Research limitations/implications** – *One of the research limitations is the fact that in the specialized literature there is no general consensus regarding the classification and content of job evaluation methods.*

**Practical implications** – *Identifying correlations between work/labor evaluation methods and job evaluation methods, will create the premises for determine ways for identifying those job evaluation methods that offer the highest levels of objectivity*

**Originality/value** – *Using the work/labor evaluation methods developed by Taylor and Bedeaux as references in selecting the most objective job evaluation methods.*

**Key words:** *work evaluation, labor evaluation, job evaluation.*

## Introduction

Job evaluation is an essential part of human resource management, and in the same time it is responsible for determining the value of a job in an organization. Job evaluation is generally based on the types of activities necessary to perform the tasks of a job, the working environment, the personal skills of the job incumbent and the importance of the work. The paper starting point consists in the review of the main types of job evaluation methods, as currently defined and accepted. Once some fundamental concepts are established, we will move on to the next part of the paper, which will consist in analyzing the approaches to work and labor management in the meanings defined by Taylor and Bedeaux. This analysis aims to identify concepts similar to those used in job evaluation.

## Current approaches to job evaluation

Job evaluation is a key activity in human resources. The role of human resources management is to connect employees with the desired results of the work performed to achieve the objectives of the

organization. Increasing the organizational efficiency of a company depends on various external and internal factors, and job evaluation can be the aspect that favors the company's chances in front of the competition (Adamus, 2009). Job evaluation is a process mainly used by large civil or governmental organizations. Kahya (2006) estimated that half of U.S. positions in the U.S. were the subject of the evaluation process.

In practice, job evaluation is a systematic process that aims to establish the relative value of jobs in an organization by developing a framework on which to base pay decisions. The same idea was highlighted by Eargle (1972), job evaluation is a complete procedure for determining the value of a job in relation to other positions in the organization. The job evaluation thus provides a necessary reference for maintaining and defining a fair wage structure based on two solid coordinates: making coherent decisions on wage levels and ensuring equal pay for work of equal value (Armstrong, 2003, p. 569).

Spyridakos et al. (2001) show that job evaluation includes comparative processes, because it is necessary to explain the relationships and interdependencies between jobs. This is done through an analysis of the roles, objectives and achievements of each position. It should be noted that job evaluation is distinct from the evaluation of the employee as a person, but of the skills he must have to occupy or fulfill that position (Mathis, Nica, & Rusu, 1997, p. 203).

In conclusion, from a practical-conceptual point of view, the main aims and objectives of the job evaluation are:

- to compare the duties and responsibilities of a post with another post;
- to achieve the hierarchy and placement of positions in an organization by establishing the degrees of importance for each position (Eargle, 1972, p. 2);
- to ensure the premises for fair remuneration based on the value of the work performed;
- eliminate bias and discrimination of any type of reward system work Mathis (1997, p. 203);
- to provide employees with a favorable climate for efficient activity by confirming that their work matters to the organization and that it is objectively appreciated.

From the point of view of the phases of job evaluation procedure, the following sequence can be identified, according to figure 1.

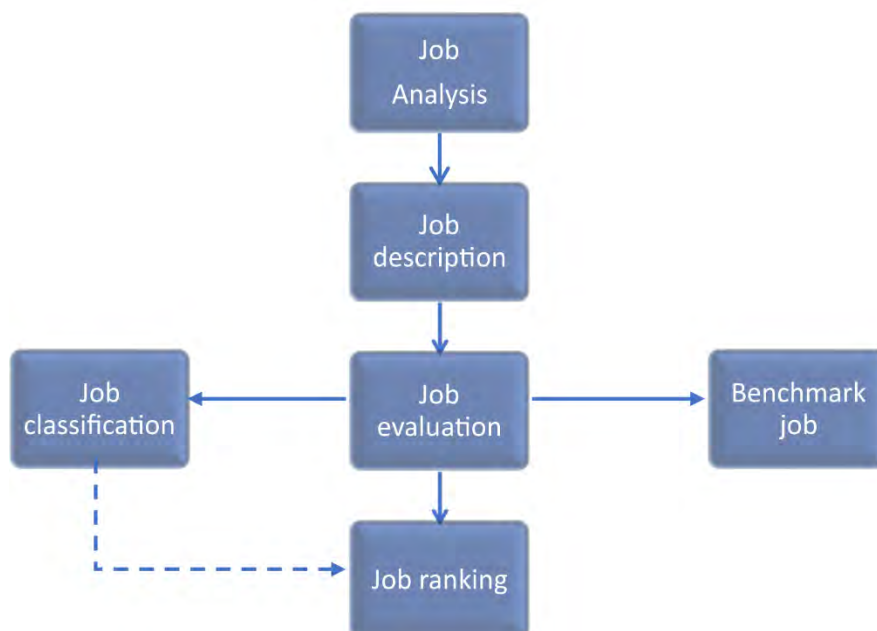


Fig. 1. Job evaluation process. An adaptation after (Heneman, 2003, p. 12)

Although job evaluation methods have been developed since the beginning of the twentieth century, there is no general consensus in the literature on their types of classification. For example, Chang & Kleiner (2002) nominates only 4 methods of job evaluation: job ranking, job classification, score-based

evaluation and factor comparison along with their possible combinations. On the other hand, Armstrong (2003) suggests the following general categories:

- non-analytical methods (job ranking, job predetermined grading, benchmarking);
- analytical methods (numerical job evaluation, factor comparison);
- methods based on a single factor;
- methods based on skills or competences;
- methods based on market pricing;
- methods developed by consulting firms in the field (Hay).

Eargle (1972) details the job evaluation methods used by the National Electrical Manufacturers Association (NEMA). They are based on the numerical job evaluation and the factor comparison method. The only non-analytical methods mentioned are job ranking and the job predetermined grading. In order to determine the hourly wages, the numerical job evaluation and factor comparison are used as working examples. From this point of view, it can be concluded that the desideratum of obtaining and using an objective foundation in the evaluation of positions can be obtained starting from these two evaluation methods.

In addition to the methods mentioned, Heneman (2003) also introduces methods for assessing competency-based positions. Thus, competencies are defined as an accumulation of knowledge, qualifications, skills and other personal attributes necessary to achieve the performance standards of the position. Competences are also defined as observable behavioral elements that manifest as a result of having the qualifications, skills and knowledge necessary to meet the requirements of the job (e.g. teamwork).

For an organization that aims to achieve medium and long-term performance and profit goals, it is necessary that all its resources be directed as efficiently as possible in this direction. From the point of view of human resources, it is necessary to achieve a harmonious internal climate conducive to obtaining the best results. It is important for employees that their work is important, that it is appreciated and evaluated correctly and fairly. In terms of working methods used, job evaluation is based on non-analytical methods such as job classification, ranking or benchmarking that would ensure rapid and inexpensive assessments, but in the medium and long term, due to the lack of quantifiable and measurable criteria they can create dissatisfaction among all categories of staff and arouse suspicion of biased assessments.

In the case of analytical methods, such as numerical job evaluation or the Hay method, the company is required to allocate significant resources of time and specialized staff to perform evaluations. But these methods, once completed, will outline not only simple job profiles, but a coherent and objective vision of the structure of the human component, credible, accessible and widely understood among employees and shareholders.

### **Working principles used in work evaluation**

The analysis of the work is based on the foundations created by Frederick Winslow Taylor (1856 - 1915), who was also nicknamed "the father of scientific management". He stated that the study of time is the most important component of scientific management. In his works "Shop Management (1903)" and "Concrete Costs (1912)", the study of time is based on time units. However, during his lifetime, few British managers understood the importance of time units and were even less able to develop a time unit system that could be used in practice.

Taylor's work "Principles of Scientific Management (1911)" has been described as the most influential book in the field of organizational theory in the twentieth century, being also Taylor's most important work. Time units represent the time required to perform basic or unitary operations as part of a worker's work. Thus, the manager has the task of dividing the work into units, more precisely into irreducible elements or operations. The division and timing of work would allow managers to compile an index of standard periods for each work activity. Such an approach to work leads Renold (1918) to say that scientific management is management itself.

However, the introduction and use of scientific management methods is conditioned by at least 2 factors:

1. the existence of a well-trained and qualified staff;
2. precise definition of the various activity types and equipment produced.

Taylor believed in transferring control from workers to management. He set out to increase the distinction between mental (planning work) and manual labor (executing work). Detailed plans, specifying the job and how it was to be done, were to be formulated by management and communicated to the workers (Rinehart, J.W., 1975, p.44). By 1912, in the United States, Taylor's system was used by at least 50,000 workers, whose results multiplied by at least 300 percent. One 1917 US study estimated that there were 169 scientifically managed plants in the USA, and this was very high compared to Britain (4), Canada (4), France (5), Japan (6) and Russia (9). Germany, Spain and Italy possessed no scientifically managed plants.

While Britain and the US were at war, a system explicitly based on Taylor's *unit-times* was being developed by a young engineer named Charles E. Bedaux, who had not only noticed Taylor's point but also that others had missed it. The system designed by Bedaux was first used in 1917 by a furniture factory - Imperial Furniture Company in Grand Rapids, which for 2 years tried unsuccessfully to implement Taylor's time units. The system proposed by Bedaux is different from Taylor's because Taylor set time rules for certain operations in order to frame them in the working hours of the workers, while Bedaux proposes the introduction of energy units of the worker workforce.

The system is based on a points system corresponding to each productive minute. A working day of 9 hours is considered by Bedaux to consist of 540 minutes with 40 minutes allowed for interruptions, the workers being thus obliged to perform 500 work points. Each activity corresponds to specific Bedaux scores and if workers get higher scores than needed daily, then they receive a bonus. Points associate predetermined tasks with their standard completion times and are then summed to obtain the required daily values. The standard values of the points are multiplied by a coefficient of rest - r or delay - d, which takes into account the time lost with fatigue or inevitable delays. Standard durations plus percentages for rest and delays provide the standard that is expected of an ordinary worker under normal working conditions. Bedaux stated that the score he proposed together with the coefficients r, d are the attributes that make his system different. The principle of the work intensity measurement system is based on the aggregation of effort and breaks in a unit, the share of breaks being given by the intensity of physical and/or mental demands from the effort made. Another interesting feature of the system is that Bedaux came up with the idea of measuring including times not assessed by the system, periods such as maintenance or overtime, called not on Bedaux time, NOB. Conceptually, Bedaux stated that "efficiency does not necessarily mean high production, but it is about maximizing the production of a worker taking into account the available facilities." In April 1921, the points became Bs and also in that period he began to use the *work measurement* as a concept.

Between 1926 and 1939, in the United Kingdom a number of 178 organizations in various fields and industries used the Bedaux system, and among the most important customers were Kodak, Gillette, General Electric. The positive effects of the introduction and use of the Bedaux system for 15 industrial fields were manifested as follows:

- labor costs reduction: 17 ÷ 40 percent;
- increase worker productivity: 33 ÷ 185 percent;
- increasing the company's revenues: 7% ÷ 25 percent.

As with the introduction of Taylor's system, the introduction of labor intensity measurement has caused industrial strife, downtime and strikes in Europe and North America.

### **Job evaluation and work evaluation – parallels and crossing points**

This section aims to achieve the two objectives of the paper: a) to draw similarities between the methods of work/labor evaluation proposed by Taylor and Bedaux and the methods of job evaluation; b) applicability verification of the working hypothesis based on the use of work/labor evaluation as a reference for selecting the most objective methods of job evaluation.

Table 1 summarizes the main features of job and work evaluation procedures.

Table 1. Characteristics of job evaluation and work evaluation methods.  
An adaptation after (Adamus, 2009)

Crt. no.	Method name	Characteristics	Advantages	Disadvantages
1.	Job ranking	A simple method based on ranking jobs from the most complex to the most simple.	<ul style="list-style-type: none"> <li>- easy to implement and use;</li> <li>- easily understood by the employees.</li> </ul>	<ul style="list-style-type: none"> <li>- it uses no definition for a model;</li> <li>- has no accuracy;</li> <li>- does not measure the complexity of a job.</li> </ul>
2.	Factor comparison	An analytical method based on determining the job posts hierarchy regardless of job difficulty.	<ul style="list-style-type: none"> <li>- easy to implement and use;</li> <li>- easily understood by the employees.</li> </ul>	<ul style="list-style-type: none"> <li>- subjectivity implied in analyzing the job;</li> <li>- does not create any job description;</li> <li>- does not measure the complexity of a job.</li> </ul>
3.	Numerical job evaluation	An analytical method based on determining the level of job difficulty giving a numerical number to every job factor and then summing them in order to obtain a value in points for every job.	<ul style="list-style-type: none"> <li>- easy in evaluating and describing the differences between post;</li> <li>- takes into account more factors responsible for influencing the difficulty level of a job;</li> <li>- offers the evaluator defined evaluation criteria;</li> <li>- provides a flexible relation between work and remuneration.</li> </ul>	<ul style="list-style-type: none"> <li>- difficult to implement;</li> <li>- it requires a thorough knowledge about post and tasks;</li> <li>- establishing the factor points implies a degree of subjectivity</li> </ul>
4.	Hay method	An analytical point method based on four factors: know-how, problem solving, accountability and work environment.	<ul style="list-style-type: none"> <li>- a method constantly adjusted and modified by the consultants of Hay Group based on the experience from over 40 countries worldwide.</li> </ul>	<ul style="list-style-type: none"> <li>- difficult to explain to employees.</li> </ul>
5.	Market pricing	A method based on evaluation of pay rates in comparison with the market pay rates for similar job posts.	<ul style="list-style-type: none"> <li>- the job is paid as much as the market is willing to pay.</li> </ul>	<ul style="list-style-type: none"> <li>- it does not take into account the fact that values of posts in one organization may differ from other from other organization;</li> <li>- difficult to acquire information about pay rates in the market.</li> </ul>
6.	Taylor method	An analytical method based on the division of activities into irreducible tasks evaluated in units of time.	<ul style="list-style-type: none"> <li>- the division of activities into irreducible tasks created the premises for work efficiency</li> </ul>	<ul style="list-style-type: none"> <li>- laborious;</li> <li>- it requires a thorough knowledge about post and tasks;</li> </ul>
7.	Bedaux method	An analytical method based on measuring work intensity.	<ul style="list-style-type: none"> <li>- takes into account the work capacity of the worker depending on the activity performed;</li> <li>- divides a working day into standard work units needed to be achieved.</li> </ul>	<ul style="list-style-type: none"> <li>- laborious;</li> <li>- it requires a thorough knowledge about post and tasks;</li> </ul>

Analyzing the data introduced in Table 1, it can be seen that the methods of labor evaluation due to their numerical nature are similar to the analytical methods of job evaluation. This is because non-analytical methods do not use a definition or model of evaluated work, nor do they measure the complexity of work. By reverse analogy, analytical methods of job evaluation are related to methods of work evaluation, as both approaches aim to measure the complexity and value of work. But this merit for both approaches comes with the price of using a very concise definitions of the evaluated work and with an in-depth knowledge of each job and the final product resulting from the work. From the point of view of the second objective of the paper, the work evaluation has matured and been completed by the approach of Charles Bedaux. This is because Taylor's time units do not take into account the conditions of the worker's effort. In contrast, the units of work intensity proposed by Bedaux take into account both

the physical effort and/or the intellectual effort involved in an activity or work. Thus, by considering the physical and/or intellectual effort, the confirmation is obtained that the analytical methods for job evaluation are those that take into account factors and sub-factors such as: working conditions (environment, temperature), physical effort (working position, driving weights), intellectual effort (numerical calculation skills).

## Conclusions

The paper reviewed the main types of job evaluation methods presenting the advantages and disadvantages of each type. Then conducted an analysis of the work evaluation methods implemented by Frederick Winslow Taylor and Charles Bedaux.

The two objectives of the paper were achieved by identifying similarities between work evaluation methods and job evaluation methods, respectively confirming the working hypothesis that the most objective job evaluation methods can be based on the approach of Charles Bedaux who uses units to measure the intensity of workers' effort.

Future research aims to identify additional ways to increase the objectivity of job evaluation, such as using combinations between the numerical job evaluation method and the factor comparison method.

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# CRITICAL ANALYSIS ON THE MANAGEMENT OF THE MEDICAL SERVICE IN THE ROMANIAN HEALTH SYSTEM, IN THE CONTEXT OF THE COVID-19 PANDEMIC

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## Abstract

**Purpose** – *The aim of this paper is to establish the degree of knowledge and subjective perception of responsible factors regarding integrated health care and its value depending on the result, in response to the management of the medical service to the challenges of health crises, in particular the COVID-19 pandemic.*

**Methodology/approach** – *Proposed hypotheses: 1. The management of the medical service, applied in the management of the crisis triggered by the COVID-19 infection is considered to be adequate to the particular conditions of our health system; 2. The degree of knowledge and perception regarding integrated healthcare and its value depending on the result is insufficient to be able to become a benchmark in the organization of the medical service. We build an interview consisting of thirteen questions, which was applied to ten leading factors responsible for healthcare management: - at the level of health policy - a senator physician, member of the Health Commission of the Senate; - at the level of public administration in the field of quality management in health - an ANMCS evaluator; - at the level of local authority - a deputy executive director, DSP; -at the level of hospital administrators / managers - two medical directors, specialists, County Clinical Hospital and Municipal Clinical Hospital; a Municipal Clinical Hospital manager; two chief physicians of the Service for the Prevention of Infections Associated with Health Care (former medical directors), County Clinical Hospital and Municipal Clinical Hospital; a financial-accounting director of the County Clinical Hospital; - at the level of a higher education medical institution - (from two faculties of Medicine and Pharmacy): a university professor, dean, and an associate professor; The individual interviews were conducted online and recorded over approximately four weeks.*

**Findings** - *There was interest from the participants, as evidenced by the length of the interviews and the new issues mentioned in the responses. The response rate was one hundred percent. Most participants freely expressed their opinions, bringing arguments. According to the majority answers, the first hypothesis has been confirmed, the other requires further research.*

**Research limitations / implications** - *1. Qualitative research is based on the subjective interpretation of the author, admitting a margin of error in the objectivity of data analysis. 2. The different opinions of the subjects on the studied aspects do not allow the generalization of some conclusions that may or may not support the theory of integrated medical care and the value of the medical service appreciated according to the result in the patient's health condition.*

**Practical implications** - *Extensive answers, with nuances or certain clarifications, highlight important details and reveal subtle aspects, obtaining new observations that offer a wider openness to the topic studied and help create a better-defined spectrum to continue with a quantitative research in order to define the conclusions.*

**Originality / value** - *The dialogue with factors responsible for formulating and applying the management of the medical service at different structural levels, belonging to different institutions, from different regions (Mureș, Dolj, Olt), takes us out of the homogeneity of a group and provides deeper information, with the possibility of confronting them.*

*Addressing the subject of value in the medical service in the context of the pandemic crisis provides a real ground for verifying the solution proposed by the theory.*

*Getting a synthesis of opinions related to specific researched aspects, which is missing from the national literature, develops the possibility of interpreting in a new way the theory under study.*

**Key words:** *integrated medical care, the value represented in the result obtained in the patient's health, the management of the medical service.*

## **Introduction**

In December 2019, the WHO was informed of the appearance of a new coronavirus in the Wuhan community, China, called SARS-CoV-2, which, in a few weeks, would become a "global virus" infecting the whole world with exaggerated speed.

We can consider this event an additional evidence of the relationship between globalization and health or, more precisely, the consequence of political-economic and social ties that transcend national boundaries and affect the health of the population in areas of the world quite distant from each other. COVID-19 infection demonstrates how globalization has spread negative health determinants around the world, significantly increasing risk factors and disease worldwide. Social and health media around the world are experiencing the impact of the COVID-19 pandemic, calling into question the sustainability of these systems.

Once again, global healthcare organizations are under pressure to demonstrate how value can be added to healthcare through the activities they carry out.

Without claiming to be the antidote to COVID 19 infection, or to any other pathology, the value-based healthcare model [Porter, 2006], on the other hand, offers added value to the patient, even in situations caused by the unexpected appearance of an extremely contagious and serious infections. Even if it involves a strategic reorientation of medical services, with many changes or changes involved, the new management means progress in developing a system that was created for the needs of the patient and which, unfortunately, as it developed and modernized has acquired characteristics of industry, with economic objectives and purposes, above human ones.

## **Value-based healthcare benchmarks used in the comparative analysis of COVID-19 infection management**

The challenges generated by an extremely serious infection, spread as an effect of globalization, highlight the need to change the management of healthcare, so that it responds to the needs in the medical system related to the pathology of the infected patient.

Designing a management of the medical service, based on integrated medical care, which aims to fully cover the pathological needs of the patient, aiming to improve the outcome of the patient's health and to try first to prevent the disease and then to rehabilitate and to monitor the treated patient, is a value-creating strategy in the medical service even in the conditions of the unexpected appearance of an unknown disease.

Changing the current orientation of medical service management, from a process-based one, in which attention is directed to diagnosing and treating the disease, to a patient-based one, in which attention is directed to the treated person, becomes a new form of approach, known under the name of "value-based healthcare". The new healthcare model [Porter, Teisberg, 2006] does not replace the medical protocol, but provides a new framework for action that remains valid even in the absence of a protocol. The value created by this new management model is obtained by the multidisciplinary approach of the patient's pathology, depending on the particular needs of each and by providing a complete cycle of medical care that includes the chain action of prevention, diagnosis, treatment / intervention, recovery, and monitoring. It also proposes the analysis of the value of the medical service according to the result obtained in the patient's health condition and according to this result the payment of the service. Essential aspects regarding this theory have been detailed in previous articles [Dorobanțu, Marian, 2018, 2019]. The theory developed by Porter and Teisberg ensures the creation of added value in the conditions in which MBD delays in issuing solutions.



## **Analysis of healthcare management in the context of the crisis generated by COVID-19 infection, in view of the factors responsible**

Each of these components of value-based health care, mentioned above, was transposed into at least two questions in an interview to verify its validity in the real context created in the social and health environment by COVID-19 infection.

**The first question** concerns the challenges faced by healthcare institutions in the face of the unexpected onset of COVID-19 infection.

Even if they were mentioned in a different order by the subjects, the opinions were analyzed according to their weight in the response.

9 of the 10 responses clearly mention the lack of equipment for laboratory tests, protective equipment and medicines and the difficulty of identifying suppliers on the market. Another challenge identified by most respondents refers to the lack of a legislative framework necessary to manage the situation, which was reflected in the gaps between information and decisions, unpredictability of actions and frequent changes of orders issued (from one hour to another), delay in coordinating actions, the bureaucracy of controls. At the highest level there was the issue of designating the institutions to handle this situation and designating the support institutions.

8 out of 10 respondents also emphasize the reorganization of hospital management (triage, functional circuits, provision of buffer zones, isolation zones) as a major challenge, to which is added the lack of new legislation for the operation of hospital wards dedicated to health care for non-covid patients. The shift of all attention (including funding) to healthcare for infected patients has led to the disruption or suppression of routine medical activities.

Also, most of the subjects point out the lack of medical and auxiliary staff and their lack of training to deal with such an epidemic (from the use of protective equipment, control and control of fear, mental balance, to medical activity in the absence of scientific information about the disease).

It is worth mentioning the opinion on the impossibility of moral support of the patient from the medical staff or the family.

Conclusion: The answers show that the Romanian health system, structural and functional, needs a profound reform, an organizational management that will allow it to react promptly in any critical situation, well-intentioned and prepared management staff. There is a lack of information and training of medical staff to be able to respond to critical situations.

It is necessary to establish an electronic information program and a basic training program to respond to the challenges posed by unexpected situations.

**The second question** concerns healthcare management dedicated to addressing COVID-19 infection, in the absence of a specific evidence-based protocol.

Most respondents agree that the care provided was based on the experience of the medical staff and then on the information coming, quite quickly, from units that had previously tested a certain protocol. However, the answers are focused on the methods of diagnosis, treatment and isolation of patients. An interesting answer expresses the idea that the favorable or unfavorable evolution of the treated patient is not due to the lack of a protocol. Two of the answers consider that the recent increase in the number of cases is not a consequence of management, but a problem of community transmission. There is also a critical view, which expresses confusion and disorganization in healthcare ("chaotic").

Conclusion: The answers expose the confusion that exists regarding the understanding of the concept of healthcare management.

It is necessary to clearly define the management of healthcare and its understanding by those involved in this management. Healthcare providers need to develop a different view of control, responsibility, risk, and outcome in addressing the care they provide to a patient.

**Question number three** tries to find out the opinion of the interviewees about covering the integral needs of the patient with COVID-19, following the use of loan protocols. Opinions are contradictory.

Some of the interviewees claim that the protocols used covered the patient's needs, although there were adjustments to them as the process progressed. Another party claims that the protocols used had many neuralgic points, referring to the lack of medication, lack of patient counseling or problems related to the method of diagnosis and then treatment for comorbidities. Discontinuities were also found, albeit short-lived, between the time of communication of the validity of a protocol and its application or supply of medicines.

A different answer, determined by the nature of the medical specialty, highlights the rapid local elaboration of operational procedures, before the issuance of official orders regarding the methods, by the higher bodies.

Only one interviewee noticed the lack of a holistic approach of the hospitalized patient with COVID-19, regardless of the protocol used.

Conclusion: These different opinions, somewhat normal, show that the medicine practiced is based on guidelines and protocols, and their lack can lead to confusion or delays in treating the patient. In general, physicians involved in diagnostic and treatment activities are tempted to follow the provisions of the protocols and instructions in the guidelines, rather than creating value for the patient.

The medicine practiced considers the treatment of the disease and less the treatment of the patient. Insecurity and fear took precedence over one's own initiatives.

It is necessary to define and understand the value line of a medical service that goes beyond the limits of any protocol and that creates the optimal dimension in which the service becomes valuable for the patient.

**Question number four** brings to the attention of the subjects the statement according to which the degree of development of a medical system does not necessarily generate value in the result obtained in the patient's health. The best example is provided by the health systems in Italy or the USA, which have collapsed in the fight against COVID-19 infection.

The statement was not reinforced, but neither refuted by the respondents. In general, subjects tend to believe that modernism, development, endowment are elements that are automatically reflected in the value of a medical service. The high number of deaths in countries with developed health systems has been attributed either to the mismanagement of the protocol for the hospitalization or isolation of COVID-19 cases, or to the population segment over the age of 65, much more numerous in developed countries, either due to an enormous influx of infected patients in the first phase, or due to the fact that no one is prepared to face an unknown situation. The accentuation, in the dialogue, of the idea of result in the patient's health, determined certain subjects to recognize that the value pursued by the patient in the medical care must be reflected in his health.

The second part of the question concerns the possibility of improving healthcare so that it still generates value for the patient even in extreme conditions.

Most respondents recognize the need for a change in the organizational structure and functioning of medical units, reorganization of health care, staff, its preparation, reallocation of funds, endowment of hospitals or informing the population by credible factors. Several voices stressed the need for health education of the population, which acted "out of fear", as one respondent said, even if this reaction was proved effective. The idea of intensifying prevention activity, collaboration between the medical sectors and communication between all functional levels of the system was also specified. The reformulation of the medical act and the establishment of an electronic health card that would include all the patient's medical information was another opinion. The importance of primary care and home care was not ruled out either. In the end, there were opinions in favor of establishing models borrowed from the outside, which put the patient in the center of attention of the medical service.

Conclusion: "If we want to be healthy, then we must start with prevention, not with treatment" - said one of the respondents. In general, physician 's thinking is directed towards diagnosis and treatment, and measures to improve healthcare refer to these two processes. There are certain aspects of value-based healthcare in the responses. Their need was signaled by respondents who were not physicians.

It is necessary for physicians to understand that value-based health services must demonstrate their efficiency and effectiveness (quality) in the end result obtained in the patient's health. It is necessary to

implement a communication platform between all bodies involved in the management of medical services.

**The fifth question** insists on approaching the clinical picture of the patient infected with the SARS-CoV-2 virus, especially in the case of comorbidities.

Almost all subjects responded in the same terms: a multidisciplinary approach. There were responses that emphasized that COVID-19 infection is a systemic disease, not a localized one, and that it is wrong to approach a patient only on a certain pathology.

Conclusion: At least at a theoretical level, the need and value of a multidisciplinary collaboration is recognized.

**The sixth and seventh questions** draw attention to the outcome in the patient's health, as an indicator of measuring the value of the medical service, seen through the patient's perspective.

The answers support the need to measure the value of the medical service and according to the result obtained in health, and several subjects want to specify the importance of resuming the activity in the family, society and work of the treated patient, as well as the duration of treatment and healing.

A courageous response categorizes a physician 's performance according to the patient's quality of life. A few other answers claim that the current performance indicators do not reveal the patient's satisfaction, much less the result in their health. There are also contrary answers to this statement, as well as others that support a mixture of indicators.

Conclusion: All interviewees consider it correct to introduce indicators to measure the health obtained in the patient. The value of a medical service seen through the perspective of the patient is understood differently by the medical staff.

**The eighth question** seeks to find out the opinion of the subjects on the change of the orientation of the medical service from a process-based to a results-based one, by introducing the measurement of the result. The answer is no, despite the fact that the need for this change is recognized, and the denial comes due to the impossibility of implementing this measure in the current policy conditions.

Conclusion: Structural and functional changes in the healthcare system are not determined by the existing evidence in reality.

It is necessary to involve political factors in implementing a profound change.

**Question number nine** refers to the importance of the integrated approach to the pathological condition of a patient and to the stage of its implementation in the Romanian health system.

The precarious implementation of this approach is also unanimously confirmed and there is even a statement that it will disappear from the system, because "the great integrators disappear", due to the fragmentation of medical specializations and overspecializations. The trends of medical schools in the world go on medical overspecializations. There is also the opinion that this concept is not properly understood in the medical world.

Conclusion: It is necessary to acquaint medical staff with this concept and create an organizational framework conducive to promoting such an approach if we want it to exist.

**Questions ten and eleven** present the integrated healthcare model based on providing a full cycle of care and the permanent presence of the multidisciplinary team. The answers to these two questions unanimously recognize the importance, the value created, the need, even the obligation to organize health care according to these processes. On the other hand, all interviewees expressed doubts about the possibility of implementation. It is interesting to note that the subjects linked these two aspects to other elements arising from integrated healthcare, such as payment by result. It is a broad aspect commented by the interviewees and mentioned as a necessity. It seems to be the subject that aroused the most interest from the interviewees (even if each considered it necessary to make certain clarifications) and which, according to the opinions issued, could lead to the practice of integrated medical care. It has also been recognized as a very good incentive for physicians and for fair competition between the public and private systems. Also, on this line, it was noted that it would be the solution for

physicians fleeing from responsibility, resorting to referrals to other specialists, which greatly complicates the healing process and increases costs.

When proposing the establishment of integrated medical practice units, several respondents expressed their agreement and even the desire to work in these units.

The answers again touched on the issue of fragmentation of healthcare, this time mentioning the rupture that exists between the weak prevention activity and the equally ignored recovery and then monitoring activity, by the rest of the care chain.

Instead, measuring the outcome at the end of the entire health care cycle elicited negative responses. Less debated was the issue of cost savings in the case of a full medical reimbursement.

Conclusion: Although it seems to be a sensitive topic, payment based on the outcome may be the link between the activities that constitute the value chain in healthcare. Although the tendency is to believe that physicians are not in a hurry to assess issues related to the economic field, no concrete opinions have been obtained on the payment of the package either from economist respondents. The tangled funding structure of the health sector raises serious barriers to a change in thinking.

There is a need for a deep justification of the assessment of the result at the end of the medical care period.

**The last two questions** require the opinion of the subjects about the managerial training of the management staff in the Romanian health system.

No definite answers were obtained. Some respondents finally plead for a physician with professional managerial training or for a return to the old form of management: the medical director and in his subordination the economic director.

There are, however, other types of clear statements: just a management course is not enough; a person outside the system is not suitable; a person without medical knowledge will not fully understand the needs of a patient; a physician without thorough management knowledge will be an incompetent manager. It also specifies the leadership qualities that a leader should have.

Conclusion: These last questions were the only ones on which most of the respondents could not give a concrete opinion with certainty. Most of the comments clearly show the inefficiency of the current form of management of the system, exposing incompetence or interests and goals inconsistent with the purpose of a medical system.

## Discussion and conclusions

In most cases, the perception of the subjects is that the management applied to the management of health care in case of COVID-19 infection was adequate, compared to the particular conditions of our health system.

Regarding the perception of the new management model, based on integrated healthcare and its value depending on the result obtained in the patient's health, the respondents' answers are oscillating. In the context of certain questions, they are favorable to the new model, in the context of other questions they become negative.

It was found that there is a discrepancy in understanding the concept of healthcare management, between the way the theory defines it and the way it is perceived in practical reality. Therefore, the answers regarding this concept cannot be fully proven with the theoretical statements and their validity cannot be verified based on the answers.

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# CASE STUDY ON MANAGEMENT RISK MANAGEMENT IN A PUBLIC HOSPITAL IN ROMANIA

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## Abstract

**Purpose:** *This paper contains considerations regarding the case study, aims to identify managerial risks in the health system.*

**Methodology:** *In this study, modern research techniques were used, such as: the bibliographic study method and the interview method.*

**Findings:** *It can be appreciated that the health unit carries out its activity based on the legislation in force which has proved to be very cumbersome and sometimes unclear.*

**Research limitations / implications:** *This research is performed in a public hospital in Romania.*

**Practical implications:** *The identification of managerial risks, other than clinical ones, contributes to the efficiency of the system, the improvement of patient safety and the elimination of managerial mistakes.*

**Originality:** *This paper is based on interviews with employees of the health unit, the originality of the opinions is the important element that contributed to this research.*

**Keywords:** *risk, management, health*

## Introduction

Like any enterprise, institution, company, and health units in Romania, they carry out their activity so that the risks are permanently present. For this reason, the management of health units must pay special attention to risks, and this requires a careful, insistent and in-depth analysis of all the risks and their effects.

Analyzing the health system, it can be stated that it can be evaluated as one of the largest "enterprises" in which activities are diversified.

Underlying good risk management are the general principles that, applied according to standards, can make a beneficial contribution to healthcare facilities.

These principles act as a guide, orientation, channeling and protection of values, so that the objectives are achieved. For this, the following must be kept in mind: the concern for creating, protecting and improving performance and value; risk management to be an integral part of processes and decision-making, being considered an act of responsibility of the manager; transparency of risk management, etc.

Risk management in healthcare units in Romania is characterized as a complex process, which cannot be treated as a simple review, and no matter how the problem is posed, the systemic approach to risk management will remain essential.

The regulatory activity in the field of health, represents a way in which the principles underlying public health are implemented.

The regulations regarding the risk management in hospitals are the norms elaborated and endorsed by the Ministry of Health and which represent reference documents.

Organizational culture is also an important factor that makes its mark in the management of managerial risks, so it is considered a priority for managers. Organizational culture is the sum of all the values in the health unit, and which represents the "lifestyle" of the health unit. Employees, through the exercise of the profession, achieve their goals, objectives that underlie professional values.

Risk management in healthcare units focuses on the risks that can affect both patients and employees and the medical institution.

Effective risk management is based primarily on knowledge of risks and at the same time the focus is on eliminating unacceptable risks.

### **Considerations regarding the risk management in the specialized literature**

In order to paint an overall picture of what management is, we can call on the opinions of great specialists in the field, who are "school creators" and who through their countless publications and stories have highlighted the role and essence of leadership. What they offer us is in fact the evolution of management, of everything that the art of leadership means.

The father of scientific management, Frederick Taylor (USA), is constantly attracted and concerned about the evolution of management as a science. The best results are obtained due to the conception and management style approached by each institution, its own conception which is based on theoretical notions and which can be applied not only in industry but also in the healthcare system. Having at hand the theoretical scientific bases, together with everything that represents elements belonging to the decision-making field, changes and changes in health, is the health reform, all having an essential contribution to obtaining an efficient and effective management that is appreciated in health.

An essential support of this research is based on the literature, publications and evaluations - health system research. Decentralization in Romania is one of the concerns of political factors and is mainly aimed at public administration, characteristic of the unitary system. In this sense, we can say that the health field is anchored on a multitude of regulations and legal norms based on the Fundamental Law of the country - the Romanian Constitution.

Theoretical and practical reasons have made the health system reform focus not only on the factors that are responsible for health care, but also on the management and coordination functions, aimed at the management of the public health system.

The management of the public health system has also undergone some changes due to the transformations that have occurred over time, more precisely it has adapted to current needs. The transition from one system to another and their improvement has only added value in terms of patient health as well as the sphere of coordination and in all that management means.

Basically, the management developed with the health reform, a reform that was constantly subject to legislative changes and often could not bend to the real situation, thus, the application of the rules presenting a discomfort for those involved. Following a research, it was shown that in the Romanian public health system, decision makers, respectively hospital managers, did not manage the situation sufficiently and conscientiously, thus, some areas managed improperly were discovered. Transparency regarding the allocation of resources, as well as their sometimes unjustified allocation criteria have led to the deterioration of the system.

Even the World Health Organization expresses its point of view, stating that health has an important role, rising to the rank of law, representing a "national treasure", which has the power to support the evolution of a society. It should be emphasized that the activity of the health system more precisely, the Romanian management system is somewhat influenced by the level of European and even global

management, which is a benefit for Romania. This benefit can be materialized in the transfer of knowledge, methods, techniques, which for us is a progress.

Scientist Peter Drucker drew attention through his publications that society is forced to accept modern management, and those who do not adapt will have unpleasant surprises. This entails a change, which can only be done with efficient management.

Management some time ago focused largely on speed and speed, and less on the target - target, and this attracted imbalances. Modern management must look for talent among the employees that managers have, in order to exponentially increase efficiency, value and quality, at the same time it must stimulate thinking with their own mechanisms to accelerate innovation.

Foreign authors, such as English or French, had a major influence on Romanian theorists, concerned with the evolution of management. An American study shows us that globalization in the medical field, presents differences regarding the problems of health systems, and collaboration and international relations are not in the field of news. (Norbert Stenczel)

If we refer in a global context, the problems multiply, which determines the detailed examination of some aspects related to the distribution of the labor force, the composition, the migration of the medical staff, as well as its size. The study of the factors related to the culture of each country, geography and economic development should not be neglected.

Another aspect of public health in a global context is economic development and the resources of each country. All attention is focused on gross domestic product (GDP), which is a "decision" factor in terms of population health. The higher the GDP, the higher the investment in health, the higher the labor force, which leads to better health management. Romania is not among the leading places in the European Union in terms of funding, on the contrary it is half the EU average, more precisely, it is close to 5% of GDP (State of Health in the EU, 2009)

In the healthcare system, financial management is one of the important links that has the role of developing the medical field, presenting at the same time a bridge of communication between the specialists in the field and top manager. In the field of health, the increase in the needs of society leads to an increase in financial resources and which is manifesting itself in an accelerated manner.

When it comes to studying global health systems, it is necessary and appropriate to analyze the impact that the field of human resources can have on health reform. The trends of globalization in health are represented by achieving the goals that lead to efficiency, quality and equity.

The socio-demographic factor represents a key role, which directs our attention to the aging population and which differs from one country to another. The aging of the population requires the health system to supplement the workforce in the medical field. Another aspect is the replacement of the elderly medical staff with a young medical staff, eager to embrace the medical career.

In modern management, in addition to the fields directly related to medical activity, an important field is also technical and technological, and here we refer to the use of information and communication technology, and the role it plays in the decision-making process.

Human resource management (HR) should, in practice, not be different from other areas, as they are the main source that proves to be inexhaustible and can be adapted to current needs. The complexity of the relationship between human resources and health requires a thorough and in-depth study.

As the public health field is also a publicly funded system, human resource costs are high and certainly affect the employment of efficient specialists, for which a workforce balance must be found.

Characteristic of all developing countries, is the migration of health personnel from rural to urban areas, directing professionals to developed countries, this labor mobility, without human resource planning, lead to an imbalance difficult to control.



## Case study on managerial risk management in a public hospital in Romania

The hospital being characterized as a complex system, it represents the support of health care of the population, and which by its nature and configuration is made up of subsystems that interrelate with each other (departments, laboratories, etc.). For these reasons, the hospital as a public entity must focus on the quality of medical services, proactive management, performance and flexibility. The hospital being a complex system, it can be stated that it is a socio-technical system, in which the individual, as a human being is considered a component of this system. Technically speaking, we can say that the hospital has the appearance of a company that provides services in favor of customers. We can practically associate this hospital environment with a business environment, in which the risks can influence it so that it can lead to insecurity. That is why a rigorous, efficient management, which is concerned with maintaining standards, looking for new methods that support evolution, inevitably leads to competitiveness and performance. At present, risk management is no longer perceived as a compliance issue, but is considered as an integral part of the decision-making process.

The course of history has shown us that hospitals in Romania are constantly facing an increasing increase in demand for medical services, which entails an increase in costs and risks. From a theoretical point of view, efficiency and quality should not be missing from the medical act, but in practice it turns out that these two factors are not always present.

The real image of a public hospital in Romania is drawn after a careful analysis that at the same time shows us the evolution of the reform process.

This presentation is made in a public hospital in Romania, which is part of the research activity aimed at managerial risks.

Thus, the health unit carries out its activity based on legal norms and regulations, joining the system and operational procedures regarding risk management. Being one of the studied departments, that of quality management, we can say that it represents an important link in the management process of the health unit, and that the analysis shows that this department faces various problems that affect to some extent the activities of both departments. as well as the hospital. The most acute problems are not only related to the specialized personnel within this sector, but also to problems related to the perception of the sanitary personnel at the level of sections, keeping in mind the following:

- Difficulties in organizing the compartment: Surprisingly, one of the problems comes from the direction of ANMCS, which turns out that it has not issued an order on the specific duties of each employee in the department responsible for quality management, and this is stipulated only at plan level, following that on future to materialize.
- Another problem reported is the lack of a head of service to coordinate and train the staff of the department, and this makes the activity of employees have a chaotic course. The existence of the vacancy vacated six months ago does not seem to be on the management's priority list.
- Insufficient staffing is a general problem at the hospital level.
- Section level issues: A less pleasant situation is the disinterest of the staff in the departments and compartments of the hospital regarding the risk management, practically, they do not want to assume the risks, and the obligations are passed on to other colleagues. The receptivity and interest of the medical staff is very low, they use materials from the Google application, which has no connection and does not meet the needs of the health unit.

The quality management department and its attributions are misperceived by the medical staff, who expect that all the specific activity of the management will be performed only by the persons specialized in this field without involving the medical staff from the departments and compartments.

The presence of the risk of non-fulfillment of the service activities, due to the resistance of the medical staff and the refusal to implement the requirements, is another impediment in performing the service tasks of the department.

In the absence of sufficient involvement, often total disinterest, in this context and the responsibilities were misunderstood, moreover, this compartment is considered useless.

Regarding the field of danger, namely labor protection and PSI, an important aspect is that the perception of employees is good, and they are beginning to realize that the rules are common sense and come to their aid, however we still encounter areas in that disinterest and implementation of the instructions are present. Another problem facing the sub-fund is the inadequacy of funds and action instruments. The most burning issue is related to legislation, legislation that has gaps, difficult to understand, what is to be done is not stated correctly, and for this reason there is confusion. National legislation is linked to European norms, but the mismatch of work systems is obvious. Another aspect regarding the legislation is the standardization, namely, the legislation does not specify the number of employees for this sector, for this reason this compartment is insufficiently standardized which leads to the difficult development of activities.

Human Resources (HR), one of the most important areas, falls in the same directions as the other departments. It is noted that there are trends in adapting to European legislation, but European standards have not been reached, so the legislation needs to be improved and updated.

One of the weaknesses of this field is the insufficient staff and the lack of sufficient involvement in carrying out the service activities. The staff inside the compartment consider that they carry out their activity in a demanding atmosphere due to the large volume of activities, legislative changes, a burning issue is related to the deadlines that must be met regardless of conditions (number of staff and overtime). In the opinion of some employees, in the activity of human resources, there is a need for a much more active participation in professional training courses, and especially for a change of mentality. The staff outside the compartment within the health unit do not appreciate and are not aware of the work done by the employees of the R.U.N.O.S.

Although the financial-accounting department works relatively well, the collaboration of the financial department with the hospital management is very good, there are still situations in which the activity is hampered by certain external factors. Despite the fact that, from a theoretical point of view, the health unit is located at the level of European Union standards, practically the situation is not in accordance with the theory. The factors that contribute to the difficulty of meeting the standards are related to the insufficient financial support from the state, the political nuances, but also to the need to improve the staff at the level of requirements.

## **Conclusions**

Although the health system is considered a priority, political factors have contributed through its levers so that this system has not benefited from unitary management.

It can be appreciated that the health unit carries out its activity based on the legislation in force, legislation that has proven to be very cumbersome, with gaps, often unclear. Another aspect is that European legislation does not always comply with our health system, which leads to a functional imbalance.

In other words, the legislative deficiencies, together with the organizational problems both at managerial and compartmental level, the lack of involvement, as well as the lack of an organizational culture lead to the difficulty of the health unit's activity.

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# DIGITAL EDUCATION – A CRITICAL ANALYZE OF WEB APPLICATIONS

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## Abstract

**Purpose** – critically analyze 4 learning applications/platforms

**Methodology/approach** - comparison in pairs alongside analytic hierarchy process (AHP) have been used

**Findings** – a digital application that is close to covering all the user's needs from a cloud learning perspective

**Research limitations/implications** – there were selected only 4 learning applications because of the limited number of platforms that are available and are able to cover most of the users' needs

**Practical implications** – analyze the affordability, general aspects, what fields do the applications/platforms cover, how user friendly are them and how efficient are to the users, analyzing in deep the downsides and upsides

**Originality/value** – helping users decide which application is best suited for each individual, given criteria's like: affordability, domains, accessibility, requirements and efficiency

**Key words:** Education, Digital, Applications

## 1. Introduction

For several years, Internet of Things (IoT) and cloud computing, have been transforming the IT environment, working together and managing to make the life of users more comfortable when using software and hardware products. The cloud environment has become important because of the motivation to improve data processing and storage resources to be done more efficiently, being cost-effective and offering multiple resources. There is a high importance for the costs of businesses to be reduced and the work productivity to improve.

In the first part of this paper there is presented an overview of IoT, cloud computing, virtual learning methods and services. The study has been conducted on over 80 papers identified and analyzed, filtered by criteria's such as: relevance to the subject and covered subdomains. A number of 40 papers have been preserved and were divided in subdomains like: IoT, cloud computing, digital education. From a list of cloud applications, the relevant ones were selected and studied, looking at the downsides and upsides of them. For the research purpose in the establishment selection criteria for a digital application that is close to covering all the user's needs, there were used 2 methods: the comparison in pairs and the analytic hierarchy process (AHP).

## 2. Background

### 2.1 IoT influence

In the present, connected devices are attracting a significant amount of attention among researches and worldwide institutes responsible with cyber security. Nobody knows how the future will look like with all

these devices interconnected and actively involved in our daily routine. Alongside IoT another domain that is growing day by day is the cloud environment. It has to be mentioned that IoT and cloud are interconnected and work together very well, as one has the equipment's to interconnect things, the other has the modern infrastructure and services. The advantage that IoT is offering comes with the connectivity freedom on using supported technologies like wireless, Bluetooth, data or mobile networks. (Ray, 2016) Another advantage of IoT devices is the capability to adapt to changes implemented on the operating conditions, user's context even on the connectivity of the network. For example, cameras could switch from lower resolution to higher resolution when any movement is detected. Also, IoT devices have self-configuring capacities allowing the devices to work together and provide high functionality. These platforms influence domains like data management, system management, applications development, analytics, deployment, education, medicine.

**2.2 Cloud environment**

The cloud environment has become important because of the motivation to improve data processing and storage resources to be done more efficiently, being cost-effective and offering multiple resources. There is a high importance for the costs of businesses to be reduced and the work productivity to improve.

The main distribution models from cloud environment, the services and the applications offered are presented in Table 1: Distribution models, services and applications used in cloud.

Table 1: Distribution models, services and applications used in cloud.

Distribution models	SAAS	PAAS	IAAS
Definition	Software as a service	Platform as a service	Infrastructure as a service
Services offered	Email Productivity tools	Security Development of applications Management of databases	Network Servers Management
Applications used	IBM Oracle Google apps	Windows azure Amazon	Cisco Microsoft

The distribution models that are used when implementing cloud products are: SAAS, PAAS, and IAAS.

Software as a service (SAAS) is referring to a software licensing model where software is licensed on a subscription and is centrally hosted being accessed by users via a web browser. (Nabil, 2010)

Platform as a service (PAAS) makes available to users a platform where there can develop, run and manage applications without the expensive of hardware components and infrastructure.

Infrastructure as a service (IAAS) is the delivery of the network infrastructure, servers, storage and the software from these resources into a service. (Overton & Dr Dixon, 2016)

**2.3 Digital Education**

With the help of IoT and cloud environment a new type of education has been growing and evolving in the past years. Digital education is an environment that is gathering a number of learning methods like: eLearning, iLearning, mLearning.

Following the general change of people's habits and the world's job market structure, the education sector has gone through a large-scale transformation over the last few years. Cisco systems, the first leaders in developing internet and networking technologies that changed the way peoples work, interact and live, were the first ones focusing on eLearning in the 1990's. (L.C. & R.J., 2002)

ELearning is short for electronic learning and can be described as the use of web-based technology tools and enables the form of distance and non-contact education. ELearning promotes distance education and facilitates the education content.

ILearning has the same principles and concepts as eLearning. It is short from internet-based learning and it can be defined as a process of searching data online and the learner stores the information found and will use that information. (Fariborz & Ehsan, 2014)

Mlearning refers to mobile learning, focusing on using mobile technology for learning purposes. It is a new technology and it allows people that have a smartphone/tablet/laptop and an internet connection to obtain learning materials.

### **3. Digital education discussions**

Digital education is already implemented in several schools but in its full complexity will remain a big challenge in traditional formal educational settings.

The supply of online education needs to be understood within the context of the educational environment. Online delivery can be very effective at the provision of domain knowledge and can assist with the development of communication skills and to extent with interpersonal skills and the co-construction of knowledge. However, the provision of work experience of higher-level interpersonal skills presents a significant challenge for online education as currently delivered. (Khare & Hurst, 2018)

There is a debate about the quality of online versus on-campus digital education that continues to rage. While some resist the move to virtual campuses and learning, it is hard to deny the preferences of a connected population who seek increasingly flexible, accessible learning opportunities, course materials, classrooms, faculty, and associated services anytime and from anywhere.

Unlike the online education courses of the past 20 years, today's online courses are of much higher quality and are available to be consumed anywhere, at any time and at any speed. A group of online education digital platforms have been launched in the past years to deliver these courses. Companies will either partner with these digital platform providers to build courses and credentialed learning paths or they will build their own platforms. (Auer & Tsiatsos, 2018)

#### **3.1 IoT in education**

Internet has changed the way people interact and education has not been immune to this change, which has created new forms of interaction between teachers and students that helps to improve the teaching and learning process and expands the context in which students learn. Technology is one of the elements that have strongly influenced education in recent years, particularly since the Internet boom. Taking technology as one of its tools, education is changing from a model by which knowledge is only transmitted to one where it is presented in an active and collaborative manner, seeking to improve the processes of teaching and learning. (Marquez, Villanueva, Zeida, & Garcia, 2016)

The Internet of Things (IoT) is influencing the education field and allows Internet based communications to happen between physical objects, sensors and controllers, changing educational institutions massively. By embedding sensors in objects and integrating cloud computing and applications, augmented reality, wearable technologies and big data in this platform, different parameters of the educational environment can be measured and analyzed to provide useful information. It also has created a new interaction between people and the environment in educational organization. (Maryam & Siavosh, 2016)

For users, students and employees of different companies it is easier to access materials and obtain information about new technologies. Internet of things in education is offering innovation, remote connectivity and helping students, employees, developers in testing and creating new technologies and new learning processes. Figure 1 represents the influence of IOT in education, in people's lives and in technology.

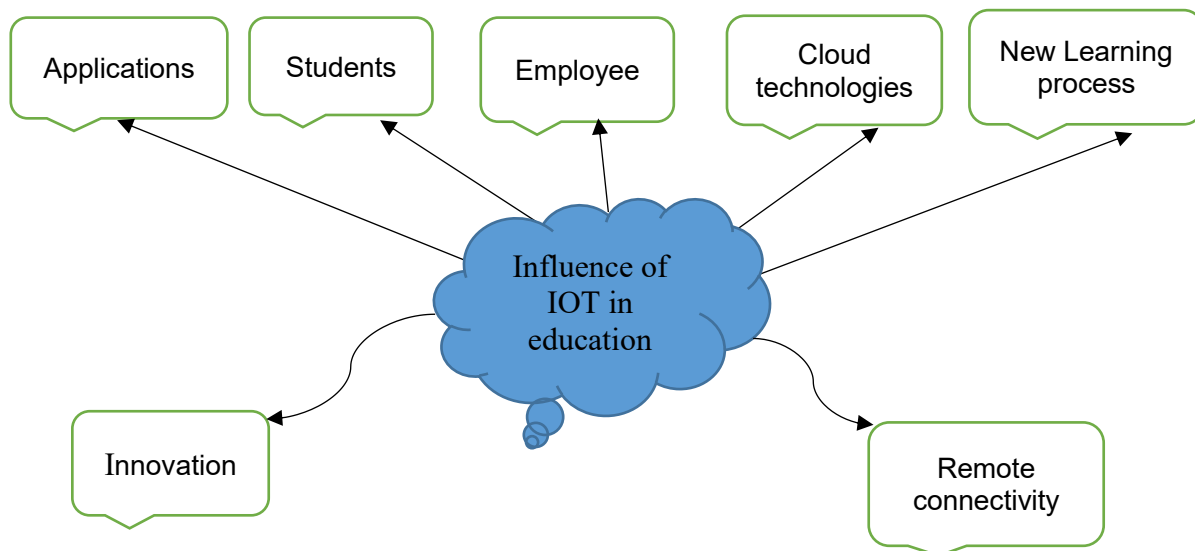


Figure 1: Influence of IOT in education, in people's lives and in technology

#### 4. Research methodology

The objective of the research is to critically analyze 4 learning applications/platforms, covering affordability, general aspects, what domains do they influence, how user friendly are they and how efficient are to users. By using a pairwise comparison and a matrix diagram it can be obtain a local objectivity, on each application, at a certain moment, by a certain work team. The results may vary if the method is applied under different conditions. We will be compiling a list of elements to be ranked and arranging them in a matrix square  $n \times n$ . Each element will be compared with all the others, going along the lines: depending on the importance perceived by the team, by mutual agreement and 10 points are distributed on each element of the comparison. The notes on each line are summed up and the final ranking of the hierarchical elements is established. The comparison in pairs alongside analytic hierarchy process (AHP) will be used in the establishment selection criteria for a digital application that is close to covering all the user's needs.

##### 4.1 Analyzing previous works

In table 2 are presented a number of most relevant papers analyzed that are influencing, helping and trying to implement correctly and with ease of access the digital education process. From the first paper we can observe that the impact is directed exactly to the users (teachers and students) helping them in the online learning process and presentation. The second paper is using learning platforms to help the people that want to learn different skills and to get specialized in key domains. In the 3rd paper a new way of thinking has been presented the "Computational thinking" that could become a cultural technique and a mutual approach to a refined working definition. Paper number 4 explores the online educational process focused in the business domain looking to increase efficiency and effectiveness of the users using this technique. In the last paper of the table studies the effect of the Internet of Things (IoT) on an Education Business Model.

The focus of the research will be to study the platforms that have been launched in the last years to deliver online courses. These are: UDEMY, LYNDIA, UDACITY and EDX

Each of these platforms will be studied by general aspects, what fields do they cover and how user friendly they can be.

Table 2: Papers analyzed, research and impact

Authors	Paper summary	Research purpose	Impact
(Marquez, Villanueva, Zeida, & Garcia, 2016)	With the help of IOT this paper introduces a new model for digital learning	Developing an Integration model of virtual academic communities with the help of IOT	Helping Students and teachers that are learning in classes Helping teachers understand better the on-line learning process
(Auer & Tsiatsos, 2018)	Oriented on the development process of IOT in education	Studying learning platforms like: UDEMY, LYNDA, UDACITY, EDX, HBS	Over 100 people are using these platforms daily to learn different skills and to get specialized in key domains that can help the work environment
(Don, Bottino, Lewin, & Sanchez, 2018)	Computational Thinking on the Way to a Cultural Technique	Debate on computational thinking from different perspectives: one of a teacher and the other view is from a reflective software engineer	Computational thinking could become a cultural technique and a mutual approach to a refined working definition
(Khare & Hurst, 2018)	Online business education	The demand side consists of the demonstrated needs of organizations desiring the skills and knowledge of business graduates whether for a degree, diploma, or upgrading.	The efficiency and effectiveness of online provision will likely prove to be central tenets of the value proposition considered by potential consumers.
(Maryam & Siavosh, 2016)	The Effect of the Internet of Things (IoT) on an Education Business Model	Integrating cloud computing, augmented reality, wearable technologies and big data in this platform, different parameters of the educational environment can be measured and analyzed	This platform has changed the Education Business Model and added new value propositions in organizations

## 4.2 Digital education platforms

In table 3 are highlighted the general aspects of each platform, the affordability and the discount packages, the domains covered and at what level where the requirements of a user experience fulfilled.

Starting with Udemy, it can be observed the high advantages offered in the affordability sector, with 30 days free subscription and a lot of discounts on different course packages. Also, the availability to learn on your schedule anywhere anytime is something to consider. Because of the high availability to learn and the discounts provided, UDEMY obtained a high rating in user experience.

LYNDA, the second platform offers digital education for people, business, schools and government organizations. The courses provided are the same as UDEMY, but unfortunately for the residential users no discounts are in place. With the same courses offered and affordability issues the rating obtained will be LOW.

UDACITY is the platform that offers multiple discounts and it is the only one from all 4. It is oriented on the tech field and strongly using IOT in the services provided. The small downside is that courses are tech oriented and fields like medicine, education, business are neglected. However, because of the vast courses provided in the tech fields and the discounts offered a HIGH rating is obtained.

The last platform is EDX, and from all it is the most complex one. Offering over 2500 online courses it has the largest database compared with the others and covering all the domains from tech, to medicine, to education and business. However, the downside is that no discounts are applied on any course and affordability has a big percentage in the users view so the MEDIUM rating has been given. All these platforms are ideal for digital education offering lots of training programs, resources, software's, discounts, and helping people developing and growing in different sectors of work fields.

Table 3: Digital learning platform

Platform	General aspects	Affordability, discount packages	Courses / domains covered	User requirements where met? (Low, Medium, High)
UDEMY	Availability to learn on your schedule anywhere anytime	<ul style="list-style-type: none"> <li>- 20 Euros discount from 100 Euros</li> <li>- 30 days free trial</li> <li>- if not satisfied the price paid will be refunded</li> </ul>	Development, business, IT, design, photography, marketing	High
LYNDA	Offer flexible, cost-effective group memberships for business, school, or government organization	<ul style="list-style-type: none"> <li>- One Free month</li> <li>- No other discounts</li> </ul>	Development, business, IT, design, education, government, developer	Low
UDACITY	Learn the latest tech skills to propel your career	<ul style="list-style-type: none"> <li>- 50% discounts on monthly and 3 months payments</li> </ul>	Cloud computing, Data science, business, programming	High
EDX	Access 2500+ online courses from 140 institutions	<ul style="list-style-type: none"> <li>- No discounts</li> </ul>	Development, business, IT, design, education, government, developer, Cloud, computing, data science, business, etc.	Medium

### 4.3 Research using comparison in pairs and AHP

In the final part of the paper for the research purpose there will be used 2 methods, the comparison in pairs and the analytic hierarchy process (AHP) in the establishment selection criteria for a digital application that is close to covering all the user's needs. The AHP was developed by Thomas L. Satty in the 1970s and it's a method used in fields like industry, business, education and other mores and has the particularity in group decision making. It uses math and psychology and is a good method for organizing and analyzing complex decisions. It provides a rational framework for a needed decision by quantifying its criteria and alternative options, and for relating those elements to the overall goal. (passagetechology.com, 2020). Figure 2 that was generated by Satty presents the fundamental scale for pairwise comparisons for assigning the weights.

The goal is for a user to decide which application is best, given criteria's like: affordability, domains, accessibility, requirements and efficiency. Affordability refers to the price that the courses cost. Accessibility represents that it can be accessed from all countries of the world and no restrictions are applied. Requirements represents that it can be accessed from all types of smart devices. And efficiency, represents the learning skills that should be gained after using the learning applications /websites.

Table 4 presents how important is each criteria to another and are given importance number from the fundamental scale. All the rows with the same name intersection will receive automatically a 1. In table 5, the fractional value will be converted to decimal value and on each row starting from upwards to bottom and the total sum will be calculated. After obtaining the total sum each criteria will be divided by that total number obtained, for example in the affordability column we will divide 1/1.65, 0.2/1.65, 0.25/1.65 and finally 0.2/1.65.



Intensity of Importance	Definition	Explanation
1	Equal importance	Two elements contribute equally to the objective
3	Moderate importance	Experience and judgment slightly favor one element over another
5	Strong importance	Experience and judgment strongly favor one element over another
7	Very strong importance	One element is favored very strongly over another; its dominance is demonstrated in practice
9	Extreme importance	The evidence favoring one element over another is of the highest possible order of affirmation
Intensities of 2, 4, 6, and 8 can be used to express intermediate values. Intensities 1.1, 1.2, 1.3, etc. can be used for elements that are very close in importance.		

Figure 2: AHP fundamental scale

Table 4: pair-wise comparison

	Affordability	Domains	Accessibility	Efficiency
Affordability	1	5	4	5
Domains	1/5	1	3	7
Accessibility	1/4	3	1	5
Efficiency	1/5	1/7	4	1

Table 5: Fractional value and total sum on each row

	Affordability	Domains	Accessibility	Efficiency
Affordability	1	5	4	5
Domains	0.2	1	3	7
Accessibility	0.25	3	1	5
Efficiency	0.2	0.142	4	1
Sum	1.65	9.142	12	18

The result will provide the normalized pair-wise in table 6. In the criteria weights/priorities are calculated all the values in the row from left to right and divided to 4, the number of criteria's. We can observe that when choosing an application the cost price is the main priority with a percentage of 44%.

Table 6: normalized pair-wise comparison

	Affordability	Domains	Accessibility	Efficiency	Criteria weights/ Priorities
Affordability	0.6060	0.5469	0.3333	0.2777	0.4409
Domains	0.1212	0.1093	0.25	0.3888	0.2173
Accessibility	0.1515	0.3281	0.8333	0.2777	0.3976
Efficiency	0.1212	0.0155	0.3333	0.0555	0.1313

Table 7: Fractional value and total sum of affordability on each application

Affordability	UDEMY	LYNDA	UDACITY	EDX
UDEMY	1	3	4	7
LYNDA	0.333	1	3	5
UDACITY	0.25	0.333	1	5
EDX	0.142	0.2	0.2	1
Sum	1.725	4.533	8.2	18

The next table demonstrates the weight of each application against the affordability criteria and it is presented the value converted to decimal and the total sum. After obtaining the total sum each criteria will be divided by that total number obtained and the result will provide the normalized pair-wise presented in table 8 and the application with the high percentage of affordability. In the criteria weights/priorities are calculated all the values in the row from left to right and divided to 4, the number of criteria's.

Table 8: Normalized pair-wise comparison applications/affordability

Affordability	UDEMY	LYNDA	UDACITY	EDX	Criteria weights/Priorities
UDEMY	0.5797	0.6618	0.4878	0.3888	0.529
LYNDA	0.1930	0.2206	0.3658	0.2777	0.264
UDACITY	0.1449	0.734	0.1219	0.2777	0.319
EDX	0.0823	0.441	0.2432	0.0555	0.205

The user's best decision based off their priorities is the UDEMY application with a priority percentage of 52.9%. It's also the most affordable one from all the applications. The next application is UDACITY with a 31.9%, offering also discounts and courses for cloud computing, data science, business and programming. LYNDA obtained 26.4% in the user priorities, offering one month discount and opportunities in fields like development, business, IT, design, education, government, developer. EDX is the most complex application from all covered in this paper and it has access to 2500+ online courses from 140 institutions but from priorities perspective it has the lowest percentage, 20% in users preferences.

## 5. Conclusions

Globalization has put digital education at the centre of the economic and social agenda, emphasizing that the integration of technology with education is considered today a qualifying factor for success. Providing agility and strategic fit for business education's role in the modern world.

The appeal to study online comes from several incentives: the provision of flexibility, the possibility of gaining a credential from a world-renowned university to compliment on-the-job experience, and the added-value of networking with fellow students and co-workers from all around the world.

Digital learning is helping and emerging as a useful resource in education, influencing and helping the main fields of the world economy. It can be considered that the learning experience will be improved consistently in the years to come as this method is just at the beginning and it is growing day by day. People will need to be prepared to invest in this learning technologies because they come with a cost if they are not supported by an institution or business company. On the other hand, by using the power of the cloud learning technologies, students and teacher will be able to use the tools they need in a limited amount of time with no costs and from different locations. Delivery of education carries great potential, but it must be done in awareness of challenges with the right infrastructure and cost effective. In present times, a large amounts of companies, websites and applications are offering user's availability to learn on schedule anywhere anytime.

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# RESEARCH ON THE MANAGEMENT OF THE COMMUNICATION PROCESS IN PRE-UNIVERSITY EDUCATION INSTITUTIONS

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## Abstract

**Purpose** – The paper considers the importance of external communication at the level of pre-university education institutions in Romania and aims to identify how this is reflected in the relationship with family and community, on the one hand, and in relation to coordinating institutions on the other hand.

**Methodology/approach** - The methodology approached in the paper consists in structuring the bibliographic study on the aspects presented in the research within the research directions. For the four research directions, a set of objectives were determined, a series of concepts were defined and methods and methodologies were established for each of them.

**Findings** – The results of this study show the importance of external communication carried out at the level of pre-university educational institutions whose beneficiaries are students, parents and society.

**Research limitations/implications** – The study presents a research based on the bibliographic study, and the analysed documents are those published by institutions on the official website. A limitation is the realization of this analysis of the process of external communication of the relationship school - family - community and school - coordinating institutions only at a theoretical level.

**Practical implications** – The study will help to create better external communication between pre-university education institutions and those governing the educational process or other partner institutions.

**Originality/value** – The main contribution of the study is a model of external communication at the level of pre-university education institutions in Romania.

**Key words:** communication, management, pre-university.

## Introduction

At the community level, the school is the institution whose activity is based on communication, and it is therefore essential that this process, presented by Ross as "always changing, dynamic and reciprocal" (wet. (Panisoara, 2006), to connect with all members of the community in order to adapt to the new realities and to meet the expectations of their pupils and parents.

Analysing the different forms that external communication can have, Annie Bartoli (2015) mentions the existence of three types:

- External operational communication, carried out between the members of the organization with interlocutors from outside the organization;
- Strategic external communication, which consists in building or expanding a communication network;
- External promotional communication (advertising, public relations).

The school is an institution that has various roles: as a mediator between a person and his future, as a mediator between its beneficiaries (children, parents, society) establishing relationships between them, as an intermediary that makes the transition between school and other institutions (family related ,

school, profession). As a result, the school is called to a rapid, profound and continuous change, to a permanent adaptation in relation to the present requirements of the society as a whole. Here comes the need to use different communication channels, especially those based on new information and communication technologies and the opportunities they offer (Totseva, 2015).

## Methodology

Through the methodology used, the present research realizes the theoretical substantiation of the external communication within the educational institutions, between the institutions aiming at the educational process and between the educational institutions and partners, establishing the following research directions:

- Researching the communication process within the school-family-community relationship
- Researching the communication process within the school-coordinating institution relationship
- Researching ways to improve / optimize the communication process between pre-university education institutions and those governing the educational process or other partner institutions
- Designing the communication model: school - coordinating institutions

In the research direction "Research of the communication process within the school-family-community relationship" a series of articles and researches from the specialized literature on the regulation of the communication process in the school-family-community relationship were analyzed. The results highlighted various implications of this relationship on students and their families.

The second research direction "Research of the communication process within the school-coordinating institutions relationship" aims to analyze the managerial documents of the institutions targeting the educational process: Ministry of National Education, county school inspectorates, higher education institutions, high school institutions, middle school, primary and preschool. The aim was to establish the way in which the external communication is reflected in the following documents: the institutional development project, the managerial plan, operational procedures.

In the research direction "Research on ways to improve / optimize the communication process between the institutions governing the educational process" the objective aims at diagnosing the existing external communication process at the level of pre-university education institutions, taking into account decisions to eliminate or reduce dysfunctions. reported. For this purpose, the stages that constitute the diagnostic methodology of the external communication process were established.

The latest research direction "Designing the communication model: school - coordinating institutions" aims to build a communication map of the educational institution and develop a model communication procedure, according to the Guide for documented procedures. In accordance to the communication map and the communication procedure, following a research scheme (Figure 1), a communication model will be designed for pre-university education institutions. The emphasis will be on practical aspects and the implementation of the theoretical aspects analyzed above.

The validation of this communication model will be done by concretizing it and taking into account the problems identified following the analysis performed. In the application of this model, the optimization of the communication process will be considered by solving the notified problems and offering recommendations.

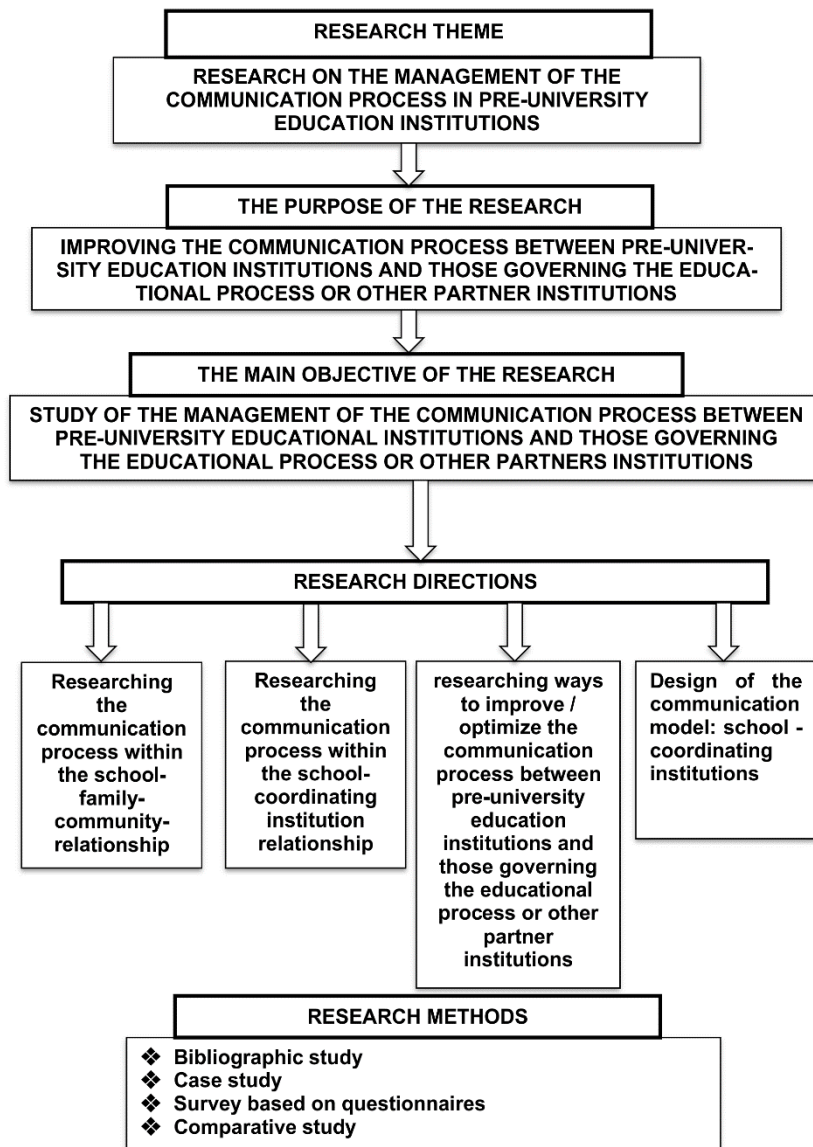


Figure 1. Research scheme

## Findings

Within any institution in general, and therefore the institutions that govern the educational field, communication is, along with motivation and professional competence, "the key to organizational excellence and effectiveness" (Grunig, 1992). Therefore, the term communication was analyzed from the perspective of several points of view offered by the literature, starting with the definition offered in 1949 by Shannon, C. and Weaver, W in the work "The Mathematical Theory of Communication": " ... the term communication has a very broad meaning, it includes all the procedures by which one mind can affect another. Obviously, communication includes not only written or spoken language, but also music, visual arts, theatre, ballet, and, in fact, all human behaviours. " (Shannon, C., Weaver, W , 1949)

In 1976 American researchers Frank E.X. Dance and Carl E. Larson (1976) identify 126 definitions of communication that they systematize into 15 conceptual classes. It can be seen that this concept offers in the literature many and very diverse approaches, leading to typologies depending on the nature of the message, the speed with which feedback is provided, the number of participants in the communication process, the context of interaction or rigour.

The term "external communication" is used at the level of institutions, referring to the place where interactions take place and all acts of communication. (Figure 2)

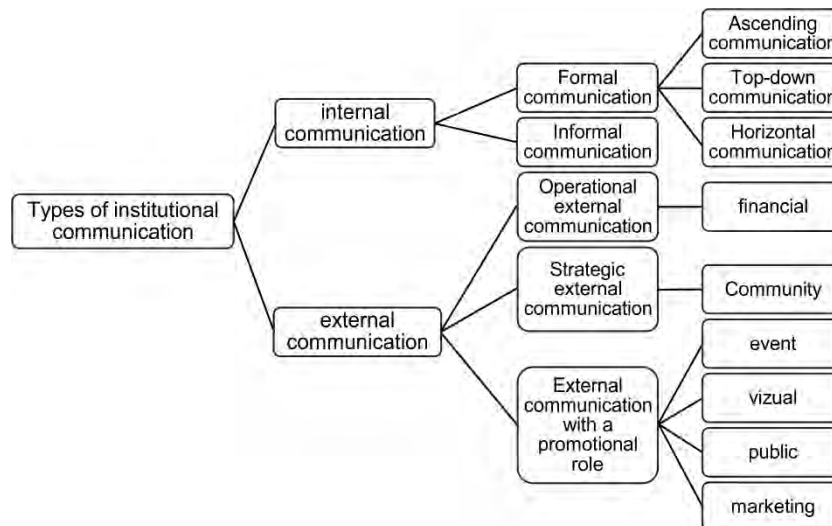


Figure 2. Types of communication

Research in the field of communication has led to the emergence of many models of communication. One of the classifications used in the literature is based on the type of relationships between the elements of a communication model graphically illustrated by the authors:

- a) linear models, which regard communication as a linear and one-way process between sender and receiver (e.g. : Shannon and Weaver Model, 1948; Lasswell's Model, 1948);
- b) circular models, which introduce feedback and conceive of communication as a circular process between two or more elements with equal or different capacity for influence (eg: The model proposed by Meyer-Eppler (1963); Osgood and Schramm's model , 1956; DeFleur's model, 1970; Ray Hiebert's circular communication model, Donald Ungurait and Thomas Bohn, 1974; Frank EX Dance's helical model, 1994);
- c) reticular models, which conceive of communication as a network process, in which more than three elements with relevant incidence intervene and which constitute processes of distribution of meaning or information (eg: Norbert Wiener's cybernetic model, 1950; Newcomb's model , 1953; Gerbner's Model, 1956; Westley and MacLean Model, 1957).

At the level of the institution, communication has the role of facilitating the achievement of the general objectives of the organization (Hosu, 2017) which leads to the creation of communication strategies subordinated to the general strategic concepts of the organization.

Within the school-family-community relationship, the parties involved decide to act together in support of the child at the level of the educational process. In this way, partnerships are established with parents, whose roles are "complementary in terms of children's education and ... that children benefit when the home-school relationship is characterized by reciprocity, trust and respect." (Beveridge, 2004).

A multitude of international educational and psychological research from the 1970s to the present attests to the link between parental involvement and children's educational achievements (e.g.: Hewison and Tizard, 1980; Simich-Dudgeon, 1986; Hoover-Dempsey, Bassler and Brissie, 1987; Peterson, 1989; Fine, 1990; Comer and Haynes, 1991; Epstein, 1992; Robinson, 1994; Delpit, 1995; Ball, 1998; Coleman, 1998; Martinez and Velazquez, 2000; Wolfendale and Bastiani, 2000; Hysop, 2001; Christenson and Sheridan, 2001; Weiss and colab., 2005).

The following table presents other aspects that emerged from the research conducted on the relationship between school - family - community:

Table 1. Relevant aspects of the research conducted on the relationship between school - family - community

NR. CRT.	TOPIC APPROACHED	STUDIES / RESEARCH
1.	School-family-community partnerships have significant benefits in terms of students' academic performance	<ul style="list-style-type: none"> <li>➤ Hughes, 1989</li> <li>➤ Fan and Chen, 2001</li> <li>➤ Epstein 2002</li> <li>➤ Jeynes, 2003</li> <li>➤ Carter, 2003</li> <li>➤ Desforjes and Abouchaar, 2003</li> <li>➤ Biddulph et al.,2003</li> <li>➤ Caspe, 2003</li> <li>➤ Redding et al., 2004</li> <li>➤ Bryan and McCoy, 2004</li> <li>➤ Boethel 2004</li> <li>➤ Fisher &amp; Neill, 2006</li> <li>➤ Bryan &amp; McCoy, 2007</li> <li>➤ Ho, 2007</li> <li>➤ Driessen &amp; Smit 2007</li> <li>➤ Moore-Thomas &amp; Day-Vines, 2010</li> <li>➤ Suárez-Orozco, 2010</li> <li>➤ Pinter, 2013</li> <li>➤ Pepe &amp; Castelli, 2013</li> <li>➤ Muijs, 2015</li> <li>➤ Jóhannsdóttir, 2017</li> </ul>
2.	The central role of parents in the social literacy of children	<ul style="list-style-type: none"> <li>➤ Chern, 2005,</li> <li>➤ Huang &amp; Wang, 2007</li> <li>➤ Ho et al. , 2010</li> <li>➤ Wollscheid, 2013</li> </ul>
3.	Increasing school attendance	<ul style="list-style-type: none"> <li>➤ Catsambis &amp; Beveridge, 2001</li> <li>➤ Sheldon and Epstein, 2002</li> <li>➤ Simon 2004</li> <li>➤ Epstein and Rodriguez Jansorn, 2004</li> </ul>
4.	Positive effects related to the social adaptation of children	<ul style="list-style-type: none"> <li>➤ Jordan, Orozco, Averett, 2001</li> <li>➤ Henderson and Map, 2002</li> <li>➤ Boethel, 2003</li> </ul>
5.	Description of the role of parents in school-family-community partnerships	<ul style="list-style-type: none"> <li>➤ Vuorinen, 2010</li> <li>➤ Krüger and Michalek, 2011</li> <li>➤ Ho et al., 2011</li> </ul>
6.	Encourage parental involvement in school activities and decision-making	<ul style="list-style-type: none"> <li>➤ Smith, 2005</li> <li>➤ Smith et al., 2007</li> <li>➤ Van Velsor and Orozco, 2007</li> </ul>
7.	Analysis of strategies used / developed by schools to help and include different types of parents in school activities	<ul style="list-style-type: none"> <li>➤ Bryan and McCoy, 2004</li> <li>➤ Moore-Thomas and Day-Vines, 2010</li> <li>➤ Vuorinen, 2010</li> </ul>
8.	The influence of resources and the socio-economic environment of parents	<ul style="list-style-type: none"> <li>➤ Abi și Cleghorn, 2005</li> <li>➤ Polovina, 2007</li> <li>➤ Moore-Thomas and Day-Vines, 2010</li> <li>➤ Spernes, 2011</li> </ul>
9.	Non-involvement of families belonging to a minority group	<ul style="list-style-type: none"> <li>➤ Lopez, 2001</li> <li>➤ Driessen , 2001</li> <li>➤ Suárez-Orozco, 2010</li> <li>➤ Pinter, 2013</li> </ul>
10.	Personal and environmental factors influence family involvement	<ul style="list-style-type: none"> <li>➤ Bandura, 1986</li> <li>➤ Van Velsor and Orozco, 2007</li> <li>➤ Walker and Shenker and Hoover-Dempsey, 2010</li> <li>➤ Moore-Thomas and Day-Vines, 2010</li> </ul>



NR. CRT.	TOPIC APPROACHED	STUDIES / RESEARCH
11.	Making comparisons between the level and type of involvement of parents in schools with good results versus parents in schools with poor results	<ul style="list-style-type: none"> <li>➤ Caspe, 2003</li> <li>➤ Desforges &amp; Abouchaar, 2003</li> <li>➤ Gorinski &amp; Fraser, 2006</li> <li>➤ Kabarere, 2013</li> <li>➤ Averill, Metson, &amp; Bailey, 2016</li> </ul>
12.	Lack of knowledge and skills a) Parents ask for teachers' help in their children's development b) Teachers ask for the support of the family in educating the children	<ul style="list-style-type: none"> <li>➤ Walker, Shenke and Hoover-Dempsey, 2010</li> <li>➤ Brouzos , 1999</li> <li>➤ Letch , 1998</li> <li>➤ Morris, 1998</li> </ul>
13.	Lack of equivalent relationships between parents and teachers	<ul style="list-style-type: none"> <li>➤ Beveridge 2003</li> <li>➤ Lareau 2004</li> </ul>
14.	Establishing the relationship between the training and biography of teachers and their attitudes towards the school-family-community partnership	<ul style="list-style-type: none"> <li>➤ Shartrand et al. ,1997</li> <li>➤ Amatea and Clark, 2005</li> <li>➤ Smith et al., 2007</li> <li>➤ Poulou and Matsagouras, 2007</li> <li>➤ Spernes, 2011</li> </ul>
15.	Involvement of school counsellors in partnerships with the family	<ul style="list-style-type: none"> <li>➤ Bryan and McCoy, 2007</li> </ul>
16.	The role of the educator and his relationship with the family	<ul style="list-style-type: none"> <li>➤ Amatea and Clark, 2005</li> <li>➤ Dor, 2013</li> </ul>
17.	Parental involvement is not a priority in many schools	<ul style="list-style-type: none"> <li>➤ Epstein, 2002</li> <li>➤ Cankar and Deutsch, 2009</li> </ul>
18.	Analysis of educational policies regarding the school-family-community partnership	<ul style="list-style-type: none"> <li>➤ Shartrand, Weiss, Kreider, Lopeze, 1997</li> <li>➤ Bryan and McCoy, 2004</li> <li>➤ Smith et al., 2007; Lin, 2008</li> <li>➤ Kristoffersson, 2009</li> <li>➤ Vuorinen, 2010</li> <li>➤ Moore-Thomas and Day-Vines, 2010</li> <li>➤ Dannesboe et al. 2010</li> <li>➤ Azaola, 2011</li> <li>➤ Ho et al., 2011</li> <li>➤ Dor, 2013</li> <li>➤ Kabarere, 2013</li> </ul>

Within the school-coordinating institutions relationship, the analysis on how external communication is reflected in the studied management documents (institutional development project, management plan, operational procedures) identified the lack of a unitary approach on this issue, at the level of all institutions of education in Romania. On the other hand, a positive aspect observed in some of the schools was the tendency to create collaborations and partnerships according to the needs of the students..

### Discussion and conclusions

Following the study of scientific research aimed at the communication process within the school-family-community relationship, two important ideas could be extracted: the first emphasizes the importance that the family must give to the relationship with the school, and the second refers to the ability of the school to adapt to the new requirements of the contemporary family. The works propose some concrete actions through which the family can be with the school. The role of the school, which has the task of initiating communication through which to contribute to the understanding of parents' needs to support their children, is also highlighted.

The communication process between the school and the coordinating institutions is based on several types of connections: coordination, subordination, collaboration, control and evaluation. The communication is made on a legal basis, using public documents. Authorities can monitor whether the

information reaches the beneficiaries in a timely manner, whether it is received correctly, whether it is used for qualitative changes.

The institutional development plans and the managerial plans of several higher education institutions, school inspectorates, as well as at the level of pre-university education were analyzed. The analysis criterion followed the way in which the external communication is reflected in the managerial activity of the educational institutions. It was observed that there is no coherence and an explicit and unitary way regarding the concept of communication, each institution having a different target audience, and external communication, as the main concern reflected in the institutional development plans or managerial plans, does not appear explicitly in managerial documents.

The aim of this study, to create better external communication between pre-university and educational institutions or other partner institutions, has led to the need to set up a model for communication between educational institutions and coordinating institutions/partner institutions.

This study presents a research based on a bibliographic study. The analysis included, in addition to the articles and researches from the specialized literature, also the managerial documents of the institutions aiming at the educational process. A limitation is the realization of this analysis of the process of external communication of the relationship school - family - community and school - coordinating institutions only at a theoretical level. This bibliographic research will be the basis of a scientific support for the research to be carried out in the thesis.

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# A CONCEPTUAL COMPARISON BETWEEN THE HOLONIC MANAGEMENT SYSTEM AND THE HARZBURG MANAGEMENT MODEL

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## Abstract

**Purpose** – Presentation of management systems which could improve the performance both on individual and macro level by creating independent thinking and acting individuals and imposing concepts like autonomy, cooperation and self-organization.

**Methodology/approach** - A bibliographic comparative analysis showing similitudes which can have a positive impact on organizational performance.

**Findings** – The two concepts have similarities, especially regarding the hierarchical and organizational structure as well as communication pattern and relations of subordination or cooperation.

**Research limitations/implications** – There is little study about each of the two proposed models and no study about the similarities of the two.

**Practical implications** – Management has to face a lot of challenges, therefore it is important to extend knowledge and practice beyond the already established management models. It is important to expand the speciality literature with management systems which can enhance innovation, creativity, motivation as also organizational performance.

**Originality/value** –We offer both an insight on the conceptual structure of two management systems, as also a comparison between the two in order to bring forward important elements which could improve performance within organizations.

**Key words:** Innovation, autonomy, cooperation.

## Introduction

Management models have always been of great interest, and due to the fact that management deals with people, there are also many theories with a more social approach which can be adapted to organizations. In the end, the main objective is to increase the self-development of people both as social constructs as also as employees' part of an organization. In this regard, we try to emphasize the role that a good management system has besides the borders of an organization. The present article aims to make a comparison between two little known management systems, the Holonic management system and the Harzburg management model, which both offer an interesting approach on organizing the internal structure of an organization but more so, set the framework for creating more performing employees.

## Main features of the Holonic Management System

The holonic concept is based on an idea formulated in the book entitled "The Ghost in the Machine" by Arthur Koestler (Koestler, 1967). Koestler's holon theory starts from the observation that complex systems can develop very quickly if they consist of stable intermediate forms. Any entity, machine tool, robot, vehicle, aggregate, human, etc., can be considered a holon if it is able to create and control the execution of its own plan and / or strategy. The characteristic of holons to tend towards an assertive

behavior, a delimitation of the environment, the fact that they want autonomy of execution and self-determination, can be attributed to the status of "whole". Holons behave in this way as an independent entity. The fact that any holon seeks to belong to a structure, to collaborate and to communicate in order to achieve its own objectives, can be explained very well with the state of "part", of component. Koestler was a follower of the hierarchy, stating that evolutionary systems, in order to survive, are by definition hierarchical. But this hierarchical structure must be based on the mechanisms of biological and social systems. As a result, it introduces the notion of self-regulating Open Hierahic Order (SOHO), as a form of general organization of biological and social systems. SOHO systems are made up of multiple hierarchical layers made up of holons. In many organizational approaches, the holonic structure involves maintaining hierarchical relationships in the organization, so if it exists at same level two holons, there must be a holon in the upper level, resulting in a tree structure similar to any organization chart (Mella, 2009) The purpose of the holonons designed by Koestler was to model any real hierarchical system with complex behavior (e.g. a firm, the administrative structure of a country, any living organism, a forest, or a manufacturing system). The hierarchy in holistic systems is in many respects different from classical hierarchies. Koestler, to describe this structure invents the notion of holarchy as a temporary hierarchical systems formed by holons, in which holons can cooperate in order to achieve a goal. This feature is one of the most important differences from classical hierarchical systems. Due to the intention to create a structure that easily adapts to unforeseen situations, holons can leave any holarchy, respectively, can enter a holarchy depending on their own interests (objectives). Creating holarchis means that we (re) arrange the process, the processes within the organization and / or the control process, in order to make the achievement of the objectives more efficient. Holacracy is a concept developed by Brian Robertson and is an extremely pragmatic concept that proposes the management of pro-profit and non-profit organizations, (almost) without bosses, through an organization in which all members of the organization are bosses. (Robertson, 2015).

### **Main features of the Harzburg Management Model**

"Anyone over the age of 45 has often had their own experiences with the" Harzburg model "or know it at least; anyone under the age of 45 has also heard about it..." the following statement shows the dissemination, but also the innovation, which is behind the Harzburg model. The model made its breakthrough through the Bad Harzburg leadership academy in Germany. There it was developed in 1956 under the lead author Reinhard Höhn.

The concept is structured as follows: the decision-making power is always at the level at which it can be made most meaningfully, so that the necessary professional competence is given. This includes that employees are equipped with the skills relevant to their area. In this manner, employees really get the decision-making power and can exercise it independently. Of course, it is necessary that tasks and competencies (downwards) are transferred from the management level of the company to the respective level. Decisions should only be taken from above, which are not transferable to the respective level, because they e.g. touch other departments.

The Harzburg model illustrates that there are clear leadership principles that have applicability in practice, are feasible and can also be used in all work processes and decision-making processes. They are transparent to employees and can therefore also be communicated to other or new employees. However, this conclusion only remains valid on the premise that the basic concept of the Harzburg model, above all in terms of its practical implementation, is fully accepted (by the employees, including all managers and specialists).

The core of the model lies within the job description and the general guidelines. The job description limits the delegation area of the employee and sets the foundation for an independent thinking and acting employee whereas the general guidelines or instructions assures the principle of delegation of responsibility through listing the obligations and rights, clear rules and principles.: "The basic idea of the model is that the motivation of employees through delegation of responsibility and the transfer of independent areas of responsibility can be promoted. Therefore, the model is also closely related to the management concept Management by delegation related. Every employee receives one tightly defined, clear area of responsibility with competencies and personal responsibility Authority to make decisions and act. For this area of responsibility the Employees also have full responsibility. By dissolving the rigid structures increase the motivation of the employees and the working atmosphere improved" (Ehm, 2004).

## Comparison between the Harzburg Model and the Holonic Management System

From the point of view of the management of the organization, it is interesting that the holonic vision appears as a conceptual element with the inclusion of holons, which represents a novelty in the connection mode of the various elements. Vertical or horizontal communication, relations of subordination or cooperation are intensely treated also within the Harzburg model, and the fact that in a holararchy we can have entities that incorporate and depend on each other is also a common feature. In the Holonic view, reality is not composed of different systems or coupled elements that form different structures, but means an inclusive relationship between structures and elements. The key notion being inclusion and how to incorporate the element (Mella, 2009). In many organizational approaches, the holonic structure involves maintaining hierarchical relationships in the organization, so if it exists at same level two holons, there must be a holon in the upper level. Analyzing the Harzburg Model from this perspective, we can consider that the employee with his clear delegated working area functions like a subsystem or entity which is included in the larger structure, meaning the subordinated and superior relations he has with the other employees as also, it can be perceived as a small autonomous entity, having his own working area with clear tasks, objectives and competencies. The hierarchy in holistic systems is in many respects different from classical hierarchies. Koestler, to describe this structure invents the notion of holarchy as a temporary hierarchical systems formed by holons, in which holons can cooperate in order to achieve a goal. This feature is one of the most important differences from classical hierarchical systems. Due to the intention to create a structure that easily adapts to unforeseen situations, holons can leave any holarchy, respectively, can enter a holarchy depending on their own interests (objectives). Creating holarchis means that we (re) arrange the process, the processes within the organization and / or the control process, in order to make the achievement of the objectives more efficient. Holacracy is a concept developed by Brian Robertson and is an extremely pragmatic concept that proposes the management of pro-profit and non-profit organizations, (almost) without bosses, through an organization in which all members of the organization are bosses (Robertson, 2015)

Within the Harzburg Model, through delegation of responsibility, the classical hierarchical structure regarding the relationship between superior and employee also gets a new content. The hierarchical structure becomes the frame in which the new forms of cooperation between superior and employee happen and slides from a hierarchical structure based on instructions to one based on responsibility. It now serves not only to enforce decisions from the top to the bottom but concentrates on setting the corresponding goals, tasks and competencies on each level. Each employee acts and decides within the presented frame based on the congruency. Each superior must allow his subordinated employees to act and decide individually and within their objectives, tasks and competencies

A holon is primarily defined to achieves certain objectives, in order to achieve which it must be coherent and must be in measure to avoid possible contradictions between objectives. A holon is considered an entity with reason, he can reach certain conclusions based on the data he receives, he can give explanations for conclusions. He can also gain new knowledge from other holons or from the environment and can incorporate them into its own strategy. Also, within the Harzburg Model, one of the main managerial function is setting individual objectives for the subordinate employee which is performed by full participation of the employee in question, because the employee is also considered an entity of reason, therefore he is delegated the responsibility for action. The focus on the conversational pattern, helps the employee gain know-how from both his co-workers and his superior and use them in the fulfillment of his own objectives. In order to be able to communicate with the other holons, and implicitly to be able to be part of a holar, each holon must have a module, a function, through which it manages its own relations with the other holons. Thus, each holon carries out its activity based on information resulting from two components. The first component would be something that can be assimilated with the "job description" – consisting from fixed rules, which establish its competencies), and the second component representing a set of self-developed relationships in order to achieve goals. Into the assimilated database the "holon job description" sets out the objectives and certain relationships which are more formal. The second component develops relationships with other holons, which can be more informal, less regulated. But these relationships, as in real life, can contribute in a way concretely when solving a problem that arises at a certain moment.

Interestingly, we meet another resemblance to the Harzburg particularities. Here, the employee carries out his tasks also according to two main components: the job description and the developed relationships which are indeed quite formal within the mentioned model. The job description is a clear set of rules with clear competencies ad tasks which sets the objectives as also the relationships (subordination and superior) of each job holder. The established relations will in turn have an effect on

the performance and task achievement of the employee. The organizational structure of the holonic systems has a dynamic, variable character, in contradiction with the classical structures which are by definition static. The holarchies formed within the organization can be divided, if the context of maintaining the structure would be to the disadvantage of the respective holararchy or of the constituent holonies. Thus, the collaboration between the holons is based on cooperation and negotiation. This collaboration is done wherever and whenever needed. It usually takes place along the flow of information and the flow of material. The core of Harzburg model is based on a generalization of leadership. There is no longer a person, in the figure of the patriarch, and always thought of as male, which has all leadership claims, but the task of leading is relationally distributed across the various levels. Ultimately everyone must follow and lead, except for those located at the lowest level. Different forms of discussions are tools in the hands of the superior which he has to choose and apply according to the different objectives. There is a high need of using different conversational forms in order to have a constructed dialogue besides daily topics, thus the discussion is also based on cooperation and negotiation as a way of building trust. Regarding the organization of the “superior entities” the holonic approach delimitates the resource holon, the control holon and the production holon.

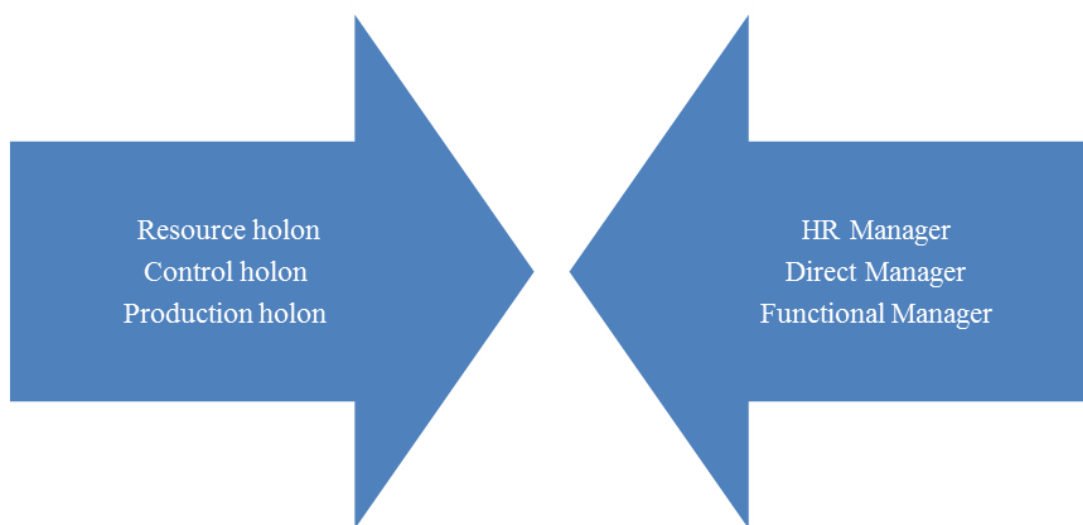


Figure 1. Corresponding managerial functions between Holonic System and HMM (author's source)

The resource holon is the abstraction of the following means of production: factory, workshop, machinery, furnaces, pipes, raw materials, tools, tool holder, material warehouse, operating personnel, energy, production spaces, etc. The production holon possesses the knowledge necessary for the execution of the product. Know both the technological process and the data on quality assurance. A product holon contains detailed and up-to-date information about the product execution stage, user requirements, data from the technical design, appearance, production plans, material receipts, quality assurance procedures, etc. The control holon is a task in the production system. He is responsible for the production tasks, so that they are carried out properly and on time. It is concerned that the product in its physical form is made and processes all the information related to internal logistics. The Harzburg model also awards different tasks to different superior position. As such, we have: the direct manager which manages the employees which are on his direct the subordinate level and has the managing responsibility being accountable for the fact that he has to fulfil his managing tasks towards his employee, thus the control holon. The HR manager which does not concern a specific field, that of Human Resources, but the task of coordinating the employees. Within the job description, it is clearly stated which superior must act as a HR supervisor and for which employee. (Resource holon). The functional manager who's managerial functions only limit to the specialist field. This is the case of managing director of central purchasing opposing the regional purchasing managers or MD of national administration office opposing the regional administration managers, thus production holon. The following figure 2 presents the similar features of the two concepts as they were detailed above:

Holon management System	HMM
<ul style="list-style-type: none"> <li>• Complex systems can develop very quickly if they consist of stable intermediate forms</li> <li>• Any entity, machine tool, robot, vehicle, aggregate, human, etc., can be considered a holon if it is able to create and control the execution of its own plan and / or strategy</li> <li>• Holons behave in this way as an independent entity</li> <li>• hierarchical systems formed by holons, in which holons can cooperate in order to achieve a goal.</li> <li>• The organizational structure of the holonic systems has a dynamic, variable character</li> <li>• the holonic approach delimitates the resource holon, the control holon and the production holon.</li> <li>• A holon is considered an entity with reason, he can reach certain conclusions based on the data he receives, he can give explanations for conclusions. He can also gain new knowledge from other holons or from the environment and can incorporate them into its own strategy</li> <li>• Holon carries out its activity based on job description</li> <li>• Clear relationship status</li> </ul>	<ul style="list-style-type: none"> <li>• level should fulfil all tasks on one's authority, without external intervention in order to develop and be motivated.</li> <li>• Employees performance increases if it has the possibility to control the execution of its own tasks.</li> <li>• Employees behave as independent entities.</li> <li>• Within hierarchical structure employees cooperate in order to achieve the individual goal and the goal of the organization.</li> <li>• Organizational structure is dynamic. Employees can change positions based on their competencies.</li> <li>• HMM delimitates the resource manager, direct manager and functional manager</li> <li>• Employee has the responsibility for action, thus is considered a independent thinking person who can increase his know-how by using the communication tools of the HMM.</li> <li>• Employee carries on his activity based on job a clear regulated job description</li> <li>• Employee has clear information regarding who is his subordinate and his superior</li> </ul>

Figure 2. Main similitudes between the Holonic Management System and the HMM (author's source).

### Discussion and conclusions

Through his theory Koestler tried to integrate several existing philosophical currents in the postwar period (reductionism, holism, evolutionary theory, etc.). The idea of the holon has a central position in Koestler's thinking regarding the human aspect. He intended to develop a model in the field of social sciences, valid both at the micro level (of the individual) and at the macro level (of society), and to explain the essence of human activity and thinking. The Harzburg Model, aims to improve the performance both on individual level as also on a macro scale by creating independent thinking and acting individuals.

Thus, we can conclude that we present two management models which focus on the development of the employees in the sense of self-development and autonomy and also that while there is a different approach between the two management models, interesting there are many similitudes which focus on effecting performance and creating independent employees.

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# RESEARCHES CONCERNING THE INSERTION OF THE STUDENTS AND GRADUATES FROM THE FIELD OF "ENGINEERING" THROUGH THE JOB FAIR

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## Abstract

**Purpose** – To find out if there is a demand from the local companies for the labor force with higher education from the "Engineering" field and to improve the insertion on the labor market of the students through the event necessary for the research to take place.

**Methodology/approach** – The research was conducted through one of the events from the project, with the help of the survey which was used as a method and two categories of questionnaires that were created as tools: one for students/graduates and another for companies' representatives participating in the event.

**Findings** – All the companies participating in the event showed their availability for hiring labor force with higher education from the "Engineering" field and a great number of the students and graduates showed their interested in this regard.

**Research limitations/implications** – The results of the research reflect in the best way the local situation, but this can vary from one branch to another within the university given that these are in different regions of the country.

**Practical implications** – The implementation of the recommendations resulting from the research would be extremely useful both for students and university and for local companies looking for labor force with higher education.

**Originality/value** – The research is innovative due to the fact that it was done for the first time within the TUC-N branch from Satu Mare (including the Job fair inside the branch necessary for the research to take place).

**Key words:** "Engineering" field, higher education, insertion of students.

## Introduction

Employability plays an important role in the Bologna Process, higher education having the task to develop the students' skills and abilities in line with the market needs that lead to their easier integration into the labor market (<http://www.anosr.ro/profesional/angajabilitate/>).

According to a study conducted by UNICEF in 2014, "high school graduates earn with 25 percent – 31 percent more than those who have completed primary and lower secondary education" while "the earnings obtained by university graduates outnumber the earnings of those who drop out of school after high school with almost 67 percent"(Crisbășanu, S.D., 2016).

Regarding the time needed to find the first job of the graduates according to the level of education and field, registered until 2011, the graduates of Engineering Sciences are in the fourth position from 13 fields, with a period of time of approximately 3 and a half months, the first three positions being occupied in the following order by the graduates of Architecture and Urbanism, Economic Sciences and Social and Political Sciences (Figure 1).

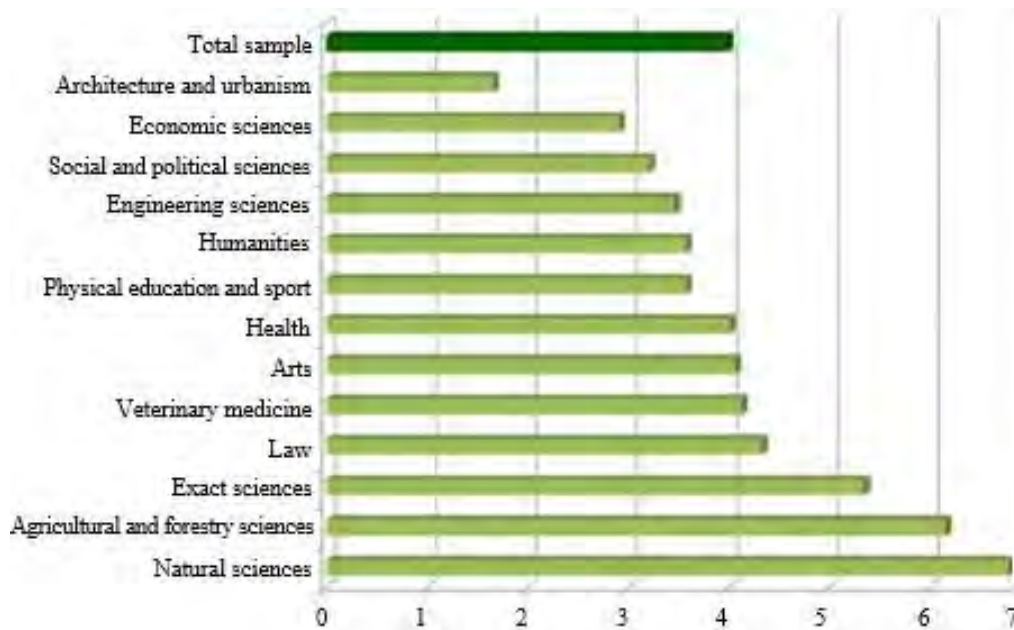


Figure 1. Time required for hiring after graduation depending on the field (expressed in months)

Source: (Pantazi, R., 2011)

Most hiring offers are for the graduates of Humanities, followed by Economic sciences and Engineering Sciences (Table 1).

Table 1. Number of offers that graduates had when hiring depending on the field

Domain	One offer	More offers
Humanities	59%	41%
Economic sciences	63%	37%
Engineering sciences	64%	36%
Natural sciences	68%	32%
Physical education and sport	68%	32%
Law	69%	31%
Social and political sciences	69%	31%
Veterinary medicine	69%	31%
Health	69%	31%
Exact sciences	72%	28%
Agricultural and forestry sciences	76%	24%
Architecture and urbanism	78%	22%
Arts	82%	18%

Source: (Florea, R., 2011)

The percentage of 36 percent can be justified by the fact that Engineering sciences is a broad field, which consists of several different specializations (civil engineering, mechanical engineering, electrical engineering, etc.), which is why the possible careers for the graduates from engineering are wide and varied(<https://www.infomunca.ro/vizualizeaza-articol/Ce-poti-face-cu-o-diploma-de-inginer-210>).

Perhaps because of this, only about 56 percent of the graduates from Engineering sciences work in the specialization they graduated. This phenomenon is not only found in Romania, it is estimated that "40

percent of the engineers with diploma from all over the world choose managerial positions, although technical careers still offer them interesting perspectives"(Vidroiu, A., 2008).

Among the methods used by the graduates for hiring are: applying for a vacant job (71 percent), calling to personal contacts (parents, relatives, friends) (25 percent), appealing to the Labor Force Agency (22 percent), direct contact with the company regardless of the existence of the job offer (13 percent), appealing to human resources agencies (9 percent), hiring during studies (8 percent) and job search by announcement (3 percent)(Pantazi, R., 2011).

According to a survey of 5,000 top companies from 20 countries realized by the French consulting group RH Emerging and the German institute Trendence, 45 percent of the international companies believe that faculty remains an important selection criterion and "only a third looks strictly to the skills and experience of the candidate"(<https://www.hipo.ro/locuri-de-munca/vizualizare-Articol/1126/Principalele-facultati-din-Romania-care-te-ajuta-la-angajare>).

If we only report to the Romanian market, 18 percent of the employers believe that "graduates need to resume the things they should have learned in faculty, and 43 percent think that new employees need to learn additionally to cope with the received job"(Florea, R., 2011).

For this reason, for some employers, partnerships with technical universities, internships or trainings are necessary, as existing programs offered by universities do not fully correspond to the multitude of jobs that they bring for hiring(Mirea, C., 2012).

At the level of 2016 at the Technical University of Cluj-Napoca, one of the major universities in Cluj, where more than 20,000 students study, graduated more than 2,000 of them (<https://www.utcluj.ro/studenti/festivitatea-absolventilor/2016/>).

According to the university statistics, "77 percent of the graduates are employed in the first year after completing their studies, of which 65 percent are in the job from the qualification domain"(Avram, S., 2016).

### Results of the research

In the light of the answers given by the participants in the Job fair, it is clear that the best ways to promote the event among young people is through "chief of the year from the specialization" (62.5 percent) and the "event announcement" (37.5 percent) through the posters within the faculty. This question had four answer variants, one or more of which could have been chosen (Figure 2).

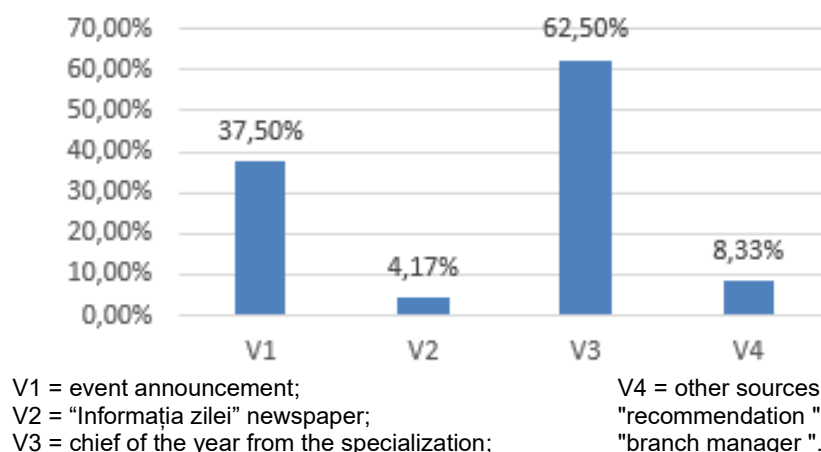


Figure 2. Participants questionnaire (students and graduates) - How did you find out about the organization of this event?

91.7 percent of the participants consider that the organized event was useful in a high, very high or extremely high extent, while more than half (53.3 percent) of the representatives of the companies are of the same opinion (Figure 3).

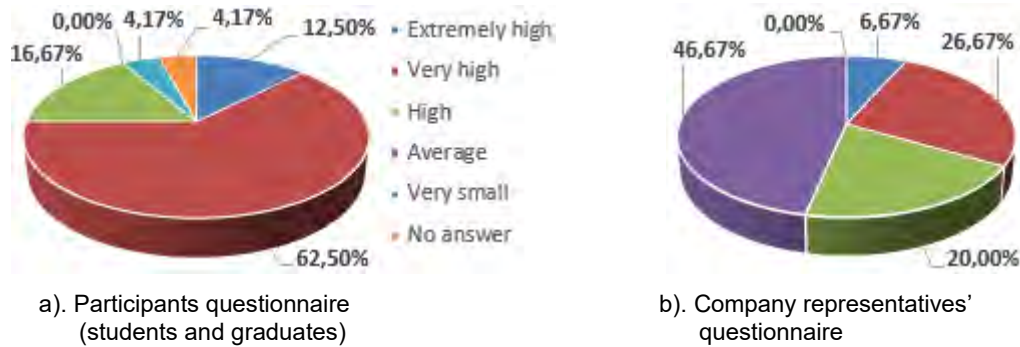


Figure 3. How do you assess the extent to which the event was useful to you?

Also, all participants in the event (100 percent) and 93.3 percent of the company representatives were satisfied with the organization of the event, its organization being appreciated as good, very good or excellent (Figure 4).



Figure 4. Please rate the organization of this event:

The fact that the most important companies from the region participated in the event is also confirmed by the participants' replies, no less than 95.8 percent of them appreciated that the participation of the companies (both in number and as a job offer) was good, very good or excellent (Figure 5).

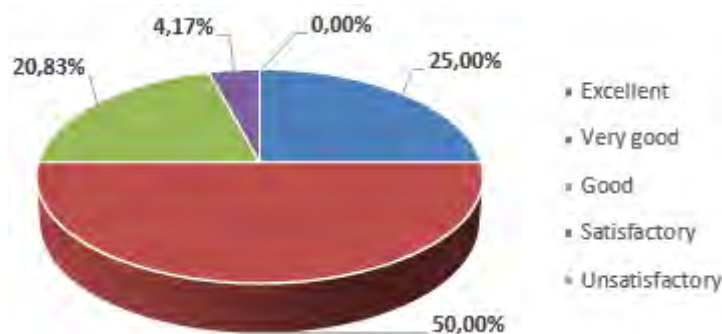


Figure 5. Participants questionnaire (students and graduates) - How do you assess the participation of companies (as number and job offer) in this event?

60 percent of the companies' representatives described the presence of the participants in the event as good or very good, both in number and as interest showed (Figure 6).

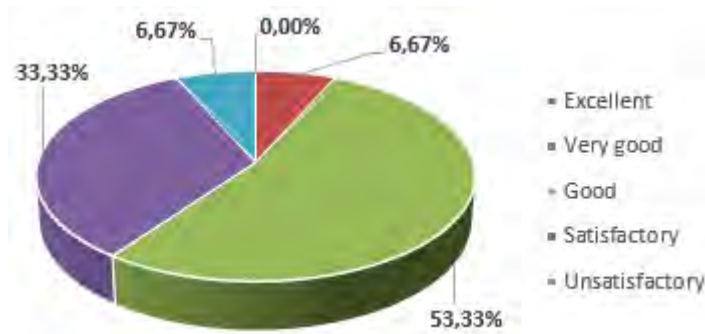
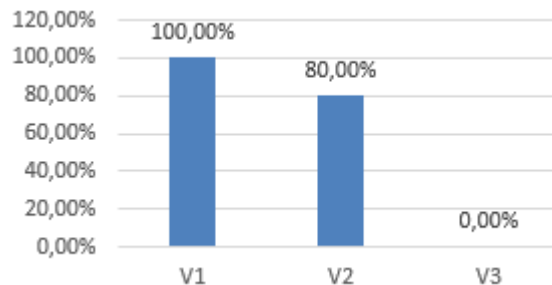


Figure 6. Company representatives' questionnaire - How do you assess the participation of students and graduates (in number and as interest showed) in this event?

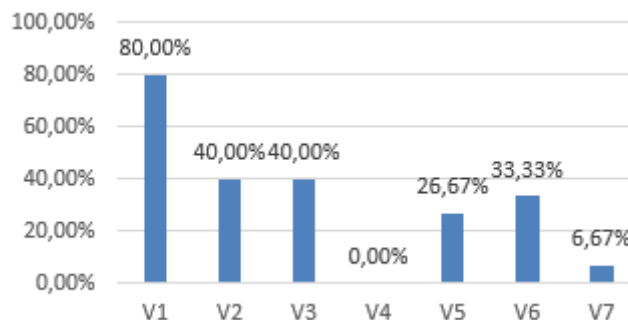
Companies that attended the Job fair came up with offers for "jobs for students and graduates" (100 percent) and offers for "summer practice for students" (80 percent). This question had three answer variants, one or more of which could have been chosen (Figure 7).



V1 = jobs for students and graduates;  
 V2 = summer practice for students;  
 V3 = other offers:

Figure 7. Company representatives' questionnaire - With what offers did you participate in this event?

From the jobs offered by the companies, most of them were addressed to the participants from "machine building technology" (80 percent), followed by "industrial economic engineering" (40 percent) and "automation and applied informatics" (40 percent). This question had seven answer variants, one or more of which could have been chosen (Figure 8).



V1 = machine building technology;  
 V2 = industrial economic engineering (management, quality, logistics etc.);  
 V3 = automation and applied informatics;  
 V4 = computers;  
 V5 = electronics and telecommunication;  
 V6 = electrical engineering;  
 V7 = other: "human resources".

Figure 8. Company representatives' questionnaire - In which domain(s) fit the jobs from the offer of the company that you represent?

The Job fair has been a real success, given the large number of participants, participating companies and the number of CVs submitted: 6.7 percent of the companies received more than 10 CVs, 13.3 percent between 5 and 10 CVs and almost half of the companies (46.7 percent) received under 5 CVs (Figure 9).

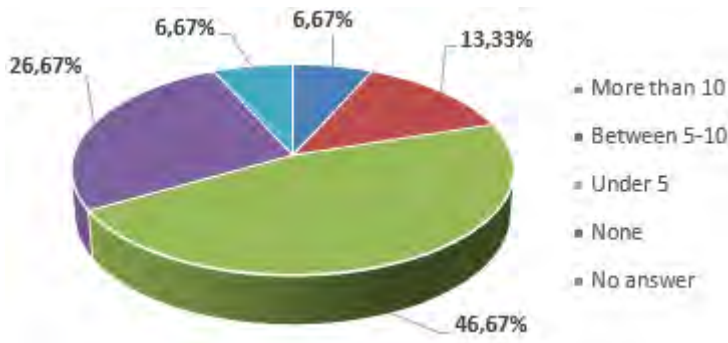


Figure 9. Company representatives' questionnaire - How many CVs did you receive from the participants in this event?

86.7 percent of the companies participating in the Job fair believe that university must be involved very much, and the rest (13.3 percent) that university must be involved much in the economic and/or social issues of the region (Figure 10).

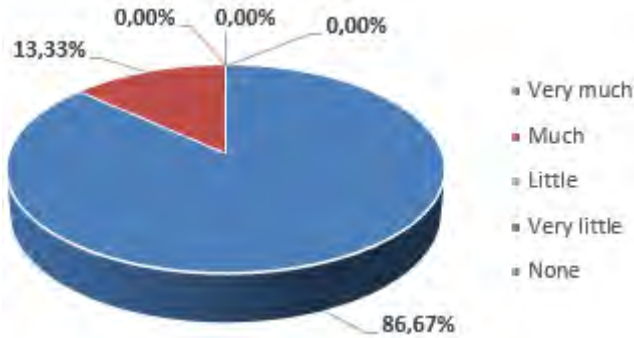


Figure 10. Company representatives' questionnaire - How much should the university involve in the economic and/or social issues of the region?

All the participating companies (100 percent) expressed their interest in maintaining the collaboration with the Satu Mare Branch of the Technical University of Cluj-Napoca (Figure 11).

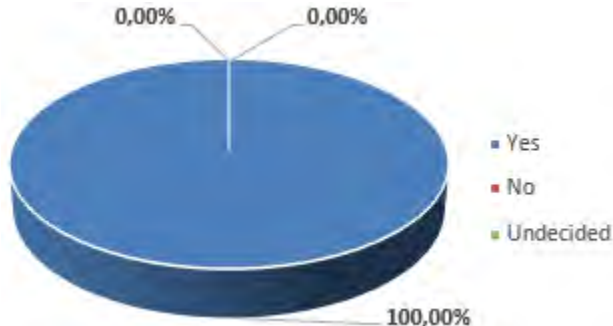


Figure 11. Company representatives' questionnaire - Is the company you represent interested in maintaining the collaboration with the Satu Mare Branch of the Technical University of Cluj-Napoca?

## Conclusions and recommendations

According to the research, the following conclusions can be drawn:

- The best ways to promote the event among the young people from the technical higher education are through "chief of the year from the specialization" (62.5 percent) who can transmit the information directly to the interested ones, usually via Facebook, Yahoo Groups, etc. and through the "event announcement" (37.5 percent) placed as posters within the faculty;
- The statement from the beginning of the research, "only about 56 percent of the graduates from Engineering sciences work in the specialization they graduated" is confirmed given the diversity of the job offers brought by the companies participating in the Job fair compared to the number of specializations existing for the bachelor's degree at the Satu Mare Branch of the Technical University of Cluj-Napoca;
- 95.8 percent of the participants in the Job fair appreciated that participation of the companies (both in number and as a job offer) was good, very good or excellent and 60 percent of the companies' representatives described the presence of the participants in the event as good or very good, both in number and as interest;
- The Job fair was a real success, 91.7 percent of the participants and more than half of the representatives of the companies (53.3 percent) consider that the organized event was useful in a high, very high or extremely high extent;
- The companies participating in the event showed their availability for both hiring and practice, offering "jobs for students and graduates" (100 percent) and "summer practice for students" (80 percent);
- The event aimed to improve the insertion on the labor market of the students and graduates from the field of "Engineering" and considering the number of CVs submitted it can be considered that the aim has been achieved: 6.7 percent of the companies received more than 10 CVs, 13.3 percent between 5 and 10 CVs and almost half of the companies (46.7 percent) received under 5 CVs;
- 86.7 percent of the companies participating in the Job fair believe that university must be involved very much, and the rest (13.3 percent) that university must be involved much in the economic and/or social issues of the region and they expressed their interest in maintaining the collaboration with the Satu Mare Branch of the Technical University of Cluj-Napoca.

The recommendations that can be made following the results obtained are:

- To organize other Job fair editions in the future in order to help students/graduates and companies, and thus to facilitate the increase of the youth insertion in the labor market;
- To organize other common actions with the business environment to improve the relationships aimed to receive students in companies to acquire skills and gaining the required experience needed for hiring after graduation (diploma themes involving the student in research, summer practice, part-time hiring, etc.).

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# ENGAGING CREATIVE THINKING TECHNIQUES TO SUPPORT STUDENTS IN HIGHER EDUCATION

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## Abstract

**Purpose** – The paper offers a conceptual model in overcoming learning barriers from several directions (theoretically and practically) and focuses on students' creativity in how they approach problem solving.

**Methodology/approach** - The methodology is based on "Six Thinking Hats" and it is used to support creative thinking in achieving a good collaboration between teams in an educational project.

**Findings** – The use of creative techniques must be done in a harmonious manner, sustained, in which the time allocated to students must be sufficient to develop their creative ideas in solving a problem.

**Research limitations/implications** – The diversity of educational projects has a major impact on today's society because the transfer of knowledge is no longer enough, he must supplement with projects that focus on developing students' skills and changing behaviors, values and lifestyles.

**Practical implications** – The primary objective of the paper is to motivate academics to invest in applied workshops for students according to the economic realities. Through these workshops are emphasizes the skills and abilities of the students, offering the chances of being selected for a good job position in the most prestigious companies in Timisoara.

**Originality/value** – Creative thinking develops tactics for responsibilities distribution, finding accurate resources, encourages collaboration between people, and help future workforce to comply with rules regulation. Within the paper are identified unique and creative ways of transmitting knowledge that come to overcome the barriers previously identified.

**Key words:** students, creative thinking, educational projects

## Introduction

Diversity of educational projects restores the capacity of educational institutions to be actively and practically involved in initiatives for integration and improvement of individual learning behavior. Improvement initiatives in education and technological changes have certainly influenced the new directions in society, creating structures that have the ability to empower digitalization in industries (Diaconescu, et al., 2019). Technological changes reshape the material, human, and social dimensions and offer solutions when society is facing the biggest challenges (ex. pandemic COVID-19). During pandemic COVID-19 higher education has reorienting his strategy and force universities towards digitized education by imposing necessary measures to analyze digital techniques used, those that support education and training systems. Consequently, all these changes had a remarkable influence on the educational environment, respectively it was a beneficial road to adapt the teaching/learning methods focusing on creative techniques and innovative technologies. More precisely exists a tacit cooperative acceptance from each university that recognizes these days the importance and advantages provided by digitized education. The advantage brought by digitized education is that it disseminates timely information through various platforms and encourages students to experiment with new learning means, developing them new digital skills and competencies that are necessary for self-

development but also good employment in market work. According to the current educational situation presented above students facing multiple changing demands on their competencies, skills especially as problem solvers in projects. These demands come from the educational systems that continue practices from the 20th century, hindering the progress of the student's varied learning style or the devotion of learners as well as proper integration into the labor market. In this sense, project-based learning is a solution in preparing students for the 21st century because projects focus on learning objectives, including skills such as: critical thinking, problem solving, communication, collaboration and self-management.

The present paper highlighting the necessity in adopting a novel movement in higher education where is an urgent need to encourage students to explore creative thinking in solving problems and bring innovation in their received projects. The new generation of students is willing to absorb and integrate more creative tools into the current learning process. Exploring creative thinking at an early stage can provide graduates with relevant occupational skills in today's work communities. The next step of the research analyzes a comprehensive set of creative thinking techniques potential to stimulate students' creativity in conducting educational projects. These types of creative thinking techniques allow students to develop tactics for business thinking and solve imminent issues.

### **Creative thinking techniques for educational projects**

Starting from the findings in the labor market, the educational system noticed a mismatch between the number of college graduates and the expectations and needs of the industry. This fact had a great impact as a result of which the educational system created a realistic link with the business environment between the career paths and the aspirations of current and future students. It is noted that academia and industry work together to develop programs that end the separation between university and market work, in a way that provides equal opportunities for all students, regardless of context and career aspirations. As example, educational programs for engineering sciences should enhance and emphasize the creative and innovative nature of engineers' work, although knowledge of mathematics and science is important and necessary, they must not have a monopoly on the necessary skills set. Engineering students enlist and enthusiastically seek out authentic and relevant engineering experiences. Training a professional engineer is a process; one that involves education, training and experience. Creative trainings in the case of engineering teams demonstrate how creative interventions through specific methods can produce the best results for the assigned projects. According to Liu, and Schonwetter, (2004) they believe that creative engineers must have the ability to explore and examine available data or information, possibly to find new solutions to solve specific engineering problems or to produce a unique product.

There are a comprehensive set of creative thinking techniques that allow students to develop skills in imminent issues and tactics as problem solvers for educational projects.

There are presented as follows:

- *Mind mapping* (known as brainstorming or spider diagrams) helps idea generation. The necessary clue behind the use in mind mapping is to take into account every idea that arises. Mind mapping provides a path of the mind that comprises a network of concepts, connected and chained together. This path transposes some visual, nonlinear representations of their ideas and relationships (Biktimirov and Nilson 2006). The advantage of this method besides “free-form” and unconstrained structure is that any opinion can be harmoniously arranged to any other. Spontaneous, free, intuitive thinking offers creative associations between ideas (Davies, 2011).
- *The Checklist* represents a standardized group of objects used to remind the main thinker of the multitude of possible variants for approaching a problem and obtaining a solution. The checklist can refer to the five senses, human needs, physical attributes. This method can also have custom checklists. The personalized approach can be used individually to refresh ideas even when are involve more factors in the game. Checklists are useful in keeping the creator of ideas active or solving problems alert to many aspects of the problem.
- *Six Thinking Hats* appeared due to the creation of Edward de Bono in 1985 and has become an easy-to-use tool through which the business environment is stimulated to approach an innovative vision. This creative tool offers different features in related stages when moments of analysis and debates around issues are needed, indicating an optimal decision. This method

has, through the creative approach, a distinct set of colored areas, a kind of creative stage of analysis of a problem, through which the initiator finally reaches an innovative decision. More precisely, this creative tool allows the change of the individual's thinking, triggering six directions of creative analysis. These directions lead to six colored areas called White Hat - Past Facts, Red Hat - Emotions provided, Black Hat - Reasoning, Yellow Hat - Logical Arguments, Green Hat - Adding New Ideas, Blue Hat - Surveillance (de Bono, 2006).

- *Lateral thinking* is a tool elaborated by Edward de Bono (1970) that describes a type of thinking that is unconventional (Butler, 2010). Lateral thinking is a skill that can be accessed by everyone and can be developed through training. De Bono encourages users to look at their situation differently and to re-analyze their problem from a much more creative perspective. Although the concept of lateral thinking has not emerged recently, the method offers a special feature by trying to separate the individual characteristics of decision makers and identifying lateral thinkers. The knowledge gained through this approach develops a better ability to understand decision makers who use heuristic rules. Lateral thinking generally makes mental connections in three ways, namely similarity, closeness or opposition. Lateral thinking seeks to find a different answer. It is not particularly desired to stagger correct steps in lateral thinking, because the correct answer is not sought. Lateral thinking uses the premise of stepping stones, looking for available stones to switch thinking elsewhere. Lateral thinking involves two categories: techniques that involve metaphor (looking for similarities and closeness); and techniques involving reversal (search for oppositions).
- *Random Word Stimulation* represents a dynamic procedure through which the practical method consists in accessing the mind of the individual's subconscious, through which other information is used, to generate new original ideas. In practice, the applied method allows the brain to make quick connections, giving it a way to adapt to this style of thinking in free form. This adaptation strengthens the connection with the subconscious mind and endows the practitioner with creativity and brings improvements to critical thinking.

Whatever the applicability of creative methods, group, or individual, these intend to improve the knowledge transfer, in so being performed innovation (Badea, et al., 2013). Creative thinking techniques allow individuals to apply strategies for identifying problems, making decisions, and finding solutions both in and out of learning class.

Currently, creativity is a vital tool for innovation in educational projects. Most innovations in technology came to life due to creativity. Technology influences creative thinking and facilitates the applicability of analytical thinking (Charyton and Merrill 2009). In the practical approaches it was observed that the set of creative thinking tools are based on the same structure repeating the same methodical models (Kohls, 2012). The great successful personalities schematically implant a strategic vision about life and business in a very rational and positive way. This planning is part of the reason why most viewers have been successful. But in their evolution many times, they encountered difficulties in how to perceive a problem from an emotional, intuitive, creative, or negative point of view. These difficulties have developed some notable shortcomings in their development of underestimating resistance to plans or the inability to make creative leaps and essential contingency plans. Due to these difficulties, the "Six Thinking Hats" method developed by de Bono (1971) came to aid focusing on an individual's creative potential.

Investigating described above techniques, we considered appropriate for creative process teaching and practice, the application of the "Six Thinking Hats" method for an educational project.

## **Methodology**

During the last decades, learning prospects for future generations of students have experienced radical changes in many business areas. Now interdisciplinarity and globalization have transformed student communities into a uniform arena of collaboration which is expanding beyond culture and context, and where creativity becomes an important milestone in developing educational projects for students. Educational projects harness students' creativity, and subsequently, allow an examination of how creativity techniques are applied in the classroom by providing students with a set of tools to use further in their exploratory behavior. Creative curriculum has quickly become a topic of great interest in recent years due to digitalization in teaching and learning. In addition to training in creative techniques, students must have good communication skills, collaboration, information networks, feedback and reception, teamwork, and even in some cases cultural understanding. All these qualities listed and corroborated

with creative techniques helps in highlighting competencies required in implementing an educational project. Due to the usefulness of creative techniques, the authors considered the application of the "Six Thinking Hats" technique by Edward de Bono (2006) regarding the development of the creative process within a teamwork project.

The methodology used in this paper is based on "Six Thinking Hats" and it is applied to support creative thinking in achieving a good collaboration between teams in an educational project. The method is useful when issues are debates from all possible angles, and problems must be solved to select the important decision.

The basic idea behind the concept of the "Six Thinking Hats" method was that the human brain makes distinct reasonings that can be deliberately provoked. These reasonings are organized in a structured way, so that appropriate spaces are allocated through which tactics can be developed for certain problems. The method signals the problems faced by the individual but gradually find the necessary solutions to solve problems. The graduality of the six ways of thinking can be accessed, when distinct programs are created.

Table 1. Six Thinking Hats description

<b>Six Thinking Hats</b>	
<b>White Hat</b>	<b><i>Information gathering Data, information, facts — known and needed</i></b>
	The white hat thinking provides the group with information on how to approach the problem.
Questions	<ul style="list-style-type: none"> <li>• What are the details of the problem description?</li> <li>• What are the implications of these details?</li> <li>• Are there any issues that are missing?</li> <li>• What is the goal pursued?</li> <li>• How will we get the missing information?</li> </ul>
<b>Red Hat</b>	<b><i>Feelings, intuition and emotions</i></b>
	The red hat thinking encourages the group to express their feelings about the course of an action.
Affirmations	<ul style="list-style-type: none"> <li>• I don't think the idea suits me.</li> <li>• I have a good feeling for this option.</li> <li>• I am afraid to get involved in this approach.</li> </ul>
<b>Green Hat</b>	<b><i>Creativity, new ideas and possibilities</i></b>
	The green hat thinking offers an opportunity to find new approaches and innovative solutions.
Questions	<ul style="list-style-type: none"> <li>• What is the newest way we can do this?</li> <li>• What are the views on tackling the problem in the opposite direction?</li> <li>• What alternatives are known and have not been considered?</li> </ul>
<b>Yellow Hat</b>	<b><i>The logical benefits of solutions. The generally accepted vision.</i></b>
	The yellow hat thinking allows the group to emphasize the creative ideas of a new idea or a certain decision and how feasible they are.
Questions	<ul style="list-style-type: none"> <li>• What are the benefits of a new idea?</li> <li>• How this new idea can be applied?</li> </ul>
<b>Black Hat</b>	<b><i>Expression of risks. Incompatibilities and potential difficulties.</i></b>
	The black hat thinking encourages the group to take into account the weaknesses of an idea or solution and to discover how to avoid or counteract them.
Questions	<ul style="list-style-type: none"> <li>• What are the weak points of the new idea?</li> <li>• How to avoid weak points of the new idea?</li> </ul>
<b>Blue Hat</b>	<b><i>Process coordination. Managing productive thinking.</i></b>
	The blue hat thinking allows the organization and control of the thinking process and supports the discussion to be productive.
Affirmations	<ul style="list-style-type: none"> <li>• All discussions have been processed.</li> <li>• When the solutions start to be productive.</li> </ul>

The nature of the human being is to react to instincts, some of them adopt a positive approach to problem solving, while others try to solve problems more critically. The two approaches to obtaining decisions are indispensable, even if both are exposed. "Six thinking hats" highlight important, triggering and edifying aspects from both points of view. Obtaining the triggering and edifying aspects are analyzed

from a technical point of view after they have forced the initiator to think in six different situations. Using this technique, creating different scenarios we can get the best possible solutions to any problem.

This method avoids those discussions in meetings where facts and opinions overlap in a disorderly way, without reaching a concrete conclusion. The "Six Thinking Hats" indicate first problems about an idea/product/service the thinker may come up with, and provide solutions which are analyzed from several perspectives as:

- Information gathering "**white**",
- Feelings, intuition and emotions "**red**",
- Creativity, new ideas and possibilities "**green**",
- Benefits and feasibility "**yellow**",
- Caution, criticism and assessing risks "**black**",
- Process control "**blue**".

The methodology is presented in seven steps, when putting the technique into practice, as follows:

### **Step 1**

In this step, the session is started by exposing the operating principles of the "Six thinking hats". The method works when a target group/person is facing a specific problem. The method offers a different perspective on approaching problems and helps those who want to change thinking patterns in solving a problem. In the first stage, a trainer/moderator/leader is established to guide the group towards each scenario. In this step, the trainer establishes together with the group what problem is to be solved, in this way the sequence of hats will be clearly known. The trainer explains each colored hat and what purpose they serve. The sketch of the method must be print out, namely the colored hats, that are each attached to a separate sheet of paper where each group will write down their arguments in the assigned scenario. The materials must be distributed among participants that attend the meeting.

### **Step 2**

Having known the procedure for carrying out the method in step one, we can move on to step two. Step two begins when the problem identified in step one went through a factual information overview. In step two the problem that needs to be solved will be assigned to a specific function of thinking, namely the white hat. Although an objective assessment of the problem is needed through facts, figures, information, the group must not offer any opinion, interpretation, criticism, or emotion.

In step two the Information gathering, white hat, must be performed. Information gathering of the problem is performed within the group. In this step, the white hat group is noticed. If the group needs guidance, the instructor can provide the group with more key information about the problem in question but only after the group presents the known data about the problem. After the statement of facts, the trainer encourages the whole group to note what emotional states (red hat) the known information causes, following that in step three to explore more views and reactions to the problem analyzed.

### **Step 3**

After gathering information, in step three the trainer starts the in-depth discussions to collect the opinions and reactions to the problem announced in step two. In this stage the group adds the most important constraints of the problem, referring to the factual information collected of white hat. In step three, the characteristics of the red hat are applied by bringing to the surface the emotions related to the central problem. In-depth discussions within the group start with the red hat. The instructor must have some control over the mentality of the red hat because this step requires a high emotional coefficient of thinking. The group assigned to the red hat has the task to present those intuitive activities or to express the direction of the actions to treat the problem according to the received vibrations. The advantage of the red hat is that it allows the emotional expression of individuals without the need for a rational explanation.

### **Step 4**

Step four begins only when the discussions in step three are worn-out. After the factual information and the direction of the actions for treating the problem are presented, depending on the received vibrations,

creativity can be started. Thus, in step four, the trainer assigns the green hat within the group through which innovative solutions are nuanced.

Having already known the data about the problem as well as the specific situations of the problem, the support brought by integrating creative thoughts allows obtaining a positive scenario. In this step, the inventive abilities of the group are fully exploited. Green hat focuses all creative thoughts through which individuals gain creative support when they want to change, remedy, or accept given problems.

### **Step 5**

Despite its apparent simplicity, the method allows extraordinary results, especially when it comes to a group discussion. In this step, it happens that there is more concern for defending the point of view in a discussion, but the method has the ability to combine group thinking to find the best creative solution.

In this step, the instructor has the task to discover the set of ideas resulting from the interaction with the group and to use the outline of the printed method for the yellow hat and the black hat. At this stage the group is guided to address 2 states: an optimistic state yellow hat and a pessimistic state black hat in solving the problem. The yellow hat task allows the group to evaluate with optimism the approached problem. This state allows the cumulation of all the opportunities and advantages from the analyzed situation. Although the gravity of the situation can be harsh, the mentality of this state offers those advantageous characteristics, bringing a positivism note in the analysis of the problem. The yellow hat runs after attracting all the harmonious actions, offering optimistic variants even when the arguments become unbearably harsh. Contrary to the thinking pattern of the yellow hat is the black hat. The pattern of the black hat works in a negative way. In this state, the group is forced to express its criticism, the pessimism that results from the analysis of the given problem. The mentality of the black hat can be a margin of protection to stop reckless actions in time, due to excessive optimism or greed.

The purpose of the black hat is to provide an alternative, a rescue plan when events enter a critical state.

### **Step 6**

Step six is for process control. The use of the blue hat has the task of monitoring the thinking of individuals throughout the entire decision-making process. This stage allows the trainer to make observations to the group on the previous states given by the other hats and to ensure the correct use of the hats. The trainer can use the blue hat to direct the group to another type of thinking, by changing the hats. The blue hat is the one that directs the group's discussion and coordinates the whole thinking process of this method.

This stage also has the effect of a boomerang because the inconsistencies between the other hats will make it difficult to summarize the major points of the discussion, as well as to make optimal decisions.

### **Step 7**

After completing step six, the trainer is the one who requests the end of the work session, giving his consent regarding the actions that the group must take. Depending on the approved actions, the trainer assigns the activities necessary to solve the problem, as the case may be. The usefulness of the method is distinguished by the fact that it is allowed to assign different roles (emotional, critical, optimistic, creative) without a personal involvement. These roles in the form of metaphorical hats encourage individuals to express their irrational emotions about a business, or to expose a new and seemingly strange idea. Also, the negative element, the critique, of an action is seen as a necessary moment for the development of an idea. Those who use the method are very knowledgeable about human behavior and intuitively notice individuals who react emotionally (Red Hat) objectively (White Hat), or critically (Black Hat). Hats are used as metaphors for every direction of thinking helping individuals face a variety of key situations and find solutions to problems.

## **Effectiveness of the Six Thinking Hats method**

The effectiveness of the method allows the analysis of the problem from all points of view, focusing each time on a single aspect, while the use of other methods overlaps the analysis functions resulting in neglecting other aspects of the problem. This creative method deals with the evolution of a problem taking into account the six states of thinking. During the thinking session, an individual's domination over

group discussions is not accepted. Due to the prohibition of this aspect, the ideas, decisions, and solutions attest to the fact that they have unwavering robustness in solving problems.

Thus, the metaphor of hats is an optimal system that requires changing the register when the data is confusing, in a negative and seemingly hopeless situation, "changing the hat" may be the simplest system to find the solution. In addition, using this system quite often, it is possible to create a kind of conditioned reflex, which will make the procedure more and more effective.

### **Creative thinking through "Six Thinking Hats" for educational projects**

In educational projects, a major important element that requires creativity exposure is the design project. Most of the time, students receive this task in the final years, after having thoroughly laid the theoretical foundations. However, these projects should be from day one and spread throughout the program to develop skills and encourage active learning. In the current situation, the educational system requires a creative approach regarding digital education that responds to global innovative initiatives in higher education. Given the current need for creative learning based on competencies and skills, the authors put into practice an educational project to involve students in the product creative area.

Because in the past during traditional brainstorming sessions, individuals tended to use sophisticated thought processes and were undecided about what outcomes must be implemented this time authors decided to apply another method that has more valences for creative development. This change occurred because the authors noted in previous implementations of other educational projects, situations in which the implementation of new ideas was not debated on all levels correctly and this issue influenced the target group that did not identify with the practicability of the last idea. These issues have emerged because new educational projects based on digitalization involve many more factors and opportunities in digital systems that are not properly mastered by all students. Thus, during the educational process, different emotional problems are generated, perceived by the students on distinct levels. Any digitized process is instrumented by programs with different menus, functions and commands. This generates the need for digital skills combined with the necessary knowledge of the study process in the digitized system. Many students do not have this combined knowledge at the same level so in the case of creative teamwork emotions or frustrations can be generated due to these differences in knowledge and skills.

To avoid this, the research team proposed another approach that would bring new innovative proposals and arouse the interest of the target group. Thus, the use of the "Six Thinking Hats" method was taken into account.

Before starting the creative process, the students attended a workshop for the creative design process by specialists. By using the method, indications were suggested that everyone in the project should think about the same issues at the same time. Then each problem was going through the filter/hat for each way of the thinking method. A particular type of thought process was applied for problem-solving.

As was mentioned above we considered appropriate for creative process teaching and practice, the application of the "Six Thinking Hats" method for students, considering the period from March 2020, the moment of entering the state of emergency due to the COVID-19 pandemic. Thus, after declaring the state of emergency, the Politehnica University of Timisoara made available to teachers and students the virtual campus for academic year continuation.

Table 2. Hat Sequence

<b>Brainstorm and Analyze Ideas activities</b>	<b>Hat sequence</b>
<b>Initial Ideas</b>	White, <b>Red</b> , Green, Blue
<b>Quick Feedback</b>	Black, <b>Red</b> , Green, Blue
<b>Identifying Solutions</b>	White, <b>Red</b> , Black, Green, Blue
<b>Problem-Solving</b>	White, <b>Red</b> , Green, Yellow, Black, Blue
<b>Choosing between alternatives</b>	Green, Yellow, Black, <b>Red</b> , Blue
<b>Process Improvement</b>	White, Yellow, Black, Green, <b>Red</b> , Blue
<b>Strategic Planning</b>	Blue, <b>Red</b> , Yellow, Black, White, Blue, Green, Blue
<b>Performance Review</b>	<b>Red</b> , White, Yellow, Black, Green, Blue



Within the Politehnica University of Timisoara, in certain curricular materials, there were difficulties regarding the examination procedure with the students on the university virtual campus. The examination procedure had several variants were topics given to the students had on the virtual campus a limited term for uploading the studied materials / projects "Cute-off data" as well as combined evaluation topics. Specifically, in certain curricular materials, teachers who knew how to use the virtual campus interacted with students to choose between different work options for their optimal examination.

For the examination of the students, four variants were presented as follows:

- bibliographic researches to be studied in which the students had as evaluation method a quiz with limited time.
- depending on the material taught at the online course, the students had to solve a questionnaire with limited response time.
- a real-time solution in which students received a limited amount of time to give the correct answer and to upload pictures of how to solve the problem.
- combinations from quiz-questionnaire-application in different proportions and variants from such combinations depending on digitization skills and emotions.

By using the application of the "Six Thinking Hats" method students were involved in *Problem-Solving* (White, Red, Green, Yellow, Black, Blue), namely:

- White: the teacher established work options and work instructions for the examination.
- Red: the teacher received emotional responses regarding the presentation of the examination variants.
- Green: the students propose combinations of examination variants and the teacher formulates the variants also from an emotional point of view, details that he obtained through the red hat -
- Yellow: the three optimal examination options were selected, which offer opportunities for all students enrolled in the exam to obtain a passing grade.
- Black: the most extensive and complicated examination variant was identified.
- Blue: took over the simple check-list algorithms so that all the information in the other hats was processed.

### **Discussion and conclusions**

More than ever, students must approach creative problem-solving in collaboration with stakeholder groups (actors, participants, customers, and users) to address problematic situations through collective creative thinking based on technology. Therefore, there is a great need to teach students to identify creative deepening methods and techniques that will help them solve problems. These creative approaches will bring an advantage by completing the traditional understanding in solving problems and developing an extremely rational and programmed process.

The method helped to make creative educational decisions, obtaining combinations of the four explicit methods to help students.

It also helped to find the best examination solution for a series of 120 students and for them to be involved in the learning process through digitized methods. Following the results obtained after the examination, the feedback was 85 percent positive regarding the completion of the subject. In other words, it is relevant that educators have an optimal collaboration with students in framing their competencies that need and vital for the involvement and highlighting of the labor market. This collaboration is especially important because it encourages students to improve their transferable skills and employability. Students must be prepared to generate innovative ideas through appropriate experiences, such as undertaking complex projects, working in interdisciplinary teams.

Modern challenges and global issues that demand the most attention from the current group of students will not be solved by any discipline but through teams from all disciplines, who gather their skills and expertise to create innovative solutions.

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# GLOBALIZATION AND THE ACCEPTANCE OF NEW TECHNOLOGIES IN OUR LIVES AND IN ORGANIZATIONS

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## Abstract

**Purpose** – This paper brings arguments for the acceptance and applicability of the new technologies as basis for globalization and organizations' market performance improvement.

**Methodology/approach** – Questionnaire based research was performed on a sample of 363 Romanian respondents. Different approaches regarding the research subject were defined and tested using SPSS. Exploratory factor analysis was used to define classes of reasons for not implementing the new technologies and groups of training areas that would increase work performance.

**Findings** – The main conclusion shows a positive perception and willingness of respondents to use the new technologies. High costs and lack of training are the main reasons, according to the respondents, that make the use of the new technologies difficult.

**Research limitations/implications** – The research was not random, it was based on reasoning, because, due to the time it took to perform the research, it would have been difficult to identify the available respondents based on a random sampling.

**Practical implications** – This paper points out some of the human resources management's challenges and the importance of the training programs, in order to prepare people and organizations to handle the use of the new and complex technologies.

**Originality/value** – This research leads to useful recommendations for the human resources management, in the context of adopting the new technologies in order to improve the organizational performances.

**Key words:** statistical analysis, human resources, abilities of the future.

## Introduction

The term globalization has multiple meanings, referring to multidimensional and complex processes-economical, cultural and political. As Erixon (2018) points out, "globalization means different things to different people", having a social and economic impact by "expanding the role for trade, foreign direct investment and other forms of cross-border exchange in national economies". Globalization may also refer to "the transfer, adjustment and development of values, knowledge, technology and behavioral norms across countries and societies in different parts of the world" (Cheng, 2003 apud Rifai, 2013).

Globalization means the use of the new technologies, developed to sustain people's and organizations' integration and interconnectivity worldwide. If, a century ago, it was not common for people to choose workplaces in companies far away from their homes, nowadays, distance is no longer an issue. Let us imagine an employee working for a company situated at a considerable distance from his home. The company provides transportation to the workplace and makes available technologies that would allow him to work, if necessary, from a distance. Furthermore, his home is equipped with sensors that allow handling and monitoring a series of home appliances from a distance. As an example, using different remotely controlled technologies one may start, at a specified time, the heating or ventilation system, wash laundry, clean-up, monitor the fridge supplies and send orders to selected shops.

Regarding the use of the new technologies in organizations, in the context of a crisis such as the current COVID-19 sanitary crisis, the company may be interested in monitoring the employees' access and involvement at his workplace, when he works remotely. The collaborative robots and the new technologies based on artificial intelligence (biometrics and voice recognition technologies) are viable solutions, especially in this context.

Further, we intend to present two categories of arguments that emphasize the human resource's role and determines us to consider accepting and implementing the new technologies as a support for globalization and organizations' market performance improvement.

### **A. Technologies and human resources: facets of globalization**

Discussing about the globalization's direct and indirect effects on a country's technological capacity and on the degree to which technology is used in economy, Erixon (2018) points out among the benefits: (1) the possibility of importing technologies that countries could not otherwise produce on their own or for which they would have to make great efforts in order to copy and (2) the stimulation of productivity of some activity sectors, due to the investments of the multinational organizations. As regards the adoption of new technology, globalization represents an extremely important framework that allows their rapid spread on the markets, in organizations and in the lives of people from different countries.

Production factors, factors that determine the product's or service's costs, determine the configuration of the businesses' operation system. Regarding the economic globalization, Ruettimann (2014) suggests a model consisting of five typologies, one of which refers to the human resource – "comparative competencies of the labor force". This type of globalization takes into consideration "the level of available skills", the costs involved in using them and "the cost for transferring that service to a lower costs economy".

From the perspective of the costs involved in using the labor force's competences, Romania is known as a low-cost economy, compared to other European countries. The situation in which Romanian employees work for companies with headquarters in different parts of the world is more and more common, a significant contribution being brought by the use of the information and communications technology. In order to maintain competitiveness, companies need to take into consideration the continuous development of the production factors, and in the decision process regarding the use of the new technology, it should be analyzed the level to which the cultural factor influences the acceptance of these technologies into work.

### **B. Technologies and human resources: contribution to the organization's market performance**

A bibliographic study on human capital measurement and the influence of the human resource on organizational performances (Mayo, 2014) shows its direct influences on profitability, productivity, market value growth and sales. The influence of the human resource can be seen in areas such as: staff commitment, staff continuous development, with emphasis on communication, change management and employees' involvement in the decision-making processes. Another aspect that leads to a higher financial and market performance and to a higher competitiveness is the introduction of new ideas and technology, as shown in a study regarding the use of the new IoT technology in the value chain of some Hungarian companies (Nagy et al., 2018). The implementation of the new technology contributes directly to the creating of new jobs, to work productivity growth and to the efficient use of resources. It also leads to the need of investing in people by developing abilities and educational programs that would prepare the human resource to handle the challenges of the future.

### **Research problem**

At an international and European level, in countries such as Finland or Germany, the new technologies are frequently used both inside companies and in the private life. In Romania and countries similar to it from the development point of view, it has been observed an openness to the use of the new technology,

especially by people with high income. Still, there may be less information available and the public may have less access to the technological news.

In order to grow the extent to which we use the new technology in our life, the target audience should first be convinced of its positive and sustainable impact and then informed and trained to use it. For this, research is needed in order to identify the reasons for which people would consider difficult to use the new technology and once these barriers are identified, they should be removed through education and training. There will be, most certainly, the need for new abilities for the employees in the future and new continuing education programs should be developed.

### Research aim and methodology

The research focused on identifying particular aspects related to: (1) the respondents' interest in using the new technology in order to increase work performance, (2) the level to which respondents are generally open to the idea of using the new technology, (3) the causes that would make difficult the use of the new technology at the workplace, (4) the respondents' perception of the competences that describe the "employee of the future" and (5) the training areas necessary to increase work performance.

Three categories of exploratory investigation were set, aiming: (1) the identification of general aspects related to the respondents' interest in using the new technology in order to increase work performance, (2) the identification of general aspects regarding the accommodation with the new 4.0 technology (the need of performance focused trainings and the respondents' perception of the assimilation of the new technology) and (3) the identification of the latent factors in adopting the new technology and training the employees in order to increase performance.

Hypotheses regarding the research theme were drawn for the study, the null hypotheses are marked with  $H_{01} - H_{011}$ , and the alternative hypotheses with  $H_{11} - H_{111}$ . The survey was used as a method and the questionnaire as an instrument for gathering information, being sent online, using <http://www.isondaje.ro> The hypotheses have been tested using SPSS. Factor analysis was used to analyze the data.

The research was performed on a sample of 363 respondents. A non-random research method, based on reasoning, was used to select the subjects. Taking into consideration the non-random sampling, we cannot see it as a 5% limited acceptable error and a 95% level of trust research, the results being valid at a sample level.

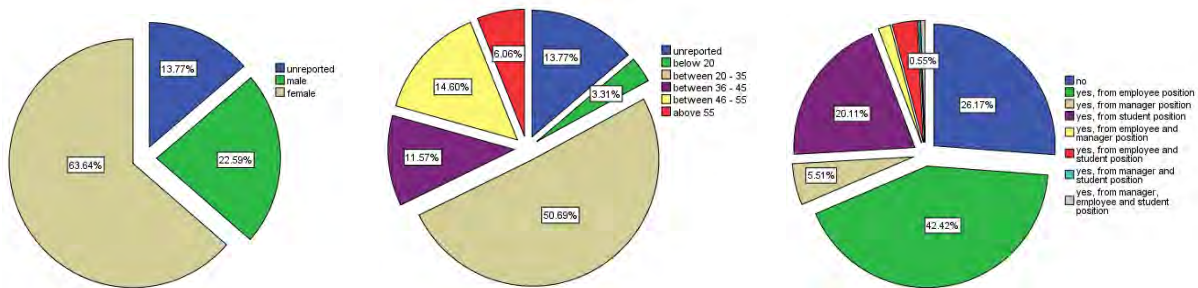


Figure 1. Respondents' profile

Figure 1 presents the profile of the investigated respondent: feminine respondent, group age 20-35 years old, who experienced teleworking as an employee.

The investigated sample may be layered in layers represented by "respondents' groups from the areas of activity". The respondents were students (25%) and employees (61%) who work in fields like: education – teachers (~11%), IT industry (7%), manufacturing industry and other industries (14%), administrative services (5,5%), other areas of activity (represented by less than 5%). Approximately 14 percent of the respondents didn't agree to offer information related to gender, age, activity, being included as "unreported" in the SPSS data base used to interpret the information.

## Findings

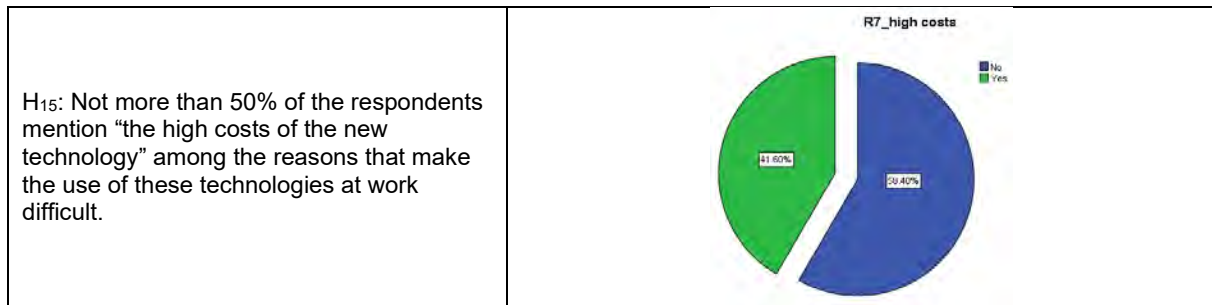
### A. The use of the new technology

Main results, presented in Table 1, show that:

- (1) more than 80% of the respondents are interested in using the new technology in order to improve their work performance; weak negative correlations, significant at the 0,01 level, with the field of activity and the age group have been identified,
- (2) the level to which respondents are, in general, open to the use of the new technology is a little above average,
- (3) high costs and lack of training are the main reasons that make the use of the new technology at the workplace, difficult.

Table 1. Confirmed hypotheses regarding the use of the new technology

<p>H<sub>01</sub>: More than 80% of the respondents are interested in using the new technology in order to improve their work performance.</p>	<p style="text-align: center;"><b>Respondents are interested in using the new technology in order to improve their work performance</b></p> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th></th> <th>Frequency</th> <th>Percent</th> <th>Valid Percent</th> <th>Cumulative Percent</th> </tr> </thead> <tbody> <tr> <td>Valid Yes</td> <td>291</td> <td>80.2</td> <td>80.2</td> <td>80.2</td> </tr> <tr> <td>No</td> <td>18</td> <td>5.0</td> <td>5.0</td> <td>85.1</td> </tr> <tr> <td>I don't know / I didn't think</td> <td>54</td> <td>14.9</td> <td>14.9</td> <td>100.0</td> </tr> <tr> <td>Total</td> <td>363</td> <td>100.0</td> <td>100.0</td> <td></td> </tr> </tbody> </table>		Frequency	Percent	Valid Percent	Cumulative Percent	Valid Yes	291	80.2	80.2	80.2	No	18	5.0	5.0	85.1	I don't know / I didn't think	54	14.9	14.9	100.0	Total	363	100.0	100.0																					
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<p><b>Descriptive Statistics</b></p> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th></th> <th>N</th> <th>Minimum</th> <th>Maximum</th> <th>Mean</th> <th>Std. Deviation</th> </tr> </thead> <tbody> <tr> <td>Respondents are opened to the use of the new technology</td> <td>363</td> <td>1</td> <td>5</td> <td>3.59</td> <td>1.201</td> </tr> <tr> <td>Valid N (listwise)</td> <td>363</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>			N	Minimum	Maximum	Mean	Std. Deviation	Respondents are opened to the use of the new technology	363	1	5	3.59	1.201	Valid N (listwise)	363																															
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<p><b>One-Sample Test</b></p> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th rowspan="3"></th> <th colspan="5">Test Value = 3</th> </tr> <tr> <th rowspan="2">t</th> <th rowspan="2">df</th> <th rowspan="2">Sig. (2-tailed)</th> <th rowspan="2">Mean Difference</th> <th colspan="2">95% Confidence Interval of the Difference</th> </tr> <tr> <th>Lower</th> <th>Upper</th> </tr> </thead> <tbody> <tr> <td>Respondents are opened to the use of the new technology</td> <td>9.310</td> <td>362</td> <td>.000</td> <td>.587</td> <td>.46</td> <td>.71</td> </tr> </tbody> </table>			Test Value = 3					t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference		Lower	Upper	Respondents are opened to the use of the new technology	9.310	362	.000	.587	.46	.71																								
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<p>H<sub>04</sub>: "The high costs of the new technologies" and "the lack of training" are the main reasons that make the use of the new technology at the work place, difficult.</p>	<p style="text-align: center;"><b>Descriptive Statistics</b></p> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th></th> <th>N</th> <th>Minimum</th> <th>Maximum</th> <th>Sum</th> </tr> </thead> <tbody> <tr> <td>R1_lack of information</td> <td>363</td> <td>0</td> <td>1</td> <td>87</td> </tr> <tr> <td>R2_lack of instructions for use</td> <td>363</td> <td>0</td> <td>1</td> <td>84</td> </tr> <tr> <td>R3_lack of training</td> <td>363</td> <td>0</td> <td>1</td> <td>145</td> </tr> <tr> <td>R4_fear of making mistakes</td> <td>363</td> <td>0</td> <td>1</td> <td>89</td> </tr> <tr> <td>R5_fear of change</td> <td>363</td> <td>0</td> <td>1</td> <td>37</td> </tr> <tr> <td>R6_fear of being monitored</td> <td>363</td> <td>0</td> <td>1</td> <td>45</td> </tr> <tr> <td>R7_high costs</td> <td>363</td> <td>0</td> <td>1</td> <td>151</td> </tr> <tr> <td>Valid N (listwise)</td> <td>363</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>		N	Minimum	Maximum	Sum	R1_lack of information	363	0	1	87	R2_lack of instructions for use	363	0	1	84	R3_lack of training	363	0	1	145	R4_fear of making mistakes	363	0	1	89	R5_fear of change	363	0	1	37	R6_fear of being monitored	363	0	1	45	R7_high costs	363	0	1	151	Valid N (listwise)	363			
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The respondents were asked to check, in the list, the reasons why it should be considered difficult adopting the new technologies at work, multiple answers being possible. The question offered the respondents the possibility of giving also other reasons than the ones suggested. (Figure 2)

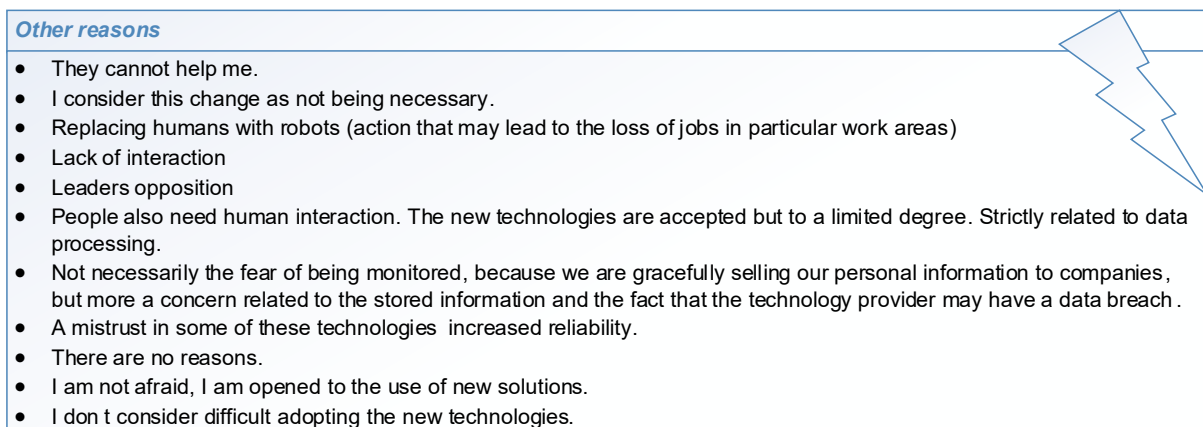


Figure 2. Other reasons that make adopting the new technologies at work difficult

In order to identify the latent factors in the process of adopting the new technologies, the exploratory factor analysis was used, in order to reduce the number of the specified reasons.

The KMO and Bartlett test, applied to determine if the partial correlations between the used variables are small, has the value of 0,584 (>0,5), which shows that the variables will group according to the factors and the factor analysis is suitable for the variables included in the research. The Extraction values from the Communalities table are >0,3.

As a result of the first analysis there are three factors that explain 52% of the total variation. The analysis has been redone, requesting the identification of 4 factors, representing 65% of the total variation. The Eigenvalues for each of the four factors can be seen in the table related to total variation. Out of the factors selected as being latent in adopting the new technologies at work, the four factors explain a rate of 19, 16, 15 and 15 percent.

The solution of interpretation of the latent factors, using the factors' rotation Varimax method, is plotted in Figure 3.

**KMO and Bartlett's Test**

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.584
Bartlett's Test of Sphericity	Approx. Chi-Square	62.792
	df	21
	Sig.	.000

**Total Variance Explained**

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.493	21.324	21.324	1.493	21.324	21.324	1.337	19.097	19.097
2	1.135	16.219	37.543	1.135	16.219	37.543	1.147	16.385	35.482
3	1.009	14.419	51.962	1.009	14.419	51.962	1.069	15.275	50.757
4	.934	13.344	65.305	.934	13.344	65.305	1.018	14.548	65.305
5	.891	12.722	78.027						
6	.807	11.524	89.551						
7	.731	10.449	100.000						

Extraction Method: Principal Component Analysis.

**Communalities**

	Initial	Extraction
R1_lack of information	1.000	.813
R2_lack of instructions for use	1.000	.450
R3_lack of training	1.000	.642
R4_fear of making mistakes	1.000	.606
R5_fear of change	1.000	.573
R6_fear of being monitored	1.000	.941
R7_high costs	1.000	.547

Extraction Method: Principal Component Analysis.

**Component Score Coefficient Matrix**

	Component			
	1	2	3	4
R1_lack of information	-.088	-.005	.859	-.040
R2_lack of instructions for use	.410	-.006	.210	-.040
R3_lack of training	.592	-.225	-.100	.154
R4_fear of making mistakes	-.015	.606	.285	.102
R5_fear of change	-.063	.636	-.189	-.043
R6_fear of being monitored	-.018	.030	-.041	.952
R7_high costs	-.501	-.234	.238	.199

Extraction Method: Principal Component Analysis.  
Rotation Method: Varimax with Kaiser Normalization.

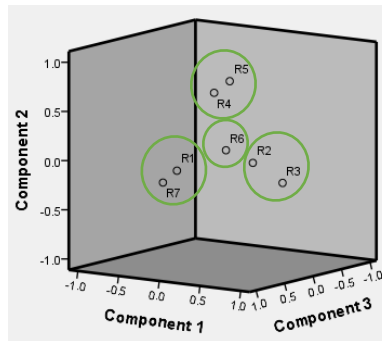


Figure 3. Graphic representation of the four factors extracted after the rotation, corresponding to the reasons that lead to not adopting the new technologies

**B. The abilities that describe the “employee of the future”**

The results show that, from the respondents’ perspective, the „employee of the future” has to be adaptable to change, creative and connected (Table 2). A few of the remarks regarding the ranking of the “abilities of the future”, performed on groups of respondents, are presented in Figure 4.

Table 2. Confirmed hypotheses regarding the abilities that describe the „employee of the future”

		Statistics				
		Creative	Connected (networking)	Communicative	Assertive (open with people)	Adaptable (open to change)
N	Valid	363	363	363	363	363
	Missing	0	0	0	0	0
Mean		2.88	3.05	3.15	3.10	2.81
Std. Deviation		1.514	1.344	1.233	1.385	1.551
Skewness		.111	-.027	-.108	-.126	.222
Std. Error of Skewness		.128	.128	.128	.128	.128
Kurtosis		-1.446	-1.145	-1.010	-1.241	-1.466
Std. Error of Kurtosis		.255	.255	.255	.255	.255
Sum		1046	1108	1143	1127	1021



Characteristics ranking – on age groups

- 20-35 years old: adaptable, connected and assertive, creative
- over 55 years old: creative and connected, communicative

**Report**

Mean

Age group	Creative	Connected (networking)	Communicative	Assertive (open with people)	Adaptable (open to change)
unreported	2.64	2.98	3.00	3.56	2.82
below 20	3.17	2.67	3.17	3.08	2.92
between 20 - 35	3.05	2.99	3.15	2.99	2.82
between 36 - 45	2.71	3.29	3.38	3.07	2.55
between 46 - 55	2.58	3.28	3.15	3.11	2.87
above 55	2.91	2.91	3.00	3.09	3.09
Total	2.88	3.05	3.15	3.10	2.81

Characteristics ranking – on gender layers

- Male: adaptable, assertive, creative
- Female: creative, adaptable, connected

**Report**

Mean

Gender	Creative	Connected (networking)	Communicative	Assertive (open with people)	Adaptable (open to change)
unreported	2.64	2.98	3.00	3.56	2.82
male	3.06	3.17	3.23	2.91	2.62
female	2.87	3.03	3.15	3.07	2.88
Total	2.88	3.05	3.15	3.10	2.81

Characteristics that describe the “employee of the future” – averages, on areas of activity

**Report**

Mean

Field of activity	Creative	Connected (networking)	Communicative	Assertive (open with people)	Adaptable (open to change)
unreported	2.64	2.98	3.00	3.56	2.82
education - student	3.23	3.03	3.12	2.90	2.71
education - teacher	3.00	2.97	3.03	2.87	3.13
IT industry	2.96	3.15	3.27	3.23	2.38
manufacturing	2.50	3.10	2.90	3.50	3.00
other industries	2.55	2.75	3.35	3.38	2.98
transport and logistics	3.50	1.50	5.00	2.00	3.00
construcții	4.00	2.50	3.25	3.75	1.50
public administration and defense	2.56	2.94	3.33	2.94	3.22
administrative and other services	2.45	3.75	3.15	3.15	2.50
financial - banking	2.14	3.71	3.71	2.43	3.00
juridic	2.14	4.00	3.14	2.43	3.29
management	2.71	2.71	3.14	3.57	2.86
marketing	3.00	1.00	4.00	5.00	2.00
trade	3.18	2.82	3.12	3.18	2.71
entrepreneurship	3.57	3.57	2.71	2.43	2.71
health and social assistance	3.00	3.83	3.33	2.50	2.33
other areas of activity	2.91	3.00	2.82	3.09	3.18
Total	2.88	3.05	3.15	3.10	2.81

H07: More than 60% of the respondents place in “top 3 characteristics of the employee of the future”: adaptable, connected and creative.

**Adaptable (open to change)**

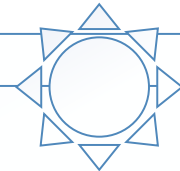
	Frequency	Percent	Valid Percent	Cumulative Percent
Valid 1-st place	106	29.2	29.2	29.2
2-nd place	73	20.1	20.1	49.3
3-rd place	52	14.3	14.3	63.6
4-th place	47	12.9	12.9	76.6
5-th place	85	23.4	23.4	100.0
Total	363	100.0	100.0	

**Connected (networking)**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid 1-st place	59	16.3	16.3	16.3
2-nd place	72	19.8	19.8	36.1
3-rd place	92	25.3	25.3	61.4
4-th place	71	19.6	19.6	81.0
5-th place	69	19.0	19.0	100.0
Total	363	100.0	100.0	

Creative (solving complex problems)					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1-st place	98	27.0	27.0	27.0
	2-nd place	66	18.2	18.2	45.2
	3-rd place	59	16.3	16.3	61.4
	4-th place	61	16.8	16.8	78.2
	5-th place	79	21.8	21.8	100.0
	Total	363	100.0	100.0	

### Remarks regarding the ranking of the abilities of the future



- The group of students rank creativity as number one.
- The group of teachers rank assertiveness as number one.
- The group of respondents from manufacturing and other industries rank creativity as number one.
- The group of respondents age between 20-35 rank assertiveness as number two.
- The group of respondents age above 55 rank creativity as number one.
- More than 40% of the respondents from the IT industry no matter the gender, rank adaptability as number one.
- None of the feminine respondents from the IT industry ranks creativity as number one.

Figure 4. Differences in the “abilities of the future” ranking

### C. Training areas in order to increase performance

The results show that more than 50% of the respondents consider training for “technological novelty” as useful in improving their work performance (Table 3). In order to identify the latent factors in performance-enhancing trainings, exploratory factor analysis was used to reduce the number of training fields mentioned in the questionnaire.

Table 3. Confirmed hypotheses regarding the training areas in order to increase performance

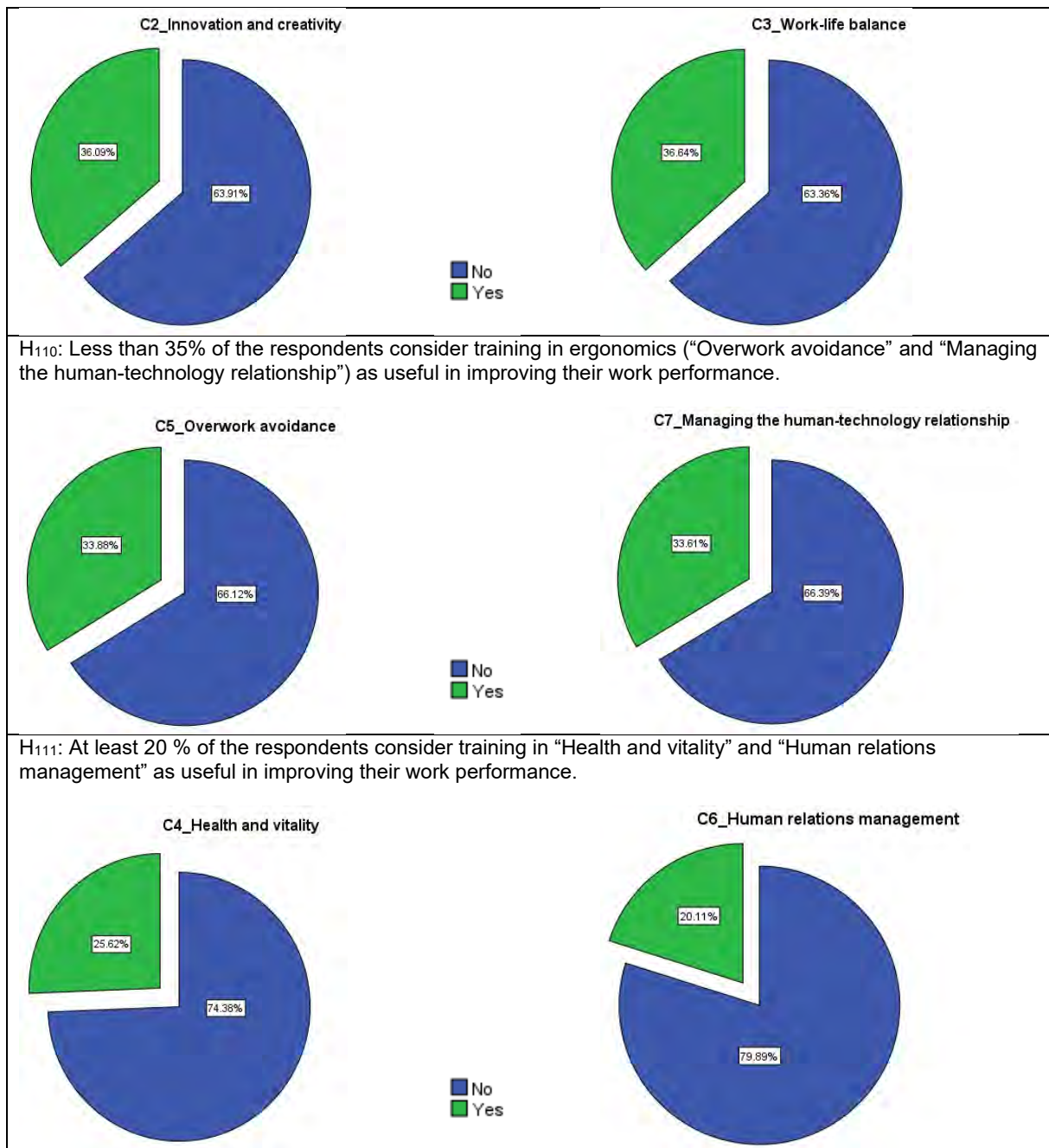
Descriptive Statistics				
	N	Minimum	Maximum	Sum
C1_Technological novelty	363	0	1	192
C2_Innovation and creativity	363	0	1	131
C3_Work-life balance	363	0	1	133
C4_Health and vitality	363	0	1	93
C5_Overwork avoidance	363	0	1	123
C6_Human relations management	363	0	1	73
C7_Managing the human-technology relationship	363	0	1	122
Valid N (listwise)	363			

**C1\_Technological novelty**

■ No  
■ Yes

H<sub>08</sub>: More than 50% of the respondents consider training for “technological novelty” as useful in improving their work performance.

H<sub>09</sub>: More than 35% of the respondents consider training in “innovation and creativity” and “work- life balance” as useful in improving their work performance.



The KMO and Bartlett test, applied to determine if the partial correlations between the used variables are small, has the value of 0,596 (>0,5), which shows that the variables will group according to the factors and the factor analysis is suitable for the variables included in the research. The Extraction values from the Communalities table are >0,3.

**KMO and Bartlett's Test**

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.596
Bartlett's Test of Sphericity	Approx. Chi-Square	152.904
	df	21
	Sig.	.000

**Component Score Coefficient Matrix**

	Component		
	1	2	3
C1_Technological novelty	-.135	.554	.008
C2_Innovation and creativity	-.210	-.102	.758
C3_Work-life balance	.475	-.069	-.069
C4_Health and vitality	.303	-.181	.318
C5_Overwork avoidance	.464	.137	-.181
C6_Human relations management	.197	.171	.391
C7_Managing the human-technology relationship	.118	.654	-.122

Extraction Method: Principal Component Analysis.  
Rotation Method: Varimax with Kaiser Normalization.

**Communalities**

	Initial	Extraction
C1_Technological novelty	1.000	.549
C2_Innovation and creativity	1.000	.749
C3_Work-life balance	1.000	.560
C4_Health and vitality	1.000	.493
C5_Overwork avoidance	1.000	.503
C6_Human relations management	1.000	.544
C7_Managing the human-technology relationship	1.000	.640

Extraction Method: Principal Component Analysis.

**Total Variance Explained**

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.690	24.141	24.141	1.690	24.141	24.141	1.584	22.629	22.629
2	1.399	19.983	44.124	1.399	19.983	44.124	1.250	17.858	40.488
3	.950	13.567	57.691	.950	13.567	57.691	1.204	17.203	57.691
4	.856	12.235	69.926						
5	.792	11.311	81.237						
6	.704	10.063	91.300						
7	.609	8.700	100.000						

Extraction Method: Principal Component Analysis.

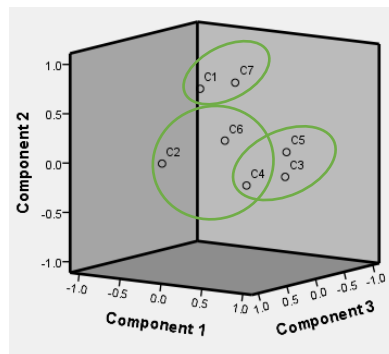


Figure 5. Graphic representation of the three factors extracted after the rotation, corresponding to training areas for work performance-enhancing

As a result of the first analysis we identified two factors that explain 44 % of the total variation. The analysis has been redone, requesting the identification of 3 factors. The Eigenvalues for each of the three factors can be seen in the table related to total variation. The three factors explain a rate of 58 percent of the total variation of all noted variables. The solution of interpretation of the latent factors, using the factors' rotation Varimax method, is plotted in Figure 5.

**Discussion and conclusions**

As it was argued in the first part of this paper, globalization leads to the growth of a country's or organization's technological capacity by adopting the new technologies. As far as the preparation of the human resource towards this development approach is concerned, the first step is accepting the new technologies and then implementing them in the organizations.

When making investments in order to enhance companies' technological capacity, human resources management should take into consideration aspects such as: (1) training the decision makers so that they can have access to the technological novelties, (2) training the employees so that they accept and

use the new technologies and (3) promoting the contribution of the new technology to the growth of organizational performance, despite the high costs involved.

This paper identifies four classes of reasons, latent factors in the process of implementing the new technologies in work (Figure 6) and three groups of continuing education programs, latent factors in training for performance-enhancement (Figure 7), by the investigated respondents. It can be noted that some of the respondents declare that they are opened to the use of the new technology, not having any reasons to fear, but there are also respondents that emphasize people's need of human interaction and a limited acceptance of the new technologies, for data processing. Other barriers mentioned, are the possible opposition of the management to the acceptance of the new technologies or the fear that the technology provider cannot ensure the security of the information requested to the users, a possible data leakage being able to occur.

<i>Latent factors in the process of implementing the new technologies in work</i>			
<b>1. educational reasons</b>	<b>2. emotional reasons</b>	<b>3. educational and financial reasons</b>	<b>4. emotional reasons</b>
lack of instructions	fear of change	lack of information	fear of being monitored
lack of training	fear of making mistakes	high costs	

Figure 6. Possible barriers in the process of implementing the new technologies in work

<i>Latent factors in training for performance-enhancement</i>		
<b>Vitality management</b>	<b>Ergonomics and technological novelty</b>	<b>Creativity and communication</b>
Work-life balance	Managing human technology relationship	Innovation and creativity
Overwork avoidance	Technological novelty	Human relations management
Health and vitality		Health and vitality
		

Figure 7. Continuing education programs for performance-enhancement

Most certainly, new abilities will be necessary in the future for the employees and new continuing education programs need to be developed. More than 60% of the investigated respondents noted in the “top 3 characteristics of the employee of the future” adaptability, creativity and connecting capability.

This paper's main conclusion shows a positive perception and openness to the use of the new technologies of the investigated Romanian respondents. It also emphasizes some challenges for the human resources management and the need for developing some training programs in order to prepare people and organizations to handle the use of the new and complex technologies.

### **Acknowledgments**

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# RESEARCH ON HUMAN RESOURCES MANAGEMENT IN PROJECTS CARRIED OUT IN HIGHER EDUCATION INSTITUTIONS IN ROMANIA

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## Abstract

**Purpose** – This paper covers a bibliographical study on suggested research directions for the PhD thesis on the types of projects and the particular aspects of integrating project human resource management into the university's human resource management and an analysis on the strategy regarding recruitment, selection and employment into the project teams.

**Methodology/approach** - In order to carry out the bibliographic research, the activities regarding project human resources management in higher education institutes were singularized.

**Findings** – The paper aims at identifying and prioritizing the factors that have a significant influence on human resources and at analyzing the implications of creating a model and a study structure of the bibliographic reference system regarding project human resource management and integration into the human resource management of universities.

**Research limitations/implications** – The aim is to create a methodological model in the qualitative and quantitative research and to design a research model.

**Practical implications** – the usefulness of potential results for concerned categories: budget managers, managers and human resource managers.

**Originality/value** – The paper contributes to the improvement of the theoretical sources regarding project human resource management within the Romanian higher education institutes.

**Key words:** Human Resource Management; Project Management.

## Introduction

The bibliographic study "Research on human resources management in projects carried out in higher education institutions from Romania" is a topic of interest, because project management is a field with an upward trend, due to the fact that any major action is carried out within a project.

**Purpose** – This paper covers a bibliographic study on suggested research directions for the PhD thesis on the types of projects and the particular aspects of integrating project human resource management into the university's human resource management and an analysis of the strategy regarding recruitment, selection and employment into the project teams. The purpose of the paper is to provide a bibliographic study to concerned factors.

**Methodology/approach** – In order to carry out the bibliographic study of Research on human resources management in projects carried out in higher education institutions from Romania, the methodology of the study includes the following steps:

1. Researches regarding the types of projects and the particular aspects of integrating project human resource management into the university's human resource management. The aim is to: recognize the types of projects and provide an overview of such projects that can be carried out in universities and to

carry out a study of the bibliographical reference system regarding project human resource management and the integration of such study into the human resource management of universities.

2. Analysis on the possibility of improving the human resource management strategies of universities in the context of integrating project human resource management/university human resource management. The aim is to identify, prioritize and supplement the factors that exert a significant influence on human resources. The research methodology is based on the bibliographic study with regards to: identification of influential factors of resources planning, recruitment of human resources, selection, and the research on research methods, techniques and tools, in accordance with specialized literature.

3. Research on human resource management in Romanian universities, influential factors of resource planning, in the context of underfinancing. We aim at identifying the factors that have a significant influence on human resources during economic crises.

4. Drafting a project human resource management / university human resource management integration model. The aim is to identify, prioritize and supplement the factors that have a significant influence on human resources.

In the case of steps 3 and 4, the bibliographical study was directed at integrating the project human resource management into the university human resource management and on the impact of integration.

The bibliographic study is schematically presented in Figure no. 1, The Proposed Plan for the PhD Thesis Entitled: Research on human resources management in projects carried out in higher education institutions in Romania.

**Findings** – Within the **Bibliographic Study on the Types of Projects and on the Particular Aspects of Integrating Project Human Resource Management into the University's Human Resource Management**, the aim was to perform an analysis of the bibliographical reference system regarding project human resource management. Project human resource management (Dociu (Anchidin), 2018) plays a fundamental and strategic role in the project management processes: the selection process, the training process and the management process. Projects are the way organizations survive in today's economic environment. The project (Nae, 2009) corresponds to the situation where the aim is to achieve a certain purpose using specific methods, within a given period of time.

In order to integrate project human resource management into the university's human management, the main concepts shall be studied: the project's schedule or timetable, the activities, the critical path, the Critical Path Method, the Gantt and Pert diagrams, multiple projects, life cycle stages, the project outline, the main plan, the planned and (effectively) carried out tests plan, strategic planning, tactical/operational planning (Ciobanu, 2011).

The attention of scientists was directed towards uncovering efficient ways of planning, managing and achieving the goals of the project on time and within the budget. According to Juliane Johnson, only a small percentage of projects achieve all objectives and a third of all projects are never completed (Hall & Johnson, 2003). The human resources development policy in higher education institutes is a project that was built and implemented by the Human Resources Department, which provides support for leadership and professional development (Nica et al., 2011). Project human resource management organizes, manages and leads the team, in order to successfully complete the project (Zaouga, Rabai, & Alalyani, 2019). The integration of project human resource management into the university's human resource management goes through the following stages: human resource planning (identifying the personnel that possesses the required skills); employment of the project team (approves the availability of human resources to achieve the successful team); development of the project team (improves skills, interaction between team members and general team environment); project team management (evaluates team performance, provides feedback, manages conflicts and solves problems).

For the **Bibliographic Study on the Potential to Improve the Human Resource Management Strategies of Universities, In the Context of Integrating Project Human Resource Management/University Human Resource Management**, the aim was to identify the influential factors of resource planning and the recruitment and selection of human resources.

The recruitment process is influenced by a series of internal and external factors (Roman, 2010). Examples of external factors are: the conditions of demand and supply on the labor market, the system's



capacity in terms of recruitment needs, the legislative and institutional framework of the labor market and a functional social partnership between representative employers, representative unions and collective labor agreements. Internal factors are: the organization's prestige is attractive to candidates; candidates' preferences depending on their level of education and training; the objectives of the organization and the organizational culture in terms of recruitment; the economic-financial situation of the entity; compliance with certain principles in the recruitment process (equality, non-discrimination); reward systems, including social ones.

In order to analyze the influential factors of human resource management in educational establishments, it is necessary to lay down, to settle and to clarify, from a theoretical point of view, certain statistical concepts and mathematical formulae which shall be useful during the actual research. Specialized literature stipulates that the university's human resources development policy is a project that should be built and implemented by the Human Resources Department (HR), which provides support for leadership and professional development (Nica et al., 2011)

The HRM component (Oprea, et al., 2011) provides IT support for the accomplishment of all human resources and personnel management processes.

Starting with the recruitment process and up to the necessary measures for the development of one's career, this component shall provide pertinent information on the basis of which the policies of guiding and motivating the employee can be established (Băduț, 2003).

The categories of educational projects and programs (Bunăiașu, 2012) can be unified depending on several criteria and are highlighted in *Classification of Educational Projects and Programs*: by the way in which projects are perceived; by extension area; by scale of design; by project management type; by funding sources; by educational field; by educational room; by factors involved; depending on the functional field of the development strategy; depending on the target groups; depending on the priority axes; by program categories and strategic directions.

### **Bibliographic Research on Human Resource Management in Romanian Universities. Influential Factors of Resource Planning in Underfunding Conditions**

Access to international databases makes it possible for current worldwide knowledge to reach Romanian organizations, which has led to significant changes in the practices of such organizations in the last two decades (Petrescu (coordinator), 2014). Globalization has enforced the employment of trained staff, who should add value through their performance, at a fast and sustained pace. The population's level of education generates social and cultural actions and is directly proportional to a country's economy. In order to improve the quality of students' education and to train them with the purpose of perform well as employees, Sebastian I. Burduja recommends measures which would require "vision, flexibility and openness" (Burduja, 2017).

The evolution and development of human resources in times of crisis is measured using the Human Development Index (HDI), which reflects a country's development level by comparing life expectancy, education and living standards ((Aneculaesei (Giurgica) & Lupu, 2012). According to the 2016 Human Development Report, Romania was ranked 50<sup>th</sup>; its HDI was 0.802, with an increase of 0.004 units, compared to 2015. In 2018 Romania was ranked 52<sup>nd</sup>, despite the fact that HDI had a value of 0.811 units, with an increase of 0.09 units and it was surpassed by Montenegro and Bulgaria (\*\*\*, Human Development Reports, 2018).

The effects of the economic crisis of 2009 – 2012 on human resources in education were also found in the National Education Law published in 2011. University education no longer represented an attractive environment for young people, in order to develop a future career. The consequences of shutting down the employment and promotion process in 2009-2012 can be found in the low number of specialists and teachers in senior positions of professors and associate professors. The forced retirement of the elite of the Romanian education has led to the narrowing or even loss of values through the impossibility of transferring knowledge to the disciples.

**Research limitations/implication** – The bibliographical study on HRM took into account the fact that organizations use and process personal data. In order to ensure confidentiality, software application,

generally known as “Personnel Records” are used. These applications are used by qualified staff who must record personal data. The database shall at least contain the following: personal data, information regarding employment, workplace, position, working hours, type of salary, salary, increments, meal vouchers, salary additions or reductions, bonuses, penalties, seniority, dependents, job description, disabilities, vacations, data regarding indefinite or definite labor agreements, main position, information regarding cessation of activity within the institution.

**Practical implications** - The research will be aimed at: creating a model and study structure for the bibliographical reference system regarding project human resource management and its integration into the human resource management of universities; designing a research model, a methodological model for quantitative and qualitative research; improvement of the theoretical sources regarding project human resource management within the education establishments.

**Originality/value** – The research presents a series of personal contributions: creating a model and study structure for the bibliographical reference system regarding project human resource management and its integration into the human resource management of universities. The paper’s originality is based on: conducting a bibliographic study directed on the research profile of the PhD thesis (laying down clear research directions, setting specific objectives for such proposed researches, etc.), which allowed for a programmatic bibliographic study and, to the surprise of international authors, the interpretation of theoretical information based on a bibliographic study model that is built on the research model of the thesis; the synthesis of information from literature allowed for the design and approval of the methodological model in qualitative and quantitative research; the improvement of the theoretical sources regarding project human resource management within the Romanian higher education institutes.

## Conclusions

Researches in specialized literature were carried out in stages and were directed towards clearly defined aspects. The studied bibliography allowed for the drafting of research models.

Project human resource management in Romanian higher education institutes is not a common theme in articles and literature.

The proposed diagram for the doctoral thesis on: Research on human resources management in projects carried out in higher education institutions from Romania, is presented in Table 1.

Table 1 Proposed diagram for the doctoral thesis Research on human resources management in projects carried out in higher education institutions in Romania

<b>Carrying out the bibliographic</b>		
<b>Research directions</b>	<b>Aspects pursued in bibliography research</b>	<b>Studied bibliography</b>
Research on the types of projects and the particularities of integrating human resources management from projects in the human resources management of the university.	Knowledge of the types of projects, provides an overview of those that can be carried out in universities	Carrying out a bibliographic study on human resources management within projects: Bunăiașu, C. M. (2012), Ciobanu, I. (2011); Dociu (Anchidin), M. M. (2018); Nae, I. (2009). Its integration in human resources management of universities: Hall, E., & Johnson, J. (2003); Zaouga, W., Rabai, L. B., & Alalyani, W. R. (2019). Categories of educational projects and programs: Bunăiașu, C.M. (2012).
Researching the possibilities of improvement of strategies in human resources management of	The need to identify, rank and complete the factors that have a	Identification of influencing factors of resource planning, human resources recruitment, selection Hall, E., & Johnson, J. (2003);

Carrying out the bibliographic		
Research directions	Aspects pursued in bibliography research	Studied bibliography
universities in the context of integrating human resources management of projects / university human resources management.	significant influence on human resources.	Oprea, si altii (2011); Băduț, M. (2010); Nica, și alții, (2011); Roman, C.(2010).
Research on human resources management in Romanian universities, influencing factors on resource planning during lack of funding.	The need to identify factors that have a significant influence on human resources during economic crises.	Research on human resources management/ projects in Romanian universities, during lack of funding Petrescu (coordonator), (2014); Burduja, S.(2017); Aneculaesei (Giurgica), M., & Lupu, M. L.(2012).
Designing an integration model for human resources management of projects / university human resources management.	The need to identify, rank and complete the factors that have a significant influence on human resources.	Research on integrating human resources management in projects in university human resources management and the impact of integration on project development. Nica, și alții (2011).

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# THE PARADOX OF THE RELATIONSHIP BETWEEN DECISION-MAKING AUTONOMY AND QUALITY ASSURANCE OF EDUCATION

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## Abstract

**Purpose** - The purpose of the article is to define the concept of education management, identifying the relational aspects between the managerial decision and the ethical-moral perspective of autonomy, based on a bibliographic study of recent approaches in the field.

**Methodology / approach** - The methodological plan of the paper consists in consulting the literature and, based on the bibliographic study, three research directions were established, determining the set of objectives and identifying concepts, methods and methodologies for each of them.

**Findings** - Following the bibliographic study, in each direction of research, it was observed that the literature has some limitations in the direction of empirical studies on education management, the object of research being treated only theoretically.

**Limitations / implications of the research** - The limitations of this research consist in the creation of a research methodology, based on the bibliographic study, which will be the basis of the subsequent qualitative and quantitative analyzes.

**Practical implications** - In the future, the application of the methodology will serve to create a management model that will successfully contribute to the reform process. The pragmatic goal is to determine the methods of increasing managerial performance.

**Originality / value** - This article highlights the paradox of the relationship between decision-making autonomy and quality assurance in education, because decision-making autonomy can lead to making the right decisions to achieve institutional goals.

**Key words:** management, quality, education, decision autonom

## Introduction

This research proposes, from the epistemic perspective of educational management, an analytical approach on the relationship between decision-making autonomy and achieving the qualitative parameters that the manager of an educational institution must constantly balance by appealing to the system of ethical values. The questions to which we try to answer as up-to-date as possible, refer to: 1.- how active is this relationship in the preschool education system? and 2.- what would be the solution for increasing the degree of autonomy? Destined to elaborate a set of stage conclusions for subchapter III.2 (Research on current trends in the evolution of applied models in Romanian education) the answers to the questions launched will bring their scientific contribution in the elaboration of the doctoral thesis entitled: RESEARCH ON INSTITUTE MANAGEMENT PRESCHOOL FROM ROMANIA IN THE CONDITIONS OF DECISION-MAKING AUTONOMY.

Specialists (Weick & Quin, 1999; Burns, 2005) found that the act generating the autonomy of the decision, although it belongs to the manager, has a limiting framework through the profile of legislative formulations, in which case the size of the manager's creativity is dependent only on professional ethics. For extracurricular activities, the degree of involvement of the local community can influence, through subsidiarity, the decision-making process by calling for consensus and the application of specific ethical principles to education. Following the achievement of the performance criteria, the managers are called

to cultivate values, to activate competences that can offer to the educational unit a well-deserved educational prestige, implicitly social. Therefore, increasing the level of decision-making autonomy implies the integration of management in a new perspective of approaching the problems of modern teaching, in a systematic sense, piloting and strategic innovation, mediating this report so that it generates managerial skills capable of fueling those better autonomous decisions.

From the thematic perspective, the title of this paper is theoretically based on the analytical directions of the research project: 1. establishing a bibliographic reference regarding the autonomy of the decision-making process; 2. researching the decisional particularities in the preschool institutions in correlation with the decisional autonomy; 3. a comparative study between state and private educational institutions by designing a model of correlation analysis with the establishment of comparative criteria (country-EU-USA); 4. designing a model for improving decisions and expanding decision-making autonomy (design, validation, the possibility of implementing the model and establishing evaluation indicators).

The management of education (Landsheere, 1992) through its multiple facets shows its continuous evolution towards synthesis, but also towards the specification on domains and subsystems of education. It remains for the fundamental and applied research, the generalized experience to prove the truth of the hypotheses that are formulated in the field. The requirements of the modern age (Hitt&Middlemist, 1988) demonstrate that management is the effective integration and coordination of resources in order to achieve organizational goals.

The particularities of the educator-leader are not minimized in the scientific management, but on the contrary, they relate to other parameters, content, dimensions, capitalization and training criteria. In a broader context of defining the interdisciplinary and integrative character of pedagogy, we have inserted the problems of designing and achieving education on such a foundation because the design and optimal realization of the instructive-educational activity depend on the way the methods, means and effective organization are articulated. of the didactic approach. The didactic methods, the level of professional competence of those who appeal to them, presenting them in an innovative way, the specialized contents represent ways that lead to the assimilation of models, legalities, descriptions and interpretations as close as possible to reality and with great relevance. psycho-pedagogical. In the conditions in which social shocks appear, events that change, major social ruptures, another type of learning is needed, the so-called innovative learning, in which certain experiences are recorded. The quality of the pedagogical act must be decisive for the effort to balance the relationship with the decisional autonomy. The social imperative of increasing the quality of education is the one that proposes as a solution to increase the level of decision-making autonomy, achievable by determining the decision-makers to trigger what private schools have already started, respectively capitalizing on higher educational traditions and models of the Romanian interwar school whose customary depository and beneficiary is and must be the community.

As far as we are concerned, only at the community level there is a relative stability, including in terms of ethical constancy supported by a system of moral values, although there are different positions generated by the level of education and comprehensibility of parents' relationships with school.

Among the theoretical principles that guide and substantiate educational management are recognized democratic leadership, combining leadership and sole responsibility (unipersonal) with leadership and collective responsibility, promoting leadership based on competence, efficiency and deontology of leadership. Given the requirements of civil society, democracy and the rule of law, the management of education must be carried out, therefore on a democratic basis. This principle implies that for the implementation of a decision it is required to consult the echelons subordinated to the management and through them and the executors of the decisional act, so as to form an interactive management based on the realization of organizational and decisional structures of education that combine, in a balanced and harmonious way, the directing the unidirectional vertical from the central level with the directing in the network, horizontally, at the intermediate and local level of the educational institutions, wishing to eliminate any administrative-bureaucratic elements towards the development of specific structures of democracy. This ensures the proper functioning of education in a democratic spirit and its inclusion on European coordinates, with all the favorable consequences arising from them. We emphasize that this would have implicitly manifested the right of education and its representatives to anticipation and opposition, reconstruction and contestation.

Through a new legislative basis, in the corpus of expectations and pedagogical norms or in the transmitted contents, the educational unit should acquire the right to make changes in the curricular plan

by operating a selection, a decantation, a hierarchy according to criteria that have in view of the pedagogical relevance of the set of knowledge inserted in the pedagogical exercise. through this, quality becomes a dynamic element of professional ethics, being, as previously mentioned, the "interface" that relates to the children's parents, to the public opinion in general. The English jurist Jeremy Bentham (1748-1832) was the first to introduce public opinion into the equation of ethics. In *An Introduction to the Principles of Morals and Legislation*, published in 1781, the English jurist Jeremy Bentham raised the issue of the moral essence that must underpin any principles of civil law, which he called private distributive law. Therefore, in the effort to optimize the educational management process as an art of leadership (with its entire causal chain involving processualism, decision management and optimization, complexity of organizing the organization and evaluating efficiency, etc.) all stages and functions acquire notable defining values. when it conceptualizes this activity as a set of principles and laws, of norms (ethical, moral) elaborated in order to govern the educational act in principle plan and regulates the decisional act. In making a decision, the most important element of its functional scheme is managerial experience, as stated by the representatives of the school of human relations management (Douglas McGregor, Michael A. Hitt, Denis R. Middlemist, Abraham Maslow, Elton Mayo, Kurt Lewin, FR Roethlisberger, Frederick Hertzberg, Rensis Likert).

The educational process manifests itself at all levels of the social ethos, as an ontological form of expressing human behavior in different civilizational stages of history, but is objectified as a fundamental effect for determining the evolution of the human being and the effective engagement of man, his personality and his background. in its chronological development through life, knowing that the success, performance and competitiveness of any educational institution, implicitly the preschool, depend largely on management, on "managerial art" (Gerbier, 1993).

### The process of decision making in management

The decision as a volitional expression in itself is a deliberate act that involves the rational choice of possible solutions to problems considered optimal, with the intention of achieving the desired effect. Henry Fayol (1966) identifies, in his research of the last century, five functions of management in correlation with the decision-making act, namely: planning, organization, ordering, coordination, control. The decision is the answer to a specific problem and is a social form of validation of an action, through the movement of human, material and financial resources. The decision is efficient, but it first requires an ordering factor, namely efficiently oriented managerial responsibility. It is logical that the efficiency of an organization, its ability to function and, in the current conditions created by the new market economy (even the survival of the institution), depend on the effectiveness of its members, especially the effectiveness of management at all levels.

The decision, without claiming a certain function, represents an essential element, an axis mundis of the managerial activity because as a result of the institutionalized decision-making process it is found in all its functions, representing its instrument of expression by choosing a direction of action (HA Simon, 1960), or implementing a strategy (PC Fishburn, 1970).

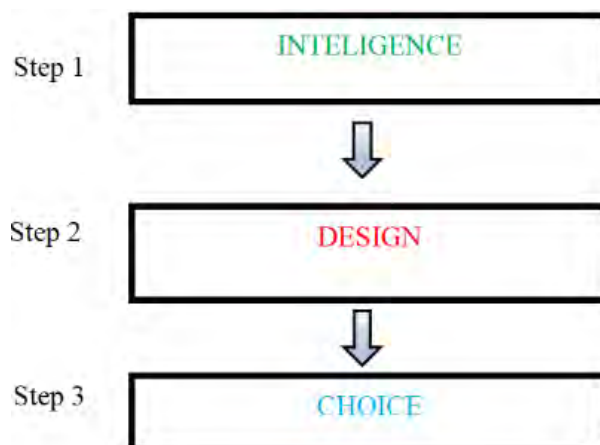


Figure 1. Stages of decision making by Herber.A.Simon

Adaptation and integration in the system are dependent on the quality of the decision because it materializes in plan formulas, program outlines or directions, strategic variants. Management, defined by specialists as the art and science of drawing, directing and administering the work of others to achieve set goals (AS Apply, 1969; Ph. Shay, 1967; LJ Kazmier, 1968; Ch. B. Handy, 1977) represents, first of all, a compound of constants of power, authority and influence, which, in order to improve their quality, must be brought to the same table as the official decision-maker. In other words, in order to make institutional decisions, the diameter of the manager's autonomy is directly proportional to the result of an equation in which political-administrative terms, dependence on financial resources within legal limits and ethical-moral openings of the legislative framework are all subject to activity, a decision. In any institution, the proposed objectives, the legal framework and the financial limitations through the amount of information, are linked to a certain context which it explains and through which it determines the decision-making act. (C. Drury, 1992: 236).

The decision - and we refer to the manager's decision - in order to have the efficiency expected by the managerial objectives must meet a series of criteria. Also called rationality requirements, they are:

- I. The legality of the decision, which implies not only its inclusion in the national legislative normative system, but has as a mandatory requirement the fact that the adoption of the act itself must belong to a person invested and empowered with official legal right. That is why it is said that the decision must be empowered by the management body in whose service tasks it is provided;
- II. The scientific substantiation of the decision represents a benchmark, a note of the manager's professionalism - cognitively demonstrable by models, techniques, knowledge, skills - through which it is enhanced to overcome the inherent level of subjectivism and the aspect of ad hoc "improvisation" of the decision-making process, precisely by knowing and applying the mechanisms of the market economy. The level of perception, assimilation, corroboration and analysis of information can ensure the reduction of the level of uncertainty in the formulation and adoption of a decision;
- III. The opportunity of the decision theoretically synthesizes the attribute of institutional self-regulation, the ability to adapt to the influence of endogenous or exogenous disruptive factors that oppose the institution's objectives, and in terms of practical applicability the ability to make decisions in a timely manner, resonating with the institution's objectives. with the actuality of the temporal development of the events (tangible by the immediate connection to niches and opportunities);
- IV. The completeness and wording of the decision, although apparently could be considered only formal requirements, in reality by conciseness and clarity illustrates the cognitive level of the manager, the degree of assimilation of expertise needed to overcome complex issues in order to develop a fully structured, correct and clear formulated in apprehensive terms (proposed objective, mode of action, available resources, allocated resources, decision maker, responsible for implementing the decision, place of application, time and deadline) by clear provisions and objectives, thus able to ensure the success of its implementation at V.- Coordination and integration of the decision, as ways of activating the principle of unity of decision and action, must be done both vertically - by correlating decisions with higher hierarchical levels, and horizontally - when aiming not only the role of manager of insertion in the team of the decision-making act, but especially based on the absolute compatibility as an expression of the horizontal harmonization of the activity of the functional compartments of its component sectors, up to the individual level, through the relations established between the personnel compartments, everything being subscribed, dedicated to achieving an important objective. ;
- V. The decision efficiency belongs temporally to the post-implementation stage, being the functional summative expression of all the previous criteria and expresses as a percentage the level of obtaining the effect related to the invested effort.

### **Decisional autonomy**

Decisional autonomy as a phenomenon, expresses the collaboration of managerial actions that the American Ricky V. Griffin in Fundamentals of Management (2014) shows in the dedicated figure 2.



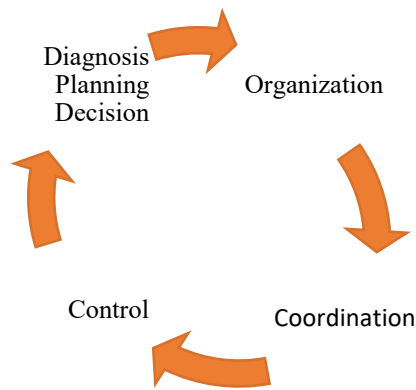


Figure 2. Managerial control as part of a feedback loop in Griffin's loop

The success, performance and competitiveness of any educational institution, implicitly of the preschool one, largely depend on the management, through the integration and effective coordination of the resources in order to achieve the organizational objectives. (D. Reynolds, R. Bollen, B. Creemers, D. Hopkins, L. Stoll, & N. Lagerweij, 2005) From a decision-making perspective, the competitive advantage of an organization lies in its people and leaders. In this context, it is known that among the organizational indicators is not only the efficiency of preschool management - by streamlining resources and professionalism of teachers - but especially the investment of trust of parents and children, teachers and employees in a successful management team, due, among other things, to the ability to optimize their decisions.

In the effort to optimize the process of educational management as an art of leadership (with its entire causal chain involving process and quality optimization, complexity of organizing the organization and evaluating efficiency, etc.), all acquire notable defining values when conceptualizing this activity as a whole. of principles and laws, of norms (ethical, moral) that govern education in principle and regulate the decisional managerial act. The competitive atmosphere, the dynamic adaptation to the requirements of modern didactics necessarily impose a new model of organization, in a systematic sense, of piloting and strategic innovation.

By applying real decision-making autonomy, the transfer of authority to the base of the hierarchical pyramid can be obtained and we refer here to the transition from central to regional authority and later to the level of educational institutions. The transfer of authority had to be complemented by access to all types of resources (human, financial focused on learning outcomes), the general and financial management being the result of the collaboration between the educational unit and the local community. Teachers would have received increased responsibilities, but also support in their professional development, and directors (managers) would have been hired for a fixed period, conditioned by the performance achieved.

## Discussion and conclusions

- a. Education requires from a managerial perspective a scientific, modern substantiation.
- b. At the basis of this substantiation must be, in the last resort, the institutionalized expression of an act of decisional autonomy.
- c. In this complex set, the axiological dosages and readjustments of the decisional autonomy can be made only by those directly involved, effectively in the educational process, by the educators themselves, the proposals being sent to the unit manager also by virtue of the autonomy and action responsibility they should have. and whereby these proposals should be centralized and analyzed.
- d. The ethical and moral values infused in the act of education must keep their true reactive and prospective dimensions in front of the present and the future.

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# MANAGEMENT OF MEDICAL DEVICES – A NOVEL APPROACH TO MODELLING DEMAND AND CAPACITY

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## Abstract

**Purpose** – *The aim of this research was to explore the potential of a novel approach to modelling medical device demand and capacity, called mission criticality.*

**Methodology/approach** - *Considered two possible techniques. One is based on the amount of time a medical device is used during a certain procedure, and the other is considering the availability of the same type of an equipment used in procedures done concurrently within the clinic.*

**Findings** – *It is believed that modelling the mission criticality of medical devices was achieved for one clinical procedures, and based on the probability densities of the procedural demand, a lack of vital monitoring devices was identified, and also an excess in the dialysis chairs' availability.*

**Research limitations/implications** – *Challenges may arise if clinical procedures are done outside one area of study, therefore, future work will need the development of a more sophisticated model.*

**Practical implications** – *Following this analysis, a review of the equipment management strategy was recommended as this could lead to a more effective use of the current available medical devices.*

**Originality/value** – *In the UK, this new opportunity to model the mission criticality of medical devices has emerged in the form of structured data on clinical procedures, the 'clinical coding data'.*

**Key words:** *Management of Medical Equipment, Clinical Engineering, Demand, Capacity.*

## Introduction

Modern healthcare is highly dependent on medical technology.

Efficient management of medical devices is an important part of delivering quality care, with the emphasis on safety as any failures in their performance may lead to an unacceptable risk of patient injury.

As a result, there is a widely recognised need to manage medical equipment effectively (MHRA, 2015). National and international guidelines and regulations have aimed to assist healthcare organisations in business planning, for the provision of a sufficient medical device inventory to safely meet a service user's needs (PHE, 2010) – however, there is a lack of precise guidance on how to manage, measure, and understand medical device demand and availability.

In literature there has been an ongoing development of management strategies and different models have been made available. However, it looks as if in current maintenance approaches, very little is known about medical device usage in certain clinical procedures; and currently there is no real understanding or any tool that can quantify the medical device demand.

Therefore, in existing approaches to business planning, management of medical device usage is only considered in general terms, and using broad, heuristic assumptions. Very little is quantified or understood about the level of medical device usage in practice and the 'one-size-fits-all' approaches inevitably result in waste. Without more information, the resourcing of medical technological infrastructure cannot be optimal.

Managing demand and service capacity has always been a controversial topic in all domains and relating the two has proven to be a challenge. The literature has offered many theoretical and empirical models to help with the decision taking process in the management of demand and capacity. The limitations in capacity come from the rather constant resources: the human and the capital one. The later includes accessibility to medical devices to perform clinical procedures. Demand, on the other hand, is not as straightforward to model as capacity. Although the flow of demand varies from service to service, as for instance, an outpatient clinic could theoretically manage and analyse its demands through patients' appointments; other services, such as the Accident and Emergency or Acute Services, have a potential unlimited demand which has long been considered to be more of an excess demand rather than a fluctuating one (Laing & Shiroyama, 1995).

Unpredictably, the financial strain on health organisations has not lead to a decline in purchasing medical devices. For instance, at Guy's and St Thomas' NHS Foundation Trust in London (GSTT) the number of equipment purchased has still increased within 2015-16 financial year whilst the number of medical equipment decommissioned has stagnated.

On the premises that there needs to be better signaling between medical device demand and the commitment to allocate financial resources for the procurement of additional medical equipment, it is questionable whether the health organisations need to buy more and more equipment. Therefore, this projects reflected on whether or not there is a realistic demand that the current capacity within GSTT was not meeting.

It was considered that through the understanding of the clinical coding data, focusing on the valuable information it contains on clinical procedures, a realistic model on medical device management demand could be built.

Modelling of the medical device demand and capacity will have a direct impact on the effectiveness of equipment management, and on equipment replacement plans; as decisions can become evidence based.

## **Approach**

The aim of this research was to explore the potential of a novel approach to modelling medical device demand and capacity using data in Borough Kidney Treatment Centre (BKTC) within GSTT.

The approach analysed the demand and capacity separately and then, based on the findings, to comprehend the relationship between them and what they mean in combination. For instance, this type of analysis can give an indication about which resources the organisation is most dependent on.

The project intended to research the number of clinical procedures in specific facilities within GSTT's Borough Kidney Treatment Centre; and what medical devices were used for a specific procedure, XC40.3 Haemodialysis. The procedure involves a vital sign check before the haemodialysis process. The most recurrent medical devices involved in this clinical procedure include: Haemodialysis Chair, Haemodialysis Machine - for dialysis & recording the blood sugar, Non-Invasive Blood Pressure Monitor, SPO2 Monitor, and Thermometer.

The hypothesis of this study was that by understanding the retrospective relationship between medical equipment availability and clinical capacity, the mission criticality of medical devices could be quantified leading to effective procurement strategies and effective prioritisation of scheduled maintenance. The analysis of this data would enable an understanding on how the demand varies within a department on a weekly or a monthly basis. Methods such as probability densities have been considered in this report.

The clinical procedural demand data has been plotted individually; thus, enabling trends to be analysed more efficiently. Procedural demand would be related to medical device demand, using procedural models. In each procedural model, the duration of use of each medical device would be defined; this approximates the actual utilisation time for the medical equipment. Further analysis of the trend should indicate the quantity of medical devices required in a department to meet the clinical procedural demand.

To measure the uncertainty in demand it was considered to plot the data using kernel density estimators (KDE) used to estimate the probability distribution of the random variable based on a sample of points

taken from that distribution. It is a smoothed nonparametric representation. Unlike histograms where the data is placed in discrete bins making it discontinuous, the kernel function produces a smooth and continuous probability curve by summing up individual probability density curves for each data value.

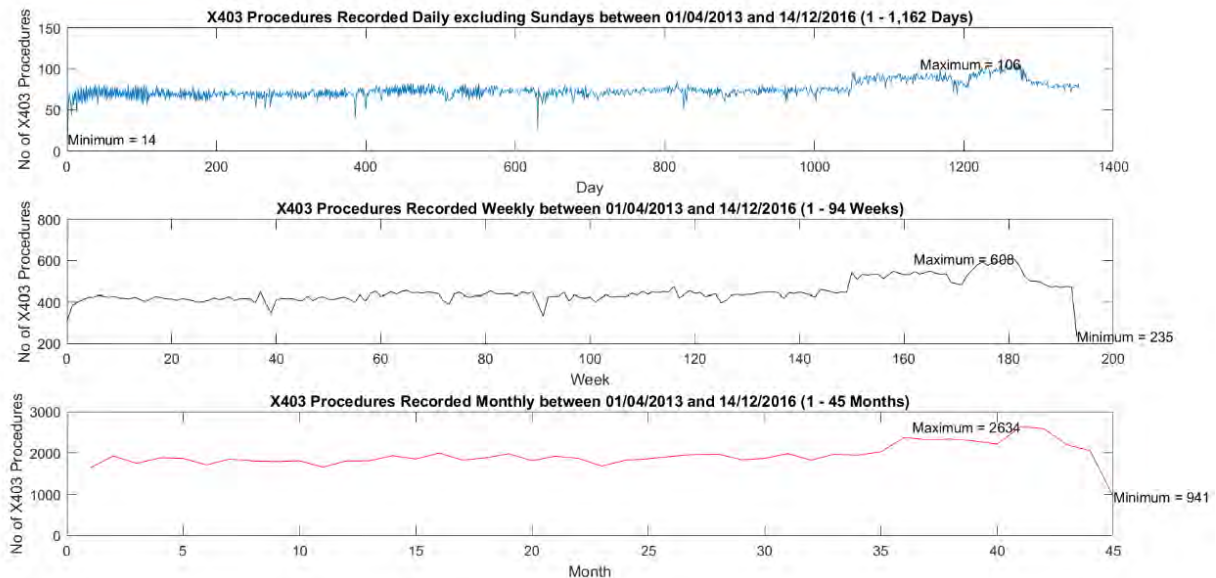


Figure 1. Different representations of the X40.3 procedural demand within BKTC - Haemodialysis unfiltered data. Haemodialysis procedural demand on a daily, week and month basis (blue, black and red respectively). The data used to plot these procedures is not filtered and it is based on raw data extracted from the clinical coding data. Daily basis procedures, as shown above, are less predictable; hence, in real terms it is easier to plan for a week rather than for a day. Planning on a monthly basis would also be less efficient either as important fluctuations in demand can be missed. Also, the daily procedural demand plotted does not contain the Sunday's data as the clinic does not run on Sundays.

To model medical device capacity within GSTT, the data was extracted from the Medical Devices Assessment Management System - MDAM. To determine the capacity of a particular medical device within GSTT, information on the assets, job management and library loans have been extracted from MDAM and analysed in MATLAB. With the focus on the X40.3 Haemodialysis procedure within BKTC, the interviews with the clinicians have dedicated on how the procedure is executed and how long each step takes in order to build the modelling assumptions. Medical device capacity does not refer only to the number of medical devices available within the department, but also to their availability at a certain time. For example, whilst the haemodialysis machines are used for the entire length of the X40.3 procedure; hence, between 3 to 5 hours; the NIBP machine is used for two minutes only. However, the use of the NIBP machine is needed before the start of the procedure; hence, a milestone in the procedure's steps. Investigating the availability of the NIBP, SPO2, and Thermometers could turn out to be more complex as their availability is required at certain times. Although the number of dialysis machines has been consistent within BKTC, the maintenance of the devices has led to a variation in their availability. The maintenance can include planned maintenance, repairs, or quality control jobs. The lowest number of available haemodialysis machines has been recorded in week 130 with only 11 devices available. Analysing the data daily, the lowest availability is reached twice on consecutive days: day 902 and 903, day 909 and 910. These periods are days when the clinic was actively running and this represents a concern in meeting the procedural demand.

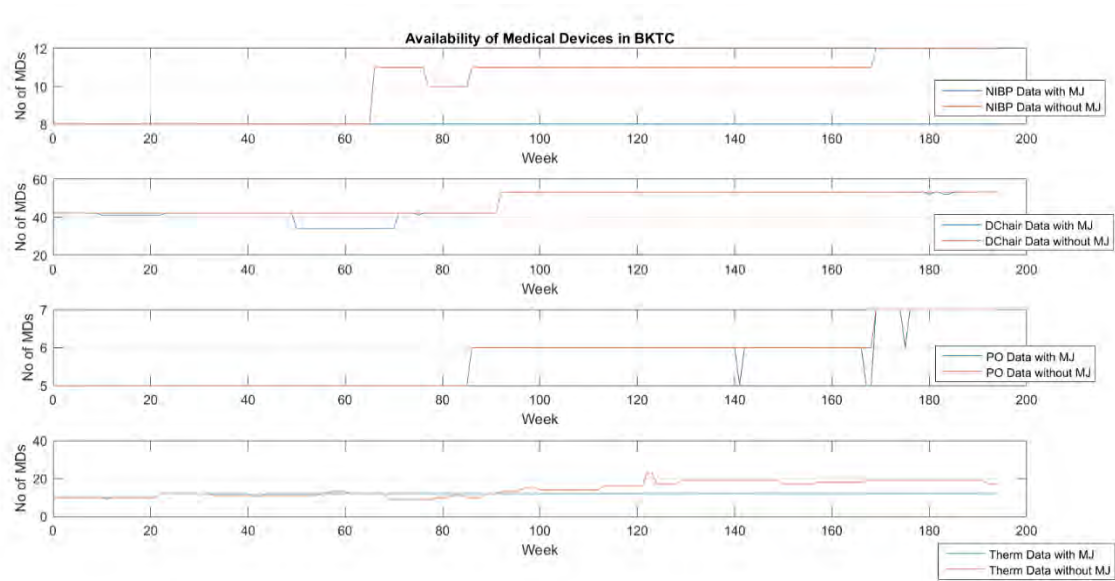


Figure 2. Availability of the other types of medical devices used in the X40.3 using unfiltered data

The availability of medical devices can be sub-categorised in equally important sub factors, such as the number of medical devices and availability at a certain time frame. Therefore, for the modelling of the mission criticality it has been considered two possible techniques. One is based on the amount of time a medical device is used during a certain procedure, and the other is considering the availability of a medical device for concurrent similar medical procedures.

**THE TIME USAGE APPROACH:** In this technique it has been taken into consideration the duration of the X40.3 clinical procedure – Haemodialysis. In the model, the procedure was estimated to take a maximum time of 5 hours, which included the patient greeting, initial observations, the procedure itself and the end of treatment.

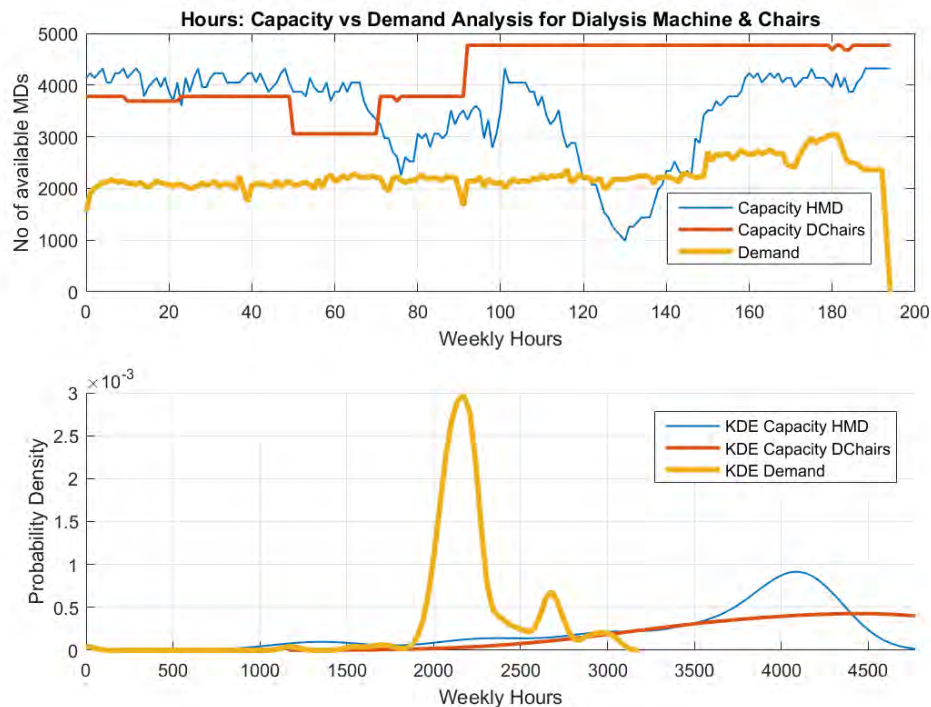


Figure 3. Time usage model of demand and capacity for X40.3 Haemodialysis procedure and medical devices used for the entire length of the clinical procedure.

THE CONCURRENT PROCEDURES APPROACH: Whilst the time usage approach to model mission criticality looked at the total hours of medical device capacity, this approach takes into consideration the availability of medical devices in concurrent alike medical procedures.

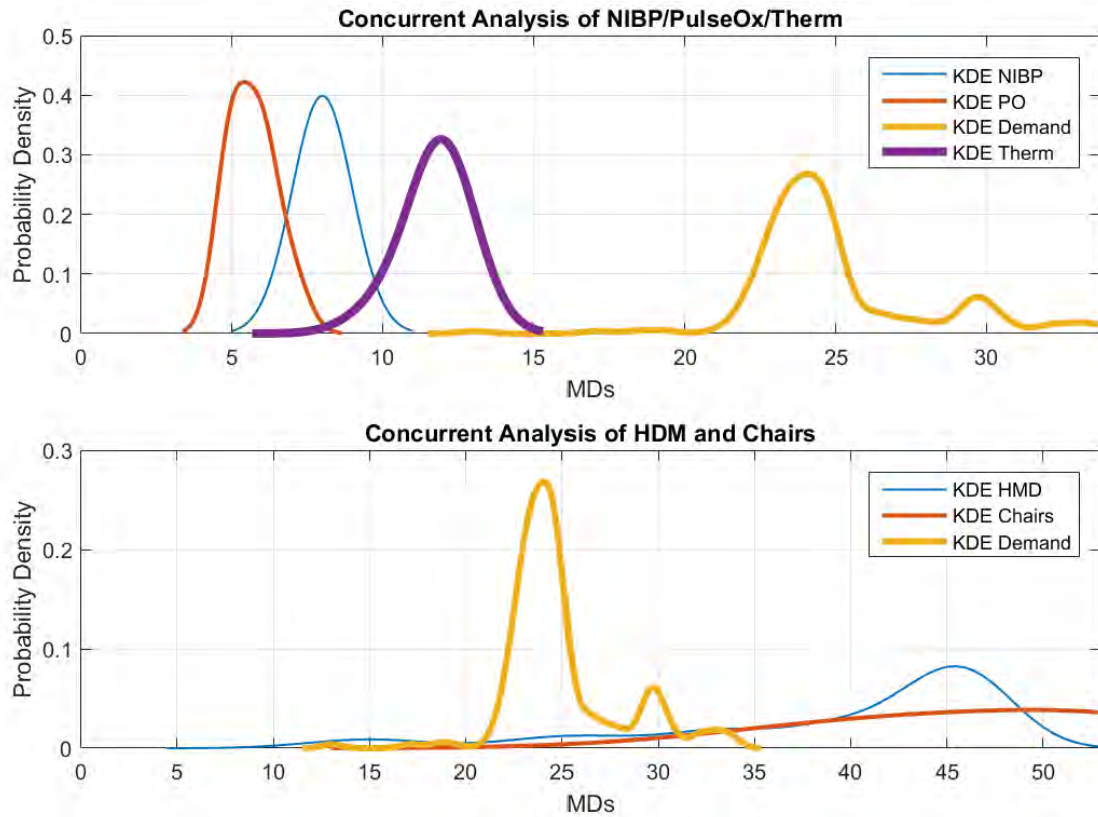


Figure 4 - analysis of concurrent capacity and demand for NIBP, pulse oximeters and thermometers. Bottom: analysis of concurrent capacity and demand for HMD and dialysis chairs.

Similarly as in the previous approach in modelling mission criticality, the number of available haemodialysis machines do not always meet demand and in the worst case scenario only 62% of the demand is met. On the other hand, as the maximum amount of concurrent procedures is 33, it is highly probable that the dialysis chairs availability will meet the demand by 150%.

In regards to devices that are used for a shorter period of time, but simultaneously, the kernel density estimators are easier to analyse than previously, as Figure 4 shows. It is therefore clear there is a shortage in the medical devices used for vital signs monitoring.

To have accurate information on what medical devices were needed and for how long they are used in each episode of care, meetings with clinical staff are essential.

The future of an increased computational power to avoid human errors, and taking management decisions based on objective data rather than heuristically is not distant any longer.

### Discussion and conclusions

Although, arguably observational studies for each individual clinical procedure can be undertaken, this would be a labour intensive approach and is not practically feasible; hence, this research that relied on modelling assumptions to define the mission criticality.

It is believed that the modelling of the mission criticality of medical devices has been achieved for the Borough Kidney Treatment Centre (BKTC) as a lack of vital monitoring devices has been identified, but also an excess in dialysis chairs availability.

Therefore, the medical device demand has realistically been quantified using clinical procedures and matched against the GSTT's asset inventory.

It is believed that following the modelling of this mission criticality, a review of the equipment management strategy within BKTC can lead to a more effective use of the current available medical devices.

For instance, because the availability of haemodialysis machines is highly variable due to planned maintenance, repair or quality control jobs and not the total asset number, it may be useful to evaluate the current procedures as these may cause bottle necks that lead to a high breakdown time. This may reveal that technicians need additional training, or that there is a delay in the delivery of spare parts. Optimising the availability time of the haemodialysis machines not only ensures demand is met, but also it can lead to the undertaking of more clinical procedures; hence, more episodes of care for patients.

On the other hand, the information on the shortage of the vital signs monitoring devices, such as the pulse oximeters or NIBPs, can be used in future capital investment planning by purchasing medical equipment based this objective data.

The statistics on the excess of the dialysis chairs can be used to reallocate these to other renal units within GSTT; therefore, taking maximum advantage of the current inventory without spending additional resources.

The objective has been to model mission criticality based on combining a quantified medical device demand with the current capacity, to better understand the medical device needs within GSTT. This has been done by analysing data for specific medical devices, based on the probabilistic modelling of their demand and capacity, and then the data on the volume of loans from the equipment library has been introduced.

It is believed that the project's objective to model mission criticality based on a realistic medical device demand with the current capacity was achieved. A lack of vital monitoring devices has been identified, but also an excess in dialysis chairs availability. Therefore, the medical device demand has realistically been quantified using clinical procedures and matched against the GSTT's asset inventory. Following the modelling of this mission criticality, a review of the equipment management strategy within BKTC can lead to a more effective use of the current available medical devices

Although, the paper presents a model for one department only this can be applied to other areas. Challenging may arise if clinical procedures are done outside the area of study, therefore future work will lead to the development of more sophisticated models applicable to other organisations, identify bottlenecks and also serve as evidence if an intervention should be considered.

The domino effect of the theory behind this project, would give access to valuable information for strategic management within GSTT and not only. Areas covered would include procurement of medical devices, replacement planning of equipment and even prioritisation of planned maintenance schedules.

Also, even though the clinical coding data is not currently error free for any of the Trusts in the UK, there is a strong financial incentive to improve it. This also applies to medical devices databases.

It is essential to highlight that the current healthcare is not going to necessarily improve if an investment to purchase more medical devices is made. The resources already available may not be used wisely. Modelling mission criticality using a quantified medical device demand and real capacity endeavours to shed light on this, identify bottlenecks and also serve as evidence if an investment should be considered.

Although GS1 (Global Standards 1) standardisation is currently under trial, the possibility in the far future to follow a patient's pathway through the health organisation can lead to a breakthrough in the analysis of use and management of medical devices.



In future work the clinical procedural data can be improved if combined with data from network connectivity if any available. For example, in GSTT there is worthy information on glucose meters connectivity and their use within the wards.

The future of an increased computational power to avoid human errors, and taking management decisions based on objective data rather than heuristically is not distant any longer.

### **Acknowledgement**

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# USING CRITICAL PATH METHODS IN THE MANAGEMENT OF RETROFITTING PROJECTS. CASE STUDY

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## Abstract

**Purpose** – The paper proposes the application of the critical path method in the management of a retrofitting project. The tool used is the Microsoft Project program.

**Methodology/approach** - It was considered the concrete case of a retrofitting project of a CNC machine tool, a project carried out within a company from Oradea. Thus, the activities to be carried out within the project were identified. Each activity was associated with duration. The necessary resources for carrying out each activity and the costs with them were established. The technological dependencies between the activities were established. All this information was entered into the Microsoft Project program.

**Findings** – The use of the Microsoft Project program allowed highlighting the critical path within the project. In order to reduce the duration of the project execution, the durations of the activities within the critical path (critical activities) must be reduced.

**Research limitations/implications** – The paper proposes a retrofitting project management solution.

**Practical implications** This approach supports the companies whose object of activity is this type of project. The method is a tool to streamline project management.

**Originality/value** – The paper proposes the use of critical path methods in retrofitting projects, through the Microsoft Project program.

**Key words:** Retrofitting, critical path methods, Microsoft Project®

## Introduction

The management of job production can be assimilated with the management of a project. The project involves the development of activities between which there are technological dependencies, which have a duration and consume resources (Abrudan and Cădea 2002), (Popescu 1996).

A major overhaul of a complex machine can be associated with a project. This is possible from the perspective of the fact that each machine requires the execution of specific operations and requires the use of a different number of different types of resources.

Industrial production involves the use of high-performance machine tools. Obviously, they must be from the CNC category. Purchasing such a car is expensive, especially for small and medium-sized companies. Therefore, they search for a cheaper solution: retrofitting applied to older machine tools. Thus, retrofitting becomes a project that requires proper management.

Machine retrofits are possible in various levels. A retrofit can be as basic as replacing old axes motors and drives with new AC digital servo technology. A comprehensive retrofit for example would include an all new machine electrical system such as CNC control, AC digital servo motors and drives, complete machine wiring, linear and rotary encoders for closed loop positioning feedback, new operator pendent, and new electrical cabinet (EURO Machinery 2019). Retrofitting is the process of replacing the CNC, servo and spindle systems on an otherwise mechanically sound machine tool to extend its useful life. Rebuilding and remanufacturing typically include a CNC retrofit. The anticipated benefits include a lower

cost investment than purchasing a new machine and an improvement in uptime and availability. But there are often other unanticipated benefits to retrofitting including lower energy costs, higher performance and a new level of manufacturing data accessibility (Galco 2019).

The paper proposes the application of critical path methods for the management of the retrofitting project of the machine tool C.B. FERRARI P-46E. The Microsoft Project program is an effective tool for implementing critical path methods (Wolfgang 2007), (Rosca 2011).

### **The stages of carrying out the retrofitting project of the machine tool at C.B. FERRARI P-46E**

C.B.FERRAR produce machines, automated systems and turnkey milling and laser solutions, with 3 and 5 axes, widely used by the world's most advanced manufacturing companies for high-tech machining.

Euroam Industries has initiated a retrofitting process for the C.B. CNC FERRARI P-46E machine tool. This was necessary because: the control panel was outdated and did not work in the parameters, the equipment did not allow the running (simulation) of CAM (Computer Aided Manufacturing) programs, the machine has a high potential in processing complex parts because it has 5 axes. Figure 1 shows the C.B FERRARI P-46E before reconditioning



Figure 1. Machine tool C.B FERRARI P-46E before reconditioning

Carrying out a retrofitting project in the case of a machine tool C.B. FERRARI P-46E involved several stages. A first step was to disconnect the car from the mains. Disassembling the machine is another important step. The solution for disassembling the subassemblies, within the machine and for simple parts, is determined by the design and must take into account the frequency of disassembly required to repair the machine or to replace or recondition a part. Disassembly work depends on the construction of the machine, machine or installation and the type of repair. In the case of the car C.B. FERRARI P-46E the following components have been dismantled: guards and chip tray, electrical installation, spindle motor, actuators.

After disassembly, the parts are washed with oil, detergents or various solutions. The washing process has three phases: washing the parts in the heated solution, the second washing in hot water, drying the parts with compressed air. Brushes are used to wash the parts, and spray pumps to wash hard to reach places. The bearings are washed in benzine or hot mineral oil.

After washing and drying, the parts are sorted into: good parts, reconditioned (repaired) or replaceable parts and unusable parts. Only those that strictly comply with the requirements of the machine documentation will be accepted as good parts. Next, the wear condition of all the component parts is checked and lists are drawn up for the worn parts: electrical components (cables, contactors,

transformers, buttons, etc.), specific parts (axles, gears, bushings, movement screws, etc.), commercial parts (bearings, seals, hoses, balls, springs, screws, nuts, etc.)

The reconditioning method is also influenced by: the functional role of the part, the nature of the material, the heat treatment applied and the hardness of the part, the degree of stress, the service life and the possibility of total or partial restoration of functional characteristics by a certain reconditioning method.

The engineers elaborate the technical documentation necessary for the execution of the specific parts that require reconditioning or their restoration. The simplest parts (spacers, washers, bushings) were made within the company. The parts with a higher degree of complexity were ordered from specialized companies.

The interior surfaces of the castings (speed range housing, electrical panel, servomotor housing and encoder, etc.) are painted. This operation involves the following phases: degreasing, priming, painting.

All these activities are carried out in parallel with the supply of parts, equipment from various suppliers. Figure 2 shows the Fanuc 0I-MF package composed of: spindle motor, servo motors, encoders, control panel, drivers, all electrical part.



Figure 2. Fanuc Equipment (FANUC 2019)

After reconditioning and making the parts, after supplying the necessary ones, we proceeded to the assembly operation. In the case of the retrofitting project of machine tools C.B. FERRARI P-46E, mounting the spindle involved: mounting the drive belt; installation of the main drive motor and the support plate, installation of the main shaft with gears and bearings, installation of the covers.

Figure 3 shows a  $\beta$ i-B series servo motor mounted on the C.B. FERRARI P-46E.  $\beta$ i-B series SERVO is high cost-performance AC servo system. This servo system has enough performance and functions for feed axis and spindle axis of machine tools. And it is also suitable for positioning of industrial machines and peripheral equipment of machine tools (FANUC 2019). Figure 4 shows the electrical panel.



Figure 3. Fanuc  $\beta$ i-B servo motor



Figure 4. Electric panel

The electrical installation and the newly purchased control equipment were installed. Figure 5 shows the control panel of the Fanuc equipment installed on the C.B. FERRARI P-46E. One of the advantages of the new equipment is that it allows editing, simulation and running programs generated with CAM modules (Figure 6). The equipment is also equipped with a dedicated software: FANUC LADDER-III. This is the standard programming system for developing, diagnosing and maintaining sequence programs for CNC PMC ladder, FANUC's integrated PLC. FANUC LADDER-III is a PC software with the following key functions: creating, displaying, editing and printing ladder sequence programs, monitoring and debugging ladder sequence programs, program monitoring, PMC signal status display, PMC signal trace, writing to Flash-ROM, connection to the CNC via Ethernet, works with NCGuide on one or multiple PCs.



Figure 5. Fanuc equipment control panel

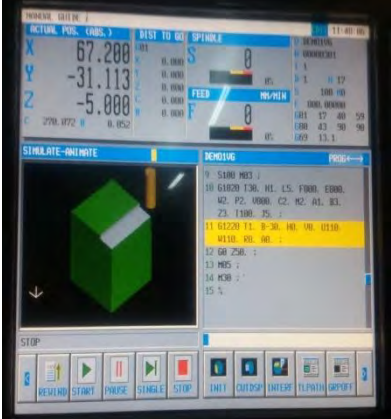


Figure 6. Part program simulation

After the assembly of all mechanical, electrical, electronic components and their integration in terms of hardware and software, the machine was put into operation.

The deficiencies revealed were remedied, after which the car was painted. Figure 7 shows the machine tool C.B. FERRARI P-46E after completion of the retrofitting project.



Figure 7a. Machine tool C.B FERRARI P-46E after reconditioning

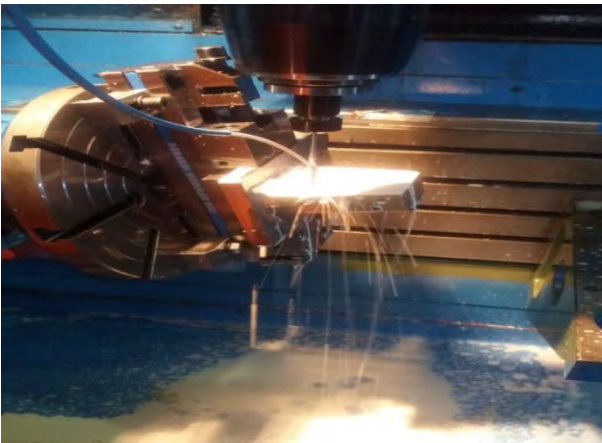


Figure 7b. Machine tool C.B FERRARI P-46E in tests

**Car retrofitting project management C.B. FERRARI P-46E using the critical path method**

In the case of the retrofitting project of the car C.B. FERRARI P-46E, the critical path method was applied using the Microsoft Project® program. The use of this program involves the organization of project activities as in Table 1. Thus, the activities to be carried out within the project were identified, these being those presented in the previous paragraph. Each activity was associated with a duration. The

necessary resources for carrying out each activity and the costs with them have been established. The technological dependencies between the activities were established (precedence-succession relations).

Table 1. Retrofitting project activities

Nr. crt.	Activity name	Duration (hours)	Predecessor	Resource Name
1	Disconnect the machine from the mains	1	-	Electrician
2	Disassembly of guards and tray for collecting chips.	5	1	Machinist
3	Removing the electrical installation from the machine	12	2	Electrician
4	Spindle motor removal	3	2	Machinist
5	Disassembly of actuators	5	2	Machinist
6	Disassemble the spindle	4	3,4	Machinist
7	Cleaning of all disassembled components	3	6,2	Machinist
8	Checking the wear condition of all component parts and drawing up lists for worn parts	36	7	Engineer
9	Elaboration of sketches for specific parts that need reconditioning or their restoration	32	8	Engineer
10	Parts executed in collaborations	60	9	Third parties
11	Self-executed parts	30	9	Lathe operator, Milling-machine operator
12	Painting the inner surfaces of the cast parts	12	7,10,11	Painter
13	Supply of all commercial materials	16	8,10	Engineer
14	Purchase of Fanuc 0I-MF package	8	1	Engineer
15	Mount spindle	8	14,13,12,11,10	Machinist
16	Installation of actuators	12	14,13,12,11,10,15	Machinist
17	Installation of electrical installation	24	14,16,15,13	Electrician
18	Commissioning	25	17,16,15,13	Engineer
19	Painting the machine with numerical control	5	18	Painter
20	Functional tests	8	19	Engineer

The allocated resources and labor costs, in lei / hour, are presented in Table 2. The available number from each resource is also specified.

All this information has been entered into the Microsoft Project® program. It allows a complex analysis of all aspects related to the management of a project: defining activities, determining the critical path, allocating resources, analyzing costs, etc. The working hypotheses are: the week was considered to have five working days: Monday, Tuesday, Wednesday, Thursday and Friday; the working day has eight working hours: the program starts at 8<sup>00</sup> a.m; the break is between 12<sup>00</sup>-13<sup>00</sup>; the end of the working day is at 17<sup>00</sup>. In the paper are presented three of the implementation versions that were analyzed.

Version 1. Considering the information regarding the project activities (Table 1) and those regarding the resources (Table 2), the project was implemented in Microsoft Project obtaining variant 1. The details regarding this version are presented in Figure 8. The program automatically determines the critical path. Critical activities can be highlighted so that they can be more easily accessed and marked in red. Figure 8 shows the Gantt Chart for variant 1. Also, some summary information regarding version 1 of the project implementation in the Microsoft Project program are presented. These are: the project lasts 31.38 days (31 days and 3 hours), the time worked is 334 hours, the costs are 12,617 euros. These costs take into account the cost of Fanuc equipment.

Table 2. Resource available

Nr. crt.	Resursa	Disponibil	Standard (Euro/hour)	Overtime (Euro/hour)
1	Machinist	1	6	10
2	Electrician	1	5	9
3	Engineer	1	7	12
4	Third parties	1	15	30
5	Painter	1	5	9
6	Lathe operator	1	6	10
7	Milling-machine operator	1	6	10

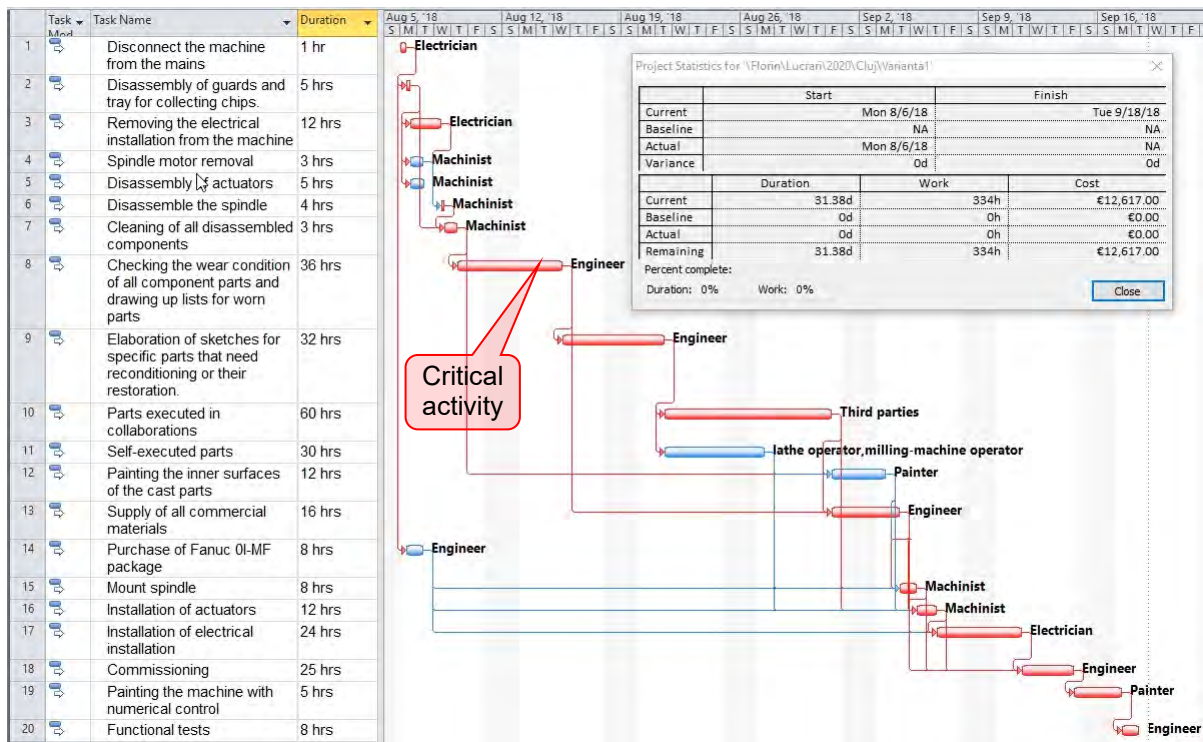


Figure 8. C.B FERRARI P-46E retriming project. Version 1

Version 2. In the second variant of project implementation in the Microsoft Project® program (Figure 9) it was considered that between the activities *Checking the wear condition of all component parts and drawing up lists for worn parts* and *Elaboration of sketches for specific parts that need reconditioning or their restoration* to have a precedent-succession *Start-to-Start* relationship with a gap of one day (8 hours). In this case it was found that the duration of the project was reduced to 27.88 days (Figure 9). The overlap, in a certain time interval of the two activities, creates a problem regarding the engineer resource. It is found that there are days when the demand from the engineer resource is higher than available. The shortage of human resources, of a certain category, can be highlighted by the *Resource Graph* option. In Figure 10 it can be seen that the deficit in the *Engineer* resource appears for four days.

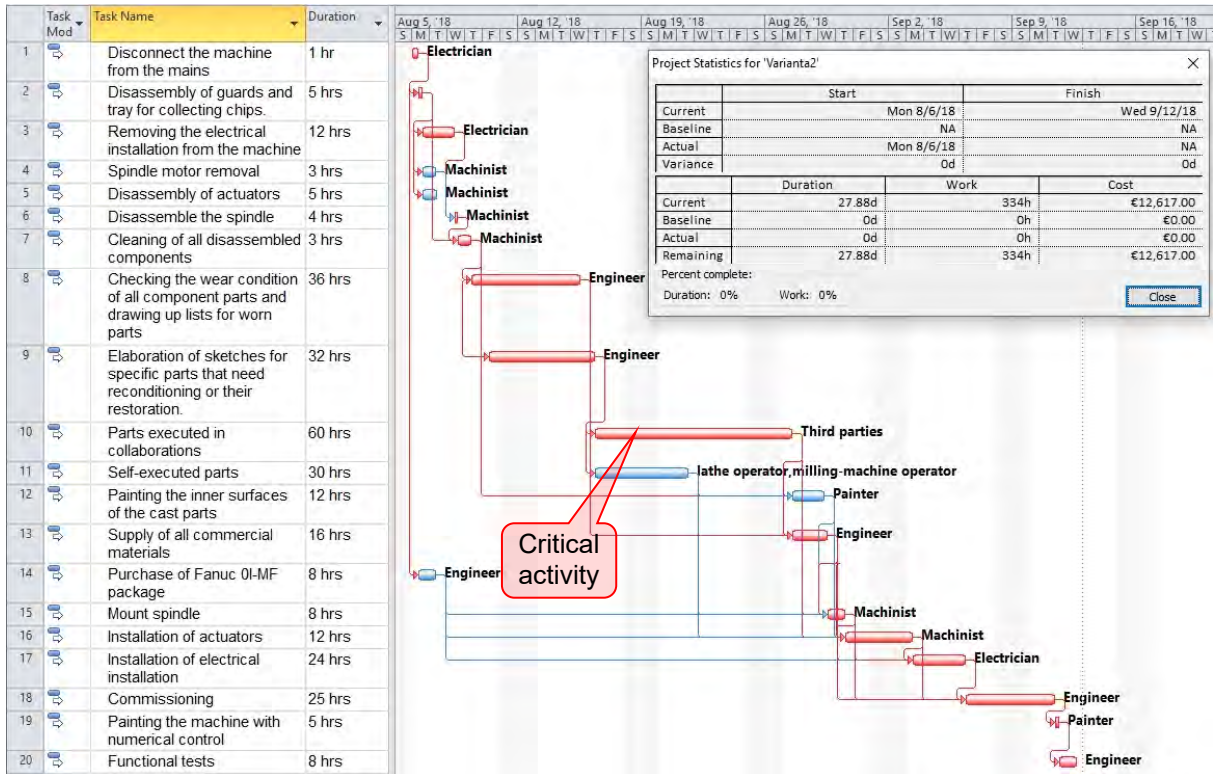


Figure 9. C.B FERRARI P-46E retrofitting project. Version 2

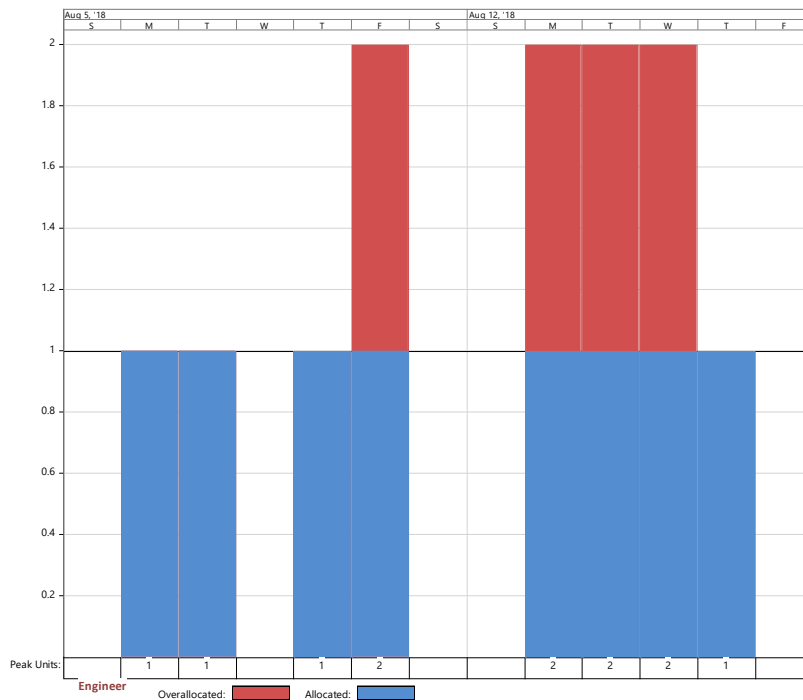


Figure 10 Deficit in Engineer resource

Version 3. In order to solve the problem of the deficit regarding the Engineer resource, we looked for the solution of allocating an engineer (Engineer 1) for the activity *Checking the wear condition of all component parts and drawing up lists for worn parts* and another engineer (Engineer 2) for the activity *Elaboration of sketches for specific parts that need reconditioning or their restoration*. Analyzing the result of the project implementation in the Microsoft Project® program, it was found that the longest critical activity is *Parts executed in collaborations* (60 hours). In order to shorten this activity, two



companies were used. Applying the presented changes, resulted the Variant 3 of project implementation presented in Figure 11. In this version the duration of the project is 22.56 days, ie a reduction of 28.10%.

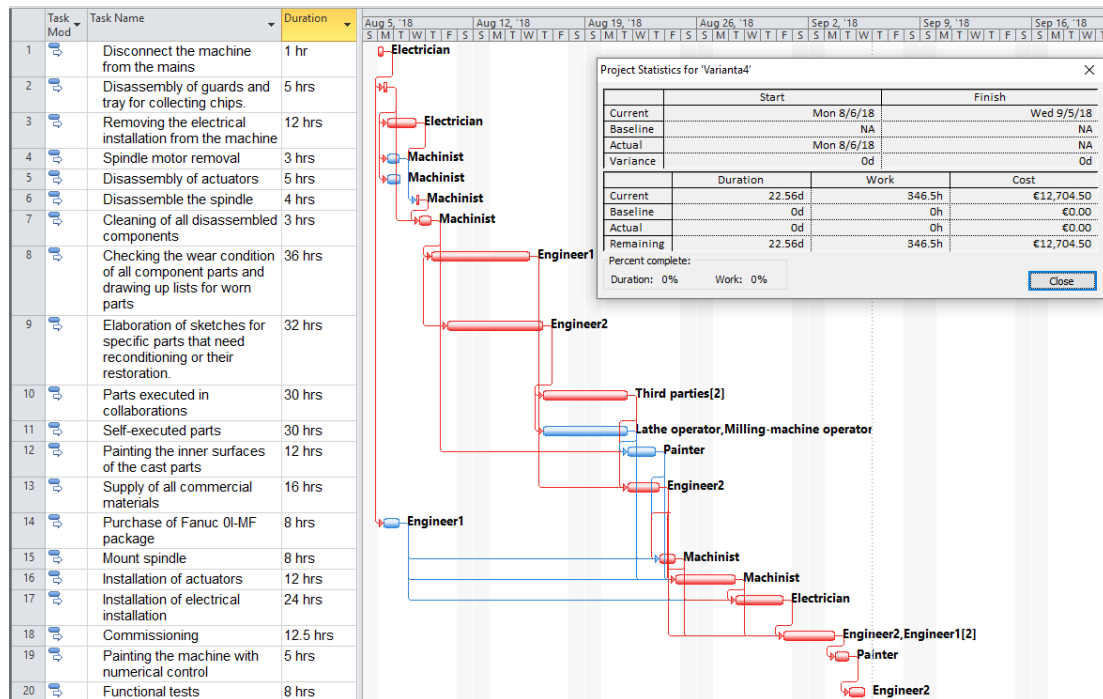


Figure 11. C.B FERRARI P-46E retrofitting project. Version 3

## Conclusions

The paper described how the critical path method was used in the management of the retrofitting project of the CNC machine tool C.B. FERRARI P-46E. Thus, the activities corresponding to this project were implemented in the Microsoft Project program considering their durations, the predecessor / successor dependencies between activities, the human resources necessary for the execution of each activity, the costs associated with these resources. The estimated duration and costs were highlighted. The program also provides information on how the allocated resources meet the necessary execution of the project activities. A very important advantage is that the program highlights the critical path and, implicitly, the critical activities. If more resources are allocated for the execution of critical activities, their duration decreases, decreasing the duration of the project execution. Several variants can be analyzed, the decision makers (project manager) can choose the best version.

For the analyzed case, the retrofitting project of the CNC machine tool C.B. FERRARI P-46E, using the critical path method using the Microsoft Project program, three project version were studied. Option 3, by allocating resources more efficiently (additional resources have been allocated for critical activities), allows the project to be completed in 22 days and 4 hours.

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# ISSUES, COMMON ERRORS AND BARRIERS TO THE DEVELOPMENT OF AGILITY IN AN ORGANIZATIONAL CONTEXT

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## Abstract

*Agility in organizational context (AOc) is a new concept in management literature and carries great importance for the companies operating in uncertain business environments as Romania and everywhere else. Many of the previous approaches to process development or transformation focus on practices and processes that organizational actors should learn. Based on our research we list a number of predictors expected to be on the attention list of organizations' leadership, have identified key features of such organizations that face an unpredictable and always connected world and have developed an integrated model defined by the dynamics of interactions between internal, heterogeneous agents and transversal networks (Lucescu and Avasilcăi, 2020 forthcoming). The way some organizations try to solve newly occurred problems often seem to create more confusion therefore it is legitimately prevailing to further cast a look upon issues, practices, bias and barriers to the development of agility in business context.*

**Purpose** –the aim of this paper is to pinpoint some of the issues, barriers and practices that may impair presence of AOc and thus, developing an agile organization.

**Methodology/approach** - An extensive literature review and observation are conducted to identify and confirm the characterization of the determined issues. Once identified, they will be in a structured catalogue.

**Findings** – The literature review comprises 2000+ references published between 2001 and 2020. We have selected 100+ papers for full consideration and have identified 8 key factors for instilling AOc, 3 types of barriers with subsequently 8 hidden ones and 5 common errors in creating conditions for AOc to thrive. We examine 14 organizations in Romania to determine the relevance of the selected issues.

**Research limitations/implications** – When the Romanian literature is reviewed, there is no other study examining AOc, except for conceptual studies regarding technical software methodology and approach.

**Practical implications** – For this reason, it can be stated that our study will contribute empirically both to related literature and to the business world.

**Key words:** AOc, common errors, development of agility

## Introduction

Pre-pandemic, most mature companies have already gone through many rounds of changes: reorganizations, mergers, decentralizations, new IT platforms, new CRM systems, new reward systems. However, the organizations confronting the realities brought by the global health crisis find themselves challenged by unprecedented demands. In order to survive, organizations detach themselves from the logic of what they knew how to do before and move in new directions from which to react from a different mindset. It is not a binary type change, but a collective transformation and of course, some organizations have a longer way to go than others, depending on the starting point (culture, market, strategy). To resist, organizations are forced to initiate emerging strategies, exploiting and building “transient competitive advantages” (McGrath, 2013). In our study we largely aim to explore the mechanisms of agility (Lucescu, Avasilcăi, & Bagiu, 2018) in an organizational context (AOc) at a level best described by being agile, living those values and principles. To a certain extent AOc seems to contribute to better navigate the turmoil of deep uncertainty by virtue of sensing the market signals (the reactive facet),

internal decision-making mechanisms and flexibility (the proactive facet) in providing the response expected by the market (Lucescu and Avasilcăi, 2020 forthcoming)

In this context, the aim of this paper is to pinpoint and spot some of the issues, barriers and practices that may impair presence of AOc and thus, developing an agile organization.

Developing AOc is not about adopting a new set of tools, processes or procedures at team level, but it is rather about how the whole organization develops the ability to respond and regrettably, almost any event in the life of any organization comes to impede the autonomy of the teams.

We have developed in our research an integrated model defined by the dynamics of interactions and functions between internal, heterogeneous agents and transversal network from an AOc perspective. In most companies AOc requires significant remodelling and changes - it is about breaking dependence, about managing without an ego, alignment of values and flows, and this type of transformation depends entirely on top management (Cattmeyer, 2019). A team will always be limited in its agility by the very organizational circumscription to which it belongs and AOc manifests differences depending on the structure of the organization. The traditional ones are designed around a static, silo-type hierarchy, with clear levels and functions and the decisions are taken from top to bottom. Those organizations that develop AOc instil the vision and purpose, are characterized by networks of operational teams that accomplish tasks in fast cycles of learning-decision-application and decision makers become those who are closer to information, with the intention of combining speed and adaptability with stability and efficiency (McKinsey, 2019). Agility in an organizational context does not proclaim a particular practice; it is the quality of the organization and its people to notice changes in the market, to be received and to continuously learn to adapt their processes and procedures to innovate and respond in accordance with new customer behaviours.

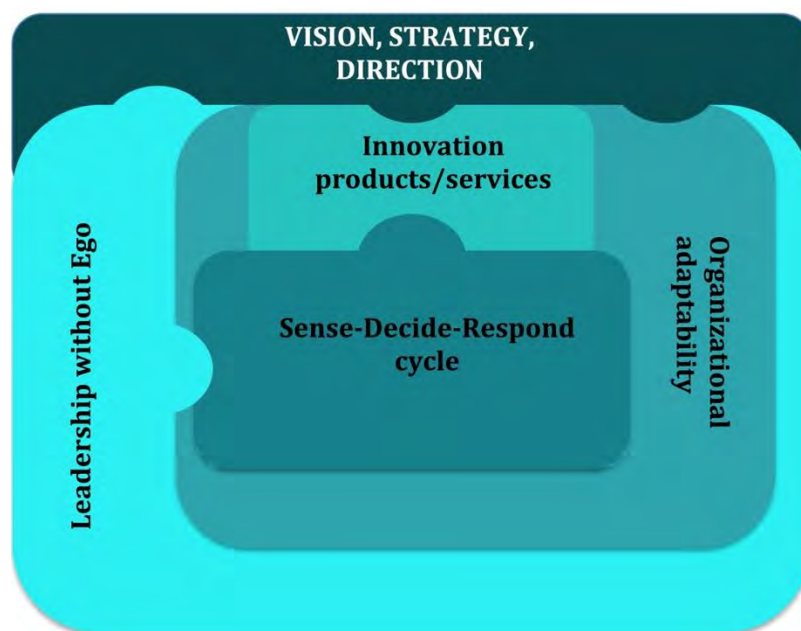


Fig. 1. Attracting and integration of the functions from the perspective of agility in an organizational context. Proposed model.

The management style reforms its mechanisms, aims towards other goals, manifold principles and it is based on a multiform set of values that disrupt the assumptions, attitudes and habits of generations before. In fact, the way we think about work is changing. Hence the new paradigm of organizations as living organisms. What will the world of work look like in the coming decades is a legitimate question to ask starting today. Either way, the whole process of designing the new way of working requires a mixture of tripartite: a mental transformation, one of abilities and another of behaviours. By influencing the paradigm, skills and behaviours will ultimately influence the organizational culture as a whole.

## Issues that impede fostering agility in organizational context

In a turbulent market all organizations, large or small, are vulnerable; none has the guarantee of supremacy and none is sheltered from any level of invincible performance. From the researched case studies (Bertolini, Duncan, & Waldeck, 2015), there are three perspectives that emerge as responsible for market failure in the most obvious way: the business model, the internal capabilities and general customer preferences. Along with them, we note as a particular issue the overconfidence that top management displays when asked about people's differences in perceptions of change.

Not every failure dislocates functions, but with every new change in the environment, new threats come along conditioning organizations to respond with new skills. Only a seamless unlearning- relearning process can confirm whether or not that organization has the ability to change. AOC is very much about putting one's own beliefs to the test, which goes further, in depth, in culture, in the “metaphorical field of the organization that exercises control over the organization through unconscious / preconscious / conscious beliefs, presumptions and paradigms. This field is an organizational system of symbolic significance” (Huțu, 1999) and plays a key role in any failure to implement agile steps, actions or projects. (Findings of the 13th State of the Agile Report, 2019).

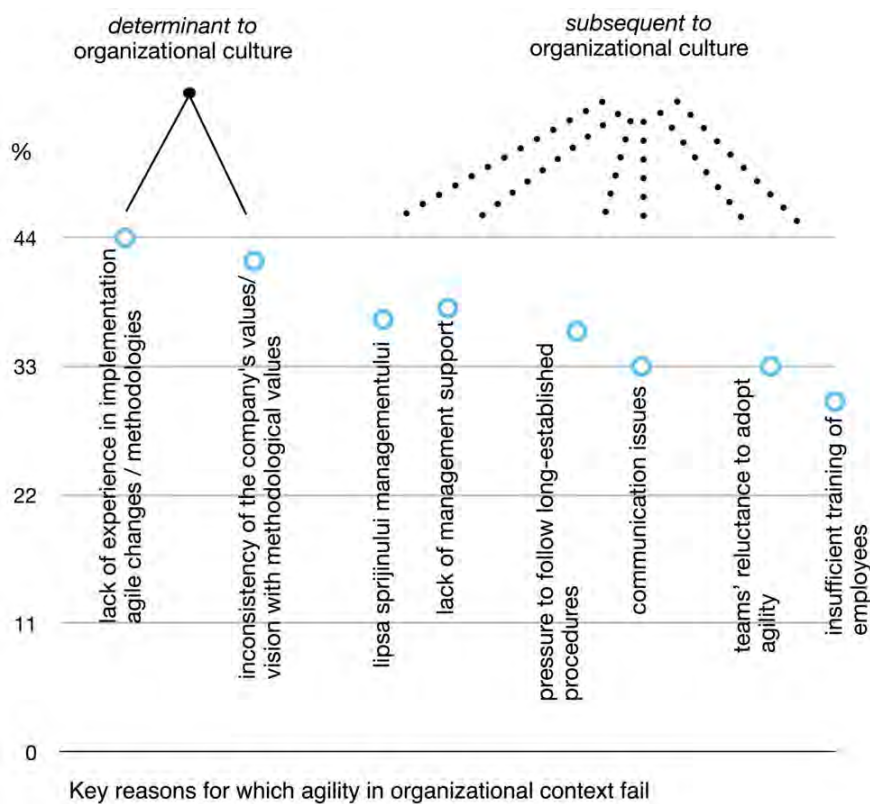


Fig. 2. The role of organizational culture in the success of organizational transformation.  
Adapted model -Findings of the 13th State of Agile Report

Failure to start from a scout-like mindset to overcome cultural resistance seems the number one issue to adopting an agile mentality.

On the other hand, agility in the organizational context, as it is, often co-exists with other traditional approaches to organizational development. Many large companies rely on decades-old systems and methodologies that carry the legacy of control. Well-established practices, hierarchical structure, well designed processes, roles, benefits, expectations support the need to control work in itself, employees feel constrained and limited by rules that no longer help them perform their tasks or unleash their creativity and impede the fast needed cycle of sense-decide- respond, as agility marker.

### Hidden barriers to the development of agility in organizational context

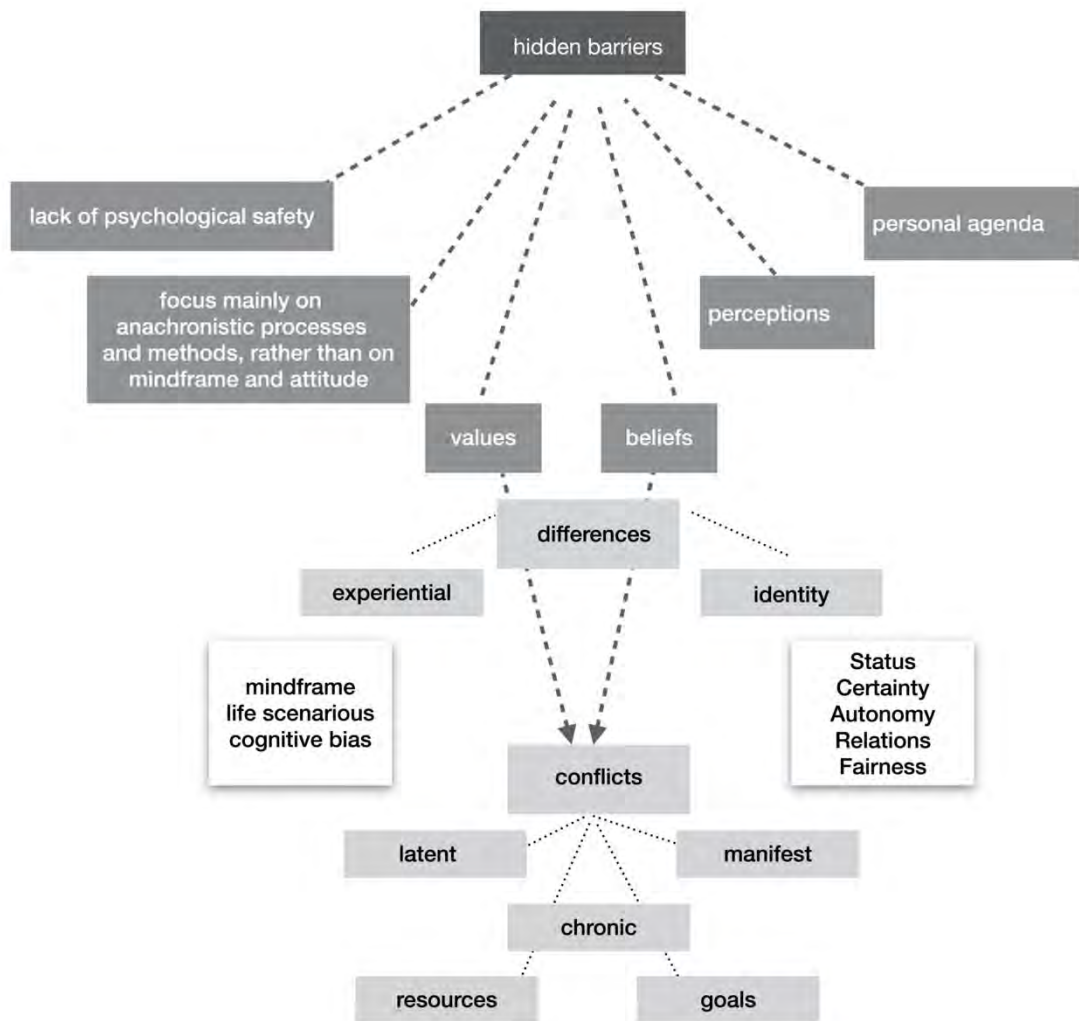


Fig. 3. Hidden barriers to the development of agility in organizational context. Proposed model.

The personal agenda prevents managers from giving up control, so the ideal of transparency in communication turns into supervision: in order to make the performance visible, tickets are introduced for any step, linking visibility to control (Wolpers, 2019) as the culture stays unchanged: decisions continue to be made by those who do not understand technology (Feynman, 1997).

A cognitive error in implementing agility is to see it as a framework for change. Organizations typically adopt sprints and sprint-associated artefacts and ignore other components of the framework, which are usually values of agility. As long as values and culture do not align with agile beliefs, adopting a package of agile practices is like improving only in spot places, leaving the organization the same, untouched. Transformation is about the transition towards being agile, adoption is about utilizing some tools (Cannon and Elford, 2017). The symptoms that the transformation did not really happen and that values are not quite lived are made visible by the absence of some key attributes:

- team members do not have the psychological security (Edmondson, 2019) to initiate discussions on issues and blockages are not openly discussed,
- tasks are assigned and planned by the traditional command centre and not by the responsible team,

- no tests / prototypes are initiated in order to reveal the problems,
- communication is one-way, teams report, do not discuss,
- stars are valued, not the team (Hansen, 2010),
- implicit information and knowledge are carefully preserved (key skills and information are seen as a subject of information management - Knowledge management - KM),
- agility is addressed as a methodology that people should apply,
- outside experts are reluctantly considered.

It is common to see in organizations different agendas of interests facing objectives or resources. Integrative mechanisms (Hansen, M., Ibidem, p. 93) that promote the alignment of goals and values do not always work, and the proposed strategies are abandoned with a disappointment that deeply contaminates the climate. This type of conflict is a fibre in the fabric of organizational life since the division of labour (Durkheim, 1863, apud Hansen, M.). Members of a group develop their own conflicting interests and values. Groups become prisoners of their own mental models, biased, and have difficulty appreciating / accepting the perspective of other groups / organizations, so their alignment becomes a difficult and sometimes painful process. Hazy or manifest, some conflicts become chronic, at their root prevailing the structural differences between expert combatants, their perspectives, beliefs and identity. There is a refined and sophisticated literature on behavioural theories about conflict around goals, feedback, mental models, but the neuroscience of communication (Turnbull, 2015) targets the depth of mechanisms that give identity to actors in organizations.

#### Distinct blockages in creating agility conditions in an organizational context

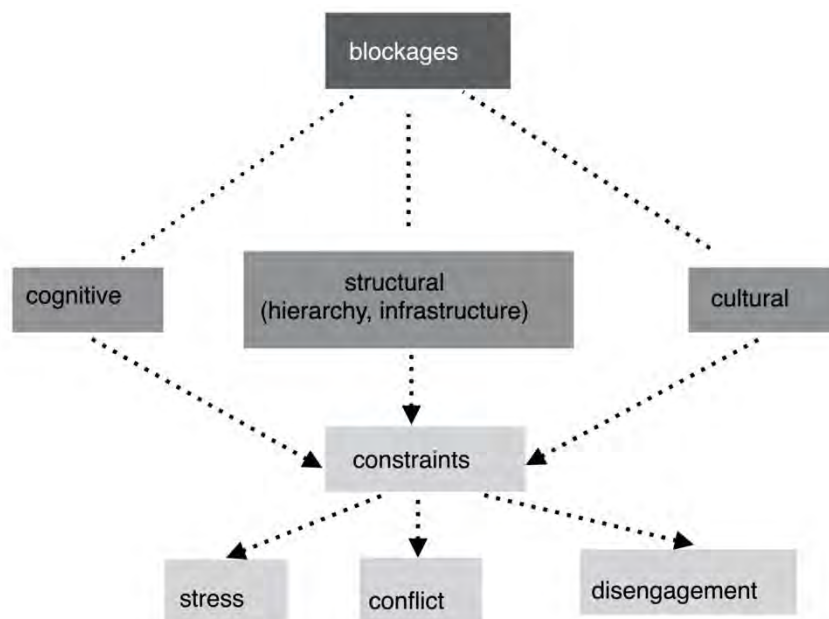


Fig. 4. Distinct blockages in creating agility conditions in an organizational context. Proposed model.

A mental block causes a series of incomplete connections that consume considerable amounts of mental energy in the expected chain of decisions (Rock, 2009):

- lack of vision,
- fundamental attribution errors (correspondence bias),
- lack of involvement (comes from non-communication of personal benefits at C-level and /or middle management level)

- lack of transparency,
- holding errors back (Syed, 2017),
- disconnecting transversal departments collaboration,
- hindering access to customers by the sales department.

These constraints lead to stress, exhaustion and disengagement in work and organization.

In 2015, after investigating more than 2,500 companies in 94 countries, Deloitte places employee exhaustion at the top of the concerns of 65 percent of executives in 94 countries. In 2016 there was a record of disinterest in work of 68 percent- a rate that has improved in the last year by up to five points in some areas of the world (Oehler & Adair, 2019) and this is very well understood for several decades.

Other companies avoid this dilemma by cutting costs, tax cuts, offshore, creating an illusory prosperity, but which undermines the real value of the organization.

Collaboration occurs when people from different departments work together in combined teams to perform a common task or to offer each other important help. Rarely does collaboration work naturally (Hansen, M. p. 34) because leaders themselves raise barriers. The problem arises when managers focus exclusively on its objectives, the organization becoming a sum of departments arranged as in a puzzle, a kind of fiefdoms, or bunkers.

The barriers are therefore personal. Factors that block collaborative behaviours belong to ego jurisdiction: thirst for power, arrogance, defensive attitude, fear, pride.

On the other hand, there are organizations that learn how to work better for its people and for those to whom they address it now form a vast global movement that transforms work itself and makes the world we live in an agile world (Denning, 2016).

### Common errors in creating conditions to foster agility in an organizational context



Fig. 5. Common errors in creating conditions to foster agility in organizational context. Proposed model.

#### 1. misaligned motivations

To the question <why do you want to become an agile organization?> (McKinsey, 2017), the surveyed managers answered:

- to give a faster response in the market (82 percent)
- to become more efficient (65 percent)
- to improve the predictability of deliveries (49 percent)

If we compare these answers with the benefits of AOc (“Why Agility Pays”, 2015):

- overcoming competitors through the ability to learn



- creating the conditions for autonomy, excellence, purpose, thus attracting talent from the market
- improving ROI, minimizing risks

we notice the misalignment of the motivations:

- little or no support from the board to become a learning organization you have to assume that it is a continuous process, with no return.

2. the organization displays an inertia that, paradoxically, ensures its success: it provides stability, and it serves the middle level management. The What's in It for Me syndrome and the question of why middle management would support an agile paradigm appear. Taylorism is still successful; autonomy implies another type of approach: coaching, mentoring, and only the change of title does not work.

3. self-sufficiency - we know what we have to do- this error is often found at the level of beliefs: so far it has worked, it will work from now on, and the failure is rationalized in terms of external environment: something happened in the market / exchange rate / policy, etc., no one could have anticipated this.

4. simplification- it's nothing complicated, we take a model and apply it to us (Linders, 2016).

## Conclusions

Not all organizations need to become agile in organizational context in order to have a culture of excellence and deliver value to customers. However, if skills change and technology continues to advance as big players invest, then organizations need to learn to swiftly adapt and take fast decisions in response to customers changing behaviours.

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# RISK ASSESSMENT OF THE DECISION IN REGARDS OF CORONA VIRUS IN ROMANIA

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## Abstract

**Purpose** – *The corona virus is a situation generated by the globalization process. Therefore, the risk evaluation of the pandemic situation used to manage a global crisis is directly linked to the conference theme.*

**Methodology/approach** - *The methodology used is the classic approach of the Failure Mode and Effect Analysis in 5 steps.*

**Findings** – *The findings are all the risks resulting from evaluation of the decision done in the pandemic situation. Also, a new domain for FMEA application is resulting from this paper.*

**Research limitations/implications** – *The main limitation of the research is that the paper is referring only to the first stage of the pandemic. The further waves of the virus and post pandemic situation is not in the scope of this FMEA analysis.*

**Practical implications** – *The practical implication are possible further actions defined in case of the unacceptable risks.*

**Originality/value** – *The authors contribution is a total new use case for a risk evaluation tool. The FMEA analysis is used usually in the technical domain, but it's applicability can be extended. On the other hand, there is a risk evaluation of the decision in regards of corona virus crisis management that can help the establishment too handle this situation.*

**Key words:** Covid-19, Pandemic, FMEA

## Introduction

System components analysis, Function Analysis, Failure Analysis, Risk Assessment and Optimization. After the first step it results a tree diagram with all the actors involved. The second step consists in evaluation of the role of each actor. The next step is the analysis of all the possible errors that actors can do. The fourth step is the analysis of the action defined for prevent and detect the consequences of the virus. The last step is the proposal of improvements of the concept.

The first step outcome is a tree diagram with all the actors involved. The second step consists in evaluation of the role of each actor. The next step is the analysis of all the possible errors that actors can do. The fourth step is the analysis of the action defined for prevent and detect the consequences of the virus. The last step is the proposal of improvements of the concept.

This paper describes a pandemic risk assessment method that can be used to evaluate the risks associated with a global pandemic situation. The method used for this purpose is Failure Mode and Effect Analysis. Also, in the paper is presented an example of risk evaluation of the concept defined by Romania to deal with Corona virus. Using the classic elements of risk: Severity, Occurrence and Detection all the measures against virus and effects of it are evaluated and prioritized.

The risk assessment of the pandemic plan used by Romanian authorities was performed using the Failure Mode and Effect Analysis – FMEA. The FMEA is a wide used methodology to evaluate and reduce the risks of a design, concept or system (Muntean, Prosteian, Pugna, 2017).

According with VDA standard (Verband der Automobilindustrie) there are five steps followed to create a complete FMEA analysis: structure analysis; function analysis; failure analysis; actions analysis and optimization.

We defined the structure tree presented in figure 1. This was done after the first step, structure definition. The main elements involved in failure chain are: Pandemic effects, Pandemic plan, Management, Control, Spread, Health Care and Communications. These elements of the decision failure chain were identified based on preparedness components defined by World Health Organization – WHO (World Health Organization, 2009).



Figure 1 Tree diagram

The functions, in second step, were defined on three levels: effects, mode and cause, starting with mode level for pandemic plan element. The pandemic plan used must fulfill the functions like:

- Exercises the national pandemic plan
- Revises periodically the national pandemic plan
- Develops the national pandemic plan
- Develops a monitoring system
- Promotes the self-protection
- Prepares the health system to be scale up
- Communicates the risks
- Prevents the virus spread
- Monitors the pandemic operations
- Containments the population
- Activates the emergency plan
- Promotes the recommended interventions
- Mitigates the social and economic impacts
- Assesses the efficiency of the mitigation measures
- Implements the auxiliary social measures
- Implements the emergency plans for health system
- Updates the evolution of the pandemic to all stakeholders
- Manages the additional resources for possible future waves
- Surveillances for possible next waves
- Evaluates the results of the measures used to update the protocols
- Reorganizes the medical system after the peak of the pandemic
- Informs the stakeholders in case of new waves

- Shares the relevant information with international community
- Prepares for next pandemics using the information from the previous ones
- Evaluates all the relevant interventions implemented
- Evaluates the impact of the measures to the health system
- Prepares the communities for next major public health crisis

If all the functions of the pandemic plan are ensured, then the following effects were identified on the level of Pandemic effects system element:

- The pandemic plan reduces the number of people infected
- The pandemic plan reduces the economic effects
- The pandemic plan reduces the social effects

Functions for management decision are:

- Creates a cross-governmental pandemic committee
- Manages the capacities allocated for pandemic situation
- Manages the national organizations involved in pandemic situation
- Updates the national pandemic plan
- Creates the legislation for considered actions
- Facilitates the business continuity planning

Control functions are:

- Develops the national surveillance system
- Assesses the virus transmission risks
- Investigates the illness caused by virus
- Develops the laboratory capabilities

Functions needed for spread control are:

- Promotes the importance of hygiene
- Promotes the control guidance for household
- Supports the ill persons isolated
- Develops plan for class suspension
- Promotes strategies to mitigate the infection in workplaces
- Reduces the travels
- Reduces the mass gatherings
- Estimates the meds requirement
- Develops procedures to provide the meds
- Assesses effectiveness of existing protocols
- Develops a national vaccine action

Functions of health care are:

- Creates a triage system
- Updates the provision strategy for health care
- Develops the management protocols
- Develops the infection control guidance
- Estimates the personal protective equipment
- Develops procedures for laboratory
- Develops the testing capacity

Communication functions are:

- Establishes an emergency communication committee
- Communicates the infection risk status
- Develops an effective relation with media
- Develops communication channels with population
- Develops communication strategies to educate the population
- Initiates public health education campaigns
- Increases public awareness of measures
- Promotes the communication toward disadvantaged persons
- Testes the communications procedures
- Updates the communications strategies

Possible failures or errors were identified for negating each function according with figure 2. This function definition represents the third step of the FMEA methodology. In this step the function and failure net are defined also according with.

The effects identified are presented in figure 2. They are referring to health care of population, social impact and economy. Also, the Severity parameter was assigned to potential failure effects. The most sever effect is rated with 10. No impact or very low impact is rated with 1.

In the fourth step were defined prevention and detection actions like: ordinance in emergency; surveillance; constitutional court decision; World Health Organization measurements; case study from other countries; protocols definition and so on. The Detection and Occurrence values are defined based on considered prevention and detection actions. The best detection/occurrence is rated with 1 and the worst ones with 10.

The outcome of this activity is the actual risk assessment presented in figure 3 and figure 4. The RPN – Risk Priority Number analysis is performed multiplying the Severity, Occurrence and Detection. Based on RPN diagram are identified 14<sup>th</sup> potential failure causes that must be improved. The biggest RPN value is 900 for potential failure cause: “Does not update the national pandemic plan”. The national pandemic plan is not updated since 2013 and this make the occurrence rating 9. The severity is coming from failure causes effects that is 10. And with no detection actions considered the RPN is 900.

In AP – Action Priority analysis diagram there is another evaluation of risks based on the same three parameters: severity, occurrence and detection. The guideline used is the one from FMEA Handbook (Verband der Automobilindustrie, 2019). There are 19 potential failure causes that have AP value High. For these 19 potential failure causes there are new prevention and detection actions that must be defined.

All these potential failure causes identified as unacceptable risks must be optimized during the fifth step of the FMEA methodology.











Figure 2 Function and failure definition

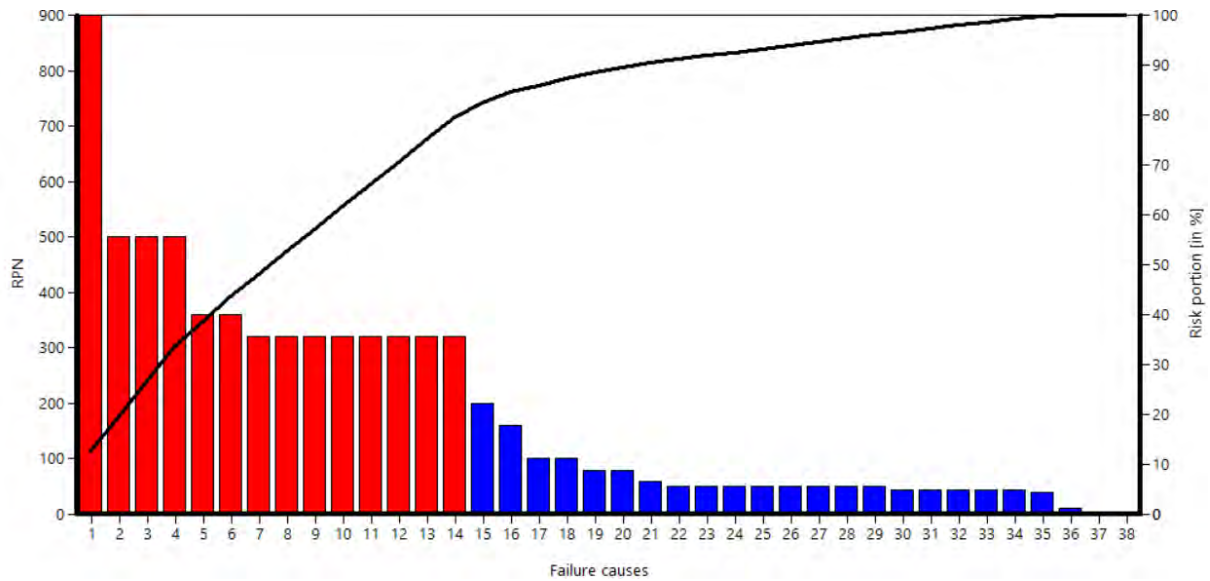


Figure 3 RPN analysis

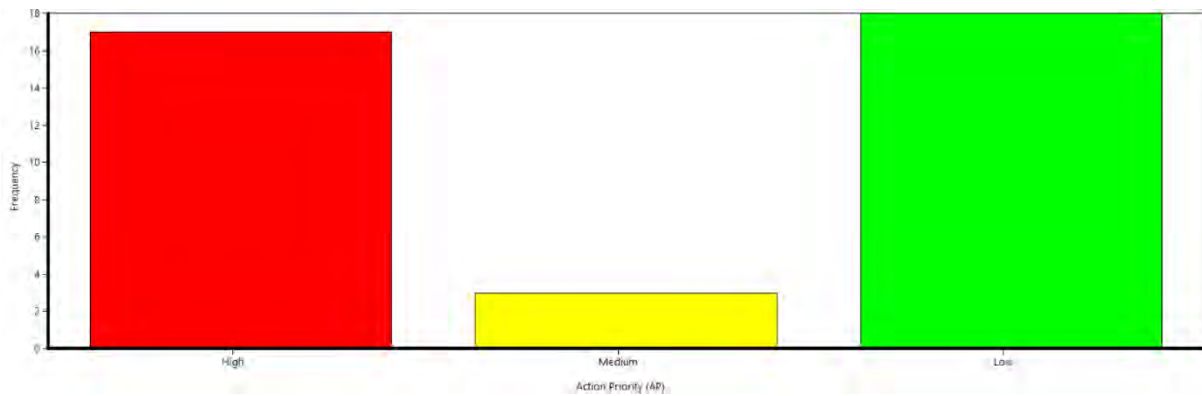


Figure 4 AP analysis

### Discussion and conclusions

There are 14 potential failure causes identified as unacceptable risks using the RPN analysis. The biggest RPN value is 900 due to updates mission of the national pandemic plan. All the other risks are associated with weaknesses of the Health Care system and Management.

There are 19 potential failure causes identified with High AP value. Therefore, there are five additional risks identified with AP analysis that are related to the Communication.

These analyses demonstrated also the effectiveness of the new introduced AP evaluation method by identifying more potential unacceptable risks then the previous one RPN.

The analysis of pandemic plan management was done based on 10 military ordnance and the initial fazes of the pandemic situation. The optimization step will be evaluated and implemented in further steps of the pandemic situation.

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# A STRUCTURED FRAMEWORK FOR INTERNATIONAL PROJECT MANAGEMENT COMMUNICATION RELATED RISKS IN A COVID-19 PERSPECTIVE

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## Abstract

**Purpose** – Communication is a crucial mechanism for project coordination, monitoring and information gathering concerning possible deviations. Today's challenges, including cross-cultural teams, virtual teams, fast technology advancement and short time working have greater impact on project success. This paper aims to help corporations identify possible sources of risks related to global communication in a COVID-19 perspective by proposing a structured framework, using the practical experience and theoretical academic literature.

**Methodology/approach** – The search for communication risks is sought at the four communication dimensions: Global Communication planning, Global Stakeholder Management, Global Communication tools & Methodologies and Motivating and protecting people's health and safety. Assessing performance of project global team, considering the challenges of COVID-19 crisis. The relevant research papers and web literature are considered as a basis for conceptual framework creation. Filtering and structuring of information is advantaged by experience of author in project management, in a systematic framework. The results are filtered and evaluated by peers' insights from project management.

**Findings** – The paper attempts to develop a structured communication risk framework which can be used to identify the possible risk sources and improve the effectiveness of the communication in project management.

**Research limitations/implications** – In the current literature there are limited research publications proposing a structured framework for communication risks in a COVID-19 perspective.

**Practical implications** – The paper imposed theoretical contributions by identifying relevant literature, filtering the needed information and creating a structured framework of communication risks intended to provide support for future risk identification in concrete cases.

**Originality/value** – Changing in ways of collaboration and communication, ways of working and changing of communication tools require management attention and keeping the projects under control by identifying and managing risks. This approach imposed to bring significant value by helping organizations do that.

**Key words:** Communication risks, risk management framework, project stakeholders

## Introduction

The COVID-19 crisis made the importance of a steady and reliable flow of information and the necessity of communication in global project management more visible. Several research papers show that an agile and transparent communication between stakeholders ensured success of various projects which are on the verge of failure during the COVID-19 pandemic. Open and clear collaboration between stakeholders is key to reduce the influence of unplanned setbacks and keep projects ongoing in the most imperceptible way.

Considering this, there are numerous obstacles to overcome. Stakeholders need to be more flexible to ensure communication across different time zones, make up for the limited social interactions, set up

the necessary IT-Infrastructure, enable access to sufficient communication tools and adapt to a new work environment.

The most impactful adjustment is the adaptation towards a new work environment. A classic office is not necessarily needed anymore, COVID-19 enabled the office to be everywhere and anytime a day. A similar perception can be made regarding the daily working schedule meetings which have been set up all around the clock.

This paper proposes to identify the key challenges that companies in international businesses will need to face and define a structured framework for risks related to global communication. The framework is focusing on four main dimensions of communication Global Communication planning, Global Stakeholder Management, Global Communication tools & Methodologies and Motivating and protecting people's health and safety Assessing performance of project global team where can emerge potential risks. The framework aims to provide an overview about the risk sources with the potentially highest influence on global project management communication.

## **Background**

Given the assumed contributions to this paper, describing the importance of communication in global project management and defining the main challenges faced by project management as a result of Covid 19 pandemic, constitutes the basis for framework creation.

### **Global project communication**

Communication is the pillar to ensure effective and efficient global project management. Projects with a high level of complexity requires collecting, exchanging and distributing of a high amount of information. On this basis correct and relevant information must be provided to the right stakeholders in the right time and through the right methods and channels (Butt & Naaranoja, 2016).

The connection within project members is often limited by personal preferences and individual actions, instead of putting effort to create a multilayered project team. Such attitude and mindset lead to failures in projects and put the success in danger. To avoid this and increase the success rate of projects communication is the key, moment-to-moment communication of task assignments, responsibilities, milestones, issues and problems. Preventive corrective actions rely on the speed of communication among stakeholders. In Covid-19 times stakeholders have less opportunity for face-to-face communication and lose non-verbal aspects of communications (Iqbal, 2015). While the stakeholders are in remote office in an isolated office space the social competences decrease, as well the aspects of teamwork and coordination are negatively impacted. Stakeholders operate in the virtual environment and have to face serious communication issues, and miscommunication. This makes the generic process of building trust within a global team significantly more difficult.

But especially in a pandemic crisis as COVID-19 a clear and quick communication between stakeholders is the most important aspect for success.

The results of literature analysis related to challenges of Covid 19 on project management and their potential influences are summarized in Table 1.

Table 1 Challenges of COVID 19 on project management

Covid 19 pragmatic challenges in PM	Potential influence	Sources
New working environment	<p>Remote project communication and collaboration:</p> <p><b>Changing in ways of collaboration and communication between project associates</b></p> <p><b>Change of work relations between peers</b></p> <p><b>Change in communication tools:</b> videoconference, audioconference, email, chat, phone, digital sharing of documents</p> <p>Remote working, including work from home:</p> <p><b>Different mindset and behaviours</b> concerning working across cultures (team engagement, commitment and support)</p> <p><b>Changing in working time</b>, move to short working time, absenteeism, reduction and restriction of overtime, limited human resources available (schedule delays for sample, trials, testing, certification, insufficient validation with impact on quality)</p> <p><b>Work flexibility:</b> scheduling meetings at late times and expectation of availability</p>	(Deloitte, 2020) (Binder, 2009) (Robbins , 2020)
Stakeholders collaboration across globe	<p><b>Challenges in communication due to shutdown of plants with differences in ramp-up timing</b></p> <p><b>Lack of transparency with regard to Covid measures</b> with customer and supplier and other partners</p> <p><b>Lack of transparency related project tasks progress</b> of other team members</p> <p><b>Issues in sharing concrete informations</b> concerning project context</p> <p><b>Single sourcing</b>, without back-up supplier</p>	(pwc, 2020) (Sonta, 2020)
Remote Management	<p><b>Changes in leading of people:</b> balance between employee productivity and wellbeing, identifying new modalities of connection with people (human emotions cannot be expressed digitally)</p> <p><b>Flat hierarchy:</b> enable trust and independency to move the task and project forward</p>	(Deloitte, 2020) (J., 2007)

### A framework related global communication risks

Although communication is the main driver in influencing the project management effectiveness, usually there is little concern about this. Even so, the practitioners cited several difficulties within communication process with direct impact on project success. (Pritchard, 2014) In this context project manager and related stakeholders need to address critical communication activities together with their risk to improve the communication effectiveness and avoid potential failure of the project. The author undertook a critical and extensive research of the present literature and web information, which created the basis of the following framework. Additional the creation of the framework was benefiting the experience and current position of the author in project management. Selection of relevant risk sources and validation of results were determined by consultation with several peers from project management and quality management field. The results of the analysis are described in Tab.2 into a structured framework related risk sources for global communication with considerations of current situation faced by Covid 19.



Table 2 A framework for communication related risks in international project management

Ref	Communication dimensions	Communication risk sources
<p>(Reed &amp; Knight, 2010), (J., 2007)</p>	<p>1. Global Communication planning</p>	<p><i>Sources of risks related to communication planning:</i></p> <p><b>1.1 a Identifying needed resources:</b> stakeholder availability and flexibility</p> <p><b>1.1 b Defining communication method, duration and frequency</b></p> <p><b>1.1 c Communication standards and template:</b> meeting schedules (cannot be followed due to Kurzarbeit, plant shutdown)</p> <p><b>1.1 d Identifying the stakeholder limitations:</b> Kurzarbeit, reduced office hours, plant shut down</p> <p><b>1.1e Updating periodically the communication plan:</b> adapt the current plan to upcoming changes</p>
		<p><i>Communication crisis:</i></p> <p><b>1.2 a Defining of crisis team for emergency situations,</b> including cross-functional and cross-cultural people, back-up for key personnel</p> <p><b>1.2 b Plan escalation modes and appropriate task force</b></p> <p><b>1.2 c Working infrastructure and tools for remote working:</b> HW and SW tools</p> <p><b>1.2 d Plan emergencies response:</b> considering ways of messaging (modes of tone, chosen words, communication style) &amp; information flow, presence of leaders</p> <p><b>1.2 e Define appropriate working models that reach the needed performance and productivity and meet the health requirements</b> (working at the office, remote, from home, etc.)</p>
<p>(Filev, 2012), (Nevogt, 2019), (Butt &amp; Naaranoja, 2016), (Pullan &amp; Prokopi, 2016), (Iqbal, 2015)</p>	<p>2. Global Stakeholder Management</p>	<p><b>2.1 Defining key stakeholders:</b> public authorities, customer, key team members, preparedness of critical suppliers</p> <p><b>2.2 Stakeholder inclusion and connection:</b></p> <p><b>2.2 a Managing communication and maintain trust and confidence across stakeholders</b></p> <p><b>2.2 b Involving new team members within the team</b></p> <p><b>2.2 c Meeting schedule:</b> managing teams across different cultures and different time zones</p> <p><b>2.2 d Managing cultural differences and language barriers</b> to avoid misunderstandings</p> <p><b>2.2 e Ensure engagement &amp; commitment</b> of the right stakeholders, at the right time and through the right methods</p> <p><b>2.2 f Communication awareness:</b> establish stakeholder awareness about communication channels where informations are updated</p> <p><b>2.2 g Establishing transparency in communication and actions:</b> constant interaction to identify possible constraints</p> <p><b>2.3 Management and decision making:</b> communication capacity of stakeholders, flexibility in decision making</p> <p><b>2.4 Analyze and understand require. and what the people feel about current situation:</b> communication speed (early, fast, often), decision making transparency and speed, the exchange of information including project requirements, activities, drawings, samples, test results</p> <p><b>2.5 Provide relevant information sets to stakeholders</b></p>

<p>(Carney, 2015), (Zulch, 2014), (Rajkumar, 2010)</p>	<p>3. Global Communication tools, methodologies and techniques</p>	<p><b>3.1 Virtual collaborative methods:</b> media &amp; audio, video conference methods impact the trust between stakeholders</p> <p><b>3.2 Face to face interaction and relationship building:</b> establish social interaction</p> <p><b>3.3 Written communication:</b> ensure understanding of sent message and providing of appropriate response message</p> <p><b>3.4 Adopting compatible technologies</b></p> <hr/> <p><b>3.5 Collecting, distributing and exchange of informations using platforms and digital tools</b> (sharepoints, cloud, communities, etc.): assure transparency of work packages and project information within the stakeholders</p> <p><b>3.6 Establish a clear versioning of documents,</b> without risk of mixing the documentation, avoiding confusion and misunderstandings</p>
<p>(Filev, 2012), (Nickson &amp; Siddons, 2004)</p>	<p>4. Motivating and protecting people's health and safety. Assessing performance of project global team</p>	<p><b>Project performance assessment</b></p> <p><b>4.1 Defining a motivation and communication strategy</b> by sharing empathy, transparency and connection trough constant dialogue</p> <p><b>4.2 Establishing communication rules/ behaviours</b> for reporting of project tasks results</p> <p><b>4.3 Assessing the capacity and prioritization of tasks</b></p> <p><b>4.4 Implementing a digital work performance tool for project team</b></p> <p><b>4.5 Monitoring and assessing constantly communication</b></p> <p><b>4.6 Adapting the project leading to the new working models</b></p> <p><b>4.7 Updating project documents and relevant procedures</b></p>

## Discussion and conclusions

For companies aiming to achieve effective communication and successful project management, identifying and assessing of current risks and continuously adapting to the upcoming changes is a prerequisite. Covid 19 request a reinterpretation of working models, communication methods and strategies, infrastructure and nevertheless management of project team and stakeholders.

Dealing with new ways of communication, new working models and multiple parties with different communication strategies and availability limitations may affect to keep the project schedules tight and the output at requested and expected quality. To keep the project under control project managers need to adopt and implement a holistic approach for risk identification in Planning of communication, Stakeholder management, Communication tools, methodologies and techniques and assessing of motivation and performance of people. This paper attempts to support the project managers to identify the processes and activities with emphasize potential risks for communication.

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# GAME THEORY IN DECISION MANAGEMENT

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## Abstract

**Purpose** - This article presents the applications of game theory in management decision making.

**Methodology / approach** - The methodology proposed in this article is based on the use of game theory for control and decision making in economics. Predictive methods are applied for urban transport planning, and their results contribute to measuring decision-making performance.

**Findings** - Based on the experiments performed by the authors, an application on traffic prediction was developed and tested within the Department of Intelligent Transport Systems of UPB, for the planning of urban passenger transport.

**Research limitations / implications** - The paper offers a concrete solution obtained at the department level. This solution based on the implementation of the game matrix is a new approach to urban transport planning in accordance with ITS requirements.

**Practical implications** - The practical aspects approached by the authors are related to the identification of the best balance matrices with intelligent agents for the implementation of urban transport planning management, using a new methodology based on game theory.

**Originality / value** - The methodology based on the algorithm-oriented approach of game theory for predicting urban traffic planning can be implemented for measuring, evaluating, and improving traffic using ITS strategies.

**Key words:** management, decision, game theory

## Introduction

In recent years, there has been a growing interest in the use of game theory algorithms implemented with intelligent agents for the development of software systems to assist in decision-making and agent-based management systems. Prediction and decision making theory is based on a set of mathematical algorithms for making decisions and generating strategies that can be applied if the results of potential actions are unknown.

Game theory developed long before the advent of the concept of "smart agent", agents are examples of software applicability for decision makers who can combine the classical theory of decision making with Artificial Intelligence algorithms.

### The interactions between game theory and prediction theory

In general, decision / prediction theory is a way of analysis, which needs to choose a predefined scenario, when the result is not known after choosing a working scenario. Decision theory focuses on identifying the best choice of "decision", accepting the condition that the notion of "best" can have several different meanings, of which the most used decision is to maximize the final planning result that the decision maker and proposes it.

Game theory studies the aspects of how interaction strategies between individuals can be developed to maximize the well-being of an agent in a multi-agent interaction, but also how protocols or mechanisms of interaction with properties can be developed. imposed by the decision maker. It can be noticed that the theory of decision is considered as the study of game theory (survival) against nature, where nature (environment) is an opponent who does not want to get the best compensation, because he has a chaotic behavior.

Based on the above, we find that many applications based on game theory with implementation on multiagent systems (experts) have been developed for the analysis of events such as negotiation and coordination / planning.

The concept of decision prediction has evolved from the concept introduced by Michael S Scott Morton (2015) to the decision management system based on intelligent agents. In 1980, Sprague defined Decision Support System (SSD) as "interactive computer-based systems that will help decision-making management use data and predictive models to solve problems." This definition was pro-active, which is why the definition was generalized to include all systems involved in prediction and decision making (Sprague R, 1980).

The extension of the initial definition led to the hiding under the name of SSD of different types of systems, many of them having nothing to do with the initial idea of SSD. Initially, these were tools aimed at large companies, but in recent years SSDs have become important and accessible tools for small companies. The existence of these tools has changed and will continue to change the way we make decisions. They allow the individual or organizational decision maker to manage the volume and complexity of information more efficiently and to better coordinate activities.

### **Circumstances of group decision making**

In most cases, SSDs are developed and implemented in companies in all fields of activity. Although most companies have a hierarchical leadership, decision making is a collective process. The decision-making group can be involved in making the decision, but the decision can also be made by a single person, such as creating a short list of alternatives or choosing the criteria for accepting an alternative.

The main purpose of the SSD system is to use appropriate mechanisms (analysis of data, documents or calculations and predictions) to provide support in making the right decision for a situation imposed by certain situations (Filip F, 2004). The correct decision can be taken only after a careful analysis of all possible results obtained, taking into account all the factors that may influence the decision-making act and following the analysis performed by all parties involved in the management process.

The decision is the result of the analysis actions for choosing an optimal direction of action, which often involves the allocation of new resources. The prediction obtained from the processing of information and databases, which may belong to a person or a group of people, with the necessary authority, is ultimately used by decision makers in certain concrete situations (Parson S, 2002). A complex decision-making environment creates the necessary framework for the use of decision-making software applications. Research and case studies analyzed by us have shown that a well-designed and structured IT system to support decision making, can improve the quality of the managerial decision and can increase the efficiency and effectiveness of the management process.

Today, computer systems have become a powerful tool to help in decision making. Decision makers work better with the relevant information obtained in the shortest time. Effective support decisions can give managers greater independence in retrieving and analyzing data (Big Data), thus obtaining quality information and desired results. The decision-making process can take place based on a well-defined "scenario", which can be formulated tangentially with the rules of a game in the concept of "Game Theory" (depending on the field of applicability) through the following stages:

- Strict determination of all parties involved in the decision-making process (persons or groups of persons);
- Defining the possible actions (scenarios) that each party participating in the given process can undertake;
- Establishing the rules of the evaluation "process" (evaluation stages and existing priorities);

- Establishing the criteria according to which the evaluation will be made, and the respective decision will be adopted;
- Creating a list of alternatives and choosing the criteria for predictive alternative;
- Creating compromises and balancing interests or creating coalitions in case of need (imposing these compromises if necessary);
- Distribution of results according to the defined criteria (directing the gains according to the adopted decision).

Given an individual "scenario" of negotiation between agents (decision makers), various techniques in the field of game theory can be applied, which refer specifically to the definition of the protocol "rules of negotiation". Protocols can have certain predefined (default) properties are:

- guaranteed success.
- Maximizing social status.
- Efficient Wall.
- Individual choice.
- Stability of choice.
- Simplicity of the solution.
- Distribution of the decision.

### **Users & beneficiaries**

Among the most important aspects that must be highlighted during the design stage of a SSD are the establishment of the user and the beneficiaries for whom the respective system will be destined, as well as the fields of use and the way of functioning it. Regardless of whether a single person or a group of people will participate in the decision process, systems must satisfy the essential characteristic which consists in: "providing support and improving the way of human judgment, control of the system, the system thus remaining entirely under the control of the user" (Holis S, 2001).

Thus, Sprague (1980) defines five categories of roles of people involved in the process of design (construction) and use of SSDs, taking into account the classification of SSDs in terms of technological levels (specific SSDs, SSD generators, SSD tools):

- Managers / decision makers (users) - the person who will make the decision and will be responsible for the consequences of the choice made
- Intermediaries - the person who helps, to a certain extent, the manager in using the support system for specific decisions and in choosing the decision by providing suggestions
- SSD Builder / Facilitator - the person who designs / builds / configures the specific SSD using an SSD generator. The builder must have knowledge both in the field of decision making and technical knowledge
- Technical support staff - develops new features for SSD, as component parts of the SSD generator (databases, analysis models, new presentation elements)
- SSD instrument developer - develops new technologies, new languages, new hardware and software components to improve the connections between subsystems.

According to Sprague, 1980, a person can assume one or more roles, depending on the nature of problems, and the level of technical academic background and the orientation of the person. Filip (2004) regroups these roles in 3 categories:

- Users - all those who are in direct or mediated interaction with SSD, to form a decision-making unit in the elaboration and adoption of decisions
- Intermediaries - make the connection between users and developers of SSD instruments in the activities of transition from instruments to customized systems (builders-specialists) or to mediate or facilitate the use of application systems (intermediaries of use)

- SSD tool makers - specialists who develop decision-making methods and those who implement associated IT products, including SSD generators.

### **Areas of application (meaning, context, purpose)**

The classical models of game theory have found their applicability during the last decades in different social fields to the analysis of some problems with decision-making or conflicting character. The most common are applied to issues in the field of economics, management or marketing, but also in socio-political issues of a voting nature. It applies to various social methods in which there is usually no independent "fake" choice that one can make - in which the "best" results depend on the actions of the other participants (Hollis M, 2001).

In game theory, the consequences refer to the values that each participant receives as a result of the choices made by both him and his opponents. The consequences are often represented by numerical values; these numerical values can be represented discretely - matrix, or continuously. A key concept in game theory is the criterion of optimality. It refers to the rational decision in which a setup of movements is designated to bring an optimal reward, even after evaluating all possible movements of appearances. In game theory, the concept of the game solution of two or more people means a situation of balance for all players. The crucial issue is how to adapt the classic mosquitoes from game theory to various decision-making problems in different social, economic, political fields. Simultaneously with the choice of the appropriate model for the problem in question, it is very important how to determine the solution and the correct interpretation in terms of the respective field.

### **Research Methodology: The use of game theory and intelligent multiagent in transportation planning**

The proposed method is based on game theory and the implementation of Intelligent Multiagent Systems (SMA). Each agent has an associated utility function. The values of this function are represented in a payment matrix that is known by both agents included in the negotiation. Each agent also appreciates an alternative law that will maximize its usefulness. Although the method based on game theory is simple and elegant, it has very strong restrictive assumptions that make it difficult to apply to practical situations. Real-world negotiations take place in conditions of partial or complete uncertainty, include multiple criteria that cannot be synthesized by a utility function alone and the utilities of agents are not known, so agents are not omniscient (all-knowing). Another way to allow an agent to learn and use an evolutionary algorithm. They are based on the biology, deriving from the theory of evolution through natural selection. The most commonly used algorithm of this type is genetic algorithm (GA).

It works with a population of individuals, each with a certain measurable level of "fitness" using a metric defined by the model builder.

The most representative individuals are "reproduced" by multiplying with other people who are adapted to the process, and by multiplying them result descendants who have characteristics taken from both parents. Multiplication continues over time, over several generations, which will lead to a state of mobility of the population as the population evolves and adapts to the environment. In the case of neural networks and genetic algorithms, the software developer must make a decision on the conditions imposed on the development model. For example, in the case of models based on genetic algorithms, it can be considered that a single agent can represent the entire population. The genetic algorithm will become a "black box" used by the agent for learning and adaptation in the environmental conditions imposed by the developer. Alternatively, each individual can be programmed as an individual agent, and the result obtained will be a population of intelligent agents interpreted as a whole in the process of evolution. Similarly, we can program each individual agent or groups of agents with neural networks, and each development environment (economy) and society to be represented as a single neural network, each neuron being assimilated with an agent (for this situation it is difficult to built all the attributes of the agent).

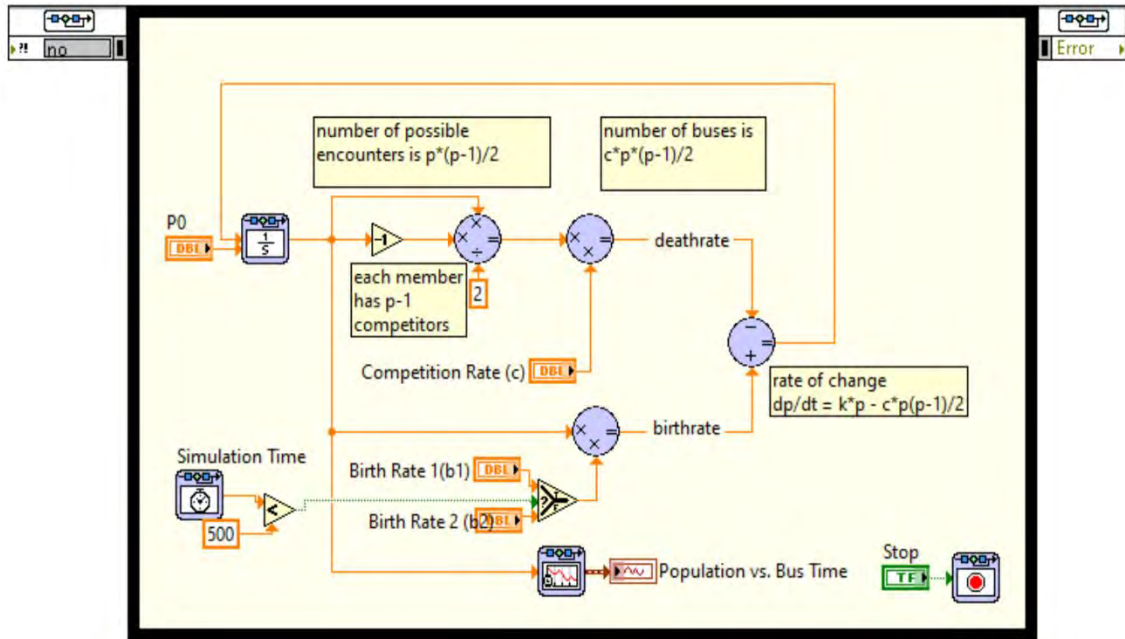


Figure 1. Implementation of game theory for the selection of bus destination

### Implementation of the SMA algorithm and game theory for urban transport

One of the simplest but most effective ways to develop agent-based models is to use a production system algorithm. A production system algorithm has three components:

- multiple rules;
- dynamic working memory;
- a set of prediction rules.

The established rules have two fundamental parts: a set of conditions that specify when the imposed rules will be enforced and when the planned actions will be carried out. For example, an agent may be designed to walk in a simulated environment to purchase any food he encounters in the action. Such an agent will work according to the rule: If I come across a food WHEN I buy it. This would be one of the rules, and each rule in the instruction set will have a different condition. Some rules may include actions that present facts that exist in the collective memory of the agent community, and the conditioning rules will have the role of testing the collective memory. The set (database) of rules analyzes each rule in turn, chooses the rules for which most conditions are met and performs the specified actions, repeating this cycle an unlimited number of times. Different rules can be executed for each action cycle, because the environment changes after an executed rule changes the collective memory, so that new rules for the functioning of the population are generated. Using a production system algorithm, it is easy to build and introduce in the community intelligent reactive agents that respond to external environmental stimuli through actions. It is also possible, but more difficult to achieve agents who may have the ability to think (reflect) on the action of the environment, and the decisions made to shape their knowledge. Another possibility for development is to build agents who create their own rules (learn on their own) using an adaptive algorithm that favors effective actions and can sanction other members of the population. This is the basis of classification and decision systems.

Agents designed on the basis of the production algorithm have a high potential to adapt and analyze their environment and can develop new rules adding knowledge to the collective memory of the population (action memory). To solve certain problems, it is necessary to create intelligent agents capable of learning on their own: so that the internal structure and processing of the rules always adapt to the environmental conditions, which are dynamic. In order to achieve the conditions for the adaptation of agents to the environment, they can be developed on the principle of functioning of neural networks, because they are closest to the human thinking mechanism.



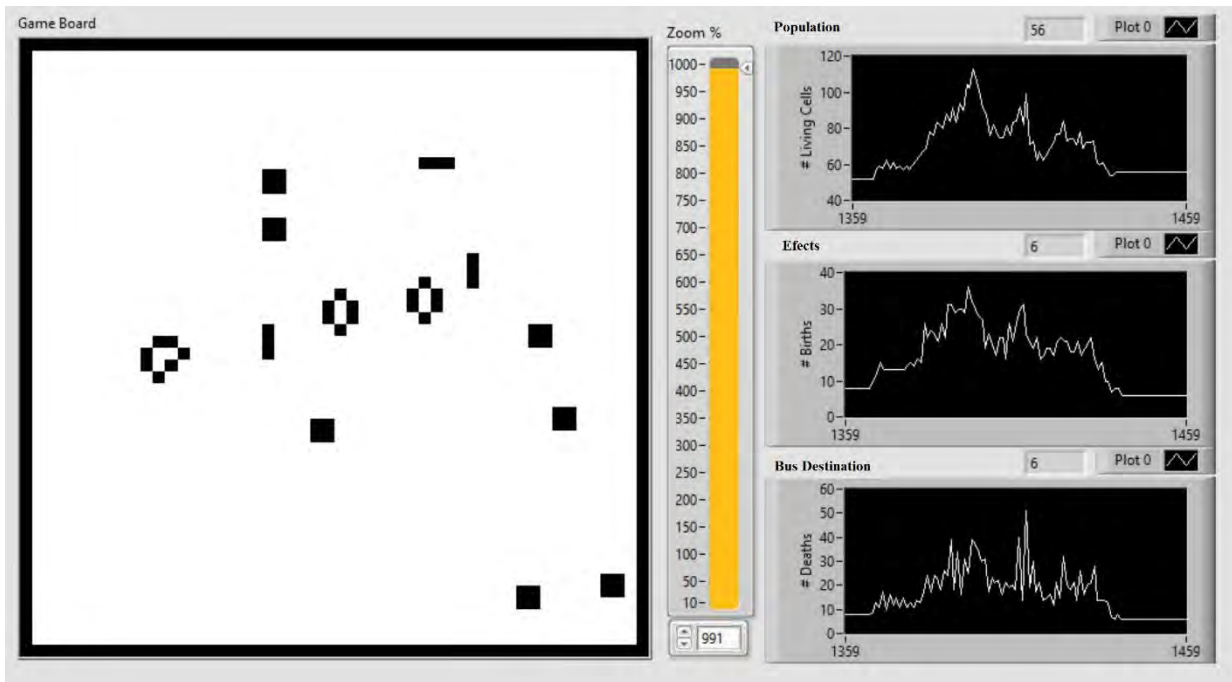


Figure 2. Development adaptive algorithm for bus destination (for the morning hour interval)

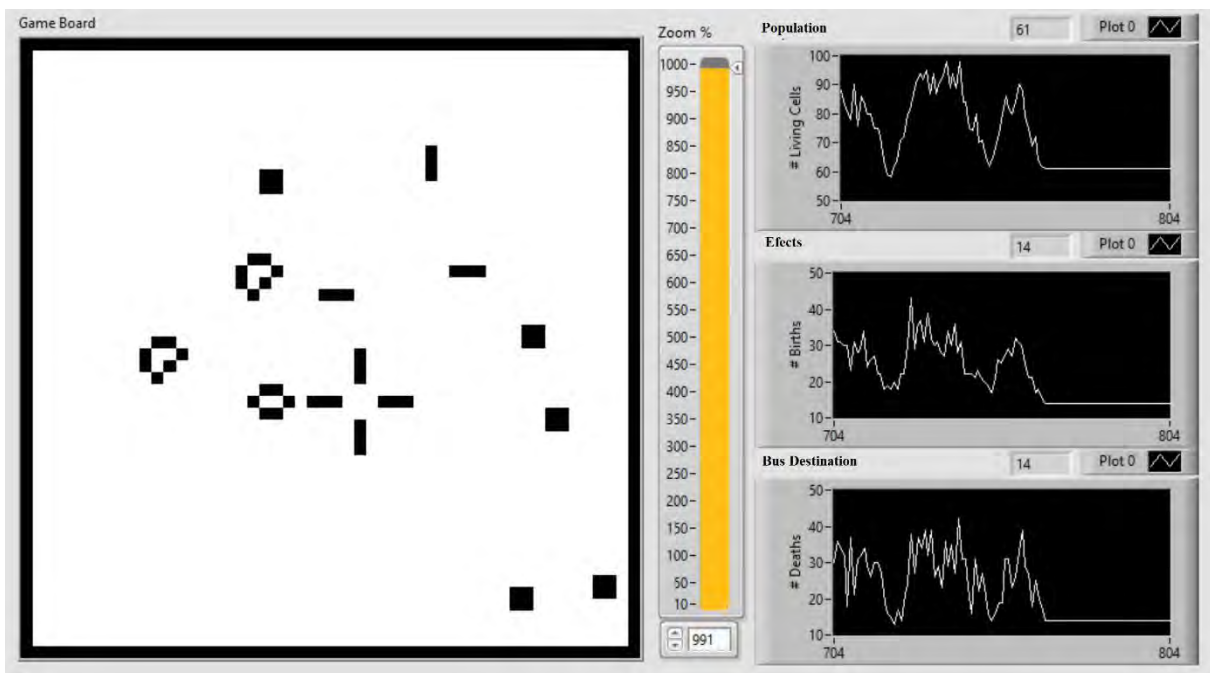


Figure 3. Development adaptive algorithm for bus destination (for the evening time slot)

In this context, the designed cognitive architecture of an agent can be defined as the part of the system that provides and manages the agent's primitive resources. Cognitive architectures usually fold on an information cycle that begins with receiving information by monitoring the execution environment, continues with filtering and processing them, memorizing relevant knowledge, making a decision based on current status and previous experience and ultimately involves taking action. . A system that implements such an architecture should be able to perform a diverse range of cognitive tasks, using a number of problem-solving and information representation methods, and be able to learn as many aspects of work tasks as possible, and of the success of their fulfillment. Theoretically, with an architecture for general intelligence, any aspect of intelligence would be studied, the system should be able to model it within the considered structure.

## Conclusions

Game theory is often found as an analytical tool for solving problems in various fields of activity and is a practical guide to model application strategies in specific areas (management, economics, or policy development by governors). The conditions of game theory are rarely approximated in real life.

Game theory and intelligent agents are algorithms used in prediction and decision-making processes, allowing the development of mathematical models for solving real problems. Prediction and decision making is of great importance in managerial activity in all areas of activity. ITS professionals have to make daily decisions on traffic management, they use both quantitative methods of analysis, but not least prediction software applications. Intelligent transport system managers apply game theory methods developed based on intelligent agents to solve problems and plan traffic problems.

The activity of managers in traffic planning is based on estimating the parameters of the evolutionary game matrix using different methods of implementation with intelligent agents. The main result of the research in this article is the application of game theory and smart agents to traffic planning and in the previous paragraphs we showed how real-time data can be correlated with historical data obtained in different time periods. To achieve very good results for modern traffic planning, software developers use quantitative and qualitative models of smart agents, along with game theory and evolution.

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# SOME MANAGEMENT'S ASPECTS REGARDING BALL BEARINGS MINIMIZING SCRAP

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## Abstract

**Purpose** – The work approaches the finding of a good sorting combination, starting from the traditional method of selective assembly, so that the control over the precision classes of the bearings is more precise and obtaining management procedures to minimize the resulting waste.

**Methodology/approach** - Systemic optimization through a selective assembly method, regarding the control on the radial play of the radial ball bearings.

**Findings** – Following the application of the selective assembly algorithm, some classifications of the radial clearance in the bearing have resulted, with the help of which some management procedures can be obtained for the reduction of bearing rejects.

**Research limitations/implications** – Limitations regarding the application of the method over a wide range of dimensions.

**Practical implications** – Being a wide range of bearing sizes, the proposed algorithm requires a C++ programming language, for the automatic calculation and sorting of the bearing components.

**Originality/value** – optimization algorithm by the method of selective assembly.

**Key words:** Ball-bearing, scrap, selective assembly, management.

## Introduction

Due to the increase of competition in the global industrial production environment, the complexity and technical requirements of the product require the manufacturing industry a higher and more precise execution, both in the semi-finished stage and in the assembly processes, which results in the finished product.

However, in any series manufacturing process, variation is inevitable, even if it is assumed that the parts and assemblies made are identical. Having a difference from the ideal / theoretical case, there are accepted with certain "visual defects, dimensional, etc." that influence little or not at all how to use the products.

In the present paper, we try to optimize the method of selective assembly in the case of radial ball bearings, with contact at a single point, with application on the initial radial clearance, which results in the accuracy class of the bearings. The radial clearance of a radial ball bearing is modified by mounting, due to tightening adjustments, and in operation, due to thermal expansions.

Starting from the definition of the minimum clearance in the whole ball bearing, we will try to define a procedure for sorting the component elements according to our own execution tolerance, having as reference the selective assembly method, and thus to find the best combination of sort, so that the conditions required by the standard are met and the accuracy classes of the bearings obtained are defined so that their scrap is minimized.

In order to ensure high quality of products in modern enterprises and to meet the demands of users, the Quality Management System (QMS) is widely implemented, which contributes to the competitiveness of

products in the market and to the satisfaction of consumer needs. In bearing industries, there is such a QMS, which involves checks and controls, in all phases and operations of achieving the quality of bearing components.

The method proposed and described below can be considered a management method in the stage before bearing assembly, subsequently following the procedures that are done to control the quality of the bearing assembly. The proposed method can be considered prior to the final control procedures, diminishing from the non-compliant assemblies, in the final phase.

### **Literature review**

The quality of bearings manufacturing is an urgent issue for the machine building industry. The method of sorting the selective assembly involves the execution of the parts at economic tolerances and the sorting of the component elements, on groups of dimensions and later their combination in groups of the same rank, so that the closing element is obtained at the desired precision. The method is only suitable for series production.

The method of selective assembly is applied in the case of size chains, in which the tolerance of the closing element is small, and its distribution, to the dimensions of the chain, leads to very small tolerances, uneconomical to achieve or, in some situations, unachievable. The method is widely used not only for assembling cylindrical parts, but also for more complicated parts. Sometimes, selective assembly acquires an exclusive use, being the only rational method from an economic point of view to increase the precision of assembly (manufacture of bearings, injection pump elements, main shafts from machine tools, etc.). The exposition of the method is made for the chain of dimensions that is formed at a clearance adjustment, where the closing element is the clearance (Georgescu, 2009). This method allows either increasing the quality of the final product or reducing the cost of production to meet customer requirements.

With the rapid development of state-of-the-art computers and advanced measurement technologies over the past decade, selective assembly technology has been frequently applied in many industries, especially in high-precision manufacturing sectors such as micro-production (Löchte, J. Kayasa, C. Herrmann, and A. Raatz, 2012), battery assembly (Sheng Yang, Hui Wang, and Hu, 2013), electrodes for batteries (Schmitt, Raatz, Dietrich, Dröder, and Hesselbach, 2014).

The radial clearance, in its initial state, is established so that, after mounting, under normal temperature conditions, the operating clearance is optimal. If the adjustments are made with increased tightening or the operating temperatures are higher, it is recommended to choose bearings with increased radial clearance (unassembled) (Pop, and Tudose, 2006) (A.B. LLC, 2011).

Kannan and the co-authors (Kannan and Jayabalan, 2001), they proposed a new method of selective assembly, which consists in dividing into two stages of assembly: inner ring-ball, ball-outer ring. In the first stage, they had as references the dimensions of the ball, in order to satisfy the minimum and maximum clearance conditions imposed, and in the second stage they had as reference the group formed in the first stage, also to satisfy the imposed requirements. Their result was the reduction of scrap, from 12,5% by the traditional method of selective assembly, at 8,39% by the method proposed by them, the study being performed on the same dimensions and characteristics.

Kannan and co-authors (Kannan, Asha, and Jayabalan, 2005), proposed an improvement of the selective assembly method for assembling a shaft with a bore, using a genetic algorithm, in order to obtain the best combinations of selective groups, in order to have a minimum variation of the overall clearance. The proposed method was performed in three steps, to use the entire population of mating parts, using a C ++ programming language.

Wang and co-authors (W.M. ; Wang, D. B. # Li, F. & He, and Y. F. Tong, 2018), proposed the approach of a selective assembly scheme for an improved grouping, based on the genetic algorithm (GA), where the elitist strategy was integrated to improve the convergence of the algorithm. The results of their experiments, using the improved GA method, were able to increase the percentage of products assembled from 35,33% at 73,84%.

In their paper (Liu and Liu, 2017), the authors approached the determination of a number of groups for selective assembly, a study conducted on the whole dimensional chain consisting of a main shaft, cylinder, upper bushing and lower bushing. The method consists in dividing into tolerance groups and

grouping the components of the size chain by color codes, so that the assembly results in the technical specifications required by the manufacturer.

In their work, Asha and Babu (Asha and Rajesh Babu, 2017), conducted a study on the variation of tolerance to selective assembly, applying metaheuristic techniques such as Genetic Algorithm (GA), Simulated Annealing algorithm (SAA) and Memetic algorithm (MA). Their case study confirms the proposed approach as more competitive than traditional ones and the reduction of surplus in assemblies.

For enterprises producing bearings for air, rail, automotive and other industries, there is the Technological Process Monitoring System (TPMS), which monitors equipment and parts, processes data on the parameters of monitored objects and makes decisions on process adjustment or machine maintenance, while increasing the quality of the parts (Vahidova et al., 2019), (Osipov, 2011). The program algorithm for diagnosing the inner ring surface uses the Trace mode, which consists in determining the amplitude parameters (reading from the vortex sensor) to identify the deviation max. and min., subsequently the coefficients being compared with the reference characteristics (Samoilova, and Ignatieva, 2015), (Ignatieva, 2015).

In their paper (Yu, Sun, and Geng, 2015), they conducted a study on the quality, inspection and sorting of ball bearings, using an electrical signal system, which is based on the theory of current inspection. The results show that the designed system can detect types of defects such as dimensional, cracks, etc.

## Model development management

### Grouping method optimization management

Starting from the possibility of a new internal geometric configuration, in which the author D. Săvescu made a study in this regard, in which he came to the conclusion that a different internal geometric configuration is possible, but there are restrictions such as mounting possibilities without elastic deformations, the minimum thickness of the rings is determined by technology (Săvescu, D. 2005), an attempt will be made to obtain an optimization for the selective assembly method, having as reference the new geometric dimensions for the raceways of the rings and the afferent balls.

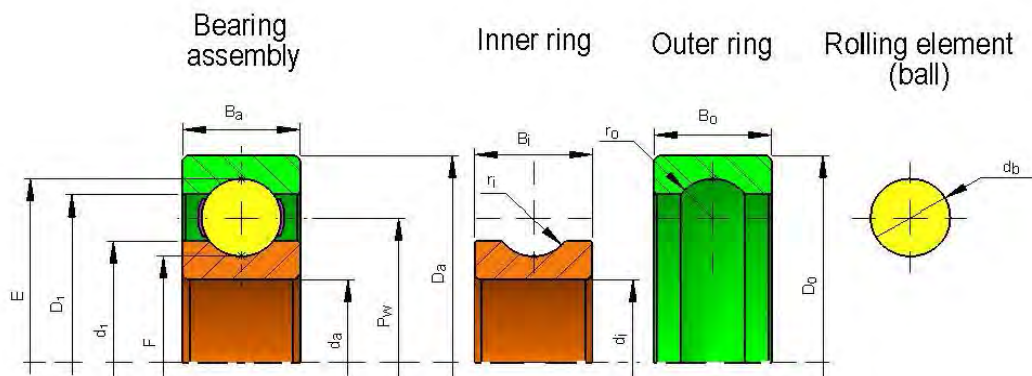


Figure 1. Geometric parameters for ball bearing

The basic geometric parameters for the radial ball bearing are presented in *Figure 1*:  $D_a$  - the outer diameter of the bearing;  $d_a$  - the inner diameter of the bearing;  $P_w$  - primitive disposal diameter of the rolling bodies;  $E$  - external ring rolling-way diameter;  $F$  - internal ring rolling-way diameter;  $D_1$  - external ring collar diameter;  $d_1$  - internal ring collar diameter;  $B_a$  - width bearing;  $d_i$  - inner diameter of the inner ring;  $B_i$  - the width of the inner ring;  $r_i$  - running radius of the inner ring;  $D_o$  - outer diameter of the outer ring;  $B_o$  - the width of the outer ring;  $r_o$  - running radius of the outer ring;  $d_b$  - the ball diameter.

In the standards in force, such as ISO 492: 2014, regarding the dimensional and geometric particularities of the bearings, the internal geometric dimensions are not mentioned, but only some tolerances and deviations, minimum and maximum, in which these bearings should work, in condition unassembled

and at normal temperatures (ISO, 492:2014, 2014). Therefore, each manufacturer has its own "internal kitchen", in which the final product must comply with some final standards of operation.

The first step, for optimizing the selective assembly method, was to determine the primitive diameter with the relation (1), the diameter of the raceways of the 2 rings, inside and outside with the relations (2) and (3).

The improved selective sorting method can be considered a management procedure prior to the Quality Management System, from the final assembly phase, starting from the internal geometry of the bearing, more precisely from the primitive diameter,  $P_w$ .

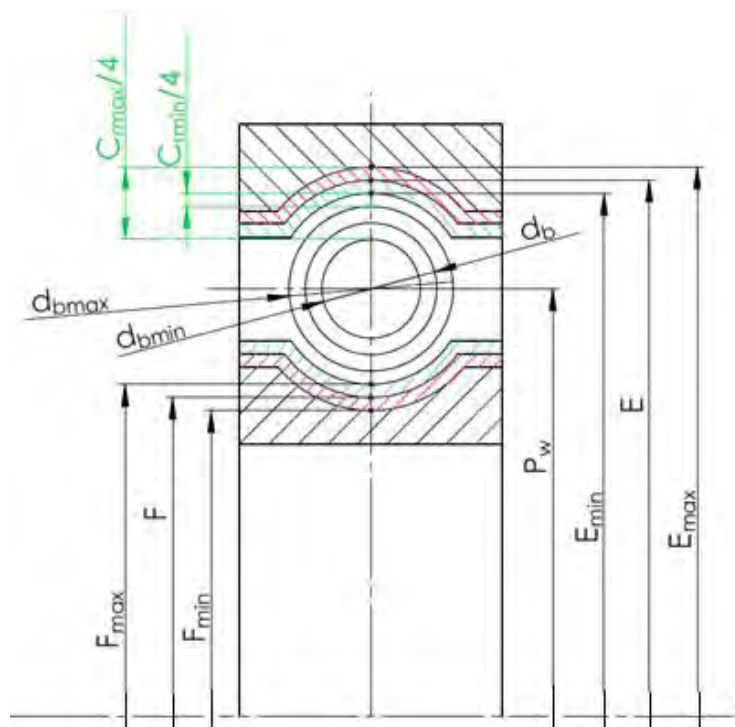
$$P_w = 0.55D_a + 0.45d_a \quad (1)$$

$$E = P_w + d_b \quad (2)$$

$$F = P_w - 2d_b \quad (3)$$

Between the rolling bodies and the raceways there is a clearance that can be radial  $C_r$  or axial  $C_a$ . This is defined as the average of the possibilities of displacement in radial or axial direction, respectively, of one of the bearing rings in relation to the other held fixed, when their geometric axes are parallel or coincide.

The value of the clearance before mounting the bearing on the shaft or in the housing was called the original clearance. And further on, the study will be done on this type of initial radial clearance, before being mounted, because after mounting the bearing, the clearances change due to the external parameters that appear.



- $A_{sE}$  – upper deviation for E;
- $A_{iE}$  – lower deviation for F;
- $A_{sdb}$  – upper deviation for  $d_b$ ;
- $A_{idb}$  – lower deviation for  $d_b$ ;
- $A_{sF}$  – upper deviation for F;
- $A_{iF}$  – lower deviation for F;
- $F_{min} = F - A_{iF}$ ;  $F_{max} = F + A_{sF}$ ;
- $E_{min} = E - A_{iE}$ ;  $E_{max} = E + A_{sE}$ ;
- $d_{bmin} = d_b - A_{idb}$ ;  $d_{bmax} = d_b + A_{sdb}$ ;
- $C_{rmin}$  – the minimum radial clearances for ball bearings;
- $C_{rmax}$  – the maximum radial clearances for ball bearings;

Figure 2. Geometric parameters with MIN and MAX dimensions

To obtain a controlled clearance in the bearing assembly, a selective sorting procedure will be applied and an attempt will be made to obtain a controlled precision class for the bearings. This method can be considered a management procedure, because it is a stage that is performed before the final stage, that

of assembling the bearings, through which their scraps can be minimized and the final quality is increased.

Minimum radial clearance, from the bearing assembly,  $C_{rmin}$ , was determined by subtracting the maximum size of the inner ring raceway,  $F_{max}$  and two maximum dimensions of the ball diameter,  $d_{bmax}$ , from the minimum size of the outer ring raceway,  $E_{min}$ , which are given in the equation (4).

$$C_{rmin} = E_{A_{iE}} - F_{A_{sF}} - 2d_b^{A_{sdb}} = A_{iE} - A_{sF} - 2A_{sdb} \quad (4)$$

$$C_{rmax} = E^{A_{sE}} - F_{A_{iF}} - 2d_{b_{A_{idb}}} = A_{sE} - A_{iF} - 2A_{idb} \quad (5)$$

The maximum radial clearance in the bearing assembly,  $C_{rmax}$ , was determined by subtracting the minimum size of the inner ring raceway,  $F_{min}$  and two minimum dimensions of the ball diameter,  $d_{bmin}$ , from the maximum size of the outer ring raceway,  $E_{max}$ , which are given in the equation (5).

The tolerance of a size is determined by subtracting the minimum size from the maximum size, for example:  $\sigma_F = F_{max} - F_{min}$ ;  $\sigma_E = E_{max} - E_{min}$ ;  $\sigma_{db} = d_{bmax} - d_{bmin}$ ;

In the traditional selective assembly method, the tolerances of the dimensions to be mounted are divided equally, into n groups and subsequently assembled so as to satisfy the final conditions and the reduction of scrap, for example:  $\sigma_1 = F_1 + E_1 + d_{b1}$ . In Figure 3 is represented the distribution of tolerances in n groups.

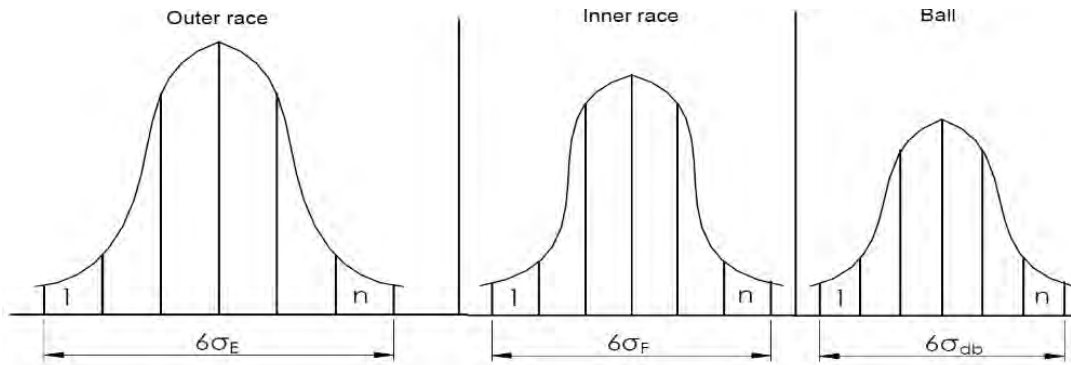


Figure 3. Group tolerance for outer race, inner race and ball

The selective assembly variant proposed in this paper, in order to minimize the scrap of bearing components, was to find a convenient sorting method, so that the final requirements are met, the scrap are minimal and also increase the accuracy of the assembly. Therefore, it was found that the most convenient selection for the first group would be the assembly of the outer ring having tolerance from group n, with the inner ring having tolerance from the first group, respectively the tolerance ball from the first group. This has been shown in the equations (6) - (9).

$$\text{Gr. I} \quad C_{rmin} = A_{iEn} - A_{sF1} - 2A_{sdb1} \quad (6)$$

$$C_{rmax} = A_{sEn} - A_{iF1} - 2A_{idb1} \quad (7)$$

...

$$\text{Gr. n} \quad C_{rmin} = A_{iE1} - A_{sFn} - 2A_{sdbn} \quad (8)$$

$$C_{rmax} = A_{sE1} - A_{iFn} - 2A_{idbn} \quad (9)$$

## Case study on the management of the optimization of the grouping method

To demonstrate the optimization of the method presented above, we will further analyze a simple radial bearing, with balls on a single row, with contact at a single point. The bearing for analysis is of type 6305 SKF, having the following characteristics:  $D_a = 62 \text{ mm}$ ;  $d_a = 25 \text{ mm}$ ;  $B_a = 17 \text{ mm}$ ;

Starting from the equations (1) - (3), the primitive bearing diameter and the bearing diameters for the two rings were determined:

$$P_w = 0.55D_a + 0.45d_a = 0.55 \times 62 + 0.45 \times 25 = 45.35 \text{ mm}$$

$$E = P_w + d_b = 45.35 + 11 = 56.35 \text{ mm}$$

$$F = P_w - 2d_b = 45.35 - 2 \times 11 = 34.35 \text{ mm}$$

It is assumed that the possibilities and capabilities of the technological process available, for the processing of the components of the bearing and more precisely for the processing of the raceway for the inner ring,  $F$ , of the raceway for the outer ring,  $E$  and of the rolling element,  $d_b$ .

$$E_{A_{iE}}^{A_{sE}} = 56.35_{-0.018}^0 \text{ mm} \rightarrow T=18 \text{ } \mu\text{m};$$

$$F_{A_{iF}}^{A_{sF}} = 34.35_0^{+0.012} \text{ mm} \rightarrow T=12 \mu\text{m};$$

$$d_b_{A_{idb}}^{A_{sdb}} = 11_{-0.0065}^{-0.0005} \text{ mm} \rightarrow T=6 \text{ } \mu\text{m};$$

These being said, for the dimensional characteristics mentioned above, with the equations (4) and (5) we can calculate the minimum and maximum clearance for the tolerances we can execute, mentioned above. As you can see below, the tolerance between maximum and minimum clearance is quite high,  $41 \mu\text{m}$ , given that, for example, normal accuracy class for this type of bearing, tolerance is up  $15 \mu\text{m}$ , according ISO 492:2014.

$$C_{rmin} = A_{iE} - A_{sF} - 2A_{sdb} = 0 - 0 - 2(-0.5) = 1 \text{ } \mu\text{m};$$

$$C_{rmax} = A_{sE} - A_{iF} - 2A_{idb} = 18 - (-12) - 2(-6) = 42 \text{ } \mu\text{m};$$

Next, the above tolerances will be divided into six groups of equal tolerances, as shown in *Figure 3*. The rang for each group was shown in the draws below, respectively  $3 \mu\text{m}$  for  $E$ ,  $2 \mu\text{m}$  for  $F$  and  $1 \mu\text{m}$  for  $d_b$ .

$$T_E = 18 \text{ } \mu\text{m} \rightarrow \sigma_E = T_E / 6 = 3 \text{ } \mu\text{m};$$

$$T_F = 12 \text{ } \mu\text{m} \rightarrow \sigma_F = T_F / 6 = 2 \text{ } \mu\text{m};$$

$$T_{db} = 6 \text{ } \mu\text{m} \rightarrow \sigma_{db} = T_{db} / 6 = 1 \text{ } \mu\text{m};$$

Table 1. Division tolerances groups (all value are exprimate in  $\mu\text{m}$ )

Group	1		2		3		4		5		6	
	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
E	0	3	3	6	6	9	9	12	12	15	15	18
F	-12	-10	-10	-8	-8	-6	-6	-4	-4	-2	-2	0
db	-6.5	-5.5	-5.5	-4.5	-4.5	-3.5	-3.5	-2.5	-2.5	-1.5	-1.5	-0.5

Following the equations (6) - (9), simultaneously with the data from *Table 1*, you can calculate the minimum and maximum clearance for each group. All groups will be calculated similarly, and the results are tabulated in *Table 2*. It was found that the accuracy of the adjustment decreases with increasing groups. Therefore, group I would be the least accurate, having a fairly large overall clearance ( $MIN=36 \mu\text{m}$  and  $MAX=46 \mu\text{m}$ ), and group VI, would be the most accurate having a very small overall clearance ( $MIN=1 \mu\text{m}$  and  $MAX=8 \mu\text{m}$ ).



Gr. I  $C_{rmin} = A_{iE6} - A_{sF1} - 2A_{sdb1} = 15 - (-10) - 2(-5.5) = 36 \mu m;$

$C_{rmax} = A_{sE6} - A_{iF1} - 2A_{idb1} = 18 - (-12) - 2(-6.5) = 43 \mu m;$

...

Gr. VI  $C_{rmin} = A_{iE1} - A_{sF6} - 2A_{sdb6} = 0 - 0 - 2(-0.5) = 1 \mu m;$

$C_{rmax} = A_{sE1} - A_{iF6} - 2A_{idb6} = 3 - (-2) - 2(-1.5) = 8 \mu m;$

Table 2. Tolerances resulting from selective grouping (all value in  $\mu m$ )

Gr. I		Gr. II		Gr. III		Gr. IV		Gr. V		Gr. VI	
MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
36	43	29	36	22	29	15	22	8	15	1	8

Following these resulting groups, it was noted that in order to obtain a good precision class, Gr. VI, from the same manufacturing batch, with the mentioned dimensional deviations, the best selective sorting was the assembly of the outer rings from Gr. n (having the largest dimensional deviations), together with the inner rings from Gr. 1 (having the smallest dimensional deviations) and with the balls from Gr. 1 (having the smallest dimensional deviations).

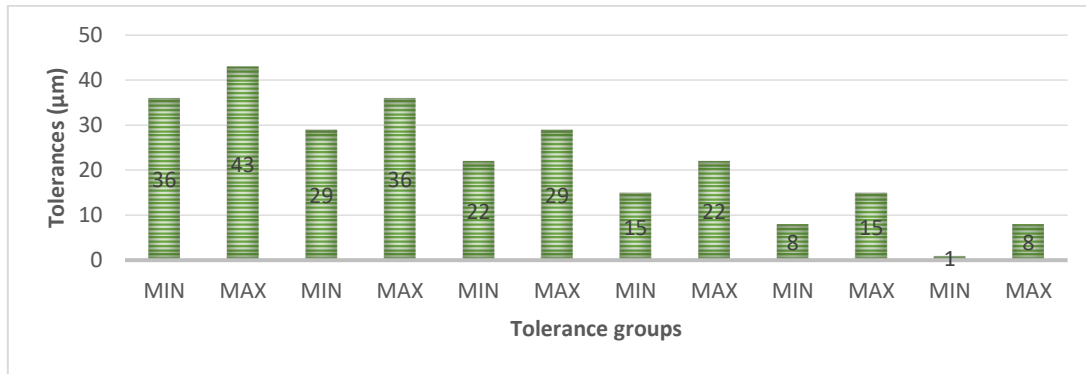


Figure 4. New tolerance groups resulting from selective assembly

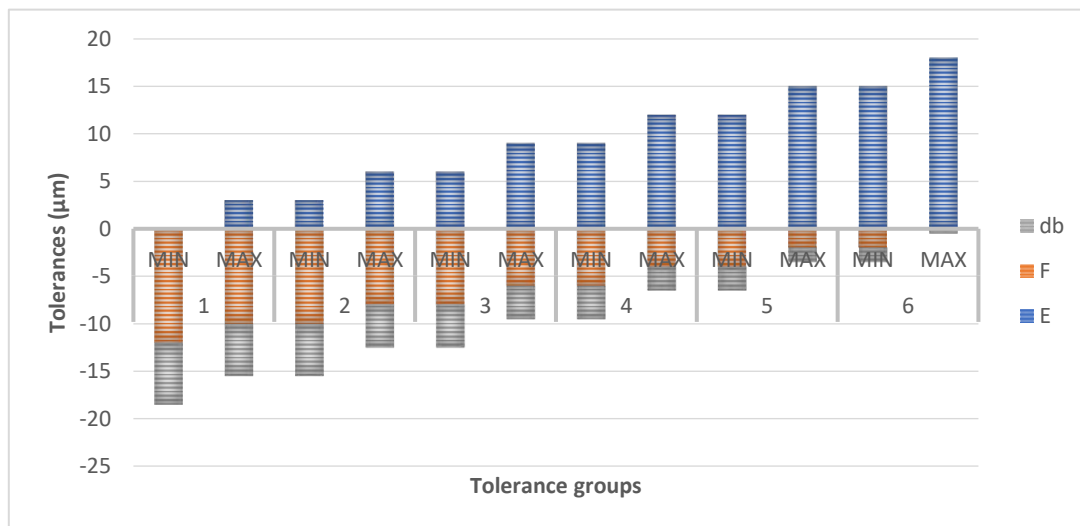


Figure 5. Diagram with dividing tolerances

In *Figure 4*, the tolerance diagram of the resulting groups was presented, following the selective assembly method. It can be seen that the tolerance distribution of the new resulting groups is similar to the tolerance of the inverted *E* bodies, as the above method was presented.

In *Figure 5*, a diagram represented here with the distribution of tolerances on the six largest groups, having as reference the zero line, for the assembly of the three elements *E*, *F*, *db*. It can be seen that it can be reduced to a minimum for *E* and *F* is below the reference line, the deviation for *db* is above the reference line.

## Conclusions

Also, through this management procedure, based on the sorting of the component elements according to their tolerance, it was found that it is possible to have a control over obtaining the dimensional deviation from the ball-bearings.

Compared to ISO precision classes of radial ball bearings, of *Table 3*, where *C2* is the most accurate class and *C5* the least accurate, it can be seen that the groups obtained with this optimized selective method can fit on the same principle of grouping from ISO 492:2014. (*Gr. I – C5; Gr. II – C4; Gr. III – C4; Gr. IV – C3; Gr. V – N; Gr. VI – C2*).

This method was also tried for its assembly *E* only with positive deviation, with *F* only with negative deviation and *d<sub>b</sub>* only with negative deviation, but the result was that in one group the minimum game was negative.

It tried to assemble and selection of *E* positive, with *F* negative and *d<sub>b</sub>* with intermediate deviation, but even in this case, the maximum clearance for one of the groups was negative.

Table 3. Accuracy classes. Extract from ISO 492:2014

d (mm)		C2 (μm)		N (μm)		C3 (μm)		C4 (μm)		C5 (μm)	
>	≤	min	max	min	max	min	max	min	max	min	max
24	30	1	11	5	20	13	28	23	41	30	53

The results obtained in this paper will be passed to a next stage, in a Mathcad programming language, to identify the possibilities of developing, verifying and implementing the sorting method, at parameterized level, for different types of bearings.

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# THE EVOLUTION TOWARDS HOLISTIC MARKETING, A SOLUTION FOR ETHICAL CONSUMERISM

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## Abstract

**Purpose** – The aim of this paper is to study the connection between marketing and consumerism and to determine whether the adoption of revolutionary marketing concepts can have as an effect a new style of consumerism: ethical consumerism.

**Methodology/approach** – The research involved conducting a study on the level of understanding and approach to holistic marketing concepts and their impact on the effect of consumerism but also an analysis of the literature on this topic.

**Findings** – The paper managed to define holistic marketing, to establish its connection with consumerism, to determine the level of knowledge of Romanian entrepreneurs related to this topic.

**Research limitations/implications** – *The literature still provides limited information on the subject of holistic marketing and ethycal consumerism*

**Practical implications** – Once these concepts are adopted, the implications are beneficial for both businesses and society and the environment.

**Originality/value** – The paper brings to the fore the definition of the latest marketing concept, holistic marketing and establishes its link with ethical consumerism, concepts that once implemented will lead to an improvement in the performance of Romanian enterprises but also to sustainable development and educating the population to a ethical style of consumerism.

**Key words:** *consumerism, holistic marketing*

## Introduction

Contemporary marketing practices are accused of contributing to the creation of a materialistic society based on consumption. Various authors have expressed opinions over or against this statement over time, but no conclusion has yet been reached to prove any of opinions. However, understanding marketing concepts and their evolution, together with their effects on society in general and the consumer in particular, has led to the development of new sustainable ideas and strategies that have positive effects on society and the environment. This new concept, called holistic marketing, can exploit man's natural desire to consume, without these actions having long-term negative effects on consumer satisfaction and satisfaction, on society and the environment.

### From marketing to strategic-societal-relational-marketing

Marketing is a complex and complete science and is more than a business process for building relationships and meeting consumer needs, and over time it has received many definitions, one of the simplest being: "Marketing involves customers and managing profitable relationships with them, creating value for customers to collect in return, value from them." (Kotler, 2018)

The father of modern marketing, Philip Kotler, says that marketing should have been written "market-ing", (Kotler, 2016) to remind us that everything starts from a constantly changing market and to understand cutting-edge marketing concepts, we need to understand how the market has evolved over time and with it, the different marketing philosophies. By accepting the compound term "market-ing", the authors of this research give a new meaning to the term "-ing" considering that it refers to the implementation through research, analysis and product design of product-market couples agreed by consumers. (Agache, Izvercian, 2020)

Since the appearance of this concept, marketing has developed around the customer and his needs and even more, around his desire to consume. In the last three centuries, the growing desire to consume and the development of increasingly sophisticated marketing strategies have gone hand in hand (Stearns, 2006) which has led to the development of a negative connotation to both marketing and the concept of consumerism, many authors arguing that marketing and its actions have negative effects on both the consumer and the environment.

Research on this topic is insufficient and no conclusion has yet been reached on whether marketing causes consumerism and whether this is harmful. The aim of this paper is to study the connection between marketing and consumerism and to determine whether the adoption of revolutionary marketing concepts can have as an effect a new style of consumerism: ethical consumerism.

Marketing as a science is evolving with the market and it is important to adapt to it. In the last 100 years, marketing has evolved continuously, being constantly interconnected with the target audience. The rapid evolution of the company's environment has meant that the company's marketing function has to anticipate changes in the environment and plan in the long run a complex approach that takes into account both changes in the environment of which the company is part and in relation with the markets in which it competes. This approach is known as strategic-marketing. (Izvercian, 2002)

The early 90's led us to strategic-societal marketing as a marketing perspective characterized by assuming social, human and environmental responsibility, when the company realizes that between the needs of market participants (customers, consumers, companies) and the needs of this planet can arise serious long-term contradictions. (Bruhn, 1999)

In the continuous development of the environment, society, consumers, values, information technologies, through the evolution of relationships due to social media and new channels and ultra-fast communication, as an effect of uninterrupted access to large amounts of information, a new approach on marketing appears, namely holistic marketing. We propose (Agache et al., 2020), taking into account the evolution of the elements mentioned above and the connection between them, in multi-dynamic systems, the notion of strategic-societal-relational-marketing whose performances become directed both to the internal objectives of the company and to the effects of the company's actions on long term in which all the factors involved in the company's activities participate.

### **Consumerism – is it a problem or not?**

The "consumer age" began when supply exceeded demand. At that moment, the companies realized that all attention must be paid to the customer, to his wishes and needs because he is the secret to the success of any company. Concern for consumer interests is called "consumerism" and according to author Philip Kotler, is not limited to an organizational effort but is more than that, representing "a social movement that seeks to increase the rights and power of the buyer in relation to the seller." (Kotler, 2016)

The problem of consumerism is a very discussed one, having, depending on the authors, two different and often contradictory approaches:

- A positive approach: the consumer must play a decisive role in market developments and market decisions. This approach supports the rights of the consumer by making the market and economic factors that carry out their activities directly responsible for consumer protection by offering tested and high quality products, according to customer requirements. Moreover, these standards have been regulated by law, with various institutions for consumer protection being set up all over the world.

- An approach with a negative connotation, initiated by Vance Pacard: consumerism referring to "high levels of consumption", being associated with an "economic materialism" and selfish and superficial activities to buy products. (Severo, 1996)

With the evolution of the market, the marketing actions of companies have become more influential and increasingly focused on the consumer. Therefore, it is natural that the term consumerism, understood as excessive materialism, to be associated with these increasingly complex marketing activities.

The link between marketing activities and excessive consumerism has created many assumptions, but it has not yet been scientifically proven whether increasing levels of consumption have a direct link with the development of marketing strategies. Empirically one can make the connection between these actions and the increase of consumerism however, marketing activities are not the only ones responsible for these effects. Other factors are also responsible, among which we can mention: human need, consumer desires, demand level, purchasing power, general economic situation, the changing environment, etc. and as long as the total effects of these elements are kept within reasonable limits, the authors consider that the effects of marketing are not harmful to society.

$$Ec = f (Mk, Nev, D, S, M ...) \leq \text{reasonable};$$

Ec - the effects of consumerism

Mk - marketing activities

Nev - human needs

D - consumer wishes

S - the level of consumer satisfaction

M - changes in the environment

As can be seen, the effect of consumerism depends on both marketing actions, which can be controlled by the company but also on uncontrolled ones such as buyer behavior and changes in the environment, therefore, marketing researchers need to focus more on the effects of science on consumerism and not so much on the effects that depend on consumer psychology.

For these reasons, the question arises of defining this reasonable limit, a limit beyond which the effects of consumerism can have a negative impact on society and the environment.

### **Research - holistic marketing, a solution for consumerism**

The presence in a market saturated with innovative products, advertisements and other customer-oriented actions is difficult for both the company and the consumer who, by its nature, is built to consume. The buyer, who is apparently the holder of a great power, namely the information, ends up being overwhelmed by the multitude of variants, opinions and recommendations in order to make a purchasing decision that satisfies both him and the needs of society. As a result of the multiple possibilities of choice, the competition is ruthless and the companies need a different vision, sustainable and global both on the company and on the market in which they operate. This new marketing philosophy, holistic marketing is an extension of the marketing philosophy that recognizes the complexities of marketing activities, their depth and interdependencies. (Kotler, 2016)

Following the research we propose to define holistic marketing as representing the set of subsystems, endogenous and exogenous to a given entity in which all relationships and connections lead to a system interconnected and integrated with other systems that focus on the "customer" in order to obtain the best solutions.

In the new perspective, holistic marketing is based on research, design, development and implementation of marketing processes and activities interconnected and integrated with other processes for the realization of products and services that satisfy the thesis of the irreducibility of the whole to the sum of its parts.

As a consequence, holistic marketing is a creative and innovative approach that is based on the analysis, organization, planning and control of all resources and activities of a company to meet customer needs in a cost-effective and sustainable manner, taking into account all elements of the

environment and society while creating a continuous and homogeneous link between the company, the external environment and society. (Figure 1)

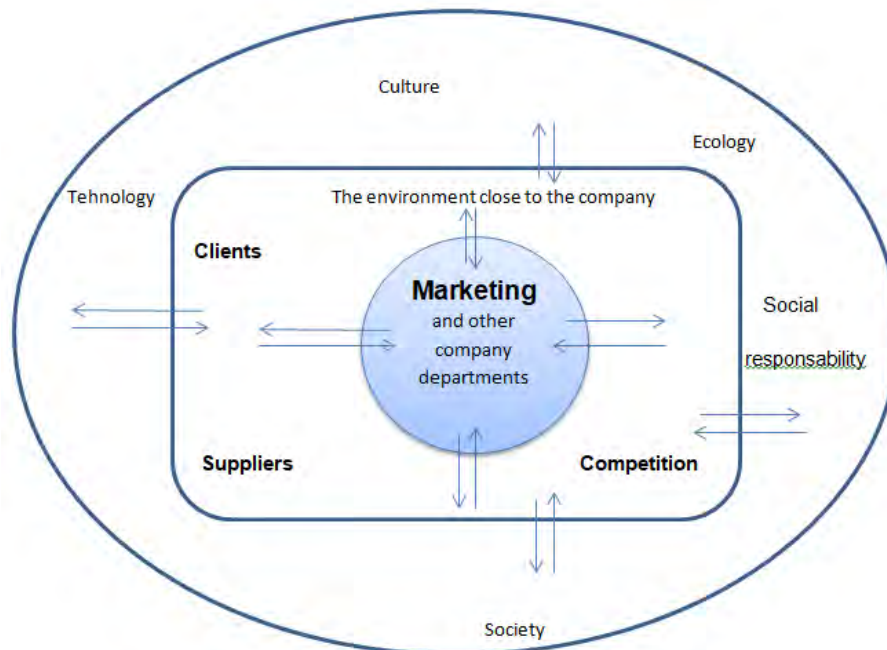


Figure **Eroare! În document nu există text cu stilul precizat.**1. Representation of Holistic Marketing

Ethical consumerism is a type of consumer activism, which is practiced through the purchase of ethically manufactured products, which supports small producers and local artisans, while protecting animals and the environment, and discourages the purchase and consumption of products that exploits children as workers, are tested on animals or harms the environment.

Our hypothesis (Agache et.al., 2020) is that raising the level of education among entrepreneurs or decision-makers in Romanian companies by offering solutions for the implementation of holistic marketing can lead to ethical consumerism.

To strengthen this hypothesis, we conducted a study on the level of understanding and approach to holistic marketing concepts and their impact on the effect of consumerism, in the form of a questionnaire structured in 32 questions, distributed online to people who are part of our group of interest. The sample is 82 respondents and includes people aged 18-70, with higher education or in the process of completing a higher education cycle. Among the respondents, 82.5percent are decision-makers in the company where they work or entrepreneurs, the difference of 17.5percent being employees or students.

### Findings and results of the investigation

The sample investigation relates to:

- The marketing termen, respectively the holistic marketing term
- Marketing practices in the responders companies
- Opinions about holistic marketing
- Sustainability
- The degree of involvment of companies in sustainability actions

The analysis of the questionnaire shows that there is a lack of managerial and marketing culture among the leaders of small and medium enterprises in Romania. The simplistic notions of marketing are not clearly understood, and the approach of more complex concepts, such as those discussed in this paper

confirms the suspicion that among Romanian managers there is a great need for education in this field. This partial conclusion follows from the questions:

- “The term marketing is very often used, what do you think it refers to”, a question with multiple possibilities of answer, to which 46 respondents say that marketing refers only to “sale and promotion of products and services”
- “In the company where you work, marketing means...”, a question with multiple possibilities of answer, to which only 21 respondents associated the marketing function with the product design and manufacturing, 27 also associated with the organization of actions for the benefit of society or with positive impact on the environment, but most said that marketing means creating offers and promotions -59 respondents, market research on consumer needs -60 respondents or the design and implementation of advertisements -59 respondents

However, the theoretical notions are better mastered by Romanian entrepreneurs than practice because in only 4.9percent of the studied companies there is a marketing department and only 14.6percent have a marketing manager. Most Romanian companies put marketing into practice through advertising and promotion through various channels - 24.4percent, sales promotion - 18.3percent and 17.1percent of subjects say that no marketing is practiced at all in the company / institution in of which they are a part.

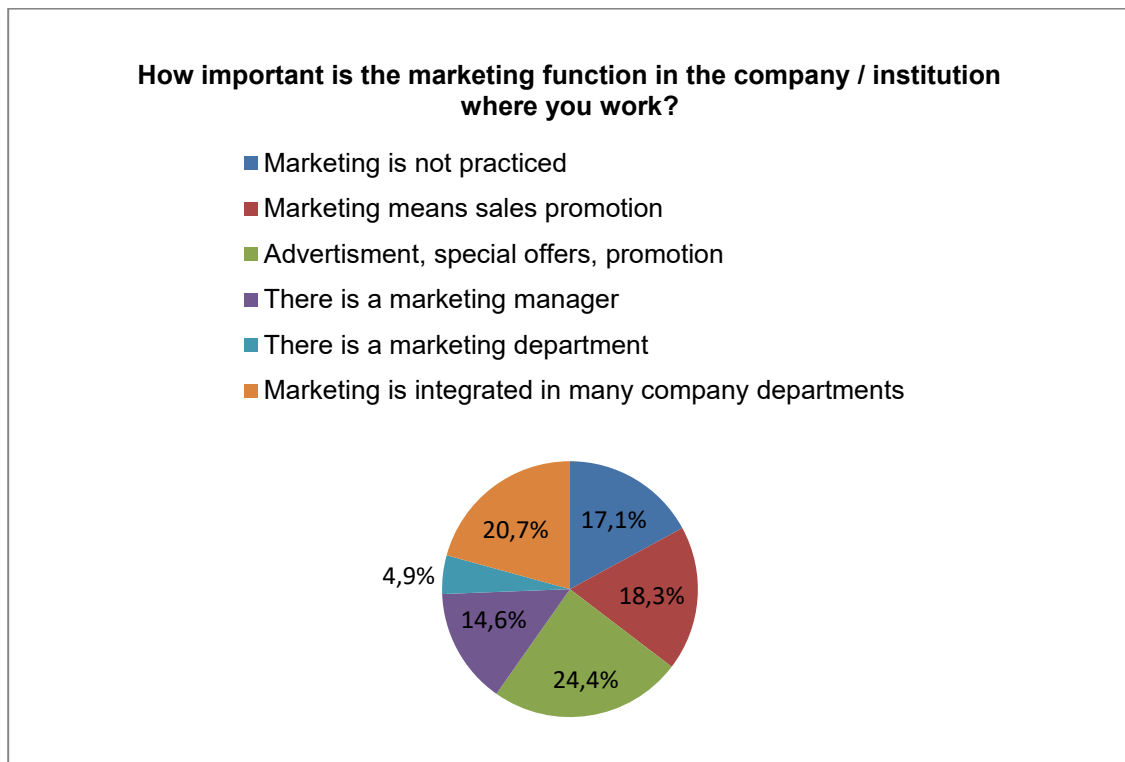


Figure 2. Importance of marketing function

However, after explaining the concepts of holistic marketing and the effects of adopting this concept, it can be said that the world is permissive, open to the new:

- 65.4percent of respondents say that the fact that marketing changes consumer behavior is a good thing, because companies, through their actions, can educate the consumer.
- 49.4percent of entrepreneurs and decision makers in Romanian SMEs (Small and Medium Enterprises) do not consider that the implementation of holistic marketing will lead to a decrease in profits of the company where they work, 43percent say they can make a profit, but not as high and only 7.6percent some of them are more pessimistic, considering that sustainable products will no longer be bought by their company's customers.

Holistic marketing is based on sustainability, a concept that respondents know but which the majority (87.3percent of respondents) associates only with environmental protection. Sustainability is a support



for holistic marketing and has been analyzed in terms of social, economic and environmental responsibility:

- When asked about the degree of involvement of ecological actions and environmental protection of the company in which the respondents operate, 11percent of them say they are not involved at all, 41.5percent are rarely involved, 14.6percent are often involved, 20.7percent organize sometimes and 12.2percent often organize such activities
- When asked about the degree of involvement of social responsibility actions of the company in which the respondents work, 12.3percent of them say they are not involved at all, 43.2percent are rarely involved, 22.2percent are often involved, 13.6percent organize sometimes 8.6percent often organize such activities
- 73.8percent of the respondents claim that their company is economically responsible and that they practice fair prices in relation to the purchasing power of the Romanian consumer, 22.2percent cannot express themselves regarding the answer to this question, 2.5percent say that their company could charge slightly lower prices and only 1.3percent say that the prices charged by their company are much too high for the purchasing power of the Romanian consumer

After analyzing the study, one can see an overview of respondents on the subject of marketing, the average consumer can see only the end of this cycle, which is a marketing action. In reality, however, marketing is not an action, but a continuous process from research, design, implementation, realization and feedback as it appears from the notions proposed and discussed above.

### Conclusions

Holistic marketing is the one that can give the answer to these "mal compris" in terms of marketing mission in the company's activities and we believe that the implementation of holistic marketing by sustainable companies brings many benefits to the business and at the same time contributes to educating and transforming the market, leading to ethical consumerism.

The duty of researchers in this field is to contribute to the formation of a managerial and marketing culture among Romanian entrepreneurs, to lay the foundations of models to facilitate the implementation of theoretical notions, both to increase the performance of Romanian companies and for sustainable development and education of the population towards an ethical style of consuming.

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# IDENTIFYING STUDENT INTERNSHIP RISKS USING THE QUESTIONNAIRE METHOD

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## Abstract

**Purpose** – The internship that students enter upon concluding framework agreements between educational establishments (internship organizers) and various economic agents (internship partners). This activity is especially important, as it is also regulated from a legal standpoint through Law no. 258/2007. In order for this activity to fully achieve its goal, and in order for it to be carried out in optimum conditions, aside from heeding the legal provisions, an awareness of the risks that may occur and the possibilities to remove and manage them is also necessary.

**Methodology / Approach** – Students' internships precede their activity as future employees, and are meant to acquaint them both with the professional aspects of the domain that they will be active in, and also with matters related to occupational health and safety. As such, it is very important for students to be aware and informed when it comes to the dangers and risks that they are contextually exposed to when carrying out their internship, and the methods to control the risks to their health, as well as their colleagues'. Furthermore, all parties that have a role in the conduct of the students' internship must be involved in the risk prevention activity.

**Findings** – The questionnaires were created after analyzing the vocational training standards and potential risk factors identified in internship activities.

**Research limitations / implications** – The purpose of this article is to identify the risks that can affect student activity and health during their internship and establish concrete and efficient measures to prevent them by using the questionnaire method.

**Practical implications** – The practical importance of the endeavor backing this article cannot be denied. The internships undertaken by the students do not only aim for the acquisition of new theoretical skills, as mentioned succinctly above, but also entail the molding of practical abilities through the specialized training and the accommodation of the students with the professional domain that they will be active in. As such, it is important for student internship activities to be carried out in a context that is as similar as possible with the one that they will be working in, and for their training to be carried out in accordance with certain vocational training standards that comply with the labor market requirements.

**Originality / Value** – Internships are an important step in the future development of the students, but they must be conducted in conditions of utmost safety to them. Students' training on the possible risks can be carried out much more efficiently if the OSH norms are included in the school curriculum and if the information presented to the students corresponds with the current knowledge in the domain. By drawing up the questionnaires described in this article, we have attempted to identify the most important risks related to occupational health and safety and, correspondingly, the best prevention methods that must exist at educational establishment and economic agent partner level.

**Keywords:** internship, risk factors, questionnaire

## Introduction

Students' internship activity represents the congruence of the common efforts of professional and technical educational institutions, and economic agent partners. The conduct of students' internship in good conditions entails the correct identification of the risks that may arise and the capacity to prevent them.

All parties involved in the preparation and conduct of students' internship (the school's management, internship coordinators, representatives of the economic agent partners, internship advisors, students) must be engaged in risk prevention in order to decrease the possibility of their emergence. To this end, labor protection training is imperative both for the educational establishment and for the economic agent partners, which should be conducted according to the occupational safety and health norms provided for in the legislation currently in force, as well as the institutions' own norms.

The students must be informed about the dangers, risks and risk control, they must recognize the dangers, evaluate the risks and adopt measures to control risks to their and their colleagues' health, as well as manage their environment well in order to ensure their health and safety, as well as others'. These skills can be developed through an initial training that is adequate for the environment where the internship is conducted, and an efficient level of communication between the school unit and the economic agent partner.

### **Risk prevention in school**

The report concerning Occupational Safety and Health in the School Curriculum – Requirements and Activities in the EU Member States (<https://osha.europa.eu/publications/reports/TE3008521ENC/view> accessed on the 23<sup>rd</sup> July 2020) conducted by the European Agency for Safety and Health at Work reveals that, in order to support education related to the domain of occupational safety and health (OSH) in schools and colleges, it is necessary to make it official in the school curriculum. The report evaluates the manner in which the EU Member States have integrated OSH and the education focusing on risks in their national programs.

There are considerable activities and progress in primary education, as well as secondary education in what concerns the actions taken, as well as those planned by Member States. The actions that aim to integrate OSH into education at school curriculum level include:

- legal provisions;
- voluntary school programs;
- practical guides and informative resources supporting the application of the legal provisions and voluntary school programs;
- official recommendations;
- national practical guides and informative resources, in the event of a school curriculum not being set out;
- promotion campaigns supporting the integration of OSH into education;
- approaches meant for safe and healthy schools.

It is necessary for students to develop skills specific to risk-related education through practical courses in the curriculum:

- to be informed about dangers, risks and risk control;
- to recognize the dangers, evaluate the risks and adopt measures to control the risks to their health and the health of their colleagues;
- to use the information to evaluate immediate and cumulative risks;
- to manage their environment in order to ensure the health and safety of themselves and others;
- to explain the steps that need to be taken for risk control.

According to the above mentioned report, it is important to include risk education in the school curriculum, because young workers in Europe suffer a higher than average rate of non-fatal accidents at work, and are especially likely to have an accident in the first few weeks of starting a new job. Many young people enter the labour market with little or no knowledge of workplace risks and preventive measures, therefore safety risk education should be a part of their schooling. Also, we believe that teaching them Occupational Safety and Health will enable their active and conscious participation in this process as future employees, because the employers cannot take the necessary actions without the involvement of the workers (Moțiu, 2012).

The problems of the professional and technical educational system identified by the Romanian Academy, the “Costin C. Kirițescu” National Institute of Economic Research, the Institute for the Research of Quality of Life in “Învățământul profesional și tehnic. Provocări și perspective de dezvoltare. Raport de politică publică” -“Vocational and Technical Education. Development Challenges and Perspectives. Public Policy Report”- (<https://www.researchgate.net/publication/310609289> accessed on the 25<sup>th</sup> July) are generally related to the curriculum and the presented instruments / devices / technologies, which are not adapted to our current reality:

- The quality of the curriculum and learning instruments
- The existing vocational training standards in the VTE system (vocational and technical education) are “obsolete,” as they are not updated according to the requirements of the labor market, both in what concerns the description of the profession, as well as the presentation of the skills which should be attained by the end of the graduates’ studies. These vocational training standards lie at the foundation of establishing qualifications, and are extremely important especially to employers who have an interest in involving themselves in the support of certain specializations in the VTE system that are necessary for their activity. Some employers have complained that they have requested certain qualifications from VTE institutions for which classes could not be organized due to the absence of these standards, while the process of devising new ones takes upwards of even two years.
- Failure to update standards has effects on the curriculum modification process (school programs, education plans, etc.). Failure to modify the curriculum leads to outdated notions and techniques being taught with the help of outdated equipment.
- The learning instruments used (manuals, learning methods) do not correspond with the current knowledge in the domain. The manuals are only updated after the modification of the curriculum. Some employers have become involved in the re-updating of the manuals and the creation of learning instruments (students’ notebooks, evaluation sheets), but the process to their being recognized at national level is extremely bureaucratic and lengthy.

An adequate training of the students in what concerns identifying and managing the risks that may appear during their activity must also focus on the types of accidents that may occur wherever they are conducting their internship, as well as occupational diseases.

## **Formulating the questionnaires**

### **1. Analysis of the vocational training standards**

The analysis of the vocational training standards was conducted with a view towards the importance given to the occupational protection and safety of the students during the practice activity carried out at school and with the economic agent. This analysis has revealed two main aspects:

A. The vocational training standards describe the skills / units of outcome that will be developed for the students after completing the modules specific to each vocational qualification. Each module entails the development of certain acquisitions for the students related to labor means, workload and work environment, so that they can efficiently exercise their profession. All of these elements generate risks in the practice activity, on top of which there are also the risks stemming from the students, depending on their ability and interest for their vocational development.

B. One category of risks that is not taken into consideration: psychosocial risks that can negatively influence the learning process and the personal and professional development of the students. According to the Guide for Appreciating the Quality of the Evaluation of Risks and Risk Management Measures in Order to Prevent Psychosocial Risks (<https://www.inspectiamuncii.ro/documents/66402/267740/ANEXA+3Ghid+psihosociali.pdf/de999d2c-4fdc-46e2-bb85-b7d8c96e24a7>, accessed on 25<sup>th</sup> July 2020), numerous different types of psychosocial risks can have negative effects on the workers’ health and wellbeing. The most representative psychosocial risks are workloads that are too heavy, work rhythms that are excessively fast-paced, as well as negative social behavior, such as violence or harassment.

Examples of psychosocial risks:

- The activity itself: the monotony of work or the short work cycles; fragmented or pointless work, insufficiently used skills, heightened degree of uncertainty, permanent contact with difficult clients, patients, students, etc.
- The workload and work rhythm: oversized or undersized workload, rhythm determined by automation, increased levels of pressure related to time and the permanent pressure inflicted by deadlines
- Work schedule: working in shifts, night shifts, inflexible work schedules, unforeseen work time, prolonged hours or a schedule that is not adapted to social life
- Control: decreased degree of participation in the decision-making process, lack of control over the workload, work rhythm, working in shifts, etc.

Another aspect that is relevant for the practice activity of the students is how they communicate with the economic agents and clients. The vocational training standards include a module of professional communication specific to each qualification. The manner in which this module is taught and learned can generate risks or, on the contrary, prevent the emergence of risks in the student-economic agent or student-client relationship.

## 2. Formulating the questionnaires

Based on the analysis of the vocational training standards and identified potential risk factors, we have formulated three questionnaires, one for the students, one for the internship coordinators of the educational establishment, and, respectively, one for the internship advisors designated by the economic agent partner.

The purposes of the questionnaires consist in:

- identifying the most important risks that can occur during the practice activity, from the point of view of the possibility of their emergence and the impact that they have on the students;
- identifying the existing student health and safety measures for the practice activity at educational establishment and economic agent partner level.

The questionnaires are divided into four parts:

- Part I – Personal data;
- Part II – Risk identification;
- Part III – Assessment and prioritization;
- Part IV – Prevention and protection measures.

Part I allows the sampling of respondents based on gender, age, class / seniority in education / seniority in student training and the domain of vocational training / activity.

Part II of the questionnaire was drawn up by focusing on five risk factor categories identified through the analysis of the vocational training standards:

1. Risk factors related to the work means: wear and tear of work devices and tools; contact with toxic / flammable substances; direct contact with sharp, prickly, slippery, contaminated surfaces; contact with faulty sources of electrical current; fires; allergic and irritant reactions caused by the protection equipment;
2. Risk factors related to the work environment: increased noise; air temperature in the space where the activity is carried out (too high / too low); toxic gases, vapors, aerosols, microbes, viruses, bacteria; exposure to biological products; exposure to radiation;
3. Risk factors related to the workload: lack of training for emergency situations; attention that is permanently solicited during work; physical (musculoskeletal) overexertion; poor communication with the clients; inadequate distribution of workload to the students (in a barked manner, with no explanations or details, with no feedback);
4. Risk factors related to the executor: investing little importance into the occupational protection training; failure to respect the internship distribution based on the skills gained; incorrect

operation of the devices and tools; incorrect usage of the protective equipment; errors when applying the procedures for the reporting of incidents;

5. Psychosocial risk factors: workloads that are too heavy; excessively fast work pace; negative social behavior, such as violence, harassment, threats; monotony of the work; insufficiently used skills.

For every category of risk factors, we have established five risks that are common for several professional qualifications, allowing respondents to add two more risks. Each risk shall be assessed according to the possibility of its occurrence and its impact, on a Likert scale of 1 to 5, where 1 = does not occur / has no impact, 2 = occurs rarely / low impact, 3 = occurs sometimes / medium impact, 4 = occurs frequently / high impact, 5 = always occurs / very high impact.

Part III of the questionnaire aims to establish a hierarchy of the ten most important risks in order of possibility of their occurrence and impact on occupational safety and health. Based on the frequency of the answers, the most mentioned risks shall lie at the foundation of the coming measures ensuring occupational safety and health.

Part IV of the questionnaire focuses on identifying the existing risk prevention measures in the internship activity of the educational establishment and the economic agents. The answers will offer an overall view on the importance given to the measures to ensure the health and safety of the students during their internship by the internship organizer and the economic agent partner.

After implementing the questionnaires and interpreting the results, we will have a clear view on the existing risks that can negatively affect the activity and health of the students during their internship, and we will be able to establish concrete measures to prevent these risks, as well as intervention procedures / protocols in cases where these risks occur.

## **Conclusions**

Educational establishments can face the same risks as any other workplace. The specific workplace element of the educational sector is the presence of students or pupils. They can be vulnerable, as they are young, inexperienced and often unequipped with knowledge of the risks concerning their safety and health. The youth can also be a danger to themselves. An educational institution should be a safe and healthy work environment, conducive to education. In order to achieve this, the risk assessment must take into consideration the planning, organization and constitution of the work environment, and must especially take into account the presence of vulnerable groups (such as very young students).

In order to ensure an environment that is conducive to the development of the practical abilities of the students, we propose:

- identifying the risk categories specific to each professional qualification from the point of view of the teaching staff, students and representatives of the economic agent partners;
- establishing the risks bearing a real impact on the three categories of persons involved;
- determining the concrete prevention or intervention measures for these risks in order to diminish the negative consequences.

As a result of creating and implementing the questionnaires for the three categories of people involved in the internship activity, we shall be able to identify the most important risks that have a real impact on occupational health and safety. Based on these risks, we will be able to set prevention measures at school and economic agent partner level. The measures must be established in the procedures and protocols of the educational establishments and economic agent partners, and also at the level of student behavior and attitude through constant notifications and open communication.

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# THE HARZBURG MANAGEMENT MODEL- A CATALYST FOR INTRAPRENEURSHIP

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## Abstract

**Purpose** – Aims to present a model which creates an environment that offers the employee the freedom to act and think independently, especially through the delegation of responsibility, thus creating the framework for intrapreneurship.

**Methodology/approach** – A historical review from two main perspectives, the corporate intrapreneurship literature and the elements of a management model, not studied before, but which will bring substantial contribution to intrapreneurship, if implemented.

**Findings** – There are positive relationships between the Harzburg Management Model (and its dimensions i.e. organizational and structural) and intrapreneurship.

**Research limitations/implications** – A survey is currently ongoing in order to establish the relationship between the particularities of the model as a factor for increasing motivation and intrapreneurship.

**Practical implications** – The hereby presented management model could offer a business model which fosters intrapreneurship.

**Originality/value** – The model offers through its main elements and methods the creation of an intrapreneurial employee which will bring only benefits in the further development of the organization.

**Key words:** Intrapreneurship, performance, delegation of responsibility.

## Introduction

Successful companies figure out that the most important elements in the organization are the ability to use the creativity of managers and employees through the recognition of their behaviours. One of the most important strategies for developing intrapreneurship in organizations is to improve and enhance the intrapreneurial behaviour of employees. The need for innovation in organizations is a topic that is much debated at the moment because intrapreneurship has finally caught the world's attention. Within the specialty literature, we found no relevant research that explicitly investigates the process of how the behaviour of the individual leads to intrapreneurial outcomes on an individual level and subsequently on an organizational level, even though the relationship between the intrapreneur and the organization is what makes an intrapreneur an intrapreneur. Thereof, we propose the Harzburg Management Model, which, with its principle of creating independently thinking and acting employees can lead to a behavioural pattern which will in turn increase intrapreneurial outcomes.

## Understanding the term intrapreneurship

One of the most important strategies for developing intrapreneurship in organizations is to improve and enhance the intrapreneurial behavior of employees. Drucker (1985) revealed that the essence of entrepreneurship is innovation. So it is natural for companies to carry out their activities leading to a process of creation. Intrapreneurship is a term introduced by Burgelman (1983) and made prominent by Gifford Pinchot (1985), where Pinchot put forward the terms "intra" and "preneurship" (taken from the word entrepreneur). Pinchot suggests and provides guidance for individuals to be able to give birth and



develop ideas to be transformed into business ventures considering that intrapreneurs are "people who focus on innovation and creativity and who turn dreams or ideas into profitable businesses, operating in an organizational environment. Research on organizational-level intrapreneurship, referred to the term as corporate entrepreneurship (Blanka, 2018), and implies an organization's corporate venturing and strategic renewal activities as a result of its employees' intrapreneurial behaviors and effective use of human resources management. Organizations have successfully implemented the intrapreneurship concept, by allocating their employees' time to work on creating innovative ideas, products and services. In accordance with the basic concept of intrapreneurship, organizations must create an entrepreneurial climate within the company by encouraging the innovation process to employees. Employees are conditioned to improve conventional ways of thinking by motivating them to be able to create new ideas for companies by utilizing company resources or creating truly new products. Thus, this lies in accordance with Drucker's statement (1985) that the essence of entrepreneurship is innovation. The concept of corporate entrepreneurship or intrapreneurship in a company can increase company income and be able to make the company survive in difficult economic conditions. Over the years, the role of employees in organizations has changed. Decision-making processes have become more decentralized and employees are gaining more discretion and responsibility (Foss et al. 2015). This trend goes hand in hand with employees being relied upon to be flexible, proactive and innovative (Giunipero et al. 2005). Rather than being passive recipients of changing jobs and products, employees need to adopt roles as "innovators" and "differentiators" (Bowen 2016). For example, Heinze and Weber (2016) found that intrapreneurial employees implement new logics in organizations by using opportunistic tactics, and leverage small changes to spark larger changes in the broader organization. In addition, Alt and Craig (2016) show that lower-level employees can induce bottom-up socially inspired innovations in for-profit organizations.

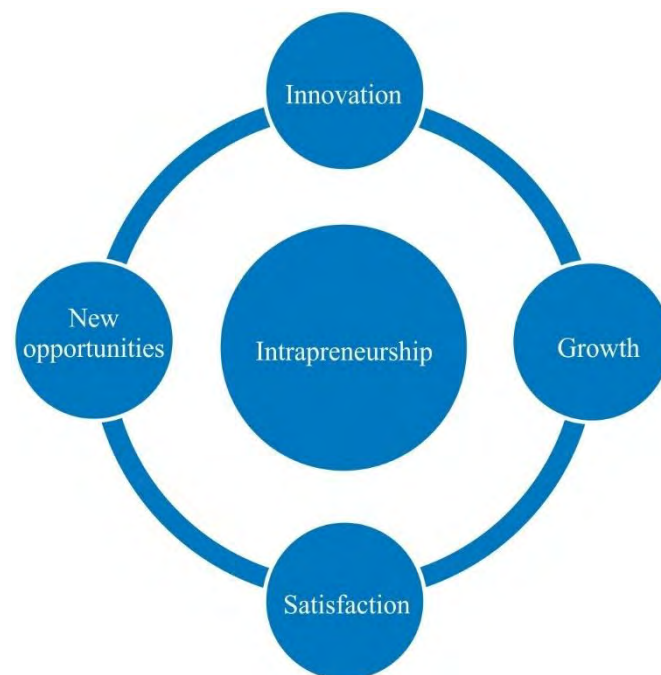


Figure 1. Effects of intrapreneurship (author's source)

### **The Harzburg Management Model as a catalyst for intrapreneurship**

Within the specialty literature, we found no relevant research that explicitly investigates the process of how the behavior of the individual leads to intrapreneurial outcomes on an individual level and subsequently on an organizational level, even though the relationship between the intrapreneur and the organization is what makes an intrapreneur an intrapreneur. In this regard, we consider that the main principle of the Harzburg Model, that of having independently thinking and acting employees leads to a behavioral pattern which will increase intrapreneurial outcomes.

For the employee of a company, intrapreneurship means acting independently, thinking like an entrepreneur and pursuing the goals you set yourself in a wide range. Prerequisites for this are creativity,

a wealth of ideas, cost awareness, the ability to cope with setbacks, a minimum of entrepreneurial talent and, last but not least, and teamwork. As a rule, intrapreneurs are the employees which are satisfied with their job. Responsible action, the possibility of contributing your own ideas and thus making a contribution to the success of the company promote motivation and the willingness to get involved within the organization. However, there is also a risk of being overwhelmed. If we consider one of the important features of the Harzburg Model, that of the attribution of total competencies to the employee in his area of activity, giving him the possibility of unlimited initiative and maneuver within the limit of the position, and thus enhancing trust, stability, pride and attachment to the organization, we conclude that this particularity of the model creates an intrapreneurial employee. The essence of the characteristics mentioned, is the motivation that the certain employee now has, within the presented organizational concept, obtaining maximal results, offering a free path towards creation and representing the general impulse towards the superior structures, by alerting them regarding the problems that will most probably occur, before they actually happen. In such a way, the trust and motivation is transmitted to all the staff members. More so, as we will further detail, the management model aims to nurture an environment which offers the employee the freedom to act and think independently, especially through the delegation of responsibility, thus the framework for intrapreneurship is set. The risk of feeling overwhelmed is also decreased if not annulled, within the Harzburg Model, due to the fact that employees have clear delegated tasks within their area of competences, so an overburden is can rarely happen. More so, exactly this clear delegation of tasks and competencies allows the employee the required time for innovation. When he has to make decisions independently, than he must also use innovation in order to surpass different problems. For a company, intrapreneurship means creating framework conditions for a start-up culture in the company and setting an example for this new corporate culture in which the intrapreneurs can develop. At the organizational level of the company, this requires not only the provision of the necessary resources, the creation of success-based incentives, shortening information channels and, above all, that the company transfers project responsibility to the intrapreneur, promotes its work, but also demands results.

Management should give the intrapreneur freedom beyond his or her actual job responsibility and description, but make sure that the freedom is not misused. Suggestions and ideas for innovations are carefully examined and assessed by the management. If an initiative is rejected, the rejection should be reasonably and comprehensibly justified.

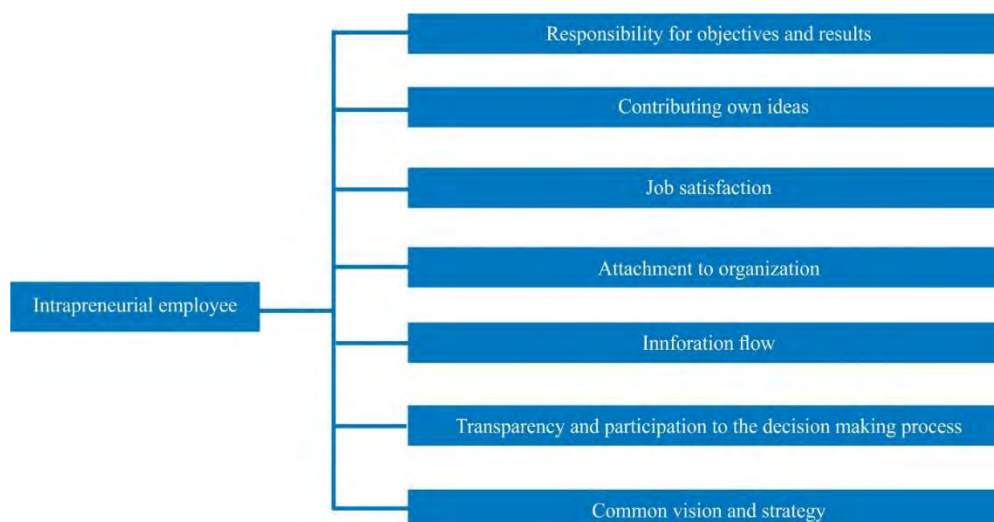


Figure 2. Features of intrapreneurial employee promoted by HMM (author's source)

The intrapreneur and an entrepreneur have a lot in common. Both are able to act independently, think like an entrepreneur and have an eye on the costs. You can motivate yourself and engage for a goal. Intrapreneurs and entrepreneurs are ambitious, they are determined, work solution-oriented and are willing to take risks. They see failure as an opportunity and can learn from mistakes.

The difference between intrapreneur and entrepreneur lies in the responsibility and the consequences that their actions can bring. The responsibility of intrapreneurs is usually very limited, thus the responsibility to act and decide within the boundaries of the working area and the thereof assign competencies (an already mentioned particularity of the Harzburg Model). Since intrapreneurship is

usually only a small part of the overall organization of a company, failures usually have no significant influence on the development of the company. If the failures persist, the intrapreneurship ends and the intrapreneur works like a normal employee again. In the worst case, the employer cancels his employment. The responsibility of the entrepreneur is much more far-reaching, and corresponding serious consequences can result in wrong decisions by the entrepreneur. The entrepreneur is responsible for the entire company. Inside and outside. This means that an entrepreneur's decision to do something or not do something has a direct impact on the success of the company, its employees, customers and business partners. The consequences of a series of wrong decisions are usually not limited to a small sub-area. Persistent mismanagement, whether consciously or subconsciously, often leads to the end of the entrepreneurial activity and the economic end of the company. In this regard, we consider the managerial responsibility awarded by the Harzburg Model to the manager/ superior. The superior is the one who bears this responsibility, must make decisions (but after consultation with employee and resting on his know-how and professional input) which influence the whole organization and often also the delegation area of the employee.

We consider that intrapreneurship and the Harzburg management model are not merely a behavior pattern of an individual or an organization, but is about a set of activities of an individual or an organization to get from point A to point B in time, with an increased competitiveness and performance of the organization as the end goal.

The success of the intrapreneur also depends on the organizational context. The organization can facilitate or inhibit the actions of the intrapreneur.

In our systematic literature review, we found that the majority of articles focused on organizational factors influencing intrapreneurship. This systematic literature review revealed which organizational factors facilitate the employee to act as such. Thus, we want to explore the relationships among the factors identified and the HMM. First, the most important factors found in the specialty literature for enhancing intrapreneurship refer to:

- Receiving management support: the willingness of management to facilitate and promote intrapreneurship including encouraging employees and recognizing that their activities involve some risk-taking and creating a norm within the organization.
- The organizational structure: flexibility of the organization, the flow of information throughout the organization and the centralization of the decision-making process. Open channels of communication and providing mechanisms that allow for ideas to be evaluated, selected and implemented are positively related to intrapreneurship.
- Giving employees autonomy: Giving the employee the freedom to design his/her work and to decentralize the decision-making process results in more intrapreneurial activities and also increases the self-efficacy of employees.
- Rewards and reinforcement: Rewards should be in line with goals and should be based on results.
- Providing the right resources: resources involve time and financial resources. The quality of time is more important than the actual amount of time.



Figure 3. Organizational factors with intrapreneurial outcome (author's source)

Considering this aspect, we find that the organizational factors leading to intrapreneurship correspond to the organizational pattern promoted by the Harzburg Model. So, second, the fact that the factors that have been proven to promote intrapreneurship correspond to the elements of the mentioned management model, we can prove the initial hypothesis, that one of the main performances of this particular model is that of promoting intrapreneurship:

- Management support: Top-management implements general management guidelines which aim to foster recognition and encouragement of the employees through different managerial instruments, such as the appraisal interview or performance review.
- Organizational structure: information flow is performed in more than one direction and under the centralization of the decision-making process, we see the concentration of the decision-process of all the different levels of the hierarchy according to area of activity and competencies.
- Rewards: Motivating employees is a focal point within the HMM. Remuneration is performed according to task fulfillment
- Autonomy: Employee has the freedom to act and decide independently within his area of activity.
- Resources: the resource of time in the sense of quality is offered by using different methods of unloading the employee, or no make him feel overwhelmed by tasks and responsibilities. This creates, as mentioned before, the frame for an innovative behavior but it also offers the job holder the required time frame to performed quality works.



Figure 4. Organizational factors of HMM with intrapreneurial outcome. (author's source)

### Discussion and conclusions

We conclude that the Harzburg Management model sets the framework for achieving intrapreneurial employees and this will in turn lead to an increase in organizational performance. It is expected that companies that apply the concept can survive in various business obstacles such as the emergence of foreign competition, technological change, accompanied by a decrease in the number of workers and the quality of labor and other problems. This review confirms the strategic importance of intrapreneurship. It shows the multilevel nature of intrapreneurship by emphasizing the link between individual intrapreneurial behavior and organizational outcomes, thus implying that employees do have a direct impact on the organization's strategic direction. By implementing the Harzburg Management Model in organizations by default, the scenery for intrapreneurship is set. The model offers through its main elements and methods the creation of an intrapreneurial employee which will bring only benefits in the further development of the organization.

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# IMPROVING THE QUALITY OF TECHNICAL HIGHER EDUCATION IN SATU MARE FROM THE STUDENTS' PERSPECTIVE ATTENDING THE TUC-N BRANCH

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## Abstract

**Purpose** – The results acquired through the present research can help to increase the quality of the activities from the TUC-N branch from Satu Mare.

**Methodology/approach** – Within the research that took place through the events organized in the project "Specialists for Satu Mare", the survey was used as method and one questionnaire for the students was used as instrument.

**Findings** – Only a little more than half of the students who received the questionnaire really want to get actively involved in solving the existing problems at the branch, especially in terms of promoting the image of the branch/university and of organizing to ensure the conditions of study and less in those of scientific research.

**Research limitations/implications** – The questionnaires were submitted only to the subjects that were present at classes during the project development.

**Practical implications** – The recommendations stated through research can be applied in practice within the branch.

**Originality/value** – The project was the first of its kind within the TUC-N branch from Satu Mare so the research is innovative.

**Key words:** quality, higher education, students.

## About higher education

There are discussions about the phenomenon of globalization for more than 40 years, especially in the economic sphere due to the expansion of the world trade. "The technological and information revolution and the opening of financial markets have helped to provide the means to spread globalization, and education must directly follow transformations and new demands in order to support future changes and vocational training"(Cosma, M., 2004).

In countries with a developed economy, "investments in knowledge (research and development, higher education, information technology) are growing at higher rates than investments in the economy"(Belostecinic, G., 2016) as contemporary society becomes more and more a society based on knowledge and information.

The most important element of the knowledge-based society is represented by the university as it is involved in three types of activities: education, research and technological innovation. Through education information is transmitted to people, new knowledge is created through research, and technological innovation translates into practice this knowledge.

Quality assurance in higher education is therefore vital and involves taking measures that will continually improve the quality of teaching, learning and research, in order to increase the competitiveness of the university, to develop skills for graduates to become more competitive in the labor market, and to provide them with the best chances of personal development(Avornic, Gh., 2009).

Improvement of the quality(Oțel, C.C., 2006) in higher education can be achieved in several directions regarding: educational process, increasing the quality level of the teaching staff, management of student activities, infrastructure, research, promotion of the faculties and international cooperation.

In this paper will be discussed some aspects regarding the improvement of the quality in the higher education which were mentioned by the respondents and that can be applied in the Satu Mare Branch of the Technical University of Cluj-Napoca:

- Educational process - obtain the feedback from the students concerning the didactic activity through questionnaires on the university site regarding the way in which the didactic activity is carried out (way of teaching, overlapping of the taught knowledge, etc.);
- Management of student activities - improvement of the student practice by participating in different projects, organization of meetings between students and employers to facilitate the employment of the students from the final years, development of the psycho-pedagogical counseling center, organization of the student scientific circles and rewarding the best students, organization and counseling of the students for participation in professional competitions, supporting of the educational, cultural, sporting events for faculty students, facilitate communication with students, master students (at the level of secretariats at both faculty and departments);
- Infrastructure - modernization of the laboratories through the own-funds, projects and sponsorships, improvement of the IT and communications infrastructure in faculties (performing computers, wireless access, etc.) and endowment of libraries, redevelopment of common spaces in faculties (sanitary groups, installing double pane glass, etc.);
- Research - increasing the involvement of masters and PhD students in the research activities of faculty departments;
- Promotion of the faculties - actions to promote the study programs of faculties to attract the best high school graduates, through visits to high schools by the teams of teaching staff and students.

### Results of the research

In the light of the answers provided by the students, they are interested in improving the activities carried out at the branch of the university from Satu Mare in a very large proportion, almost 97 percent (Figure 1).

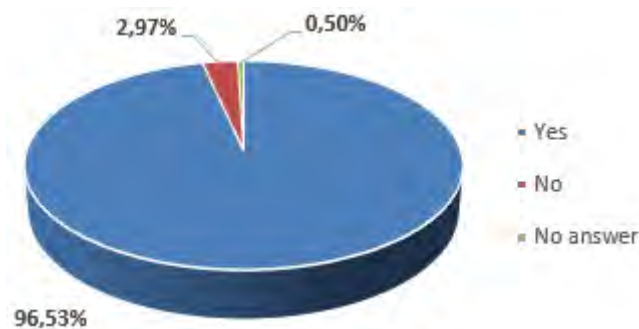


Figure 1. Are you interested in improving the quality of the activities carried out at the TUC-N branch in Satu Mare?

However, not all those who have showed themselves to be interested in this aspect want to be involved that much. Thus, only 59 percent want much and very much to get involved in solving existing problems (Figure 2).



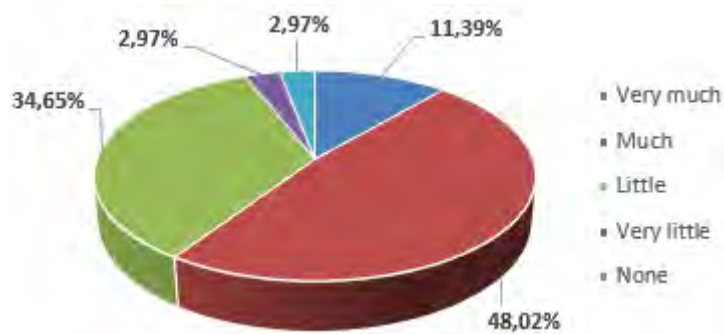
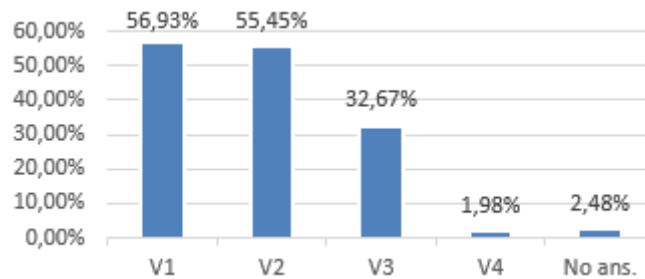


Figure 2. How much do you want to get involved in solving the problems of the branch/university?

They consider that students can best be involved in "promoting the branch/university image" (57 percent), "organizing to ensure the study conditions" (55 percent) and less in "scientific research" (33 percent). The question addressed to the students had four variants of answers, and several variants could be chosen (Figure 3).

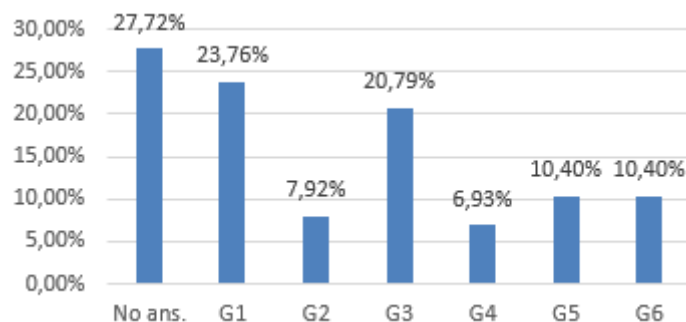


V1 = promoting the branch/university image;  
V2 = organizing to ensure the study conditions;

V3 = scientific research;  
V4 = other: "ideas, proposals, suggestions for improving the study conditions".

Figure 3. In what activities do you think the students of the branch/university can be involved?

In order to increase students' employability, the respondents placed on the first two positions of their options: "increasing the chances of practice in companies" (23.7 percent) "job/ internship/research collaboration" (20.8 percent) and almost 28 percent did not respond (Figure 4).



G1: increasing the chances of practice in companies;  
G2: high standards/quality of education;  
G3: job/internship/research collaboration;

G4: visits to companies;  
G5: meeting between companies-university-students/job fair;  
G6: collaboration to promote students/increase the students confidence.

Figure 4. How do you think the university/TUC-N branch of Satu Mare can be involved in increasing the chances of employing students in the companies from Satu Mare?

Regarding the study conditions from the branch, 81.7 percent of the students appreciate the material basis as good, very good or excellent (Figure 5).



Figure 5. How do you assess the material basis of the TUC-N branch in Satu Mare?

Approximately 88 percent of the respondents consider that the documentary material of the branch library is good, very good or excellent (Figure 6).

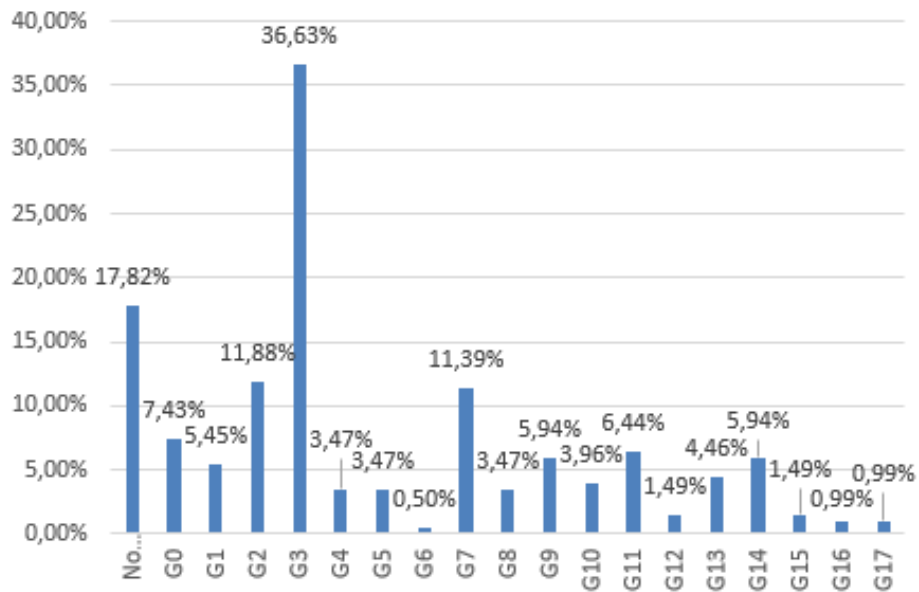


Figure 6. How do you evaluate the endowment of the library with documentary material?

Among the endowments mentioned by the students as necessary it was mentioned by far "equipped laboratories" (36.6 percent) followed, in almost equal proportions, by "sports facilities – gym/sports ground, tennis table, basketball basket" (11.9 percent) and "functional computers" (11.4 percent) (Figure 7).

The questions from Figure 4 and Figure 7 were open-ended, so in order to interpret the results, the answers were grouped into six groups (G1-G6) for the first question (Figure 4) and seventeen groups (G1-G17) for the second question (Figure 7). One respondent could mention several aspects, so the answer could fit into several groups.

Communication with the branch secretariat proves to be good, very good or excellent, according to the students (99 percent) that answered this question (Figure 8).



- G0: satisfied;
- G1: library/books;
- G2: sports facilities – gym/sports ground, tennis table, basketball basket;
- G3: equipped laboratories;
- G4: place for practice;
- G5: bigger parking;
- G6: rooms for students;
- G7: functional computers;
- G8: reading room/studio;
- G9: kiosk in the branch yard/automatic for food and refreshments/canteen;
- G10: modern equipment;
- G11: internet/wireless;
- G12: smoking area;
- G13: auxiliary spaces – benches, rocking chair, place for dining, park, recreation center, toilet in block B;
- G14: endowments in classrooms – modern blackboards, video projectors;
- G15: more access ways in the courtyard/ suitable entrance for cars;
- G16: medical office/medical assistance;
- G17: xerox/printer for students.

Figure 7. What other endorsements do you consider necessary for students?

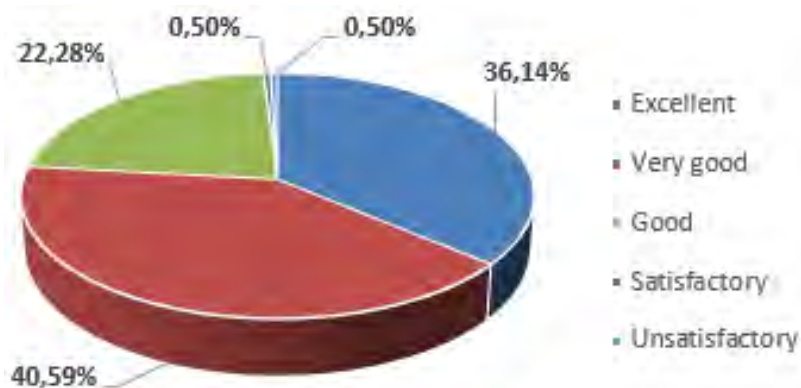
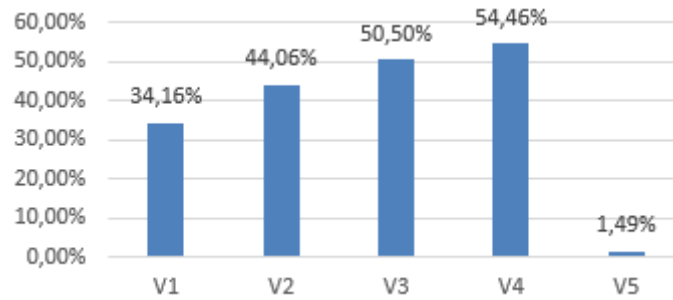


Figure 8. How do you appreciate the communication with the branch secretariat?

Asked what extracurricular activities should be developed for the students, they have chosen for the first three positions: "counseling – professional guidance" (54.4 percent), "communication/socialization" (50.5 percent) and "sports" (44 percent). The question addressed to the students had five variants of answers, and several variants could be chosen (Figure 9).



V1 = cultural;

V2 = sports;

V3 = communication/socialization;

V4 = counseling – professional guidance;

V5 = other:

"electronic sports", "development activities in electronics", "student organization".

Note: The respondent had the option to mark multiple variants.

Figure 9. What extracurricular activities should be developed for the branch students?

## Conclusions and recommendations

Based on the undertaken research, the following conclusions can be drawn:

- At the declarative level, 97 percent of the surveyed students are interested in improving the activities carried out at the university branch from Satu Mare, but only a little more than half (57 percent) really want to get involved in solving the problems of the branch.
- Students consider that the activities they can be involved in are "promoting the branch/university image" (57 percent), "organizing to ensure the study conditions" (55 percent) and less in "scientific research" (33 percent).
- 81.7 percent of the students appreciate the existing material basis, including the documentary material of the library (88 percent of students), but would like more "equipped laboratories" (36.6 percent), "sports facilities – gym/sports ground, tennis table, basketball basket"(11.9 percent) and "functional computers"(11.4 percent).
- Among the extracurricular activities that should be developed for students, they mentioned those of "counseling – professional guidance" (54.4 percent), "communication/socialization" (50.5 percent) and "sports" (44 percent).

According to the above-mentioned results the following recommendations can be made:

- To stimulate and encourage students to participate in existing scientific research projects between the local companies and team of the technical university branch.
- To allocate additional funds for a better endowed laboratories, redevelopment of existing sports facilities and purchasing more performant computers.
- To establish an office for "counseling – professional guidance" and "communication/socialization" to help students find the right job and integrate more easily into the labor market.

## Acknowledgements

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# APPROACHING THE STUDENT ENTREPRENEURSHIP IN ROMANIA FROM A GENERATIONAL PERSPECTIVE

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## Abstract

**Purpose** – *Is to study the specific features of the Student entrepreneurship for generation Z from Romania.*

**Methodology/approach** - *The issue of entrepreneurship from the perspective of generational theory.*

**Findings** – *It is important in practice to use the characteristics of generation Z in entrepreneurship for the development of the national economy.*

**Research limitations/implications** – *Significant reduction in business start-ups by Generation Z students is a worrying economic phenomenon that needs immediate action to limit it.*

**Practical implications** – *It signals the decline of business start-ups by generation z students*

**Originality/value** – *Addressing entrepreneurship from a generational perspective*

**Key words:** *students, entrepreneurship, Generation Z*

## Introduction

It is widely accepted that the entrepreneurship is considered the trigger of the current economies as it mobilizes, through innovation, a series of individual and group resources that have beneficial effects, quantifiable throughout the entire human society. According to Eurostat, in Romania, there are over 480,000 SMEs that employ nearly two-thirds of all employees. In the European Commission document "A strategy for SMEs for a sustainable and digital Europe" this idea is reconfirmed, being stated that "The 25 million small and medium enterprises (SMEs) in Europe represent the backbone of the EU economy. They provide jobs for about 100 million people, representing more than half of Europe's GDP and play a key role in creating added value in each sector of the economy." (Eurobarometer, 2017)

Starting with 2020, the strategic orientation of the development of the sector of small and medium enterprises considers the double transition of the EU towards a sustainable and digital economy. The two orientations are part of the changing of the paradigm of economic development and are already present in the functioning of nearly one quarter of SMEs (including the social economy) in Europe which, in addition to high-tech, innovation and digitalization, respect the values of sustainability and circular economy offering green products or services.

Meanwhile, regarding these issues both from the perspective of generational theory and as a whole, the two European orientations – digitalization and sustainability – overlap the desires, options and characteristics of Generations Y and Z, with generations having the birth dates between 1977 and 1994 and between 1995 and 2012, respectively.

This study aims to examine the extent to which the entrepreneurial characteristics emphasized by the generational theory and results of entrepreneurship activities performed by students in Romania overlap.

## **Student Entrepreneurship in Romania**

In Romania, as well as in the whole Europe, there are strategies for developing and strengthening the SME sector and, subsidiarily, constant concerns for stimulating the youth entrepreneurship. The government strategy for the development of small and medium enterprises is the central element of planning in this field, being built on five lines of action: the support of the entrepreneurship, SMEs' access to appropriate finance, SME access to abilities/skills and innovation, SMEs' access to markets and the government responsiveness to the needs of SMEs. To implement this strategy, a series of laws aimed at regulating the following areas have been issued: establishment and operation of SMEs, fiscality and access to SMEs financing, administrative simplification, regulation of labor relations.

To stimulate the entrepreneurship among students, the government issued, in 2003, the GD 166 regarding the granting of tax incentives to students who want to start their own business, a regulation that stipulates the exemption from fees and charges for start-ups in case of students who have business ideas and exploit them through entrepreneurship, by setting up their own company. This law provides exemptions from fees and charges to the National Trade Register Office, fees and charges for authorization of the tradesmen functioning requested when they found up the business, fees and charges necessary to obtain the authorization for self-employment from the local administration, taxes for publication in the Official Gazette of Romania and stamp duties for notary activity. These facilities are for all students enrolled at least in the second year of study in accredited higher education institutions who have fulfilled all the requirements and are under 30 years. For these entrepreneurs, the National Trade Register Office maintains separate accounts and follow them separately.

It is important to note that the stipulations of the GD 166/2003 are applicable for two generations, even since the beginning of their implementation. The two target generations are: Generation Y, with birth dates between 1977 and 1994 (with the proper age to access the law facilities between 2006 and 2013) and Generation Z, which is defined as the interval comprising dates of birth between 1995 and 2012 (with the maturity period comprising the years between 2013 and 2030, established for granting facilities).

### **Description of the research context**

After the emergence of generational theory and until now, researchers in various fields of study, including marketing and human resource management have conducted several scientific studies aimed at the analysis and the more detailed knowledge of the characteristics and behaviours of the generational cohorts. From the human resources perspective, the studies have become more in-depth as generational groups have entered the labour market. At the same time, in correlation with the labour market, these researches were extended to the area of entrepreneurship.

In this study we started from the following premises:

- the analyzed period - between January 2014 and May 2020 is the period in which Generation Z exponents can be entrepreneurs and can exploit the provisions of GD 166/2003, i.e. they are at least 19 years old, are second year students in an accredited higher education institution, without arrears at the end of the first year and who have business ideas which they want to implement by setting up a company;
- in case they want to set up a company, they have to apply to the National Trade Register Office for their company registration, at which point they will also exploit the facilities offered by the normative act specified above; GD 166/2003 allows the reduction of the registration and authorization costs of the newly established companies by students by approximately 500 lei;
- at the same time, if the established company is no longer active, in order to avoid legal complications, tax, accounting etc. deriving from inactivity, the logic of things leads to the deregistration of the company, a process that is also carried out at the Trade Register;
- as a result, the statistical situations posted on the website of the National Trade Register Office starting with August 2013, offers a quantified image of the phenomenon of registration, but also of the deregistration of companies set up by students.

It is important to note that since the application of the government decision, the National Trade Register Office did not publish data on the effects of the application of GD 166/2003 until December 2012 when it published the fact that a number of 17,368 companies were set up by students, i.e. with a monthly average of the period of 147.19 companies. Of these, 4,901, i.e. 28.22% were deregistered (which represents a monthly average of deregistration of 42 companies in the period). At the end of 2013, the number of companies established according to GD 166/2003 was of 18,854 companies, which represents a monthly average for 2013 of 123.83 companies set up by students. Of these, 5,613 were deregistered, i.e. a monthly average of 59.33 companies. This demonstrates that since 2013 students have started to set up fewer and fewer companies, and accordingly, the facilities provided by law for them have been less and less used.

From the data published on the National Trade Register Office website, the number of companies established and deregistered by students, with the operation of the facilities offered by GD 166/2003, for the period December 2013 - May 2020, on semester intervals had an evolution described by Table 1. The reason for analysing this period is because starting with January 2014, the exponents of generation Z can enter the area of entrepreneurship (i.e. they are 19 years old, they are in the second year of university studies) and thus, they can benefit from the provisions of the government decision.

The graphical representation of the data in Table 1 is reflected in Figure 1.

Table 1 - Semi-annual evolution of the number of companies established and deregistered according to GD 166/2003 during December 2013 - May 2020

	<b>Foundation</b>	<b>Deletion</b>
<b>2013 dec</b>	150	335
<b>2014 jun</b>	250	455
<b>2014 dec</b>	136	429
<b>2015 jun</b>	176	444
<b>2015 dec</b>	101	535
<b>2016 jun</b>	95	638
<b>2016 dec</b>	60	466
<b>2017 jun</b>	50	352
<b>2017 dec</b>	27	385
<b>2018 jun</b>	35	316
<b>2018 dec</b>	24	311
<b>2019 jun</b>	22	324
<b>2019 dec</b>	26	244
<b>2020 may</b>	12	100

Corresponding to the evolution described in Figure 1, there is a sharp decrease in the number of companies set up and deregistered by students, but there are small increases for the first semester of each year, compared to the second semester of each year. It is important to note the following: if in December 2012 the percentage of deregistered companies out of the total of the existing ones was of 28.22%, in May 2020 this percentage reached 53.41%, i.e. almost doubling the deregistration, which led to the closure of more of the companies set up by students. Also, if between August and December 2013, the number of deregistered companies was 2.23 times higher than those established (335 deregistered companies and 150 established), between January and May 2020 this ratio was of 8.33 times (i.e. 100 companies deregistered and 12 established), which shows that the rate of deregistration compared to the establishment of companies increased almost 4 times between 2013 and 2020. At the same time, it is worth mentioning that, in the last part of 2018, the number of active companies became approximately equal to those of the deregistered ones. In May 2020, there were still 9,256 companies out of the 19,868 established by students according to GD 166/2003.



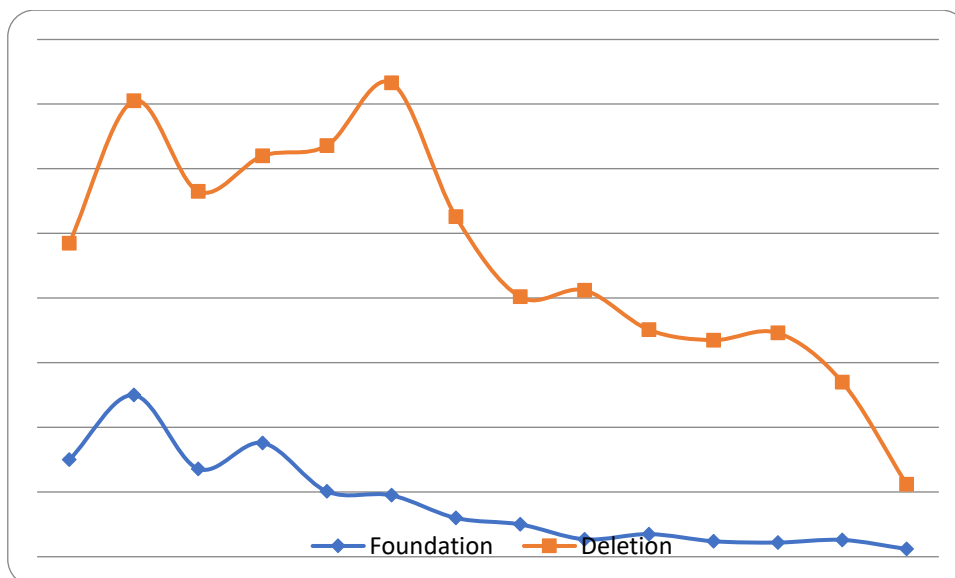


Figure 1. Semi-annual evolution of the number of companies established and deregistered according to GD 166/2003 during December 2013 - May 2020

Until August 2013, no data were published by the Trade Register, but interpreting the above data, it can be assumed that at the beginning of the period there was a slow, launching growth, specific to any process of this type. The launch was followed by an increase and then by a period of maturity which was highlighted until mid-2013. Since then and until now the process of granting tax facilities to students who wanted to set up their own business was in a steady decline, a situation confirmed by the current statistical data of the National Trade Register Office. According to them, starting with January 2017, less than 10 companies were set up every month in the whole country, in the first part of 2020 being a period of several months in which no company was set up to operate the facilities provided by GD 166/2003 (for the period March - May 2020 the Covid pandemic situation is a cause of limiting the establishment of companies, in March 2020 being established 3 companies, only one in April, and none in May).

A potential cause of the decline of business start-ups by students may be related to the increase in population income resulting from successive, more frequent and significant increases in the minimum wage in the economy since 2013. In this context, the amount of about 500 lei which is the value of facilities provided by law represented in January 2013 71.43%, while in January 2020 this share was less important, i.e. 22.42%. This also overlaps with the attitude and behaviour of students, elements that will be described below.

### Generation Z – an entrepreneurial generation?

Theoretically, starting with 2017, the access to the facilities granted by GD 166/2003 can be exploited, in a considerable majority, only by the exponents of Generation Z. Exceptions may occur for students in Generation Y who started their university studies after 18 years, studies of faculties with a duration of more than three years, which repeat years of studies, etc. From 2018, the percentage of students in Generation Y becomes insignificant, i.e. Generation Z is the majority. At the same time, from 2018 until now, the period with the lowest number of companies set up by students is highlighted.

Several scientific studies have been conducted to analyze the characteristics of Generation Z from a psychological, sociological perspective, their behaviour on the labour market, their consumer perspective, their perceptions of various aspects of social life etc. So, starting from the general studies conducted by William Strauss and Neil Howe (1991) and William J. Schroer (2008) and reaching the newer research that targeted young people (entrepreneurs) at the global level (The Global Entrepreneurship Monitor - GEM), from European Union (European Start-up Monitor) or Romania (Public Opinion Barometer), they highlighted the characteristics of this generation, intentions, perceptions, worries, attitudes, lifestyle etc.

Thus, the members of Generation Z are called true "digital natives", almost half of them have smart phones and internet access, are multi-tasking and mobile, must have everything at a click away, are independent but also social (through social networks), visual (they like storytelling and are very attracted to influencers, youtubers and Instagram stories), they are global, they get bored easily. Also, an important feature is related to their more accentuated entrepreneurial and competitive spirit, given by their independence and at work they set their individual targets and they want that the reward be established following the individual performances not of the team, they prefer the flexible program and remote work, they do not like bosses but respect organizational hierarchies. In 2020, Generation Z represents 24% 4 of the global workforce.

Among the latest studies that targeted Generation Z, the research conducted by Ipsos MORI, called the IPF Financial Welfare Report, highlighted the fact that 53% of young people in Generation Z in Romania would like to open their own business, this being the highest percentage of countries analyzed.

Also, 61% of young people who participated in the study consider themselves more prepared for entrepreneurship than the previous generations. An important but also interesting result to follow is the one that shows that although they have all the openness to start up their own business, 67% of them claim that the current socio-economic context raises more barriers to entrepreneurs than in the past, and 55% of them consider that the difficult access to funding limits their opportunities to be more involved in the development of an entrepreneurial project.

These last aspects regarding the difficulties of entrepreneurs, but without direct connection with the generational theme, also result from the study of the EY Barometer 2019, 6th edition, which shows that 74% of the respondents consider that entrepreneurship is not supported by society, 52% consider that the fiscal and regulatory environment business deteriorated (8% more than in the study conducted in 2017), and in terms of measures that the state can take to stimulate the start-up business environment, 33% of entrepreneurs indicated the reduction or exemption of taxes and duties for start-ups and 27% mentioned financing solutions for this type of business. Also, the biggest obstacle is considered to be the mentality and the fear of failure (20%) and 22% consider that the school / university does not prepare them to be entrepreneurs.

## Conclusions

Throughout the world, entrepreneurship is a strong force for economic development and the orientation of the young Generations Y and Z towards entrepreneurship mobilizes and directs towards the economy, with quantifiable results, the innovative and entrepreneurial spirit that characterizes them.

Combining the information from the analysis carried out on the companies set up by students since 2003 up to the present with the capitalization of the provisions of GD 166/2003 (on granting fiscal facilities to students wishing to set up their own business) and the studies carried out by specialized survey companies, the conclusions converge to that the entrepreneurial spirit of students, especially those of the Generation Z, is found in the intentions of establishing their own entrepreneurial career but these are not confirmed by the number of the established companies. This takes place in the conditions in which exemptions of taxes and tariffs are granted by legislation when students set up their own companies.

The main causes are in three directions:

- In the skills and individual development of Generation Z in Romania; by modification of the way in which young people are trained, in such a way as to give them self-confidence, to be oriented towards entrepreneurship etc.
- In the education system; in recent years, steps have been taken towards student entrepreneurship (Student Entrepreneurial Societies and the financing of programs to support entrepreneurship), but there are still many ways in which things can change in this direction;
- In the current economic and legislative environment; In these areas, measures are needed to lead to fiscal predictability, state funding for development, promotion of start-up financing programs, facilitating access to finance etc.

All these topics can be the subject of separate research through which it will be possible to establish concrete ways to reach the goal - to capitalize on the entrepreneurial potential of Generation Z.

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# ASPECTS REGARDING THE EVOLUTION EXPECTATIONS OF THE HEALTHCARE SYSTEM AFTER THE GLOBAL PANDEMIC CRISIS OF 2020

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## Abstract

**Purpose** – Great crises bring change that triggers evolution. The purpose of this paper is to present evolution expectations of key people acting in the medical field regarding managerial and scientific evolutions, that will appear in the decades that will follow triggered by the greatest global healthcare crisis faced in the modern times.

**Methodology/approach** – In order drive the research, there were developed a set of instruments consisting in extended interviews and questionnaires. The results fare from different point of views - hospital managers and key decision makers in the medical system, teaching professors and researchers in Medicine and Medical devices. In the study are also represented the next generation of medics and researchers - students from medical universities.

**Findings** – The parties involved in this study highlights some trends in research and development in the field of medicine, medical technology and management in medical branches. More important is the fact that due to its major stress caused by the pandemic and all the effort invested in fighting the pandemic, the humanity has a great chance to evolve.

**Research limitations/implications** –This study was conducted with focus on responders from Bucharest and Cluj, two important medical and university cities in Romania.

**Practical implications** – Extended studies regarding the expected evolution should be intensified by governments, universities, research institutions and international alliances or organizations acting in this field. We identified a great economic and social opportunity for Romania.

**Originality/value** – We designed several instruments in order to organize the results of our study regarding the evolution expectations after the actual global healthcare crisis. As we are looking into the future, the subjective answers from qualified responders offer possible perspectives of the progress that will follow the 2020 Global Pandemic.

**Key words:** Global healthcare crisis, managerial and medicine evolution.

## Introduction

What role will robots play in medicine in the future? How will the pharma industry evolve? Will telemedicine and other technologies enable non- contact treatment possibilities? What will be the status of medical professionals in the future? What chances should Medical University Cites exploit? Will life-prolonging technology change our lifestyle? How will the access to healthcare look like in the future? Will humanity achieve the next big technical and social evolutionary step after the COVID-19 global medical crisis?

We look to questions regarding the future that will follow the COVID-19 greatest global healthcare crisis of all modern times. We are targeting responders already involved in different stages in the healthcare system. We discussed, interview and received answers from a variety of targeted responders. This variety consists from experienced hospital managers and key decision makers in the healthcare system

which acted in the first line during the first stages of the pandemic to experienced researchers and professors at medicine universities and of course, the students, representing the next generation medics, researchers, professors and decision makers in the healthcare system.

## Methodology

Our study was conducted in three stages:

1. The first one consists in conducting extensive interviews with managers and key decision makers as well as with specialists involved in research in medicine and medical technology. The goal of this stage was to identify and structure the topics.
2. The second stage, consists in developing questionnaires and gathering data from teaching professors and students. Although they have the same structure and target the same topics, we developed different questionnaires for the two different categories.
3. The third stage was to compare and analyze the results in order to present the relevant conclusions of this study.

## Results

The study has two parts, the first one concentrates on the technical expected evolution in the medical field, while the second part reflects the expected evolution from social point of view, like the role and status of medical professionals in future and general access to high level treatments.

The first part presents the general idea of expected evolution from technical point of view, as well as some fields where evolution is highly expected.

Almost every crisis is followed by evolution in technology, society etc. In this case, we speak of the greatest global healthcare crisis in modern times. We wanted to investigate the opinion of our responders regarding the expected evolution in medical technology after COVID-19 crisis.

Our first significant result is the difference of expectation levels between the younger generation represented by students at medical university versus the experienced teachers and researchers. 64% of the students expect a high and very high evolution in medical techniques and technology in following years as a result of the crisis, while only 42% of the experienced teachers and researchers expect a high and very high improvement and also, the same percentage expect a moderate rate of evolution in medicine and medical technology. Another difference comes in the rate of 23% of young students who think that the COVID-19 crisis will not accelerate evolution, compared with less than 15% of experienced professionals who believe the same.

For now, we will note, that 75% to 85% of all responders expect moderate or high to very high rates of progress in medicine and medical technology after the COVID-19 healthcare crisis. More than this, the younger generation is more polarized between very high to very low expectations while the experienced generation has moderated to high expectation, as presented in Figure 1.

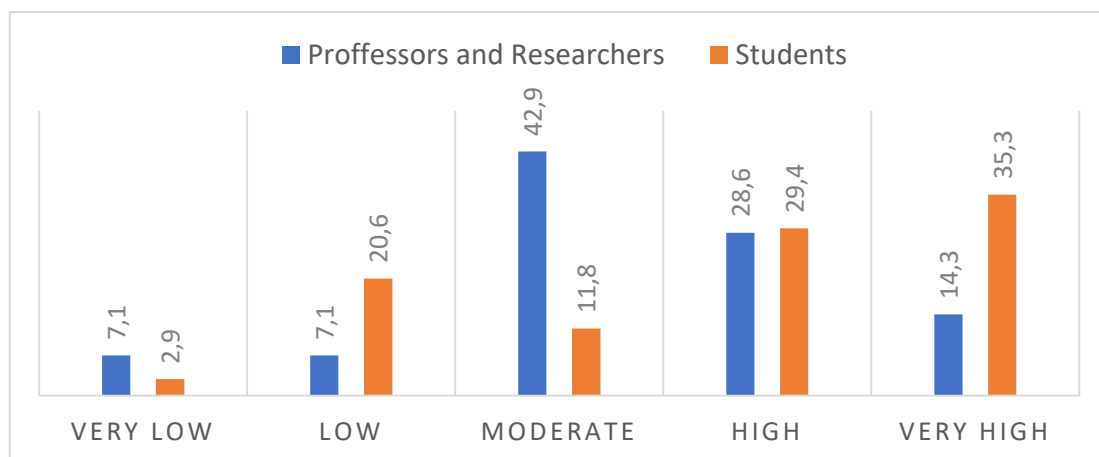


Figure 1. Comparison between generations regarding the expectations on evolutionary progress in medicine and medical technology after the COVID-19 crisis

Our next result goes deeper into the fields of expected evolution. While anticipating important evolutionary steps in the healthcare system and medical technology, most of the key decision makers are expecting evolutionary steps in research and development and medical technology, medical field and teaching system in medicine. Almost 67% of them think that the most important progress will be achieved in research and development as well as in medical technology.

Regarding telemedicine, the young generation of students again has higher expectations with 73% of them expecting high to very high progress in the next years, compared to only 50% of the experienced generation who expects high to very high progress in this field. Figure 2. illustrates the results for both categories of responders. But overall, it is obvious that both generations expect moderate to very high progress in the next years in the field of telemedicine.

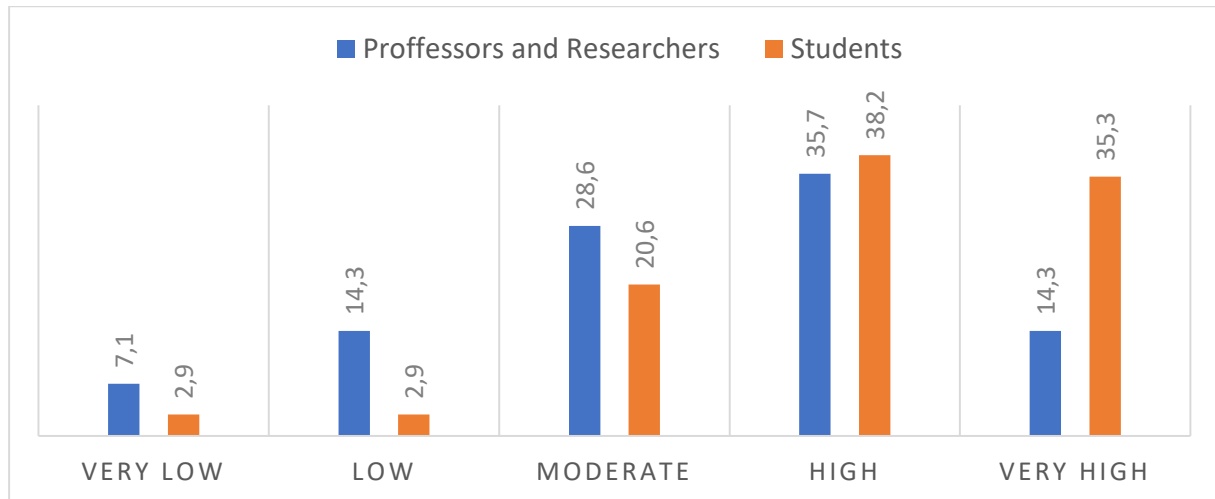


Figure 2. Expected evolution in telemedicine

Regarding the role of digitalization of the healthcare system both generations consider it will grow. 94% of the student's generations and 92% of the experienced generation consider that the role of digitalization will become more important.

Now, taking into consideration the major impact that the COVID-19 global healthcare crisis has on almost all sectors and with respect to the financial sector, we were looking on possibilities that could become economic drivers to recover after the crisis. Like major infrastructure programs and IT investments who helped recover the economy in past crises, the investments in life prolonging technology might become the new economic drivers.

Regarding the investment in life prolonging technology and evolution in this field, the younger generation is very confident, 91% of them think that great progress will be obtained in the next years in this field. In contrast, only 57% of the professors and researchers think likewise. Although the experienced generation is more moderate in this topic, the general result that the majority of them, together with the large majority of the next professional generation think at life prolonging technology with such hope, might actually be the starting point for increasing research and development budgets on all levels in this direction.

The second part, is dedicated to sociological aspects like the role of medical professionals in society, expected resources for research in medical field, general access to high quality medical treatments and the impact of the COVID-19 healthcare crisis on the professional planning of the new generation of medicine students, like international careers, involvements in research projects and even the impact on choosing their further specialization.

While many specialists in many branches fear that their role will diminish as automation, robots and artificial intelligence (AI) step in, we were looking on how the experienced but also the young generation of medical students look at the position of the medic in the society, after the COVID-19 crisis. We forced the answer by replacing one of the obvious possibilities, like the role of the medic will diminish, with the expression: automation will take over many of attribution of medical staff'. In this order the results from the young generations and the experienced one are almost similar at a distance of few percentages.

The overall interpretation of the combine result presented in Figure 3. illustrates that most of our responders see an improvement of the status and role of the medics in the future.

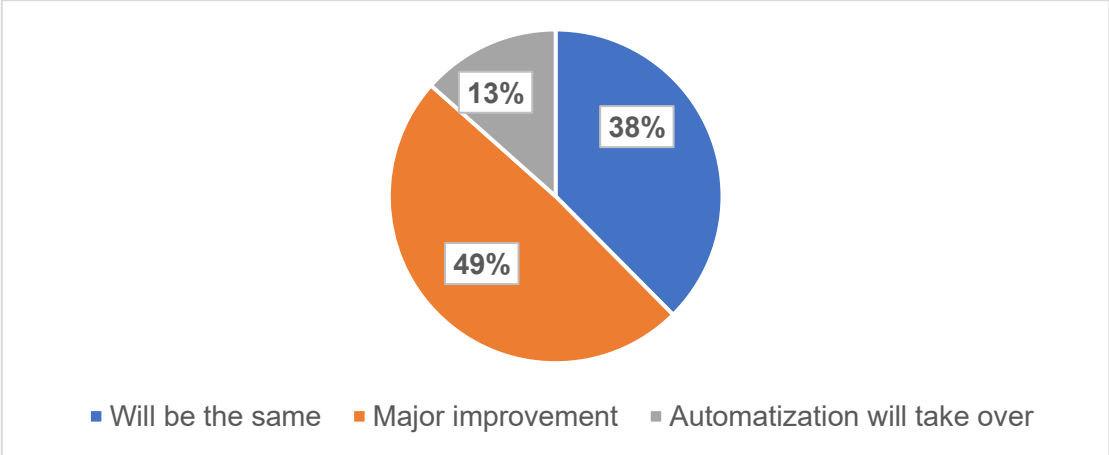


Figure 3. The role of the medic in the Society

Only 13% of them prefer to concentrate on the threats of their position due to automatization, robotics and digitalization. Therefore, we could presume, that the attractiveness of this profession could attract high potentials from future generations. Also, the education system in this field, could become of great interest, not only due to its impact on the healthcare system, but also regarding the impact on the economy. As university education is expensive and taking into consideration that the Romanian medical university system has a very good international reputation, the education system could become national strategic interest. Furthermore, half of the students are considering an international career. This is very relevant for the high quality of the educational system, and the fact that the students feel confident in the education they receive, education that would allow them to build international careers. On the other hand, as the education in medical field is very consistent and the studies usually take more years, by the time of this study, only 13% of the students consider that the COVID-19 global healthcare crisis impacted their choice regarding the future medical specialization. This is presented in Figure 4.

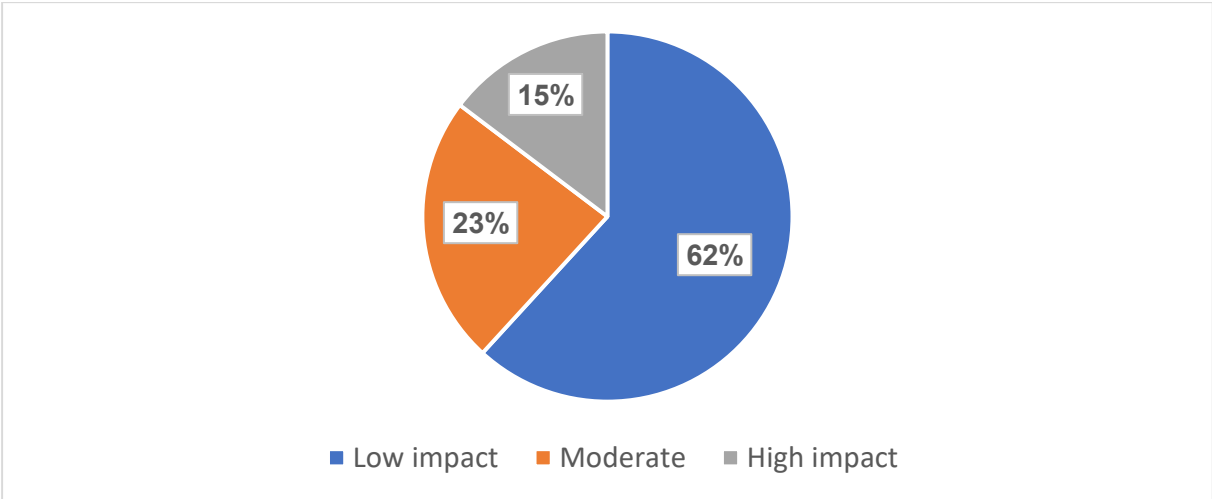


Figure 4. COVID-19 impact on choosing the specialization

Regarding the confidence in financial investment in medical research, 57% and 28% of the experienced professionals expect more and considerably more investments, while the students generation is more sceptic, as 52% of them do not expect an increase of resources for medical research, as shown in Figure 5. In contrast, the skepticism of the young generation of medics do not demotivates them regarding their involvement in research activity, as 41% of the students wish to take part in research projects, and 32% percent of them consider this option as very likely.

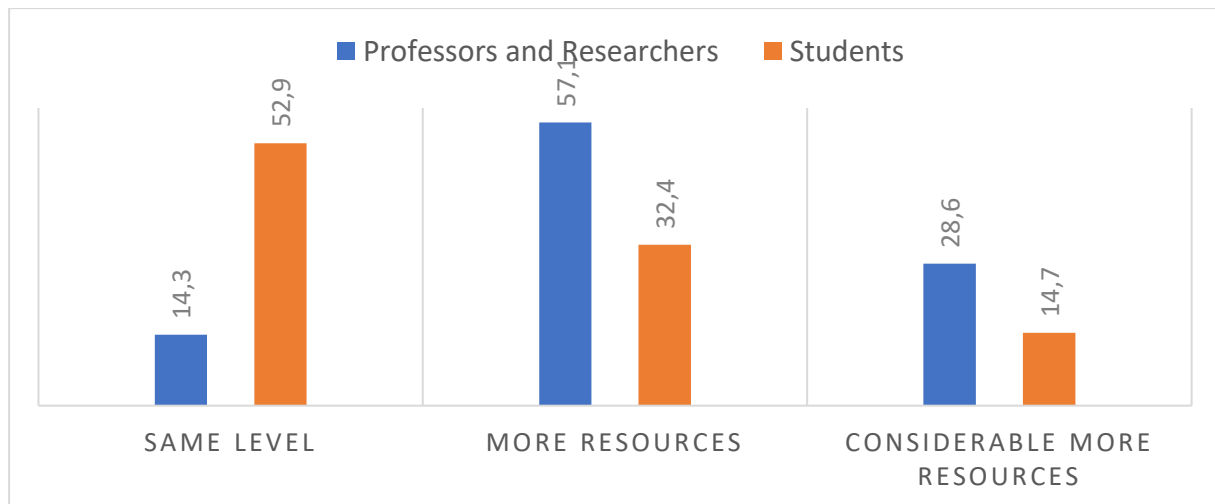


Figure 5. Financial investment in medical research

Our last result comes as a great surprise. When asking both experienced and young generation regarding the further the access to high level medical treatment, 76% of the young generation and 71% of the experienced generation consider that top level medical treatment will only be available for those who can afford them, while the minority considers that most of the people will have access to advanced treatment and medical technology. Analyzing this result with the expectation that medical technology will evolve with an accelerated rate, could bring great differences between different healthcare systems.

### Discussion and conclusions

Our first conclusion is related to the general high expectation level from medical specialists regarding the evolution both technological and social in the field of medicine and healthcare systems. The polarized younger generation of medicine students compensates the lack of experience with enthusiasm.

The idea of having separate instruments for each generation helps us identify the differences, but also helps us to consolidate the results. For example, all the generations expect high rate evolution in medicine, digitalization, telemedicine. Although we have to mention that such decisive results might also be a consequence of the high rate of evolution in the past years in the field of digitalization but also a consequence of the physical distancing imposed by the COVID-19 pandemic.

The greatest gap between generations appears when discussing about life prolonging technology. While in this case, the young generation seems very optimistic, most of the experienced specialists still think, great evolutionary steps will be reached. Since 91% of students and 57% of experience professionals expect this evolution, it appears to be a good direction for research investments.

With respect to the educational system, we can conclude that this vital sector in our society might also become of higher importance since it's great performance, half of the students consider themselves ready and consider to build an international career and most of them are determined or think at getting involved in research projects, although the experienced generation has higher expectation to get more resources or medical research after the COVID-19 crisis.

While taking into consideration, that in the opinion of more than three quarters of all responders, the society will become more polarized, and only those who will afford will have access to high level medical treatment, following question appears: what are the chances in Romania?

One answer could be a national strategy on development and major investments in the educational, specific medical education and healthcare system. The general expensive but particularly in Romania, the very performant medical educational system, could become one of our greatest assets on international scale. It is not a secret that Romanian medical universities are highly appreciated worldwide and many foreign students attend their courses. It could become one of our most valuable export products, if we consider education as a product.



On the other hand, since we expect only the rich citizens to have access to the highest medical treatments, one of the solutions to ensure large-scale high-level access in a country with the development status like ours, is to concentrate resources in education, research and production in this specific field. This conclusion could become the research topic of a national scale for those who are interested.

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# EDUCATIONAL MANAGEMENT CHALLENGES AT THE CLUJ MEDICAL UNIVERSITY DURING GLOBAL HEALTHCARE CRISIS

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## Abstract

**Purpose** – We present aspects regarding the managerial and organizational challenges in order to ensure the highest possible educational results inside the Medical University of Cluj-Napoca during the most severe global medical crisis of our times, the COVID-19 Pandemic.

**Methodology/approach** – In order to challenge our thesis, we designed and conducted several questionnaires for all the parties involved in the educational process. Both students and teaching professors were asked to fulfill the questionnaires.

**Findings** – Our results refer to the challenges and organizational efforts of transferring a well-established and acknowledge educational system in a very short time exclusive in the online dimension. We present valuable information for each significant section from the educational process of medical specialists.

**Research limitations/implications** – We only conducted this study inside the Medical University of Cluj-Napoca. As one the most important educational institution in this field, the results of our study may apply to other educational institutions, as all the educational system in Romania was heavily impacted during the 2020 spring lock-down.

**Practical implications** – The results of these study might be of great interest for all the parties acting in the educational system, mostly for medical branches, but not only. Especially those involved in the design of the educational system can find valuable data for the future, as being prepared for future possible lockdowns.

**Originality/value** – The study implies parties directly involved in the educational system during the spring lock-down of 2020. The structure and design of our surveys were both adapted to the needs and target sphere of respondents.

**Key words:** Global Medical Crisis, Educational Management Challenges, Healthcare System.

## Introduction

COVID-19 Pandemic, the world's largest healthcare crisis changed everybody's lifestyle, the humanity faces challenges and restrictions in social distancing like never before. What started as a local healthcare crisis, became very fast a global crisis with impact in almost all the aspects of social reality. First healthcare systems were affected, then education, economics, financial, government measures, social habits suffer major challenges.

Governments are taking actions imposing restrictions in order to keep the pandemic under control are heavy disputed, as control of pandemic also implies control of population, in some opinions, even beyond the limits of human rights.

For the teaching professors in the medical universities, this crisis brought two dimensions: They had to concentrate on both medical activity as doctors, but also on the teaching activity inside the university. They had to adapt with highspeed on both dimensions.

As the COVID-19 threat is far from being overrun and second or third wave appear in different countries on the globe, it is hard for specialists and governments to predict social distancing measures for mid-term. All the statements and decisions are taken mostly according to the very oscillating evolution of the pandemic in the region.

With major impact on the educational systems, further possible physical restrictions will have to be overrun by creative solution supported by technology and digitalization. What will be the future in education of medical staff? What challenges are we facing while completely renouncing at educational methods that require in person presence? What opportunities appear while all educational systems apply major changes and many resources are allocated to the educational systems world-wide?

### **Hypotheses**

The educational systems were under high pressure as social distancing during lock downs which blocked most of the traditional education forms, was imposed suddenly. As COVID-19 provoked a global crisis, governments had to act specific to the crisis management decision style. Crisis management also implies fast decisions which most of the times upset the affected environment because of the lack of adaption periods. Therefore, our hypotheses are that the high pressure on the medical educational system obliged the system to adapt with very high speed. The high access level to technology and communication systems made the conversion to online education easy in the field of theoretical education. The challenges in the practical part of the educational process are still very high, some aspects remain still unsolved. Solutions in this part of practical education without in person contact are still expected.

While the medical educational system was the most affected educational system, not only because the most of the teaching staff was also in the first line of fighting this global medical crisis, but also the students could not interfere with the core of their studies: the patients. Unlike other fields of activity, the medicine students suffered the most, because the patients they had to come in contact with, during the practical stages were representing a great risk of spreading the virus. In fact, on a world-wide scale, many hospitals became source of spreading the virus, not because lack of risk management measures, but simply because the general medical healthcare system was overrun and was not prepared for such a big scale of this pandemic.

As every major change brings risks and opportunities, we are looking at both of them in order to decrease the lacks and risk of poor qualitative education and also increase the advantage brought by new opportunities in the field of education. We studied this perspective during all the stages of the educational process for medical staff.

### **Methodology**

Our interdisciplinary team which covers specialists in medicine, teaching, research and management designed two different questionnaires, one for students and one for professors. Although both instruments have the same structure, specific topics are analyzed from different perspectives and the questions are adapted to the targeted responders.

Our instruments follow a strict structure which follows the main stages of the educational process at the University of Medicine Iuliu Hatieganu from Cluj-Napoca. In this order we first looked at the available infrastructure by taking into consideration only the new aspects imposed the social distancing and the 2020 spring-lock-down. For now, we find no need to focus on deep topics like content development, as this kind of changes require much more time than few months, but this might become a topic of further studies, depending on the evolution of the educational systems. This section is also very relevant for the adaptation process to the new teaching environment, almost exclusive online.

The second part of our instruments refer to the theoretical teaching system. By comparing both traditional and crisis – online teaching system we are also interested of new findings regarding the field of teaching techniques for improvement of theoretical knowledge transfer.

The third and maybe the most critical part of our study takes into consideration the practical part, which was heavy impacted by the lock-down and social distancing measures. As presented before, medical professionals have to prepare themselves for interaction with patients. In these first stages of the global healthcare crisis, the medical educational system was not prepared to accomplish the need of interaction

between students and patients because of the very high risk of contamination. For sure, on the long run, the educational system will have to improve in order to fulfill the needs on active interaction between students and patients.

Another important stage of our instrument reflects appreciations regarding the examination system. As one of the most effective quality guaranties of the educational system, the examination of acquired knowledge, was also questioned in order to check if it reflects the needs and if it allows enough adaptation freedom in respect to each course versus standardization.

The last part of our study is reserved to present unique techniques and general improvement points of the new online teaching system and also to help extract and present the most important conclusions of this study.

## Results

The first part of our study focuses on the access to required technology in order to continue the interactive educational process during social and physical distancing measures.

Regarding the access to internet, the professors seem to be very satisfied, 71% of them consider having had excellent access to internet connection. With few exceptions the majority of over 93% of both of professors and students had satisfying or excellent access internet connection. In fact, good access to internet connection made it possible to continue the studies in online medium during the spring-lock-down. Figure 1. presents the above-mentioned results.

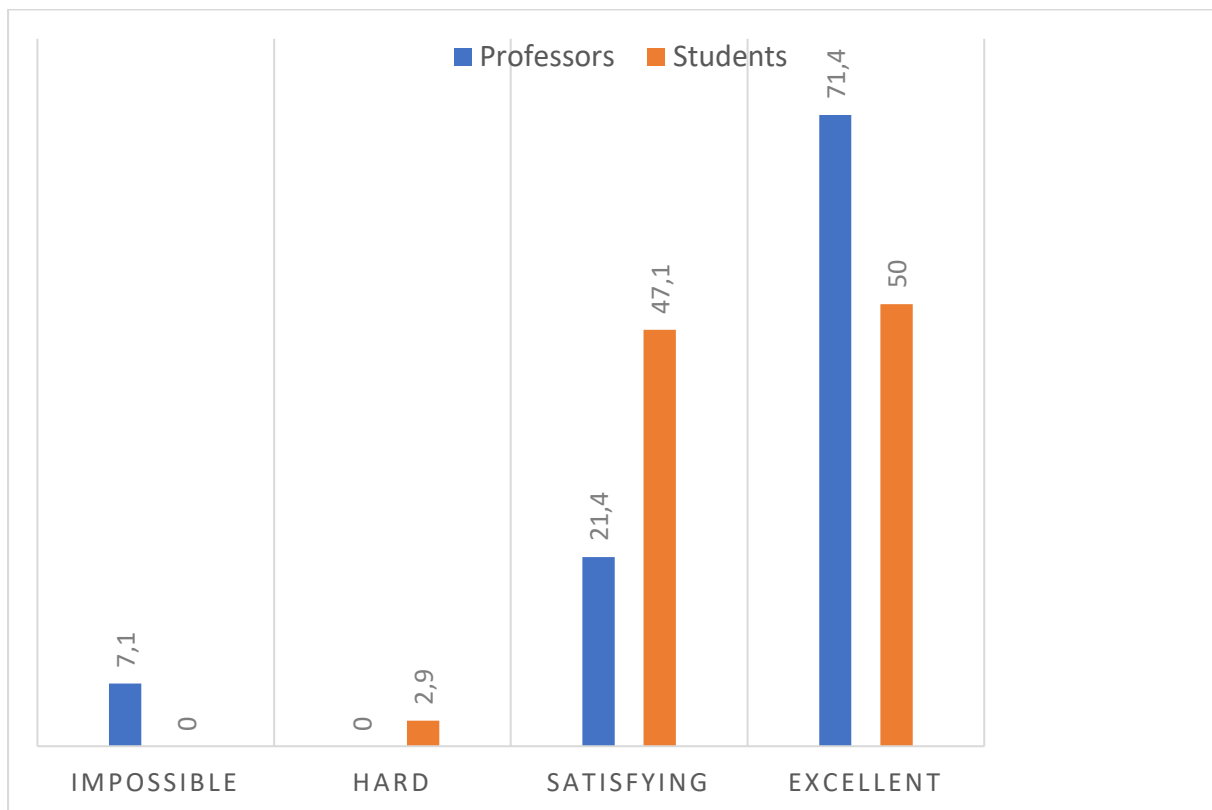


Figure 1. Access to internet connection

While over 93% of professors and students claim to not have any problems with access to the necessary devices, the results presented in figure 2. shows that most of our responders prefer laptop and smartphone. While tablets seem to have a very low usability, the usage of desktops seems to be rather preferred by professors. An explanation to this is the higher possibility that professors own an office at home, while students still have to rely on portability.

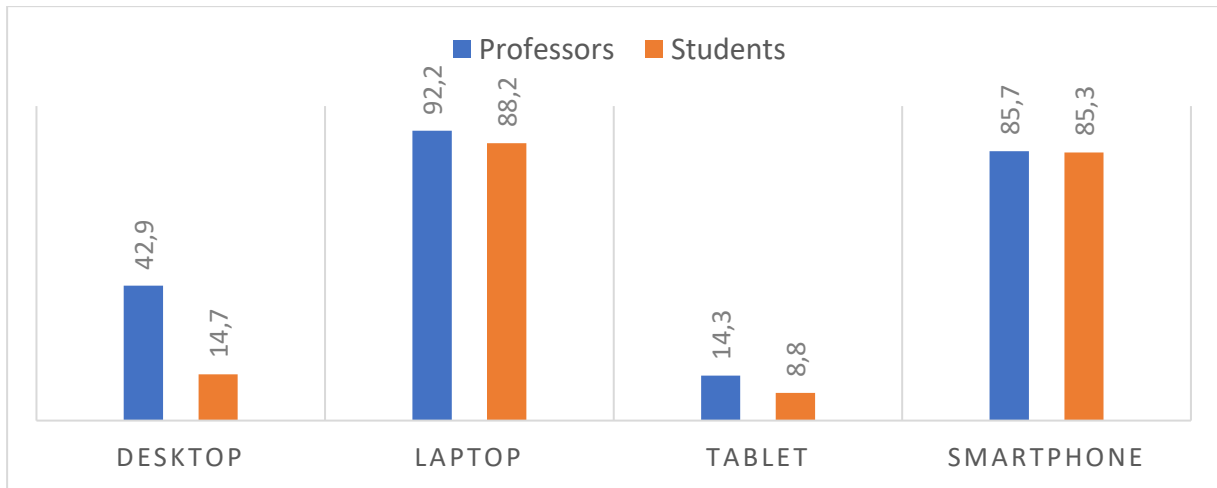


Figure 2. Access to devices

Overall, the adaptation challenges to the online environment for both professors and students seems to be overrun with no particular major inconvenience. In fact, 35% of professors and 32% of students say they had no problem at all and 28% and 32% of professor's respective students say it was hard to adapt but they found useful support. Other aspects reveal that the younger generation, the students adapt faster and easier to changes.

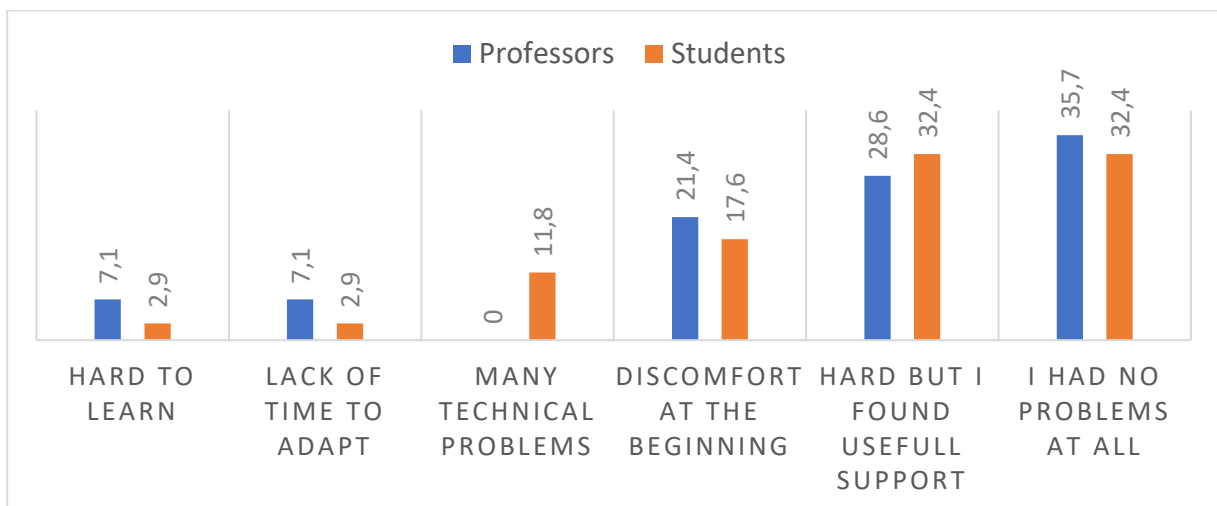


Figure 3. Adaptation challenges

Another interesting aspect is that 55% of the students say that they left the university city during the semester. This was possible due to the online classes. From the logistic point of view, students don't lose time to get/come back from university, another advantage mentioned in the responses of the students.

The second part of our study presents the challenges faced at the theoretical classes. In the beginning of this part, we should mention that 29% of the students consider online classes more efficient than traditional classrooms, while 41% think the opposite. 29% consider the efficiency of both ways as equal. If we take into consideration that only 41% prefer the traditional classroom after only one semester, the chances that online education will take proportion is very high.

A comparison between professor's vs student's choice between classroom vs online education regarding the theoretical aspects reveals that professors are rather more resistant to change, only 7% of them would prefer online classes, compared with 20% of students. Very important is the fact that a large number of responders do not consider the environment as important but rather the teaching techniques. A percentage of 42% of professors and 38% of students think likewise.

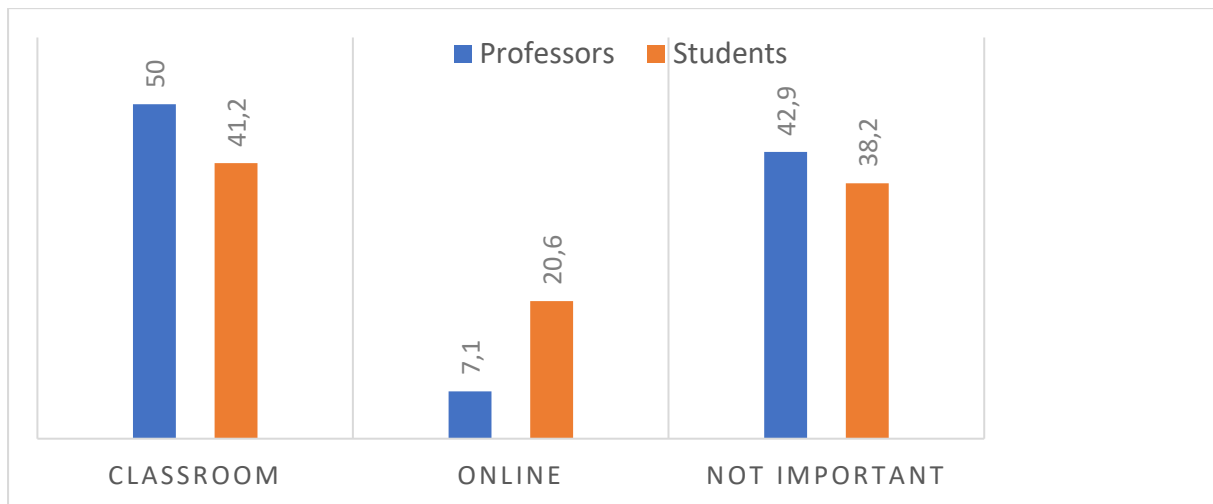


Figure 4. Online vs classroom theoretical lessons

Another comparison is the subjective evaluation of meeting the actual requirements. Related to this, students seem to be more exigent than professors. Figure 5. presents the answers, where both professors and students have evaluated from a scale from 1 to 5, where 1 means that the online training does not meet the actual requirements and 5 means that the requirements are fully fulfilled.

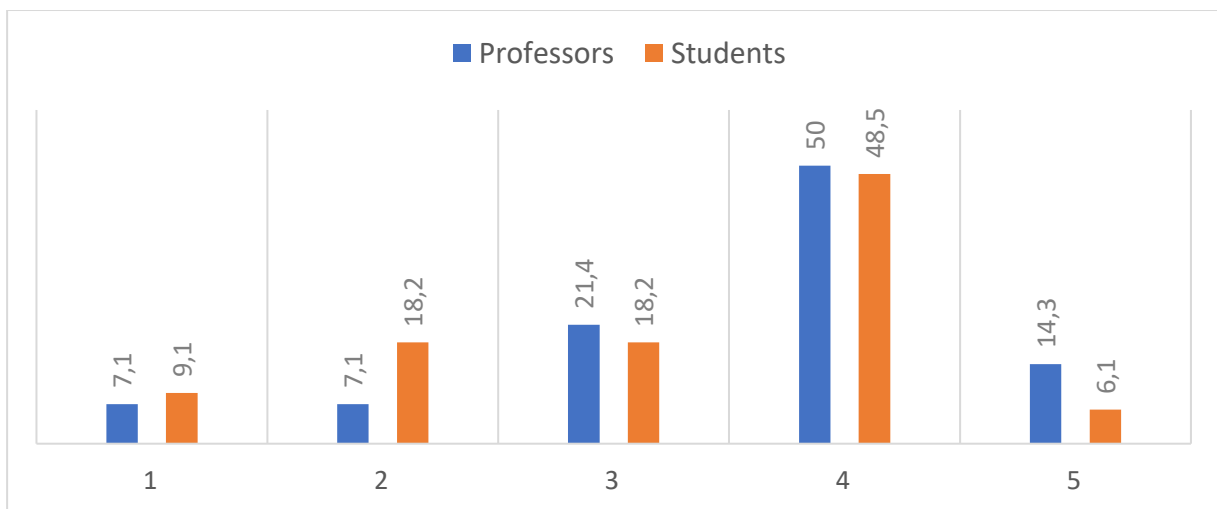


Figure 5. Theoretical education meets requirements

With the next topic, we seem to reach a sensitive topic: the capacity to remain focused during online trainings or the capacity to maintain the audience attention in online trainings. On a scale from 1 to 5, where 1 represents a very poor capacity to maintain attention and 5 represents a very high capacity to maintain the attention, the professor's answers are more concentrated around a neutral evaluation, meaning that they had not really a challenge regarding focusing during the classes. On the other hand, the students admit that 36% of them have major challenges on remaining focused during online classes.

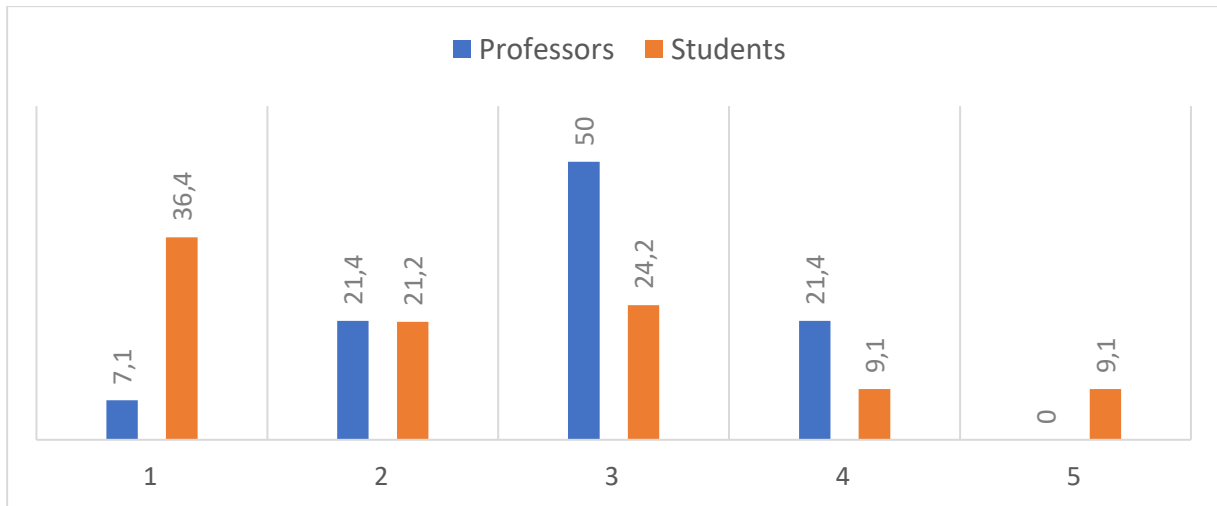


Figure 6. Capacity to remain focused

Furthermore, different pedagogical techniques like quiz, role-play, scenario, etc. were inserted in the online trainings. While the professor's opinion regarding the efficiency of these exercises is equally divided in two, the students do not appreciate this. 78.8 percent of the students do not consider that these exercises bring added value in comparison with the direct interaction with the professor and patient.

The third part of our study presents aspects on the practical training of the students. The results reveal critical aspects regarding the practical training of medicine students. 12% of the students and 21% of professors think the stages should be taught again, as the incapacity of getting in direct contact with the patients has a major impact on the educational process. Another 72% of the students and 50% of professors admit that practical stages are highly impacted when delivered in online and only 3 percent of students think that the educational act is not impacted.

On another question regarding the lack of time spent in hospital with patients reveals the same problem. 42% of professors and 60% of students admit this will have a major impact and 12% of students and 28% of professors think that this impacts the education severely, so the practical stages in hospital need to be recovered in the following semesters. Both professors and students admit in 71% and 54% that students have to invest more time in their theoretical preparation because the lack of practical stages in hospitals. They are also convinced, 92% and 97% of professors and students, that the online activity cannot replace the practical stages in hospitals.

The fourth part of our study presents aspects regarding challenges in the evaluation process of the acquired information. As presumed, the two categories of professors and students have very different opinions regarding the evaluation process. 81% of the students do not see a problem if the examination process is readapted while 53% and 46% of professor see a major impact respectively a small impact on the future generation of medics. This year, the exams were concentrated in 10 minutes per student per discipline. This had a certain impact on the stress level on students. The impact is presented in Figure 7. It seems that students, as they were the ones examined in this case, feel a higher level of stress than the professors would expect.

We also present improvement points gathered both from professors and students like: the implementation of a dedicated online platform or app better suited for examination. There should be more time (more than 10 minutes) for the examination. Development of virtual patients for the long run. Another improvement could be the possibility for students to choose the date of the exam from at least 2 options. Focus on what students learned. Evaluation can be an ongoing process during the classes. Intermediate presentations, essay or papers could represent a large amount of the final mark.



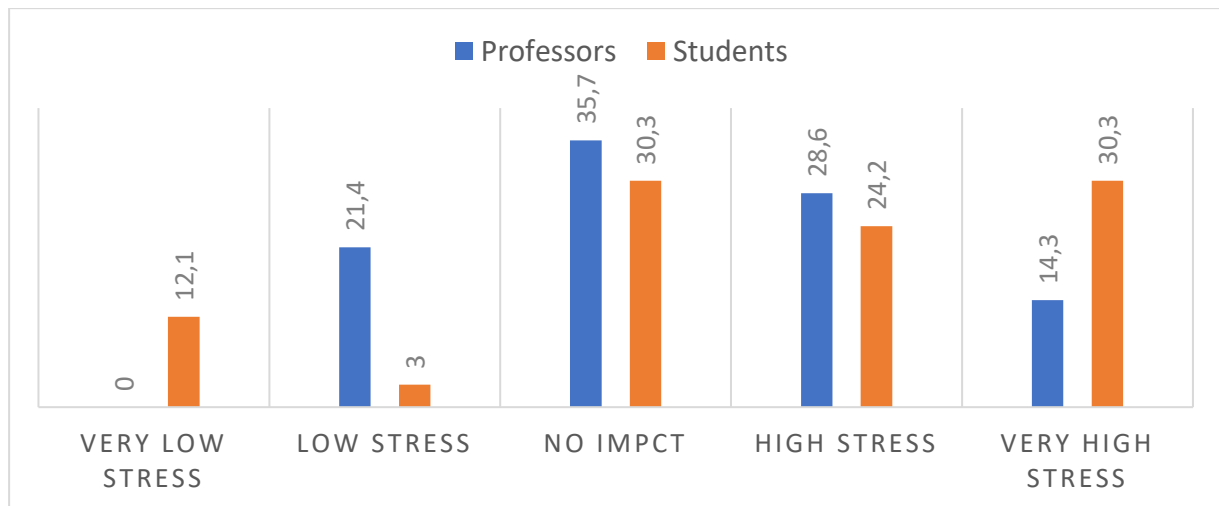


Figure 7. Impact on stress during online exams

### Discussion and Conclusions

The general opinion of students is that theoretical courses can be taught remotely, while practical works are impossible to be taught online. Therefore, it's hard to consider that a permanent online teaching method is a long-term solution. Probably not even a medium term one. Also, the evaluation method is problematic, since it is dependent on a lot of technical parameters that can bring bad results even if the student is a hard learning one. As a positive feedback, online courses can have its advantages, since they can be watched later and remain store for later consultancy. In the online courses there can be integrated images and videos that help the student to understand the topics. On the other hand, a long course, held online brings no interaction and attention is lost easily.

The professor's point of view is that online courses should be a complementary measure, for completing the educational activity, not the replacement for it. If there is the case, universities should help the professors to build the need infrastructure and adapt to the tooling. The online exams have a positive result, since the system corrects automatically the exams and information is easily kept into the archive.

### Notes

Our study presents the main challenges in the educational process at Iuliu Hatieganu University of Medicine and Pharmacy Cluj-Napoca during the first so called online semester in the history of the University. Due to the lock-down forced by the COVID-19 greatest global crisis in regarding social distancing, neither educational system nor students and professors were prepared for such a fast reaction. In our opinion, because all the universities were able to continue the educational process in such hard conditions is an accomplishment that had to be mentioned and highly appreciated. Because of great adaptation speed many challenges were overrun, nor necessary all of them in the best form. Our goal was to present the challenges and effects, as well as possible improvement points for the future.

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# MANAGEMENT CHALLENGES AND LESSONS LEARNT IN THE HEALTHCARE SYSTEM GENERATED BY THE PANDEMIC GLOBAL CRISIS

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## Abstract

**Purpose** – We present the most important lessons learnt regarding managerial activity hospitals during the global healthcare crisis of 2020.

**Methodology** – We conducted extensive interviews with hospital managers or key persons with wide decisional involvement in health institutions in Romania who were directly involved in their role during the first four months of the pandemic crisis generated by COVID-19.

**Findings** - As we are facing a global healthcare crisis, the lessons we present from hospitals from Romania can be compared with lessons from other countries and the learnings should prepare the healthcare system for a better response in future.

**Research limitations**– We conducted the interviews in medical institutions from major cities in Romania, as the general procedure in the first stage of the pandemic consisted in transferring positive patients into the regional special equipped COVID-19 hospitals, also called first line hospitals. We mention the fact, that we also conducted interviews in hospitals that were not COVID-19 hospitals, but they had to operate as usual because of specific emergencies and both staff and patients were also exposed to the virus and could become source of spreading.

**Practical implications** – the conclusions we present should be taken into consideration by risk management specialists and all the persons acting in the managerial process of medical institutions.

**Originality** – the learnings and conclusions come from key persons directly involved in managing challenges on a scale that has never seen before in the medical system. By combining expertise from different fields like medicine, management, teaching, research, development and production, we organized the study by specific criteria in order to obtain valuable results. Some of the authors were also involved in the first line during the COVID-19 crisis.

**Key words:** Management challenges, Medical system, Global healthcare crisis

## Introduction

November 2019, a new virus called COVID-19 was first identified in China. Two months later, the virus spread in the whole world and became the source of the largest global healthcare crisis ever faced by the medical staff world-wide. With implications beyond imagination, the COVID-19 pandemic affects almost all sectors of our life. Healthcare system, economy, finances, politics, education, even societies and technology are influenced by the pandemic. Social distancing becomes the new normality and citizens trust into authorities is tested. We encounter discipline vs social unrest, hope vs fear, economical breakdown vs massive support measures by different governments. Even concepts as democracy and human rights are highly disputed while the world fights on all fronts against the COVID-19 pandemic.

As no one would presume, the pandemic wave hit Romania unexpected. The medical healthcare system was heavy tested, especially in the first weeks of pandemic, when all the countries were fighting to get medical equipment and devices, protection masks from the largest producer in the world, China. As a direct consequence of globalization trends and permanent pressure on production costs in the past

decades, China with its impressive production capacity became indispensable to the world through its exports. We will only refer to the products needed by the medical system. As the largest producer was already highly affected by the virus, many other countries were trying to prepare and face the pandemic wave.

When taking into consideration the research and development and production processes of medical devices/equipment, we know, that this field is highly regulated which makes new production capacities very time consuming until to deliver the first products into the market. Especially in the European Union, which has a very protective legislative system, ensured by European Council Directives, the production facilities in medical field are very expensive and require huge amounts of time investments. What would be the new ratio between speed and compliance?

Governments all over the world took strict measures of social distancing in the hope of preventing the virus to spread. Economic, social and political consequences followed several weeks and after two months most of the countries gradually relaxed the restrictions. A second infection wave appeared in summer 2020, and at the moment it looks like most of the specialists involved in the medical system are preparing for a long run against the COVID-19 crisis.

Looking back to the first four months of this healthcare crisis we study the reactions of the medical system in Romania and look after learnings from key persons who were directly involved in the managerial process of first line hospitals and also specialized hospitals. Both were operating hospitals during the entire period, so they faced the major risk of infection and virus spreading.

## **Hypothesis**

In order to present valuable results, we conducted a study organized in several sections. After extensive interdisciplinary collaboration we defined out hypotheses.

The first hypothesis refers to the effort of the hospital management to reduce the spreading of the virus. Because of the direct contact with infected patients, the proportion of infected medical staff was very high at global scale.

The second hypothesis consists in under or over evaluation of specific risks and measures. As the decision makers had few historical data and there were great differences between the spread rate and speed in different countries and very few valuable information regarding the virus and the reactions, we presume that many reactions and measures might have been wrong estimated.

Our third hypothesis looks forward to the future. As all the major crises in history brought also technological progress as consequence, we think that this major global healthcare crisis will bring significant progresses in many fields of our life. In this article, we will only consider the progress in the close related fields like medicine, healthcare management, production of medical devices, pharmaceuticals and training of medical specialists.

## **Methodology**

Our hypotheses were confronted with the results of extensive interviews with hospital managers and key decision makers in the healthcare system. Although we developed a specific questionnaire, we also ensured enough space in order to not limit the valuable input from the first line. Our goal is to obtain valuable information in a format that can be compared and analyzed from experienced key persons. During our activity to validate or invalidate our theses, a more important aspect occurred, namely, to not undermine useful information that we might have overlook.

## **Results**

Regarding the effort to reduce the spreading the most important measures to protect patients and medical staff rely on high quality adequate equipment, disinfection standard and protocols and epidemic selection of all patients by testing all patients. Another measure was the effort to reduce the number of patients, per day by filtering the emergencies. Also, the organization of the circuits in the hospitals and medical institutions helped significantly, but not all institutions had enough space to adapt to the crisis mode activity.

One of the greatest managerial challenge was to ensure the acquisition of medical supplies. We were facing a global crisis on masks, disinfectants, gloves, etc. the so-called basic equipment. Not only that prices were rising exponentially, but some of them could not be found on the market at all. A major factor which amplified the supplies crisis was the lack of local producers for such supplies. Since the whole world was depending on the Chinese exports, we all had major blockades in the supply chains.

In extreme cases, solutions were needed. One of them was the compensation of lack of UV lamps with long time ventilation of the rooms.

With consideration to the progress obtained in the last months in order to reduce the spreading of the virus in the hospitals and medical institutions, our interviews revealed several important aspects. First, we have a better, more effective selection protocols. The increased testing capacity helps all the hospitals and medical institutions react faster. Another essential progress we can find in the field of consumables, although still expensive, we can find them on the market. One of the reasons why we can find consumables on the market is the fact that with great speed all the European countries started producing medical consumables and the dependency from China was not strict anymore. Another great progress is estimated in the field of knowledge and communication. While in the beginning the unknown regarding this new virus was spreading fear and panic, now as we gather information and data regarding SARS-CoV2 we can treat it more adequate. As a general conclusion, all the key persons admit that the progress on knowledge is still very slow.

As most of the hospitals and medical institutions were not directly involved in the fight against COVID-19, in the attempt to minimize the number of patients and possible contamination, the government decided to close many medical institutions. Also, many sections in hospitals were closed or had the activity reduced, especially those who did not treat emergencies. Our next question reflects the consequences of this lock-down. In order to answer this question, we have to define two different categories. The public healthcare sector and the private one. For the first one, some specific measures were to reduce the activity if they were not COVID-19 hospitals. For the second one, the private sector, the lock-down brought heavy loss from the economic point of view.

The second part of this study presents the reactions in the medical healthcare system. As we were facing a global crisis, the fast reaction crisis style had to be adopted, as managerial style. One of the consequences of taking decisions very fast is the lack of calibration with the importance and impact of the decision. It is generally very common that fast decision making can easily bring to under or overreaction to many problems.

When asked what decisions from the last three months they would keep regarding the consumables, most of the answers we received were that they would implement the same measures regarding protection materials. The only difference is that they would like to buy materials directly from producers in order to obtain better delivery and commercial conditions. One other thing was the necessity to have enough quantities of supplies. The idea that we need to encourage local producers was very often heard.

In the field of human resources, our responders highly recommend that the staff should be organized in more shifts, the more and smaller shifts - the better, in order to protect some of the shifts in case of contamination. While most of them admit that most medical units had enough human resource, some complain that the personnel structure was under-dimensioned. Both categories admit that medical staff could have been relocated more efficient in case of supplementary bonuses. In case of private medical institutions that had to close because they were not directly involved in the fight against the COVID-19 pandemic, personnel costs are a heavy loss, and some private players might close the business after this period, other will recover very slow. For all units, the epidemiologic sorting before the beginning of the activity remains a mandatory measure. In the end, a general common solution appears to be more communication in the teams. Sometimes, because of lack of communication panic can appear. Large institutions should have communication trainings for all the responsible with communication.

Regarding the communication process during the first three months of the pandemic we can highlight some ideas. One of them is the importance of an aligned message between all layers, starting with, some say, WHO – World health Organization, Minister of Health and Medical Council. In the last period, due to lack of proper information but also because abundance of misinformation, we are facing a very dangerous involution of trust in authorities. A major role for this is played by the quality of communication. Another topic is the improvement of electronic information archive process.

Regarding the communication with patients we should include more telemedicine techniques. On the other hand, specific instructions for patients have to be very easy to understand and follow.

Although the mass-media had an abundance of governmental information campaign of public interest, some specialists consider that the media, also had a confusing role for the population regarding the debates on certain topics related to the impact of COVID-19 pandemic. Such impacts on human rights, political and economical environment were debated in press.

One last mention is related to the public health direction, DSP, who some specialists consider are heavily outnumbered and did not have the structure and capacity to inform both population and medical staff. In order to ensure an efficient information process, there could be at least two solutions. The first one is to enforce and grow the structures of DSP in order to manage the communication process with population but also with medical staff. Another solution would be to establish on national level a new institution with communication attributions for medical staff.

Based on the experience in the last three months, one of the appreciated administrative measures were the direct acquisition process which enables an easy and fast form to procure supplies and equipment.

Another suggestion is that every hospital with more than 100 beds should have its own epidemiologist.

In the third part of our study we present the most relevant aspects regarding the expectations to the future in the context of COVID-19 global healthcare crisis and the post-pandemic times. It is well-known that every major crisis led, during the history, to technological or social evolution. From this perspective, the year 2020 brought the greatest healthcare crisis of modern times.

When asked how the evolution of medical field in the next decade will look like, we received some very interesting point of views. While some think that the access to existing but expensive technology will become more accessible, other mentioned automatization with focus on efficiency. Almost everyone agrees that the progress will rely on technology. We have concluded with a general idea that the focus will slowly move from treatment to prevention, as prevention can be a more effective way to fight future possible pandemics.

The progress of medical equipment is expected to be accelerated because of the COVID-19 crisis. Until now we observed in the last three months governmental measures in order to rebuild some of our medical equipment producing industry. This field was sadly neglected and the integration in the European Union led this field almost to extinction. The reason is that the government did not negotiated fair conditions for the existing producers before and during the integration and in this field of heavy regulated industry producers of medical devices in UE need time and resources to adapt to the new European conditions. Nevertheless, we received answers that in the future the evolution of medical devices producers will evolve fast because of great competition on the international level and hopefully also on the national level.

The European Union is well-known for its extensive, highly documented procedures and standards. The key persons acting in managerial positions in hospitals and medical institutions expect that the certification process of medical devices will be accelerated because of the great need of such products on the market. In order to obtain this, they do not necessary expect lower standard, but at least less bureaucracy. In a similar way, the process of introducing new drugs on the market is expected to be easier, but only for the big pharmaceutical players.

One other interesting topic is related to the chance that online education in the field of medical specialists could present many opportunities. As the whole educational system was forced to switch in several days from traditional teaching to online environment and the system had measurable results without being forced to post-pond generations of students, it is obvious that online teaching will play role from now on and investments in specific technologies and techniques will for sure bring valuable results.

## **Discussion and conclusions**

Confronting our results with the first hypothesis that refers to the effort of the hospital management to reduce the spreading of the virus we can conclude that the healthcare system consumed many efforts and capacities to react and avoid spreading the virus. From easy to understand instructions for all patients to well defined procedures for medical staff, with discipline and great effort, by organizing the

staff in different shifts in order to avoid contamination from one shift to another, this continuous effort shows its measurable result.

Our second hypothesis was that during the specific crisis-managerial style, it is often expected to under or over evaluate specific risks and take accordingly disproportionate measures. Although at the first view, our hypothesis would not stand, as most of the key persons that answered to our interview declared they would not change many things, we consider that there are specific fields like provisions with supplies and medical devices, human resource organization, communication inside the healthcare institutions and with the population were field where we had disproportionated reactions. Even the lock-down of all private stomatology institutions for several month is considered by some as an abusive decision.

Our third hypothesis referring to high expectations regarding the evolution in the field of medicine and medical technology after the global healthcare crisis of 2020 is confirmed. With more focus on prevention than treatment, relying on technology, with less bureaucracy and high competition, in the thrive to achieve national or local independence on producing medical essentials and with new opportunities in online medical education the evolution in the medical field is expected to be accelerated.

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# COMPARATIVE STUDY REGARDING STUDENTS' PERCEPTION ON EDUCATIONAL SERVICES PROVIDED BY INTERNATIONAL UNIVERSITIES

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## Abstract

**Purpose** – *This paper aims to reach two coordinates: identifying the determinant factors for increasing international students' satisfaction with the educational service provided by the host university, on one hand, and advancing a set of measures that could increase this satisfaction, on the other hand.*

**Methodology/approach** – *The applied research method consists in the comparative analysis of different results obtained by various previous researches, based on the application of the SERVQUAL model in universities from different areas of the world, with the aim of determining international students' perceptions regarding the quality level of the received educational service.*

**Findings** – *The paper emphasizes the determinant factors for increasing international students' satisfaction with educational services and the measures that once adopted could increase their satisfaction.*

**Research limitations/implications** – *The sample of universities taken into account for the study is relatively small and therefore the obtained results cannot be extrapolated to the majority of foreign students that study at universities abroad.*

**Practical implications** – *The study highlights those elements that could lead to the improvement of quality management in a higher education institution.*

**Originality/value** – *It is a specific study that could help stakeholders to acknowledge the importance of the foreign student's perceptions about the quality of university management.*

**Key words:** *service quality measurement, quality management, higher education.*

## Introduction

Education has become nowadays one of the most important sources for the global economy. Higher education is expected to have great contributions due to the high impact it has on every nation's economy. Higher education institutions face a very intense competition, which requires the sustained improvement of their educational services, in order to attract a high as possible number of local students, but especially foreign ones. The latter ones represent a valuable source of revenue and at the same time, they are true catalysts for increasing the reputation of the respective universities. To reach this goal, they seek to harmonize the standards, to deepen the mechanisms for quality assurance and to acknowledge professional qualifications. In the same context, it has to be brought into discussion the academics' efforts, which try to continuously improve the teaching and learning methods, given the requirement to align them to the significant changes that all educational systems face under globalization and technological progress. With the enhancement of globalization of higher education and of the competition on the educational international market implicitly, universities are challenged to positively influence whenever possible the level of satisfying the needs of international students by increasing the quality of the provided services. Students' feedback represents an important requirement for capturing the information that can correctly guide the quality assurance process in higher education. Moreover, current students are more aware of consumer rights and of information and claims issued by the current labor market. Hence service quality measurement has become more imperative than ever. However,

the quality of services provided by higher education institutions cannot be measured objectively, because it is a complex and varied concept, which needs to be continuously explored, being essential for:

- attracting a larger number of students;
- ensuring an efficient development of human capital, in the absence of which economic progress would not be possible;
- helping the decision factors to identify and implement on time those strategic measures that bring value to the educational environment, transforming them into true opportunities for the higher education institution. All these will make a positive mark on the effectiveness of each university's offer and the quality of the provided services will be improved.

The aim that was sought by comparing studies conducted in different universities in the world on the opinion of international students related to the received educational services has two coordinates:

1. identifying those dimensions proposed by the SERVQUAL model that should be the most and most often prioritized and stimulated in order to achieve a high as possible level of student satisfaction;
2. determining a set of measures that could reduce or even help eliminate the gaps that affect student satisfaction with the educational service quality.

All these preoccupations were determined by the interest of emphasizing those ways by which students from various countries can be attracted to university studies in the conditions of an extremely competitive and versatile international education market, with them also being important sources for the host country's budget. Probably the best example in this respect is that of Australia, one of the countries that annually attracts most of the international students and this has generated in 2018 34,9 billion USD for the country's economy (Study International, 2019).

## Methodology

The basis of this analysis consists of researches conducted by foreign researchers in other countries. These studies have emphasized the local situation regarding the dimensions of the SERVQUAL model and highlighted those elements considered as being the most important for the investigated students for choosing a university and also for continuing the studies started there.

The instrument used for analyzing each university included in the present study is the SERVQUAL model which is considered an instrument that enables a good knowledge of students' opinion about the educational services provided by the university. This model consists in questioning students through 22 statements regarding their perceptions on the quality of the received service, as well as through 22 statements regarding their expectations about this service's quality. The respondents are asked to evaluate those statements using a Likert scale. These statements are grouped into the following dimensions (Parasuraman, Zeithaml and Berry, 1988):

- **Tangibles** that emphasize the existence of physical aspects that are specific for the educational service adapted to present days;
- **Reliability** reflects the university's ability of safely and correctly providing the promised services, even if these are performed for the first time and of respecting the established time frames;
- **Responsiveness** reflects the consistency of the academics' performance;
- **Assurance** is expressed through the academics' training, their professional ability of delivering high quality services, through the politeness, respect and consideration that the staff shows towards the student, or in other words, assurance is expressed through the knowledge and courtesy of the staff and their ability of inspiring trust (Zeithaml and Bitner, 2003);
- **Empathy** resides on the manner in which the communication between academics and students is performed.

Each dimension comprises various elements, with some of them being exemplified, in a less exhaustive manner, as it follows:

- The tangibles dimension includes statements regarding the endowment level of spaces dedicated to both teaching and recreational activities, the existence of state-of-the-art equipment and technologies, the generosity of the library's book offer, attractiveness of informative materials (brochures, files etc.);
- The reliability dimension comprises statements that enable determining student's satisfaction with the university's interest for promptly solving the promised services, the educational process's conformity with the academic regulations, the correspondence between university's offers and students' needs;
- Responsiveness collects information regarding the level of informing the student about various aspects related to the academic community, if the lectures are taught according to students' understanding level and adapted to the requirement of the labor market, if the students are satisfied with the schedule;
- Assurance seeks to remark the positive attitude of the academic staff, teaching the courses with the help of attractive materials, supporting student's critically thinking;
- Empathy groups statements about encouraging the communication between the academic staff and the student, active participation in class through developing team-work abilities, easy access to information about the faculty (notice board, website), support from the university for solving student's individual problems.

The difference between the average of customers' perceptions and the average of customers' expectations reflects the quality level of the delivered service. The results are compared in order to identify the magnitude of gaps for each dimension. A large gap shows the low quality of that service, while a small gap reflects the service's good quality (Parasuraman, Zeithaml and Berry, 1994).

## **Results**

A previous study determined high satisfaction rates among students from Central Asia that studied abroad at universities from various countries like Russia, United Kingdom, Kyrgyzstan, Turkey, China, United States of America, Malaysia, Czech Republic, Germany, Netherlands, France, Canada, South Korea, Austria, Belarus, Ukraine, Australia, Ireland and Norway. These students' high satisfaction was largely attributed to the level of physical facilities found especially in the ITC area and in the universities' libraries (specific elements of the tangibles dimension), but also to the relevance of academic courses at which the investigated students participated for their future perspectives on the labor market (the assurance dimension) (Sabatayeva et al., 2018). In the same context one can place the opinion of foreign students who opted to study at universities in Canada and which had the same perception regarding tangibles, but also showed a high appreciation for the assurance dimension found in the services provided by the higher education institutions (Yasin and Belanger, 2015). Another study revealed that foreign students studying in Malaysia are very satisfied with the physical facilities, especially those related to ITC, but also with the superior courses and the expertise of the academic staff (the assurance dimension). However, the investigated students had a double recommendation for the university: to focus more on solving students' individual problems (the empathy dimension) and to promptly and professionally provide the promised services (the reliability dimension) (Ong, 2013).

Impressed with the physical facilities offered by the university were the international students in Singapore as well, but unlike the others, they had higher expectancies for the assurance dimension (Min, Khoon and Tan, 2012). The importance of higher education institutions' investments in IT facilities for improving students' satisfaction was also in line with the results of other studies (Mai, 2005).

At the opposite pole are the overseas students studying in universities from United States of America, which presented a novel situation. The satisfaction of international students from universities in Indiana and Michigan seems to be positively influenced as long as there are reliability and empathy. In other words, there is a high impact on their experience as long as they find at their host university communication, interest for solving the problems they face individually and solving problems as quickly as possible (the reliability and empathy dimensions). They seemed less preoccupied with specific tangibles aspects like the aspect and maintenance of installations, equipment and staff (Ongo, 2019).

A study conducted in the United Kingdom, a country whose universities are preferred by students coming from all over the world, comes to emphasize some of the previous results. This research

identified that the assurance dimension represents the basis for foreign students' satisfaction. Moreover, they considered that a university's consistent reputation is built through both the provided physical facilities and the interaction between students and the academic staff (Onwumere, 2018).

Becoming more and more aware that students are demanding consumers of educational programs and that measures should be adopted for the continuous improvement of provided services, the higher education in South Africa closely follows those in UK and Australia in what concerns the development of external agencies for quality assurance. Previous research shows that students studying in this country are satisfied with the physical facilities they find in the university and with the advice received when they arrive at the university, but they wish for their requirements to be solved more quickly, for the environment to be friendlier and for the staff to be able to adapt according to the problems that arise from the perspective of intercultural and language differences (the assurance and empathy dimensions) (Noel, 2011).

Previous analysis of students that have come to study in Scotland revealed the following elements as being important for outlining their expectations regarding the quality of the educational service (Essam, Wang and Hassan, 2013):

1. The staff should be willing to help both from the teaching perspective and at a personal level (the responsiveness dimension);
2. The university should be willing to solve students' problems and preoccupations (the reliability dimension);
3. The academic staff should be fair and consistent in assessing students' materials (the reliability dimension);
4. The tuition fee should reflect the quality of all services provided by the higher education institution.

The first three aspects mentioned above come to emphasize the conclusions of another study, showing that students coming from different cultures can have different opinions when assessing the provided service, but their attitude is the same when it comes to reliability and staff's responsiveness (Furrer, Liu and Sudharshan, 2000).

A different situation was revealed by a study conducted in seven universities from the United Arab Emirates, as the investigated students externalized their dissatisfaction with all the dimensions of the SERVQUAL model. This reflects student's strong disappointment with the services provided by these universities. A large gap was recorded especially regarding the assurance dimension, as there exists mistrust in universities' abilities to provide career opportunities on the labor market, because most of the institutions are just campuses of universities from other countries and there was no collaboration between the academic environment and industry. The smaller gap between the scores for services' quality was registered for the empathy dimension, as students were satisfied with the care and attention shown by the university, although they came from different cultures. The investigated students revealed a hierarchy for prioritizing university's efforts for increasing reputation, containing the dimensions in the following order: reliability, assurance and responsiveness and less for the tangibles and empathy dimensions (Datta and Vardhan, 2017). If the international students studying in the United Arab Emirates were most satisfied with the empathy expressed by the staff in the host universities, in universities from Turkey the sensitive areas detected by the investigated students consisted precisely in the weak support they perceived receiving from the university personnel, especially from the non-academic staff (Bozbay et al., 2020).

Another study revealed that with the support of the Chinese government, Chinese universities are strongly oriented to attracting a high as possible number of international students and they therefore offer attractive incentives in the form of scholarships, that can be governmental, provincial and presidential. In what concerns the satisfaction of international students in China, it is emphasized that this is based more on specific elements for the dimensions of tangibles, empathy and reliability and less on the assurance and responsiveness dimensions (Zaineldeen, Hongbo and Ibrahim, 2020).

In universities from Japan the international students' preoccupation for meeting competent academics (the responsiveness dimension) was noticed, while students considered that the academic program should be designed and formulated according to the international standards (the reliability dimension). Moreover, it is expected for the staff to be proactive in providing the promised services (the reliability dimension). At the same time, it was emphasized that advertisement and recommendations of former

beneficiaries of these programs represent stimuli for students when choosing a university program (Sultan and Wong, 2010).

An interesting aspect was noticed following a research conducted in Barcelona. In this case, the trigger element for the international student's satisfaction was empathy. The student seemed very impressed with the interest shown by the university for the problems he faces during his studies, for facilitating him access to the important information. Students' expectations for the future show that they expect an increasing interest of the university in the direction of elements included in the tangibility, reliability and assurance dimensions (Mongay, 2014).

## **Discussion and conclusions**

Comparing the expectations and perceptions of international students from different year of studies can generate additional important information for a better guidance of the actions for improving the quality of higher education. The SERVQUAL represents a helpful instrument in this direction, because it enables identifying those strategic areas for which triggering measures should be implemented in order to raise the quality level of educational services.

Analyzing studies conducted by various researchers in universities located in different countries has enabled the outlining of some measures, that can generate a reduction of the gaps that affect the satisfaction of the student studying abroad and which can have as effect even reaching a stage that corresponds to students' requirements from the perspective of SERVQUAL model's dimensions:

1. Focusing resources for buying new equipment, in order to ensure facilities that are physically maintained and visually appealing. This aspect is supported by the majority of previous referred studies, which demonstrate a very high impact of the tangibles dimension on the satisfaction of students studying abroad.
2. Implementation of the university management of a culture of high-quality services in the institution. For this goal, the staff should be trained to know the technology at the workplace, to have a digital education, such that it can reach high standards of efficiency and performance. The staff should have capabilities that enable understanding students' problems, both from the academic and the administrative areas, which are mostly generated by the different cultures where they come from (the assurance dimension).
3. A strong determinant factor for the investigated international students' satisfaction is assurance. Improvement of this dimension can be obtained through establishing a support service that keeps a direct and permanent contact with the students and their problems; in case this service does not work, higher level decision makers should be notified.
4. The reliability dimension that was mentioned many times in the analyzed studies and that represents for Parasuraman the most important dimension in order to reach a high level of student satisfaction, can be improved through implementing a mechanism for checking the time frames that were promised to students and the existence of a system that monitors students' feedback.

Synthesizing the previously mentioned aspects, it can be stated that the existence of communication channels between university and student, that enable promptly recording the gaps in the relationship between these two parts, can become viable managerial instruments through which university management can correctly and timely control and assess the situation regarding the quality level of the provided services. This way the decision factors are connected to students' problems and focusing on solving these problems can turn into a true competitive advantage.

It is therefore absolutely necessary for universities to be interested in evolving in a sustained manner, in enabling a better understanding of intercultural differences, in being in accord with the standardization degree and at the same time, in taking into account service customization.

The development of this preoccupations will obviously generate the existence of advanced educational services, which together with high quality health services, will enable a nation to have a high development level from economic, social, but also cultural point of views (Săvoiu et al., 2014).

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# **Management across cultures: Challenges and strategies**

# IDENTIFYING SMARTPHONE CONSUMER PREFERENCES IN A CHANGING TECHNOLOGY

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## Abstract

**Purpose** – To figure out the factors that impact purchase intention of technological devices in a technology changing world. The role of loyalty of consumers versus common purchase intention factors.

**Methodology/approach** - Initial data from this study were collected from 126 respondents. The responses obtained were analyzed by several statistical tools, such as descriptive statistics, joint empirical distributions, and multinomial regression analysis.

**Findings** – As age increases, people feel that their smartphone devices are complicated to use. Because of the technical difficulty, they choose to use non-advanced devices. But there are a large number of smartphones accessible to a higher age. This study revealed that brand loyalty, prices, and smartphone design influence a consumer's purchase decision on a smartphone.

**Research limitations/implications** – It is conducted in one country and should be expanded to other countries. The age of the respondents seems to be very crucial, so the age distribution of respondents should be enlarged., words, words.

**Practical implications** – This study deals with an essential issue of globalization: the loyalty of consumers to devices and producers and changing and improving technologies.

**Originality/value** – Identification of the significant constructs on the revealed preference of consumers in changing technology.

**Key words:** max. Product Life Cycle, Purchase Intention, Smartphones

## Introduction

In the last decade, smartphones have revolutionized our lives in ways that go beyond how we communicate. In addition to calls, messaging, e-mail, more than two billion people worldwide use these devices to navigate, compare prices, follow the news, watch movies, listen to music, play games, commemorate vacations, and participate in social media.

As times change and technology continuously improves, businesses must get ahead of the game and take every new opportunity to improve their sales, marketing, and customer loyalty. Manufacturers need to market their products differently, make their brands more personal, and communicate with customers in new ways. One of the biggest concerns is keeping customers happy.

The lifespan of the smartphone can last up to several years. Consumers end up replacing a smartphone not primarily because it is technological wear and tear, but because they want better features such as a more durable battery, a more robust operating system, a better camera and more. From time to time, a new smartphone is launched with upgraded features from what the consumer already has. As a result, the consumer's tendency to buy a new smartphone is rising. However, the consumer cannot afford to buy a new smartphone every year, whether from Apple or the Samsung premium series.

Besides, Xiaomi launches smartphones at a low price, not necessarily high quality, and can last a long time. Their target audience is people who want to buy cheap smartphones and, as a result, will be renewed with a new device almost every year, which is very little time.

In light of the above and mainly due to the intrusion of new and advanced technologies into our lives, it was interesting to examine the factors that motivate consumers and what triggers their decision to purchase the products.

This study focuses on factors such as brand loyalty, price, social influences, age, smartphone design, and more. These factors are relative advantage, and we would like to know how they affect the motivation to purchase a smartphone from a particular brand.

The purpose of the study is to examine whether there is a relationship between the influence of factors (brand, social impact) on the consumer's final choice in light of the dynamics and technological advancement in the world of smartphones.

The study deals with brand awareness, which plays a vital role in creating buying intentions and brand loyalty.

## **Literature Review**

The mobile phone is now considered one of the most popular gadgets in life. The advancement of information technology enables unlimited communication between people. This communication is vital to keep in touch with friends and family, allows access to e-mail, correspondence between business partners, and more (Yusuf et. al., 2015). The smartphone gives users the impression that they are constantly connected to the outside world, and therefore less alone. The physical and mental communication on mobile devices has increased. (Srivastava, 2005) Many are afraid to leave home without it and feel uncomfortable if others are looking at their messages or private things.

The consumer's buying behavior refers to selecting, purchasing, and consuming goods and services to their satisfaction. Many factors influence the decision-making process. At first, the consumer tries to find the goods he wants to purchase and brings him the most benefit, but various factors affect his purchases, such as social, cultural, economic, and more.

We review comprehensive literature describing the phenomenon of consumer purchasing intentions in light of the dynamics and technological advancement in the world of smartphones. We will try to understand the causes of this phenomenon. This review aims to expand existing knowledge on consumer behavior and examine points of interest in consumer preferences.

### **Brand**

A brand can be defined as a name, term, symbol or design or a combination thereof, which is intended to represent the company or services of one seller or a group of sellers to distinguish them from those of competitors (Keller, 1993).

Intense competition and rapid technological developments have led companies to increase their market share by gaining more customers and protecting their market shares (Ercis et. al., 2012). The way to save their market share is to create customer loyalty, brand awareness, and customer satisfaction level to explain this later.

When the customer continues to purchase the brand even in front of the leading competitors who offer lower prices, the higher quality means that there is significant value to the brand. The customer will not change his mind. Therefore, when customers repeat one brand's purchases, we can say that they have become loyal to that brand. There are many factors related to brand awareness and perceived brand quality that can affect customer loyalty, such as brand name, logo, quality, innovation, price, design, etc. However, companies need to choose the best strategies for attracting and retaining customers to be loyal (Akkucuk & Nooshabadi, 2016).

### **Duration of smartphone life**

Today in the smartphone industry, there is fierce competition, companies are forced to develop technological innovation and creativity due to such rapid technological advancement. When Apple launched the iPhone in 2007, it created a new smartphone market for the average consumer. Before this launch, the phones were mostly for business users. Since companies like HTC Nokia etc. are trying their best in market competition when it is difficult when there are big players in the smartphone industry like Apple and Samsung (Mohapatra, 2016).

As consumers, we buy millions of products every year. And just like us, these products have a life cycle. Older, long-term outcomes eventually become less popular, whereas the demand for newer and more modern products usually increases quickly after their launch. Since most companies understand the different stages of the product life cycle, and that the products they sell all have a limited lifespan, most will invest heavily in developing new products to ensure their business continues to grow (Mohapatra, 2016).

Our research questions that arise from the literature review are:

- (1) Does the brand name and loyalty to a brand name is a dominant factor in purchasing a technology-based device, over time.
- (2) Is the lifecycle of a smartphone among customers of smartphones differs among brands?
- (3) Are the impacts of design, quality, price, and education strong enough compared to the brand factor?

### Methodology

A pilot was conducted to get an incomplete picture of the research topic, develop hypotheses and ideas on issues relevant to the research, such as: Do people develop loyalty to their smartphone brand.

The research method includes data collection using questionnaires and quantitative analysis. Since the purpose of the study is to examine whether there is a relationship between the influence of factors (brand, social impact, etc.) on the final choice of the consumer also in light of the dynamics and technological advancement in the world of smartphones.

The Questionnaire was sent to an aerospace industry organization that includes a wide variety of workers: engineers, technicians, practical engineers, managers, and manufacturing workers and students from a technological high education institute. The Questionnaire was sent to 204 persons, and we got 126 valid full responses.

We used a Multinomial regression analysis to figure out the significant factors that may impact the purchase of certain smartphone brands. We emphasize our study on three known brands, Apple, Samsung, and Xiaomi.

### Findings

Some descriptive results from the survey are presented in Table 1. They are typical factors while examining technology-based devices for daily personal usage.

Table 1: Means of scores with respect to purchase intention, by brand holders

	Mean (Samsung)	Mean (Apple)	Mean (Xiaomi)
Age	40.8571	29.3548	38.1739
Years of Education	15.1964	14.7742	16.3913
Importance of Design	3.0536	4.1613	2.6522
Owning a device (Months)	19.2963	19.4516	14.3043
Impact of Brand on Perceived Quality	3.6250	3.8710	3.3043
Impact of Brand on Purchase Intention	3.7321	4.1935	2.5652
Importance of Price	4.1250	3.5161	4.4783

- Age - During the study, a wide range of ages were selected, although the average age is 36. Hence, the review is less concerned with low age, such as elementary and high school children, but we want to explain how the age factor influences the consumer when purchasing a smartphone.

Nowadays, people are digitally connected, ranging from technical issues of ordering home food to express feelings in front of electronic audiences of hundreds and thousands of people on social networks such as Facebook, Instagram, Twitter, and more. The smartphone is undoubtedly a dominant and integral part of the fabric of modern life. A whole generation of children goes through adolescence with a smartphone in their hands.

According to the research findings, it could be seen that Samsung has an average age of 41.14. As a result, Samsung has an Android operating system that is simpler to use, so people of higher age will enjoy the devices Samsung offers. Compared to Apple, the average age is 30.14, which means that users' age is lower because the company has a relatively complicated operating system.

- Price -According to the research findings, it could be seen that price is a significant factor for consumers when purchasing a smartphone. But it also depends on which brand you belong to. That is, Apple has a loyal target audience willing to pay a high price tag for a very high-quality smartphone. Besides, some consumers love Samsung and are eager to pay a relatively high price for their premium devices and whether or not Samsung is introducing cheaper A-Series smartphones. That is, Samsung wants to appeal to everyone, whether it is high-class or middle-class. And finally, there's a high-tech company whose target audience is the middle / lower class, which means those consumers prefer to buy a low-priced smartphone.
- Brand loyalty - Today, brand loyalty is one of the important things for smartphone companies. They want the Israeli consumer to be loyal, in one way or another, to some brand. That is, he will continue to buy the same brand he currently uses.

Samsung's smartphone companies realized that it needed to place a low price tag that would allow consumers to continue to purchase a smartphone from Samsung and prevent its users from defecting to Chinese competitors, headlined.

According to the research findings, you could see that brand loyalty was for all three smartphone companies Samsung, Apple, and Xiaomi. It is highly likely that every customer, who has already put their trust in the name of a particular brand, will continue to purchase smartphones from the same manufacturer. Being well accustomed to this brand, the customer will find it challenging to transfer to another brand to the smartphone's satisfaction.

- Smartphone design - Smartphone design is a no less important factor than perceived brand quality or smartphone price. Nowadays, anyone who comes to purchase a smartphone checks the size, shape, button position, color, and other decorations.

According to the research findings, smartphone design is fundamental to consumers when purchasing a smartphone. Consumers understand that this is just as important as anything else, and that is why most people test the device when it is presented before purchase.

- Perceived quality of the brand - Perceived quality is a factor that can decide the consumer whether or not to buy the smartphone. Sometimes quality can be expressed in the way that customers or users believe that the product or service exceeds their needs and expectations.

Samsung and Apple are in the top spot of the smartphone quality level. Still, today it is one of the world's largest mobile manufacturers. It has become an empire of smartphones and a host of technology products.

According to the research findings, it could be seen that the Chinese company, Shiom, was not far from Samsung and Apple's results. In other words, the consumer understands that it may be my goal with less experience in the smartphone market, but can take out an equally high-quality device from the big companies.

- Adjusting the palm size of the smartphone - When a consumer is looking for a new smartphone, it takes into consideration how it feels on the hand. In the market, we can find different sized screens, and it is up to the consumer to decide which one meets his needs.

Apple has several different size iPhones, so it is advisable to check and hold the smartphone to figure out the most convenient shape. Samsung has smartphones that have the home button on the side of the device, and some are on top of the device screen, so the size of the smartphone device is no less critical than the palm-size. Especially as the smartphone grows, the more difficult it is to navigate or type with one hand.

According to the study's findings, it didn't seem to matter to consumers whether their smartphone device would be best suited to their palm. These results are for the three smartphone companies Samsung, Apple, and Xiaomi tested during the study.

The statistical analysis includes the role of having in the past a particular brand on the respondent's current brand. We used a multinomial regression analysis to find out these magnitudes as they are provided in Table 2. Table 2 is designed to be as concise as possible to reflect the three important magnitudes.

Table 2. The estimated impact on probability to have a brand while not having it in the past.

	Samsung Now	Apple Now	Xiaomi Now		p-value
No Samsung in the past	-1.295				0.01
No Apple in the past		-4.700			0.00
No Xiaomi in the past			-3.307		0.006

The coefficients are significant. It means that a person that didn't have Samsung in the past has less probability of having Samsung now (-1.295). This is compared to Apple (-4.7) and Xiaomi (-3.307). The numbers are the coefficients from the exponential function of the multinomial part.

### Discussion and conclusions

The study gives us some exciting insights and justifications to well-known facts in the smartphone industry. The loyalty of customers to their smartphone brands over time and technological changes is very high. We see that the chance of respondent to have a particular brand is much lower if he or she didn't have it in the past. This contributes to our first research question.

On average, we found that respondents who have Apple or Samsung have the same device for 19 months. And only Xiaomi holder have their device for 14.3 months on average. The no difference between Samsung and Apple is meaningful. Xiaomi is a relatively new brand, and it is relatively not expensive. This reflects our second research question.

On average, Apple holders give score 4.16 on a scale of 1 to 5, to the importance of design in smartphone purchasing, compared to Samsung (3.05) and Xiaomi (2.65).

It is inferring that typical factors that affect purchase intention are still valid in the smartphone industry. This reflects our third research question.

The added value of this study is in several concepts. The usage of smartphones in learning is desirable to students (Sadeh, Feniser, and Dusa, 2020). The rapid changes in technology affect our wellbeing feelings and smartphones are very influential.

The study has a few limitations. It is conducted in one country and should be expanded to other countries. The respondents' age seems to be very crucial, so the age distribution of respondents should be enlarged.

### Notes

\* This paper is based on an M.Sc. project of Sapir Shimri at HIT, Israel 2019.

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Mobile phones and the evolution of social behavior. *Behaviour & Information Technology*, 24(2), 3-4, 18.

# ICT EVOLUTION IN EASTERN EUROPE COUNTRIES

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## Abstract

**Purpose** – *The study focused on ICT analysis, to determine the level of development of countries, adaptation to new technologies and performance as a result of the implementation.*

**Methodology/approach** - *The study considers the use of ICT in enterprises using existing data in the Eurostat database, in three directions: e-commerce, internet connection and e-business.*

**Findings** – *The study shows that there are countries which dispose to favorable internal conditions such as: government policies, flexibility and availability, openness to competence and effort supported by the virtual transmission of public information, etc.*

**Research limitations/implications** – *Comparative analysis through the indicators present allowed the identification of the differences between countries in terms of ICT implementation in the private and public domain, differences that are reflected in their evolution and in the economic results they register.*

**Practical implications** – *From the existing data it is observed that there are countries that have started procedures to facilitate access to ICT but also countries that have delayed their implementation.*

**Originality/value** – *ICT is no longer a specific sector, but an integral part of modern innovative economic systems. Thus, for managing the challenges of globalization, the inclusion of ICT in business and communities is a way to maintain and develop.*

**Key words:** *ICT development, innovative economic systems, internet and digital technologies.*

## Introduction

The evaluation of digital development has become increasingly important due to the benefits of ICT technologies on enterprises and national economies (Aerts et al., 2004; Elmualim and Pelumi-Johnson, 2009). The advantages offered by internet technologies and applications produce changes both in terms of flexibility and receptivity but also in the way the entire system of organization and functioning of companies, processes and economic and social life is conducted (Elmualim & Pelumi-Johnson, 2009, Wang and Xie, 2002).

The opportunities offered by e-commerce (increasing competitiveness, rapid expansion of commercial transactions and international trade) are the effect of globalization, these being found in all countries of the world, regardless of their degree of economic development (Biagi and Loi, 2013, Chiu and Lee, 2019). Electronic transactions are found in all types of economic interaction, affecting the market, products, industrial structures, commercial and competitive rules, laws and regulations that will be in a continuous adaptation (Zhu, 2004; Luu and Freeman, 2011; Mishra and Narayan, 2014).

The digital divide has become an important social and economic problem gaining significant interest among governments, world organizations and specialists around the world (Bagchi, 2005; FAITTNM, 2013; Ayanso et al., 2014). Improving access to and use of ICT is a priority on the political agenda of many states because it allows improving the quality of life through access to online resources that thus lead to socio-economic integration and development (Deichmann, 2006; Fryer and Grandner, 2008).



In this study, an analysis was made of the evolution of ICT in enterprises over a period of 5 years, for 8 countries in Eastern Europe, through the indicators: Enterprises having received orders online, Share of enterprises' turnover on e-commerce, Enterprises with broadband access, Enterprises giving portable devices for a mobile connection to the internet to their employees, Enterprises whose business processes are automatically linked to those of their suppliers and / or customers, Enterprises using software solutions, like CRM to analyse information about clients for marketing purposes.

## Material and Method

The study included the period 2013-2017 for the following Eastern European countries: Czech Republic (CZ), Lithuania (LT), Estonia (EE), Slovakia (SK), Hungary (HU), Poland (PL), Romania (RO) and Bulgaria (BG). The study considers the use of ICT in enterprises using existing data in the Eurostat database, in three directions: e-commerce, internet connection and e-business. On all three directions, companies with at least ten employees were considered.

For e-commerce, the following indicators were included in the study: Share of enterprises having received orders online (EHROO) (%) and Share of enterprises' turnover on e-commerce (SETEC) (%).

For the connection to internet, the following indicators were included in the study: Share of enterprises with broadband access (EBA) (%) and Share of enterprises giving portable devices for a mobile connection to the internet to their employees (EGPDMC) (%). For EBA, companies that use fixed or mobile connections and that use xDSL technology on a modernized cable network for internet traffic or other broadband technologies have been considered. For EGPDMC, the enterprises that offer employees portable devices with at least 3G technology for internet access (through a computer with modem or receiver that uses UMTS or GPRS) were considered.

For e-business, the following indicators were included in the study: Share of enterprises whose business processes are automatically linked to those of their suppliers and / or customers (EWBPALTTSC) (%) and Share of enterprises using software solutions, like CRM to analyse information about clients for marketing purposes (EUSSAIACMP) (%). For the EWBPALTTSC indicator, the enterprises that have computer programs that allow: the exchange of information between suppliers and customers to coordinate the availability and delivery of products or services to the final consumer, accessing forecasts, inventory, production, distribution or development were taken into account, products, data collection via computer networks or other connections between computers in different enterprises, excluding handwritten internet messages. For the EUSSAIACMP indicator, the enterprises that use software solutions for customer relationship management or other software solutions necessary for the enterprise management were considered.

## Results and Discussion

The global competitiveness of the European Union can be assessed at EU level also in terms of individual performance, respectively the capacity through which countries improve their position permanently.

For the e-commerce activity were presented in Figure 1 the companies that carry out online activities.

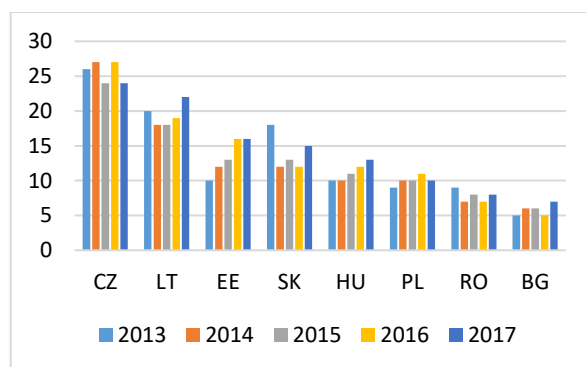


Figure 1. Distribution of the share of the companies that received online orders

From Figure 1 most companies that register online transactions are found in the Czech Republic, Lithuania and Estonia. In 2017, there were increases in Lithuania, Slovakia, Hungary, Romania and Bulgaria. From the analysis of each country it is observed that values above the average registered by these 8 countries are found only in the Czech Republic and Lithuania during the 5 years studied. Estonia registers above average values only in 2015-2017, and Slovakia in 2013, 2015 and 2017.

Figure 2 shows the situation of countries depending on the share of e-commerce in the turnover of companies.

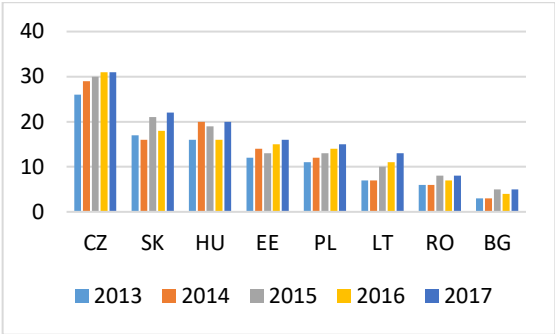


Figure 2. Distribution of the share of e-commerce in the turnover of enterprises

From the analysis of Figure 2 the first three places are: Czech Republic, Slovakia and Hungary. The Czech Republic has an upward evolution from year to year, as do Estonia, Poland, Lithuania and Romania. Changes are also registered in Slovakia, Hungary and Bulgaria, these countries reaching in 2017 the level of 2015, as a result of the decreases suffered in 2016. Above these values above average values are obtained in the following countries: Czech Republic, Slovakia and Hungary. Estonia also has above average values, except for 2015.

The possibility of companies connecting to the Internet is studied through the indicator that measures broadband access, which is shown in Figure 3.

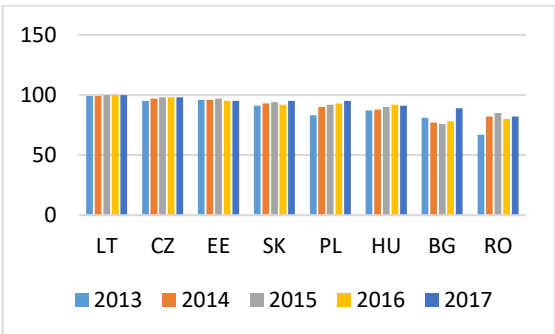


Figure 3. Distribution of the share of companies that have broadband access

From the analysis of this indicator, presented in Figure 3, there are quite small differences in the countries studied (below 20%). Among the countries that recorded values above the average of the 8 countries studied are: Lithuania, Czech Republic, Estonia, Slovakia and Poland (except for 2013). Hungary also registers above average values only in the years: 2013 and 2016.

Figure 4 shows the countries according to the share of companies that offer portable devices for a mobile internet connection to employees.

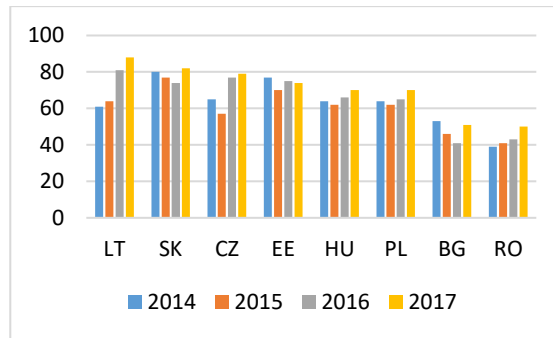


Figure 4. Distribution of the share of companies that offer portable devices

The analysis of Figure 4 shows that in 2017, Lithuania, Slovakia and the Czech Republic are on the first places. Above average values are recorded in the following countries: Lithuania (except 2014), Slovakia, Czech Republic (except 2015), Estonia, Hungary (except 2017) and Poland (except 2017).

Figure 5 shows the share of enterprises whose processes are automatically linked to those of suppliers / customers.

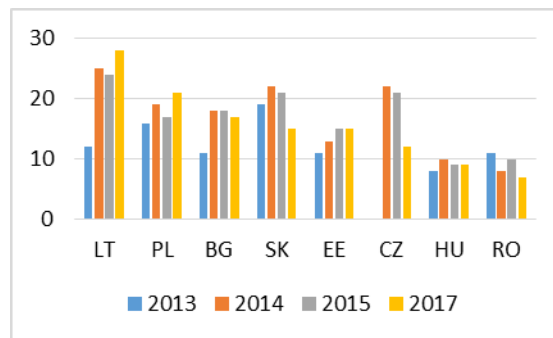


Figure 5. Distribution of the share of companies that have commercial processes

From the analysis of Figure 5 in 2017, Lithuania, Poland and Bulgaria are on the first places. For this indicator there is no information for 2016 in the Eurostat database. Above average values for this indicator were obtained in the following countries: Lithuania (except 2013), Poland, Bulgaria (except 2013) and Slovakia (except 2017). Values above average were also obtained by the Czech Republic (in 2014 and 2015).

Figure 6 shows the share of enterprises that use software solutions to analyse information about customers for marketing purposes.

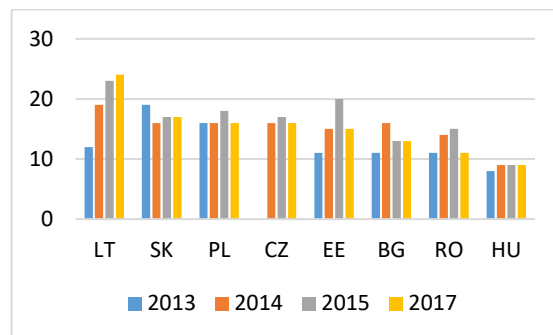


Figure 6. Distribution of the share of companies that use software solutions

From the analysis of Figure 6, in 2017, the following countries are on the first places: Lithuania, Slovakia, Poland and the Czech Republic. Above average values are recorded in: Lithuania (except 2013),

Slovakia, Poland, Czech Republic (except 2013 for which no data are available) and Estonia (except 2013). Bulgaria registers above average values only in 2014.

Figure 7 shows the distribution of countries in terms of indicators for 2017.

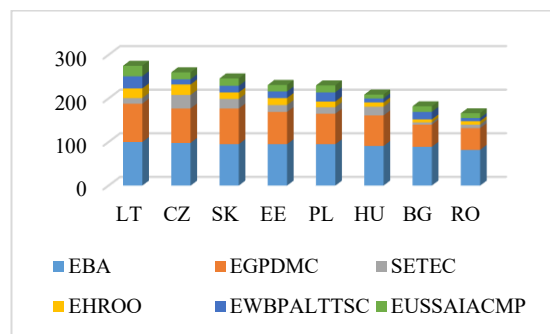


Figure 7. Distribution of countries in terms of indicators in 2017

From the analysis of Figure 7 if we centralize the results to all 6 indicators, in 2017, Lithuania, the Czech Republic, Slovakia and Estonia are on the first places, followed at a relatively short distance from Poland.

The arithmetic average registered at the level of the 8 countries in 2017 amounts to 37.48. Values above the average are registered by the countries: Lithuania (45.83), Czech Republic (43.33), Slovakia (41), Estonia (38.50) and Poland (38.33). Values below the average of the 8 countries are registered by the countries: Hungary (34.83), Bulgaria (30.33) and Romania (27.67), which shows the existing gap at the level of these countries.

## Conclusions

The study shows that there are countries in Eastern Europe, such as: Lithuania, Czech Republic, Slovakia, Estonia and Poland, which due to favourable internal conditions (government policies, flexibility and availability of people involved in the business environment, openness to competence and effort supported by the virtual transmission of public information, etc.) registers an ICT development in all three directions: e-commerce, internet connection and e-business.

The study shows that Lithuania is the only country with the best values, ranking first in the indicators: Share of companies with broadband access, Share of companies giving portable devices for a mobile connection to the internet to their employees, Share of enterprises whose business processes are automatically linked to those of their suppliers and / or customers and Share of enterprises using software solutions, like CRM to analyse information about clients for marketing purposes.

The Czech Republic is the next country in the ranking, being only with two indicators on the first place: Share of enterprises' turnover on e-commerce and Share of enterprises having received orders online, on the second place on the Enterprises with broadband access indicator, on the third place on the indicator Share of enterprises giving portable devices for a mobile connection to the internet to their employees, on the fourth place to Share of enterprises using software solutions and on the sixth place to Share of enterprises whose business processes are automatically linked to those of their suppliers and / or customers.

Slovakia is on the 3rd place in 2017, being only with three indicators on the second place: Share of enterprises' turnover on e-commerce; Share of enterprises giving portable devices for a mobile connection to the internet to their employees and Share of enterprises using software solutions, on the fourth place at the indicator Share of enterprises having received orders online; Enterprises with broadband access; and Share of enterprises whose business processes are automatically linked to those of their suppliers and / or customers.

Estonia is the country that registered two positions on the 3rd place (on the indicators: Share of enterprises' turnover on e-commerce and Enterprises with broadband access), two positions on the 4th

place (on the indicators: Share of enterprises' turnover on e-commerce and Share of enterprises giving portable devices for a mobile connection to the internet to their employees), and 2 positions on the 5th place (at the indicators: Share of enterprises using software solutions and Share of enterprises whose business processes are automatically linked to those of their suppliers and / or customers).

The result obtained by Lithuania in the field of ICT can be understood as a result of the existing conditions in terms of internal policies adopted, it taking the first steps since 1991, starting with the adoption of the development strategy for ICT, e-government (2002), e-Service portals, e-nationality, e-bill, digital electronic signature (2011) [14].

The Czech Republic is the country that has specialized services of e-government, e-commerce, e-communication and e procurement, e-signatures legislation, this register since 2010 impressive values for indicators: Percentage of enterprises with Internet access (95%), Percentage of enterprises with a broadband connection (86%), Percentage of enterprises with a broadband connection (20%) [15].

Slovakia enjoys a very strong development in the field of ICT due to the country's attractiveness for outsourcing centres, but also due to the emergence of a start-up ecosystem and the emergence of e-government services [16].

Estonia has also made significant progress in the field of ICT with the introduction of e-Identity (1992-2014), e-tax (2002), e-Business (2007), Computer Security (2009), e-Residency (2014) [17].

Poland has been implementing the e-government strategy since 2005, in 2006-2008 it built the digital government services platform, the EPUAP platform and the web-Tax platform and later e-Procurement and e-Tendering [18].

The gap registered by Hungary, Bulgaria and Romania can be explained by the existence of a delay in the governmental policies for establishing and implementing the National Strategy on the digital agenda. In Romania, this Strategy was defined in 2015 (by Government Decision 245/2015) which led to a lack of progress in the field of ICT found both at the level of public services (lack of electronic resources) and at the level of enterprises.

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# PUBLIC OPINION AND PUBLIC FOREST MANAGEMENT POLICIES IN THE CONTEXT OF COVID-19

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## Abstract

**Purpose** – *The research aims to establish whether there is a link between civil society concerns and public policies adopted in the context of the social distance generated by the COVID-19 epidemic.*

**Methodology/approach** - *The present study analyzed on the one hand the press reports on deforestation, the activity of emblematic NGOs in the fight against deforestation, the messages promoted by personalities of the society (actors, musicians, journalists), petitions promoted in the virtual space, but also the environment ministry's and parliament's agenda by adopting regulations governing the field of forests.*

**Findings** –*The environmental protection authority promotes forestry policies and strategies that take into account both the demands of civil society and the needs of the forestry sector. There is another actor in this whole complex equation, certain politicians who, for populist purposes, promote legislative acts.*

**Research limitations/implications** – *The research considers the interaction between the public authority and the society through the prism of the social networks.*

**Practical implications** – *The research results can be used as a predictor of the evolutions of future forest management policies and strategies.*

**Originality/value** – *The present study analyzes the potential of social networks regarding the setting of the public agenda of the authorities.*

**Key words:** *deforestation, public forest policies, social networks.*

## Introduction

Management is a set of techniques used to lead, manage, guide. Like any activity, it can be brought to the level of art, of perfection in leadership. Forest management refers to the organization and coordination of specific activities at the temporal, spatial and micro-economic level by hierarchically organized institutions, starting from practicing foresters, landscapers, public authority and the state (Nichiforel, 2019). In the forestry sector, management involves the administration and management of forests and "all technical, economic and legal activities carried out by public or private forestry authorities, in order to comply with forestry laws, in compliance with the forestry regime" (Law 46, 2008).

Forest management strategies are embodied in forest policies. Between 2013 and 2020, forestry policies have been regulated at EU level by the Commission "A new EU strategy for forests and the forestry sector" (COM, 2013). It set out the Union's new strategy and proposed a European reference framework for the development of sectoral policies that have an impact on forests. This strategy has two main objectives: 1) to ensure that Europe's forests are managed sustainably and 2) to strengthen the Union's contribution to promoting sustainable forest management and combating deforestation worldwide (U.E., 2020). The key directions so far this year have been sustainable management and combating deforestation.

Since 2021, forestry strategies have identified forests as one of the key areas for action to combat climate change (COM, 2019). Policy is including specific actions focus on European sources of funding

for forests, regulation of timber trade, forest biomass. The direction of European forestry strategies goes towards good forest governance, sustainable forest management and protection.

Stakeholders (De Meo, 2018) on forest policies are grouped around forest workers, civil society, politicians, environmental activists. Stakeholders in forestry tend to polarize and form opposing camps. Most forest managers and owners are aware and comply with legal requirements, however, the appreciation of the environment seems to be strongly affected by the degree of restrictions faced, being often perceived as excessive (Brukas, 2018). The divergence of interests and approaches between stakeholders lead to the idea of the need for a common language, in which there are various priorities and concerns (Ugolini, 2018). It is a positive correlation between stakeholder pressures and implementation of environmental management practices (Sarkis et al., 2010).

The period of emergency triggered by the pandemic determined the restructuring of the activity at economic and social level, through a sudden COVID-19 outbreak. There were problems related to business stability, management of daily tasks (telework or classic), increased employee stress, difficult hiring and layoffs, difficult collaboration between employees, performance parameters were difficult to achieve, the impossibility of travel. The interaction time of people with the devices has increased (Bratu, 2018b), the one related to social interactions has decreased. At the individual level, there were problems related to anxiety, depression and stress. People focused their attention on social aspects that give a meaning to existence (promotion of safety measures, environmental protection). From a psychological point of view, the individual mental balance is achieved when, against the background of a strong individual devaluation, caused by the lack of career meaning, the obligation to create a new life for children, new household occupations, there is a higher meaning of life involving present generations and future - the forest, as a source of life and vital energy (Bratu, 2019b). The well-being (Bratu, 2018a; Bratu, 2019a) that the public feels when militating for superior causes is often speculated politically; it is pleasant to be part of a national movement for good and beauty, but often they remain utopian ideals and the mass becomes a unit that can be easily manipulated.

The pages on the social networks of environmental NGOs and some personalities were analyzed, as well as the draft normative acts on the agenda of the Ministry of Environment and the Parliament, as well as normative acts published in the Official Gazette of Romania. Also, official statement of the Romanian Government were consulted regarding the environmental regulations, as well as the economic activity of the forestry sector.

It is found that during the pandemic, the activity in the online environment, especially on social networks, is much more intense. This activity corresponds to the need of society to inform and interact. Information is taken from international organizations, but also messages from environmental activists. At the same time, on the part of those who work in the forestry field, the activity of the groups has intensified, even new groups appearing that aim to counterbalance the activity of the environmental groups. Finally, with the lifting of the restrictions on the state of emergency, some environmental activists resumed their physical activity, bringing arguments in their case, arguments documented in the field. At the same time, due to the COVID-19 pandemic, there was a reduction of activity in the forest economy.

Following the Presidential Decree 195 of 16.03.2020 regarding the establishment of the state of emergency on the Romanian territory published in the Official Gazette no. 212 of 16.03.2020, the activity in almost all economic branches was suspended or drastically reduced. Prior to the Presidential Decree, large campaigns were launched announced by the Ministry of Environment, so that on March 6, the Launch of the National Afforestation Campaign "A forest as a country" was announced, on the afforestation site in Uliești, Dâmbovița County (Romanian Government, 2020c). Following the establishment of the state of emergency and the recommendations of the sanitary authorities, on March 20, on the social networks, the Ministry of Environment announces the suspension of the campaign regarding the planting of volunteers.

## **Material and methods**

In the present study was analyzed mainly the activity on the social networks of the Public Authority for Environment, Waters and Forests during the state of emergency triggered by the COVID pandemic 19.



It is found that the social network Facebook is one of the strongest communication channels of environmental authorities, which is why the present study aimed to analyze the activity during the emergency.

The posts of the Ministry of Environment, Waters and Forests were analyzed between March 16 and May 15, 2020, in terms of total number of announcements, number of announcements related to forests, public reaction to these posts, number of comments, number of distributions, and in case of videos, number of views. Following the analysis of the announcements of the environmental authority, the impact was followed, respectively if there is a correlation between the public pressure and the legislative initiatives promoted by the authorities. The study took into account only those posts that focused on the forest.

The analyzed data were organized in the form of a database, having the following structure:

Table 1. Database structure

Article	Type
Post data	Data
COVID 19 subject	Boolean
Subject of post	Text
Forest subject	Boolean
Interacts	Number
Comments	Number
Sharing	Number
Video visualization	Number
Law impact	Text

## Results and discussion

During the analyzed period, it is found that the environmental authority posted a number of 214 announcements, of which 69 had as subject the forest. Of these, the total number of interactions was 14,273, with an average of 209 interactions per post. Extracting the abnormally high values, values that we will treat separately, the average was 156 interactions at each post. The total number of comments was 10859, and extracting the maximum values of the three posts, the average is 85 comments per post. The postings had a number of 12,431 distributions, and except for the three posts, the average is 99 distributions. Out of the total number of posts, 4 of them had the effect of initiatives for legislative changes, and the post of April 1 announces the amendment of a normative act by Ministerial Order. The latter act brings stricter clarifications and regulates the activity of economic operators that carry out logging. Of the four posts, one promotes public access to the forest, and the three promote the concept that 75% of the forest area in national parks is strictly protected.

The page of the Ministry of Environment, Waters and Forests took over topics and posts of some agencies and organizations, thus 4 messages of the National Forests Authority are taken over, and one post of the Brasov Forest Guard, NGO Kogayon, Ministry of Interior, Piatra Craiului National Park; WWF Romania.

Posts that incorporated video sections provided a total number of views. Of these, two topics stand out, namely: an interview of the minister and a film related to wind gusts, each bringing 1.6 million views.

The topics that attracted the most reactions were the following:

Table 2. Top 10 topics after reactions

Subject	Reacts	Comments	Share	Movie views
Wind-uprooted trees	1.7k	2.0k	3.1k	1.6 mil
Press statements	1.3k	1.8k	1.6k	1.6 mil
Live	1.1k	1.6k	1.3k	232k
Wood transport control	567	291	621	
Proposal for strict protection of 75% of the National Parks area	423	572	278	194k
Wood traceability software (SUMAL)	411	292	476	
Planting trees	403	104	125	
Fake-news	370	151	593	
Import of wood timber	363	314	341	
Landslide	357	282	408	

The most distributed topics are listed in the table below.

Tab. 3. Top 10 topics after sharing

Subject	Reacts	Comments	Share	Movie views
Wind-uprooted trees	1.7k	2.0k	3.1k	1.6 mil
Press statements	1.3k	1.8k	1.6k	1.6 mil
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Wood transport control	567	291	621	
Fake-news	370	151	593	
Wood traceability software (SUMAL)	411	292	476	
Landslide	357	282	408	
International Forest Day	209	15	381	
Wind-uprooted trees	298	377	342	82k
Import of wood timber	363	314	341	

The topic that garnered the most reactions, comments and distributions was Wind-uprooted trees. During the analyzed period, the subject that gathered the most reactions in correlation with the COVID 19 pandemic is related to Wood transport control.

The posts that led to legislative proposals garnered 900 reactions, 726 comments and 408 distributions.

It is observed that there is a correlation between the number of reactions, the number of comments and the number of distributions. It should be noted that, in general, the most distributed posts have the highest number of reactions. However, the number of distributions is, in most cases, higher than the number of reactions or comments.

## Conclusions

During the COVID 19 pandemic, the role of social networks increased in terms of information transmission, and to some extent was one of the few means of public consultation. The large number of viewers of the video content (3,432 million the first three views) leads us to believe that the subject of forest protection does not remain without echo. Perhaps, among the most visible effects of the interaction on social networks, it is the modification of normative acts that have a major impact on society. It is noted the adoption of an Order on the tightening of sanctions for deviations of economic operators (Romanian Government, 2020b), the adoption of a Decision on the operationalization of Wood traceability software (SUMAL) (Romanian Government, 2020a), and the initiation of the amendment of the Forestry Code.

We can conclude that social networks play a priority role in setting the public agenda, in adopting forest management policies.

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# REGIONAL DEVELOPMENT THROUGH CLUSTERS

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## Abstract

**Purpose** – *At the level of global market competition, the economic success of a region or country focuses on the specialization of supply, the development of key areas, offering competitive advantages, skills and qualified resources. From this perspective, clusters are the key to success, involving entrepreneurial dynamism, intense links between organizations and institutions with top-level knowledge.*

**Methodology/approach** – *Accentuating the phenomenon of globalization and increasing competitiveness in national, European and international markets, membership in a cluster becomes a real advantage for small and medium enterprises, providing easy access to production, innovative products, using advanced technologies, common development strategies.*

**Findings** – *The most important role of a cluster is to facilitate development, having as success factors: building trust between cluster members and creating a cluster development strategy, the geographical proximity of cluster members.*

**Research limitations/implications** – *The clusters support the transfer of know-how and technology transfer, cooperation between companies and institutions and the importance of strengthening the support environment.*

**Practical implications** – *The ability to innovate in the business environment is a key factor for increasing competitiveness and for smart and sustainable development. The innovation process contributes more and more to local-regional and national development.*

**Originality/value** – *Clusters are the pillars for smart, sustainable inclusion growth, facilitating and creating jobs, improving cooperation between business, research institutes, universities and other organizations based on increasing competitiveness, labor specialization, regional development.*

**Key words:** *cluster, human capital, competitiveness.*

## Introduction

At the level of global market competition, the economic success of a region or country focuses on the specialization of supply, the development of key areas, offering competitive advantages, skills and qualified resources. From this perspective, clusters are the key to success, involving entrepreneurial dynamism, intense links between organizations and institutions with top-level knowledge.

Accentuating the phenomenon of globalization and increasing competitiveness in national, European and international markets, membership in a cluster becomes a real advantage for small and medium enterprises, providing easy access to production, innovative products, using advanced technologies, common development strategies.

The most important role of a cluster is to facilitate development, having as success factors: building trust between cluster members and creating a cluster development strategy, the geographical proximity of cluster members.

Currently, in the North-West Region of Romania there are 7 active clusters, in the fields of wood industry, renewable energy, agriculture, IT, services, generating successful business in this region, which are presented in detail in this research.

Clusters support the transfer of know-how and technology transfer, cooperation between companies and institutions and the importance of strengthening the support environment. At national level, 6 are members of CLUSTERO - Romanian Association of Clusters, from those analyzed in this paper.

In the report we identified examples of good national and international practice in the field of clusters, highlighting the diversity of multiple ways of applying the cluster concept. Cluster implementation reports lead to transformations of opportunities and determinants with positive effects on smart, regionally sustainable development. We tried to analyze the situation in Romania of clusters and their development factors, such as the involvement of specialized human resources, identifying trends and development prospects at national and regional level, promoting examples of good practice based on the Europe 2020 Strategy. It can be said as an essential role on the processes of economic and social competitiveness, creating the premises for sustainable development, reducing the gaps between regions, but also the creative, innovative potential of the component resources. To achieve this stage of intermediate research, we considered ensuring a solid foundation of research, by studying the literature and using relevant publications included in the main flow of publications, identifying and analyzing best practices at national, international and analysis to the extent that some of these experiences can be adapted later to the national and regional specifics, performing a more rigorous radiography of the situation in Romania with appropriate projections in the regional plan, to identify areas with clustering potential. In the context of the studied topics, the successful examples are a real source of knowledge and information.

The Romanian Cluster Association is one of the most well-known organizations at national level. It aims to support and encourage the development of clusters, playing an important role in facilitating interactions between national clusters.

The complex and interdisciplinary nature of the research required the use of cluster research, both qualitative and quantitative, in the study of clusters.

The ability to innovate in the business environment is a key factor for increasing competitiveness and for smart and sustainable development. The innovation process contributes more and more to local-regional and national development. Partnerships made in the form of clusters have a positive effect on reducing disparities between regions, as well as in achieving economic convergence and developing smart specialization strategies for cluster development, thus accelerating the differentiation and emergence of structural change towards a knowledge-based economy.

Increasing the quality and competitiveness of organizations by developing quality training programs and resources, identifying ways to manage time, active participation in lifelong learning and effective communication makes it possible to strengthen the business environment at European standards.

The information and globalization era demands an open attitude towards human capacities for understanding and interacting with an increasingly complex and challenging world.

### **Regional development clusters**

The role of regional policy in implementing the Europe 2020 strategy in the field of smart development, promoting innovation, offers complementarity between EU, national and regional support for innovation, research and development, entrepreneurship and information and communication technology.

By creating favorable conditions for innovation, education and research, encouraging, research and development, investments with a high degree of knowledge and orientation towards activities with higher added value. [Cosnita, 2010]. Thus, regional policy can contribute to the successful approach to the challenge - the region, to increase the capacity for innovation, research and development in enterprises and to strengthen the links they have with universities and research centers. Regions play a central role, as they are the main institutional partners for universities, other research and education institutions and SMEs, which are the key to the innovation process, making them an indispensable part of the Europe 2020 strategy.

The knowledge and innovation capacity of the regions depends on a multitude of factors, including: entrepreneurial culture, workforce skills, education and training institutions, innovation support services, technology transfer mechanisms, research infrastructure and development and ICT, researcher mobility,

business incubators, new sources of funding and local creative potential. Research and development and innovation performance varies widely within the EU.

Direct investment flows in recent years have been concentrated where they have found skilled labor, capital, experience, business traditions, specialist suppliers, capital institutions and competitive research institutes, as well as adequate infrastructure. [Dudian, 2011]. The positive results of these interconnections are related to skilled labor, reduced travel costs, transfer of know-how, availability, making it circulate both vertically through the number of sellers and buyers, and horizontally through complementary products and services.

Within the NW region, the economy has experienced a natural development trend. The economy of the region has the characteristics of an emerging economy in development, with an average share of services, GDP / VABR growing, a large number of enterprises compared to the national average, but small compared to the European average, relatively intense foreign activity, increasing investment attractiveness.

There are intelligence-intensive economic sectors that use specialized and skilled labor, such as creative industries, information technology, scientific and technical activities, which encourage innovation in all fields, thus identifying new sources of growth. [Nicolescu, 2015].

From the point of view of economic specialization, in terms of financial indicators, those related to human resources, industrial agglomerations and the potential to generate high added value, the main sectors of regional importance for the North-West Region were identified as: industry food, textile and clothing, wood and furniture, road transport vehicle industry, IT&C, creative industries, construction materials industry. These areas have the potential to generate high value-added products through concerted investments according to the smart specialization strategy. Having a real associative potential, in five of these fields the clusters were set up which, in addition to supporting the sector in which they operate, also fulfill the role of regional promoters.

Low labor productivity and the share of labor and resource intensive sectors to the detriment of those with high added value are the biggest weaknesses of the regional economic system. The industries in the North-West Region have, in addition to the relatively low added value, a low technological content, and their development is based on the cheap cost of labor and on imported materials.

Polycentric territorial development, the existence of a relatively well-developed business support infrastructure and the functional specialization given by the sectors with proven economic performances can contribute to attracting investments for capitalizing on the potential of domestic resources.

The North-West Region will have to act on the factors that determine the increase of productivity, respectively in the direction of increasing investments in physical and human capital, in the sectoral structure of the economy, in improving infrastructure, innovation capacity and R&D activities, entrepreneurship, public policies. . [Nicolescu, 2015].

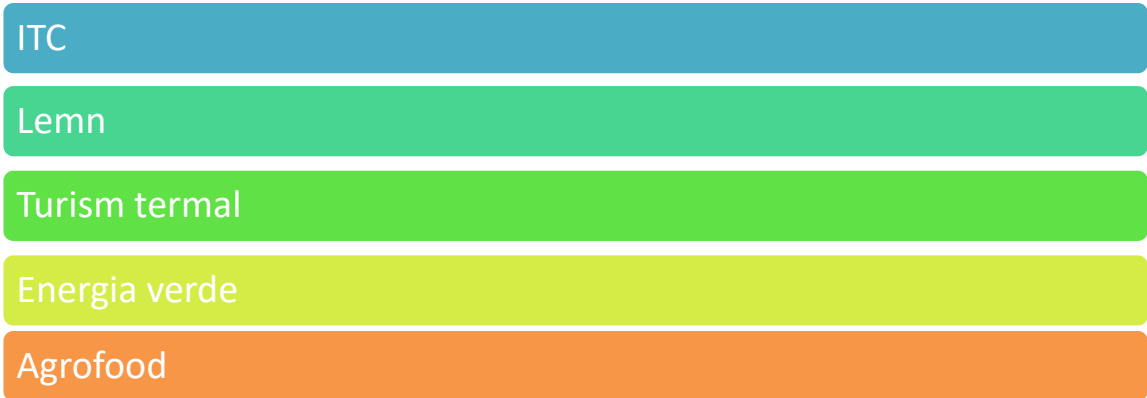


Figure 1. Composition of clusters in the North-West region  
Source: own processing

## **Contributions regarding the study and analysis of the factors of human capital development on the competitiveness of the clusters from the North-West of Romania**

Research studies in the field have analyzed the links between human capital development and the competitiveness of clusters worldwide, European, but there are a small number of studies in this regard regarding the level of Romania, and especially at the level of the North-West development region.

The general objective of the research focuses on analyzing the existing links between specialized human capital, the study and evaluation of investment factors in human capital within industrial clusters, in the context of increasing competitiveness in the North-West development region of Romania.

This requires deepening the study of the impact that the development of human resources has on obtaining high performances within the Romanian clusters, but also the influence of the cluster relations on the human capital within them.

In Romania, the clusters were formed spontaneously, as a result of international projects, given that there was no policy to stimulate the formation of competitive productive agglomerations.

Research on clusters, so far has focused on the connection between specialized human capital (training, education, qualification, training), relationships within clusters (management, procurement, sales, technology, innovation) performance of the organization (productivity, low costs, quality, innovation).

The processing, analysis of the obtained data and interpretation of the research results were performed using the following programs: SPSS 20.0 (Statistical Packages for the Social Sciences).

The method of data collection is the survey, and the tool used is the questionnaire, which was applied to the representatives of the clusters set up in the North-West region in various fields of activity.

In order to perform a detailed analysis in the evolution of the resultant variables, using statistical-econometric models, we will use multiple linear regression. In terms of this multiple linear regression, the degree of contribution of each factor involved in the process of obtaining the expected effect can be analyzed.

Using the Whard method, the dendogram was performed, on which occasion the factors that have a high influence on increasing competitiveness were established, resulting in the fact that the most influential factors in the category of regional development are the market, environment and organization and in the category of increasing competitiveness. are the satisfaction of the human resource, the motivation, the quality of the offered service and the innovation / creativity.

The factors influencing the development of human resources within clusters will have to be correlated with performance based on additional quantitative information, which influences the efficiency of human capital, a multivariate analysis of human capacity, resources, competitive advantage and the relationship between them.

In order to be able to perform an analysis of cluster development factors in terms of human capital, it was considered the most relevant to apply a questionnaire, in order to perform qualitative analysis, in the North-West development region of Romania, taking into account the definition of the problem. , planning the research project, formulating the hypotheses, reviewing the specialized literature, elaborating the items of the questionnaire, building the questionnaire, pretesting the questionnaire, administering the questionnaire to the target group.

The analysis of the hypotheses through the prism of the SPSS 20.00 program led to the following correlations:

1. There is a positive influence between knowledge management and human capital efficiency.

This hypothesis came true, Linear correlation coefficient = 0.290 Sig = 0.000 which shows that there is a positive influence from knowledge management and human capital efficiency, but of lower intensity because this coefficient has a lower value. This conclusion is also supported by the graph below, where we find a small grouping of points on the diagonal.



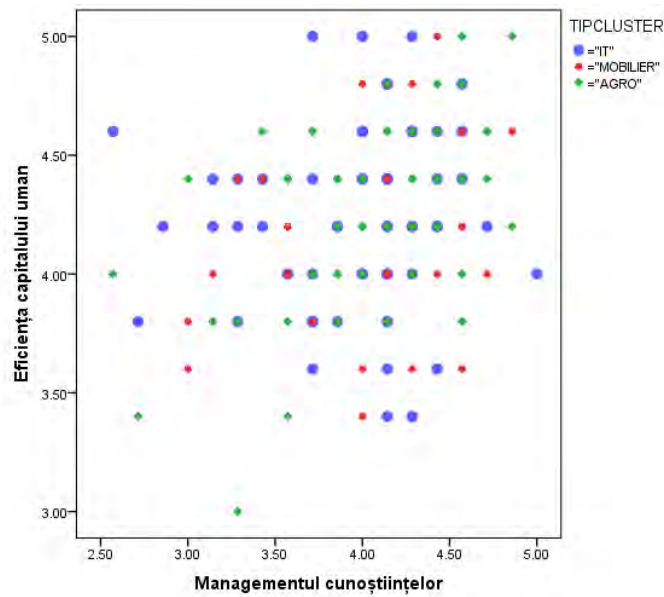


Figure 2. The point cloud that shows the distribution of companies according to the efficiency of human capital, knowledge management and the type of cluster

Source: own processing

2. There is a positive influence between increasing the efficiency of human capital and the effects within the organization

The hypothesis was accepted, Linear correlation coefficient = 0.223 Sig = 0.001, which shows that there is a positive influence from the effects within the organization and the efficiency of human capital, but of lower intensity because this coefficient has a lower value. This conclusion is also supported by the graph below, where we find a small grouping of points on the diagonal.

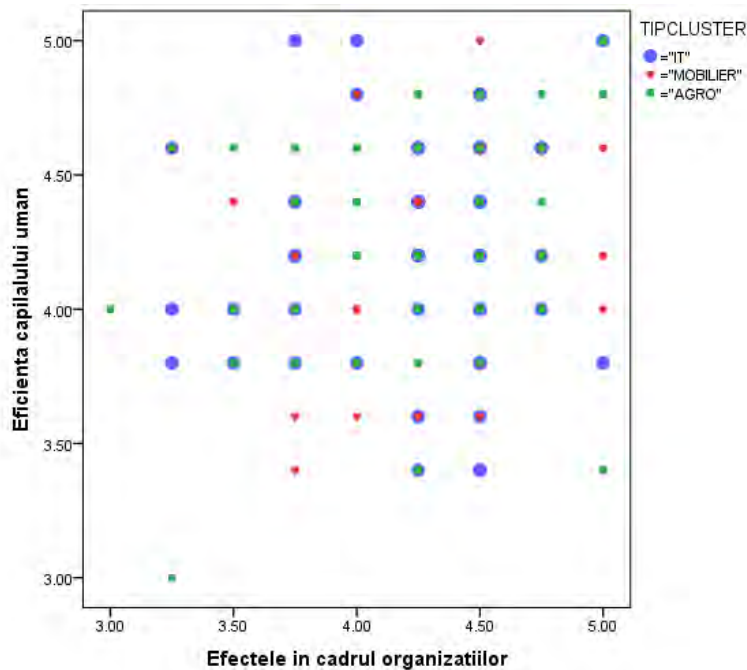


Figure 3. The point cloud that shows the distribution of companies depending on the efficiency of human capital, the effects within organizations and the type of cluster

Source: own processing

3. There is a positive influence between increasing efficiency and increasing employee performance

Linear correlation coefficient = 0.188 Sig = 0.007 which demonstrates that there is a positive influence between increasing the efficiency of human capital and increasing employee performance, but of lower intensity because this coefficient has a lower value. The value of Sig allows us to state the existence of this influence even with a significance threshold of 1%.

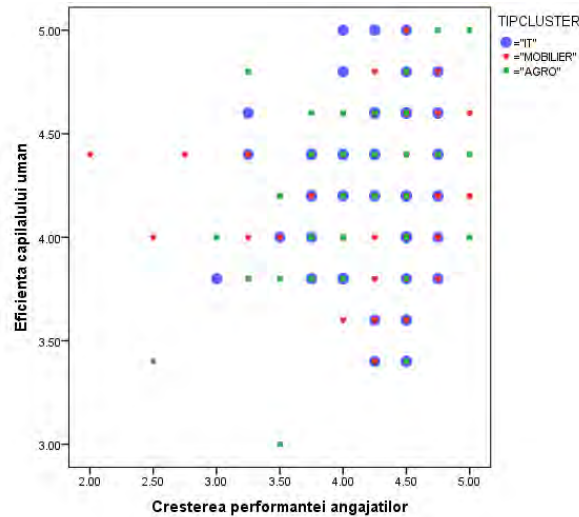


Figure 4. The point cloud that shows the distribution of companies depending on the efficiency of human capital, increasing employee performance and the type of cluster.

Source: own processing

4. There is a positive influence between the frequency of situations in the organization and the results of the investment in human resources

Linear correlation coefficient = 0.484 Sig = 0.000 which demonstrates that there is a positive link between the frequency of situations in the organization and the results of investment in human resources, the connection quite strong given the value of the correlation coefficient and sig. This conclusion is also supported by the image below where we observe the grouping of the points around the main diagonal and the high concentration of the points towards high values of the two variables.

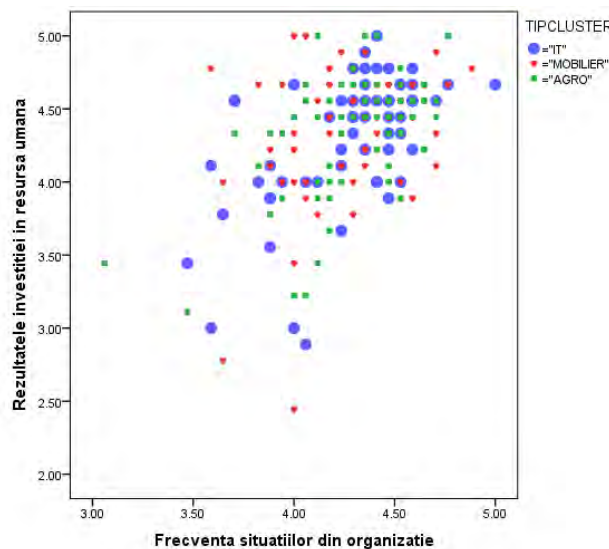


Figure 5. The point cloud that shows the distribution of companies according to the results of the investment in human resources, the frequency of situations in the organization and the type of cluster

Source: own processing

5. There is a positive influence between the dissemination of knowledge and the increase of employee performance

The hypothesis was accepted, Linear correlation coefficient = 0.397 Sig = 0.000, which demonstrates that there is a positive and medium intensity influence between the dissemination of knowledge and the increase of employee performance. This demonstrates that in the case of companies where there is a constant concern in disseminating knowledge, they expect an increase in employee performance. This idea is also supported by the chart below where we find that companies in which employee knowledge management is included in the organization's strategy, employee performance is higher.

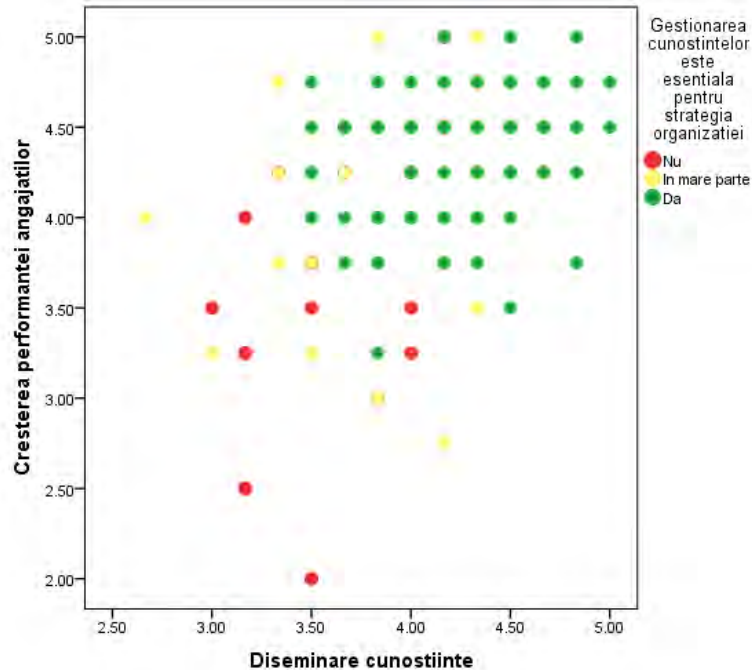


Figure 6. The point cloud that shows us the distribution of companies according to the increase of employee performance, knowledge dissemination and cluster type

Source: own processing

## Conclusions

It can be said that regional development through the prism of clusters brings the development of infrastructure, labor, cities, business, the formation of a network that eliminates certain costs, but with continuous investment and implement projects that bring benefits to both the development of the organization with the necessary endowments, but also the improvement of the human resource through exchanges of experience and participation in training courses, all leading to competitiveness, innovation, performance, increase of productivity.

From the analysis of the resulting data, by grouping the items on a number of 5 clusters, it is found that the companies are open to the external environment, which thus denotes an improvement of the managerial style in order to pay more and more attention to both the external environment. as well as to the parties involved.

At the same time, this research study can be used as an educational informative guide among the existing regional clusters at national and implicitly regional level, clusters formed by large zonal representatives of national and global corporations, which carry out their activity at the level of the analyzed research area. by new members and for opening the thinking horizon of newcomers, being thus at least a very useful didactic and educational analysis material, accessible to all and in an accessible manner, only the most important thing is to have the will to access and analyze.

The ability to innovate in the business environment is a key factor for increasing competitiveness and for smart and sustainable development. The innovation process contributes more and more to local-regional and national development.

In the case of this scientific research, the analyzes conducted led to the outline of the existing situation in the North-West development region of Romania, regarding the existence/ non-existence of a link between investment activities in human capital and the performance of selected clusters.

By cluster analysis it is desired that the entire data collection be divided into a collection of homogeneous groups, to analyze the influence of classified variables, depending on the influence and the smallest distance between them, respectively to classify objects according to groups homogeneous.

In the light of this paper, we highlighted the need to create clusters in as many counties of the region, especially in areas where it does not exist, generating added value to this region, providing a favorable framework for economic recovery in this dark period existing at national level. as well as globally.

Through the methods applied in the analysis of the importance of human capital on organizations, it can be said that human resource development programs make possible a professional retraining, in-depth training in a field, adaptation to new information technologies that provide dynamism to the cluster and increase profitability.

This paper is in line with the conference, as it aims to explore the challenges within clusters that influence business performance at the regional, national and global levels in step with new information, educational technologies and a more prosperous environment.

Clusters are the pillars for smart, sustainable inclusion growth, facilitating and creating jobs, improving cooperation between business, research institutes, universities and other organizations based on increasing competitiveness, labor specialization, regional development.

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# IMPROVING STRATEGIC MANAGEMENT IN BUSINESS FIXED CAPITAL INVESTMENT

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## Abstract

**Purpose** – This article aims to highlight, on the one hand, the factors that determine the demand for investments in fixed capital and which influence the investment decision and on the other hand, the role and importance of this demand (request) for the strategic management of the enterprise.

**Methodology/approach** - The data sources used in the study are numerous: papers, documents, statistics and information obtained directly from firms. These data have been analyzed and interpreted by the authors.

**Findings** – This article presents the main investment models that are able to explain the investment behavior of the companies and tests some investment models taking into account the Romanian energy sector. Precisely, the article refers to the activity that carries, according to the classification of activities in the Romanian national economy, the following name: electricity and heat, gas and water. The results obtained from these tests revealed that the demand for investments in fixed capital is not determined by a single factor but by a combination of factors. Our data analysis revealed factors such as: changes in the volume of investments made in the national economy, which occurred in the current period compared to the previous one, changes in the level of tangible fixed assets currently existing in the activity compared to the previous period, the current average interest rate and partially, the volume of industrial production obtained in this economic activity field.

**Research limitations/implications** – The limits of this research are given by the analysis of a single field of activity, namely the activity that bears the name: electricity and heat, gas and water.

**Practical implications** – Practical implications of this study, regarding the strategic management of an enterprise, are related to analysis, knowledge and anticipation of the demand for fixed capital investments. Based on an investment model, compatible with the economic activity carried out, allows the enterprise to take concrete measures, choosing the best global and partial strategies to ensure a certain competitive advantage.

**Originality/value** – There are two main contributions of this paper: the first one refers to a model able to determine which are the main determinants of the demand for fixed capital investments in the analyzed activity field, after testing several investments; the second one, is to highlight the role and the importance of this demand for the company strategic management.

**Key words:** Investments, demand, firms, strategic management, decisions.

## Introduction

In the equation of the development and economic growth of a societies, investments are the driving forces on which human efforts are directed towards improving the economic results. Through investments, the increase and modernization of fixed capital is realized, with immediate effects on the increase of the labor productivity and of the economic performances.

The role and the importance of the investment demand on the economy, from a generally point of view and upon each enterprise have been analyzed over time, by the world's great economists. For example, J. M. Keynes highlighted the importance of demand on the evolution of the economy and on production, postulating that aggregate demand determines the level of combined production or output.

Investments can be divided into three main categories: residential investment, inventory investment and business fixed investment. This article analyses only business fixed investment and the importance of the strategic management involving business success.

Business fixed investment involve funds used to produce goods and services or to increase production capacity. This kind of investment can be decomposed into equipment, structures, and intellectual property. The stock of machines or plants represents fixed capital. Business fixed investment is an important component of aggregate demand and it is the most volatile element. Investment decisions of firms have implication at the macro level and at the micro level of the economy. At the macro level, they have implications for capital market development, interest rates and regulation. At the micro level, such decisions affect capital structure and firm growth.

For a company that the demand for fixed capital investments must be analyzed considering all the factors that may influence this request. The strategic management of the company has the task of quantifying the role and importance of each factor, making at the right time, the investment decision that will provide them, a certain competitive advantage over other competitors.

### **The most important theory concerning business fixed investment demand**

According to the neoclassical theory, business fixed investment is determined by the cost of capital and by marginal product of capital. In turn, the cost of capital depends mainly on the tax rate, the interest rate and the rate of amortization of fixed capital. The cost of the capital reflects the costs of each source of financing, respectively the average cost of financial resources that the company uses (Drob, 2009).

The cost of capital reflects the costs of each source of financing, respectively the average cost of financial resources that the company uses. The investment decision must be based on a comparison of the cost of capital used to finance the investment with the expected return on that investment, or between the cost of using a new unit of capital and the marginal income generated by its use. If the expected return on investment is higher than the cost of capital used, or if the marginal income is higher than the cost of using an additional unit of capital, then the investment decision can be made. Marginal product of capital is the additional product made by using an additional unit of the same capital. In turn, the marginal productivity of capital is determined by the volume of labor and the labor technology used. The higher the volume of labor is, the more efficient manufacturing technology is, the bigger it is the marginal productivity of capital.

Bischoff, C. W., Bosworth, B. and Hall, R. (1971) has been developed an extension of the neoclassical model, emphasizing that investments are more sensitive to changes in the level of production than to changes in the cost of capital. J. M. Keynes proposed another approach to explain the investment behavior of firms. According to this approach, the incentive to invest can be attributed to two factors: the marginal efficiency of capital and the interest rate. According to Keynes investment decisions are taken by comparing the marginal efficiency of capital with the interest rate (Drob, 2009). If the marginal efficiency of capital is higher than the interest rate, the firm investment decisions is to invest.

Another theory, which aims to analyze and explain how the demand for investment in fixed capital manifests itself is that of the investment accelerator. This theory is often associated with Keynes's approach but was first proposed by Maurice Clark (1917) and later developed by Hollis Chenery (1952), Leendert Koyck (1954) and others. The investment accelerator model establishes that the demand for investments in capital goods is determined by the demand for production made based on those goods. The effect of the accelerator principle translates into net investments during the period of increasing sales of consumer goods and through net divestments during periods of crisis (Drob and Serbu, 2010). Robert Eisner and colleagues reviewed the accelerator theory, considering profit. Eisner believes that investments in capital goods depend on sales, depreciation, and profit. Other studies related to the field of investments have highlighted the fact that the company's cash flow is also an important determinant of investments (Drob and Serbu, 2010).

Neoclassical investment theory and accelerator theory do not consider signals given by the market when making decisions about fixed capital investments. To remove this disadvantage, William Brainard and James Tobin developed a theory (Theory "q") that tries to explain the demand for investments considering the market value of firms' assets established on the capital market. This model starts from

the premise that the demand for fixed capital investments varies in proportion to the ratio between the market value of the company's assets and the replacement value of the capital held by that company. This ratio is known as the "q" factor (Eklund, 2013).

The neoclassical theory of investment has another vulnerability: it starts from the assumption that investments are reversible and have a neutral risk. Investments in fixed capital are irreversible, because through the disinvestment process only a small part of the capital initially invested is recovered and the recovery process supposes a certain period of time. The risk-neutral investment assumption is also unacceptable because any investment involves a risk dose. Because investment involves risk, general expectations about the future will influence an investment decision of the firm. Recent investment research has highlighted that investments decisions must consider another factor, namely uncertainty (Dixit and Pindyck, 1994). Uncertainty is generally caused by macroeconomic factors, such as: changes in state fiscal policy, interest rates or exchange rates, and so on. This uncertainty can refer to the future evolution of demand, profit, sales, prices of inputs or outputs, etc.

Since investments are irreversible, investment decisions should be postponed until there is sufficient information on market development. Generally, the cumulative effect of uncertainty and irreversibility is reflected in the decline of current investments and the postponement of investments projects.

### Own study concerning business fixed investment demand

For the analysis of the demand for fixed capital investments, we chose as economic field of study the power energy sector, focused on the activity named, according to the classification of activities in the Romanian national economy: electricity and heat, gas and water. The purpose of the applicative part is to develop and analyses different models regarding the demand for fixed capital investments and, finally, to choose the best model able to explain the evolution of this demand within the analyzed activity. In the carried-out research, we started from the hypothesis that the request is fully transformed into investments made in the targeted economic activity. Taking into account certain economic legitimacies and the statistical data available to the analyzed sector, two economic variables were selected for the construction of the models: first one: investments related to "electricity and heat, gas and water" (considered dependent variable), and second one: GDP, interest rate (r), total investments made in the national economy (IT), industrial production (Y) and existing tangible fixed assets (K) within the analyzed economic activity (considered independent variables). The dependent variable (I) - investments made in the economic activity "electricity and heat, gas and water" - refers mainly to investments in capital goods, materialized in expenses for the purchase of equipment, means of transport and other expenses for the creation of new fixed assets and for the reconstruction of existing ones in this sector.

It was designed and analyzed 16 models that contain, in a certain combination, the variables considered:

$$M_1: I_t = a_0 + a_1Y_t + u_t$$

$$M_2: I_t = a_0 + a_1Y_t + a_2r_t + u_t$$

$$M_3: I_t = a_0 + a_1K_t + a_2Y_t + a_3r_t + u_t$$

$$M_4: I_t = a_0 + a_1IT_t + a_2K_t + a_3Y_t + a_4r_t + u_t$$

$$M_5: I_t = a_0 + a_1PIB_t + a_2IT_t + a_3K_t + a_4Y_t + a_5r_t + u_t$$

$$M_6: I_t = a_0 + a_1I_{t-1} + u_t$$

$$M_7: I_t = a_0 + a_1I_{t-1} + a_2Y_{t-1} + u_t$$

$$M_8: I_t = a_0 + a_1I_{t-1} + a_2K_{t-1} + u_t$$

$$M_9: I_t = a_0 + a_1I_{t-1} + a_2K_{t-1} + a_3IT_{t-1} + u_t$$

$$M_{10}: I_t = a_0 + a_1PIB_{t-1} + a_2I_{t-1} + a_3K_{t-1} + a_4IT_{t-1} + u_t$$

$$M_{11}: I_t = a_0 + a_1K_t + a_2I_{t-1} + a_3K_{t-1} + a_4IT_{t-1} + u_t$$

$$M_{12}: I_t = a_0 + a_1K_t + a_2K_{t-1} + a_3IT_{t-1} + u_t$$

$$M_{13}: I_t = a_0 + a_1IT_t + a_2K_t + a_3K_{t-1} + a_4IT_{t-1} + u_t$$

$$M_{14}: I_t = a_0 + a_1IT_t + a_2K_t + a_3r_t + a_4K_{t-1} + a_5IT_{t-1} + u_t$$

$$M_{15}: I_t = a_0 + a_1IT_t + a_2K_t + a_3Y_t + a_4r_t + a_5K_{t-1} + a_6IT_{t-1} + u_t$$

$$M_{16}: I_t = a_0 + a_1PIB_t + a_2IT_t + a_3K_t + a_4Y_t + a_5r_t + a_6K_{t-1} + a_7IT_{t-1} + u_t$$

Where:

$I_t, I_{t-1}$  – investments made in the economic activity "electricity and heat, gas and water" in year "t", and "t-1", respectively.

$IT_t, IT_{t-1}$  – total investments made in the national economy in year "t", and "t-1", respectively.

$Y_t, Y_{t-1}$  – industrial production related to the economic activity "electricity and heat, gas and water" in year "t", and "t-1", respectively.

$PIB_t, PIB_{t-1}$  – GDP in year "t" and "t-1", respectively.

$K_t, K_{t-1}$  – existing tangible assets within the economic activity "electricity and heat, gas and water" in year "t", and "t-1", respectively.

$r_t$  – average interest rate in year t.

$u_t$  – random variable.

The random variable, also called residual or random, encompasses all variables, except exogenous ones, which, even if they influence the resultant variable, are not specified in the model. In the present study, both for estimating the parameters of the designed models and for calculating statistical indicators, we used the Statistics software. This software allows complex analysis of statistical data. The analysis consists, among others, in establishing the regression equations, in calculating some indicators and some statistical variables, in applying statistical tests, drawing correlation graphs between certain variables, making predictions, etc. Among the calculated statistical indicators is the coefficient of multiple determination R. This indicator measures the proportion of variation of the dependent variable explained by the regression equation. The square of this coefficient ( $R^2$ ) can take values between 0 and 1. The closer the size of  $R^2$  to 1 is, the better the variation of the dependent variable is explained by means of the regression equation. When  $R^2$  takes values close to zero, then the chosen model to explain the dependent variable is considered inadequate.

Among the statistical tests we chose the "t", "F" and the Durbin-Watson test. The "t" (Student) test is used to check the significance of the model parameters. The "F" test is used to verify the significance of the model. This test indicates if the results obtained on the model are significant, with a certain significance threshold. The Durbin-Watson test is used to test the error interdependence hypothesis.

Among the analyzed models, the model that give the best explanation for the variation of investments, respectively the demand for capital goods, is the model  $M_{15}$  ( $M_{15}: I_t = a_0 + a_1IT_t + a_2K_t + a_3Y_t + a_4r_t + a_5K_{t-1} + a_6IT_{t-1} + u_t$ ), since from all the models developed in this paper, it has the highest value for the statistical variable "F" and for the coefficient of multiple determination  $R^2$  ( $R^2 = 0.862164$ ).

In a concise form, the above model can be presented in the following form:

$$I_t = a_0 + a_1\Delta IT_t + a_2\Delta K_t + a_3Y_t + a_4r_t + u_t$$

where:

$$\Delta IT_t = IT_t - IT_{t-1} \text{ and}$$

$$\Delta K_t = K_t - K_{t-1}.$$



This form of the M15 model makes easier to interpret the results obtained on its own. According to this model, the current demand for fixed capital investments in the economic activity "electricity and heat, gas and water" is dependent on changes that appears in the volume of investments in national economy, which occurred in the current period compared to the previous one. It is also dependent of the changes in fixed assets currently existing in the analyzed activity compared to the previous period, of the current average interest rate and, partially, of the volume of industrial production obtained in this economic activity. More precisely, the dependence is positive towards the changes of investments within the national economy and negative at the variation of the level of tangible fixed assets afferent to the field of activity targeted and towards the average rate of active interests. For an enterprise in this field of activity, these empirical results shows that the demand for fixed capital investments must increase during the boom of the national economy, when there are positive changes, from one period of time to another, in terms of regarding the level of total investments and / or when the average interest rate is low, respectively decreases in times of crisis or at times characterized by a high average interest rate. At the same time, this demand must be permanently correlated with the variation of the level of tangible fixed assets, from one period to another, both at the economic activity level and at the enterprise level.

### **The role and the importance of the study**

The usefulness of this study can be found in the strategic management of the company. In the vision of modern strategic management, the approach of the enterprise-environment relationship implies the anticipation and modification of the evolution of the external environment by training, coordination and adequate targeting of own resources, in order to achieve a competitive advantage. This advantage can be obtained by the efficient use of new fixed assets, new technologies, leading to an output as high as possible per input unit etc. At the same time, the achievement of the competitive advantage can be obtained by ensuring an optimal stock of capital, both quantitatively and qualitatively. This means triggering the investment or divestment process whenever the current capital stock is different from the optimal one. In this case, the demand for fixed capital investment must be in line with the optimal level of fixed capital. Even if there is a continuous gap between the current level of capital and the optimal one, managers must act permanently to reduce it.

Some companies expect to increase their demand for industrial or consumer goods first, and then adjust their demand for capital goods accordingly. Such an approach is fundamentally wrong because only companies that anticipate both the demand for the own goods and the capital goods needed to be achieved, can make effective decisions regarding the timing of the investments or divestments process in capital goods, thus obtaining a competitive advantage over other competitors (Simionescu and Drob, 2001). For an enterprise, the demand for fixed capital investments must not be analyzed in a static way but in a dynamic one, by considering all the implications generated by its links with the external environment. The strategic management of the enterprise has the task of quantifying the role and importance of each factor, which leave traces on its activity, to ensure a certain competitive advantage.

Investment theory and practice have proposed several investment models that incorporate some of these factors and can provide information on how the demand for fixed capital investments can evolve. For the strategic management of the enterprise, the knowledge of such information is important because the changes that occur regarding the level of demand for fixed capital investments exercise a strong influence on the production capacity of the enterprise, the need for staff, the balance of payments, etc. This means that, when designing the global and partial strategies of the enterprise, the multitude of consequences generated by the change in the demand for fixed capital investments on the specific fields of the enterprise (production, human resources, financial field, etc.) must also be taken into account. The outcomes that appears considering the demand for investments in capital goods when the company's strategies are fundament upon those considerate, are found in a more efficient allocation of resources, in reduced production costs etc. and finally, in increasing the enterprise competitiveness.

### **Discussion and conclusions**

The role and importance of the demand, in general and demand for fixed capital investment has been the subject of several researches conducted in the contemporary period. The unanimous conclusion of the authors who studied this issue is that demand plays an essential role in the market economy

equation, more important than the supply. Investment theories and models developed over time have shown that the demand for fixed capital investment is dependent on several variables. These variables include the cost of the capital, interest rate, output, marginal product of the capital, marginal efficiency of the capital, uncertainty, cash flow, profit, “q” factor etc. Depending on the authors, the models developed contain one or more factors that have a greater or lesser importance.

Among the models analyzed by the authors, the model that best explains the variation of investments, respectively the demand for fixed capital investments, is the model that has as the following variables: the first one refers to changes in the volume of investments made in the national economy, occurred in the current period. The second one refers to the level of tangible fixed assets currently existing within the analyzed activity compared to the previous period. The third one refers to the current average interest rate and the volume of industrial production obtained within the analyzed economic activity. For the strategic management of an enterprise, the analysis, knowledge and anticipation of the demand for fixed capital investments, based on an investment model compatible with the economic activity carried out, can allow the enterprise to take concrete measures regarding the choice of the best global and partial strategies, in order to provide a certain competitive advantage.

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# ORGANIZATIONAL AND FINANCIAL PERSPECTIVES IN THE CURRENT CONTEXT OF GLOBALIZATION

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## Abstract

**Purpose** *In the current world economy, the process of continuous development of technology, technical-scientific progress, together with economic development, materialized in the opening of the circulation of goods, services and information, lead to the intensification of the globalization process. All these have major influences on the organizational and financial situation of companies.*

**Methodology/approach** *The method applied in this paper focuses on an analysis of the situation of companies both from an organizational and financial point of view, in the current context of the market economy. The changes that take place due to the current situation, influence the structure, organization and financial status of most companies. A redefinition of the situation and priorities is urgently needed.*

**Findings Research limitations/implications** *The study aims at an analysis of the evolution of the globalization process in our country Romania, going through the stages of development and integration of companies in the international context, the emergence and development of multi-national firms, and the forecast of the future situation, starting from the current context. It is inevitable to redefine priorities both nationally and globally, through a serious re-thinking and analysis of the economy and its effects.*

**Practical implications** *In the era of the Internet and oil as commodity, travelling, mass production, consumption and transportation are re-defined. From cheap maritime transportation, online communication to low-cost flights all these make people's life more dynamic, affordable and increases the way of life. These are parts of the benefits of the economic effects of globalization. There are also other effects, the re-location of different businesses or certain industries, like manufacturing to low costs labor costs regions/countries/continents, increasing for example un-employment in western countries or forcing a re-orientation or re-education of the work force. If we compare this with 100 years ago there are a lot of changes, most of them happening in the last 20 years with the start of Internet and the start of automation/robotization. With the 2020 Covid-19 pandemic, globalization will be most impacted, probably re-defined with a high pressure on local resources development to serve local needs in products and services.*

**Originality/value** *The problem under study is an analysis of the evolution of companies in our country in the context of globalization, starting from communication, democratization and market economy, that is not achievable without the liberalization of capital flow, with the clear purpose of development and profit. The main companies involved in the globalization process are the multi-national firms, which exist and function in all sectors of activity. Many of them have and manage important financial flows, but which are currently in a delicate status. The study of their situation, priorities and possibilities of future evolution represents the main purpose of this paper.*

**Key words** *financial situation, globalization, business, multi-national firms.*

## Introduction

Any economic activity in order to achieve its ultimate goal must be efficient and there needs to be a demand for its object of activity. Economic agents are aware of the importance of determining needs as a primary factor in achieving production, because it ensures the added value of the entire activity. The specialists in the field unanimously appreciate the fact that the success of a business depends on the needs and motivations of the buyers, who in fact do not buy products or services, but the satisfaction of the needs and desires that they procure.

The economic optimum is a term that can be defined as a state towards which the economic activity tends, where the existing resources and the production factors are used in such a way as to lead to the maximization of the satisfaction of the needs. The search for this optimum is based on certain economic norms but also collective preferences that allow the evaluation and comparison of different states. These preferences are the basis of the criteria for selecting the economic and social optimum. Such a criterion requires that collective preferences respect individual preferences. In the market economy, the search for the optimal must take into account the preferences of consumers, the producers having the role of taking those measures that lead to the transformation of goods that satisfy individual and collective preferences. An essential element is the optimization criterion that establishes the most advantageous option of combining production factors.

The Arrow-Debreu model for establishing the optimum, achieves a global optimum starting from partial equilibria, the balance being achieved between vectors of prices, expenses, production and consumption, provided that the total demand for each product does not exceed the total supply. This is an issue that must be taken into account in the current situation of the world economy. It is essential that each company re-evaluates its priorities both in terms of products made or marketed, as well as human resources. Within a company you can find a lot of vectors of expenses with fixed or variable capital, but also vectors of production. Depending on the vector of market prices, the company will choose the vector of production and sales expenses to ensure profit maximization, while the consumer who benefits from the company's products will choose a rational consumption vector that will satisfy the equivalent between the amount of his expenses and his income.

## **Methodology**

The issue of globalization has been and is widely debated, with different views on the emergence and development. The pace of life and economic development is becoming more and more alert, registering an alert increase in the level of communications, transport, but also of financial flows.

International trade in goods and services across the country's borders is an important aspect of a country's economy, being a significant part of GDP. Trade between different countries of the world is based on certain reasons such as: the distribution of resources in the world, different climate, insufficient domestic production to meet needs, specialization that leads to increased division of labor.

The profitability of trade between different nations is due to the different ratios of alternative costs. Prosperity in developed countries will trigger increased exports of raw material from the suppliers' countries. The crisis that occurs with the 2020 pandemic, is strongly affecting the price of raw materials. The specialization of the countries supplying raw materials for the export of such products, determines the dramatic decrease of the price. They cannot quickly reorient their export to anything else.

Economic transactions take different forms being influenced by different parameters. The transaction itself is a meeting between the manufacturer, supplier, seller and customer. However, this relationship is much more complex when we talk about international trade, because international trade, although it is a social act in which two people/parts are involved, is also an act of culturalization because goods and services are based on material elements, which include science, experience and traditions that are part of a people's culture.

According to statistical data, one can see that the worldwide international trade has grown to a share of 24% of GDP. World's biggest corporations perceive the international market as a single market. The emergence and development of multinational companies has been a key factor in the development of the world economy and the expansion of globalization.

At present, multinational companies provide two thirds of the country's income, their number being quite large. The desire to be employed in such companies increases exponentially as a result of the attractive salary and the opportunities offered.

Table 1: Top 10 of the most desired employers in Romania (Catalyst.ro, press, 2020)

No.	Company
1.	Continental
2.	Oracle
3.	Microsoft
4.	Amazon
5.	IBM
6.	OMV PETROM
7.	Bosch Romania
8.	ING Romania
9.	Vodafone Romania
10.	Groupe Renault Romania

As for how to get hired into these companies, it varies greatly depending on the status of each candidate and how to apply.

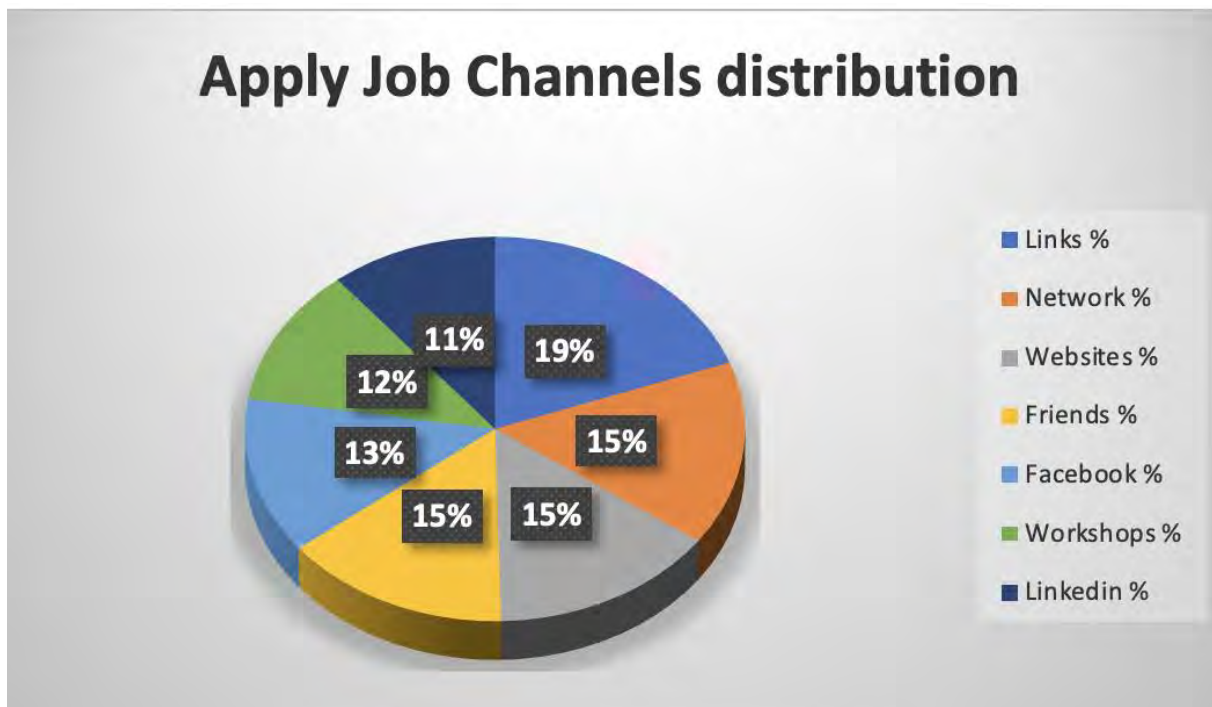


Figure 1: Apply Job per type of channel (Catalyst.ro, press, 2020)

Redefining the priorities, the way of organizing and functioning of large and small companies, is the problem that organizations face both nationally and globally. The reorganization of the activity, the choice of the representative projects, the organization of the human resource, of the way of accomplishing the activity are the essential point in redefining a successful business. In order to estimate a profitable activity, the first step is to estimate sales and expenses, the result materializing in profit or loss for the company. There are situations when due to conjunctural influences can occur or large profits in a short period of time, or significant losses.

In order to be able to establish the company's strategy as realistic as possible, it is necessary to take into account all the technical and financial information.

In order to estimate a profitable activity, the first step is to estimate sales and expenses, the result materializing in profit or loss for the company. There are situations when due to conjunctural influences, the company might have large profits in a short period of time, or significant losses.

The sales market is the place where competing companies meet, the transactions made by them rooting problems of creditworthiness and of negotiations' management.

The supply market raises problems of creditworthiness of suppliers, quality of products sold, methods and delivery times. The choice of the transport method is an aspect that must be taken into account due to the problems it raises. Thus, road transport is recognized for the flexibility it offers, but it is strictly conditioned by weather conditions. Air transport offers a short delivery time, but the costs are much higher. Shipping by sea is the most economical mode of transport, flexible and tailored to customer requirements, but dependent on weather conditions and long delivery time.

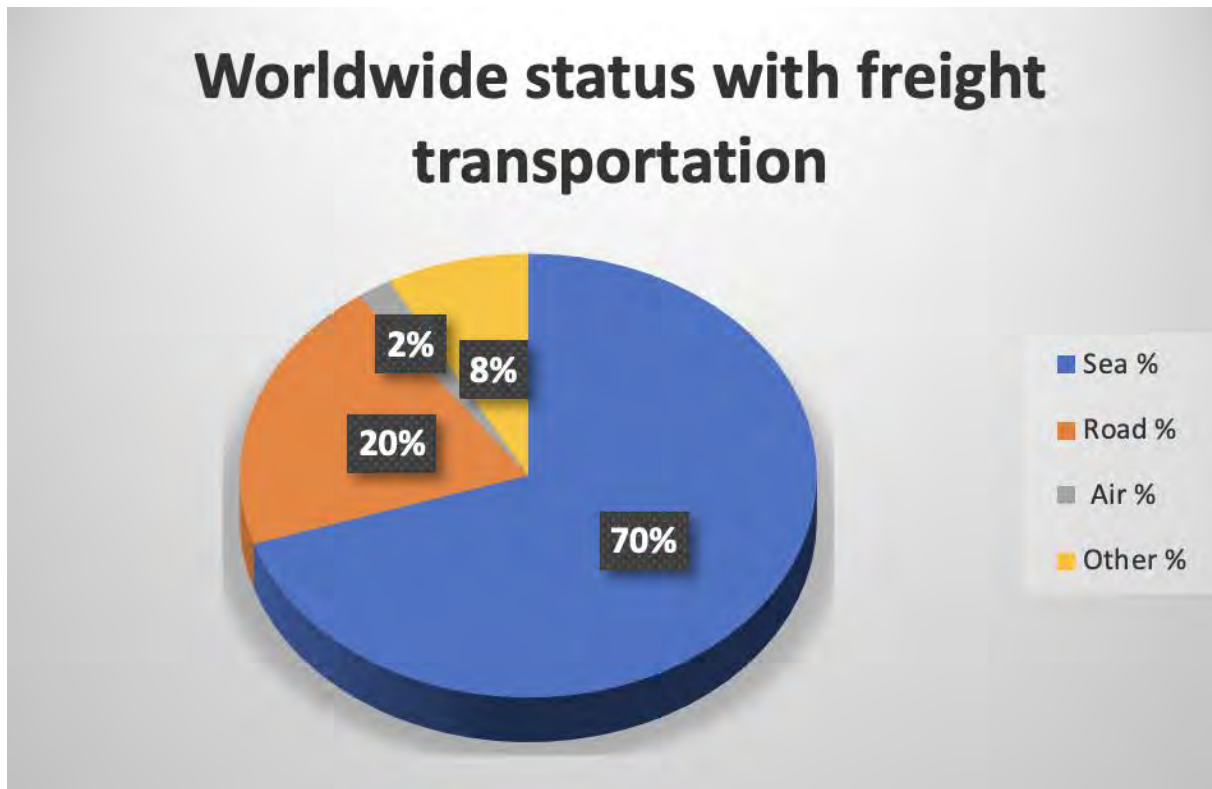


Figure 2: Worldwide status of freight transport (European Union website, press, 2020)

The financial market is the one that will cover all financial flows, it is the meeting place of the demand and supply of liquidity.

The labor market is the place where employers and employees meet, in some cases through recruitment companies. Here is selected the information about the structure of the jobs, of the offer and of the requested salaries. Currently we can talk about the year of changes on the labor market both in Romania and worldwide. Many companies have had to close their businesses, while some multinational companies have chosen to leave certain markets to reorient. We live in a period in which new forms of work appear in the digital economy, some even atypical.

Until the crisis we are facing now in 2020, both domestic and multinational companies thought and forecasted the economic strategy they wanted to follow for the coming years. Currently, all these strategies need to be re-analyzed and re-thought in order to be applied to the current context. All companies' activities were affected, their main concern being an immediate reduction of expenses. This could had been done immediately but only on the short term due to the fact that in the next period, companies had to increase the expenses with ensuring health safety at work in the context of Covid-19 pandemic.

According to estimates made by several multinational companies, a 25% reduction in profits is expected compared to the previous year, which raises serious questions about the desire of parent companies to keep and support their operation in other markets.

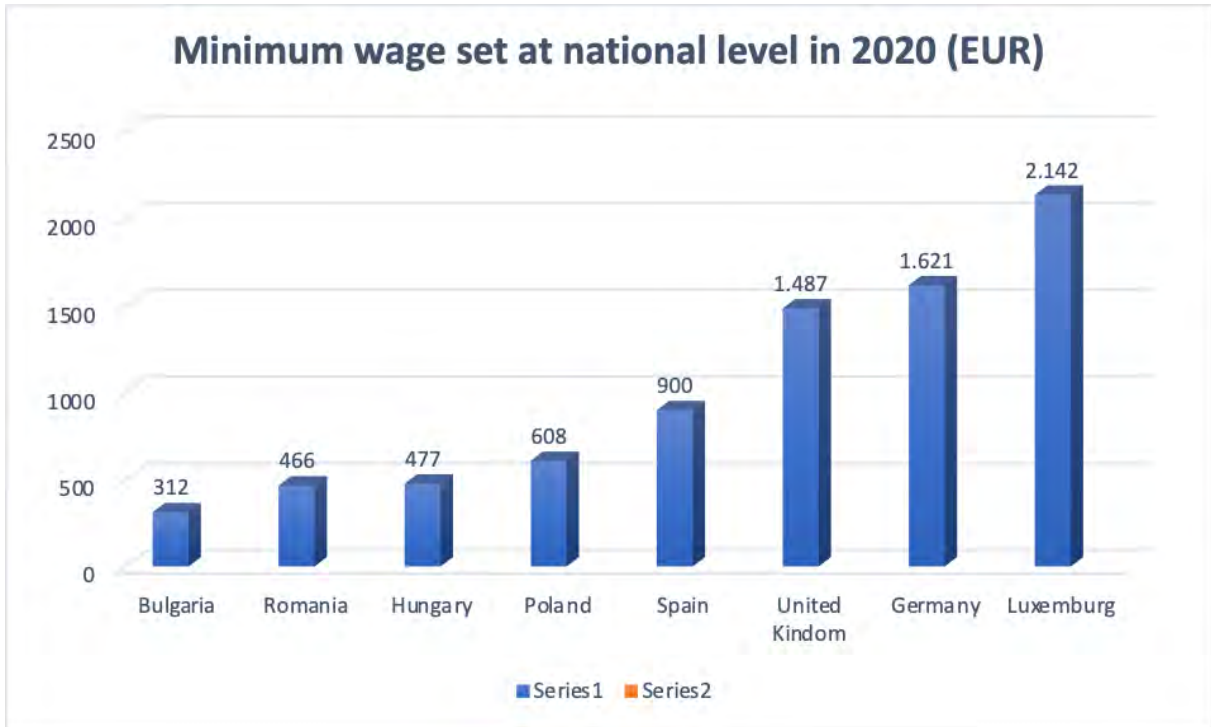


Figure 3: Minimum wage set at national level in EU in 2020 (KPMG, press, 2020)

From the data published by the Romanian National Trade Register Office, we can see a substantial reduction in the registrations of companies with foreign capital. In conclusion, the crisis we face worldwide affects all markets, the main concern at the moment is to maintain the existing companies without major losses.

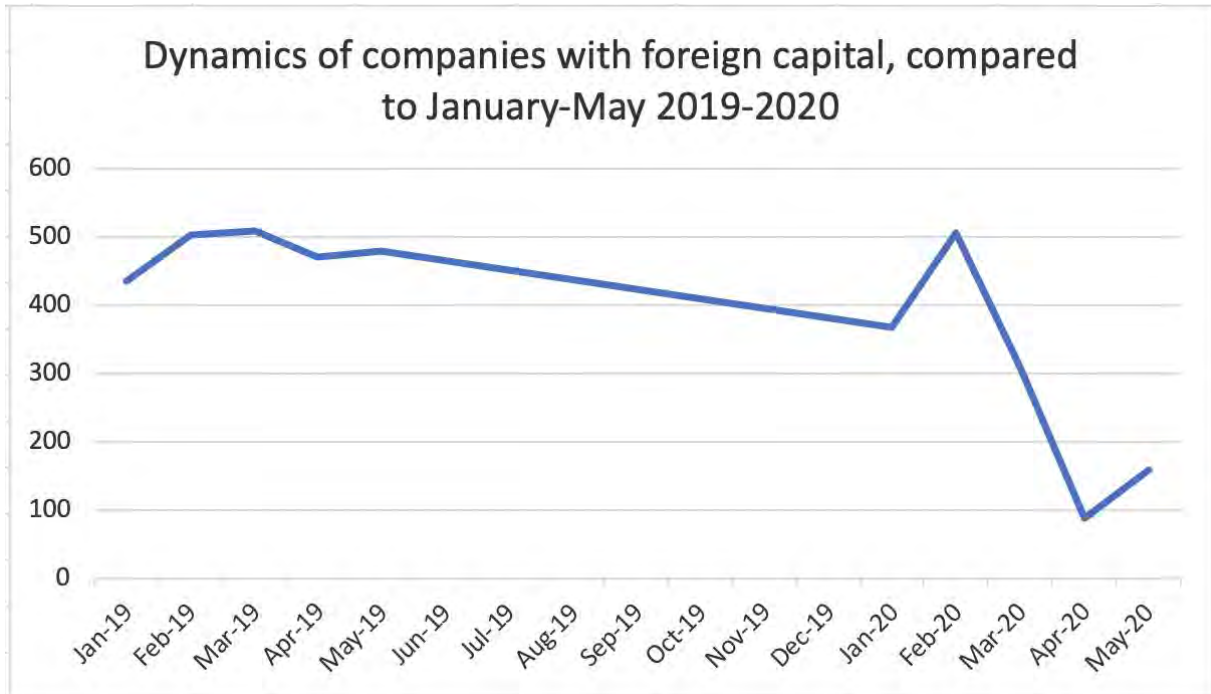


Figure 4: Dynamics of companies with foreign capital, compared to January-May 2019-2020 (Romanian National Trade Register Office, online statistics, 2020)

The economic downturn is major and unprecedented. Certainly, the process of globalization is stagnant and possibly even in regression. The consequences are clearly unfavorable and with bleak prospects. The question is how many national companies will survive and whether they will survive. In the European Union, the European Commission has called for a suspension of the Stability and Growth Pact (SGP) in order to encourage governments to support domestic companies.

## Conclusions

The conquest of new markets in order to carry out new economic transactions, involves conducting in-depth research and studies, which involve high costs. All these are influenced by the constantly changing economic situation but also by possible unfavorable events foreseeable or not.

The emergence and development of multinational companies in our country has brought with it a number of opportunities for both companies and the population. Cheap labor was the main aspect that encouraged their development in the first place. Currently the situation has changed, we talk about cheap labor only when we talk about unskilled labor. On the other side in different regions of Romania like Cluj for example, IT clusters are employing large communities of very skilled IT professionals for their technical expertise and with focus on building business expertise as well, providing consultancy for clients from western Europe or US based clients, making this the most important focus of multinational companies in IT.

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# USING CUSTOMER RELATIONSHIP MANAGEMENT SYSTEM TO IMPROVE ORGANIZATIONAL PERFORMANCE – EXPLORATORY STUDY ON ROMANIAN SMES

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## Abstract

**Purpose** – This aim of this research is to understand how the dynamics of CRM usage have changed SMEs practices and influenced their organizational performance. Following a literature review to establish the key issues in the field, this research study will develop an exploratory framework.

**Methodology/approach** - The elements of influence for the formation of CRM practices within companies have been examined from different theoretical points of view and received significant attention. Theories that have been used to understand the elements of CRM practices include the theory of resource-based visualization (RBV) and the theory of marketing relationships (RMT). In this study, CRM resources are classified as technological CRM resources, knowledge management and customer orientation. The survey questions were stated as closed questions, using the Likert scale (with values from 1 to 7) as an answer.

**Findings** – The study proposed analyzes the the impact of CRM usage on SMEs performance. Using statistical data, technical information and case studies, through quantitative and qualitative analysis, the research conducted identifies the current state of CRM usage. Based on this research, this research defines CRM as a core business strategy for providing information through the use of information technology tools to establish long-term customer relationships. It is impossible for organizations to have all the necessary resources to remain competitive without having a close relationship with customers.

**Research limitations/implications** – Respondents were especially young people whose behavior could differ somewhat from the population average. Another limitation was that the Romanian sample contained many full-time workers. However, many of the students in Romania work full time, which makes the two samples compatible.

**Practical implications** – This study will be added to the relatively limited empirical research, based on Customer Relationship Management system usage. More than that, it adds to the limited number of empirical studies by exploring the impact of CRM system adoption on the organizational performance of small and medium business enterprises.

**Originality/value** – The significant effect that influences the organizational performance toward using CRM system is represented by organizational capability had the most important influence.

**Key words:** Customer Relationship Management system, SMEs performance, business digitalization.

## Introduction

As small and medium-sized enterprises (SMEs) are considered to be the main driver of global economic development, they have attracted enough attention from researchers. This interest stems from the fact that innovation, especially in information technology, depends substantially on the potential of small and medium-sized enterprises. The nature of business in all countries is changing fast and developing countries are upgrading their infrastructure and capitalize the Internet. There are problems associated with this new interactive media such as security and technological problems, lack of trust, face-to-face communications lack or privacy issues. Moreover, the changing can mean that SMEs may not fully understand the potentials of a digital market place since the Internet and electronic communication is rapidly changing traditional marketing practices and techniques.

There is an urgent need to understand the impact of CRM system usage on customer and business market performance. To address SMEs competitive needs, companies need to carry out research to investigate the antecedents for successful implementation of CRM system. In the context of the economic and trade transformations specific to the 21st century, digitalisation among SMEs and e-commerce have a strategic, defining role in modernizing the multilateral trading system. It can be said that digitalization is part of the life of SMEs and brings efficiency in business, production and marketing and sales processes. It can help strengthen energy efficiency, resource efficiency, innovation, sustainability and competitiveness. Romania needs an innovative ICT industry and an upgrade of the digital innovation capacity of all industries.

## Theoretical background

### Small and medium enterprises - theoretical methodological aspects

The Micro, Small and Medium-sized Enterprise (SME) category consists of enterprises that employ less than 250 people and have a net annual turnover of up to EUR 50 million and / or have total assets of up to EUR 43 million. SMEs importance began to appear especially in the 1970s, and in the 1980s they experienced a significant expansion, their share increasing significantly both in Europe and in the United States and Japan. Small and medium-sized enterprises (SMEs) are the basic structure of the economy and the main source of economic growth in both developed and least developed countries in Europe. These are very important at the governmental level due to their potential to provide jobs for the population. However, the gaps between the regions are still important both in Romania and in the Member States of the European Union. In Romania, the SME sector represents approximately 99.7% of the business population, and in Europe 99.8%. 93% of non-financial firms are micro-enterprises with up to 10 employees (Mascu&Mureşan, 2019).

The importance of SMEs in Romania is based on the following facts: it is the supply for most products and services needed by the population of a country, they are the main generating values in any country, they provide jobs for most people and their performance affects the status and performance of all countries. the living standard of the population (Nicolescu & Nicolescu, 2008).

### CRM system and organization performance

CRM is a useful system for generating, storing, representing, reproducing and translating information. It is adopted to manage customer interactions or relationships and to improve the company's understanding of consumer profiles (Gupte, 2011). The general process of developing and maintaining profitable communication with the customer is by delivering or presenting a higher value for the customer and obtaining his satisfaction. Gamson considers CRM as a necessary rule for those organizations that need development and growth, in which the identification of the key dimensions of CRM is very important. Regarding large-scale studies in CRM, there are several classifications, the most important of which are presented below in Table 1.

Table 1. Classification of CRM-related system factors

Classification of CRM-related factors	Source
Operation, analysis, interaction	Berson et al., 1999
Data collection, storage, summary, display and application	Swift, 2001
Understanding customer behavior based on multiple viewing	Amrit, 2001
Internet support, customer support and market support	Ming&Chen, 2002
Organizational structure, knowledge management, value creation strategy, information technology, culture, individuals, process, customer interaction	Lindgreen, 2004
Philosophy, capacity and technology	Zablah et al., 2004
Excellent management, internal market, management knowledge and IT business	Chen, Q., Chen, H, 2004

(source: Mozaheb et al., 2015, p.44)

## Methodology

The elements of influence for the formation of CRM practices within companies have been examined from different theoretical points of view and received significant attention. Theories that have been used to understand the elements of CRM practices include the theory of resource-based visualization (RBV) (Halawi et al., 2005; Keramati et al., 2010) and the theory of marketing relationships (RMT). RBV provides an adequate multidimensional perspective on the application of CRM, as it seeks to link the performance of superior firms with the various resources that lead to a competitive advantage (Coltman, 2007).

In this study, CRM resources are classified as technological CRM resources, knowledge management and customer. RMT is met to promote the customer and supplier on an adverse, stimulating reaction to marketing feedback (Rese, 2006). This study incorporates RBV and RMT theories to understand how Romanian SMEs form CRM practices and organizational performance. From this theory results a set of hypotheses that have been expressed in research:

**H1: Customer orientation is positively related to organizational performance.**

**H2: Organizational capability is positively related to organizational performance.**

**H3: Technological resources are positively related to organizational performance.**

**H4: The knowledge management of the organization is positively related to the organizational performance (Mohammad, 2013).**

The data collection was carried out between March and May 2020 by the method of the questionnaire, which has 27 questions, and at the end of the session allocated to complete the questionnaire, a total number of 65 respondents was registered. The significance level of 5% will be used as a threshold for testing research proposals. The sample sample will be based on the stratified sample that would have formed from the small and medium-sized companies, defined as a sample frame.

## Results

Table 2 presents some of the demographics of the respondents. Descriptive statistics show a fairly young and well-educated population, about 95% of respondents being under the age of forty, while 70% of them have at least a university degree. In terms of gender, the population is not evenly divided between male and female respondents. Most respondents are in the female category, which are 41 people (63%), and men the difference of 24 people (37%).

Table 2. Demographic statistics

	Attribute	Frequency	Percentage (%)
Gender	Female	41	63.1
	Male	24	36.9
Age	18-23 years	28	43.1
	24-30 years	29	44.6
	31-37 years	5	7.7
	38-45 years	2	3.1
	More than 45 years	1	1.5
Education level	Postgraduate studies	16	24.6
	University studies	46	70.8
	Others	3	4.6

According to Table 3, the value of the correlation coefficient for the 17 variables structured in 5 factors in this study ranged from .240 to .823. The Cronbach Alpha coefficient is used to study the internal consistency of the items in a questionnaire or can be used as a method to reduce some items. The not-too-distant values produced here (.917 vs. .915) indicate that the means and variances in the original scales do not differ much, and therefore standardization does not make much of a difference in Alpha. In this case, the Cronbach Alpha value is .917, which indicates a very good to excellent value. Moreover, it indicates a fairly high degree of internal coherence with regard to the specific sample.

Table 3. Cronbach Alpha analysis

Cronbach Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.917	.915	17

A correlation is often called a bivariate correlation to designate a simple correlation between two variables (Table 4), as opposed to relationships between more than two variables, as is frequently observed in multiple regression analyzes or modeling of structural equations. A correlation is also often called the Pearson product-moment correlation or Pearson r. Karl S. Pearson is credited with the formula from which these correlations are calculated. The highest positive relationship existed between Organizational Performance and Organizational Capability ( $r = .713$ ,  $\text{Sig} = .000$ ), followed by the link between Organizational Capability and Information Technology ( $r = .695$ ,  $\text{Sig} = .000$ ). These values indicate a positive relationship for the connection between the factors Organization Performance and Organizational Capability, respectively Organizational Capability and Information Technology.

Table 4. Pearson Correlation Matrix

Factors		OC	CO	TI	MC	PO
OC	Pearson Correlation	1	.510**	.466**	.483	.426**
	Sig. (2-tailed)		.000	.000	.000	.000
CO	Pearson Correlation	.510**	1	<b>.695**</b>	.595**	.713
	Sig. (2-tailed)	.000		<b>.000</b>	.000	.000
TI	Pearson Correlation	.466**	.695**	1	.658**	.614**
	Sig. (2-tailed)	.000	.000		.000	.000
MC	Pearson Correlation	.483**	.595**	.658**	1**	.576**
	Sig. (2-tailed)	.000	.000	.000		.000
PO	Pearson Correlation	.426**	<b>.713**</b>	.614**	.576**	1**
	Sig. (2-tailed)	.000	<b>.000</b>	.000	.000	

As can be seen in Table 5, the linear regression coefficient  $R = 0.743$ , which indicates that there is a correlation between the dependent and the independent variables. Regarding variability, the value of  $R^2 = 0.552$  or 55.2% which explains the variability within the population (this means that 55.2% of the population in the sample agree with the correlation between the given variables).

Table 5. Linear Regression

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.743 <sup>a</sup>	.552	.523	.83589

From table 6 respondents answers, more than half of them (88%) work in private companies, and 12% of respondents in state companies.

Table 6. Company type

The company you work for is:	Frequency	Percentage (%)
Micro enterprise	14	21.5
Small business	23	35.3
Medium enterprise	28	43.0
private	57	87.7
Of the state	8	12.3

In Table 7, the answers to the question regarding the years since the company operates, most companies have more than 15 years on the market (49%), followed by those between 7 and 15 years (19%) , and the difference of 33% is cumulated by those aged between 3 and 7 years (15%) and less than 3 years (17%).

Table 7. Company age

How many years has the company been established?	Frequency	Percentage (%)
Between 3 and 7 years	10	15.4
Between 7 and 15 years	12	18.5
More than 15 years	32	49.2
Less than 3 years	11	16.9

The validity of the acceptability model was verified, using the modeling of structural equations, adapting the model to the sampled sample (shown in figure 1) and then validation / invalidation of hypotheses, taking into account the coefficient  $\beta$  and standard error, analyzed using SPSS AMOS program, demonstrated in table 8.

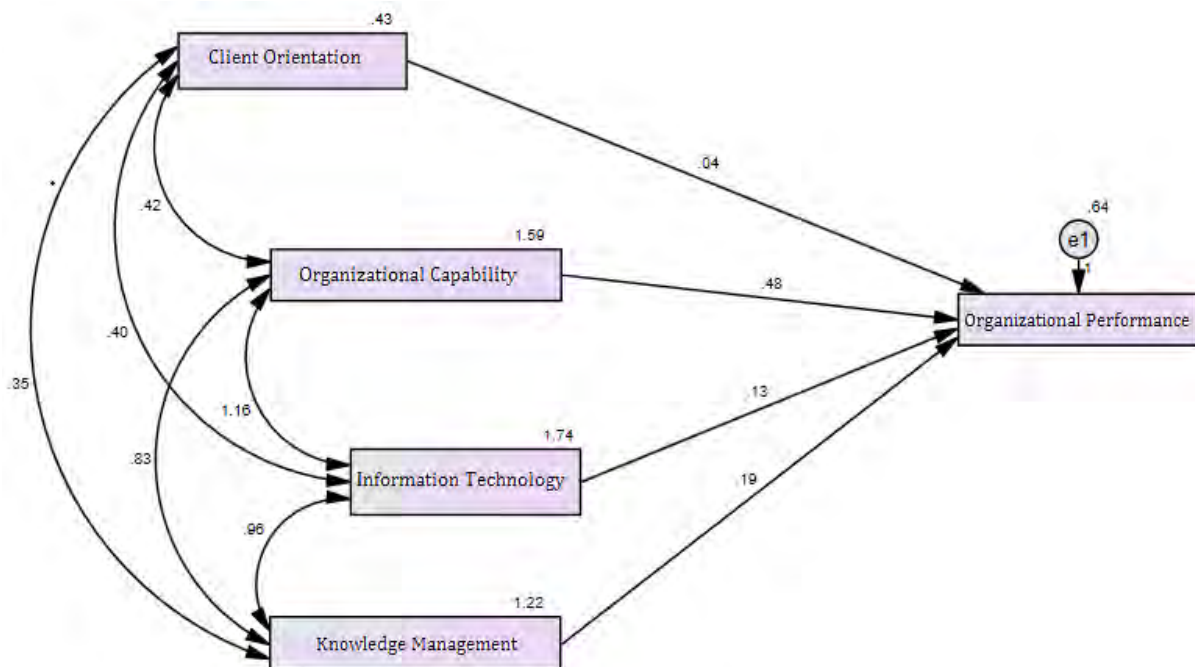


Figure 1. Model on organizational performance in SMEs in Romania, resulting from research

Table 8. Validation / Invalidation of Hypotheses

Hypotheses	$\beta$ Coefficient	Standard Error	Hypothesis Validation / Invalidation
H1: Customer orientation is positively related to organizational performance.	.037	.186	VALIDATE
H2: Organizational capability is positively related to organizational performance.	.475	.118	VALIDATE
H3: Technological resources are positively related to organizational performance.	.129	.117	VALIDATE
H4: The knowledge management of the organization is positively related to the organizational performance.	.191	.127	VALIDATE

### Discussion and conclusions

However, another very important aspect is that Romania is in the queue for European charts that measure the progress of EU countries towards a digital economy and society. Romania, which is a destination for IT services and products, which has very relevant players on the regional and global market, seems to be waiting between two realities: that of innovative industries and the preservation of digitalization. The results indicated that all variables, except customer orientation, significantly affected the organizational performance of SMEs following the adoption and use of the CRM system. Among them, organizational capability had the most important influence.

Based on this research defines CRM as a core business strategy for providing information through the use of information technology tools to establish long-term customer relationships. It is impossible for organizations to have all the necessary sources to remain competitive without having a close relationship with customers. Therefore, it is essential for organizations to implement CRM resources to develop strong CRM capabilities, subsequently improving the performance of companies.

Thus, by managing and maintaining CRM more efficiently, SMEs can satisfy their customers and achieve operational performance. On the other hand, the study found a positive and significant influence of only three dimensions of CRM (ie customer orientation, organizational capability and knowledge management) on learning and growth,

### Limitations

This study had some limitations, mainly in terms of sampling and technologies examined. Respondents were especially young people whose behavior could differ somewhat from the population average. The other limitation was that the Romanian sample contained many full-time workers. However, many of the students in Romania work full time, which makes the two samples compatible. The consumers examined use the system, even if they do not fully accept it. This research is an exploratory one, designed to identify the organizational performance according to the adoption rate of Customer Relationship Management in Small and Medium Enterprises in Romania. The research is relevant to understanding the experience of sample respondents, but is still unrepresentative for CRM solution users.

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# STUDIES WITH RESPECT TO THE IMPACT OF THE START-UP NATION PROGRAM

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## Abstract

**Purpose** – *The paper presents the financing opportunities of SMEs, within a competitive and productive entrepreneurial environment. Entrepreneurship has become the subject of many studies during the last decade and it has been proven that it leads to the increase of economic competitiveness, business development, it creates new jobs and makes the business process more efficient.*

**Methodology/approach** - *A theoretical research using generous references in the field of entrepreneurship, as well as lots of statistical data.*

**Findings** – *The objective of the Start-up Nation program to stimulate the establishment of new small and medium enterprises has been reached. This program will stimulate young people to stay in the country and to develop entrepreneurial activities, it will contribute to the creation of new companies in fields of high added value so that Romania's attractiveness within the region will increase. This program will create tomorrow's successful companies that will consolidate the bases of the Romanian economy.*

**Research limitations/implications** – *The theoretical research is using statistical data up to 2017, this it needs to be updated as soon as those data will be available.*

**Practical implications** – *The evaluation of this program is set on a series of objectives, such as: the presentation of the SMEs situation before and after the program, identifying the main fields that have been financed, the number of financed projects, the analyses of the way in which the beneficiaries have assumed their duties according to the financing rules.*

**Originality/value** *Such a study cannot take place without a documentation from pertinent sources according to the purposes of the research.*

**Keywords:** *entrepreneurship, Start-up Nation, financing, small and medium enterprises.*

## Introduction

At present, entrepreneurship represents one of the most debated themes within the European Union as well as within the entire world. Communities, cities, regions and nations are starting to consider entrepreneurship an engine of economic development, of the increase of the number of jobs and competitiveness of companies, while the program Start-up Nation has all of these objectives.

To understand the applicants and to adjust the financing program to their needs should be a purpose in order to elaborate the next financing guide. The applicants' feedback has a significant contribution to a correct elaboration and a positive direction of the financing scheme; thus it is necessary to study their expectations in order to be able to facilitate fundraising and a successful implementation of business plans.

Start-up Nation is a program that has been elaborated by the Romanian Government, in order to stimulate new small and medium enterprises, and the legislation that regulates it is OUG 10/2017, approved by Law 112/2017.



We will approach as follows the regulations that have been in force during the program's first year of application, that is 2017. The program was submitted to the Ministry of Business Environment, Commerce and Entrepreneurship, through the Territorial Offices for Small and Medium Enterprises and Cooperation.

As it has been mentioned in the previously mentioned norms, the companies that were eligible were those established based on Law 31/1990, the cooperative societies established based on Law 1/2000 as well as the start ups registered according to OUG 6/2011, established by individuals after January the 31<sup>st</sup>, 2017. All of those had to fulfill the eligibility requirements imposed through legislation in the field of minimis helps, as well as the specific requirements in the case of European funding.

The main objective of the minimis scheme is based on stimulating the establishment and development of small and medium enterprises, the improvement of their economic performances, the creation of new jobs, the insertion on the labor market of the disadvantaged persons, unemployed and young graduates, as well as the increase of investments into new innovative technologies, the scheme being applied in all 8 development regions of the country.

According to the legislation in 2017, the minimis help is up to 200.000lei/beneficiary, representing 100% of the value of eligible expenses to a maxim number of 10.000 beneficiaries per year, the sums being provided from the state's budget and/o external funding.

The program finances the implementation of business plans, in the decreasing order of the scores.

**Comparative data on the impact of the Start-up Nation program**

Due to the fact that one of the eligibility requirements for applying was that the company should be established after January the 31<sup>st</sup>, 2017, we have decided to analyze the impact of the program Start-up Nation through the new established firms in the first 6 months of 2017, by making a comparison to the previous two years: 2015 and 2016.



Figure 1: New firms in the first 6 months of 2015, 2016, respectively 2017, at national level

To the data from the National Office of Commerce Register, the number of new companies at national level has increased with 12% compared to 2016.

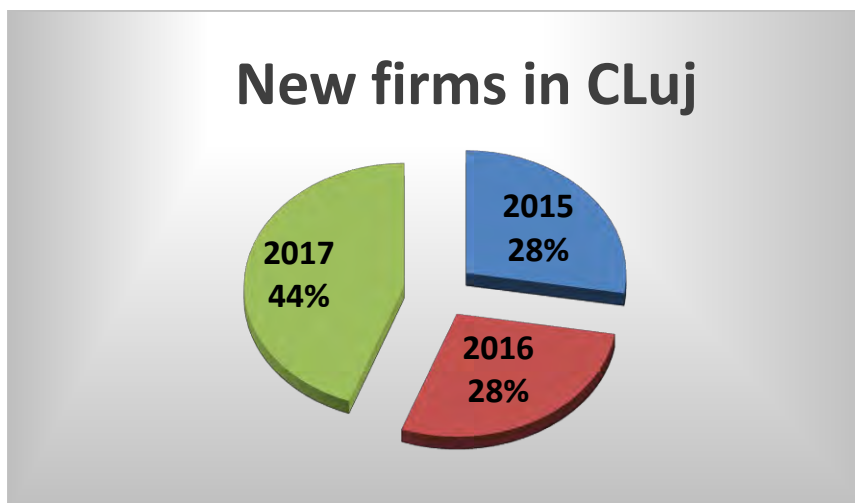


Figure 2. New firms in the first 6 months of 2015, 2016 and 2017 in Cluj

An increase of new firms during the first 6 months from 2017 can also be noticed in Cluj District. The percentage is 16% compared to the previous period of 2016, while 2015 and 2016 are stable.

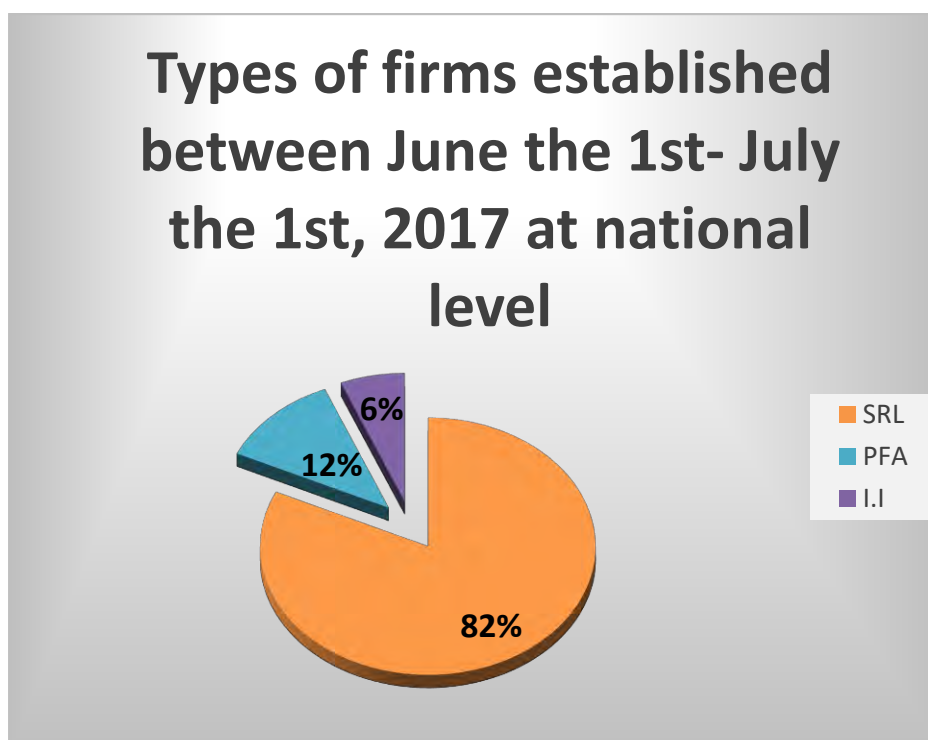


Figure 3. Type of firms established between June the 1<sup>st</sup> – July the 1<sup>st</sup>, 2017, at national level

The impact of the Start-up Nation program can also be noticed from the number of new firms that have been created during the last month for projects' application.

According to the data supplied by the National Council of Small and Medium Enterprises in Romania, just in June there have been registered a number of 15.877 new firms, most of them being SRL.

With respect to the financed projects, according to aippimm.ro, a number of 8653 projects have been financed, due to the fact that most of the applicants have required the maximum value of 200.000lei. Out of these projects, 3466 have obtained 100 points, 4041 had 95 points, while 1146 projects obtained 90 points.

With respect to the domain of the financed projects, it was mainly IT and production, and also creative industries and services. Among the 3466 projects with 100 points, 452 were IT, while the rest – production. Among the 4041 projects with 95 points, 153 were in IT, 1472 – production and 2416 – creative industries. Among those evaluated at 90 points (1146), 38 of them were in the field of production, 13 in the IT, 83 in creative industries and 1012 in services.

Thus, out of the total of the financed projects, 618 were in IT, 4524 in production, 2499 in creative industries and 1012 in services.

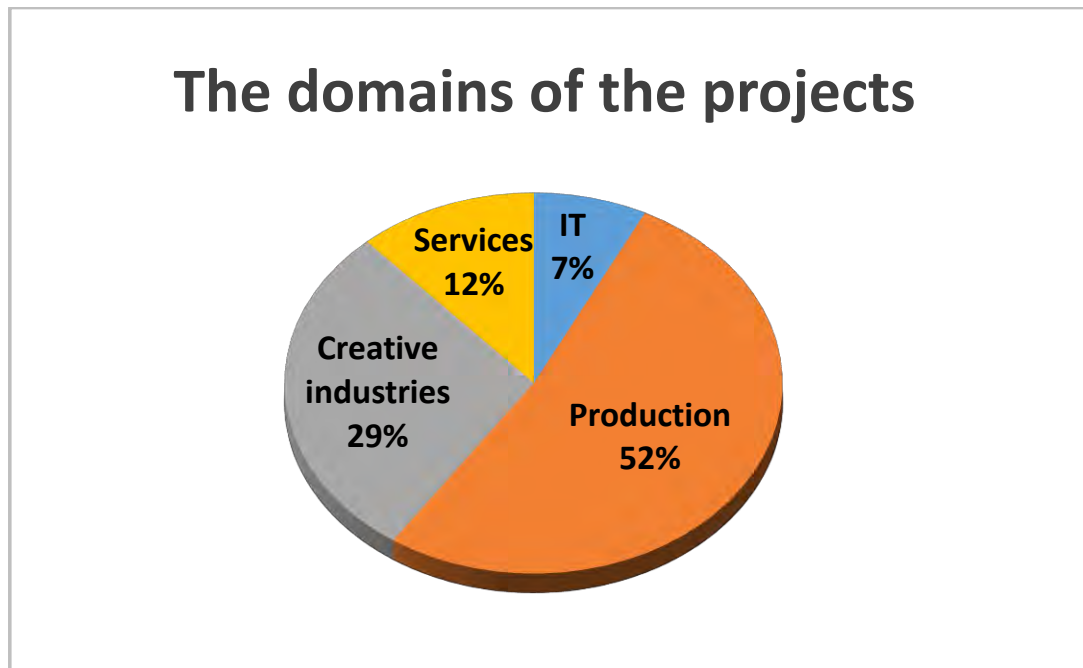


Figure 4. The domains financed through Start-up Nation Romania

As it can be seen in Figure 4, the main field of the projects within Start-up Nation program was production, 52%. This can be explained by the fact that production and IT were the best scored domains, with 40 points. Still, 29% of the financed projects were in the field of creative industries, which had 35 points, while services obtained 30 points. The small number of projects for IT can be explained by the fact that in this field it is difficult to hire disadvantage categories of people, since the level of difficulty is high. This field mainly hires university graduates in the field of computers and programming.

Another thing that needs to be mentioned is the fact that there was no financed project in the field of commerce, due to the fact that they received a very low score.

Also, 77.08% of the projects came from the urban environment, while 22.92% from the rural one. The average age of the entrepreneurs was 36.27 years, and 55.85% of them were men.

In every project, to create new jobs is extremely important, while the Start-up Nation program considers these eligible expenses that can be settled. Most of the applicants stated that they will create 1 or 2 working places within the project, 13 of them declared between 10-43 new jobs, according to startupcafe.ro. Thus, out of the total of financed projects, 20.956 new jobs have been created in the fields such as production, services, creative industries and IT.

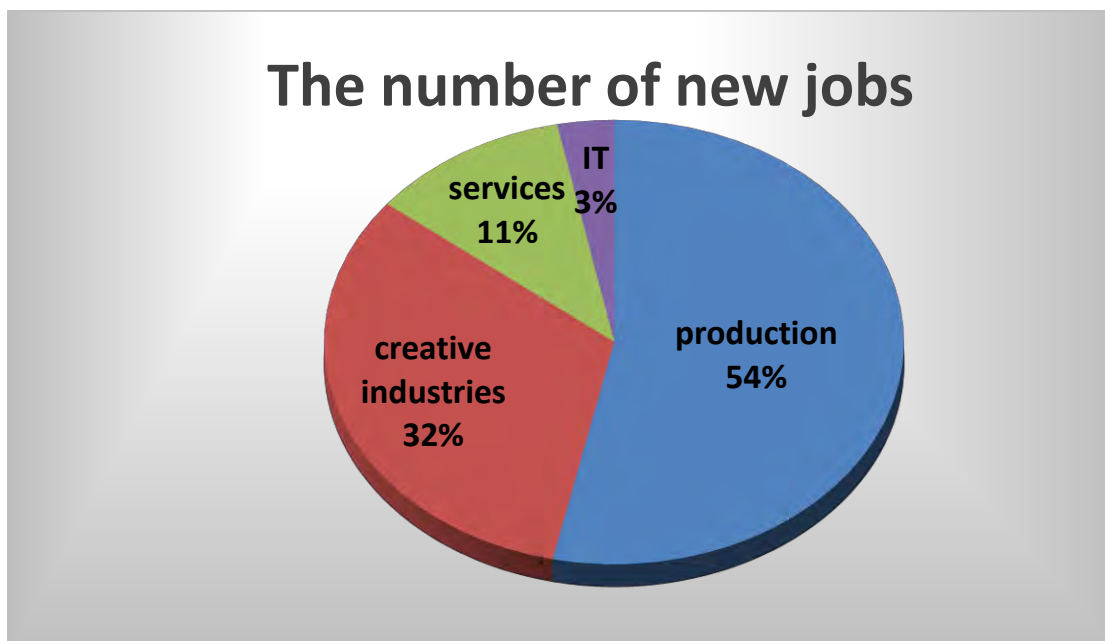


Figure 5. The domains with the most new jobs

As it can be noticed in Figure 5, most of the new jobs that have been created through the Star-up Nation program are in the field of production – 54% (being the ones that were scored the best), followed by the creative industries with 23%, then 11% in the field of services and just 3% for IT.

The session for applying to the program has been opened on June the 15<sup>th</sup>, 2017, 10:00 a.m., until July the 14<sup>th</sup>, 2017, 20.00p.m., using an electronic application on the site aippimm.ro.

With respect to the dynamics of the applications, it seems that during the first 5 hours since the opening of the site have been registered more than 2000 applicants. At the end of the first day, 700 projects have been registered. After the sixth day there were 1511 projects, while at the end of the first week there were 1844 projects.

On June the 30<sup>th</sup>, 2017, at the half of the application period, there were 3111 projects and 8000 users with an account.

On July the 6<sup>th</sup>, 2017, after 3 weeks of the Start-up Nation program, 4389 applicants have been registered and 11.000 user accounts.

Thus, the statistics of the Ministry for the Business Environment, Commerce and Entrepreneurship shows that more than 70% of the business plans have been registered during the last 5 days, respectively 13.477. According to the same source, 34% of the business plans were registered during the last day, meaning 6.539 projects. This shows that the applicants have prepared their business plans until the deadlines.

### Discussion and conclusions

According to the data presented, it can be stated that the program's objective to stimulate the establishment of new small and medium enterprises has been reached, since 19.000 new companies applied. Start-up Nation motivates the young people to stay in the country and the develop entrepreneurial activities, it will contribute to the creation of new companies in fields with high added value, thus increasing Romania's attractiveness within the region. This program may create tomorrow's successful companies that will consolidate the bases of the Romanian economy.

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# COMPETITIVE INTELLIGENCE THROUGH SENTIMENT ANALYSIS

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## Abstract

**Purpose** – *The aim of our research is to identify new emerging technologies that could be used to gain competitive intelligence and to present a systematic literature review related to this topic.*

**Methodology/approach** – *Our methodology consists of a literature review for evaluating the validity of the proposed theory, namely quantifying the potential competitive gain generated by using sentiment analysis tools. Our methodology uses a mixed design of both qualitative and quantitative reviews and represents a cornerstone in the initial design of a more complex business approach.*

**Findings** – *Our main findings are related to the discovery of a limited research in this field, with few academic papers addressing the theme of improving a company's competitive advantage through the use of automated sentiment analysis techniques. Concurrently, the advantages of using these technologies in different businesses are clearly emphasized throughout the selected papers, which highlight its applicability in moderating challenges of business competitiveness in a global context.*

**Research limitations/implications** – *The research is limited to consider advantages of sentiment analysis implementation in gaining competitive intelligence. Moreover, literature is collected from selected databases and journals from 2010 to 2020.*

**Practical implications** – *The comprehensive literature review can provide the basis for a better understanding of the implications of using customers' opinion for developing competitive advantages, as well as encountered drawbacks or limitations.*

**Originality/value** – *Our paper constitutes a structured analysis of existing literature and it identifies key inquiries on subjects that require further research. Also, we identify key matter experts on the topic for a deeper understanding and study on the subject. At the same time, our literature review presents a merge of business analysis, management and technology, building an argumentation of how innovations in technology and science can improve businesses and provide solutions in usually disregarded areas.*

**Keywords:** *competitiveness, globalization, sentiment analysis*

## Introduction

In the current business environment one of the main resources is knowledge and thriving in a global market could depend on the development of strategies that have to take into consideration present and future competition at a world wide scale. If a few decades ago information about competitors was limited to market share and merchandise and it was satisfactory for the time being, the complexity and swift changes that modern times imposed to businesses determines broader directions of information gathering. It becomes important a better knowledge of opinions of one's own clients, or competitors' clients, services quality-price relations, sales volume and so on (Gracanin, S., Kalac, E., Jovanovic, D., 2015).

The increase in competitiveness levels has been determined by globalization, which is mediated by fast developing technologies. On one hand, technology facilitates innovation and research, but on the other hand it imposes challenges throughout organizations and managerial environments. The encountered challenges in a global economy are extremely diverse and range from conflicting corporate cultures, to mitigating risks from various areas. In this context, competitiveness at a global scale can be seen as an

opportunity, but also an impediment forcing management to consider differentiators in terms of innovation, efficiency, and customer responsiveness.

For identifying potential risks that may affect the proper development of a business it is necessary to collect and analyze information related to the plans and offers of competitors. Based on the resulted analysis a company could learn what its strengths and weaknesses are in relation to the market on which it operates. Conventionally, the sources for insights regarding competitors were mainly press releases, trade journals report and more recently companies' websites and news sites, but having only these sources has some downsides, because in the most cases the information is generated by the company itself. Hence, the existing information is limited and questionable in terms of objectivity. (Xu, K., Liao, S. S., Li, J., Song, Y., 2010).

Nevertheless, the emerging of second-generation web-based technologies (Web 2.0) represented by online media, online communities, social networking sites or blogospheres delivered and continues to do so, countless user generated content which encompasses valuable market intelligence and business insights (Kim, Y., Jeong, S., R., 2018). All of this information, coming directly from the targeted audience, becomes a chaotic but natural source for competitive intelligence, missing just the rights tools for extracting the necessary data.

According to some recent research studies, it has been observed that organizations where a competitive intelligence process is implemented are more successful in a competitive environment (Oraee,N., Sanatjoo,A., Ahanchian, R., M., 2020).

Throughout our research we gain knowledge over the usage of sentiment analysis tools for gaining a competitive edge by conducting a systematic literature review on existing studies and research papers linking competitiveness and sentiment analysis. Our analysis opens up the possibility of new research topics and contributions on the subject.

For example, Wang, H., and Gao, S., (2017) believe that extracting comparative opinions and product features in order to analyze competitiveness is in the interest of business for discovering weak points or strength of products.

Also, a research of He, W. and Zha, S., (2013) shows that competitive analysis using data extracted from social media through sentiment analysis help companies in understanding customer – generated content in order to improve their business.

The following sections present a comprehensive analysis of relevant discovered works related to competitive intelligence and sentiment analysis from specialized journals and databases.

## **Method**

### **Research Question**

The current paper aims to address a question regarding the extent of research related to using sentiment analysis to gather information and generate business-level competitiveness.

A detailed representation of the method used is presented in below., with each stage detailed in the following subsections. The selected papers are related to our research objectives

After defining our research question, we started with the formulation of a formal search strategy to analyze all available materials specific to the topic of this literature review which is described in the following sub-sections.

### **Search query**

After establishing our research question and our objectives, we defined a formal search strategy for analysing the available papers that fits the objectives of the present work.

The terms selected for identify papers related to the subject refer to both sentiment analysis and competitive intelligence. Our searches included also some terms in the field in order to have a broader

view on the existing research. The search query used for the purpose of obtaining the list of articles in the online databases is the following:

("Competitive Intelligence" OR "Competitiveness" OR "Business Intelligence" OR "Competitive Knowledge") AND ("sentiment analysis" OR "opinion mining")

Although the above search query was the one meant to be used in all data sources, each search engine of the databases had a different configuration and there were sometimes restrictions related to the length of the query, the place in which the search will be applied (e.g. only title, full text, metadata etc.).

## Data Sources

The papers analyzed during our research were extracted from several electronic international databases, as follows: Science Direct, IEEE Xplore Digital Library, Emerald Insight, ACM Digital Library, JSTOR. These data sources are typically used for conducting researches and they are acknowledged for integrating a large number of articles.

The results returned during our search for relevant articles in the previous mentioned data sources are described below, as well as the search queries used and adapted for each of the databases, including the number of articles found and their duplicates.

*ScienceDirect*<sup>1</sup> has an advanced search function that allows addressing a query in the Title, abstract or author-specified keywords. In order to identify the accurate articles for our literature review, we did an initial search using the full search query "competitive intelligence sentiment analysis" followed by several splits of the initial query into smaller sub-queries using the terms "sentiment analysis" OR "opinion mining" which were paired with either "competitive" OR "intelligence" OR "business". Although, some queries resulted in a large number of articles (e.g. sentiment analysis intelligence), the papers were on broader subjects related to sentiment analysis and not what we were trying to identify. Table 1 below presents the summary of ScienceDirect database inquiries

*IEEE Xplore Digital Library*<sup>2</sup> has the most complex search function of the queried databases which allows users to search in Metadata, Full text and Metadata, Document Title or many others. Also, there is the possibility of exporting the search results in a .csv format which can be very useful in conducting a thorough research.

Nevertheless, the query was modified and split so that it could match the restrictions in the platform interface for searching directly in a specific part of an article and due to the elaborated search function, the results were fewer but more relevant to the subject.

The results and the detailed sub-queries are presented in Table 1 below.

*ACM Digital Library*<sup>3</sup> has a similar interface to IEEE Xplore and a similar function of advanced search, users being able to search the specific terms in Full text, Abstract, Keywords and many others article parts. Thus, search words were grouped so that relevant article could be found. The results are presented in Table 1 below.

*Emerald Insight*<sup>4</sup> is one of the world's leading digital first publishers, with a broad possibility of research due to its advanced search function which makes possible to apply the search terms in different parts of an article. All the results and search queries used are described below in Table 1.

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<sup>1</sup> <https://www.sciencedirect.com/>

<sup>2</sup> <https://ieeexplore.ieee.org/Xplore/home.jsp>

<sup>3</sup> <https://dl.acm.org/>

<sup>4</sup> <https://www.emerald.com/insight/>



Table 1. Centralized list of databases search queries and results

<b>ScienceDirect</b>			
	<i>Search query</i>	<i>Articles resulted</i>	<i>Articles relevant to the research</i>
	Title, abstract, keywords: sentiment analysis competitive	42	4
	Title, abstract, keywords: sentiment analysis intelligence	71	2
	Title, abstract, keywords: competitive intelligence sentiment analysis	8	1
	Title, abstract, keywords: opinion mining competitive	20	3
	Title, abstract, keywords: Opinion mining intelligence	29	2
<b>IEEE Xplore digital library</b>	(("Document Title":sentiment analysis) AND "Full Text & Metadata":competitive intelligence)	93	5
	("Abstract":competitive intelligence sentiment analysis)	5	1
	("Abstract":opinion mining competitive intelligence )	4	1
	(("All Metadata":competitive intelligence sentiment analysis) AND "Abstract":competitive)	44	1
<b>ACM digital library</b>	(title: "competitive intelligence" AND abstract: "sentiment analysis competitive intelligence")	6	1
	(title: "sentiment analysis" AND keywords: "sentiment analysis competitive intelligence")	32	0
	(all: "sentiment analysis competitive intelligence" AND abstract: "competitive intelligence")	3	0
	(abstract: "opinion mining" AND all: "competitive intelligence")	0	0
<b>Emerald Insight</b>	(all fields:"sentiment analysis competitive intelligence" AND title:"competitive")	4	1
	(all fields:"sentiment analysis competitive intelligence" AND abstract:"competitive")	85	3
	(title:"sentiment analysis" AND all fields:"competitive intelligence")	12	1
	(abstract:"opinion mining competitive intelligence")	2	1

### Inclusion/exclusion criteria

The focus for our research was to find adequate papers in the field of sentiment analysis with applications in business and management through competitive intelligence. In order to ensure a relevant selection of articles we have chosen only the papers that had as a main subject either the advantages of competitive intelligence or applications of it and were from the sentiment analysis field.

Also, the period of time in which the papers were published was selected to be the last ten years, for having a literature review on recent researches.

We have excluded papers that were incomplete or only study cases together with articles which appeared as a result only because they had a subject in the sentiment analysis field, but studied a different subject on that matter.

## Quality assessment

The next stage of our research method implied a full reading of the selected papers and a final selection of relevant work is presented in Table 2 below.

Table 2. Detailed list of selected articles

Paper name	Year published	Results
A global supply chain risk management framework: An application of text-mining to identify region-specific supply chain risks (Chu, C-Y., Park, K., 2020)	2020	A risk categorization (hierarchy) containing a total of seven global supply chain risk types and underlying risk factors was developed.
A generic framework for sentiment analysis: Leveraging opinion-bearing data to inform decision making (Kazmaier, J., Vuuren, J.H., 2020)	2020	Developed a framework to aid organisations in successfully leveraging unstructured, opinion-bearing data in combination with structured data sources to facilitate decision making.
Identifying comparative customer requirements from product online reviews for competitor analysis (Jin, J., Ji, P., Gu, R., 2016)	2016	Opinionated sentences referring to a specific feature are first identified from product online review and used on large amount of real data from Amazon.com in order to identify comparative features of a product.
Product Opinion Mining for Competitive Intelligence (Amarouche, K., Benbrahim, H., 2015)	2015	This article presents a new source that helps and leads the company to identify, analyze and manage the various risks associated with its business/products.
Mining comparative opinions from customer reviews for Competitive Intelligence (Xu, K., Liao, S.S., Li, J., Song, Y., 2011)	2011	The experiments on a corpus of Amazon customer reviews show that the proposed method can extract comparative relations more accurately than the benchmark methods.
Identifying competitors through comparative relation mining of online reviews in the restaurant industry (Gao, S., Tang, O., 2018)	2018	Proposing a novel model for extracting comparative relations from online reviews, and then constructing three types of comparison relation networks.
SoMEST: a model for detecting competitive intelligence from social media (Dai, Y., Kakkonen, T., 2011)	2011	Integrating a competitive intelligence analysis method, event timeline analysis, with natural language processing technologies which results in a novel social media analysis model, SoMES.
A Sentiment Analysis of Online Reviews Based on the Word Alignment Model: A Product Improvement Perspective (Li, S., Li, Y., 2018)	2018	Developed a word alignment model to analyze the customer's emotional response to product attributes in online comments, from the perspective of product designers and a method is applied to analyze online comments and develop appropriate product improvement strategies.

## Conclusion

As expected, literature in the field of Sentiment Analysis applied to Competitive Intelligence is not vast, even though the initial search queries were showing hundreds of results; this gap was caused by the frequency of the term "Sentiment Analysis," and its many applications in research and development.

Once relevant articles were identified, an in-depth analysis showed that, there are many proofs in favor of the assumption that every business could benefit of the advantages that competitive intelligence

generates and using sentiment analysis for acquiring intelligence from the market offers more accurate data than traditional methods.

Further practical research and clear market insights after competitive intelligence processes integration is needed.

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# THE INFLUENCE OF THE FINANCIAL-ACCOUNTING PROCESS ON THE PERFORMANCE OF THE ORGANIZATIONS IN THE FIELD OF SERVICES

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## Abstract

**Purpose** – *This paper aims to analyze the influence of the financial-accounting process on the performance of the organizations in the field of services*

**Methodology/approach** – *For this study, it was conducted a quantitative research, the sample of this study being represented by the employees from the professional service companies. The dimensions taken into account for describing the performance of the financial-accounting process were: time, quality, flexibility, budget, and level of importance.*

**Findings** – *The results indicated that the performance is given more by the quality of the financial-accounting operations and by the respect of the deadlines, as well as by the budget allocation for these operations*

**Research limitations/implications** – *This is an exploratory study, applied in professional service companies that are active in Romania*

**Practical implications** – *The results indicate that by increasing quality, ensuring lower costs in the financial and accounting areas, and respecting the deadlines, the performance of the company will increase. Also, improving the performance of the financial-accounting process directly contributes to improving organizational performance in the services field.*

**Originality/value** – *The authors analyzed the simple linear regression between the organizational performance and the performance values of the analyzed processes.*

**Key words:** *financial-accounting process, organizational performance, service performance,*

## Introduction

Over the years, in the specialty literature, there have been several approaches to the concept of performance, this concept being important in any activity, but especially in the economic field. One of the most popular approaches to performance was conducted by Kaplan and Norton (1996), through their Balanced Scorecard matrix (Kaplan and Norton, 1996). When defining the customer perspective, Kaplan and Norton (1996) insisted from the beginning on some key issues that organizations need to focus on when it comes to customers or market segments: market share, customer retention, customer attraction, customer satisfaction, and customer profitability.

From the analysis of other concepts, like the profit-service chain (Heskett et al., 1994; Koys, 2001; Larivière, 2008; Coviello, Winklhofer, and Hamilton, 2006), we deduce other important indicators that describe the organizational performance: employee satisfaction level, level of employee loyalty, employee productivity, the quality level of the service, employee fluctuation, the level of customer satisfaction, customer retention rate, repeat rate of purchases, number of recommendations received from clients, company revenues, company profit.

Apart from the existing papers in the specialized literature, there were also developed some awards for quality and organizational excellence: Malcom Baldrige National Quality Award, Deming Award, European Quality Award (EFQM - European Foundation for Quality Management Award, 2013), and

The Romanian quality award J.M. Juran. In general, these awards analyze customer orientation, business results, employees, leadership, strategy, and processes.

Through this paper, the authors propose to analyze the relationship between the financial-accounting process and the performance of the service organizations. In this regard, a quantitative research was conducted, being analyzed the employees' perceptions. The paper focused on the situation existing in professional service companies that are active in Bucharest, Romania.

## **Literature review**

Financial indicators were among the first used to measure the performance of an organization. They are easy to identify, define, measure, and improve (Hannabarger et al, 2007). However, just analyzing these indicators and improving them was not enough to describe the performance of companies. Thus, in 1992, Kaplan and Norton (1992) had the idea of building a "balanced dashboard", most commonly known as the Balanced Scorecard, where the financial perspective is just one of the main components that influence performance.

With the evolution of technology, the financial-accounting process has changed, this starting to be realized more and more with the help of computer programs. Cleary and Quinn (2016) studied the impact of cloud-based infrastructure in the field of accounting/finance on SMEs, as well as their performance in the enterprises analyzed. Their results indicated that the cloud-based accounting/finance infrastructure has a positive and statistically significant impact on organizational performance.

Analyzing various papers published in the financial field (Holler, 2009; Ebert et al., 2005; Kerzner, 2011; Okes, 2013; Militaru, 2015) scientific articles (Horváthová, E., 2010; Huang, 2010; Magness, 2006; Donker, Poff, and Zahir, 2008; Berrone, Surroca, and Tribó, 2007; Chang et al., 2016) it is found that there is there a great interest for this perspective and its relation with the organizational performance, but the results are presented in a general way, without being done concrete distinctions of these results for different categories of companies.

Thus, the authors wanted to test whether, in the case of the service providers in Bucharest, there is a positive direct relationship between the financial-accounting process and the organizational performance, the hypothesis to be tested being:

H1: Improving the performance of the financial-accounting process directly contributes to improving organizational performance in the services field.

## **Methodology**

For this study, the authors used a questionnaire that was applied online for one month. The sample was represented by 150 employees working in the service companies in Bucharest, Romania. The largest share of respondents holds executive positions (81%), while the rest (19%) hold management positions within the analyzed service companies from Bucharest. The questionnaire measures the respondents' perception, the authors opting for a Likert scale measurement system with 5 response variants.

To define the organizational performance, the following variables were taken into account: profitability, revenue, market share, the perspective of clients, employees and interest groups, the process perspective, and the quality of services. Table 1 presents the variables chosen to determine the level of organizational performance, the codes of these variables, as well as the statements used to characterize these variables.

For the financial-accounting process, the analyzed performance had the following dimensions: time, flexibility, quality, cost (Barbu and Militaru, 2019), the statements that were used for describing them being presented in Table 2.

Table 1. The statements and variables associated with the organizational performance

Variable code	Variable	Statement
P	Profitability	I work in a profitable company.
R	Revenue	I work in a company with a high income.
M	Market share	The company has a good market share compared to its competitors.
Q	Service quality	The quality of the services offered by the company is high.
C	Clients	The clients are very satisfied with the goods and services provided by the company I work for.
E	Employees	I am generally satisfied with the job I have.
Pr	Processes	The usual processes in the organization I work for can / should be improved.
S	Stakeholders	The stakeholders were always satisfied with the performance of the company I work for.

Table 2. The statements and variables associated with the financial-accounting process

Variable code	Variable	Statement
P.L.P	Level of performance	In the company I work for, the financial-accounting process is performing.
P.L.I	Level of importance	In the company I work for, the financial-accounting process is very important.
P.T	Time	Financial-accounting operations are always performed on time.
P.F	Flexibility	The financial-accounting process is flexible in terms of changes that may occur in the operations performed.
P.Q	Quality	The quality of the financial-accounting services is very good.
P.C	Cost (Budget)	The activities carried out within the financial-accounting process aim at correctly establishing the budgets within the company, monitoring and carrying out corrective actions to respect these budgets.

## Results

In the case of the financial-accounting process, the performance is given more by the quality of the financial-accounting operations and by the respect of the deadlines (the average being 4.21), as well as by the budget allocation for these operations (4.13), all of these results being presented in Figure 1.

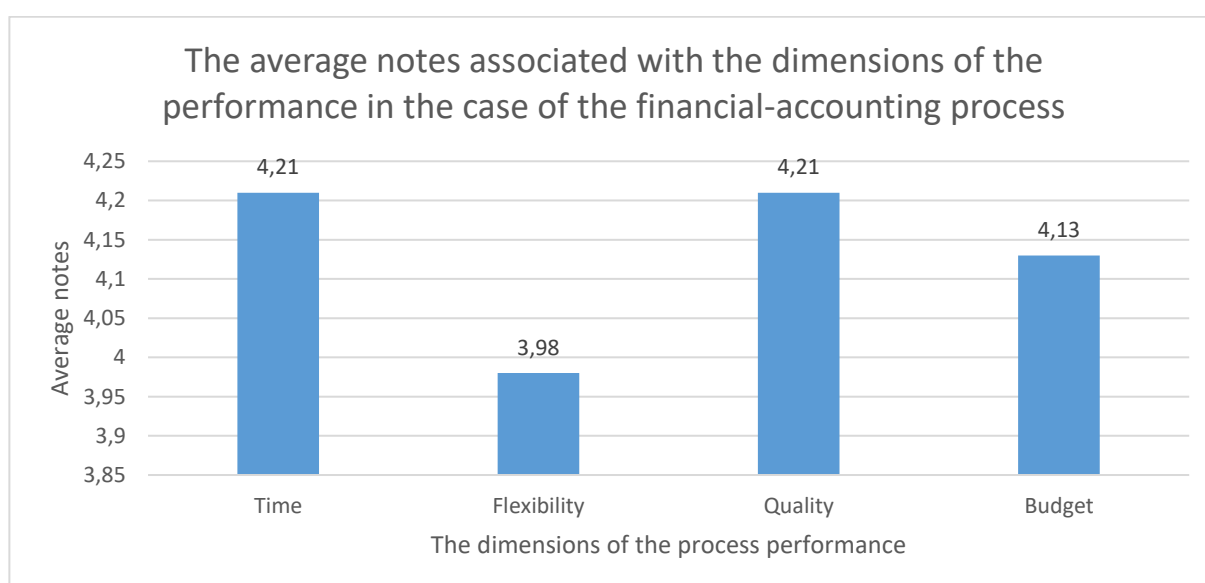


Figure 1. The average of the notes associated with the dimensions of the performance in the case of the financial-accounting process

The note associated with the overall performance of the process was calculated according to Table 3, where its value is 4.13, which indicates a general level of agreement on the fact that in the analyzed companies providing services, the financial-accounting process is a performance one, with note 4.13 of 5.

Table 3. The calculation method of the financial accounting process performance

Variable	Calculation method	Value
Financial-Accounting process performance	$=(P.T+P.F+P.Q+P.C)/4$	4.13

Figure 2 shows the averages of the notes associated with the dimensions of the organizational performance, but also the general average of the performance of the studied organizations. Thus, it is found that the general average is 4.15 (the maximum being 5), the highest average being registered in the case of profitability (4.31). Also, the respondents considered that in general, the customers are satisfied with the services offered by the service providers (the average is 4.22). On the opposite side, the lowest average is recorded in the chapter of employees, where the average of these marks is 3.99.

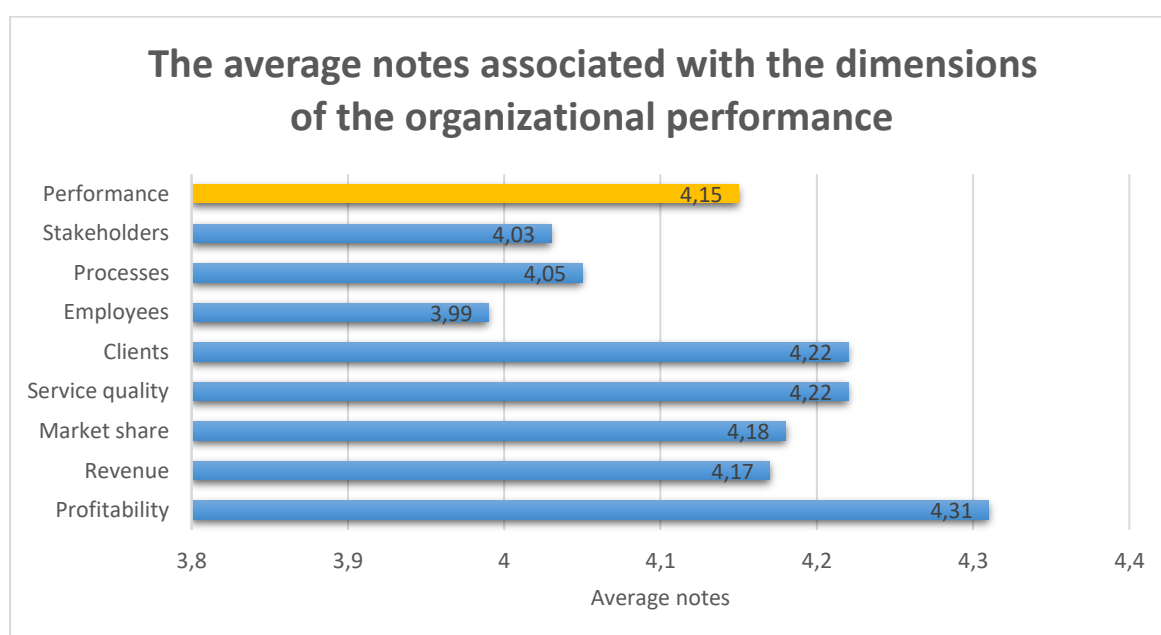


Figure 2. The average of the notes associated with the dimensions of the organizational performance

The score associated with the organizational performance was calculated according to table 4, where its value is 4.15 out of the maximum of 5.

Table 4. The calculation method of organizational performance

New variable	Calculation method	Value
Performance	$=(P+ R+ M+ Q+ C+ E+ Pr+ S)/8$	4.15

In the case of the financial accounting process (Table 5), moderate positive correlations can be observed between the company performance and the quality of the financial-accounting operations ( $R = 0.451$ ), respectively the performance of the company and the respect of the budget ( $R = 0.531$ ), significant statistical correlations at a level of 99% confidence, this suggesting that with the increasing quality or ensuring lower costs in the financial and accounting areas, the performance of the company will also increase, this process being closely linked to the overall performance of the service company ( $R = 0.558$ ,  $p < 0.01$ ), which means that H1 is confirmed.

Also, in the case of this process, it is noted that the variable quality is closely related to the perception of the performance of the process, the Pearson coefficient being 0.697, which indicates a strong connection between the 2 mentioned variables, this connection being statistically significant at a degree of 99% confidence.

Table 5. Correlations between the financial-accounting process and organizational performance

	P.L.P	P.L.I	P.T	P.F	P.Q	P.C	Financial-Accounting process performance
P.I	<b>.481**</b>						
P.T	<b>.554**</b>	.474**					
P.F	.256**	.368**	.466**				
P.Q	<b>.697**</b>	.565**	.683**	.455**			
P.C	<b>.424**</b>	.475**	.452**	.254**	.475**		
Financial-Accounting process performance	<b>.617**</b>	.604**	.842**	.723**	.840**	.687**	
<b>Organizational Performance</b>	<b>.515**</b>	<b>.401**</b>	.385**	.373**	<b>.451**</b>	<b>.531**</b>	<b>.558**</b>

Next, the simple linear regression was analyzed, the dependent variable being the organizational performance, while the independent variable was represented by the performance values of the analyzed processes. Table 6 presents the summary of the models between the organizational performance (the dependent variable) and the performance of the analyzed processes (the independent variables).

Table 6. The relationship of performance with the financial accounting process

Model	The relationship of performance with the financial accounting process	R	R <sup>2</sup>	Adjusted R Square	Std. Error of the Estimate
	Financial-Accounting process performance	0.558	0.312	0.307	0.477

In the case of the analyzed model, the value of the R2 determination coefficient is 0.312, which means that the variation of the dependent variable, that is, the organizational performance, is explained in a proportion of 31.2% of the independent variable, that is, the performance of the supply process. In Table 7, there are presented the coefficients of the analyzed model, where it can be seen that the value of Sig. is smaller than 0.05 which indicates that the coefficient is significant.

Table 7. Coefficients of the analyzed model

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Confidence interval for B (95.0%)	
	B	Std. Error	Beta			Inferior limit	Upper limit
(Constantă)	2.19	0.242		9.046	0	1.712	2.669
Financial-Accounting process performance	0.473	0.058	0.558	8.187	0	0.359	0.588

a. Dependent variable: Performance

The Pearson coefficient is 0.558 ( $p < 0.05$ ), the two variables having a moderate, positive correlation, the equation of the regression line being:

$$Performance = 2.190 + 0.473 * \text{Financial Accounting process performance}$$

If we consider only the standardized coefficients, then for each increase with a unit of the independent variable, the dependent variable would register an increase of 0.558.



## Conclusions and limits

By analyzing the financial-accounting process, the authors discovered that the performance of the analyzed process is influenced the most by the quality of the financial-accounting operations. Also, two more aspects need to be analyzed when we talk about process performance: time and budget. These results indicate that by increasing quality, ensuring lower costs in the financial and accounting areas, and respecting the deadlines, the performance of the company will increase. Also, improving the performance of the financial-accounting process directly contributes to improving the organizational performance in the services field ( $R = 0.558$ ,  $p < 0.01$ ), which means that H1 is confirmed.

When the notes associated with the dimensions of the organizational performance were analyzed, the authors discovered that the highest average note accorded by the respondents is in the case of profitability (4.31), which means that the employees considered that the company in which they work is largely profitable. On one hand, respondents believe that customers are satisfied with the service providers due to the high quality of the services. On the other hand, according to the employees' responses, their satisfaction about the workplace is a problem, which is why the service companies should give greater importance to this aspect, taking into account the fact that the human resource is one of the most important resources, which can directly affect the performance of the service provided.

This study also presents some limitations. Even though the sample was targeting the employees from the professional service company, the respondents surveyed worked in different fields. For example, 25 of them were working in the IT industry, 21 in Commerce, 19 in Financial and Banking, 14 in Construction, repairs, installation, 14 in the Transport sector, 11 in Consulting, the rest of them working in other sectors. If everyone worked in the same field, then the results might have been slightly different. Also, those results might have been different if all of the respondents had a management position, not just 19% of them.

Taking into account these data, this study can be considered an exploratory one. For future research, the authors will focus on a single domain of service activity, making separate studies on managers and the rest of the employees of the surveyed companies.

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# BRIEF RESEARCH OF THE NATURAL CRISIS-MANAGEMENT APPROACH IN THE INTERNATIONAL TECH-COMPANIES

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## Abstract

**Purpose** – Gain a theoretical overview of the crisis types and of the operational crisis management during a natural crisis, which is built around the current global pandemic situation with the focus on the digital business sector, namely on the tech-companies.

**Methodology/approach** - A literature review related to the crisis management, a peer review based on online-structured interviews and a conceptual framework create the epicenter of this paper work.

**Findings** – The international tech-companies are powerful organizations that are stable due to their global influence. They are the ones that play an important role in the recovery of the economy, both on national and global level.

**Research limitations/implications** – The research has been performed on more levels, beginning with theoretical literature references and continuing with studying current articles from official sources in accordance with the paper's subject. The practical part of the research has been conducted on an employee level, rather than on a managerial level.

**Practical implications** – A qualitative research was performed for the practical analysis of the current crisis, considering the personal experiences of ten individuals who currently professionally act in in two different IT-companies. The interviews were carried over during the pandemic, exclusively in online environments.

**Originality/value** – The most recent articles from the web, written during the current global pandemic, by both international journals and even tech-companies, have been thoroughly analysed and after considering every aspect in accordance with the paper's subject they have been presented within this article, being supplemented with a practical involvement.

**Key words:** Crisis Management, International Tech-Companies, Covid-19 Crisis

## Introduction

Over the years, the world was pushed to face, fight and overcome various crisis. One can relate of such a situation according to (Rodrigues, Quarantelli, & Dynes, 2006) when a community of people remarks a sudden and urgent threat to their core, life-sustaining values, dealing with it under uncertainty. It is considered a critical point in the road of development, implying both threat and opportunity. As (Evans & et.al., 2005) and (Spence & et.al., 2007) describe that there are numerous types of crisis, such as: natural (public health threat), financial, strategic, chemical, technological, man-made. Particularly considering an international organization, (Boin, 2008) lists some possible causes that may lead to a crisis: bribery, security breach, natural disasters that disrupt a major product/service or recall key stakeholders, technological breakdown.

The natural crisis disrupt major services, destroy organizational information base and headquarters, eliminate clients and employees (Boin, 2008) and are defined as large-scale events framed by potential loss of life or property (SAMSHA, 2020). The problems of the international companies at an operational level consist in: mobility restrictions, difficult supply of essentials, import-export restrictions, depreciation of the financial performance and ruin of the reputation, redefined relationship with customers, employees, stakeholders (OECD, 2020). There are multiple reactions that are being established in such

constelations: as per (Bundy & et.al., 2016) “total responsibility approach, focused on recognizing the importance of an organization’s responsibilities towards stakeholders, creating a response strategy, while other companies reflect their reactions by stabilizing revenues, aligning their businesses, building new digital competences, such as: data-driven, agile, cloud, automation, e-commerce and security”.

## **Research Methodology**

This paper discusses the current situation of the crisis management among the tech-companies floating during the global COVID-19 pandemic crisis. The aim is to identify how are the operational processes within this industry, both managerial and support, affected.

A literature review, a conceptual framework and a peer feedback have been performed.

- The first step was to identify the information sources, such as literature, web (up to date articles, journals, websites), personal observations based on experience and peer feedback. The start point has been to choose 30 literature sources from which 20 were filtered according to the common points with this paper’s theme, remaining 16 such references to carry out during the process. Nevertheless, 15 web sources have been identified and analysed, wherefrom only eight have molded to the subject approached. The ideas were gathered and united into achieving a theoretical overview of the crisis management in the actual context of the global pandemic.
- Afterwards, a qualitative research method has been used, considering the personal experiences of ten individuals that professionally act in two IT-companies. The interviews were held during the Coronavirus-pandemic, in an offline environment, via Skype and phone. During the aftermath the gathered information has been thoroughly analysed and furthermore discussed and also interpreted. The goal was to appraise the reactions of the tech-companies and acquire lessons and innovative solutions.

Following the empirical research and the literature review, a conceptual framework was built, concluding by stating that the international tech-companies are powerful organizations that play a crucial role in the national and international economy. In the end, they are considered important actors in the recovery process, being the engine of many industries. The crisis management of operations plays an important part in this framework, being carefully taken care of by the CEOs and the strategic management teams of the businesses. Nevertheless great solutions have been discovered due to the unusual crisis of the Coronavirus, realizing that the virtual and digital environments can provide many advantages nowadays, other than the traditional human-made elaborations.

## **Background**

Within this brief research of literature review, there are some subjects that have been analyzed, such as the characteristics of the IT-companies, the crisis and the crisis management of operations.

### **Particularities of Tech-Companies**

The IT-companies act among the businesses in different ways in comparison with other types of organizations. The following tables presents their fundamentals, highlights the types of tech-companies based on the market segment they are involved in, compresses some characteristics that differentiate them from other business typologies and creates an overview of the service-shared delivery.

This type of organizations usually act on an international level, aiming to achieve a global status. They are specialized on IT-services, meaning that various actors work according to the client’s requirements, using a common language and common tools, with the purpose of delivering the tasks required by the client in a qualitative way and within the agreed timeline.

**Table 1 Particularities of Tech-Companies**  
(based on literature review and web sources listed in column 1)

<b>Source</b>	<b>Fundamentals</b>
(Bailetti, 2012)	<ul style="list-style-type: none"> <li>-Tech-companies focus on investment in projects, assembling and deploying specialists and heterogeneous assets</li> <li>-Purpose: flourishing the scientific and technological knowledge, in order to create and capture value for the company</li> <li>-Explore and exploit technological knowledge for a period of time</li> </ul>
(Blomerley, 2017) (Wu, Garg, & Buyya, 2011)	<p>Types of tech-companies:</p> <ul style="list-style-type: none"> <li>- Tech-hardware: digitalization, gadgets</li> <li>- Software-as-a-service: delivery of services based upon service level agreements</li> <li>- Extension of offline business: due to convenience</li> <li>- A marketplace: networks and platforms that connect buyers and sellers</li> </ul>
(Dovleac & Balasescu, 2013) (Hout, Porter, & Rudden, 2020)	<p>Characteristics of international tech-companies:</p> <ul style="list-style-type: none"> <li>- Uncertainty of problem solving possibilities</li> <li>- Resources: chosen and provided by highly qualified individuals</li> <li>- Orientation: targeting the technological arrays</li> <li>- Well-structured and qualitative infrastructure</li> <li>- Service networks</li> <li>- Maintenance, installation, high-tech functionality services</li> <li>- Continuous development of the technology</li> <li>- Innovation strategies for competitive advantages within unpredictable markets</li> <li>- New business models</li> <li>- Major investment projects</li> <li>- Delivery of services in high and low labor-cost countries</li> <li>- A country-by-country market position, included in a worldwide portfolio</li> <li>- Financial investments, marketing investments, investment in the distribution network</li> <li>- A unique global strategy</li> </ul>
(Wei, 2011)	<p>Service-orientated tech-companies:</p> <ul style="list-style-type: none"> <li>- Autonomous, reusable, unique and portable products</li> <li>- Services: based on arithmetic calculations, programs, maintenance activities, all in virtual, distributed environments</li> <li>- Cloud computing as a solution for cost saving</li> <li>- High Service Availability</li> <li>- Different service providers</li> <li>- Markup language techniques: common communication, implementation and understanding</li> <li>- Service Level Agreements (SLAs)</li> <li>- Service analysis</li> <li>- Reputation of the services</li> <li>- Software-service: separate business models</li> <li>- Service-based information, assurance and privacy</li> </ul>

### **Crisis and their impact on the operational management**

The term of crisis is a general definition of an unusual situation, but it can have various root-causes that need different approaches and solutions. Among this concept, over the years, there have been developed some crisis-models. Their aim is to frame the event within a standard and afterwards to build an actual scenario of the situation and of the possible solutions. The management of such disasters is very important, so it takes places granularly, on organizational managerial levels, such as operational, strategic and support management.

Table 2 Crisis and their impact on the operational management within a tech-company  
(based on a literature review and web-sources, cited in the first column)

Authorship	Outcome
(Boin, 2008)	Crisis: a critical point, a milestone, in a series of events that can be considered as threatening for a community of people due to uncertainty, under pressure of time.
(Evans & et.al., 2005) (Nojoumi & et.al., 2015) (Gundel, 2005)	<p>Crisis typologies:</p> <ul style="list-style-type: none"> <li>-Natural: sudden and unpredictable threat, various negative effects, hard to foresee. Usually not due to human mistakes.</li> <li>-Financial: cash flow problems, requires immediate actions, can be foreseen</li> <li>-Strategic: changes in the business environment, can be prevented by avoiding risky decisions</li> <li>-Smoldering (man-made): disruption that causes injuries to lives and properties, corporate wrong-doing</li> <li>-Technological: breakdown or failure of technological systems. Can be prevented</li> </ul>
(Evans & et.al., 2005) (Ahmad & Mat, 2013) (Booth, 1993)	<p>Models of the crisis management:</p> <ul style="list-style-type: none"> <li>-The "Cobra"-model, by Seymour and Moore: sudden, comes as a shock and feels as a threat. Reaction: an immediate response based on the known and trusted</li> <li>-The 4Rs, four independent phases of a crisis, defined by Roberts (1994):               <ol style="list-style-type: none"> <li>1. Pre-Event</li> <li>2. Emergency</li> <li>3. Intermediate</li> <li>4. Long-Term</li> </ol> </li> <li>--The "Python"-model, by Seymour and Moore: gradually, increasing threat. Reaction: once the crisis is being recognized. In this context a double-loop-learning has been highlighted:               <ul style="list-style-type: none"> <li>- Emergent Knowing</li> <li>- Paradigm Shift</li> <li>- New understanding</li> </ul> </li> <li>-Slatter's crisis susceptibility model: economic side. The effectiveness of the decisions according to managerial and organizational characteristics and frames</li> <li>-Booth and the process model: identification of common features of various crisis. Approach: from general to simple</li> <li>-The crisis lifecycle, by Seymour and Moore: activities and decisions that are being taken during a crisis, from planning to implementation</li> <li>- Clarke and Varma: risk management as a strategic process</li> </ul>
(Christiaens, Moreau, & Richez, 2020) (2020, 2020) (Cluj24.ro, 2020)	<p>Operational crisis management:</p> <ul style="list-style-type: none"> <li>-Review of the IT-organization, procedures, tools and project portfolio to ensure adaptation to new business paradigms.</li> <li>-Re-definition of the IT-Target Operating Model, in terms of IT service and capabilities (related KPIs, competences, resources, procedures, tools).</li> <li>-The investment projects are frozen, due to uncertainty and due to the risk of failure along the process</li> <li>-Liquidity resources: protected by stopping the uncritical interventions</li> <li>-Focus: possible risks and action plans for urgency situations.</li> <li>-Aim: analyze and identify the moment when the client represents a risk for the company</li> <li>-New recovery scenarios concerning the relationship between the companies and their active and possible clients</li> <li>-Continuity plan of the operations: infrastructure, raw materials, materials for a considerable timeframe</li> <li>-Work from home initiative</li> </ul>
(ManagementEvents, 2020) (WHO, 2020)	<p>Levels of impact of the pandemic crisis:</p> <ul style="list-style-type: none"> <li>-Short term: on the revenues- predictable fall of 10-15%</li> <li>-Long term: business continuity planning (BCP) and scenario planning</li> <li>-Post-crisis: return to normal</li> </ul> <ul style="list-style-type: none"> <li>-Local level: businesses are being first of all individually affected</li> <li>-National level: the multinational companies are directly dependent on the country's economy standard</li> <li>-Global level: the international businesses that act on a global level suffer as a whole</li> </ul>

The variety of crisis is the result of a complex and dynamic world. They are either man-made or human independent. The management of the international companies needs to create an emergency plan in case of a crisis, to foresee it at the right moment, and to make the right decisions at the right time. Such events affect the organizations on more levels, according to the root-cause and severity.

## Epirical Research

The empirical research of the paper presents a process-map and the affected areas by the current pandemic crisis, created by the author, based on personal experiences within an international, global, tech-company. Afterwards, as per ten structured interviews, a peer review is next, aiming to analyze the facts and the solutions during the Covid-19-crisis, from the perspectives of other employees.

### Engineering of the Business Processes in a Service-Orientated IT-Company

The following figure reflects the process-map of an international tech-companies, with an unique global strategies, created by the author due to personal experiences and analysis.

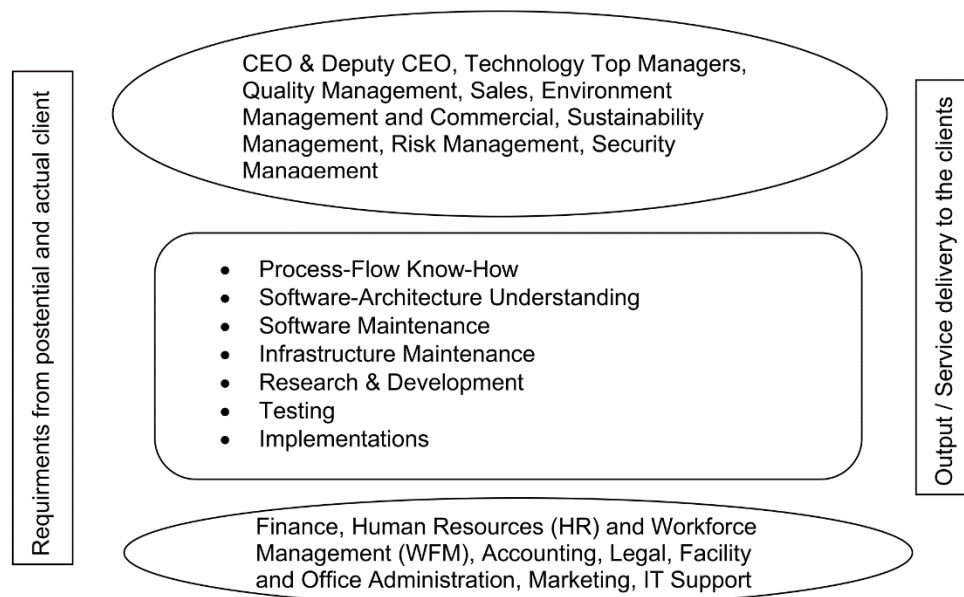


Figure 1 Process Map in an international tech-company  
(personal elaboration based on facts and experience)

The figure from above orchestrates a process-map within an international company, orientated to service-shared activities. First of all, it highlights the strategic processes of the business:

- CEO & Deputy CEO: establish strategies on a global level, sustain the maturity of the company and try to expand
- Technology Top Managers: coordinate the project related activities and make decisions, each on divergent technologies
- Quality Managers: maintain the quality standards, redefine the actual status
- Sales: gain new projects and new clients within the market
- Environment Managers and Commercial: place the business within a market and keeps up with the competition
- Sustainability Managers: Long-term achievements
- Risk Managers: calculate the risk possibilities and statistically prevent different types of crises
- Security Managers: data privacy, workers security

The support processes are meant to help the main activities of the business work in normal parameters, such as:

- Finance: budget allocation, remuneration
- HR and WFM: human resources recruitment and employee care
- Accounting: incomes and taxes
- Marketing: marketing strategy, advertising, events
- IT-Support: secure the soft-and hardware functionality and the network infrastructure

The operational processes imply:

- Process-Flow Know-How: understanding the internal process procedures of the client
- Software-Architecture understanding: comprehending the interconnected information objects of the software
- Software-Maintenance: monitor and manage software reactions and responses
- Infrastructure-Maintenance: ensure the netting of the physical and virtual components
- Research & Development: continuous improvement and innovation
- Implementations: accomplish new requirements, introduce them in the client's product and adapt them to the current constallation and standards
- Testing: try-outs of the changes and new implementations

### Operational Processes Affected by the Crisis Nowadays

The next table illustrates the level of impact caused by the current Covid-19-crisis among some operational processes of the international tech-companies, with globalized services.

Table 3 Affected operational processes in international tech-businesses due to the pandemic crisis (personal elaboration based on facts and experience)

Operational Process	Level of shock	Impact	Description
Process-Flow Know-How	Neutral	No visible changes	The process-flow remained unchanged during the lockdown
Software Architecture Understanding	Increase	Visible changes	During the lockdown the time has been used to perform changes in advance, so the software architectures changed and therefore also their level of understanding increased
Software Maintenance	Decrease	Visible dchanges	The no-production situation lead to less problems than usual. Less technical issues than normally
Infrastructure Maintenance	Neutral	Balance-increase of the changes and decrease of the load	In a normal work environment the load of infastructure maintenance activities is high, but during a lockdown is none, so the agreed transformations involve more maintenance activities.
Research and Development	Increase	No visible changes, but lots of experiments	New solutions, ideas of innovation
Implementations	Virtual-Increase	Visible changes	Due to increased research, the new solutions had to be implemented
	On site-Decrease	No visible changes	During the lockdown there were no on side implementations
Testing	Virtual-Increase	Visible changes	Due to increased research, the new solutions had to be tested, once developed, before the final implementation
	On side-Decrease	No visible changes	During the lockdown there were no on side tests necessary

The current pandemic managed to create mixed reactions and feelings among the CEOs of the international companies. A crucial moment for the world has been the lockdown, which stopped the production of various products and services. The reactions and the effects have been, however,



different, in each industry. The tech-companies have distinguished themselves through stability and strength. In some areas both negative and positive effects can be remarked, while in others everything remained unchanged.

### Peer-Feedback

For the study, a qualitative research method was used around the perspective that every crisis is unique in its own way, causing particular effects to individuals and industries. The information was acquired out of structured interviews performed by one interviewer, the author, containing seven questions. The target group has implied employees of two international tech-companies that perform their job activities around operational processes. The interviews were carried out via Skype; afterwards the gathered information was analyzed based on the crisis management approach in times of global pandemic, according to the relevant literature background.

Table 4 Summary of the information gathered as a result of the interviews  
(personal elaboration based on peer feedback and experience)

Goal	Opinions
1. Level of impact on the jobs	-High, because the communication possibilities and the social skills have been reduced, which lead to a higher settlement time -High, because of financial shortage (less or no bonuses, no events) -Low, because the cost cutting did not affect the employees directly
2. Ways in which the impacts have been highlighted within the company	-Restructured Organigram -Cost cutting -Work from home procedures -Allocated budget for health protection -Projects loss -Difficulty in gaining new clients
3. Ways in which the impacts have been highlighted in the clients activity	-Due to the lockdown the clients have closed their subsidiaries -Focus on development, implementations, digital changes and infrastructure -Pressure on achieving the targeted goals in advance in order to minimize the risks
4. Effects on the career	-Less promotion possibilities -Job changing due to higher pressure and requirements -Project loss, transition activities
5. Company's solutions	-Upgraded infrastructure -Online events for psychological support of the employees -Allocated budget for health care and disinfection -Resource management -Cost cutting -Less working days
6. Client's solutions	-Temporary close of the subsidiaries -Focus on the ongoing project that could be developed in a virtual environment -New providers (good financial offers, stable and strong providers) -Granular division of tasks -Special work shifts in order to keep the business ongoing
7. A different approach	-Financial support for the needy employees -Cost cutting instead of unemployment -Strategies for safe office work -Load should be shared

Aftermath of the peer-feedback:

- Risks (job loss, salary renegotiation, health) in service-shared, international tech-companies, are very low
- Specialized risk management (quick and correct measures, unexpected solutions)
- Employees perceive the taken measures differently
- Clients managed their requirements differently, based on their needs
- Different companies implemented different solutions

- The employees are generally satisfied with the measures
- There are various opinions on improvement potential and possibilities

The following figure represents a graphic representation of the peer-feedback results. The purpose is to visualize the effects of the pandemic crisis from the point of view of some employees in such companies, in order to highlight the reactions, perceptions and the quality of the operational management:

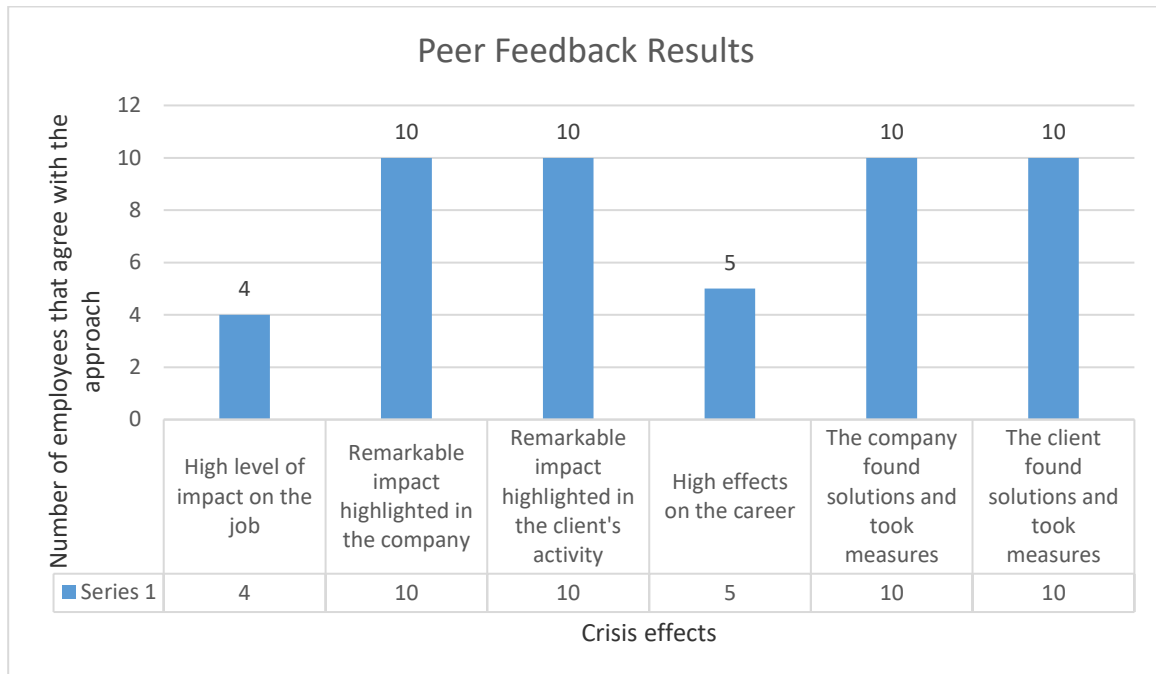


Figure 2 Peer Feedback Results (personal elaboration based on peer feedback and experience)

According to the graphic representation in figure 2 the conclusions sustain the idea that the international tech-companies that develop their business activities in a service-shared way, did not suffer exponentially during the pandemic crisis. They did, however, perform unexpected actions in this regard. The way the employees perceived the changes is different from company to company. The reason is that each organization calculated its own risks and planed its own emergency plan, based on the requirments of the active clients and on the continuity plans of wining new customers. Many interviewd employees are happy with the measures taken by their employer and wouldn't have changed anything, while others consider that some measures were too drastic.

### Originality and Value

Covid-19 is the most recent crisis that needs to be correctly and urgently managed by the international companies worldwide. The pandemic lead to a global crisis with great negative and positive effects in the international businesses. While many business sectors have been on hold due to the lockdown and other governmental restrictions, the tech-companies have been scrambling since the beginning to support the local and global economy.

There are many discussions and scientific publications around the crisis management, for various crisis typologies, but few concerning the natural crisis within health disasters. Among the world pandemics, we encounter the Covid-19, since 2019 that appeared in a digital and modern world, while the last worldwide-declared pandemic was announced two centuries ago, when the globe lived in very different circumstances and the business concepts have been very different in comparison with their understanding and breakthrough.

The paper remarks itself because the analysis of the literature review is based on the most recent articles appeared on the web regarding the natural crisis management due to the coronavirus. Through the fact that the paper is being written during the global crisis, aiming to determine the most accurate and most recent information regarding this topic. Because the topic is being approached in the frames of

interviews among various persons that activate in the tech business sector, individuals that are being directly affected, at the time of the interviews and at the time of the crisis, created an accurate framework.

The paper brings a plus because the subject approached is currently being very deliberated and analyzed at the time being, serving for a better comprehension of the circumstances and trying to offer another perception of the current struggle of the international tech companies and their employees.

## Conclusions

Natural crisis have great impacts of the industries. The health of the individuals is the most sensitive topic worldwide, which, in times of critical events, is placed on the top of any business's priority list. The Coronavirus-pandemic caused both negative and positive effects, for those international organizations that managed to see the opportunities. The tech-companies, that target the service delivery rather than own products manufacturing, perform their activities among various markets and aim scientific and technological innovations.

During the pandemic the world went through various crisis scenarios, which lead to emergency actions, decisions and measures. Most of the international IT-companies protected their revenue, liquidities and assets, their specialists and their clients. All the safety measures taken in this context went gradually from non to the current status. The employees are satisfied with the way their companies dealt with the crisis and recognize their efforts, not having to many different ideas to approach the situation.

The global tech-companies are probably the most stable businesses, as they perform their activities in various parts of the world, having both global and national strategies. They managed to use the times of the lockdown to go on with the innovations, implementations and scientific research, many of them creating new technologies in order to help among the current crisis context.

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# SADT MODELING OF A CULTURAL PROJECT

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## Abstract

**Purpose** – Cultural products of any kind must be the result of a logical and methodical managerial process with objectives, activities, resources, and especially indicators that are properly defined and accomplished according to the forecasts.

Without altering the artistic component, which is creative and defining for the cultural product, the scientific management, based on rules, procedures, models and working algorithms developed in the last century, especially in the business sphere, also develops in areas that do not necessarily follow additional gain but it ensures efficiency corresponding to artistic work.

**Methodology/approach** - The methodology used involves identifying the main activities of the process of creating and implementing a theatrical performance and defining the parameters in which these steps will be managed - inputs, outputs, conditions, rules and prescriptions, existing or acquired resources, etc.

The SADT model designed to theatre performances will have a character of universality and will be tailored to each situation.

**Findings** – The SADT model seeks to professionalize the management of the performance staging process so that the proposed objectives and pre-established indicators are respected and even improved.

The created model does not generate understanding problems or additional skills for managers in the cultural sector but ensures the correct implementation of the management act.

**Research limitations/implications** – Having experience in the management of theater performance, the authors of the paper found a series of inadequacies in the managerial act leading to waste of resources and of course not respecting the objectives initially assumed (quality, duration of implementation, additional costs, scattered human energy, etc.).

**Practical implications** – The contribution of the paper is that it transfers from the scientific management a method of systemic modeling in a sector, the cultural one, which needs managerial efficiency and efficiency.

**Originality/value** – This paper, for the first time in Romania, transfers one of the SADT system simulation methods already widely used in project management, developed in the US but widely used in all countries and fields of activity.

**Key words:** SADT, cultural project, managerial performance

## 1. The advantages of applying the SADT method in cultural productions

The present paper presents the usefulness of prioritizing the functions of a cultural production based on the SADT method defined by Douglas T. Ross and known among specialists (Hunt D., Process Mapping. How to Reengineer your Business Process, Ed. J. Wiley, N.Y., 1996, Marca D., Structured Analysis and Design Technique, McGraw-Hill, London, 2006, Mylopoulos J., SADT Diagrams, [www.cs.toronto.edu](http://www.cs.toronto.edu), 2004) in systems analysis as the IDEFO method. It brings a number of advantages that managers of cultural institutions can not ignore:

- represents a synthetic, realistic and correctly argued decision support;

- presents in stages, from the beginning to the end, the activities that contribute to the materialization of a cultural product;
- explains the specific processes of the system and creates the possibility of analysing each component of the activities without which it cannot fulfil its specific objective;
- processes are fully defined only if their components are nominated: inputs, outputs, information and control rules and, last but not least, the resources needed for the specific transformations of each process;
- the flow chart of cultural production made by an initiated and experienced system analyst is a synthetic document that can be used by the manager to streamline activities by framing processes in the initial prescriptions (resources, specific conditions, stage objectives, specific performances, etc.). ;
- diagrams are dialogue tools, they can be commented, annotated or completed by all those interested in achieving superior performance (cost reductions, elimination of unnecessary activities, etc.);
- the created tool can be used in process monitoring, and by adding a Gantt chart it can be used in managing the implementation of the process itself;
- for certain cultural productions with common characteristics (theatre performances, exhibitions, conferences, etc.), preconceptualized SADT schemes can be used. They will adapt to each particular situation, thus facilitating the process of analysis and design of the flow chart. Analysts and managers thus use contingent solutions in which experience and the ability to identify the particularities of each cultural production greatly reduce intellectual effort and working time.

## 2. Notions about SADT modelling specific to the realization of a theatrical performance.

The basis of the SADT model is the cultural function, in our case a complex of activities that ultimately leads to the achievement of a clearly defined objective. It is a product materialized in a theatrical performance, which in turn can be derived, due to partial objectives specific to each significant activity, for the materialization of the cultural act.

This activity, the core for the SADT method (Marian L., Project management, Ed. Efi-Rom, Tg.Mureş, 2001), represented by a rectangle, is defined by the action that it performs. It has specific input sizes, in fact the elements that will be processed in the module (the input arrows left side), has the resources with which the activity will be performed (the arrows at the bottom of the module) and the product / service achieved by the specific transformation of the module (the output arrows right side). In the nomination of the modules two actigram methods are used: the method that uses the defining verb for the module and the other one naming the product created as datagram. (Figure 1)

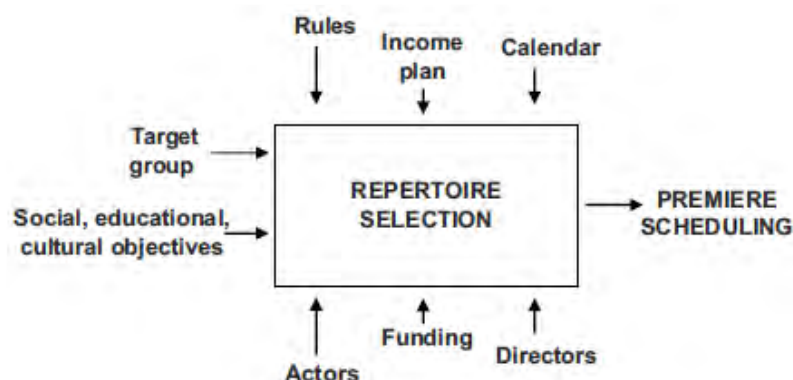


Figure 1. SADT module structure

A complex function can be decomposed into several component subfunctions that can in turn have subcomponents, and the more detailed the decomposition, the more comprehensive the SADT analysis

becomes and the more successfully it can be used in the cultural product management. Rarely are cultural products that can be created through a single action and with little diversified resources. Most of them are created through multiple activities that are each represented by functional blocks logically chained forming a flow chart which highlights the sequential development of the complex process. Figure 2 shows the flow chart of the processes specific to the staging of a theatre play, the first SADT scheme made in Romania for cultural productions.

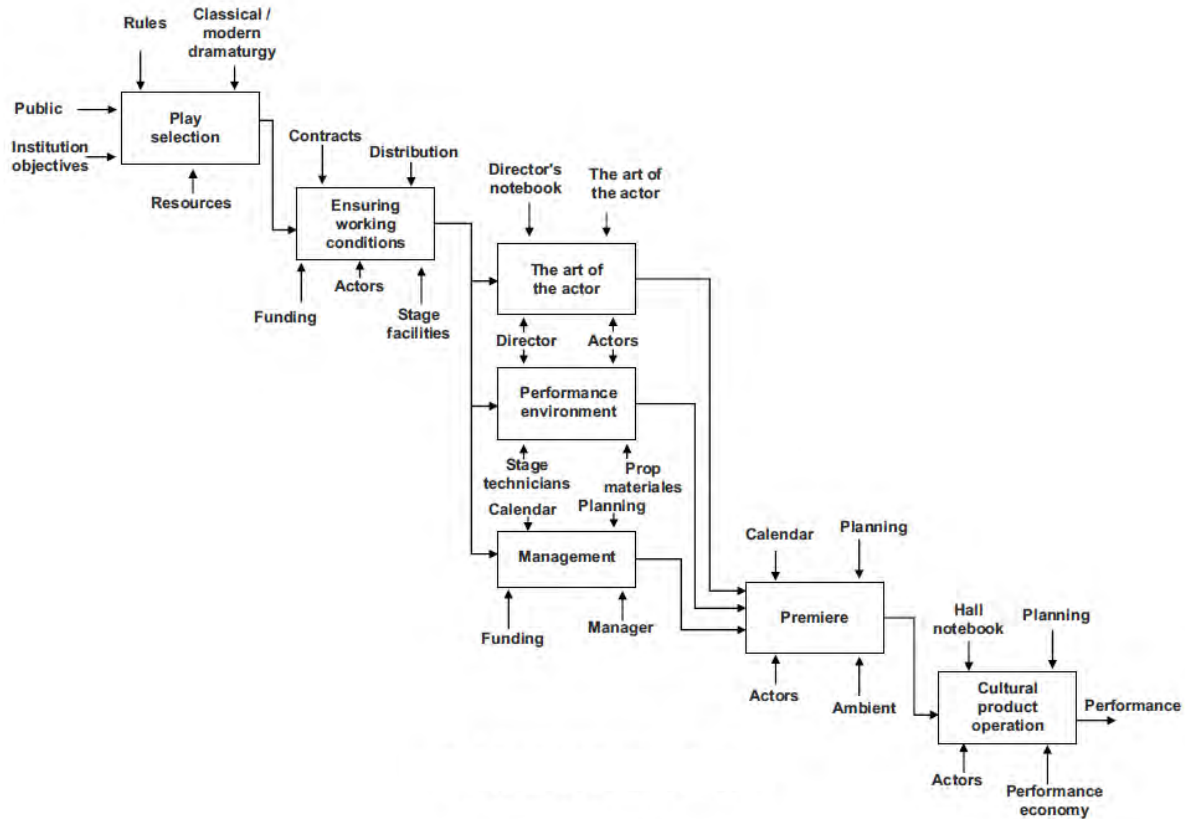


Figure 2. Flowchart of the staging of a play

Based on a systemic analysis of the processes that are carried out in the staging of a theatre play, 7 basic modules were defined which are then in turn expanded into submodules with specific activities and derived activities from each basic module.

### A. The Choice of the theatre play

- A1. The minimum annual program
- A2. Use of human resources (actors, directors, set designers, etc.)
- A3. Sources of funding
- A4. Performance Opening Nights planning
- A5. Collaborators

### B. Ensuring working conditions

- B1. Casting
- B2. Sets sketches
- B3. Costumes Sketches
- B4. Elaboration of the Technical Conditions Sheet

B5. Production estimate

B6. Copyrights

**C. The actor's art**

C1. Objectives, messages, purposes

C2. Individual rehearsals

C3. Collective rehearsals

C4. General rehearsals

**D. The environment**

D1. Sets

D2. Costumes

D3. Technical conditions (sound, lights, special effects, etc.)

**E. Management**

E1. Supply

E2. Financial management

E3. Promotion

**F. Launch of the cultural product**

F1. Technical rehearsal

F2. General rehearsal

F3. Opening Night

**G. Product operation**

G1. Performances planning

G2. Transport

G3. Technical maintenance

G4. Performance marketing

To the graphical representation of Figure 2 there is attached a synoptic document in the form of a table – Table 1. - which contains all the components and characteristics of the modules necessary for their definition according to the SADT methodology.

Table1. Synoptic table of SADT module components

Module	Name	Inputs	Resources / Facilities	Information / Control	Output	Notes



The basic modules can in turn be represented in a cascade of sub-activities performed sequentially using the aforementioned work technique. For example, module C The actor's art has as inputs the outputs from the previous module B: technical conditions, casting, director and adapted text, and the output is the mastering of roles, activities that are expanded and represented by the flow chart in Figure.3

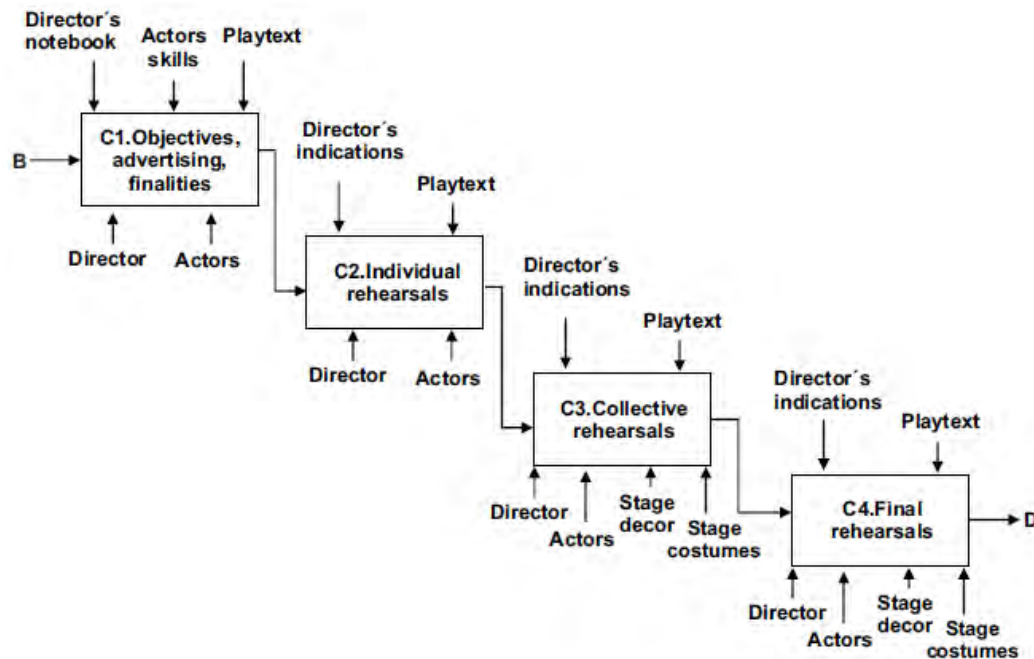


Figure 3. Flowchart of C module

## Conclusions

The SADT method used for the first time in Romania when staging a theatrical performance proves to be a useful and necessary procedure. It highlights the stages, means, conditions and conditionalities that must be observed in order to obtain efficiency and managerial efficiency. The conditions for using this procedure are minimal: availability for systemic analysis of procedures, relatively average knowledge of the SADT technique and the desire to manage through a proper management performances as attractive as possible to viewers.

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# RESEARCH ON THE SUPPLY OF HUMAN RESOURCES WITH SPECIAL NEEDS AND IMPACT ON THE LABOUR MARKET

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## Abstract

**Purpose** – *The study explores the integration of people with special needs on the workforce.*

**Methodology/approach** – *The bibliographical study consults peer reviewed articles, specialty books, national and international databases, statistical databases, private and public institutions data, legislations and regulations, and so on.*

**Findings** – *People with special needs have a lower employment rate. Two prominent reason are lack in accessibility – as disability is a relationship of individual and environment; and superficial perceptions of people with disabilities.*

**Research limitations/implications** – *Limitations arise from the everchanging situation, with especially hard to measure attitudes and hard to change norms. Even more, there are no universal and comparable ways to measure progress – should it be percentage of employed people, should it be proportion of people with special needs in positions of power?*

**Practical implications** – *The paper underlines the importance of first hand interactions with people with special needs, their visibility in regular environments.*

**Originality/value** – *It is valuable to analyse disability and workforce integration in a single model, giving a better insight into a more complete story and its interactions.*

**Key words:** *People with special needs, Workforce integration, Human resources*

## Introduction

This study proposes the research of the management of integration of the human resource with special needs at an organizational level. Based on these considerations, the paper introduces the analysis of the necessary resources that the person with special needs must obtain from school and society to integrate into the labour market. It is essential to achieve the objectives, as well as to implement the most correct decisions for structuring a model.

The relevance and need of the research lie in the fact that over time, both the person with special needs and the labour market had been approached in the literature from different perspectives, yet rarely in relation to their interdependence. Many countries have committed themselves to implementing policies, laws and administrative measures that ensure the rights recognized in international conventions, laws, regulations, customs and human rights, practices that constitute discrimination (World Health Organization (WHO), 2011). Furthermore, in many European countries, the need to take a step forward in integration and in creating an inclusive labour market in which everyone can participate regardless of any form of disability or vulnerability is emphasized (European Disability Strategy 2010-2020, 2010).

## Methodology

The proposed research model starts from highlighting the legislation that is meant to influence and determine the impact on people with disabilities.

The research directions are: bibliographical study on human resources with special needs and their integration into organizations in Romania; and research of the offer of human resources with special needs.

The stages of the bibliographic study are: bibliographic analysis of the legislation associated with human resources with special needs, the organizational characteristics involved in the integration of the human resource with special needs, the characteristics of the human resource with special needs, the characteristics of the manager in relation to the human resource with special needs.

The research continues through the identification and description of the most representative variables that characterize the dimensions of human resources with special needs as well as of the variables that characterize the organizations involved in hiring human resources with special needs.

## Findings

The year 1981 marks a pivotal time and the beginning of a change in the paradigm of disability, as The United Nations declared it The International Year of Disabled Persons. Its focus was on participation and equality, meaning the right of people with special needs (PWSN) to fully be a part of the life and development of their societies (United Nations, n.d.). Disability got defined as the relationship between person and environment, thus it is not an attribute of an individual but created by the social environment, and requires social changes (Mitra, 2006). The International Classification of Functioning, Disability and Health (ICF) is a framework developed by the WHO, and endorsed by 191 countries as of May 2001 (resolution WHA 54.21), making it the international standard to describe and measure health and disability. ICF is distinctive as it offers nuanced descriptions based on an interconnected model of impairments, activity limitations and participation restrictions.

Globalization influenced the matter by putting into effort more people to solve the issue. In this way developments could diffuse better and faster for the improvement of the lives of people with disabilities, them being a category with not enough research on national levels.

The European Commission estimated the disability percentage of the European population at 20 percent (European Commission, 2020), and WHO at 15 percent globally (WHO, 2011). While the proportion of PWSN on and in the labour force is unclear, the employment rate of PWSN is much lower as accounted by multiple sources: 52.8% for men with disability and 19.6% for women with disability, compared with 64.9% for non-disabled men, and 29.9% for non-disabled women according to a WHO Survey (applied in 51 countries); OECD, based on a 27 country analysis, estimates the employment rate of PWSN at 44%, compared with 75% of people without disabilities; the U.S. Bureau of Labour Statistics (2013) rates employment of PWSN at 18% compared to 64%. The Romanian figure is 12.7%, compared to 70% of the general population aged 18-55 (Alpha MDN, 2010).

The previous figures show undoubted inferior engagement of human resources with special needs on the labour force. Whereas there is some evidence that it could be a consequence of the nature of the work (Unger, 2002; Beegle and Stock, 2003; Jones and Sloane, 2010;) or dependency on social benefits (Acemoglu and Angrist, 2001), most evidence supports some facet of discrimination as the cause.

Discrimination is when a person cannot find work not because of its inability to work but as a repercussion of no accessibility (WHO, 2011). It is however illegal, in both private and public sectors, largely everywhere, as United Nations Convention on the Rights of Persons with Disabilities (UNCRPD), is universally adopted by all UN members, 193 countries. Moreover, there is vast and everchanging legislation, as well as policies, such as quotas, both at national and supranational levels.

Some of the most prominent theories aiming at understanding discrimination on the labour market are expectancy theory and statistical discrimination. Expectancy theory shows that when facing a hiring decision, employers, lacking information, will choose employees based on observable characteristics (Thurow, 1975; Reskin and Roos, 1990). Statistical discrimination explains choices regarding a person based on placing them in a category and then assessing their skills as the average of that group (Arrow, 1973; Lundberg and Startz, 1983). So, people have certain expectations and attitudes towards PWSN, not necessarily based on reality.

Attitudes differ dependent on the type of disability (Maroto and Pettinicchio, 2014), and once a firm hired an employee with a certain disability, it was more likely to hire other employees with the same disability (Unger, 2002).

Legislative methods can backfire and negatively impact attitudes (Maroto and Pettinicchio, 2014), some colleagues could develop negative attitudes towards PWSN because they associate them with less productivity and higher costs (Schwochau and Blanck, 2000; Unger, 2002). To conclude, this discrepancy suggests that previous experience can create more balanced and fair views about PWSN, reducing the uncertainty of hiring and promoting them in the workforce (Maroto and Pettinicchio, 2014).

## **Discussion and conclusions**

In order to have a complete view, one has to analyse three characteristics: of the person with special needs, of the manager, and of the work. The first two construct various psychological attributes associated with managers, such as stereotypes, expectations, affective orientation. On the other hand, the characteristics of the work give expectations to the managers, which arise from the job interview and strictly from the results obtained from the done work. All these contour an image of the behaviour of the manager towards the person with special needs. The effect on the people inspires legislation and so forth, in a cyclical process. This can be visualized in Figure 1.

Despite benefits, legislation cannot lead to significant positive emotional changes for people with certain types of disabilities. The legislation may evoke negative reactions among employees if they are perceived as coercive or implemented as a preferential treatment for disabled applicants. Adherence to legislation can serve to perpetuate stereotypes and negative expectations, as observers may conclude that an individual with a disability has been hired because of legal requirements, rather than his or her ability to perform their job.

As determined by the research, people with disabilities should have greater access to organizations. Increased participation can serve to expand contact and interaction between people with disabilities and employers, and this communication can help change the expectations of others and overcome existing stereotypes about people with disabilities.

It is also aimed to create norms and values that can influence the experiences of people with disabilities in organizations. They identify the types of behaviours that are appropriate and provide moral justifications for organizational policies and practices.

These influence the formulation of organizational policies and practices. They clarify organizational objectives, direct organizational activities, and prescribe methods for achieving objectives. Thus, it is suggested that organizational policies and practices may affect people with disabilities because they influence job design, staffing methods, evaluation of procedures, and reward systems within organizations.

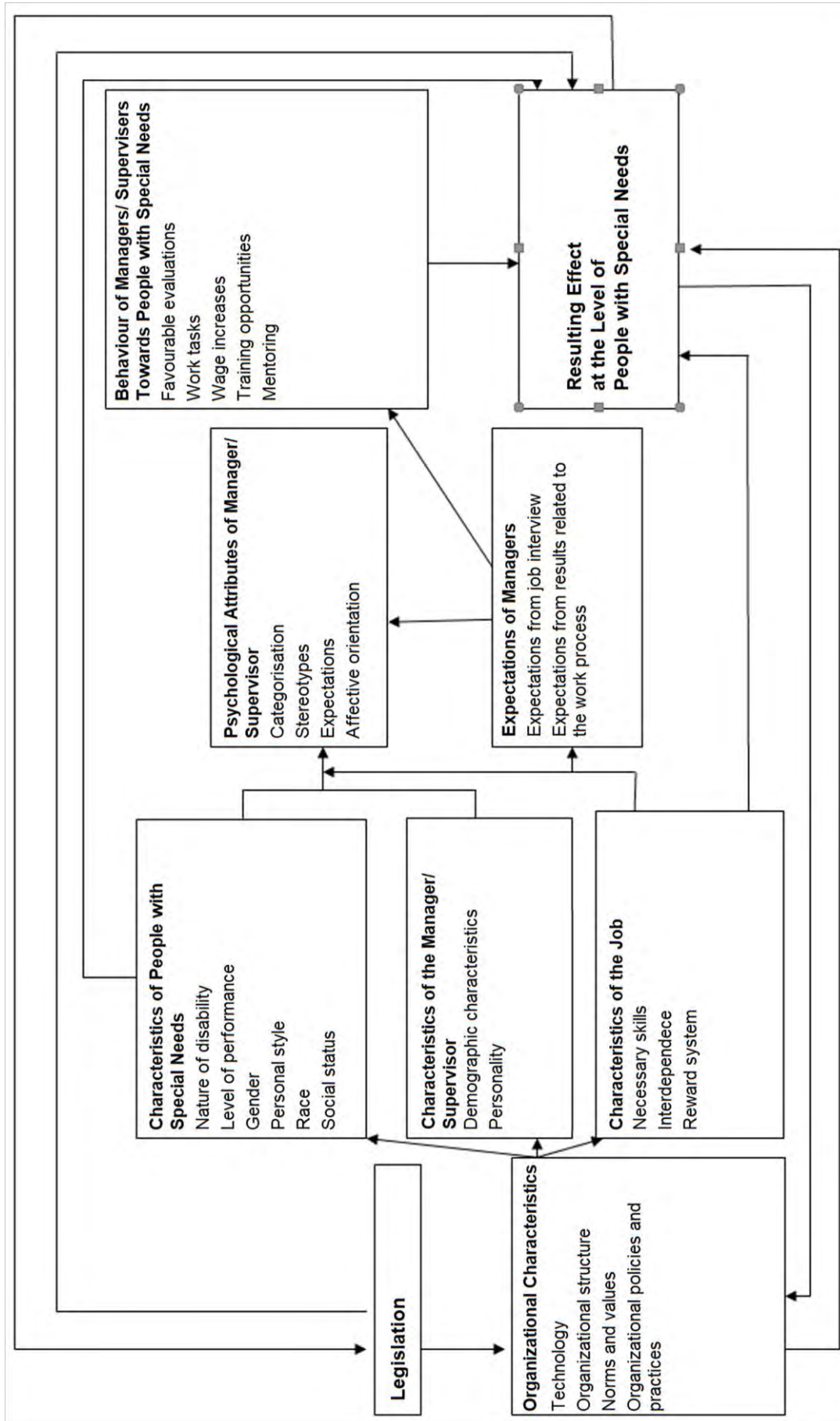


Figure 1. Model of Integration of Human Resources with Special Needs at the Organizational Level

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# DETERMINANT FACTORS OF THE PRIVATE EQUITY AND VENTURE CAPITAL INVESTMENTS IN CENTRAL AND EASTERN EUROPE

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## Abstract

**Purpose** – *The study aims to identify and analyze the factors that decisively influence the investments of private equity Funds (PEF) and venture capital Funds (VCF) in Central and Eastern European countries (CEE).*

**Methodology/approach** – *The link between PEF and VCF investments and a number of factors considered determinant is tested by using a sample of data from 11 CEE countries, data that were analyzed by descriptive statistics and econometric models, the chosen method being the one of the least squares.*

**Findings** – *The research results reveal that macroeconomic factors have a major impact on PEF and VCF investments. In addition to macroeconomic factors we have identified other country-specific factors that have a significant impact on PEF and VCF investments.*

**Research limitations/implications** – *In the conditions of more complex analyzes, on extensive databases, there is the possibility of determining other relevant factors.*

**Practical implications** – *The conclusions of this study can support the authorities to make informed decisions in order to stimulate foreign investment in the national and regional economy. At the same time, through the identified factors, the local Funds have at their disposal a relevant image on the investment context in the regional countries.*

**Originality/value** – *The study complements previous research, proposes new factors, puts together data and information on both PEF and VCF activity, most studies treating them separately.*

**Key words:** *Venture capital, Private equity, Innovation.*

## Introduction

Innovation is a key factor in stimulating sustainable growth and long-term competitiveness. Private equity (PE) and venture capital (VC) play a key role in supporting innovation and, implicitly, in mitigating global disparities in technological advancement. Through these operations, in the context of globalization, banks, investment funds, private entities get involved in local companies, in order to increase their value, through capital infusions, the use of new management strategies and/or the introduction of advanced technologies.

PE addresses long-term financial needs of companies in various stages of development with the main goal on increasing value through innovation. By implementing financial, operational and corporate governance strategies, the managers of PE entities contribute to the improvement of the financial statements of the acquired company. Unlike traditional sources of financing, through PE funding, an active relationship is created, in which the representatives of the investing entity collaborate closely with the existing management or with a new management team.

The main component of the PE activity, the VC activity, represents those operations aimed at financing start-ups and risky young companies but with great potential for growth and innovation.

In this case, the investing entity holds a minority stake and the degree of involvement is passive (advisory role, know-how, business relations). Unlike VC activity, in the case of another component of PE activity, namely the buyout activity, the representatives of the investing entity are actively involved in the company, sometimes even generating its restructuring.

Financing through PEFs and VCFs allows companies to prioritize long-term growth, with positive effects on their financial performance.

Regarding innovation, according to the latest data published by the European Commission in the European innovation scoreboard, Romania is part of the last category, that of „modest innovator”, among other CEE countries.

Given the context of globalization and the importance of PE and VC investments in supporting innovation, this study focuses on identifying the factors that PEFs and VCFs take into account in financing companies in Eurozone countries but which in the same time are geographically located in CEE.

## **Theoretical background**

The factors that have a decisive influence on PE and VC investments have been the subject of studies and research conducted by a number of researchers in recent years. We note some of these that we considered relevant for this research.

Romain and La Potterie (2004) have identified the following determinants of VC investment: GDP growth, Interest rate, Labour market rigidities, Level of entrepreneurship, Number of triadic patents, R&D expenditures. Félix et al. (2007) argue that GDP growth, interest rate, stock market growth and venture capital divestments significantly and positively influence VC investments. Cherif and Gazdar (2011) indicate that GDP growth, unemployment rate, Stock market capitalization, R&D expenditures are the main factors influencing VC investments. Félix et al. (2012) analyze the influence of GDP growth, long term interest rate, stock market capitalization growth, IPOs, R&D expenditure, unemployment rate, market-to-book ratio, total entrepreneurial activity index and size of the M&A on VC investments. Bernoth and Colavecchio (2014) conclude that GDP growth, unemployment rate, inflation rate, stock market capitalization, labour costs, the institutional and legal environment are determinants of PE investments. Groh and Wallmeroth (2016) indicate that M&A activity, legal rights and investor protection, innovation, intellectual property protection, corporate taxes și unemployment rate have an impact on VC. At the same time, the authors pointed out that the determining factors can vary depending on the stage of development of a country. Precup (2017) analyzes the influence of GDP growth, market capitalization, R&D expenditures, interest rate, Unemployment rate, Productivity and Corruption on VC investments and leveraged buyout.

Other relevant studies that analyze the influence of VC investment determinants are those performed by Gompers and Lerner (1999), Jeng and Wells (2000), Schertler (2003), Leleux and Serlemont (2003) and Marti and Balboa (2001) analyze the determinants of PE investments.

## **Data and variables**

This Study is performed on a sample of data from 11 countries in Central and Eastern Europe (Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia), valid for the period 2011-2018.

Several data sources were used in the study. Data on the volume of PEF and VCF investments were collected from the Invest Europe Association. Data on the volume of M&A transactions were collected from The Institute of Mergers, Acquisitions and Alliances (IMAA). Information on EIF's Private Equity and Venture Capital Funds Investments was taken from the European Investment Fund. The following data was collected from The World Bank: GDP growth, High-technology exports, ICT goods, Patent applications, R&D expenditure, Foreign direct investment, Time required to start a business, Stock market return. The following data were collected from Eurostat: Business enterprise R&D expenditure



in high-tech sectors, Innovation Index, Interest rate. The Credit - Market sophistication indicator was taken from the Global Innovation Index.

The variables that were analyzed in this study were the following:

*European Investment fund (EIF).* By developing and offering financial products to its intermediaries, the EIF improves SMEs' access to finance. EIF works with VC funds, which act as intermediaries and invest in innovative high-tech SMEs in the early and growth stages. Therefore, we consider that the activity of the EIF in financing SMEs should be a determining factor of PE and VC investments in CEE countries.

*M&A Investment Volume.* This variable represents the volume of mergers and acquisitions transactions in a year, for each country as a percentage of the country's GDP. Groh and Wallmeroth (2016) and Félix et al. (2012) have shown a positive influence of the volume of M&A transactions on VC investments. We expect that an active M&A market to have a positive impact on PE and VC investments.

*GDP growth.* Calculated as a percentage change from the previous year of GDP, this variable is a measure of economic activity. Gompers and Lerner (1999), Romanin and de la Potterie (2004), Félix et al. (2007), Cherif and Gazdar (2011), Félix et al. (2012) and Bernoth and Colavecchio (2014) have indicated a positive influence of GDP growth on VC investments in developed countries in Western Europe and the United States. On the other hand, Jeng and Well (2000) and Marti and Balboa (2001) consider that GDP growth is not a determining factor of VC investments. Precup (2017) has obtained mixed results, GDP growth has a positive impact on VC investments, but is not a significant factor for leveraged buyout investments.

*High-technology exports.* Calculated as a percentage of manufactured exports, this variable represents products such as computers, electric machines, products from the aerospace industry as well as scientific instruments and pharmaceuticals. All these products have in common the fact that they were produced with high research and development expenditures. This study will test whether High-technology exports are a determining factor in PE and VC investments.

*ICT goods exports.* Calculated as a percentage of total goods exports, this variable represents the export of *Information and communication technology* goods. This study will test how this variable will influence PE and VC investments.

*Foreign direct investment, net inflows.* This variable represents the new investment flows of foreign investors as a percentage of the GDP of the country in which those investments are made.

In this study we will test the positive link between foreign investment and PE and VC investments.

*Patent applications, residents.* This variable represents the patent applications registered by residents for exclusive rights to an invention. Romain and La Potterie (2004) and Schertler (2007) indicate a positive influence of patent applications on VC investments. This study will also test a positive influence of patent applications on PE and VC investments.

*Research and development expenditure.* The variable represents the total value of domestic research and development expenditure as a percentage of GDP. Among the authors who have demonstrated a positive influence of this factor on VC investments are Gompers and Lerner (1999), Schertler (2003), Romain and La Potterie (2004), Schertler (2007), Cherif and Gazdar (2011) and Félix et al. (2012). Although, Precup (2017) obtained mixed results, showing a positive impact on VC investments and a negative impact on leveraged buyout. This study will test a positive influence of R&D expenditure on PE and VC investments.

*Business enterprise R&D expenditure in high-tech sectors.* High-tech has long been considered a key factor in the sustainable growth of economic activity and business enterprise R&D expenditure is a determining factor of the high-tech sectors. Knowing that PE and VC investments contribute to the stimulation and development of innovation activity, we will test the positive link between this variable and PE and VC investments.

*Innovation Index.* Based on the European Innovation Scoreboard, this indicator reflects research and innovation performance, including other indicators such as: Human resources, Attractive research systems, Innovation-friendly environment, Finance and support, Firm investments, Innovators, Linkages, Intellectual assets, Employment impacts, Sales impacts. Groh and Wallmeroth (2016) studied

the influence of innovation on VC investments, they obtained positive results. This study will test the positive link between this variable and PE and VC investments.

*Interest rate.* This variable represents the long-term interest rate. Romain and de la Potterie (2004) and Félix et al. (2012) indicate that the long-term interest rate has a positive influence on VC investments. On the other hand, Gompers and Lerner (1999) indicate that short-term interest rate has a negative influence on VC investments. Romain and La Potterie (2004) argue that both, the short-term interest rate and the long-term interest, rate have a positive influence on VC investments. A positive influence was also obtained by Félix et al. (2007). Precup (2017) indicates that the interest rate positively influences PE investments but is not a significant factor for leveraged buyout investments. In their research, Cherif and Gazdar (2011) have shown that the interest rate is not a relevant factor for VC investments.

*Stock market return.* This indicator provides us information regarding the development of the stock market. Gompers and Lerner (1999), Félix et al. (2007), Schertler (2003), Cherif and Gazdar (2011) confirm a positive influence of stock market development on VC investments and Bernoth and Colavecchio (2014) confirm a positive influence on PE investments. Precup (2017) finds that market capitalization has a positive influence on leveraged buyout investments and a negative influence on VC operations. A negative influence of stock market capitalization growth on VC operations is also found by Félix et al. (2012). On the other hand, Jeng and Wells (2000) consider that the development of the stock market is not a determining factor of VC investments. This study will test the positive influence of stock market development on PE and VC investments.

*S&P Global Equity Indices.* This indicator measures the change in the price of the US dollar in the stock markets covered by country indices Standard & Poor's Global Equity Indices and Standard & Poor's Frontier Broad Market Index and is an important measure of overall performance. This study will test whether the S&P Global Equity Indices has an influence on PE and VC investments.

*Time required to start a business.* This is a Business Environment Measurement Indicator and represents the number of calendar days needed to complete the legal procedures for setting up a business. A high level of this indicator is expected to negatively affect PE and VC investments.

*Credit.* Granted as a score for each country, from 0 to 100, this indicator reflects market so-phistication from the perspective of ease of getting credit, domestic credit to private sector and microfinance institutions' gross loan portfolio. This study will test whether market sophistication influences PE and VC investments.

## Statistical methodology and empirical analysis

The methodology used to estimate the econometric models by the least squares method involves several stages. Unit root tests were used to verify the stationarity of the variables. The selection of the type of unobservable effects was made based on the Hausman Test. The hypothesis of independence of the factorial variables is verified by calculating the Variance Inflation Factor indicator. Through the Jarque-Bera Test it was checked whether the residuals are normally distributed. Heteroskedasticity testing was performed with White's Test and to analyze the existence of a correlation between the errors of the econometric model, Durbin-Watson Test and Correlogram Test were applied.

In order to reveal the determinants of PE investments, after going through the above stages we estimated the following models:

Model (1):

$$PE_{i,t} = \alpha + \beta_1 \cdot RD_{i,t} + \beta_2 \cdot Patent_{i,t} + \beta_3 \cdot ICT_{i,t} + \beta_4 \cdot Time_{i,t} + \varepsilon_{i,t}$$

Model (2):

$$PE_{i,t} = \alpha + \beta_1 \cdot Patent_{i,t} + \beta_2 \cdot Innovation_{i,t} + \beta_3 \cdot ICT_{i,t} + \beta_4 \cdot Time_{i,t} + \varepsilon_{i,t}$$

Model (3):

$$PE_{i,t} = \alpha + \beta_1 \cdot RD_{i,t} + \beta_2 \cdot Patent_{i,t} + \beta_3 \cdot EIF_{i,t} + \beta_4 \cdot GDP_{i,t} + \beta_5 \cdot ICT_{i,t} + \beta_6 \cdot Time_{i,t} + \beta_7 \cdot S\&P_{i,t} + \varepsilon_{i,t}$$

Model (4):

$$PE_{i,t} = \alpha + \beta_1 \cdot RDH_{i,t} + \beta_2 \cdot Patent_{i,t} + \beta_3 \cdot M\&A_{i,t} + \beta_4 \cdot ICT_{i,t} + \beta_5 \cdot Time_{i,t} + \varepsilon_{i,t}$$

Model (5):

$$PE_{i,t} = \alpha + \beta_1 \cdot M\&A_{i,t} + \beta_2 \cdot FDI_{i,t} + \beta_3 \cdot Rate_{i,t} + \beta_4 \cdot Time_{i,t} + \beta_5 \cdot Credit_{i,t} + \varepsilon_{i,t}$$

Model (6):

$$PE_{i,t} = \alpha + \beta_1 \cdot M\&A_{i,t} + \beta_2 \cdot FDI_{i,t} + \beta_3 \cdot Time_{i,t} + \beta_4 \cdot PE(-1)_{i,t} + \varepsilon_{i,t}$$

The determinants of VC investments are highlighted by estimating the models below:

Model (7):

$$VC_{i,t} = \alpha + \beta_1 \cdot RD_{i,t} + \beta_2 \cdot Stock_{i,t} + \beta_3 \cdot Credit_{i,t} + \beta_4 \cdot VC(-1)_{i,t} + \varepsilon_{i,t}$$

Model (8):

$$VC_{i,t} = \alpha + \beta_1 \cdot RD_{i,t} + \beta_2 \cdot GDP_{i,t} + \beta_3 \cdot Rate_{i,t} + \beta_4 \cdot Time_{i,t} + \beta_5 \cdot Stock_{i,t} + \beta_5 \cdot High_{i,t} + \varepsilon_{i,t}$$

Table 1 presents the results of the estimated models (1)-(6) which reveal the impact of determinants on PE investments.

Table 1. Determinant factors of the private equity investments

	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)
PE (-1)						-2.314018 (0.0244)
R&D exp.	2.891172 (0.0038)		3.734002 (0.0004)			
R&D exp in high-tech				2.493451 (0.0148)		
Patent	2.070359 (0.0418)	3.468209 (0.0009)	3.500530 (0.0008)	1.216812 (0.2274)		
Innovation		3.781279 (0.0003)				
M&A				2.321731 (0.0229)	2.220920 (0.0301)	2.244799 (0.0287)
EIF			2.039036 (0.0455)			
FDI					2.675675 (0.0096)	2.335764 (0.0231)
GDP			-1.735777 (0.0873)			
ICT	-2.61911 (0.0106)	-3.596224 (0.0006)	-2.476713 (0.0159)	-2.020009 (0.0469)		
Rate					2.960612 (0.0044)	
Time	-3.554691 (0.0007)	-3.364113 (0.0012)	-4.610817 (0.0000)	-2.965293 (0.0040)	-2.513162 (0.0147)	-1.288245 (0.2030)
S&P			-1.168024 (0.2471)			
Credit					-2.784689 (0.0072)	
Constant	-0.518164 (0.6058)	-3.939815 (0.0002)	0.721623 (0.4731)	1.531678 (0.1298)	2.532023 (0.0140)	-1.691490 (0.0963)
R-squared	0.220198	0.282535	0.381225	0.224651	0.854989	0.823509
F-statistic	5.435747	7.580562	5.720893	4.404083	25.26874	18.66408
Prob(F-statistic)	0.000658	0.000033	0.000035	0.001417	0.000000	0.000000
Cross-section effects	random	random	random	random	fixed	fixed
Period effects	none	none	none	none	none	none

Analyzing the results of the estimated models presented in Table 1, we can conclude that the determinants of PE investments are R&D expenditure, Business enterprise R&D expenditure in high-tech, Patent, Innovation, M&A, EIF, FDI, Interest rate, ICT, Time și Credit. The first eight factors have a positive influence on PE investments and the last three have a negative influence. These models did not validate a statistically significant link between GDP growth and S&P Global Equity with PE investments.

The results of the estimated models (7) and (8) are presented in Table 2.

Table 2. Determinant factors of venture capital investments

	Model (7)	Model (8)
VC (-1)	1.161434 (0.8723)	
R&D exp.	2.677953 (0.0096)	2.174094 (0.0343)
GDP		2.692157 (0.0095)
Rate		2.951630 (0.0047)
Time		-2.993753 (0.0042)
Stock market return	2.291993 (0.0255)	1.731652 (0.0893)
Credit	-0.522512 (0.6033)	
High-technology exports		1.214744 (0.2300)
Constant	-0.918613 (0.3620)	-2.281478 (0.0266)
R-squared	0.89467	0.921517
F-statistic	35.79619	40.70405
Prob(F-statistic)	0.000000	0.000000
Cross-section effects	fixed	fixed
Period effects	none	none

The analysis of the results of the estimated models presented in Table 2 indicates that R&D expenditure, GDP grow, Interest rate, Stock market return and Time significantly influence VC investments (the first four factors have a positive influence and the last factor has a negative influence). Credit and High-technology exports factors were not statistically validated.

## Conclusions

The conclusions of this study are relevant for all PE and VC activity. Given that the largest share in the activity of PE and VC is the activity of the Funds, the influence of the determined factors is more important for them.

Processing the statistical models, several determining factors were identified for this activity, some of them being in fact reconfirmed and others new, obtained through statistical correlations, being proposed as determinants for PE and VC activity. These new factors identified are: EIF activity, FDI, ICT, Business enterprise R&D expenditure in high-tech, Time required to start a business (Time) and Credit - market sophistication (Credit). EIF, FDI and R&D in high-tech factors have a positive influence on PE investments while ICT, Time and Credit factors have a negative influence. Although, the Credit factor was not statistically validated as a determining factor of VC investments. For GDP grow and stock market development indicators, factors reported in previous studies, we obtained mixed results, so that these variables positively influence VC investments but a significant link between these factors and PE investments was not validated.

From the perspective of the science and innovation, the results of the study highlighted that there is a direct, positive link between the variables Innovation, R&D expenditure and Patent and the PE and VC investments.

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# PRACTICAL RESEARCH ON THE IMPLICATIONS OF THE START-UP NATION PROGRAM

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## Abstract

**Purpose** – The paper's main objective is to obtain information on the level of satisfaction of the investigated subjects with respect to the financial programs for small and medium enterprises, the main field of the applicants, the access to the online platform with respect to the Start-up Nation program.

**Methodology/approach** – The research used the boring as method, based on accessibility and the working instrument was the questionnaire.

**Findings** – Cluj district has developed a lot during the last years and the impact of the Start-up Nation program had a major contribution in the regional economy. Its objectives have been fulfilled through the increase in the number of enterprises, new jobs, the decrease of unemployment and the improvement of the standard of living.

**Research limitations/implications** – Due to the organizational restrictions related to time, finances and human resources, the sample was 97 subjects who applied for the Start-up Nation program in the Cluj district. The sample method was non-aleatory, based on accessibility, thus we cannot talk about a representative sample, the conclusions being applied only to the investigated sample.

**Practical implications** – The financing programs for small and medium enterprises are beginning to play an important role in Romania's businesses. The conclusions of the research are important for the Agencies for SMEs, Investment Attraction and Promoting Export because they reveal the perception of the applicants on the program.

**Originality/value** – The paper presents the results of a totally original research.

**Key words:** entrepreneurs, Start-up Nation, financing, small and medium enterprises, Cluj district.

## Introduction

Most of the studies focus on entrepreneurship and its role in innovation, new businesses and the economic development of the country. Romania's main issue with respect to entrepreneurship is the fact the ratio of start-ups is a high one, but the numbers of those who can make it on long term is much smaller. Even if we register the biggest increase within the European Union, at micro level the incomes include a small number of companies. 4% of the companies are the engine of the economy, while half of them are experiencing difficult times.

The economy of the Cluj district has experienced an accelerated development during the last few years, becoming one of the most dynamic regions in Romania with respect to the contribution to the gross domestic product.

The economy of the Cluj district is based on services and industry, mainly creative industries and IT. More than 15.000 people are working in the IT field. That is why Cluj is called the "Silicon Valley" of Romania.

With the support of the local authorities, business environment, universities and NGOs, Cluj has become an important player in the national economy. An indicator that underlines the involvement and

entrepreneurial spirit is also the number of projects that applied for Start-up Nation 2017 – 2289 business plans.

### **The hypothesis of the research**

Starting from the issue that has to be studied, a series of hypothesis can be elaborated [Bacali et al., 2010, p. 279-280].

- H01: Most of the investigated subjects are satisfied by the financing programs for SMEs.
- H02: The online platform for application has been easy to access for the majority of the respondents
- H03: Production is the main field that has received financing by most of the applicants.
- H04: The non-refundable financial help covers more than 50% of the expenses.
- H05: Most of the applicants are pleased with the information presented on the Agency's site.
- H06: Most of the applicants are pleased with the implementation period of the program.

### **The instrument of the research**

The method that has been used within this research was the boring, and the instrument was the questionnaire.

For the questionnaire, different types of questions have been used [Bacali et al., 2002, p. 31-32]: open questions (addressed to the active process of the subject's memory, verifying and testing what is stable, consolidated in the behavior and knowledge of the subject) and closed questions (dichotomic, multidichotomic and scale responses).

For the elaboration of the questionnaire, the following basic principles have been respected:

- the question should be as short as possible, meanwhile clear and concise;
- the question should be elaborated in such a way that it is avoided a predisposition of the subjects to offer a certain answer;
- the ability of the subjects to answer certain questions has to be taken into account; and
- the question should not be threatening or unpleasant.

### **The sampling**

Due to the organizational restrictions related to time, finances and human resources, the sample was 97 subjects who applied for the Start-up Nation program in the Cluj district. The sample method was non-aleatory, based on accessibility, thus we cannot talk about a representative sample, the conclusions being applied only to the investigated sample.

### **The results of the research**

Further on we will present the level of satisfaction of the SMEs towards the governmental programs. The hypothesis was H01: "Most of the investigated subjects are satisfied by the financing programs for SMEs".

To the question "What is the general satisfaction level with respect to the financing programs for SMEs in Romania?", 41% of the respondents state that they are satisfied, while 9% are completely not satisfied.

The hypothesis is thus confirmed.

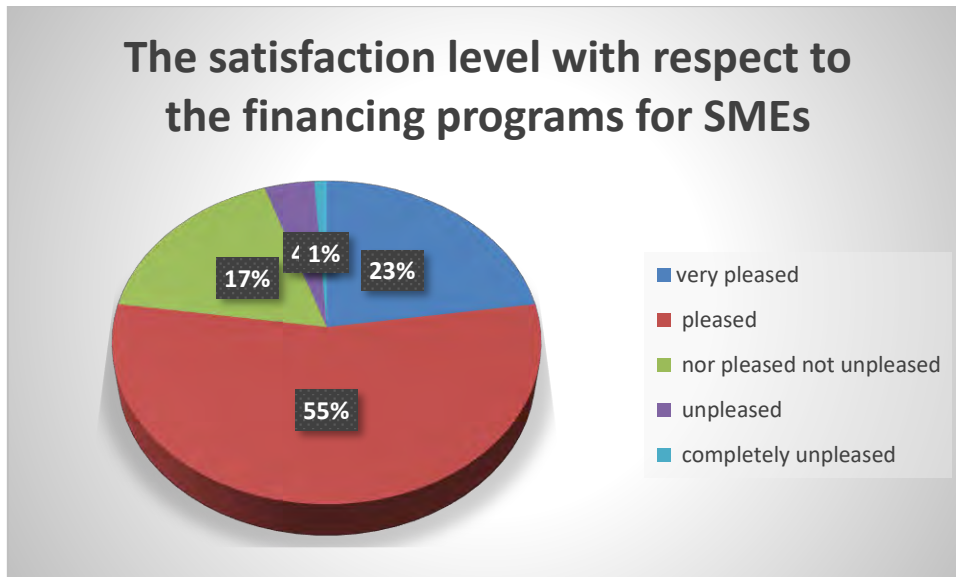


Figure 1. The analyses of the satisfaction level of the financing programs for SMEs

The online platform for application has been easy to access according to the majority of the respondents is the hypothesis that the following question was based on. The majority answered that the application was easy to access, for 21 of the investigates subjects it was not easy to access and 14 cannot answer due to the fact that they did not use it. The application has been opened for a few days before the start of the application so that the potential users can test it.

Those 14 subjects who didn't know if the platform was easy to use or not are those who used a consultancy company in order to register the project. The hypothesis is confirmed.

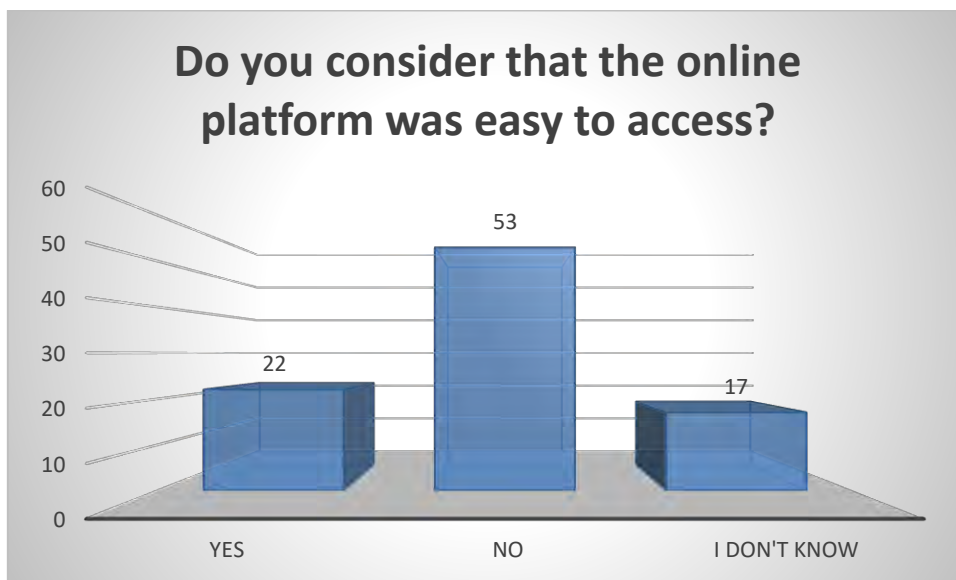


Figure 2. The analyses of the access to the online platform

Within the following question the activity field of the applicants have been investigated. Thus there are 34 enterprises in production, 29 in IT, 26 in services and 8 in creative industries.

Production represents the main field. Out of the 97 respondents, the majority have chosen a business in the production field, an equilibrium being IT and services being noticed, with just 1 company difference. The hypothesis is thus confirmed.



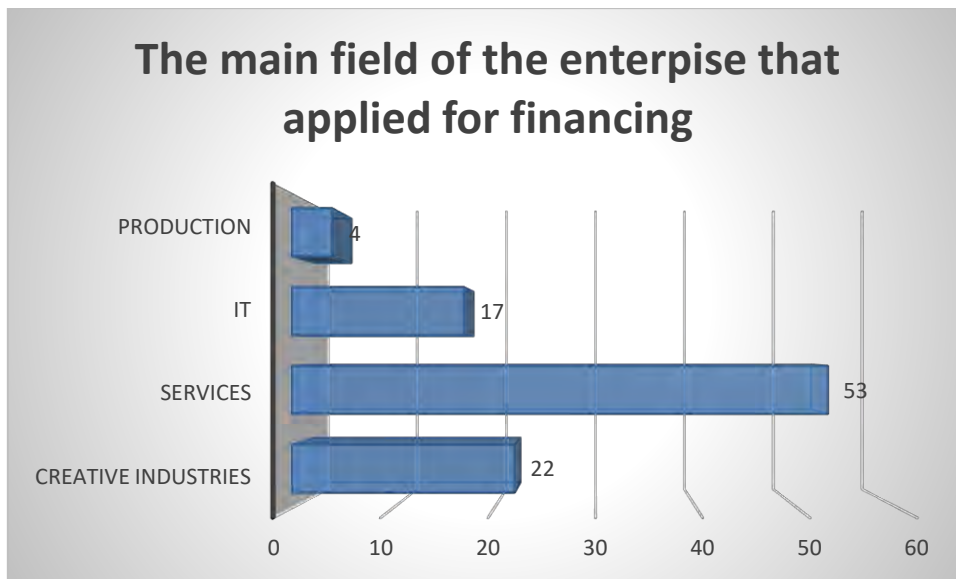


Figure 3. The field of the applicant enterprises

The next question analyses the measure in which the non-refundable financial aid covers the expenses for starting the business. The results show that in 7 cases the expenses are totally covered, 38 of the respondents state that 80% of the expenses have been covered, 35 of them state that they have covered 60% of the expenses and 17 subjects say that the non-refundable aid covered less than 50% of the expenses.

The answers to this question are influenced by the domain of the applicants. Thus, an applicant in the production field has found the funds to be insufficient, while those in the field of services state that the aid covers 100% of the expenses. The hypothesis is confirmed.

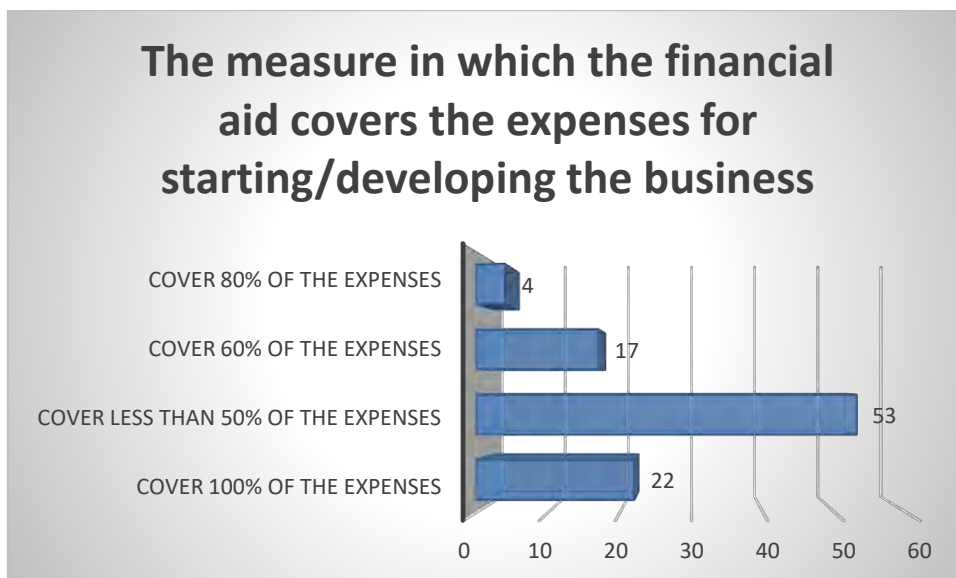


Figure 4. The analyses of the level of covering the expenses

“The majority of the investigated subjects are pleased with the information presented on the Agency’s site” has been the hypothesis for the question “How do you appreciate the information on the site?”. 42 of the investigated subjects consider the information to be good, 22 appreciated it with very good, 21 as average, while 9 consider it bad and 3 as very bad. The information that has been available on the site have fulfilled the principle of transparency, a fact proven by the answers of the investigated subjects. The hypothesis is thus confirmed.

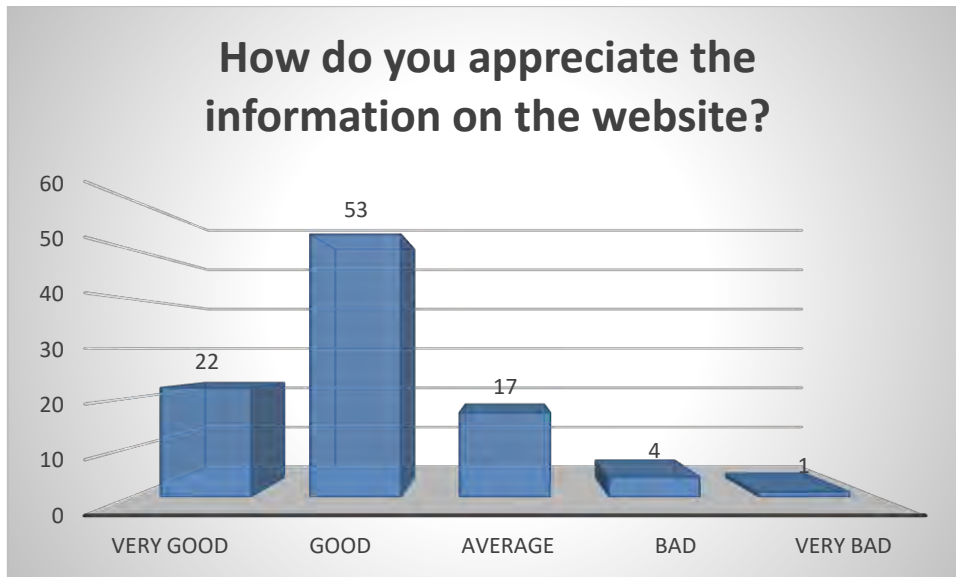


Figure 5. The opinion on the website information

The following question was about the period of implementation, starting from the hypothesis that most of the applicants are pleased with it. The answers were as follows: 53 consider it a good one, 22 as a very good period of time, 17 appreciate it as average, 4 as bad and 1 as very bad.

It needs to be mentioned that the implementation period for the project has been a generous one (12 months), which is also proven by the answers ((75 respondents consider it good and very good). The hypothesis is also confirmed.

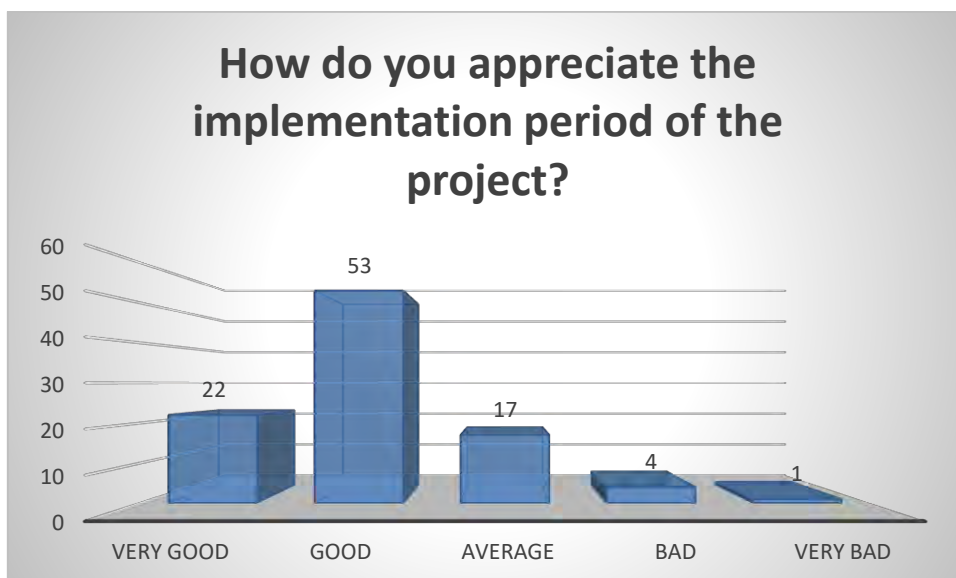


Figure 6. The analyses of the implementation period

### Discussion and conclusions

Cluj district has developed a lot during the last years and the impact of the Start-up Nation program had a major contribution in the regional economy. Its objectives have been fulfilled through the increase in the number of enterprises, new jobs, the decrease of unemployment and the improvement of the standard of living. Most of the applicants have been satisfied by this program and will recommend it to others.

The financing programs for small and medium enterprises are beginning to play an important role in Romania's businesses. The conclusions of the research are important for the Agencies for SMEs, Investment Attraction and Promoting Export because they reveal the perception of the applicants on the program.

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# MANAGERIAL CHALLENGES REGARDING THE PROVIDING OF ESSENTIAL SERVICES WITHIN THE INSECURITY GLOBALIZATION CONTEXT

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## Abstract

**Purpose** – Organizational resilience is a topical issue today, which deserves an interdisciplinary investigation aimed at the identification of the best intervention solutions to improve managerial processes and the situation of the organization as a whole. Things are all the more relevant when it comes to systems of services essential for the organization's functionality: the supply of electricity to consumers, the transportation of goods, payment services, the production of medicines, public services for emergency medical assistance, etc. What is the intensity and magnitude by which the (systemic, technical and operational) management of essential services will change over the next period, considering the manifestation of some crises and, especially, of the pandemic crisis? Can we identify lessons learned in the past that are similar in terms of the potential for change in management? What is the role of digitization and digitization in this framework?

**Methodology/approach** - The research methodology focuses on the consultation of recently developed literature to capture the trends manifested as possible paradigm directions in the development of management, in the context of the disruptive events affecting regions, continents or the entire world.

**Findings** – Under these conditions, the managerial systems are forced to place more emphasis on flexibility, by incorporating adequate information technologies. It is expected that the organization's resistance to change itself will alter, with obviously different intensities at individual or organizational level, as the robustness of organizations in the pre-crisis situation has mainly favored stability.

**Research limitations/implications** – The specific aspects of the pandemic crisis are still ongoing, with no known paradigmatic scientific approaches.

**Practical implications** –Of the specific processes of globalization, the one related to the security of individuals, organizations and, implicitly, of specific activities was selected. The challenge for political, economic, military decision makers, etc. is highest when the insecurity has regional or continental implications and consequences (example: the limitation of the free movement of people and goods). There is also an urgency to restore the normal functioning of the systems providing essential services.

**Originality/value** – This article brings to attention some managerial trends already manifested during the crisis generated by Covid 19. Interdependent and possible evolutionary trends are presented.

**Key words:** crisis, essential services, resilience.

## Introduction concerning crisis management and organizational resilience

This study draws attention to crisis situations closely related to the essential services for the proper functioning of society, already manifested during the pandemic caused by Covid 19. The growing threat generated by Covid 19 affects the management processes and the organization as a whole. Therefore,

the aim is to find the best recommendations and intervention solutions for improvement and adaptation in the new pandemic context.

The term "crisis" is hotly debated and there are many definitions of crisis. Starting from the topic of this article, we will embody the notion of crisis as follows: (1) "an event or set of circumstances threatening the integrity, reputation or very existence of the individual or organization" (Sapriel, 2003, p.1); (2) an event or series of specific, unpredictable, out-of-routine events that create uncertainty and threat or are perceived as threatening an organization's highest priority goals (Ulmer, Sellnow and Seeger, 2017). Consequently, "crises appear as phenomena that can cause damage to an organization, both in terms of material losses and in terms of social prestige" (Sanda and Enea, 2014, p. 278).

Therefore, crisis management is defined as a specific administrative activity during the crisis state of the organization. In times of crisis in an organization, the main goal is to manage and improve the activities of the organization by taking measures to overcome the negative phenomena in the production and service of the entire organization or its components (Kazeem, 2009). Specialized literature captures various aspects regarding managerial processes in crisis situations. According to a recent research, the following steps are presented: (1) crisis reduction stage, (2) crisis preparedness stage; (3) crisis response stage; (4) crisis recovery stage (Fung, Tsui and Hon, 2020). The Crisis Management TEAM (CMT) consists of intergovernmental and inter-organizational networks that are called upon to respond to a crisis (Wester, 2011).

In order to effectively cope with the Covid 19 health crisis, the need for resilience is active in order to best "capitalize on the opportunities it presents, needing appropriate (and often new) organizational capabilities, innovation and entrepreneurship" (Liu, Lee and Lee, 2020, p, 278). "Resilience has become increasingly important for individuals, organizations and society in order to thrive in the uncertain, risky, hectic and ambiguous world we live in today" (van der Vegt et al., 2015, p. 974). To successfully manage and combat a global health crisis, resilience is needed both through psychological training and through organizational and system-level training support. A vital aspect of resilience is the cultural differences that "need to be carefully examined and incorporated into the design of any intervention aimed at strengthening resilience at the level of individuals, organizations and society in general" (Liu, Lee and Lee, 2020, p, 279).

## **Materials and Methods**

In what regards essential services, the relevant national legislation, in accordance with the well-known NIS Directive ("EU Directive 2016/1148 of the European Parliament and of the Council of 6 July 2016 on measures for a high common level of security of networks and information systems in the Union" (<https://eur-lex.europa.eu>)), with specific address for essential service operators (ESO) in 7 sectors of economic activity: "energy, transport, banking, financial market infrastructure, health sector, drinking water supply and distribution, digital infrastructure" (Andersson, Charrie and Treeck, 2018, p. 10) and for Digital Service Providers (DSP) from three categories (online markets, online search engines, cloud computing services), specifies the conditions under which a service is considered essential, as follows: the service is essential in supporting the most important societal and / or economic activities; its supply depends on a network or computer system; the provision of the service is significantly disrupted in the event of an incident. Therefore, in this article we will conceptually use the essential notion in the extended sense, that of critical service.

Currently, the new crisis we are facing is caused by Covid 19. In December 2019, a severe acute respiratory infection caused by the new Covid 19 began to spread from Wuhan throughout China (Li Q., et al., 2020), and then affected the entire world (World Health Organization, 2020a). In the context of the Covid 19 pandemic, when an epidemiological outbreak threatens to have an impact on global economies and reputations, we find a global response through the overall link between the public health, science, politics, society and media sectors (McCloskey and Heymann, 2020). Therefore, communication plays an important role in the crisis management of essential services (Schultz, Utz and Göritz, 2011). This Covid 19 emerged so quickly that most organizations did not have time or had very little time to establish a strategy on how to run managerial processes in a crisis situation (World Health Organization, 2020b). Therefore, the main objective of each organization is to ensure that all employees, customers, suppliers, collaborators, etc. are informed about the real situation of Covid 19 and that important information is not missing. Organizations must also ensure that they take responsibility

following the advice of medical professionals and that activities continue to operate as smoothly as possible (Sohrabi et al., 2020).

Closely related to the pandemic evolution, managerial trends are heading towards the creation of a crisis plan on good management for the company's functionality. At European level, the European Commission is coordinating the Covid 19 pandemic by taking firm action "to strengthen public health sectors and mitigate the socio-economic impact in the European Union" (European Commission, 2020a; 2020b). At the same time, the European Union is directly involved in the proper functioning of essential service systems of general interest throughout Europe for the proper functioning of the society, ensuring the continuation of professional activities such as: medicine production, public emergency medical services, critical staff for public utility services, etc. (European Commission, 2020c).

The psychological impact on human resources on the Covid 19 pandemic regime is a vital factor in crisis management (Hamouche, 2020). "This pandemic crisis highlights the need for managers to be educated on the principles of implementation science in order to be able to make evidence-based decisions through an integrated, multi-sectoral response, taking into account contextual factors affecting implementation. This approach is essential in developing appropriate preparedness and response strategies during the current and future threats" (Binagwaho, 2020).

As jobs around the world are affected, management systems need to adapt to this new situation and develop managerial trends in order to prevent the damage that Covid 19 virus can cause. When referring to damage, we are referring to both safety and security, as well as to the productivity of the entire workforce worldwide. As the Covid 19 crisis spreads globally, organizations around the world are testing their training in crisis management. Particular importance is given to the way of managing the services that are essential for the good functioning of the company and for supporting the critical infrastructure systems, becoming a framework support in the development of management in critical situations (Badea, Bucovețchi and Iancu, 2020).

Following an analysis of specialized literature regarding different ways of crisis management, a number of researches on the topic process were selected. This study provides a set of good practices on service systems essential for the proper functioning of society and the trends manifested in the development of management. These proposals provide a general crisis management framework and provide guidelines on how to properly manage a crisis "in the context of disruptive events" (Bonanno, 2008, p. 102) such as Covid 19.

One model for managing the activity of organizations generated by the pandemic is the Kurzarbeit model. This model is a combination of the employment contract that each employee has and technical unemployment. The main feature of the model is the flexibility of the employees' work schedule, given that their activity gradually returns, as they recover the other areas of the economy, on which the employing entities are dependent. This model applies individually to each company, department, per employee and per day, and offers additional benefits. It is a system that extends the standard unemployment insurance system in three ways: (1) allowing workers to work fewer hours and the state pays proportionately unpaid time; (2) in the current pandemic context, job retention is important, even if employers do not work at all, a benefit for both the employee and the employer when they start work again; (3) allowing more generous incomes than usual unemployment. In Europe, the main measure to help workers has been the introduction or expansion of job retention schemes inspired by the Kurzarbeit scheme. The SURE program has been approved at the level of the European Union. It is aimed to reimburse the expenses incurred by the states for the Kurzarbeit type measures (European Commission, 2020d). In Romania, the implementation of this model involves the subsidy by the Government of a part of the salaries for those workers whose employers have changed their work schedule from normal to part-time, due to the economic crisis (Emergency Ordinance no. 92/2020). The details of the algorithm differ from country to country, but the essential principle is the same: employees keep their employment contracts with employers and receive a small reduction in wages, and the government pays most or all of the costs to employers.

Since the beginning of the threat of the Covid 19 outbreak, Korea has been facing a huge crisis. For a period of time, it was the second largest country in terms of the number of confirmed cases. However, this country has managed to slow the spread and prevent a second wave of infections and turn the medical crisis into an opportunity. "The Korean government and businesses have developed a variety of innovative prevention measures and products, for example: population testing and testing kits that can be used worldwide. Korean producers have the chance to revalue and restructure global supply

chains in order to make them more sustainable. Both the government and business sectors see clear growth opportunities in non-contact industries, including telecommunications, online education and distance learning solutions" (Liu, Lee and Lee, 2020, p, 280). Organizations can improve their reputation and help mitigate the negative impact of the global health crisis by implementing corporate social responsibility initiatives. "In short, resilience, strategic agility and entrepreneurship will continue to play a key role in capitalizing on the value of these opportunities in order to overcome the crisis" (Liu, Lee and Lee, 2020, p, 280).

Faced with certain challenges and an uncertain set of risks posed by Covid 19, "leaders are concerned about how their organizations will be affected and what they need to do next" (Deloitte, 2020). According to Deloitte, there are five key leadership qualities in organizational resilience during the COVID-19 crisis. Regardless of the magnitude of the impact of the virus on an organization, and although organizations are at different stages in what concerns their approach of the pandemic, which makes the impact vary by geography and sector, leaders need to be genuinely empathetic, treating employees, customers and their wider ecosystems with compassion, being "able to stabilize their organizations to deal with the crisis while finding opportunities through a series of key actions" (launching and supporting a crisis control center), maintaining continuity and funding of the business), maintaining as much illustrative data, even though information may be partially correct, in order to take decisive measures, anticipating emerging business models, etc. (Deloitte, 2020). The McKinsey team recommends five behaviors to help leaders during the Covid 19 pandemic for a good management and rebuilding of organizations: organizing through a network of teams, displaying deliberate calm and optimism, making decisions against uncertainty, showing empathy, and effective communication (McKinsey & co, 2020).

In terms of the medical system, the Covid 19 pandemic "brings new challenges to health systems, even to well-developed ones" (Médecins Sans Frontières, 2020). In order to face these new challenges, it is vital to observe and also act based on the experience of the countries affected by this virus, for example Italy, China, etc. It is important for healthcare systems to adapt and implement strategies. The experience of organizations in supporting communities facing the Covid 19 pandemic recommends "the protection of front-line personnel as a first step in combating this outbreak. Thousands of them get sick in the affected countries, so keeping them safe and free of infections is essential. The next step is to realize that although hospitals are vital, home care and information are very important. In an outbreak, it is not recommended that attention be focused only on hospital care; GPs and family doctors have a key role to play, and the wider community must be taken into account. People in health care facilities are at huge risk of Covid 19, because older people are the most vulnerable and live in close contact in these facilities, so it is important to reorganize the way these centers are run" (Médecins Sans Frontières, 2020).

Following the launch of an appeal to all members of The Romanian Academic Society of Management (SAMRO), on what and how to proceed in the current conditions, especially for the contribution to shaping an effective and efficient post-crisis management in Romania (SAMRO, 2020), we highlight some answers that are closely related to the topic of this article: (1) a negative factor manifested in the countries affected by the pandemic is the lack of stocks of medical supplies needed by the first line of defense personnel, this having multiple consequences: at the level of the person (risk of personal infection, colleagues, family, friends) and at the level of health organization (medical staff removed from the activity, therefore reducing the functionality of the medical system); (2) digitization is necessary and requires training / development of skills to understand and work in the online environment, and new developments are expected in the intensification of digitization - there is a high probability that virtual / online learning will become a component of education in the near future; (3) the closure of schools and universities can have a long-term negative impact on students, with regard to the online teaching and assessment process, which will later reflect on the labor market both at individual level and society-wise.

This crisis also demonstrates the need for management to move from a quantitative to a qualitative approach, which is also "imposed" by the characteristics of the industrial revolutions (Figure 1), an aspect that must be corroborated with the tendencies of crises (almost regardless of type) to exceed local or regional borders. Concepts such as VUCA (volatility, uncertainty, complexity, and ambiguity) demonstrate their paradigmatic value by determining the re-instrumentalization of management for an "open world" and the full incorporation of ideas of communities and citizens into management systems, ideas that were first circulated 10 years ago by the famous group by North American specialists, "Renegade Brigade".

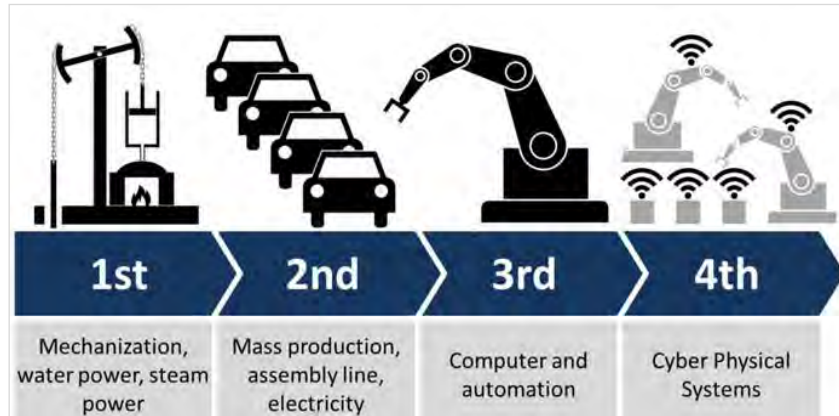


Figure 1. Characteristics of industrial revolutions

Source: <https://stiintasitehnica.com/patra-revolutie-industriala-8-previziuni-despre-schimbarea-lumii/>

## Discussion and conclusions

The global and interconnected nature of essential services presents an important risk in the pandemic context, and consequently requires a critical analysis followed by a series of proposals for sustainable management in order to have a low social, economic and environmental impact.

In this article, the crisis is presented as a significant threat to the basic processes and, implicitly, on managerial processes and can have negative consequences if not managed properly. In most cases, crises can create threats in three directions: public safety, financial loss, loss of reputation. The Covid 19 pandemic context unites all three threats that an organization may face. If the managerial processes are not managed correctly or in due time, the health of the employees and not only, can be endangered. This will immediately have a negative influence on the organization's reputation and bring about inevitable financial losses.

The implementation of advanced information technologies and digitized applications contributes to reducing the impact of the pandemic crisis in the sense of favoring communication and process management within critical service systems. The use of SCADA systems also favors the continuity of activities, allowing the reduction of the presence of staff at work.

The potential generated in the field of organizational learning must be also pointed out in the sense of identifying good practices and awareness of the usefulness of viable contingency plans, and implicitly of internalizing the values of standards in the field of security and business continuity.

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# DIGITAL LABOR IN THE CONTEXT OF GLOBALIZATION

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## Abstract

**Purpose** – *The paper is dedicated to the analysis of opportunities stemming from digitalization, in terms of digital labor, as a tool for globalization. Throughout recent decades, globalization has become a strong force. This paper examines various aspects of digital labor.*

**Methodology/approach** – *The theoretical and methodological basis of the research is determined by a systematic approach which allowed defining the precise scope of this analysis. The methods combining logic, deduction and induction were used in the course of the research.*

**Findings** – *Globalization, technological innovation, and digitalization are among the most significant drivers of long-term growth. New digital systems offer tremendous benefits for the people. Objects, places, people, society are now being interconnected in a way that fundamentally changes the way we run everything, including labor.*

**Research limitations/implications** – *The development that we addressed is still in its inception and is expected to increase exponentially in the coming decades.*

**Practical implications** – *Development of digitalization creates favorable conditions for digital labor. Consequently, every country seeks opportunities for digitalization, on the basis of fast development of the digital technologies, to enter global markets.*

**Originality/value** – *Authors conceived and designed the study built on reviewed literature and on the statistical data.*

**Key words:** *globalization, digitalization, digital labor*

## Introduction

From the beginning, digitalization has been associated to globalization, first being subordinated to globalization and then second, as an element increasing the speed of globalization. The relationship between globalization and digitalization is not inherently one-way but can evolve in tandem.

Globalized business processes, digitalization, enhanced international competition and the struggle for adaptation in order to integrate into the international environment set new challenges for the world's countries which need to be efficiently tackled in the shortest time possible. Understanding the role of the digital economy as an instrument of the globalization process is mandatory in order to establish priorities for the development of national economies that in turn will stimulate the development of our society. Digitalization both at the macro (i.e. country) and micro (i.e. organization) level is among the main priorities. Digitalization increases productivity, creates new jobs, and thus leads to overall economic growth.

In recent years the rapid growth of online platforms has been the focus of considerable studies. Online platforms allow individuals and organizations to exchange information and expertise more easily, rapidly and effortlessly than at any time in human history, thus promoting the growth of collective knowledge. Not being tied to the places where they live, workers are now able to do digital work which originates from anywhere. Digitalization brought jobs that might have not been available before in certain labor markets or locations.

## **Digitalization into the globalization framework**

The corporate world is characterized by high complexity and dynamism, as well as by the globalization of competition and digitalization. Competition became considerably more intense in recent years because of the increased national border opening, growth of multinationals and digital networks. The economic success of the organizations depends on their ability to innovate. Innovation processes have greatly developed due to the decentralization of knowledge and talent centers and digital networking. The use of digital information and communication technology offers new possibilities, such as Internet-innovation networks, which are a basis for collaboration in science and research, thus enabling teamwork without limits in terms of time, geographical location and distance.

Digitalization can be described as using digital technologies to alter a business model and provide new prospects for revenues and value development, which means transitioning to a digital business. Digitalization is a technological drive that strengthens economic and cultural globalization. The digital economy produces new products, defines new needs and rises the speed and the amount of information every day.

The effect of digitalization on increased globalization can be seen in a variety of ways, including digital goods, improved flows of products and services, online networks, enhanced cross-border connectivity and globally dispersed teams. Nevertheless, labor and talent have been much slower to globalize relative to the movement of consumer goods and financial resources across countries.

In this scenario, there are some opportune questions: what effect does the economy's digitalization have on globalization processes? Does digitalization strengthen globalization? How does digitalization affect market features, organizational structure or job availability? What challenges does digitalization prepare for the workforce, for global economy and for us all?

## **Digital labor disregards the borders**

People and their work have traditionally come as a single, completely integrated package, which makes location decisions complex. If someone or an organization seeks to access labor available abroad, one alternative is to attract and host the person, temporarily or permanently, near the location of the work that has to be performed. For different reasons this has proved to be politically controversial and almost every nation imposes limits on migration. A second alternative is to find out how the needed work can be shared at a distance, without requiring physical migration of the person. The horizon of time and location associated with the fulfillment of working tasks in another place or country has become a major force in business functions where tasks can be performed effectively at a geographical distance. The attention moves from "trade in goods" to "trade in tasks needed to be performed" (Grossman and Rossi-Hansberg, 2008).

Digitalization enables remote work across borders. Individuals create their own cross-border connections thanks to social media and to internet platforms. Individuals with imagination and motivation can launch themselves onto a global stage in ways that would have been impossible in the pre-digital era. Globally dispersed teams work together remotely across borders and in this way digitalization brings together talent from all over the world. Digital talent platforms have the capacity to better match the workers and the jobs, creating efficiency and transparency in labor markets (McKinsey Global Institute, 2017). Organizations can access a global pool of talent. Talented people from poor or developing countries are now able to compete with people from rich countries.

Besides all digital labor's advantages, a number of significant issues for workers also arise. One of the issues is the wide over-supply of labor force. This issue shows that sometimes there are ten times as many online job seekers on one platform as the workers who manage to get a job (Graham, Hjorth and Lehdonvirta, 2017). This excess in labor supply has the effect of reducing labor costs and limiting workers ability to negotiate for better conditions. Workers feel that they are competitors on global markets, recognizing that if they do not do a job or task at the level and conditions for which they were offered, someone else might do it. Another issue is that workers are considered self-employed rather than employees who deserve the rights of employees and could benefit from collective organization (Graham et al., 2017).

## Digital labor across European Union (EU)

As we mentioned earlier, digital platforms provide to the people new ways to interact, collaborate, learn, develop new skills, find freelance work or a job to an employer to whom to showcase and prove the own talents. Digital labor has some mandatory basic requirements: internet access, digital technological equipment and proper digital skills. The EU's internal labor market has promoted cultural exchange and is currently the most common pillar of the EU (Barslund and Busse, 2014).

In 2019, 90 percent of households across Europe had internet access at home, through fix or mobile connections, up from 83 percent five years ago. In what regards the percent of EU citizens' use of mobile devices like mobile phones, laptops, tablets or other mobile devices in order to access the internet on the move via mobile or wireless connection, this was 75 percent in 2019 compared to 57 percent in 2015.

While already 90 percent of citizens used the internet in 2019, only 58 percent had at least basic or above basic overall digital skills. You cannot fully take advantage of digital technologies without the digital skills. Increased numbers of internet users do not automatically develop digital skills. Although, both basic and advanced digital skills have improved over the past years, the percentage of people with at least basic or above basic overall digital skills only slightly grew from 55 percent in 2015 to 58 percent in 2019. In 2019, the Netherlands and Finland were the EU's front-runners, while Bulgaria and Romania lagged behind, with a huge gap of almost 50 percent in between. However, a significant proportion of the EU population still lacks basic digital skills, while the majority of jobs require these skills. In school curricula across all EU countries, basic and advanced digital skills need to be improved.

In 2018, around 9.1 million people across the EU worked as Information and Communications Technology (ICT) specialists, 1.6 million more than four years earlier. Nevertheless, there is still a deficit of ICT specialists on the labor market: 64 percent of large companies and 56 percent of small and medium-sized enterprises that recruited ICT specialists in 2018 found it difficult to fill ICT specialist vacancies. The problem is even more common in Romania and Czech Republic, where these difficulties were identified by at least 80 percent of companies that recruited or tried to recruit ICT specialists. There is also an issue of gender balance, as only one in six ICT specialists is female.

The internet use rose continuously with 79 percent of Europeans surfing the internet every day or almost every day in 2019 compared to 67 percent in 2015. The figures refer to internet use in both private and work/business related circumstances. In 2019 the estimates range from 57 percent in Romania, 60 percent in Bulgaria to 90-92 percent in Finland, Sweden, Denmark and Netherlands. Furthermore, the percent of EU individuals that use the internet for sending/receiving e-mails was 75 percent in 2019 compared to 69 percent in 2015. In 2019 the figures range from 40-43 percent in Bulgaria and Romania to 90-94 percent in Finland, Netherlands and Demark. The use of video calls has risen the most, in just one year, since 2018 till 2019, the percent of internet users who were engaged in video calls grew from 49 to 60 percent. We have to point out the fact that in 2018 the percentage of EU's individuals working from home every day, almost every day or at least once a week but not every day was 5 percent and of those who used the internet for the job when working from home was 15 percent.

We have to mention that in 2019 the percent of individuals across EU using the internet for job search or sending a job application was 17 percent. The figures range from 32 percent in Finland, 30 percent in Sweden and 25 percent in Netherlands to seven, six and five in Bulgaria, Czech Republic and Romania, respectively.

Digital technologies influenced very quickly the economy and our society. The digital revolution offers a huge opportunity for society. It is one of the greatest forces for prosperity, employment and well-being nowadays and in the years to come. All countries need to be aware and to take advantage of these opportunities.

## Tracking European Union (EU) digital performance and the access to digitization

The Digital Economy and Society Index (DESI)<sup>1</sup> monitors the overall digital performance of Europe and tracks EU countries' progress in digital competitiveness. Figure 1 presents EU Members States ranking on the 2020 DESI based on 2019 data.

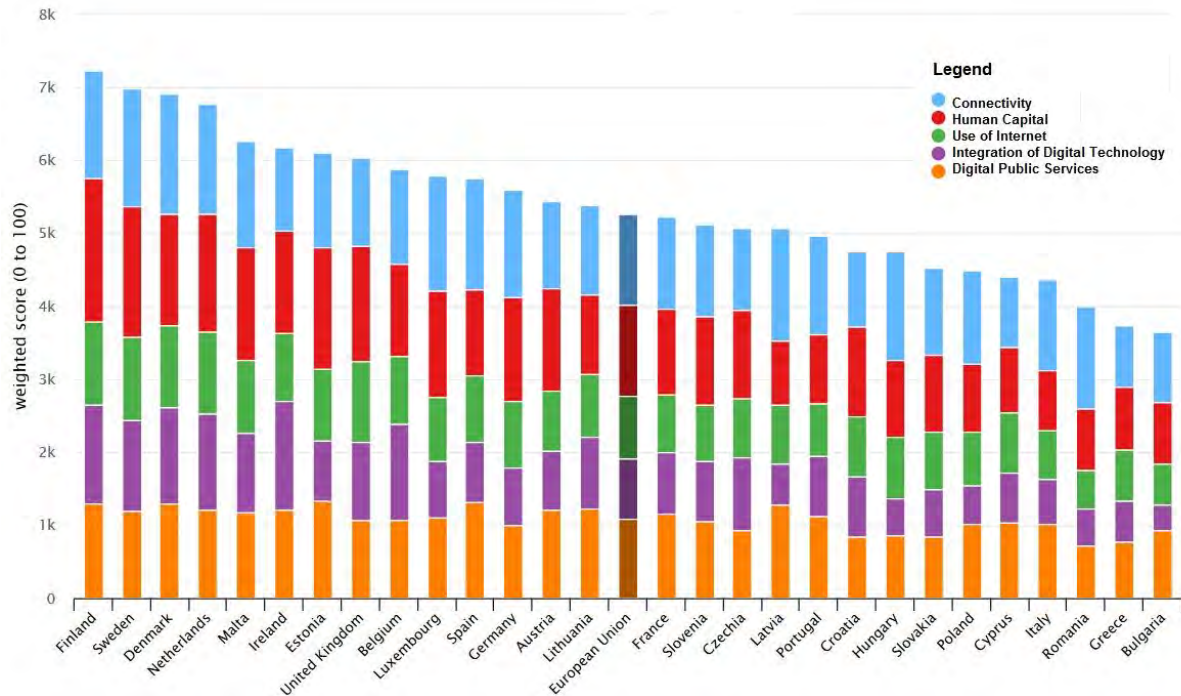


Figure 1. Digital Economy and Society Index, 2020

Source: DESI 2020, European Commission

All EU countries enhanced their digital performance over the past years. Finland, Sweden, Denmark and the Netherlands achieved DESI 2020's highest scores and are among the world leaders in digitalization. It is necessary to underline the fact that EU large economies countries like Germany, Italy or France are not among the digital leaders in 2019. In what concerns the progress of European Member States as regards the overall level of digitization of the economy and society, over the last 5 years, the most notable improvement is noted in Ireland, followed by the Netherlands, Malta and Spain. Finland and Sweden, even though they are leading the list of the countries in matter of digital performance, they are marginally above average in terms of progress over the last five years. Little progress was also registered in the countries with a level of digitization below the EU average or in those that are placed at the end of the ranking, countries like Bulgaria, Greece and Romania. Nevertheless, all of these Member States have recently set up many initiatives, policies and measures in different areas tracked by the DESI. These initiatives require solid implementation and investments and the effects, hopefully, may be evident in the coming years. Nonetheless, there is still a long way to go for some countries, and in order to be able to compete on the global stage, the EU as a whole requires change.

<sup>1</sup> DESI overall index is calculated as the weighted average of the five main DESI dimensions with the weights selected by the user: Connectivity (fixed broadband take-up, fixed broadband coverage, mobile broadband and broadband prices), Human Capital (internet user skills and advanced skills), Use of Internet (citizens' use of internet services and online transactions), Integration of Digital Technology (business digitisation and e-commerce) and Digital Public Services (e-Government). The DESI 2020 reports are based on 2019 data. The United Kingdom is still included in the 2020 DESI, and EU averages are calculated for 28 Member States.

## Conclusions

The evolution of digitalization made possible by robotics and artificial intelligence promises higher levels of efficiency, as well as increased protection and convenience. Digital technologies also change the world of work and generate whole new kinds of digital or virtual labor. Digitalization influences labor demand, skill requirements and organization of work. Both workers and businesses looking to expand in the digitalized world need new capabilities.

People with an internet connection and the basic or adequate digital skills can be employed in a wide variety of online activities. However, one of the key barriers to the digitization is the digital knowledge gap, which is caused by low rates of digital proficiency. Lack of digital skills decelerate further development of the society and economy. Adequate digital skills enabling people to access knowledge and resources are important for the entire population. Digital skills are mandatory for the successful and effective use of solutions for remote work and easier access to networks.

Digital labor associated with globalization is not limited by the national borders or by the national identities and it generates cultural mixing, transnational dialogue and collective knowledge. Under the unrestrained communication landscape provided by globalization and digitalization, the world feels like just one single nation. Even though digital communication gives access to, supports and intensifies multinational teamwork, the nation-centered framework is not weakening. This happens due to the fact that digital labor does not imply physical migration. Now, people have the opportunity to live in their native country, near their beloved ones, to enjoy their native customs and traditions and in the same time to work abroad through digital labor.

The emergence of the knowledge society ensures that economic growth is subordinated to the qualitative parameters of social and economic development. Future development would, after all, be dictated not only by the output of goods but also by the increased use of knowledge and talent. Digital labor paves the way to digital economy. Nowadays, to be able to handle competition, digital labor must be integrated into the global business environment.

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# COMMUNICATION BETWEEN SUPPLIERS OF GOODS, SERVICES AND CONSUMERS IN THE FIELD OF ELECTRONIC COMMERCE IN TERMS OF CONSUMER PROTECTION

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## Abstract

*In recent years, e-commerce has gained considerable momentum, being present in the daily lives of most active people, young people, but viewed with great interest and by the elderly but eager to be up to date, especially in the current context of global trade rules. The new trade measures imposed by the state in the world in the context of COVID-19, ensure a greater visibility but also vulnerability of electronic commerce, which imposes a series of new rules, necessary to be adopted by economic agents which invariably leads to the application of almost unitary international of the new requirements. The paper analyzes the way in which the Romanian consumer adapts to the international conditions of electronic commerce and to what extent he has an identical or almost identical behavior with the international consumer.*

**Purpose** – *The role of this paper is to highlight in the spirit of this dynamic of the evolution of e-commerce, the optimal forms of communication between the parties involved so that the consumer is satisfied with the result of the process of purchasing goods and services through the online system and the selling company can develop communication, new, secure and reliable systems for presenting and selling products and services, while adapting to new consumer requirements.*

**Methodology/approach** - *Relevant statistical data are collected and centralized for the two types of trade, classic and online, data related to three years, useful for forming a clear but punctual opinion on the state we are in, both in relation to the domestic and international market and to what extent can communication improve this sector.*

**Findings** – *The centralization of the data found that in terms of online commerce, consumers in the NW region of Romania face the same types of problems as consumers in other states, which is highlighted by comparison with international statistics published by various institutions approved in the field of electronic commerce. and we are also willing to buy and spend more money on online transactions just like consumers in other countries.*

**Research limitations/implications** – *In the context of globalization, the management of the relationship between suppliers and consumers in the field of electronic commerce is an important issue in terms of the current situation in which a special emphasis is placed on online activities both nationally and internationally.*

**Practical implications** - *It was analyzed in terms of data collected and centralized at the level of consumer protection Cluj the reasons why some consumers choose to buy products and services online compared to consumers in other countries, according to data taken from international statistics published online*

**Originality/value** - *Acquisition of a relevant number of data from the Cluj consumer protection institution, which in fact reflects the regional, maybe even national, trend. The data were collected with the agreement of the management of the above-mentioned institution.*

**Key words:** *e-commerce, communication, consumer protection.*

## INTRODUCTION

The current outbreak of COVID-19 has led to a major disruption to people's daily lives, work and travel, while affecting the way they purchase goods and services in the traditional system through direct sales. Many European companies have thus moved their activity mainly online, trying to adapt to the new conditions, which has invariably led to the adoption of relatively uniform e-commerce procedures. It is a considerable effort by economic operators to adapt to a type of global trade in the online environment, given that European bodies anticipate a severe crisis on the European economy. (Europe, 2020)

In an extremely short period of time, COVID-19 has highlighted how much economic power has shifted to the customer and how this change has widened the gap between those who are in the field of online commerce and those who are not. All companies, not just those in Europe, are now more aware than ever that e-commerce is essential and that they need well-defined digital strategies. (KPMG, 2020)

The major interest in online commerce is highlighted by several international statistics for 2020 (Mohsin, 2020): 1,8 billion people shop online, aproape 50% of consumers shop more on mobile than in-store, because of the coronavirus 42% of the US population bought groceries online in March 2020, nearly double the 22% in 2018.

This paper is important by the way the Romanian consumer is analyzed in comparison with the consumer from other states using the same analysis parameters.

We analyze through the collected data whether the consumer behavior in the NW region of Romania, a representative area for trade and consumption throughout the country, is comparable to the behavior of international consumers.

Taking into account this aspect, the behavioral changes of the international economic agents will affect to the same extent both the consumer from the country where the enterprise originates and the rest of the world and to the same extent the Romanian consumer, the borders not existing in online trade.

The paper is current in terms of data collected and centralized in the last three years, data provided by the consumer protection institution Cluj which is responsible for six counties in NW Romania and also capitalizes on essential data on the perception, understanding and usefulness of e-commerce in the current global context.

Summarizing the data collected, it was found that the problems highlighted by the Romanian consumer are largely identical to those reported in various publications and international reports on consumers in other countries, not just European.

Also, from the analysis of these data as well as from the cited publications it appears that through a good communication of the factors involved in the online trade almost all the impediments of this type of commercial activity can be solved, taking into account the globalization of the trade act. The usefulness of the chosen topic also emerges from the title of the paper due to the extremely important role that communication has in the relationship between the consumer, the company and the authorities.

## BACKGROUND

The main topics used in this paper on which the research was built are e-commerce and communication.

Since the 2000s, the emphasis has been on e-commerce communication, (Lee, Corbitt, & Kong, 2000 ) examines the typology of e-commerce in terms of communication and uses this typology to examine the role and nature of the relationship created in the practice of e-commerce.

Effective communication between these parties will lead to positive financial results for the company.

The influencers described in "What e-commerce communication strategy should you adopt in 2019" (Herpin, 2018) are people who are part of the e-commerce landscape and who motivate their audience through a specific form of communication.

Communication formats according to the paper „*Building an Agile Communications Strategy*” (Oracle Corporation, 2014) they can include several types, such as those commonly used to print specific customer access documents, interactive formats, and responsible formats that allow for a logical view of the content.

Factors described according to (Baubonienė & Gulevičiūtė, 2015) leading to the decision to shop online and develop an understanding of the factors that influence online shopping by consumers can be divided into those that offer benefits, namely security, fast delivery, comparable price, comfort, cheaper prices and a range wider and on the other hand the disadvantages.

Disadvantages can easily turn into advantages if we use effective communication through which the consumer understands the benefits of online commerce. The role of selling companies is to use all communication strategies in such a way that the consumer notices the advantages of this type of online commerce compared to traditional commerce.

Communication between suppliers of goods or services and consumers is of major interest in the context of the exponential growth of the type of trade defined as "e-commerce", "online commerce" or the international language "e-commerce".

This topic on e-commerce communication in all its forms can be topical and requires careful consideration due to the existence of an imbalance between the participants. Thus, companies operating in the field of online commerce have the economic power that allows them to apply working methods beneficial to their financial interests often using aggressive promotion techniques, while on the other hand the consumer presents himself as a vulnerable and destitute person. The levers needed to balance this balance.

The success of the business depends on the communication between employees and employer, owner and manager, manager and employees, salespeople and customers, etc. (Kumbhar, 2014).

## **RESEARCH METHODOLOGY**

The paper is based on research literature and based on a synthesis of centralized data related to the last three years, used with approval in this research. At the same time, bibliographic research highlights the importance of communication techniques used by stakeholders.

Thus, the comparison by which the behavior of the Romanian consumer is analyzed compared to the behavior of the international consumer is based on the bibliographic research using the specialized literature that identifies the problems of the international consumer as well as various statistical data by which the purchasing decisions are analyzed. and services and on the other hand a centralization of some data close as content and significance of those highlighted in research literature, data that are collected from the institution of consumer protection Cluj and subsequently centralized.

The main reasons that determine buyers to choose a certain type of trade, respectively online or offline, and on the other hand the reasons for dissatisfaction of both types of buyers are identified.

Communication between suppliers of goods, services and consumers in the field of e-commerce in terms of consumer protection is analyzed through a research that uses centralized data of the consumer protection authority, collected and centralized over 3 years, respectively 2017, 2018, 2019 and partly 2020. It is thus verified to what extent an efficient communication between the factors involved in solving some management problems leads to a favorable solution for the consumer in the shortest possible time.

In terms of data collected and centralized for the years mentioned resulted a large but relatively constant number of complaints and complaints from consumers addressed to economic operators for violation of rights, respectively 3715 in 2017, 3809 in 2018, 3067 in 2019 and 608 in the first 2 months of year 2020.

From the interpretation of the data, it must be clear whether the reasons that lead buyers to buy products and services online or directly from stores as well as the reasons for dissatisfaction associated with both types of trade, but also ways to improve communication that could reduce dissatisfaction of both categories. Romanian consumers, are also found in the results present in world statistics.

## RESEARCH FINDING

After interpreting the graphs resulting from the centralization of the data, a comparison was made with the data resulting internationally, presented in several papers. This information, which refers to the communication present in e-commerce and the traditional one at international level, is important to understand what will be the next steps in the future, taking into account the ascending evolution of e-commerce. They are useful in formulating conclusions that can lead to improved communication between the factors involved in the process of purchasing products and services online, described above.

The description of commercially non-compliant facts by the consumer is essential in centralizing the initial data, as shown in Figure 1.

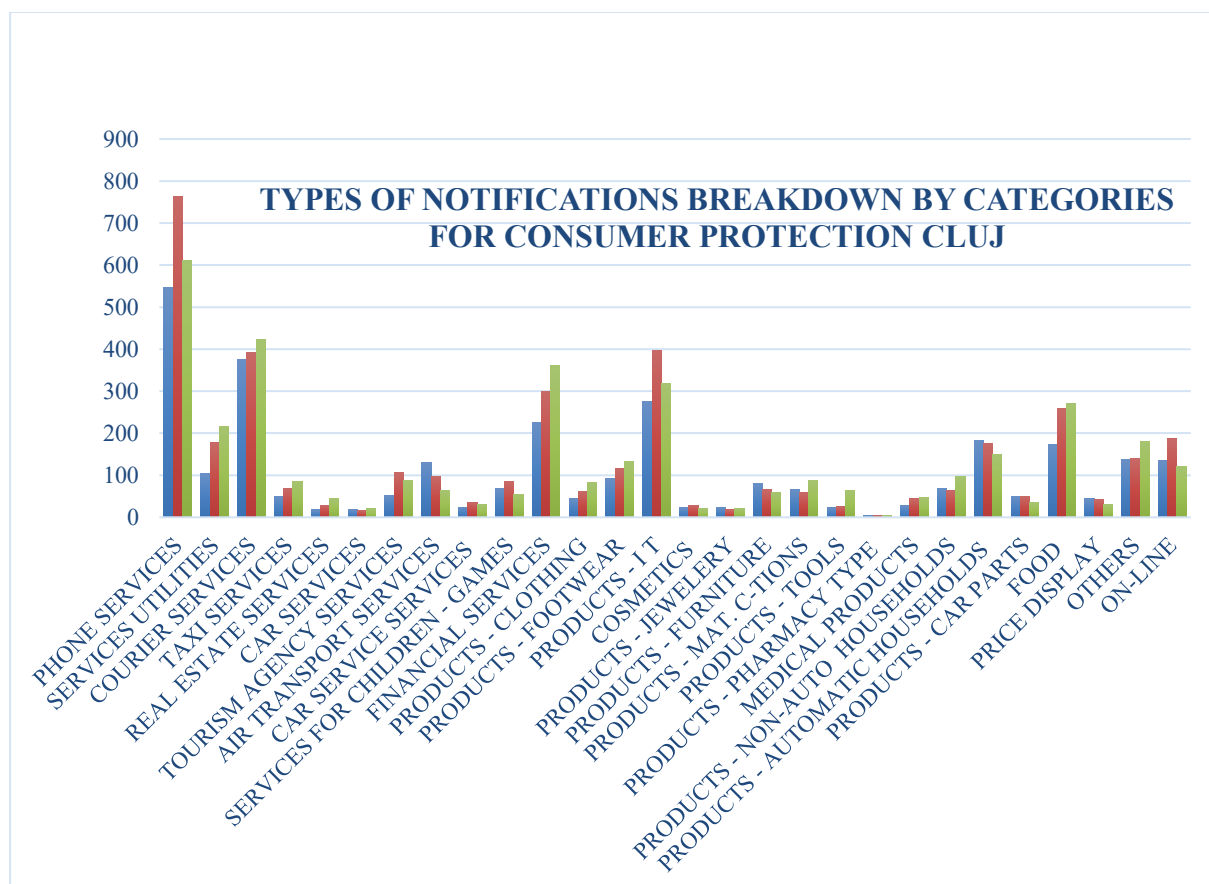


Figure 1. Consumer complaints broken down by categories registered for consumer protection Cluj, before their actual research, seen through the prism of consumers in 2017, 2018, 2019 and partially 2020

By comparison, reasons for international consumers, other than those in Romania, to buy from stores, ie purchased offline at the expense of online purchases, according to (KPMG Report, 2017) the following are in descending order: I want to see or touch the product, I want to try, delivery time is too long, purchase costs are too high, I like the shopping experience, I will go shopping anyway, I want to check through my own senses the authenticity of the product, the form of return of the goods is too complicated I do not trust online commerce and lastly, is the desire to actually talk to a seller.

The data resulting from the centralization of statistical data at the level of the consumer protection institution, the situations are similar to those present in statistics performed at the international level. Thus, the annual global report on online consumers in 2017, prepared by KPMG and presented in the paper, states eloquent data based on an online survey applied to 18,430 consumers living in more than 50 countries aged between 15 and 70 years old, and who have purchased at least one consumer product online in the last 12 months. According to this report, as in Figure 1, the reasons why shoppers choose classic stores over online ones are shown. The desire to touch or see the product, to try it, to see if it

looks different, are the most chosen options by international consumers followed by the statement that the delivery time in the online case is long, which creates a disadvantage for the customer.

Thus, the reasons and factors for which Romanian consumers choose to purchase products or services directly from stores at the expense of online purchases are similar to those in the international statistics.

However, taking into account the change produced by COVID 19 in the entire act of trade, online commerce is clearly detached from the classic trade, almost all economic agents who understood the phenomenon and did not cling to the past, took the step and began to offer services and in the digital sphere.

This has invariably led to deficiencies in the act of electronic commerce, an aspect reported by all consumers regardless of the country where they purchase products or services.

It should be noted that 88% of customers consider that highlighting the details of the products to be purchased are crucial for making an online purchasing decision. (Ouellette, 2020), aspect also found in the decisions of the Romanian buyer.

As consumers continue to change their types of online shopping (KPMG Report, 2017), Retailers who understand the factors that motivate them to shop online or in-store will be better positioned to create sales-specific communication channels that meet the needs and preferences of their customers.

Among the reasons described in the report based on which customers choose online stores, we mention in descending order of interest: the ability to buy 24/7, the ability to compare prices, selling online means a competitive price, save time, convenience of purchase, great variety of products, all in one place, the products I am interested in are not found in my area of residence,

Another study (Fang, Wen, George , & Prybutok, 2016) conducted on 651 online shoppers, empirical evidence shows that both age and gender can affect the intention to buy online in terms of the quality of the product or service, respectively the quality of communication, as well. These values are also found in the case of consumption in Romania, a fact highlighted by the centralized data on consumer protection in the NV Cluj Region.

The Romanian consumer finds himself with the same types of problems among international consumers according to the data centralized at international level in the paper (Hunter & Riefa, 2017) respectively: non-delivery of purchased products, long delivery time, questionable quality of purchased product, delivered product that does not match the order, defective delivered product, lack of nearby service for repair, higher final costs than initial, impossibility to return the product and non-receipt of the amount paid and lack of information on the seller's data.

Understanding the online phenomenon is essential for the future of this type of business. The caution and vigilance regarding what follows leads us to evaluate much better the decisions to purchase products or services online, which led to a decrease of about 9% in transactions in May and June of this year. (Paul, 2020). By comparison, we can say based on the centralized data that the Romanian consumer is also in this category, of those who pay attention to the money paid to achieve an economy, taking into account the current context.

## **CONCLUSIONS**

The interpretation of the data also shows that not all non-compliant aspects of traders are reported by consumers, time playing an important role and the communication of disturbing or unrealistic aspects of the act of trade are overlooked by consumers. The small financial inconvenience for the consumer determines him to accept the loss, a fact that the selling companies take advantage of financially.

Given that in this period deeply marked by restrictions on the purchase of products and services offline due to COVID-19, merchants who sell products online take full advantage of the major interest of consumers in this way of shopping, which leads, in the medium or long term, to a degradation of the quality of the online trade act, a fact highlighted by the increase in the number of complaints and the lack of interest in communicating with the customer.

The issues presented lead to the conclusion that consumers are increasingly willing to buy more products from all categories online and spend more money on online transactions while respecting in principle the same predominant factors regarding the decision to buy or not a product or a service, both international and local.

Thus, the results of data centralization in the institution of consumer protection Cluj fits almost perfectly on the international model, in the sense that this trend towards often aggressive or misleading communication from many selling companies to attract more customers, regardless of the subsequent loss of customers is manifested not only in the Cluj region but also internationally.

It is gratifying that since the Romanian consumer falls into the same pattern as the international consumer, we will have to adopt the same strategies of the big players in the online market under the careful regulation of the profile bodies specific to each community.

Highlighting and applying a common strategy regulated in the e-commerce market without taking into account borders, shows the direction we are heading, respectively a globalization of these commercial activities carried out by almost all companies and communication is the key to implementing these mechanisms successfully.

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# AN OVERVIEW ON THE IMPORTANCE OF SUSTAINABILITY AND THE ENVIRONMENT

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## Abstract

**Purpose** – *The evaluation, reduction and minimization of the consequences and the negative impact human activities have on our Planet, in order to increase the quality of life of both current and future generations*

**Methodology/approach** – *Based on the analysis of the literature in the field of Sustainability and Environment*

**Findings** – *Sustainability means awareness, not human sacrifices. Through awareness, things can be done differently than we are used to, and our long-term decisions can have positive results on the environment, reducing the negative impact of our actions. As a principle, Sustainability is important to be applied in all areas of activity, in order to meet the basic needs and to provide the necessary resources for a qualitative life in health and education.*

**Limitations/implications** – *Any type of development, but especially economic development requires measures of efficiency, especially of human resources, but also other types of resources, as well. Sustainability must be implemented at all levels of society, in order to reach a sustainable society.*

**Practical implications** – *Sustainability refers not only at changing people's behavior towards the environment, but also at changing the conception of the economy and society. A major challenge for Sustainability is to find solutions to encourage economic activities that have a lower negative impact on the environment and discourage activities that harm the environment*

**Originality /value** – *The importance of approaching Sustainability taking into account the four types of development capital: human, economic, social and environmental*

**Key words:** *sustainability, environment, the '3P', sustainable product, technological development*

## Introduction

Concerns about protecting the environment as well as raising people's living standards have increased worldwide.

A major problem that exists world wide is caused by some anthropogenic activities, which result in the destruction of resources, that increasingly become insufficient; pollution has effects on both human, plant and animal health, causing the extinction of some species in large numbers, as well as climate change; all this resulting in an increasingly rapid deterioration of the environment.

The sustainability of society and the proper management of all resources and necessities that need to be implemented represents the way to solve all problems at a society level.

One of the major challenges of our era is to protect the environment to meet the needs of present and future generations.

The objectives of each generation are the technological, economic and social development, between which there is a close interdependence as they result in a better life. The consistency of achieving these goals has led to the current stage of development.



## Sustainability

The Sustainability Science is a new field in the scientific research, that was officially launched in 2001 in Amsterdam, at the World Congress 'Challenges for a Changing Earth 2001', organized by the International Council for Science, International Geosphere - Biosphere Program, the International Human Dimensions Program on Global Environment Change and World Climate Research Program. In 2006, the Journal of Sustainability Science was published, and in February 2007, another journal entitled S.A.P.I.E.N.S [Surveys and Perspectives Integrating Environment and Society - <http://sapiens.revues.org/>] was published.

These two journals are devoted to studies on Sustainability in different areas of human activity. The science of Sustainability is based on the concepts of Sustainability and Sustainable Development [Komiya H., Takeuchi K., 2006], and the methods of measuring Sustainability provide the database necessary to substantiate policies and governance in this field. [<http://mone.acad.ro/wp-content/uploads/2014/08/Prelegere3sept.pdf>]

Achieving Sustainability will allow the Earth to continue to support human life



Figure 1.

[<https://ro.wikipedia.org/wiki/Sustenabilitate>]

According to the Romanian language Explanatory Dictionary, sustainability is **'the quality of an anthropic activity to be carried out without exhausting the available resources and without destroying the environment, therefore without compromising the possibilities of satisfying the needs of the next generations'**. [<https://dexonline.ro/definitie/sustenabilitate>]

The 1992 World Environment Conference in Rio de Janeiro paid particular attention to the concept of **Sustainability**, which involves striking a balance between economic growth, environmental protection and finding alternative resources.

**'Therefore, I can say that the earth belongs to every generation during its existence, which is fully and entirely entitled to, no generation can incur greater debts than can be paid during its own existence'** – [Thomas Jefferson, September 6, 1789]

**Sustainability** is the ability to last.

**'The word durable (sustainable) has roots in Latin, sustaining meaning 'to hold back' or 'to support from below'. A community must be supported from below by current and future residents. Some places, through the specific combination of physical, cultural and perhaps spiritual characteristics, inspire people to take care of their community. These are the places where sustainability has the highest chances of existence (maintenance)'**- [Muscoe Martin, "A Sustainable Community Profile," from Places, Winter 1995]

**'Sustainability refers to the ability of a society, ecosystem, or any such existing system to function continuously in an indefinite future without depleting key resources.'**- [Robert Gilman, President of the Context Institute].

When referring to the overall economic development of a country or region, the term **sustainable development** is usually preferred. [<https://ro.wikipedia.org/wiki/Sustenabilitate>]

Sustainability becomes a model of development only if countries, economic sectors, companies and people are aware of, appropriate and use its principles.

In a world where there are resource constraints, where ecosystems are degrading, where climate change is influenced by human activities and where economic growth has failed so far to include the entire population of the planet, the company's role is no longer sufficient to generate sustainable development [V Danciu - *Theoretical and applied economics*, 2013 - store.ectap.ro]

The report of the World Commission on Environment and Development (1987), known as the Bruntland Commission, considers **sustainable development** as 'a way of development that meets the needs of the current generation, without compromising the ability of future generations to meet their own'.

**The role of Sustainability** is to maintain the balance between the environment, the social and economic environment, between which there is an interdependent link, avoiding its irreversible transformations.

Due to anthropogenic activities which have a negative effect on the environment for extended periods, the result is imbalance and degradation of the ecosystem. If no initiatives are taken, and sustainable strategies and solutions with long-term benefits are not established, negative results will continue to emerge at a faster pace in the future. Slowing down and reversing the deterioration of life's quality and of the environment are things that take time. All efforts to improve sustainability need to be long lasting and permanent, in order to keep the company running while producing profit, without jeopardizing the prosperity of future generations.

It is important that the goal of each generation to be the technological, economical, social growth and development, which lead to a better life. Perseverance in achieving these goals has made it possible to reach the current stage of development.

### **Sustainability subsystems**

The three subsystems of sustainability are:

1. Ecologic sustainability;
2. Economic sustainability;
3. Social sustainability

The Sustainability Model, which is based on the three subsystems mentioned above, is presented in the figure 2.

There are no important or less important factors in Sustainability, all of them being equally important.

*Ecological sustainability* requires specific management for the entire ecosystem, areas, and combinations between them, which together make up the natural environment or nature. It also refers to the company's ability to use natural resources responsibly, but also to control waste. Ecological sustainability also means the company's ability to reduce the negative impact of its actions on the environment by using less polluting raw materials and new, more modern technologies.

*Economic sustainability* is interdependently linked to the ecological one. There can be no sustainable economic stability without an integrated approach of the ecological factor and nature, a situation which none of the world 's economic and political leaders can imagine could exist. The economy, as well as the social context, can no longer develop in polluted environments. [www.asigurarea\_viabilității\_economico\_manageriale.pdf]

The economic sustainability of the company is its ability to make profit, in order to survive and benefit from local, national and global economic systems. The goal of economic sustainability is to increase the quality of life. Achieving such goals requires a radical change in production methods and consumption patterns that are not yet sustainable. [von Hauff, Kleine, 2009], [http://store.ectap.ro/articole/898\_ro.pdf]

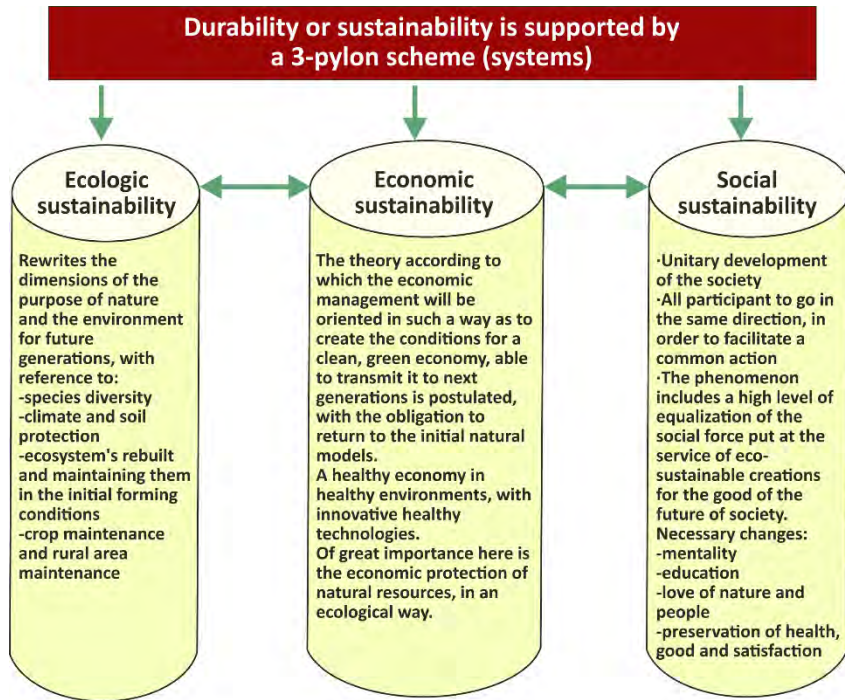


Figure 2. Sustainability Model  
[www.asigurarea\_viabilității economico manageriale.pdf]

For a sustainable lifestyle all efforts need to be subordinated to the preservation of material and immaterial living conditions. The sustainable economy must create renewable resources if necessary, use non-renewable resources when renewable ones dwindle and control the level of emissions that have a negative impact on the environment. (von Hauff, Kleine, 2009, p. 31). Economic sustainability is fully linked to the results regarding the protection of the environment and the social field, which the company obtains.

In conclusion, economic sustainability depends on the ability of natural ecosystems to obtain and store sufficient amounts of energy to support human life on Earth. [Ikerd, 2013] [[http://store.ectap.ro/articole/898\\_ro.pdf](http://store.ectap.ro/articole/898_ro.pdf)]

Figure 3 shows a negative correlation between the economic indicator, which puts a certain pressure on the ecological and the development of ecological indicators. According to Millington (2009), this particular case can be generalized on a larger scale (regional, national, global)

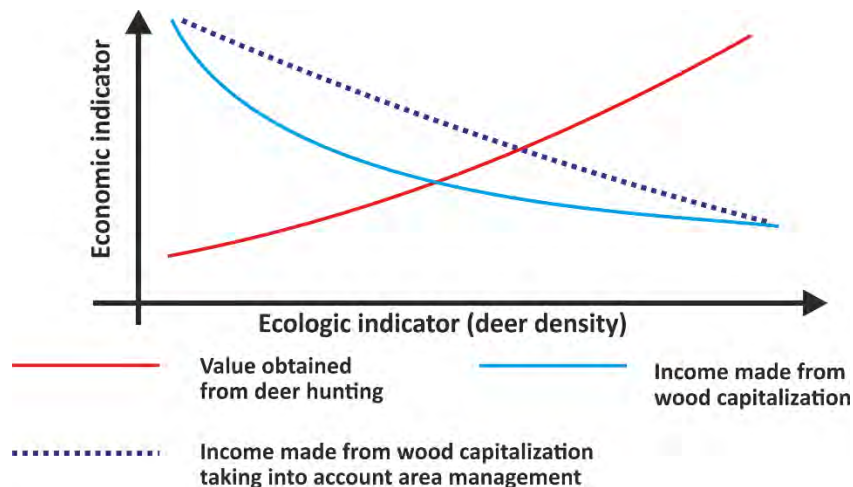


Figure 3.  
[Millington, 2009]

Because sustainable development was not taken into account, the economy used the resources of the environment, sometimes in very large quantities, the energies, the resources and the services it provides, eliminating itself in the environment as a result of man-made activities: heat (which produced global warming), different kinds of waste, some highly polluting and directly polluting emissions, in the form of gases, wastewater, etc., in quantities exceeding its processing and degradation capacity. Economic growth has led to life improvement by increasing incomes, respectively GDP / capita. The decrease in economic indicators was positively correlated with GDP growth until that maximum (M) generated by nature's inability to survive was reached. [www.asigurarea\_viabilității economico manageriale.pdf]

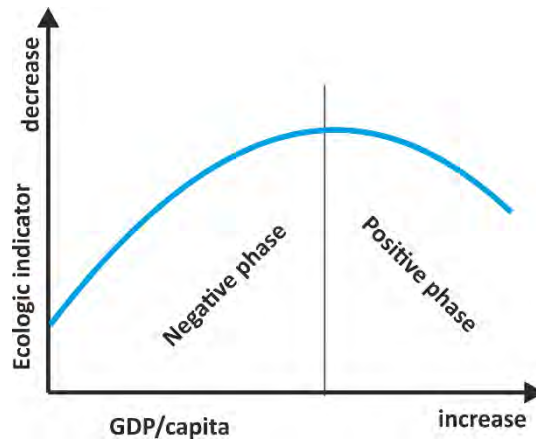


Figure 4 The correlation between GDP growth and the ecological indicator of the area [http://www.population-growth-migration.info/essays/kus3.gif]

In the developed countries from Western Europe and in some countries in the U.S. it became aware the importance of Sustainability, and a large part of GDP began to be used for the protection and reconstruction of the environment, regarding the implementation of the sustainable development concept. Therefore, we have reached the positive constructive stage, in which sustainable management uses part of the economic growth to create the new economic order, the new green economy. The strong destruction of the quality of the environment determines the economic experts to rethink the whole economic activity: new alternative technologies which replace the old technologies with new (clean) technologies by using less polluting raw materials, tending to the lowest possible pollution, avoiding pollution and reintegrating in the productive circuit of all kinds of waste the realization of new models of economic development, which would greatly reduce the consumption of energy and materials. Thus, the environment is recovering, being necessary to achieve an innovative approach, meaning a creativity of integration and use, and a management in which the economy and the environment are common (figure 5)

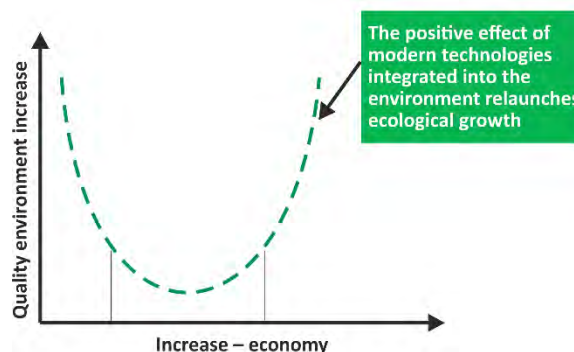


Figure 5. [http://canadatransportation.blogspot.ro]

A company is sustainable only if it manages to achieve economic efficiency, social equity and environmental preservation.

### The '3 P' 'Planet – Population – Profit'

The role of each generation is the technological, economic and social development, which lead to higher living standards. Perseverance in achieving these goals has led to the current stage of development.

Due to human activities, more and more resources have become insufficient, the climate is changing, the atmosphere is warming, and the result is the accelerated deterioration of the environment.

Given the environmental, social and economical constraints, people have begun to understand that if we continue to consume resources in unjustifiably amounts, to waste and ignore climate signals, the result will be self-destruction.

If in the past producers and economic operators were focused on making profit, now more and more companies are establishing their development strategy in a sustainable way.

This strategy of sustainable development has led to the emergence of the concept of 'the 3 P', which are a symbiosis of the three components of the economy and is represented in Figure 6



Figure 6  
[<https://medium.com>]

- **'Planet'**— demonstrates that a company through its activities seeks to reduce as much as possible the negative effect on the environment, by: reducing waste, investing in renewable energy, more efficient management of natural resources and improving headquarters or logistics
- **'Population'**— expresses the human component of a company as well as the work that people do, their daily activities, but also the action and impact of the company on the community in which they operate. Another importance of population in this symbiosis is how much the society receives from that company.
- **'Profit'** — it is known that every company aims to make profit. Sustainable companies consider profit a part of their business plan. Also, sustainable companies recognize that profit is not diametrically opposed to 'Population' or 'Planet'. Even if in the short term a sustainable company may seem less profitable, in the long run sustainability can even be cost-effective, especially when it comes to reuse and recycling.

Due to the fact that Sustainability encourages the responsible use of resources, the company will not only make profit, but also will produce sustainably, making sure that the production process does not create environmental imbalances. [<https://medium.com>]

If we take into account the impact of the company's activity on population, the company can choose less polluting raw materials with a lower negative impact on the environment and establish a strategy to collect, reuse and dispose the waste in a manner that is as less harmful as possible on the environment.

If we take into perspective the financial point of view, the three components of sustainability described above, can be renamed as follows: **environmental capital (Planet), social capital (Population) and economic capital (Profit)**.

In conclusion, given all these aspects, a product or service is sustainable only if in its production and marketing process, the company manages to maintain a balance between **economic gains, social equity and environmental conservation**.

## Conclusions

'Sustainability is the urgent doctrine by which economic development and progress must take place and be maintained over time, within the limits set by ecology in the broadest sense - through the interdependence of human beings and their services, the biosphere and the laws of physics and the chemistry that governs it. It turns out that environmental protection and economic development are indeed antagonistic processes.' – [William D. Ruckelshaus, Toward]

The contribution of global sustainability for a better future is also recognized by the World Business Council for Sustainable Development (WBCSD). WBCSD has developed Vision 2050 which aims to achieve a sustainable global society by 2050, which will allow all of us to fit within the limits of planet Earth, slowing the pace of ecosystem destruction, including climate, forests, fisheries and agricultural land and facilitating overcoming human difficulties, with the help of inclusive development. [UN Global Compact and the Principles for Responsible Investment. Communication of Progress 2012/13,2013].

Vision 2050 holds companies' requirements, thus trying to convince companies to work for a strong transformation that supports the improvement of sustainability.

In order to reach a sustainable society, Sustainability must be implemented at the level of the whole society.

A sustainable society is one that shapes its economic and social system so that natural resources and life support systems are maintained.

The transition from Sustainable to Regenerative requires an improvement and a change in the way of thinking among the population and at a governmental level, as well. Only countries where leaders are organized and trained can act correctly in the distribution of resources nowadays and for future generations, and can also take steps to limit the risks.

In order to reach the standards of '**cradle to cradle**' (**regenerative**) thinking of materials, it is necessary to have an education in the field of environmental protection, as well as a policy orientation for the benefit of the population, in order to have long-term financial possibilities, which will help in building green cities and mobility strategies to enable society to withstand change.

A properly educated and informed population can set standards in the use of ecosystem resources, which leads to an increase in the quality of life of both present and future generations.

"There can be no more encouraging purpose than entering the age of restoration, reshaping the wonderful biodiversity of life that still surrounds us" [Wilson, 1992]

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# ANALYSIS OF THE ECONOMIC PERFORMANCE OF THE COUNTRIES IN EUROPE

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## Abstract

**Purpose** – Analyse of indicators to identify the economic performance, obtained by the countries, through economic indicators of economic growth.

**Methodology/approach** – The comparative and the exploratory analysis to verify the correlation and dependency relationship between the indicators.

**Findings** – From the comparative analysis we obtained the maximum and minimum levels, as well as information on the average value over the past 9 years. By regression analysis was obtained information about the link that exists between the dependent and independent variables.

**Research limitations/implications** – From the exploratory analysis it was found that for some indicators the data are correlated by establishing stronger links and for others these links are weak.

**Practical implications** – The economic performance is given by the level of indicators questioned, which expresses the policies adopted at the level of companies and the population.

**Originality/value** – The results show that there is a high cost of labour and a high level of public investment in some countries and a high level of taxes and the concern for research and development in an others.

**Key words:** economic growth, level of development, economic performance.

## Introduction

The disparities that exist, from one country to another, is correlate with the modality of using and the level of the developments of the labour force (Hanushek and Kimko, 2000). The studies sustain that most countries that have a GDP per capita acceleration have, experienced, an increase in the use of labour, and those who have suffered a stagnation or decline have experienced a deterioration in their performance relative to growth (Hall and Jones, 1999; Quatraro, 2009). In these countries, the rate of increase in labour productivity could not compensate for the negative contribution from the poor performance related to the use of labour (Lyigun and Owen, 1999; Sianesi and Reenen, 2003).

The importance of sustainable development to ensure competitiveness and growth is discussed by Arrow (1962), Uzawa (1965) and then Nelson and Phelps (1966) that highlights the role of human capital in adopting technologies and its impact on growth. Lucas (1988) and Barro (1991) develops the contribution concept of human capital and demonstrates that this is one of the determinants of per capita income, along with the taxes charged by each country and the standard of living. Krueger and Lindahl (2001) in their work demonstrates the effect of education on economic growth. Many researchers have analysed government spending and their contribution in economy, Barro (1991), Turnovski and Fisher (1995) and Devarajan et al (1996), they establishing the importance of investments for developing for the long terms.

The purpose of this study was to analyse the countries in Europe through six indicators which measure the economic performance. These indicators were selected to identify: the degree of labour force development, the level of fees charged by the state that may influence the standard of living, the concern



for research and development, the investments made by public funds and social welfare, the fiscal burden that is borne by the employees of a country.

## **Material and Method**

For analysis, we used the Eurostat database to collect information for following indicators: Nominal unit labour cost growth (NULCG), Taxes on production and imports less subsidies (TPILS), Research and development expenditure, by sectors of performance (RDESP), Investment by institutional sectors (IIS), Current taxes on income, wealth (CTIW) and Net Social contributions (NSC), from 28 EU countries. Data collection was done March 27, 2019 and with data available for all years of interest (2009-2017) was included in the analysis.

In the first part of the study a comparative analysis of the indicators was carried out by grouping the countries by regions and analysis of each indicator was then carried out based on the average of the nine years studied.

The exploratory analysis used in the second part of the study was conducted using the statistical program (v.8, Stat Soft, USA) using the Tukey test for comparisons between countries taken two in two. The significance threshold was 5%. Simple regression analysis was used because it is a statistical technique that uses the data to estimate interception and to establish the link between the variables taken into the study (addiction and independence). For this, the dependent variable (y) was considered to be the study countries and the independent (x) statistical variables (indicators).

The NULCG indicator is the ratio between labour cost and labour productivity, a composite indicator reflecting any differences between countries in terms of both the values obtained by the numerator (cost of production) and of denominator (labour productivity). NULCG was obtained by through several indicators: Employee compensation in all Industries, Gross Domestic Product, Employees in all industries, and Total employment in all Industries.

TPILS is current unconditional payments to or from the public administration or institutions of the EU that are payable per unit of good or service produced or traded. It is an indicator that reflects the fiscal burden that can be measured at the level of each country and influences the standard of living.

The RDESP reflects spending on research and development, which is considered to be the engine for future development of new knowledge. Includes all R & D expenditure in the enterprise sector (EBRD) over a given period regardless of the source of the funds, which is presented as a percentage of GDP (research and development intensity).

This IIS indicator shows the investments for the total economy, the business environment and the household sector, the share of GDP used for the gross investment. The investments made by both the private sector and the public sector have a multiplier effect and accelerator effect, leading to technological development and ultimately economic growth at national level.

The CTIW covers all mandatory perceived by the public administration and the rest of the world on income and wealth of institutional units and periodic taxes that are not valued on that income or wealth.

The NSC indicator includes the perceived or imputed contributions of households to social security schemes to provide for the payment of social benefits. It is an indicator that reflects the tax burden of each country through social contributions.

## **Results and discussions**

As a result of the comparative analysis carried out by selected the European countries, studied in the regions, obtained the results of Figure 1 (a-d): Northern Europe (NE), Western Europe (WE), Southern Europe (SE), and Eastern Europe (EE).

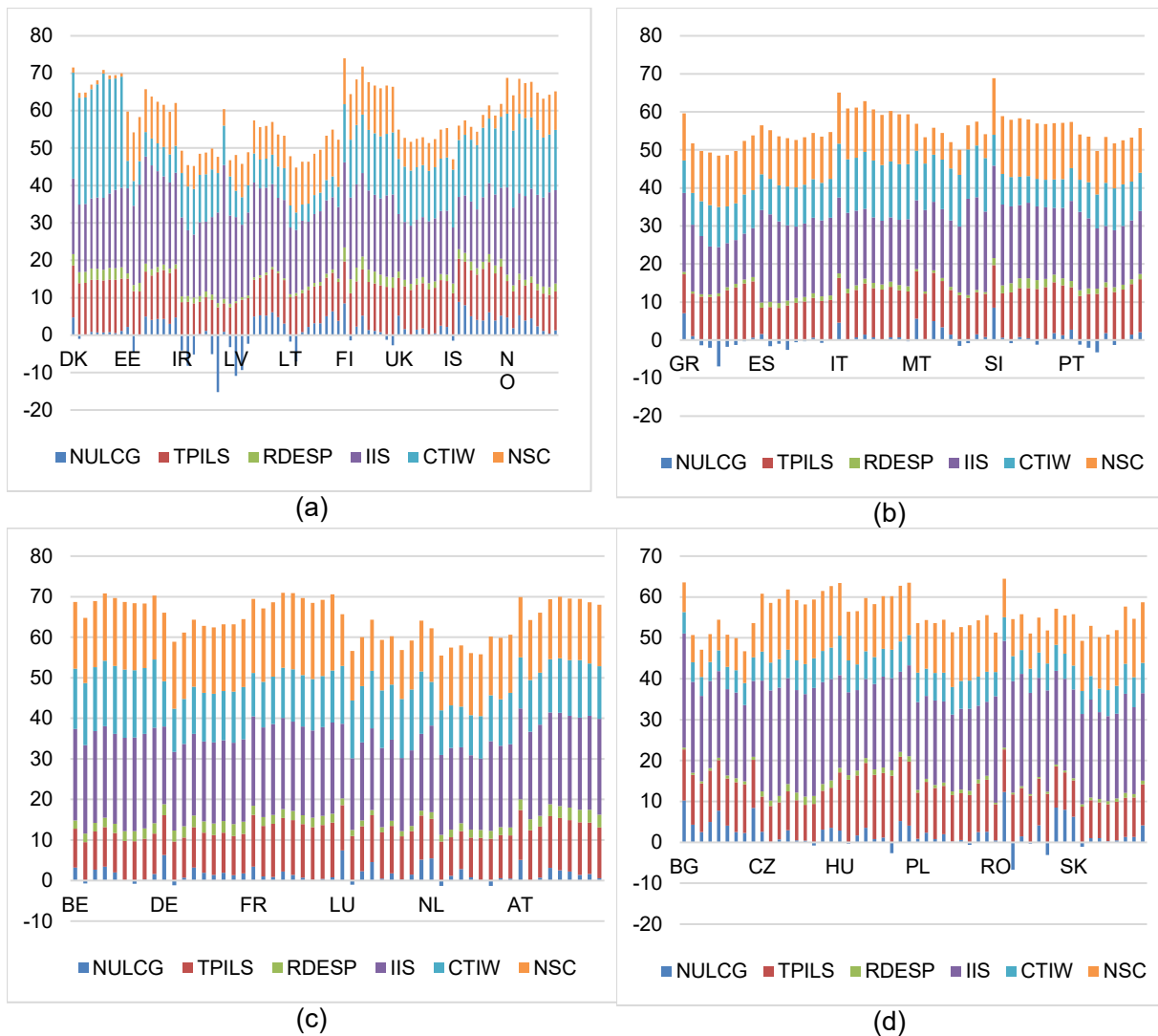


Fig. 1. Indicators evolution by region country: (a) NE, (b) WE, (c) SE, (d) EE

The analysis of Figure 1 (a-d) shows that the highest value of the NULCG indicator, was recorded in the EE region (RO / 2015, BG / 2012, SK / 2012) NE region (IS / 2016, FI / 2012 and EE / 2014), WE region (LU / 2017, FR / 2010, AT / 2012) and SE region (SI / 2013, GR / 2009, MT / 2016). This indicator shows that the lowest level is achieved in the NE and WE regions, where costs are lower than the EE and SE regions, was due either to better use of the workforce due to technology, either because of the existing qualification or the better organization of working time.

The TPILS indicator, recorded the highest values in the EE region (HU / 2013 & 2015, BG / 2011, RO / 2009), followed by the SE region (ES / 2009, SI / 2010, PT / 2012), the NE region (DK / 2009, NO / 2015, IR / 2013) and the WE region (LU / 2009, FR / 2013 & 2016, AT / 2016). This indicator shows that taxes for production are higher in the EE and SE regions in compares of the NE and WE region, the fiscal burden being a brake on development.

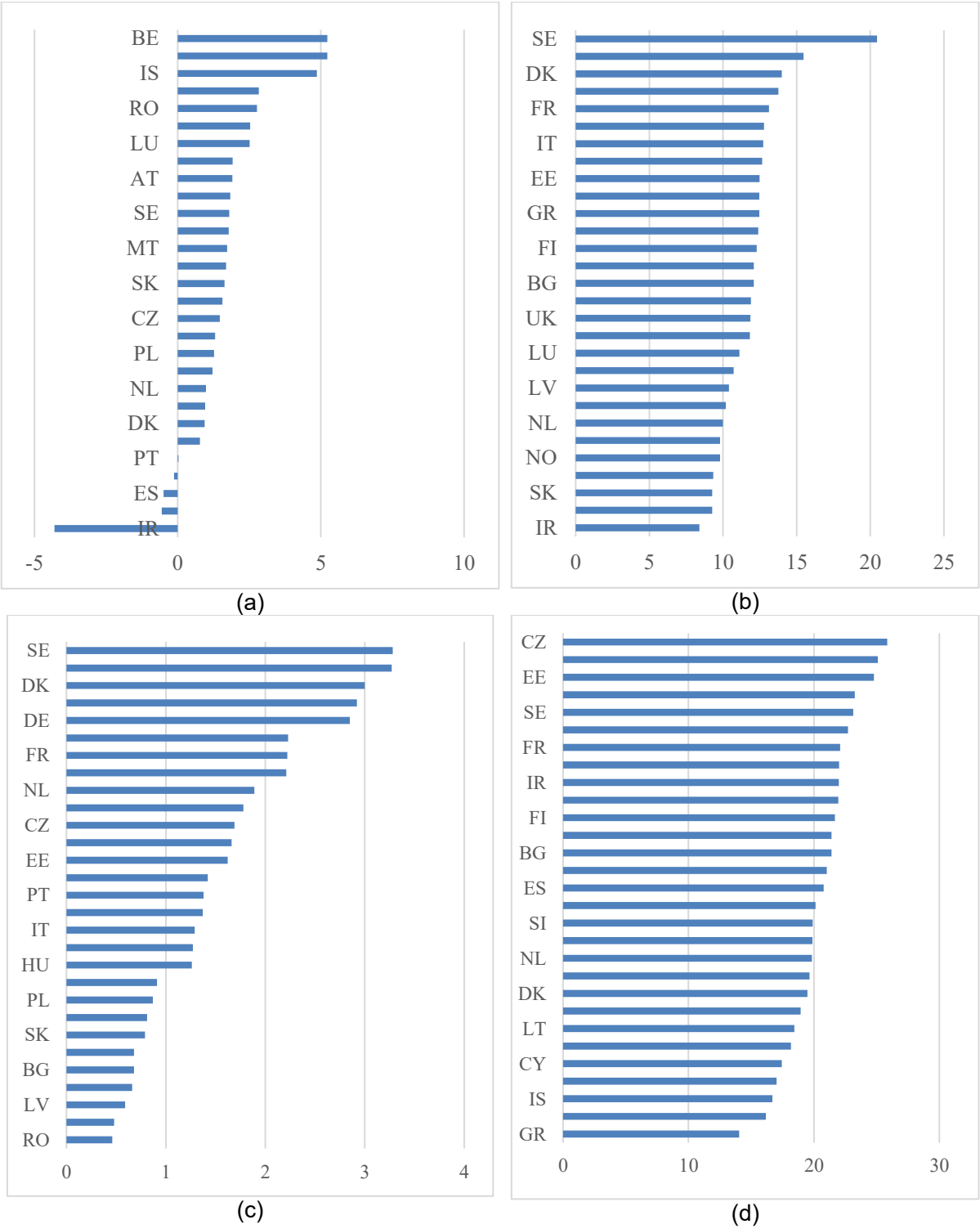
At the RDESP indicator, we notice that the highest values are given by the countries of the WE region (FR / 2014, AT / 2015, DE / 2016) followed by the countries of the NE region (DK / 2012 & 2017, FI / 2012, IS / 2009 & 2016), then SE region (SI / 2014, PT / 2017, IT / 2012, PL / 2016). The results show us that the countries in the WE and NE regions have economic resources that are directed to research and development, which will allow them to continue to be technology promoters.

The IIS indicator, recorded high values in the NE region (LV / 2016, EE / 2012, NO / 2017), followed by the EE region (BG / 2012, RO / 2012, CZ / 2012), the SE region (SI / 2013, ES / 2016, PT / 2017), WE region (AT / 2015, BE / 2009, LU / 2016).

The CTIW, recorded high values in NE regions (DK / 2011, NO / 2009, UK / 2013), followed by the WE region (DE / 2016, NL / AT / 2013), the SE region (IT / 2015, MT / 2014, SI / 2013) and the EE region (HU / 2011, SK / 2017, RO / 2009). This indicator shows that in developed nations in the north, west and south, the income and wealth tax is higher than in the EE region.

The NSC indicator, recorded the highest values in the WE region (FR / 2017, DE / 2017, BE / 2017) followed by the SE region (SI / 2017, 2016 and 2017, IT / 2017), the EE region (CZ / 2017, SK / 2017, PL / 2017) and the NE region (UK / 2016 & 2017, LT / 2017, EE / 2017). The level of social contributions is higher in the WE, SE and NE regions of the EE region.

In Figure 2, the mean values for the 9 years surveyed for six indicators are shown.



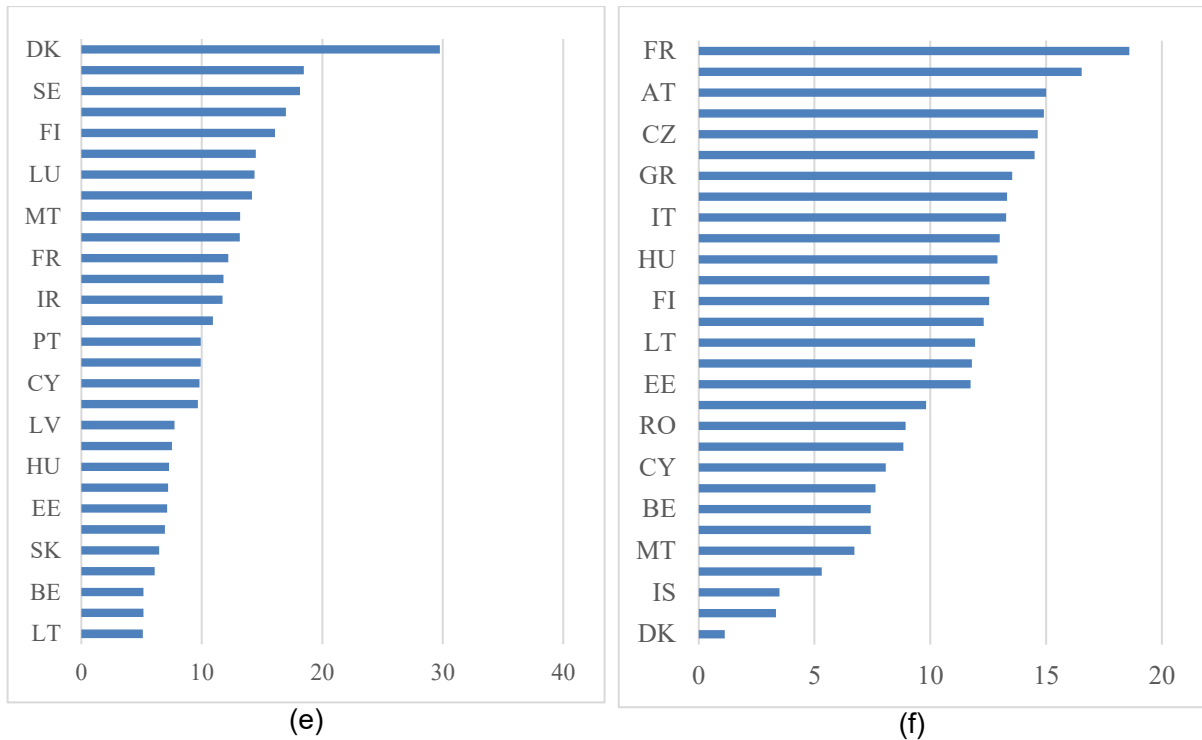


Figure 2. Evolution of indicators according to the average of the years studied: (a) NULCG, (b) TPILS, (c) RDESP, (d) IIS, (e) CTIW, (f) NSC

From Figure 2 (a-f) we can see that for NULCG the highest values are held by the countries: BE (5.23), BG (5.23), IS (4.86), for TPILS, the highest values are registered by the SE, HU (15.46) and DK (14), at the RDESP indicator the highest values are in SE (3.28), FI (3.27), DK (3), RO (25.1) and EE (24.79), the CTIW indicator has the highest values in the countries: DK (29.77), NO (18.48), SE (18.14) FR (18.6), DE (16.54), AT (15).

As expected, significant difference has been observed between investigated indicators (see Table 1).

Table 1. Summary of descriptive statistics

Variable	Valid N	Mean	Minimum	Maximum	Std. Dev.
NULCG	261	1,42797	-15,2000	12,30000	3,298535
TPILS	261	11,81916	6,9000	20,90000	2,414351
RDESP	261	1,62674	0,3800	3,75000	0,863310
IIS	261	20,56383	11,5400	35,74000	3,360183
CTIW	261	11,63678	4,3000	33,20000	5,261678
NSC	261	11,03985	0,9000	19,00000	4,239333

In order to see if there is a relationship between the country (the dependent variable) and the indicators taken in the study (independent variables), the correlation coefficient (R), presented in Table 2, was calculated.

Table 2. Summary Statistics

No.	Variable	Multiple R	Multiple R <sup>2</sup>	F	p
1	NULCG	5,03E <sup>-01</sup>	2,53E <sup>-01</sup>	2,81E <sup>+00</sup>	1,20E <sup>-05</sup>
2	TPILS	9,61E <sup>-01</sup>	9,23E <sup>-01</sup>	9,97E <sup>+01</sup>	0,00E <sup>+00</sup>
3	RDESP	9,80E <sup>-01</sup>	9,61E <sup>-01</sup>	2,04E <sup>+02</sup>	0,00E <sup>+00</sup>
4	IIS	8,13E <sup>-01</sup>	6,61E <sup>-01</sup>	1,61E <sup>+01</sup>	0,00E <sup>+00</sup>
5	CTIW	9,89E <sup>-01</sup>	9,79E <sup>-01</sup>	3,77E <sup>+02</sup>	0,00E <sup>+00</sup>
6	NSC	9,95E <sup>-01</sup>	9,89E <sup>-01</sup>	7,51E <sup>+02</sup>	0,00E <sup>+00</sup>

From the analysis of Table 2 it is observed that the value of R is closer to the value 1 for the variables: TPILS, RDESP, IIS, CTIW and NSC, and a small value for NULCG, which shows us that there is a greater correlation for the five variables mentioned (2-6) as compared to the NULCG variable (1). The value of multiply determination coefficient R<sup>2</sup> shows us that variables (2-6) are largely influenced by the country.

From the post-hoc analysis with the Tukey test, that it can be observed at the level of each indicator taken in the study there is statistically significant differences between pairs of countries but also insignificant statistical differences.

From the probability analysis with the Tukey test – NULCG it can be noticed that there are more statistically insignificant differences than those statistically significant. Thus, statistically significant differences are recorded in the NULCG indicator at the following pairs of countries: IR-BE, IR-BG, IR-DE, IR-EE, ES-BG, LU-IR, HU-IR, MT-IR.

The average value of the NULCG indicator is 1.43, and the countries below the average are: BE, DK, IR, GR, ES, FR, IT, CY, LV, NL, PL, PT, SI.

For TPILS it can be noticed that the insignificant statistical differences are recorded in the following countries: CZ-BE, DE-BE, DE-CZ, EE-BG, GR-EE, ES-BE, ES-EN, ES-DE, ES-IR, FR- FR, CY-DK, CY-FR, CY-IT, LV-BE, LU-CZ, LU-DE, LV-ES, LT- LU-LT, LU-LT, LU-LT, HU-GR, MT-LT, MT-EE, MT-LT, MT-IT.

The average value of the TPILS indicator is 11.82, and the countries below the average are: BE, CZ, DE, IR, ES, LV, LT, LU, NL, RO, SK, NO.

For RDESP it can be noticed that statistically in-significant differences were recorded in the following pairs of countries: DE-DK, EE-CZ, IR-CZ, IR-EE, GR- FR-BE, IT-IR, IT-ES, CY-BG, LU-BG, LV-GR, LV-CY, LT- ES, LU-IT, HU-IR, HU-ES, HU-IT, HU-LU, MT- EN-PL, CZ-NL, CZ-PT, CZ-UK, CZ-NO, DK-AT, DK-FI, PT, EE-UK, EE-NO, IR-PT, IR UK, GR-PL, GR-SK, LV-PL, LV-RO, LT-SK, LU-PT, LU-UK, HU-PT, MT- UK, NL-NO, PL-SK, PT-UK, SI-IS, FI-SE, UK-NO.

The average value of the RDESP indicator is 1.62, and the countries below the mean value are: BG, EE, IR, GR, ES, IT, CY, LV, LU, HU, MT, PL, that is, countries that have a lower than aver-age R & D expenditure ratio.

For IIS, there are statistically significant differences in the following pairs of countries: CZ-BG, DK-CZ, DE-CZ, EE-DK, EE-DE, IR-CZ, GR-BE , GR-BG, GR-CZ, GR-DK, GR-DE, GR-EE, GR-IR, ES-CZ, ES-EE, ES-GR, IT-BE, IT -CZ, IT-EE, IT-IR, IT-GR, IT-FR, CY-BE, CY-BG, CY-CZ, CY-EE, CY-IR, CY-FR, LU-CZ , LV-IT, LT-BE, LT-EN, LT-EE, LT-GR, LT-FR, LU-BE, LU-CZ, LU-EE, HU-EE, HU -GR, MT-CZ, MT-EE, MT-GR, BE-PT, BE-UK, BE-IS, BG-PT, BG-UK, BG-IS, CZ-NL, CZ-PL, CZ , BE-UK, BE-IS, BG-PT, BG-UK, BG-IS, CZ-NL, CZ-PL, CZ-PT, CZ-FI, CZ-UK, CZ -IS, DK-SE, DK-NO. DE-UK, EE-NL, EE-PT, EE-UK, EE-IS, IR-PT, SI, GR-SE, GR-FI, ES-PT, ES-RO, ES-UK, ES-IS, FR- IT-RO, IT-SK, IT-SE, IT-NO, CY-AT, CY-RO, CY-SK, IS-LT, LT-AT, LT-RO, LT-SE, LTU, LU-AT, LU-RO, HU- MT-RO, MT-UK, NL-RO, NL-UK, AT-PT, PT- NO, RO-SI, RO-UK, SI-UK, SK-UK, SK-IS, FI-UK, FI-IS, SE-UK, SE-IS, UK-NO, IS-NO.

The average value of the IIS indicator is 20.56 and the countries below the mean are: DK, DE, GR, IT, CY, LT, LU, MT, NL, PL, PT, SI, UK, IS.

For CTIW, there are statistically significant differences in the following pairs: EE-CZ, IR-DE, ES-GR, FR-DE, CY,-GR, CY-ES, LV-CZ, LT, BG, LU-IT, HU-CZ, HU-EE, HU-LV, MT-DE, MT-FR, MT-LV, BE-FI, BE-IS, BG-RO, BG-SK, CZ-PL, CZ-RO, CZ-SI, CZ-SK, DE-NL, DE-AT, EE-PL, EE-RO, EE-SI, EE-SK, IR-NL, IR-AT, GR-NL, GR-PT, ES-NL, ES-PT, FR-NL, FR-AT, IT-AT, IT-UK, CY-NL, CY-PT, LV-PL, LV-SI, LV-SK, LT-RO, LT-SK, LU-AT, LU-UK, HU-PL, HU-RO, HU-SI, HU-SK, MT-AT, MT-UK, NL-PT, AT-UK, PL-RO, PL-SI, PL-SK, RO-SK, SI-SK, FI-IS, SE-IS, SE-NO.

The average value of the CTIW indicator is 11.64, and the countries below the average are: BE, BG, CZ, EE, GR, ES, CY, LT, HU, NL, PL, PT, RO, SI, SK.

For NSC it can be observed that there are statistically insignificant statistical differences in the following pairs of countries: DE-BE, ES-EE, IT-GR, IT-ES, CY-BG, LU-CY, LT, LT-ES, LU-EE, LU-ES, LU-LT, HU-GR, HU-ES, HU-IT, HU-LU, MT-BG, CZ-NL -PL, GR-SK, ES-PL, ES-PT, ES-SK, ES-FI, IT-PL, IT-SK, IT, FI, CY-UK, LV-RO, LT-PT, LT, LU-PL, LU-PT, LU-FI, HU-PL, HU-SK, HU-FI, NL-AT, NL-SI, AT-SI, PL-SK, PL-FI, PT-FI, SK -FI, HU-FI, NL-AT, NL-SI, AT-SI, PL-SK, PL-FI, PT-FI, SK-FI, SE-IS.

The average value of the NSC indicator is 11.04, and the countries below the mean are: BG, DK, IR, CY, LV, MT, RO, SE, UK, IS, NO.

## Conclusion

From the comparative analysis it was found that the maximum levels of the indicators for the countries under study appeared in different years, the year being not a reference for all countries and neither for everyone indicators. At the NSC indicator, in the year 2017, was the highest level of social contributions (9 countries out of 12). The RDESP indicator show as that countries in WE, NE and SE regions spent more research money than those in EE region. From the average analysis for the 9 years studied, it is found that the maximum values for the NULCG indicator are recorded by countries: BE, BG and IS. At the TPILS indicator the performance are recorded by countries: SE, HU and DK, and the RDESP indicator: SE, FI, and DK. To the IIS indicator the performance are recorded by countries: CZ, RO, EE, the CTIW indicator: DK, NO and SE and at the NSC indicator: FR, DE and AT. Taking into account the maximum values of each indicator from the 28 analysed countries, RO obtained the following classification: NULCG (5), TPILS (20), RDESP (29), IIS (2), CTIW (26), and NSC (19).

Thus, it can be concluded that the economic performance of the countries in Europe is given by the country's ability to sustain certain expenditures at the economic agent level, at the state level and at the level of the population which is able to bear the taxes and social contributions imposed. The highest recorded level, we find that is: a high labour cost in countries like BE, a high level of taxes that are perceived by the state as a result of traded goods that may affect living standards in countries such as the SE, the concern for future development of firms through R & D spending in SE, a high level of the investments made from public funds with long-term beneficial effects in: CZ, a higher tax burden in: DK and FR.

From the exploratory analysis using ad hoc analysis, it was found that for the NSC, CTIW, RDESP and TPILS indicators there is a stronger link and for the IIS and NULCG indicators this link and correlation relationship is lower.

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# PERFORMANCE INCREASING STUDIES WITHIN THE VALUE CHAIN STAGES IN THE OIL INDUSTRY

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## Abstract

**Purpose** – To present the way of using the performance indicators within the value chain stages in case of the oil companies.

**Methodology/approach** – In order to perform the research, it was used the step-by-step multiple regression analysis, part of the Statistical Package for the Social Sciences - SPSS software. The research methodology was a survey-based questionnaire, the obtained data being processed using the SPSS program, version 23.

**Findings** – Description of the key activities performed by the oil companies; performance indicators presentation; analyzing the correlations between performance indicators and presenting the regression equation for the main value chain stages.

**Research limitations/implications** – Difficulties to access specific oil industry related data; no option to use for the research new indicators out of the existing ones; lack of an open oil industry related database.

**Practical implications** – The main importance of the analysis consists in the functionality of the model, with applicability in case of any other oil company with a similar activity profile.

**Originality/value** – Presentation of the main oil industry specific activities and performance indicators used in the value chain's stages; and the ranking of the main oil value chain stages based on the importance resulting from the answers processed in the research.

**Key words:** performance, oil industry.

## Introduction

The concept of "value chain" has received major significance in the context of the world economies' globalization. Its importance has grown with the development of technologies and the increasing pace of modernization of factories and production units.

The companies' desire to gain market share, to surpass competition, respectively to have a competitive advantage in the market in which they operate, required a more flexible and much more efficient way of organizing their business processes than in the past (Michael Porter, 1985). Thus, each type of activity should be viewed from the perspective of its contribution to the total added value, so that, to help the performance improvement within the value chain stages.

Within oil companies, one of the most important aspect is related to the operational continuity, without interruption along the supply chain stages, emphasizing the process optimization efforts by using the synergies of the main and support activities. Specifically to the oil companies is the fact that for certain activities they could use their own resources or could appeal to outsourced resources as well (which is a trend more and more common in current practice in case of the "non-core businesses"); or they could rely on experts' involvement by contracting specialized services.

The oil business is and will remain an engine of the global economy, so performance researches will add value to the working processes, contributing to the companies' performance increasing. Being part



of the doctoral thesis, this research aims both to highlight the current state of knowledge of performance measurement in the oil industry and to identify the current state of use of performance indicators based on which the management of oil companies could evaluate performance along the value chain stages.

### **Main objectives of the study**

In order to perform the practical research, it was necessary to establish specific main and secondary objectives, these being presented in figure 1.

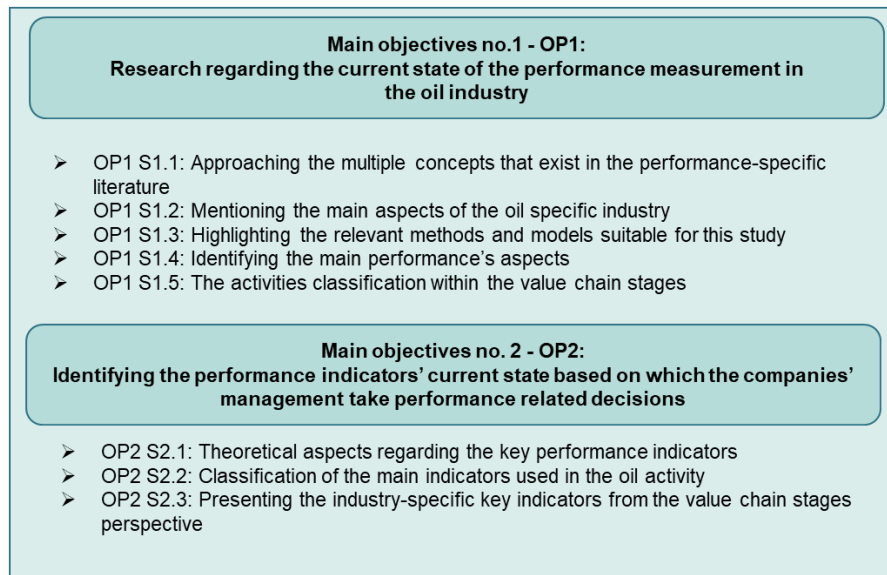


Figure 1. The research's main and secondary objectives

In the first part of the research, was introduced and debated the notion of performance, respectively were discussed the value chain related concepts both from a historical and from the modern theory perspective. Different risk elements within the value chain were also mentioned, highlighting the importance to ensure the business continuity without any process interruption during the day-by-day operations.

The inclusion of risk elements in the research is a recognition of the importance of this aspect. With all precautions, however, accidents can occur during the value chain stages. They occur as a result of a certain critical risk factor, or due to several non-major risk factors that together trigger an event which might cause a disruption in the supply chain. In this sense, unintended risks could have technological or process reason, respectively they may be caused by human error.

As the performance of companies is directly influenced by ensuring a continuous activity, it was necessary to address the non-fragmentation aspects of the business. This risk can occur due to two factors, which are delays and interruptions in the value chain.

Delays usually appear when the company is unable to respond to a series of unforeseen events that have occurred in the company's internal or external environment and could have causes, such as:

- lack of raw materials;
- manufacturing defects;
- fluctuations or breakdowns of utilities;
- unannounced controls and inspections;
- bad weather conditions;
- lack of well-specialized staff;
- customs procedures, authorizations, etc.

Interruptions appear along the supply chain, as a result of very serious events, which generally have a rare but unpredictable frequency and with devastating effects for the company, such as:

- blocking a company's accounts;
- withdrawal of operating permits or licenses;
- calamities and natural disasters;
- strikes and revolutions;
- acts of terrorism and sabotage, etc.

As a result of the negative effects, both in case of delays and in case of interruptions, the companies' management have tried to find solutions and methods to manage these delays.

Because the evaluation of the companies' results is performed based on calculations, it was necessary to appeal and study the specific literature regarding the activity monitoring methods by using the key performance indicators.

The oil industry is influenced both by the current legislation, but also by the new consumer's trend that tries to promote a healthy, safe and green technology and culture, as well. Despite all the efforts made by the various groups interested in promoting green energy, the classic technology, based on hydrocarbons, is the most used, having a major impact on the world's economy. The value chain related to this business model is also well defined, and the performance of this chain could make the difference between the companies' success or failure. Therefore, the usage of the key performance indicators is undoubtedly necessary, and large oil companies have developed their own ways of monitoring, controlling and reporting their activity.

The objective of the research could be achieved only by identifying the performance indicators used in the stages of the value chain in the oil industry, the indicators being presented in the table no.1.

Table 1. Key Performance Indicators used within the supply chain stages

Primary (basic) activities		
Supply Chain stages	Activities	Indicators
Inbound Logistics	Transportation planning	Truck Loading Grade (TLG)
		Average km per truck (Av km)
		Average trucks no. used per day (AVTno)
	Reception of goods	Unloading discrepancies (ULD)
	Storage and Warehousing	Storage Tank Loading Grade (STLG)
		Tank turns (TT)
Inventory management	Inventory discrepancies (Sf)	
Operations	Producție și activități administrative	No. of orders processed (PO)
		Fuels throughput (FT)
		Losses (LS)
Outbound Logistics	Terminal operations	Truck Loading Gantry Utilization (TLGU)
		Storage Days (SD)
	Transportation, grouping and distribution	Entry-Exit Time (EET)
		Out of Product (OOP)
		Out of Stock (OOS)
		Daily truck no. (DTN)
Daily loading quantities (DLQ)		
Marketing and Sales	Data and market research	Finding market niches
		Selecting the right sales & promotion channels
		Defining product-price promotion policy
		Retail operations management
		Customer and competitors' data analysis
		Market share monitoring
Service and Maintenance	Service and repairs	No. of unscheduled repairs (URep)
		No. of unscheduled repairs hours (HUR)
		Maintenance time (MT)
	Training and Testing	Training & Acceptance (TA)

<b>Support (secondary) activities</b>		
<b>Supply Chain stages</b>	<b>Activities</b>	<b>Indicators</b>
<b>Technology Development</b>	<b>New projects</b>	Number of the new won project for execution phase
	<b>Financing value</b>	Values and found won for research and development
	<b>Contracts value</b>	Value of new or extended contracts
<b>Procurement</b>	<b>Sourcing and negotiations</b>	Value of Cost savings
		Cash flow improvement effect
<b>HR Management</b>	<b>Staff selection and recruitment</b>	New hires number
		Successful interviews number
	<b>Training and development</b>	Average trainings per employee
		Average trainings value per employee
<b>Staff development, remuneration and retention</b>	Attrition rate	
<b>Company Infrastructure</b>	<b>Management team</b>	EBT (Earnings Before Taxes)
	<b>Planning and controlling</b>	EBIT (Earnings Before Interests and Taxes)
	<b>Finance and accounting</b>	EBITDA (Earnings Before Interests, Taxes, Depreciation and Amortization)
	<b>Finance and accounting</b>	Netto Profit
	<b>Legal</b>	Fines and Penalties Paid (FPP)
	<b>Public Relations</b>	Total Cost of Social Responsibility related activities (CSR value)
	<b>Quality</b>	Number of audit findings
	<b>Corporate Security</b>	Internal Security Incidents
		Fatalities (Ft)
	<b>Health and Safety Environment</b>	Loss Time Injuries (LTI)
Non-LTI Injuries (Non-LTI)		
Accidental Spillages (AcSp)		

### **Methodology and approach**

In order to perform the research, it was used the step-by-step multiple regression analysis, part of the Statistical Package for the Social Sciences - SPSS software. The research methodology was a survey-based questionnaire, the obtained data being processed using the SPSS program, version 23. The main source of obtaining the primary data was a multinational company, operating in Romania and focusing especially on the oil and gas industry. Through the involvement of their employees from various positions, specialists and experts as well, it was possible to obtain relevant information for conducting the research.

The questionnaire was used as a research tool, in order to obtain the data necessary for the study. It was designed in such a way that closed questions predominate, most of them being with multiple answers, respectively with answers in scale (using a scale of importance in five steps, varying between the extremes: very- and not at all). This allowed the respondents to choose from several predetermined answer options. The responses were then analyzed and processed using SPSS software.

From the different options available for performing a multiple regression, was used the stepwise variant. This is identical to the simple regression, with the mention that the difference consists in the use of several predictor variables, aiming to find some links that can explain the variance of the dependent variable.

The variables considered predictor were introduced in the model one by one, starting with the predictor variables having the highest correlation with the analyzed criteria. The test looked at whether each variable entered in the model contributed to its success, and if it was found that one or more of these variables did not significantly contribute to the success of the model, then these variables were automatically excluded by the program.

To exemplify the way in which the program was used, it can be seen how the analysis was performed, in order to determine the existence of any connection between the stages of the value chain and the

activities carried out within each stage, such as: inbound logistics, operations, outbound logistics, marketing, service and maintenance, technological development, procurement, human resources management and company infrastructure.

### Correlations between the value chain's stages and the activities related to each stage

As a next research's step, were presented the links between the value chain's stages and the activities related to these stages, using the specific performance indicators.

The analysis aimed to determine the importance given to each stage, according to the importance level of the activities carried out within the value chain stages. For example, a complete analysis performed for the Input Logistics stage can be seen, according to Tables 2-7.

In the table 2, could be observe which variables were introduced into the analysis model.

Table 2. Variables Entered/Removed

Model	Variables Entered	Variables Removed	Method
1	ActivitN2: Inventariere: Grad_de_Imp		Stepwise (Criteria: Probability-of-F-to- enter <= .050, Probability-of-F-to- remove >= .100).

- a. Dependent Variable: Eta
- b. paLantValoareAN3: LI\_Grad\_de\_Importanta

The table 3 indicates the variables that were not included in the regression analysis, not being considered as a significant predictor of the dependent variable.

Table 3. Excluded Variables

Model	Beta In	t	Sig.	Partial Correlation	Collinearity Statistics
					Tolerance
1 ActivitN2: Planif_Transp: Grad_de_Imp	.035 <sup>b</sup>	.184	.854	.019	.246
ActivitN2: Receptia: Grad_de_Imp	.019 <sup>b</sup>	.063	.950	.006	.101
ActivitN2: Depozitare: Grad de Imp	-.100 <sup>b</sup>	-.576	.566	-.058	.296

- a. Dependent Variable: EtapaLantValoareAN3: LI\_Grad\_de\_Importanta
- b. Predictors in the Model: (Constant), ActivitN2: Inventariere: Grad\_de\_Imp

The result of the regression analysis is found in table 4, called Model Summary and reflects the fact that the predictor introduced in the regression equation, in our example being the Inventory activity, explains the variance of the dependent variable, in our case being Inbound Logistics, in proportion of 11.7 percent (R<sup>2</sup>adj = 0.117). In other words, the importance of the Inventory activity explains 11.7 percent of the variant of the dependent variable (Inbound Logistics).

Table 4. Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.355 <sup>a</sup>	.126	.117	2.768	.126	14.256	1	99	.000

- a. Predictors: (Constant), ActivitN2: Inventariere: Grad\_de\_Imp

Table 5, named ANOVA, shows the existence of a statistically significant linear connection between the predictor variable (Inventory in our example) and the dependent variable (Inbound Logistics in our case).

Table 5. ANOVA

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	109.241	1	109.241	14.256	.000 <sup>b</sup>
Residual	758.601	99	7.663		
Total	867.842	100			

a. Dependent Variable: EtapaLantValoareAN3: LI\_Grad\_de\_Importanta

b. Predictors: (Constant), ActivitN2: Inventariere: Grad\_de\_Imp

Table 6 of this analysis, named Coefficients, contains the non-standardized Beta coefficients, respectively the standardized Beta coefficients for the exemplified variable predictor: Inventory. The values of "t" and "Sig" show that the independent variable has a significant contribution from the variance of importance given to the Input Logistics stage. The significance level in this case indicates the value of  $0.000 < 0.05$  (being therefore below the maximum allowed significance threshold of 5%); so, the inclusion of the Inventory variable predictor in relation to the dependent variable (Inbound Logistics) is validated, being a significant variable.

Table 6. Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
1 (Constant)	<b>2.666</b>	.456		5.841	.000	1.760	3.571
ActivitN2: Inventariere: Grad de Imp	<b>.775</b>	.205	<b>.355</b>	3.776	.000	.368	1.183

a. Dependent Variable: EtapaLantValoareAN3: LI\_Grad\_de\_Importanta

It can be noticed that the non-standardized coefficient's value of the predictor taken into consideration is 0.775, and the standardized Beta coefficient is 0.355. The values recorded for the coefficients (both standardized and non-standardized) reflect the existence of a statistical connection between the Inbound Logistics dependent variable and the predictor variable considered (Inventory). In other words, it can be stated that the non-standardized Beta coefficient shows us how much the dependent variable changes, when the independent variable changes.

The significance is as follows: at an increase by one unit (from grade 2 to 3, or from 4 to 5, etc.), of the value of the Inventory variable, the value of the dependent variable (for our case was considered the importance of the Inbound Logistics) increases by 0.775. Thus, it will be close to one, which on a scale of 1 to 9 is the most important stage.

Based on the received answers and to elaborate the formula, in table 7 are presented the importance levels (grades), relevant to each analyzed activity of the value chain stages.

Table 7. Descriptive Statistics

	Mean	Std. Deviation	N
EtapaLantValoareAN3: LI_Grad_de_Importanta	<b>4.04</b>	2.946	101
ActivitN2: Planif_Transp: Grad_de_Imp	1.02	1.789	101
ActivitN2: Receptia: Grad_de_Imp	1.78	1.354	101
ActivitN2: Depozitare: Grad_de_Imp	2.43	.864	101
<b>ActivitN2: Inventariere: Grad_de_Imp</b>	<b>1.77</b>	1.348	101

Based on the previously presented information, it was possible to write the regression equation between the importance given to the analyzed stage and the calculated predictor. Therefore, the equation of the proposed conceptual model, when the non-standardized Beta coefficients are used, is the following:

$$Y = c + a_1 \cdot x_1 + a_2 \cdot x_2 + \dots + a_n \cdot x_n$$

Respectively, when using standardized scores, the proposed conceptual model's equation has the following form:

$$Y = A_1 \cdot X_1 + A_2 \cdot X_2 + \dots + A_n \cdot X_n$$

Where:

Y= represents the importance of the value chain stage;

c= represents the constant;

a= represents the non-standardized beta coefficient;

x= represents the importance grade of the considered predictor;

A= represents the value of the standardized beta coefficient;

X= represents the importance grade of of the considered predictor;

1, 2 ... n= represents the number of variables considered.

## Discussion and conclusions

Based on the performed analyses regarding correlations existing between the stages of the value chain, it was found that the step-by-step multiple linear regression calculations indicated a statistically significant relationship in eight cases out of nine (representing 88.89 percent).

In case of the existing correlations related to the activities and operations, the obtained result has indicated a lower success rate than in the case of the value chain stages. Thus, for the core and support activities, together resulted 9 statistically significant regressions out of 34 simulations, which mean a 26,47 percent success rate).

The centralization of the received answers allowed the classification of the importance level of the value chain stages, as follows:

- 1st place: the most important value chain stage was considered the Company Infrastructure (with an average score of 2.75);
- the 2nd place, with an average score of 2.80 was assigned to the Operations stage;
- on the 3rd place is the Human Resources Management value chain stage, obtaining the average grade of 3.07;
- the Inbound Logistics stage was ranked on the 4th position, obtaining the average grade of 4.04;
- Technological Development ranks 5th, with an average grade of 4.09;
- the 6th place went to the Acquisitions stage, based on the average score of 4.18;
- the Marketing stage was ranked on the 7th position with an average score of 4.98;
- 8th place went to the Outbound Logistics stage, accumulating an average score of 5.09;
- and on the 9th place was ranked the Maintenance and Service stage, with an average score of 5.98, not accumulating any votes for the most important value chain stage.

The research's aim was to quantify the importance given by the respondents for each element presented in the model, taking into account all three levels of the analysis, as follows: stages, activities and operations.

These three dimensions were studied in terms of performance indicators, being considered the most relevant in this research. Even in the case of variables that do not seem to be statistically significant, it was nevertheless considered useful to observe them at least at the modeling and conceptual level, from

the perspective of the influence they may have on assessing the importance of activities during the supply chain stages.

Due to the non-random nature of the sampling methodology, the results obtained cannot be extrapolated, being representative only at the level of the investigated company, but the methodology used can be adapted for any other company, mentioning that certain activities or operations can be found or not in their activity portfolio. Respectively, certain specific operations may have different weights and importance, depending on several company-specific factors. In case of any other further research, it would be possible to reduce the limitations of the current study and to introduce new elements in the performance analysis of the value chain stages.

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# INTERNATIONAL MIGRATION - A CHALLENGE: A GAIN OR A PROBLEM?

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## Abstract

**Purpose:** *The paper addresses the problems of international migration and the importance of the current labour migration on the Romanian economy. Labour migration is the subject approached by many studies that are the subject of interdisciplinary sciences such as economics, international business, European law, sociology, and many others.*

**Methodology/approach:** *Due to the evolution of the Romanian economy in recent years, it is important and necessary for any future economist to understand this topic as well as possible.*

**Findings:** *If the main reason why the labour force has now chosen to leave the country of origin and migrate to economically developed countries is a better living, the aim is to provide children with a better future.*

**Research limitations/implications** *These results are confirmed by the answers given to the questions formulated in a questionnaire applied in the representative communities.*

**Practical implications:** *After analysing the statistical data taken from specialized studies, as well as those from the questionnaire, the main question will be answered: "what is international migration - a challenge: a gain or a problem?"*

**Originality/value:** *Looking ahead, it is necessary to know as much as possible about the factors underlying the development of the country's economy as well as about the factors that determine this labour migration at the international level*

**Keywords:** *migration, immigration, emigration*

## Introduction

The phenomenon of migration has always existed and has materialized since the first appearances of mankind through invasions, transhumance, colonization and crusades, or in general, provoked by the attraction of richer regions about the poorer population.

Although in recent years in some parts of the world also Europe, migration of significant flows, the problem of international migration is for many countries of the world or conjunctural concern, and it is rather to see some developments when creating a movement of people. For the European space, the movement for customers and for a large or important workforce, the enlargement of the EU in successive waves, the demographic aging of the population of (western) European countries at an accelerated and motivating pace, which can be factors in increasing traffic and of labor a labor force.

Nowadays, the demographic population must reappear due to the risks we take care of in the manifestation of crises at local, zonal, continental or global level that influence the social order, or in the triggering of disturbances of ethnic or religious balances.

In terms of population flows, labor circulation may increase in size, but may have a higher intensity and value in number. Globally, migration is relatively low, about 3%<sup>1</sup> of the world's population. Although migration meetings important meetings are in a relatively relative state of the world - no country in the

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<sup>1</sup> [http://ec.europa.eu/eurostat/statistics-explained/index.php/Migration\\_and\\_migrant\\_population\\_statistics/ro](http://ec.europa.eu/eurostat/statistics-explained/index.php/Migration_and_migrant_population_statistics/ro)



world is left out of the flows of international migrants. Currently, the country of origin, country of transit or destination for migrants, but can retain all three attributes listed above, simultaneously.

### **The current state of research - literature**

The specialized literature approaches synthetically and integratively the phenomenon of labor migration<sup>2</sup> looking for new meanings in approaching the phenomenon of international migration.<sup>3</sup>

Legal migration must be the result of the common will of the migrant and the receiving Member State, for the benefit of both, and even more so, and for the benefit of the State of origin, in the context of circular migration. In applying the *acquis*, each Member State must decide on the conditions for the admission of migrants into its territory. Romania applies a specific immigration policy, depending on the needs identified at national level, but at the same time concerted, taking into account the impact that this policy may have on other EU countries, while ensuring fair treatment of immigrants and balanced integration in the host company.

Romania is exposed to both legal and illegal migration routes from European countries, but also from eastern and southern countries, having origins in the states of the Middle East, Southeast Asia or Africa. Although in some EU Member States there were migration trends from Central and South American countries, they were not felt in Romania, probably due to the geographical position and low attractiveness for citizens from these states.

Migration is a phenomenon that involves several consequences such as demographic, social, economic and political consequences. The phenomenon has grown significantly since 1980, and the desire to analyze this process has intensified in recent years and has covered all regions of the world, being currently a global problem.

International migration of highly skilled labor is a current feature of labor migration, and is also known as the "brain drain" which clearly evokes a loss of intellectual capital for countries of origin.

Migration is defined as "the mass movement of tribes or populations from one territory to another, determined by economic, social, political or natural factors; migration".<sup>4</sup> The International Organization for Migration defines the term migration as the process of population movement within a state (internal migration) or across borders (international migration). The phenomenon can also be analyzed, studied from the point of view of their two specific elements: time and space. "Migration involves the territorial relocation of persons between two or more states" the latter being the way of viewing the phenomenon of migration of the United Nations. The two organizations argue in terms of space, that migration is the movement beyond the borders of a country.<sup>5</sup>

In international migration, we encounter two closely related processes: immigration and emigration.

Immigration is defined as the receipt of persons or labor displaced in the country of destination for a temporary or permanent period. The main characteristics of the host country / immigration from the economic point of view are the following: relatively higher degree of economic development; high demand for labor, compared to national availability; low share of the able-bodied population in the total population.

Emigration is defined as having a commute for a person or workforce in terms of residence (country of origin) and country of reception (place of work). Thus, the country of origin is characterized by a lower degree from an economic point of view, with a higher share of youth and, in general, a population with a population activity of the entire population, perhaps high birth rate, but also the absence the possibilities of using them national plan for available labor force, the absence of investigations in some economic sectors. At the same time, the country of origin, for the care of labor or labor problems, there are many countries of emigration.

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<sup>2</sup> Katsel, L.T., Lucas, R.E.B., Xenogiani, Th. – *Effects of Migration on Sending Countries: What Do We Know*, Paris: OECD Development Centre, Working Paper Nr. 250, 2006.

<sup>3</sup> Iancu, Nicolae – *Migrația internațională a forțelor de muncă: considerații teoretice și repere economice ale fenomenului migraționist*, București, Editura Pro Universitaria, 2013.

<sup>4</sup> <https://dexonline.ro/definitie/migra%C8%9Biune>

<sup>5</sup> <http://www.oim.ro/ro/>

The balance of international migration is represented by the differences between the number of immigrants and the number of emigrants, in reference time (cancellation);

The resident population<sup>6</sup> includes all persons (Romanian, foreign or stateless citizenship) care and habitual residence in Romania, for a period of at least 12 months.

Types<sup>7</sup> of migrations encountered so far, even in our country can take into account the country and the country, when the criteria can be established:

- after each number and nature to overcome specific migrations, temporary / seasonal / rhythmic and diurnal;
- according to the residential environment, migrations can be: rural-urban, urban-rural, interurban, intrarural, interurban and intraurban;
- or according to the administrative criterion: internal and external;
- according to the mode of development: organized or unorganized;
- by purpose: economic, tourist, pilgrimage, etc.

Migrations are selective - this gives them a disruptive role; as an exception, they are those organized and carried out according to certain rules. Due to the selective character, the destructuring of the communities takes place, which requires the analysis of the phenomenon by age, by sex, by profession but also by the social environment.

The causes that determine at this moment the international labor migration are based either on the economic conditions in the respective country, or on the general conditions of a political, religious, cultural, ideological, national, geographical or other nature. People leave an area either in search of development opportunities and a better socio-economic level, or take refuge in another area following calamities or disasters, wars, religious or political persecution.

At the macroeconomic level, migration leads to the destabilization of the labor market, by creating either a surplus in certain areas or a labor shortage in certain sectors, for certain periods and in certain areas.

At the microeconomic level, both positive phenomena appear, by increasing the standard of living, satisfaction, the feeling of job security, and negative ones, which aim especially at the relationship with the group of origin.

The impact in Romania means affecting some sectors (construction, services, production) that were facing a shortage of labor, currently alarming unemployment at international and national level, as a result of the crisis that has severely affected various sectors such as construction or banking services. The decline of the active population is also influenced by direct loss and effects over time, due to the imbalance of age structures and as a result of the migration of the young population.

States are concerned with identifying and implementing measures that foreshadow some tendencies to avoid secrecy or to bring it to the lowest level. In Romania in the 1990s, it was based on an asylum application, with employment in the labor market until the asylum application was resolved.<sup>8</sup> Other ways are: leaving the country with a tourist visa, followed by illegal employment in the destination country, migration mediated by the state and leaving the country of origin by identifying potential employers in the destination country even by the migrant.

### **The legislative framework**

The management of the migration phenomenon is based on the participation of all institutions with competences in this field, through a participatory management and through inter-institutional, national and international cooperation.

The current normative framework that regulates the regime of foreigners in Romania, of the citizens of the EU member states and of the European Economic Area, as well as the legal norms that regulate

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<sup>6</sup> [http://www.insse.ro/cms/sites/default/files/com\\_presa/com\\_pdf/poprez\\_ian2017r.pdf](http://www.insse.ro/cms/sites/default/files/com_presa/com_pdf/poprez_ian2017r.pdf)

<sup>7</sup> [http://www.insse.ro/cms/sites/default/files/com\\_presa/com\\_pdf/poprez\\_ian2017r.pdf](http://www.insse.ro/cms/sites/default/files/com_presa/com_pdf/poprez_ian2017r.pdf)

<sup>8</sup> [https://www.mae.ro/sites/default/files/file/anul\\_2016/2016\\_pdf/2016.11.01\\_anexa\\_4\\_oug\\_194-2002.pdf](https://www.mae.ro/sites/default/files/file/anul_2016/2016_pdf/2016.11.01_anexa_4_oug_194-2002.pdf)

asylum in Romania is mainly conferred by GEO no. 194/20029 regarding the aliens' regime in Romania, republished, with subsequent completions, GEO no. 102/2005<sup>9</sup> regarding the free movement on the Romanian territory of the citizens of the member states of the European Union and of the European Economic Area, approved with modifications and completions by Law no. 260/2005<sup>10</sup>, with subsequent amendments and completions, Law no. 122/2006<sup>11</sup> on asylum in Romania, with subsequent amendments and completions and GEO no. 56/2007<sup>12</sup> regarding the employment and secondment of foreigners on the Romanian territory, approved with modifications and completions by Law no. 134/2008<sup>13</sup>.

Romania's membership of the EU has led, in recent years, to substantial changes in the legal rules governing the regime of aliens in Romania, the citizens of the Member States of the European Union and the European Economic Area, as well as the legal rules governing asylum in Romania, in order to ensure compliance with European legislation in the field and with other legal instruments of an international nature to which the Romanian state is a party. For the full application of the provisions of the Schengen acquis, since the adoption of the Council decision in this respect, the general framework has been created by adopting legislative, institutional, administrative-technical measures in order to implement the relevant acquis.

The regulation of the migration process is ensured by the International Organization for Migration (IOM). By promoting international cooperation on migration issues, IOM believes that regulated migration benefits migrants and society alike.

IOM opened its office in Romania in 1992 to respond to information and counseling needs related to emigration.

The ILO Constitution<sup>14</sup> provides explicit recognition of the link<sup>14</sup> between migration and economic, social and cultural development, as well as the right of persons to free movement.

## 1. Method and tools of analysis

In the public administration a lot of data collection methods are used, methods that can be included in the qualitative or quantitative or even mixed ones, this group being formed by the cumulation of the first groups, the most common in this field are: observation, experiment, document analysis, the interview that can be conducted individually or in groups, opinion polling and case study.

In social research, the most common method for the best possible analysis of the migrationist flows is the opinion poll, by the word opinion can be understood a predisposition or a state towards a certain referent. Beliefs and skills are what form the opinion.

The fundamental aspects that we must take into account when we talk about public opinion are: the intensity of the opinion, the importance of the subject, the establishment of opinions.

It is very important to take into account these three fundamental aspects because if the opinion does not have a desired intensity, and the importance of the subject is very small and the opinions are unstable then it is wrong to take into account the public opinion.

The study has as a basic tool the questionnaire that can be done only when we know exactly how the problem is presented. The questionnaire has an introductory part, a part that aims to gain the trust of the respondent. In this part it is written who makes the questionnaire, for what purpose and for what purpose it can help him. Then follow the questions that must be clear and formulated in accessible language. Mainly short questions are used that can be opened, each to give an answer but there can also be closed questions, which will be answered, yes or no.

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<sup>9</sup> <https://www.politiadefrontiera.ro/files/docu/1460966067379-oug102.pdf>

<sup>10</sup> [http://www.cdep.ro/pls/legis/legis\\_pck.htm\\_act?ida=59593](http://www.cdep.ro/pls/legis/legis_pck.htm_act?ida=59593)

<sup>11</sup> <https://www.oim.ro/attachments/article/364/LEGEA122ANUL2006.pdf>

<sup>12</sup> [http://www.cdep.ro/pls/legis/legis\\_pck.htm\\_act?ida=72877](http://www.cdep.ro/pls/legis/legis_pck.htm_act?ida=72877)

<sup>13</sup> <http://www.legex.ro/Legea-134-2008-87987.aspx>

<sup>14</sup> <http://www.oim.ro/ro/>

For this study, in addition to the results obtained from the interpretation of the answers received from the application of the questionnaire, statistical data were used from the Eurostat website (statistical office of the European Union) which promotes the following values: respect and trust, promotes innovation and information services.

### Research results

The main statistical results show that the population of the European Union in terms of demography and migration is estimated to be growing - 513,154,880 people in 2018 (estimate) compared to 511,698,062 people in 2017. In Fig.1 we see estimated data for 2017: Germany is at the top of the ranking with an estimated total population between 69,400,001 and 83,195,677 people. Next in the ranking are England, France and Italy with the related islands, with a population that is estimated between 55,610,001 and 69,400,000 people.

Between 41,820,001 and 55,610,000 people are only Spain, Poland's population is estimated this year between 28,030,001 and 41,820,000, in terms of Romania, it is located between 14,240,001 and 28,030,000 along with the Netherlands . The rest of the EU28 countries have an estimated population between 443,544 and 14,240,000, these being all the Nordic countries, the Central Western countries (Austria, Hungary, Croatia, etc.) but also the southern countries (Portugal, Greece and Bulgaria).

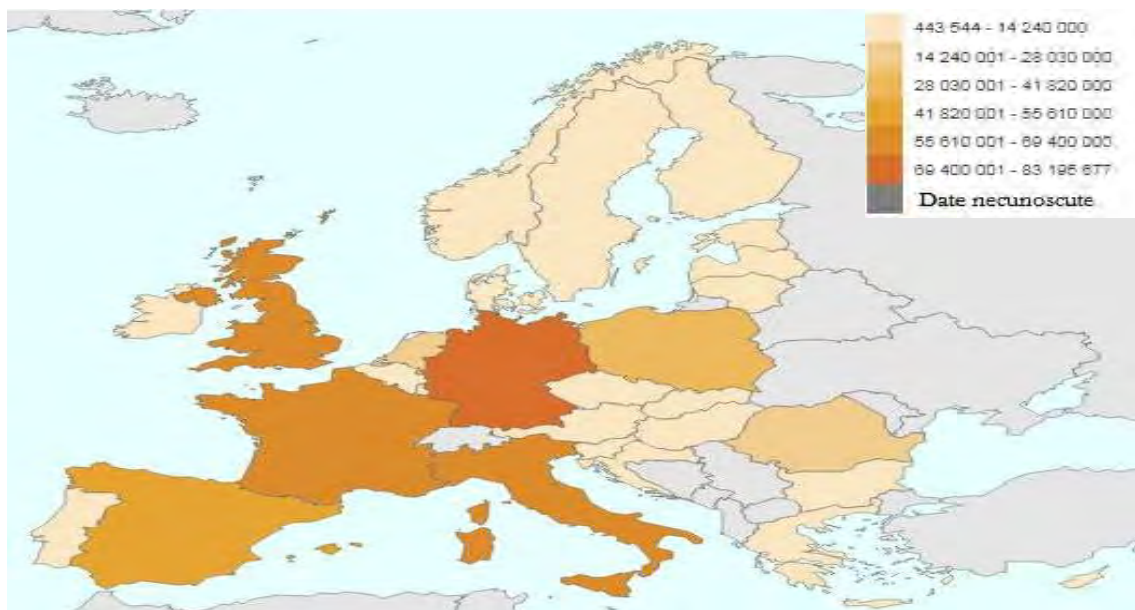


Fig. 1. EU population in 2017 - demographics, migrants and projections (estimate)

Source: <http://ec.europa.eu/eurostat/web/population-demography-migration-projections/statistics-illustrated>

Although migration is on the rise at EU level, for some Member States the number of migrants is increasing and for others it is declining. Table 1 shows that countries such as Germany, France, Italy, Austria, Romania, Finland and England show a slight increase in emigration, and countries such as Spain and Portugal fall from about 400,430 people, respectively 49,572 people in the year 2014 arrives in 2016 to have emigrants of 327,325 persons, respectively 38,273 persons, even if both countries there is also a decrease in 2015, but this is much smaller compared to 2016. This can be easily seen in fig.2.

Romania in 2014 registered 172,871 emigrants, a value that increased in 2015 by 21,847 people. And compared to 2015 in 2016, it also had an increase of 12,860 people.

Table 1. Emigrant population in the period 2014-2016

Country / Period	2014	2015	2016
Germany	324,221	347,162	533,762
Spain	400,43	343,875	327,325
France	136,328	295,911	157,065
Italy	53,491	146,955	64,428
Austria	49,572	56,689	38,273
Portugal	172,871	40,377	207,578
Romania	15,486	194,718	18,082
Finland	15,486	16,305	18,082
England	319,086	299,183	340,44

Source: <http://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do>

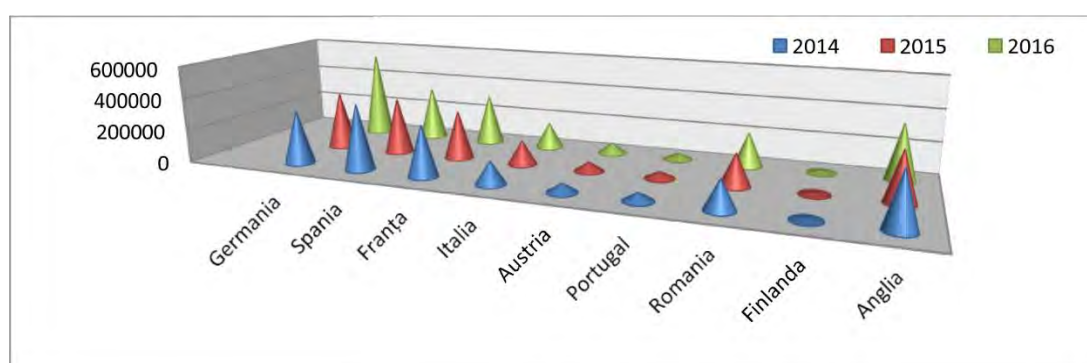


Fig. 2. Emigrant population

Source: <http://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do>

Immigrant population in the three years analyzed increased considerably

in countries such as Germany, Spain, France, Italy, Austria, Portugal, Romania and Finland, but England recorded decreases if in 2014 the immigrant population was 631,991 people, in 2015 it decreased but by 539 people, but in 2016 they reached 588,993, the difference between 2014 and 2016 it is 42,998 people. I believe that this visible decrease between 2015 and 2016 is also due to the fact that England wants to leave the EU28.

Romania, according to the data in table 2, registered an increase, if in 2014 the immigrant population was 136,035 people, in 2016 it reached 137,455 people, even if in 2015 it had a decrease of 3.24 people. All the above can be seen best in fig. 3, where all the data in table 2 are represented graphically.

Table 2. Immigrant population in the period 2014-2016

Country / Period	2014	2015	2016
Germany	884,893	1,543,848	1,029,852
Spain	305,454	342,114	414,746
France	340,383	364,221	378,115
Italy	277,631	280,078	300,823
Austria	116,262	29,896	129,509
Portugal	19,516	132,795	29,925
Romania	136,035	132,795	137,455
Finland	31,507	28,746	34,905
England	631,991	631,452	588,993

Source: <http://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do>

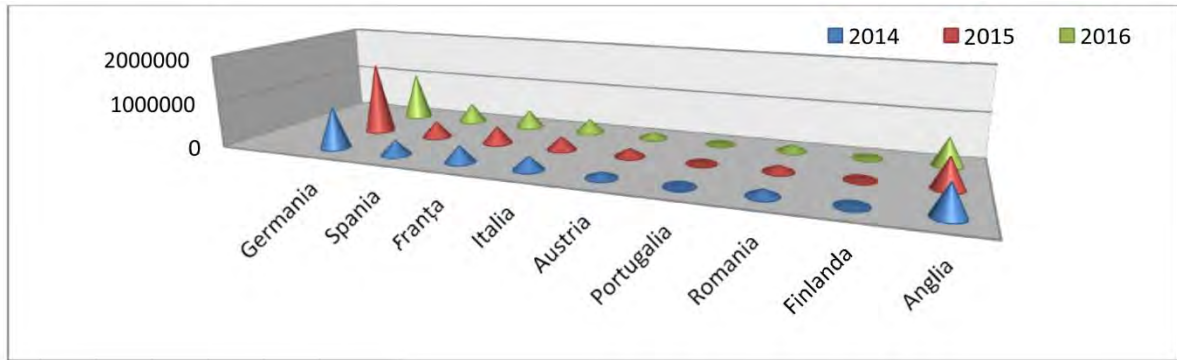


Fig. 3. Immigrant population

Source: <http://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do>

The completed questionnaire was applied to a sample of a 125 people who at the time presently works abroad, and has been applied online. The questionnaire included 15 questions, questions that were asked with both open and closed answers. Out of 125 questionnaires, we took into account 105 (represents the number of respondents employed in a paid activity) and 10 (represents the number of employees who do not have a paid activity abroad).

Results of the questionnaire: approximately 33% are between 26 and 35 years old, and the fewest are those over 46 years old only 18%, between 18 years old and 25 years old the percentage is 23% and between 36 years old and 45 years old only 26%. The age at which they went abroad varies between 18 and 45 years and only 16% are those who have chosen to leave at the age of over 46.

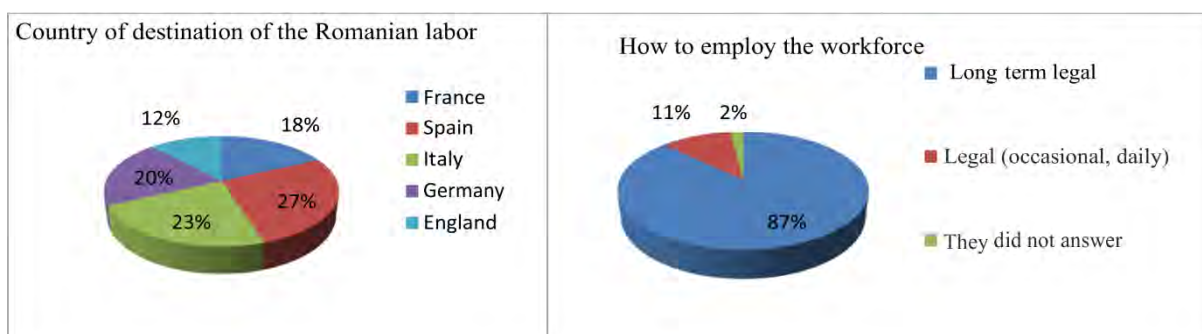
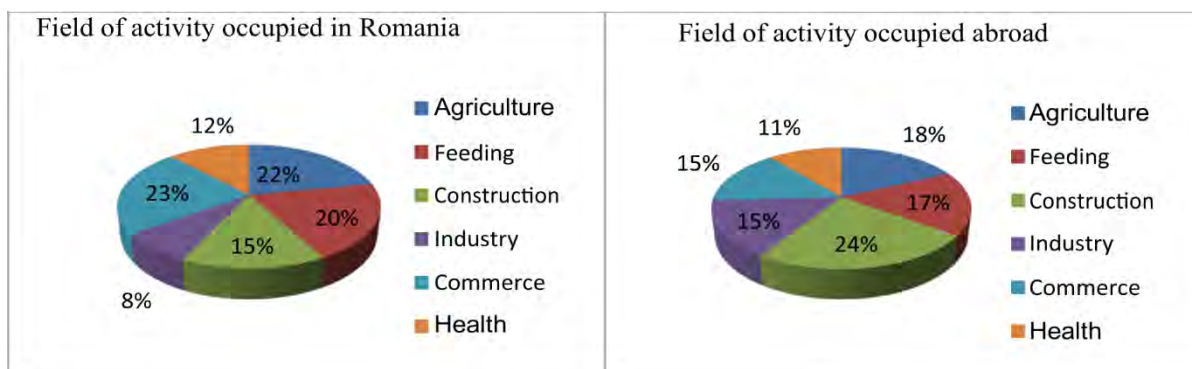


Following the centralization of the data, it is observed that the share of females is 33% compared to the share of males, which is 67% of the total number of respondents. This result does not support the fact that men are more willing than women to go abroad to work or that their role in the family is easier to fill, but it results from the fact that hard physical work is the one that requires coverage and can be performed by men. . 55% of the men surveyed are employed in construction (construction sites, stone quarries, wood processing plant), 35% in agriculture and 10% in services (IT, health, transport). 75% of the female population is employed in services (health, housekeeping, including care for the elderly or disabled), 25% in agriculture. Italy ranks first as a destination for females, and Spain as a destination for males; next is Germany (as a choice for women) and England (as a choice for men).

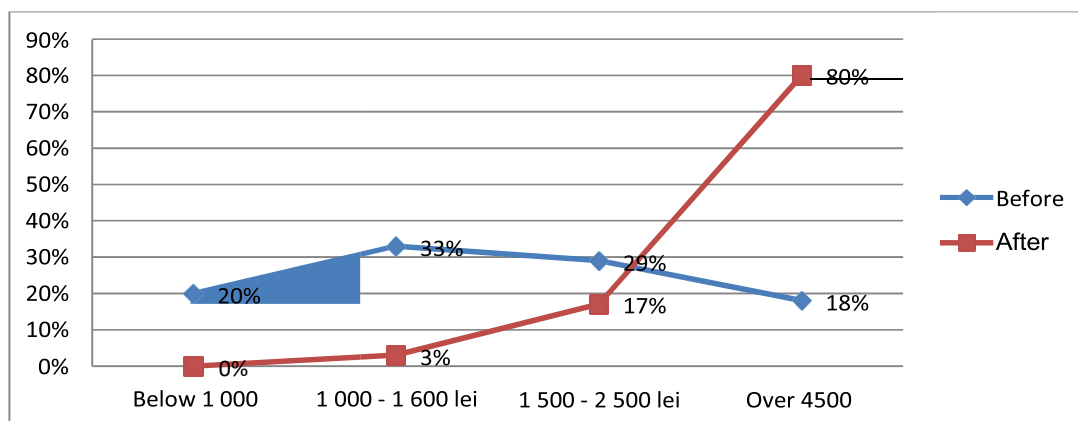
The origin of the respondents is varied: 27% from western Romania, 53% from the east and 10% from the central area of Romania. These weights are not relevant given the number of border crossing points and the fact that, in order to avoid congestion, less frequented crossing points are sought, especially during the holidays (ie those in smaller localities). In addition, due to the introduction of low-cost flights / flights on the main routes connecting Romania with the destination countries for the labor force in our country, this mode of transport is preferred, which offers comfort and time savings.

The results obtained by centralizing the answers, Spain is the main destination of the workforce (27%), followed by Italy (23%), then Germany (20%), France (18%) and the few chose England (12%). ). Out of a total of 125 respondents, 87% are legally employed, 11% work occasionally, seasonally and 2% did not want to answer this question. If in the country the field of activity where they worked was in trade / services about 23% after they left, now they work in the field of construction about 24%. The field where

they worked before and registered the lowest value is the field of industry, 8%, and after they left, we find the lowest percentage in the field of health, 11%.



Those who chose to leave previously earned between 1300 lei and 1600 lei, 33%, and in the current moment earns in euro the equivalent of over 4500 lei approximately 80%, and 97% at the moment have the possibility to make savings from the monthly incomes. Even for a lower income, they preferred to go to work abroad in the hope that over time their income will increase and give them real chances for a better life.



Graphic representation of salary income before and after leaving abroad

Unfortunately, most of them, 88% are left alone abroad, leaving the family in the country.

Most are 35% high school graduates, 5% vocational and vocational schools and only 28% are with higher education. Fortunately, 75% would go back, but if certain things changed in the country's leadership. The environment of origin of the respondents is 68% urban and only 32% rural.

## Discussions and conclusions

External migration has multiple effects that affect the entire social system. Thus, from this study, we list some levels of their analysis: demographic, social, economic, political, from the perspective of global relations. From the demographic point of view it is clear that if a consistent segment of the active population leaves, then the mortality rate will increase, due to the increase of the older population segment. Also, external migration has a significant influence on the fertility of the country's population. The emigrants increase the fertility rate of the country of destination, reducing the departure of the origin country.

Obviously, the Romanians decide to leave their native country not only because of the level of the net salary. There are other socio-economic factors that determine the decision to emigrate, but the satisfaction with the wage income or the total income obtained is important.

After conducting this study we can find an answer to the question that concerns from economically and socially: international migration - a challenge: a gain or a problem? The results indicate that international labor migration is a short-term gain for the country that provides the workforce but over a long period of time this gain becomes a problem because when the skilled labor force does not return to the country of origin to exercise their skills, the remaining population is aging, thus we will not have a very high yield.

The unemployment rate is rising because of many people give up continuing their studies so they do not have the necessary skills to be able to replace the aging workforce. But for the host country, the one that receives the labor force is a gain for a longer period of time because they will benefit from the apt and well-prepared labor force, but in addition to the gain brought, problems will appear because the population will be more and more. more, the greater the demand for jobs.

Therefore, international migration is currently a challenge not only for the labor force but also for the host country.

## Notes

External migration is a strongly conditioned socio-demographic phenomenon. Starting from defining the concept of "migration" and its operationalization in dimensions and indicators, we will analyze the statistical-descriptive which is the impact of the net average wage on the external migration. Then, we will emphasize the influence of external migration on the phenomenon of aging of the population and on the workforce in Romania.

The issue of migration is so complex that it concerns a broad spectrum of specialists in social sciences: demographers, sociologists, geographers, economists, political scientists or experts in international relations. Lately, practicing psychologists and social workers are interested in the social and economic consequences of migration as they must provide services oriented to the needs of migrants faced with problems of socio-cultural integration in the countries of "adoption" or with specific problems of the so-called "return migration". "

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# BLOCKCHAIN TECHNOLOGY AND MACHINE LEARNING ALGORITHMS FOR A NEW MANAGEMENT APPROACH IN THE CONTEXT OF BIG DATA FOR AVIATION INDUSTRY

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## Abstract

**Purpose** – *The purpose of this article is to define the current context of the fourth industrial revolution and to highlight the importance of making sense of the huge amount of available data for data-driven business decisions.*

**Methodology/approach** - *In this paper, we analyzed the general impact of the cutting-edge technologies from the sphere of AI, like Blockchain and machine learning, especially in the aviation industry.*

**Findings** – *Now, more than ever, emerging technologies will take the phenomenon of globalization to a whole new level. In a data-driven business ecosystem, traditional management it is no longer an option.*

**Research limitations/implications** – *Not every company is ready to implement the proposed technologies. The right path is changing the culture towards digitalization and step by step adding new technological tools.*

**Practical implications** – *Organizations that will understand the benefits of the Blockchain technology and data analytics tools will have an exponential business growth.*

**Originality/value** – *The concept of the Blockchain technology was emphasized in a small application developed in the Python programming language. This program presents an innovative approach for the supply chain management of an aircraft's components.*

**Key words:** *Big Data, The fourth revolution, Aviation Industry.*

## Introduction

Our modern society will never be the same. In every phase of globalization, technology has played an important role in the world's economy, being a catalyst for this process of transforming the world into a single unit, with a common policy and economy.

We are certainly living in a world ruled by technology, which is indispensable for both industry and common user. The term "technology" refers to a very wide area of innovations which are not all applicable in our current society. Choosing the right technology for the right industry can be challenging. Often, managers are either too confident in the benefits of a technology and make things complicated in their organizations or are either too scared or skeptical to realize the advantages of embracing the new technologies. Thanks to a cheaper storage media, faster processing methods, faster communication channels and better algorithms, data can be stored and processed in huge quantities, giving organizations the opportunity to achieve new performances. However, the process of digitalization and technologicalization implies downsides if they are not properly understood and implemented in the context of each industry.

The current context of the third millennium is the digital reality generated by the expansion of data. A situation that needs new business approaches, new marketing campaigns and new tools for interpreting and analyzing data.

Big data, or in other words, information of extreme, diverse and complex dimensions governs around any modern organization today.(Youssra Riahi & Sara Riahi, 2018) Whether we are talking about employees who produce a multitude of data (emails, reports, recordings, social media, etc.) or suppliers and customers who generate various data by the nature of their actions, the data is produced throughout the entire chain of a company. The challenge is to have quick access to data and transform it in structured information. The ability of storing all this information is worthless if there is no capacity to analyze and interpret this data.

According to a study on the evolution of data globally so far and estimated until 2025, there is an exponential increase over the years (Statista, 2020).

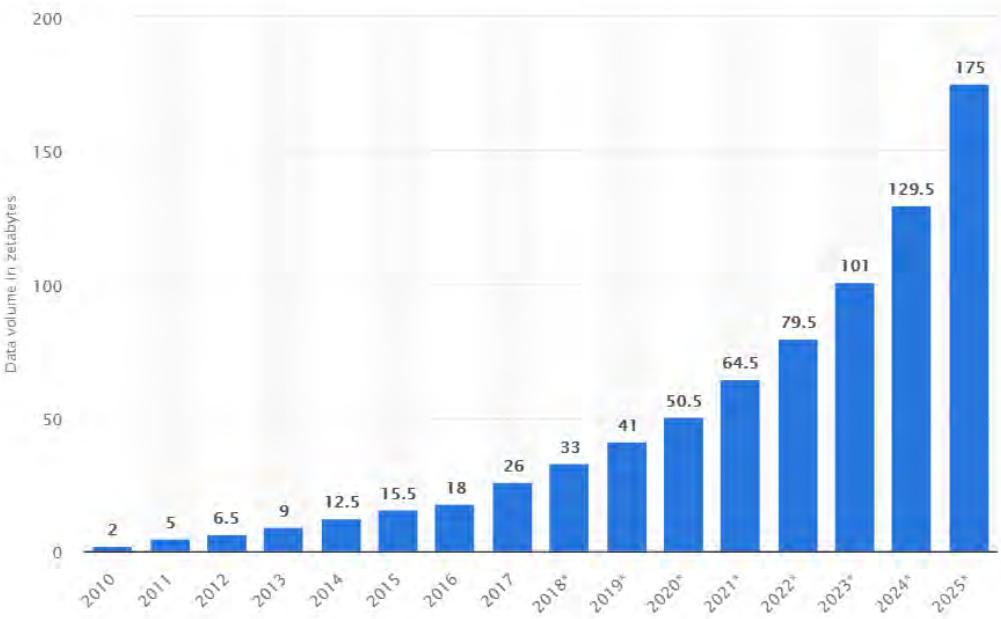


Figure 1. The evolution of data globally so far and estimated until 2025(Statista, 2020)

### Research problem

The strategy based on the idea of continuous improvement and meeting customer requirements is alive and well rooted in the strategy of any successful organization in the world. Achieving these objectives is due to the implementation of quality improvement concepts. The positive results of a company are never accidental, on the contrary, they appear due to the implementation of well-established methods of quality improvement. However, traditional approach of quality improvements is no longer a viable solution in a system governed by data.

For instance, “Lean” thinking refers to the fluency of a process and consists in eliminating all unnecessary elements and simplifying the whole process to make it faster and easier to follow. (Yagulawathi Thangarajoo, 2015). The ideal result of applying the “Lean” philosophy is a shorter, faster and a more productive process, which will satisfy both the customer and the employees.

“Lean” management is about speed and simplification, about delivering an order in the shortest possible time without compromising quality and by eliminating unnecessary elements that do not add value. This method of streamlining a process involves using only the resources strictly necessary. Thus, the goal is to do more with less. Basically, a “Lean” process is “smooth” because it aims to achieve a maximum yield for each available resource.

Therefore, the “Lean” approach is a well-known fundamental concept of optimizing a process which is still valid nowadays. Now, more than ever, these principles can be applied in the current industry, with the help of technology. Starting from the root quality principles, discovered in the past, mixing them with the latest tools of automatization and data analytics, improvements can be amplified in an unprecedented way.

## **Research Methodology**

The emergence of a new industrial revolution is a natural evolution of the society in which we live, given the expansion of technology in the recent years. The fourth industrial revolution completes the previous revolutions generated by the discovery of the steam engine, electricity and innovations in the field of information and communication technology (Mustafa Ertunc Tat & Melih Cemal Kushan, 2017). The main features of this new industrial revolution are connectivity and digitization with obvious benefits both in terms of process efficiency and in terms of economics.

These technological developments are also applicable in the air transportation, where the safety and quality of the technical interventions should be always at the highest standards. All these technologies that are based on automation, IoT, artificial intelligence, digitization, data analysis, 3D printing and augmented reality have the potential to change the aviation industry by generating new mechanisms to make it not only more efficient but even safer.

The aviation industry realized that a predictive maintenance activity could be prepared in advance, based on real-time information obtained directly during flight. At the time of landing of an aircraft, the technical staff would be able to already know what is wrong with the aircraft and act accordingly. It is indeed a challenge, but it can be achieved in the current technological context. Theoretically, this situation could be possible due to the connectivity between the aircraft sensors and the ground receptors or through a satellite. Identifying the cause of a defect even during the flight could automate the maintenance activity, by notifying the maintenance staff and ordering the parts needed for the repair process.

An aircraft is equipped with many sensors capable of recording data related to the evolution of the flight parameters (Victor Emmanuell BADEA & Alin ZAMFIROIU & Radu BONCEA, 2018). The cumulative analysis of these parameters using specific technologies of the fourth industrial revolution would help specialists to understand on time the behavior of an aircraft, so maintenance intervention can be performed before faults occur. Identifying a pattern in the way a technical system will fail is now possible with the help of artificial intelligent. Predictive maintenance translates into aviation safety because it has the potential to avoid certain accidents and extend the life of an aircraft. Anticipating technical problems before they strike and spread in the system has always been a concern for specialists in this field. Synchronizing predictive maintenance with logistics activities will lead to a much higher aircraft availability, time and financial resources saved.

Moreover, the fourth industrial revolution bring to light the benefits of using augmented reality. The lack of expertise or experience can be compensated with the help of augmented reality, directly from the user's tablet. This type of technology that combines actual reality with virtual reality develops an augmented reality which provides more suggestive instructions for technicians. The technician's activity is monitored and verified in real time. Difficult situations can be resolved through a video conference, where a more experienced specialist, located anywhere in the world, can provide real-time assistance. At the same time, artificial intelligence algorithms process the data collected through the system, identifying new risks and activities that can be improved or optimized.

An aircraft technical logbook is a specific document which provides information about the maintenance status and operational data of an aircraft. It is the main communication tool between pilots and a maintenance organization. Pilots see the condition of the aircraft and report any malfunctions after the flight. Its digitalization will ensure top management that all tasks are consulted, understood, and executed in full volume (Abd Hakim Haruzly & Ghadzali I.F.S & Fadzil Adly Ishak, 2019). This way of working involves the implementation of an information system at every level of the organization powered by intelligence algorithms for data analytics. All the necessary information for the technicians is managed in electronic format and accessed through individual tablets.

The implementation of an electronic logbook would allow a real-time data interpretation and a fast identification of optimal solutions to fix a malfunction in a much shorter period. A digitized technical logbook synchronized with an integrated maintenance system and combined with a friendly interface would allow an efficient and a fast communication with all the personnel involved in the flight preparation activity of an aircraft.

Digitalization is the first step in the attempt to improve management activities in an organization. Further, after the first step is completed, as a result, more data will be generated. Therefore, the second step is to find an innovative method of storing data – Blockchain solution.

### **The Blockchain platform in the supply chain management of an aircraft's components**

Airlines, aircraft production companies and maintenance organizations focus on creating a digitalized environment by implementing emerging technologies such as cloud computing, IoT and blockchain.

Implementing a Blockchain platform defines a new paradigm where the Internet of Things (IoT) play an important role to ensure an interconnected ecosystem. "Internet of Things" is the promoter of the fourth industrial revolution due to the development opportunities that this concept brings to the industry. The principle of connecting household devices to the Internet also applies to industrial processes.

The Internet of Things, or IoT, refers to the billions of devices around the world that are now connected to the internet, all collecting and sharing data. Due to the recent improvement in the computing power system and wireless network infrastructure it is possible to transfer almost anything at impressive speeds.

However, once the transfer is realized, sensitive data is not safely stored. This is why Blockchain technology defines a new standard in data storage.

Blockchain is an immutable and distributed digital database which uses cryptography to secure the trade data (Ahrash Aleshi, Remzi Seker, Radu F. Babiceanu 2019). The resulted digital ledger is a chain of many blocks of content. Each block has an associated unique number, which basically encode the whole information and consist in a hexadecimal hash. In addition, each block usually contains a link to a previous block. Therefore, results a chain of blocks distributed in a private or public network, governed by a set of predefined rules.

Transparency and immutability are fundamentals for the Blockchain technology. Once a data is recorded, nobody can change or delete it. Blockchain is also remarkable because it is a self-sustainable database with no central authority. Due to its characteristics, blockchain is a reliable solution for data storage and for ensuring traceability of an asset. Blockchain was design for cryptocurrencies but it can be successfully used in any industry because of its benefits.

Aviation industry manage sensitive information, in a system with various parties involved. Applying this technology to a supply chain would optimize this flow by reducing downtimes and deliver products just on time. Solutions based on blockchain technology are currently being explored to improve the sustainability of supply chains (Yash Madhwal & Peter B. Panfilov, 2017).

The international supply chains of the aviation industry are extremely complex. It generally involves many players in different stages of delivery and often rapid changes appears. For this reason, it is important to be able to clearly track the route or origin of the supply of a component. At present, the entities involve in the flow manage their own data separately, which can lead to confusion and miscommunication.

The IT systems of companies involved in a supply chain are not able to communicate with each other constantly. Therefore, ensuring the transparency and traceability of components involves the use of a secure common network such as Blockchain. This ensures immediate transparency of data in supply chains for all partners involved.

In the aviation industry there are various expensive aircraft's electronic components that need special storage and transportation conditions in terms of temperature, humidity and vibration. Having the ability

to not only monitor those parameters in real time of every electronic component but also share that information with all members in the supply chain is extremely useful.

In order to highlight the Blockchain concept and present how it can be applied in a real-life scenario, we developed an application using Python programming language. Its purpose was to create a chain of events associated to a supply chain activity. In a business to business situation, we assumed that an aircraft component supplier has to deliver an electronic component to an aircraft final assembly line, located cross-country. The asset was loaded onto a truck equipped with IoT sensors for temperature, humidity and vibration in order to be delivered. Every time the value of the three parameters has changed a new block was generated. Each block consists of a unique hash number("current\_hash"), hash of the previous block ("previous\_hash"), temperature, humidity, vibration, compliance status and a number called "nonce" which is used to verify the correctness of the Blockchain.

In the following figures, three stage of the developed Blockchain was presented:

- Figure 2: The initial block, also called genesis with no data stored;
- Figure 3: The second block that contain the first recorded data. Values of the recorded parameters are in the correct range, as a result the compliance status is "Compliant";
- Figure 4: The third block recorded a temperature above the normal value, therefore the compliance status is "Non-Compliant";

```
1  {
2    "chain": [
3      {
4        "SupplyChainParameters": [],
5        "current_hash": "8a080cea809d1b9d33b541f3498b1b6366ffc66df75423108947085057cf2f99",
6        "index": 1,
7        "nonce": 1,
8        "previous_hash": "0",
9        "timestamp": "2020-07-22 13:16:15.761889"
10     },
11  ],
12 }
```

Figure 2. The genesis block

```
11  {
12    "SupplyChainParameters": [
13      {
14        "ComplianceStatus": "Compliant",
15        "Humidity(%)": 55,
16        "Temperature(°C)": 39,
17        "Vibration(Hz)": 50
18      }
19    ],
20    "current_hash": "00042a67283d67d27b4d1f4245e59b93e304327a36e9c72a02645047c63dc55f",
21    "index": 2,
22    "nonce": 1969,
23    "previous_hash": "8a080cea809d1b9d33b541f3498b1b6366ffc66df75423108947085057cf2f99",
24    "timestamp": "2020-07-22 13:18:08.507097"
25  },
26 }
```

Figure 3. The second block – compliant data

```

26     {
27         "SupplyChainParameters": [
28             {
29                 "ComplianceStatus": "Non-Compliant",
30                 "Humidity(%)": 55,
31                 "Temperature(°C)": 79,
32                 "Vibration(Hz)": 50
33             }
34         ],
35         "current_hash": "000877944b1f87e0a2d0e58abebf46f2dc9fdac41649f7ba09bc701104b4ed62",
36         "index": 3,
37         "nonce": 16201,
38         "previous_hash": "00042a67283d67d27b4d1f4245e59b93e304327a36e9c72a02645047c63dc55f",
39         "timestamp": "2020-07-22 13:24:00.770575"
40     }
41 ],
42 "length": 3
43 }

```

Figure 4. The second block – non-compliant data

As it can be observed, the purpose of a Blockchain is to ensure traceability and transparency of an asset within a business network. Using this solution, quality will increase considerably, and some processes can be automated to reduce time and cost. In the presented scenario, the driver could be automatically notified to cancel the order and return to the original base to replace the damaged component.

Having the capability to ensure this kind of traceability of an aircraft components, not only throughout the supply chain but also throughout the fabrication, storage, repairing and operational period, will reduce counterfeiting and will increase the lifetime of the monitored components. All together, means saving time and money and safety improvements for aviation industry.

As a future work, the above theory will be implemented in a real case scenario in which we intend to equip a truck with a series of sensors for measuring temperature, humidity and vibration. The truck will transport aviation components from a Maintenance Repair and Overhaul supplier to an Aviation Maintenance Organization. The Data will be sent in a cloud infrastructure in real time in order to build a Blockchain structure. If some of the three parameters will exceed the established limits, the driver will be automatically notified on his mobile to cancel the transportation. The encountered challenges, technical details and results will be presented in a future article.

## Conclusions

The fourth industrial revolution will certainly change business models. The most productive decisions are those based on the interpretation of data. Nowadays, the collection, storage and interpretation of data must be a priority for any competitive company. A relevant interpretation of these data can be made only by a total digitization within the organization and by using the latest technologies.

Well rooted concepts about quality improvement remain valid but their application need technology to be more efficient.

One of the most complex industry in the world is the aviation industry, where the need of innovation is more severe due to its complexity and safety requirements. Therefore, moving to the next level involves the use of artificial intelligence.

On top of that, creating an open platform, like Blockchain, to enable the secure and anonymous exchange of data for the aerospace industry, is the best management strategy today.

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# ASPECTS REGARDING THE MANAGEMENT OF THE DESIGN AND TESTING OF A NATURAL GAS MEASURING DEVICE

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## Abstract

**Purpose** – Limiting or stopping unauthorized natural gas consumption on natural gas meters.

**Methodology/approach** - It is presented the impact that an unauthorized intervention has on the measuring device, its verification in the laboratory and the elaboration of some management procedures that will help to improve it.

**Findings** – Natural gas meters are quite vulnerable, and due to these unauthorized interventions safety in operation is endangered, and the damage caused is very high.

**Research limitations/implications** – Even if a lot of precautions are taken to stop this phenomenon, gas meters are of many types of construction and the possibilities for intervention are quite many.

**Practical implications** – Verification of measuring devices with unauthorized intervention in the metrology laboratory and determination of measurement errors.

**Originality/value** – Designing a new type of natural gas measuring device by developing management procedures with which to be able to reduce all known methods of fraud and to provide safety in operation.

**Key words:** gas meter, quality and risk management, prototype.

## 1. Introduction

In the distribution of natural gas, meters are a main element, because with their help we measure the amount of gas sold or bought. For this reason, it is very important that the gas meters be designed and constructed in such a way that their indication errors fall within the maximum allowed limits. This paper presents two methods of unauthorized intervention on a measuring device. Emphasis is placed on operational safety, prevention and the impact on the distribution company, as well as a set of management procedures that help reduce these interventions. For each intervention method, a meter measurement error is established in the metrology laboratory, this again meaning a loss for the distributor.

A case study was made regarding the analysis that emerged after the verification of the meters in the laboratory and an optimized meter is sketched that is able to prevent these interventions. Basically, in this paper we try to optimize a gas meter based on management procedures so that it can no longer be fraudulent, no longer represent a risk in operation and implicitly no longer cause damage to the distributor.

## 2. Literature review

The construction of the meter must be made of resistant materials that suffer little or no changes due to aging and that must be resistant to moisture and the corrosive action of gases. Meter housings must be constructed in such a way that they are watertight at the maximum operating pressure of the meter. (0.5 bar in our case). The meter must operate in normal outdoor conditions, subject to rain and solar radiation. The meters must be protected against interventions that could affect the measurement. They

must be constructed in such a way that any mechanical intervention from the outside produces a permanent deterioration of the metrological mark or of the meter, as the case may be. Gas meters whose numerical integrator only works for a certain direction of gas flow must have an arrow on its housing to indicate the direction of gas flow. With the help of some rules or procedures, a device can be imposed to prevent the gas from flowing in the opposite direction.

The meter must operate at the maximum flow in the time interval that is specified in the meter norm, without the changes of the metrological characteristics exceeding the limits prescribed in it. (NML 3-04-96)

The quality management of the gas meter can be defined as a set of coordinated activities aimed at controlling its quality. Quality management is done through quality planning, quality control, quality assurance and last but not least quality improvement. (Morariu, 2016)

From the perspective of the customer but also of the distribution company, it is important that the gas measurement is as accurate as possible. Even though gas meters are constantly being improved, they are quite vulnerable to outside action. A main factor is given by the economic component, a cheap meter cannot have all the elements of protection against a deliberate external action.

According to Law 123 of 2012, unauthorized intervention in the distribution system is a crime and is punished accordingly. The management of these interventions is quite elaborate and expensive.

Looking at this meter from the perspective of quality management, it must satisfy through all its technical and economic characteristics the purpose for which it was designed, that of measuring as accurately as possible. (Ilea and Stoica, 2020)

The role of this study and of the improvement to the gas meter is to help natural gas distributors to be aware of the risk they are subject to, so that they can manage these risks. Here we can see the connection between quality management and risk management, two branches of management that cannot exist without each other. (Risk management course)

In this paper, the product innovation is represented by the natural gas meter, and the identification of the problem for which the innovation is desired is represented by the unauthorized intervention. There are solutions to stop them and put them into practice. (Popescu, 2016)

The process management proposes planning the optimization activities of the new meter by improving the actual process; by innovating it, starting with the problems / criticisms brought to it, needs and expectations. The whole process is evaluated, the improvement opportunities are selected, the meter is optimized, and then the obtained performances are continuously monitored and evaluated. (Olaru, 2000)

Pantelemon Frasineanu proposes the introduction of smart meters on the market. An economic analysis was made of the benefits brought by this implementation, both quantitative and qualitative. Not only the implementation costs are quite high but also the costs for their maintenance. According to those presented, I believe that in addition to the smart side of the meters, the design must be as well done so that the fraud aspect must be at minimum. In the case of smart meters, if they are fraudulent with known methods, the economic impact can be up to 10 times higher, because of the price point from the classic ones. (Pantelemon, 2014)

The great professor of Romanian origin Joseph M. Juran reminds us that quality is everyone's problem. "If we do something, let's do it right from the start." These principles show us again the importance of designing and executing a meter that is qualitative at the highest level. This principle brings very good results, both for gas consumers and for the distributor. (Managementul Calitatii)

Risk management is a cyclical and continuous process. The risk is defined by the possibility of certain damages being created. The risk probability in this case is relatively high, and the impact of the risk is given by the financial damage caused but as well of that of the image (Managementul Riscului)

A gas meter must not have features that would facilitate fraudulent use, or the possibility of unintentional misuse. Measurement errors must not be overly influenced when flows or currents have values outside the controlled range. (NML 001-05)

According to ISO 9001: 2005, organizations must demonstrate that they have identified risks and take action to eliminate or limit their effects. To assess the risks, we must answer the following questions: what are the consequences? what is the probability of occurrence in the future? What are the factors that reduce the likelihood of risk occurrence? (ISO 9001:2015)

### 3. Unauthorized interventions and control management

#### 3.1. Drilling the outlet connection of the measuring chamber

In this case, three holes were made in the outlet connection of the measuring chamber, with the aim of reducing the consumption of natural gas. An amount of gas that is not measured passes through the 3 holes. To perform this type of intervention, the meter must be removed from the installation. The damage done can be quite large.



Figure 1. Drilling the outlet connection of the measuring chamber

#### 3.2. Intervention on the metrological mark and the numerical integrator

In this case, intervention was made on the metrological mark that secures the cover of the recording mechanism and on the cover of the recording mechanism. Basically, the cover of the recording mechanism was detached and part of the gear teeth of the digital integrator were cut. Through this method, the natural gas meter still records only a part of the real natural gas consumption.



Figure 2. Intervention on the integrator and cutting the gear teeth of the mechanical index

From the two examples of unauthorized interventions highlighted above, it can be easily seen that safety in operation is endangered. The damage is great and can be defined as a sum of the amount of unmeasured and uninvoiced gas, destroyed measuring devices, costs of identifying unauthorized

interventions, travel and maintenance costs, changing the meters and last but not least salary costs of the staff.

The competitive management of this product proposed a set of procedures with the help of which we can stop this phenomenon.

### 3.3. Checking the meters in the metrology laboratory

After finding the unauthorized intervention, the gas meters are taken to a legal metrology laboratory and are checked with the help of a bell installation or other types of installations.

The meters are taken to the laboratory, kept for acclimatization and placed on a checkpoint. Their operation is compared with a standard, in our case the standard is represented by the bell installation. The comparison of the air volumes measured by the bell installation with the air volumes measured by the gas meters is made only if the two measured air / gas volumes are related to the same thermodynamic contents, absolute temperature and absolute pressure. The meters must operate and measure the amount of gas circulated within the maximum allowed limits.

With the help of this installation the operating errors for the 2 methods of unauthorized interventions mentioned above can be determined. Operating errors show us the amount of gas not measured and not billed.

The management of a metrology laboratory must ensure the competence of metrologists who perform metrological verifications. (NML 004-05)



Figure 3. Installation of checking gas meters with bell

## 4. Case study

### 4.1. Testing natural gas meters in the metrology laboratory

For the 2 cases of unauthorized intervention described above, the gas meters were checked in the metrology laboratory to see their operation and to establish the errors given in operation. (NML 3-05-96)

The measurement errors of the gas meters are determined for 3 flows: the minimum flow **Q<sub>min</sub>** = which represents the minimum flow that the meter can record; transition flow **Q<sub>t</sub>** =  $0.2 \cdot Q_{\max}$  = represents the flow between the minimum and maximum flow; maximum flow rate **Q<sub>max</sub>** = represents the maximum flow rate that the gas meter can measure. (NML 004-05)

The measurement of the gas volume with the deformable wall meters is carried out with the help of the measuring chambers with deformable walls, with or without built-in temperature conversion devices. (Stoica, and Feier, 2016)

Measurement errors are calculated with the following formulas and are divided into 2 categories, gas meters without temperature conversion devices and gas meters equipped with mechanical temperature conversion devices.

For gas meters that do not have a mechanical conversion device:

$$e_i = \left( \frac{V_i}{V_E} \times \frac{P_i}{P_E} - 1 \right) \times 100 (\%); \text{ (NML 004-05)}$$

$V_i$  is the volume of air measured by the meter  $i$ ,  $V_E$  is the volume of air measured by the standard,  $P_i$  is the absolute air pressure at the inlet to meter  $i$  and  $P_E$  is the absolute air pressure in the standard;

For gas meters that have in their component a mechanical conversion device:

$$e_i = \left( \frac{V_i}{V_E} \times \frac{P_i}{P_E} \times \frac{T_E}{T_i} - 1 \right) \times 100 (\%); \text{ (NML 004-05)}$$

$T_E$  is the absolute temperature under the bell,  $T_i$  is the air temperature through the meter  $i$ .

Table 1. Tolerated errors according to NML 004-05 (NML 004-05)

Test flow (m <sup>3</sup> /h)	Tolerated error (%)
$Q_{max}$	-1,5...+1,5
$Q_t$	-1,5...+1,5
$Q_{min}$	-3,5...+3,5

Table 2. The results of the analysis of the first meter in the laboratory (3.1)

Counter	Case 1 (3.1.)				
P atm (mbar)	993				
	$Q_{max}$	$Q_t$		$Q_{min}$	
T amb °C	20,6	T amb °C	20,6	T amb °C	20,6
T air standard °C	20,6	T air standard °C	20,6	T air standard °C	20,6
T output °C	20,5	T output °C	20,5	T output °C	21,4
$\Delta p$ (mbar)	1,96				
Volume standard (dm <sup>3</sup> )	400	Volume standard (dm <sup>3</sup> )	100	Volume standard (dm <sup>3</sup> )	20
Index initial (dm <sup>3</sup> )	3238172,3				
Final index $Q_{max}$ (dm <sup>3</sup> )	3238429,4	Index final $0,2Q_{max}$	3238430,4	Final index $Q_{min}$	3238430,4
Error (%)	-34,48	Error (%)	-98,98	Error (%)	-100

Table 3. The results of the analysis of the second meter in the laboratory (3.2)

Counter	Case 2 (3.2.)				
P atm (mbar)	983				
	$Q_{max}$	$Q_t$		$Q_{min}$	
T amb °C	18,5	T amb °C	18,5	T amb °C	18,5
T air standard °C	18,5	T air standard °C	18,5	T air standard °C	18,5
T output °C	18,4	T output °C	18,4	T output °C	18,4
$\Delta p$ (mbar)	1,96				
Volume standard (dm <sup>3</sup> )	400	Volume standard (dm <sup>3</sup> )	100	Volume standard (dm <sup>3</sup> )	20
Index initial (dm <sup>3</sup> )	4288428,5				
Final index $Q_{max}$ (dm <sup>3</sup> )	4288559,0	Final index $0,2Q_{max}$	4288591,5	Final index $Q_{min}$	4288598,2
Error (%)	-66,98	Error (%)	-67,11	Error (%)	-69,09

Analyzing the data in table 2. we noticed that for the first method of unauthorized intervention (3.1) the results are catastrophic. When the meter operates at a maximum flow rate, it records 34.48% less than the amount of gas consumed, when it operates at the transition flow rate it registers 98.98% less, and at the minimum flow rate it no longer records the amount of gas circulated, the error being -100%.

Analyzing the data from table 3. we notice that for the second method of unauthorized intervention (3.2) the results are also catastrophic. When the meter operates at a maximum flow rate, it registers with 66.98% less than the amount of gas consumed, when it operates at the transition flow rate it registers with 67.11% less, and at the minimum flow rate it registers with 69.09 % less.

Neither of the two meters falls within the normal operating limits shown in Table 1.

By the calculations presented above, the total losses of the approximation meter can be calculated. In addition to the losses mentioned above, the costs for laboratory verification are added. Laboratories must have a set of management procedures to verify the meters that must be observed accurately.

From this analysis it is necessary to draw up an impact study to indicate the total losses generated by this phenomenon of fraud, a study that includes the damages resulting from the differences between actual and measured consumption, but also the costs related to on-site inspection, team travel , disassembly - assembly, laboratory verification, etc.

#### **4.2. Design of a prototype natural gas meter**

With these results, a new natural gas meter was designed and built as a prototype, which would be able to stop unauthorized intervention.

A set of management procedures has been developed to help optimize the meter so that it is as high quality and has as few vulnerabilities as possible.

A meter has been designed to have a sensor capable of triggering a silent alarm in case of unauthorized disassembly of the meter embedded in the input and output connections. This alarm is to be transmitted to the distributor in real time or when the meter is read, depending on the chosen constructive variant. This procedure prevents damage of any kind inside the meter and implicitly would have prevented the unauthorized intervention from point 3.1.

Mounting some sieves on the input and output connections. If these sieves are damaged we can conclude that someone intervened or tried to intervene on the meter.

Another management procedure proposes the integration of the recording mechanism in the metal body of the meter. In this way the gearing and indicating rollers of the recording mechanism are secured, and the intervention method from point 3.2 could have been prevented.

The meter is able to transmit the index automatically via a GSM card or via low frequency radio waves.

Installation of anti-fraud stickers to seal the electronic parts or on the cover of the recording mechanism on classic meters.

Creating an orifice in the lid of the recording mechanism for classic meters through which the distributor can seal its integrator with a disposable seal.

The incorporation of a throttle that prevents the flow of gas in the opposite direction, is able to disconnect gas consumption and trigger a silent alarm. This solution is practical for reverse meter mounting attempts. (Ilea, 2019)

Using temperature and pressure sensors for the most accurate measurement.

The meter can be optionally equipped with the elements mentioned above as required.

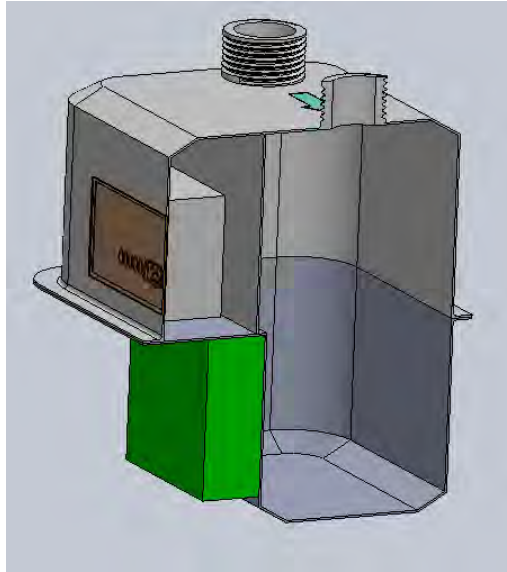


Figure 4. Gas meter prototype

## 5. Conclusions

Following the presented ones, the gas distribution companies must understand the importance of the quality of a natural gas meter, both from a constructive and a functional point of view. Meter quality is a must.

Natural gas consumers must understand the dangers to which they are exposed by producing this phenomenon, safety in operation being the most important in the end.

We can see that natural gas meters are quite vulnerable to external interventions, causing significant losses. In order to prevent or diminish this phenomenon, it is necessary to invest in more efficient measuring devices.

There is a need to implement a complex quality and risk management system. The two branches must complement each other. As advantages of using the new type of meter we can list: reduction of money losses generated by unauthorized interventions, reduction of unauthorized interventions, reallocation of staff dealing with these checks in other key points of the company, elimination or reduction of expenses for detecting, solving and checking meters with unauthorized intervention

At the same time, it is necessary to carry out a study regarding the manufacturing costs, to be within reasonable limits, able to ensure the profit of the builders but also of the handlers (maintenance and assembly companies). One possibility for which some research has already been undertaken is based on the DFMA, which helps to choose the materials from which the meter is made and to choose the most suitable assembly procedure.

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# ANALYSIS OF EUROPEAN UNION IMPLICATION IN ENTREPRENEURSHIP PROMOTION BY MEANS OF THE SUPPORT NETWORKS

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## Abstract

**Purpose-**This study started from the observation of the multidimensional implication of European Union in entrepreneurship promotion with present effects in each member state. In this context, from the multitude of strategies, projects and actions, by this research we followed the identification of the role attributed to the dimension of the support networks in entrepreneurship promotion at EU level.

**Methodology/approach-**In the realization of the study we used of a qualitative methodology, considering the fact that the research has an exploratory character, and as a research technique we made used of analysis of content of the texts, of European Commission's official publications, limited in time, respectively only the publications of the 2020 year.

**Findings-** Following the performed analysis we found out that from the perspective of the European Commission the support networks are important pillars of the entrepreneurship promotion, being a critical dimension of the entrepreneurship promotion.

**Research limitations/implication -** The process of research was limited by lack of access to information related to traffic on these online platforms.

**Practical implications-** Nevertheless, by means of the performed research we identified each support network with role in entrepreneurship promotion allowing dissemination of information regarding these, as well as the observation from a different perspective of the online platforms made available by the European Commission, as resources of entrepreneurship promotion.

**Key words:** "entrepreneurship", "support networks", "European Union"

## Chapter 1. Plan of action Entrepreneurship 2020-Restart of the Enterprise spirit in Europe

Building of an economy in service of citizens is a priority of European Commission in whose direction this achieves different actions. An economy in citizens' service supposes a series of aspects, among which entrepreneurship has its role, as source of innovation, competitiveness and of creation of new jobs, a source of economic growth. Thus, among the primordial objectives of the European Commission there is the entrepreneurship promotion in European Union. For this the Commission elaborated and adopted in the year 2013 *the Action plan for entrepreneurship 2020-Restart of entrepreneurship spirit in Europe*, with the target to develop the entrepreneurship potential, eliminated the obstacles and revolutionized the culture of entrepreneurship in EU.

The plan was built as a natural consequence of the progresses registered after the adoption in the year 2008 of Small Business Act-with role in promotion of entrepreneurship spirit, of the review of the year 2011 of this and following the adoption in October 2012 of the Communication regarding the industrial

policy. Thus, the plan was proposed as a continuation of the objective of supporting the entrepreneurship in Europe through a new vision and action.

The plan is based on three strategies: development of education and training in the field of entrepreneurship; creation of adequate business environment; models and implication of some specific groups [*THE ACTION PLAN FOR ENTREPRENEURSHIP 2020*].

The initiatives by which the European Commission promotes the entrepreneurship are contained on short in the Action plan for entrepreneurship 2020-*Restart of the entrepreneurship spirit in Europe* adopted in January 2013.

Thus, the Plan proposes three great directions in immediate intervention:

1. Education and entrepreneurship training in order to support the growth and creation of enterprises;
2. Strengthening of framework conditions for entrepreneurs by removing of existing structural barriers and by supporting of entrepreneurs in the key stages of the enterprises life cycle;
3. Stimulating of entrepreneurship culture in Europe: training of new generations of entrepreneurs.

## **Chapter 2. Promotion of entrepreneurship continues to be an adequate answer for the economic crises**

At the beginning of year 2020 Europe was still recovering after the financial crisis from the year 2008-2012 although it passed quite a big period since that moment. The year 2020 is probably the biggest attempt with which the economies and population confront at the European world level, in recent 50 years in the context of pandemic of Covid 19. At the outbreak of Covid 19 crisis, the echoes of the crisis from 2008-2012 had just gone out. As now, the crisis a decade ago occurred after some consecutive years of economic growth. Propagation of the effects of the crisis and the response policy in the two contexts but they tend to differ. In 2008-2012 the risk of economic crisis outlined with a year before, while now in only 2-3 months.

Ten years ago the recession felt gradually, but equally in relation to the economic branches, while now this had a differentiated impact. For years it has been discussing at the world level in the context of globalization of certain world threats, possible risks (bacteria resistant to antibiotics, world food crisis, noxious emissions from the air caused by transport, losing of oceans and seas biodiversity, the lost generation because of unemployment etc.), that can affect us from economic, social, health point of view. The "Global Opportunity Report 2016" of Global Compact shows us at the respective time how the global preset problems, beyond of their threat, can be transformed in business opportunities. Their resolution opens new markets to which can make for both the big companies and start-ups, small, medium and big entrepreneurs. For example the finding of resolutions for the pollution provoked by transport or for food waste can become both source of incomes and contribution for some world problems improvement.

Starting from the premise that the business is the key of economic coming to normal, the innovative, competitive entrepreneurship spirit are essential for European economic coming back to normal. In an epoch of globalization and a growth of competitiveness from the part of countries, on a prolonged period of time, the economic prosperity in European Union depends on the strong industrial basis, and not only by banking services. Europe must believe again in its capacity of innovation, creativity, are still necessary the launch of new projects, of increase the innovations in different priority fields, pre-eminently priority. Thus, Europe should put into application the real economic power, business, economic incentives.

Considering that at the level of European Union the main engine as regards the number of employed persons is represented by the small and medium enterprises sector, one of the main objectives of European Union is encouraging of this sector of activity, so that a number of more persons to become entrepreneurs, respectively creation of necessary premises so to have the possibility to develop their business. According to a study achieved by the European Commission only 37 percentages from Europeans would like to become entrepreneurs, as compared to the USA and China population where this percentage amounts to 51 percentages.

Taking into account that we are in a historical moment from the last fifty years, with a record number of unemployed people over 25 millions, the European Commission plan in the year 2020 is of restart of the entrepreneurial spirit at EU level. The European Commission strategy as regards the entrepreneurial sector is based on three important pillars:

1. Training and entrepreneurial education of quality with a view to support this sector both on the part of start-ups and as regards the existent business.
2. Creation of an environment for entrepreneurs in which these can thrive and can extend their business (facilitating of the access to different sources of financing, facilitating of the rules and procedures by applying of clear and simple regulations, development of entrepreneurship in new directions taking into account the evolution digitalization at the global level, facilitating of procedures for the bankrupt companies by granting of new chances for honest entrepreneurs.
3. New perceptions: promotion of entrepreneurship and of their success stories as examples to follow at global, local level, respectively the creation of the necessary premises and encouraging of certain categories of persons: women, seniors, respectively emigrants in view of becoming of some successful entrepreneurs, respectively of the last ones implication who are already models worthy to follow in the entrepreneurial sector in new business training and launching.

More than ever society is before some challenges that ask global solutions.

According to Eurostat, the economic decline from the European Union and euro zone is the worst since the moment when there have begun to be reported date of this type, in 1995. At the level of European Union, the economy contracted with 11,9 percentages compared to the first term and with 14,4 percentages compared to the second term of the last year, show the Eurostat data adjusted to the season. Against the background of the present crisis, the new enterprises continue to represent a key ingredient so that to assist at a revival as regards the creation of new jobs at UE level.

### **Chapter3. The support networks as size of the entrepreneurship promotion at the European Union level**

The support networks in the form of some online platforms represent essential elements for communication achievement in the present economic environment characterized by speed. These contribute at the policies promotion, transparency insurance and have the advantage of facilitating the communication quickly and easily regardless of the place where there are interested subjects.

One of the ways of promotion of entrepreneurship by the European Commission is represented by the online available support networks. Thus, with role in ensuring the implementation of the action plan for entrepreneurship is the SME Envoys network. Other support networks and information related to entrepreneurship and IMM (SMALL AND MEDIUM-SIZED ENTERPRISES) are: Your Europe Business Portal; Enterprise Europe Network; SME Internationalization support page; portal on Access to Finance.

#### **SME Envoys**

For the implementation of the action plan for entrepreneurship work the SME envoy networks named at the national level, with role in: promotion of IMM (SMALL AND MEDIUM-SIZED ENTERPRISES) interests to all the governmental structures and ensure the integration of principle "think small first time" in elaborating of policies and the proposals for elaboration of regulations; ensure an interface between Commission and national factors of decision; report the SBA ( the act for the little entrepreneur) adoption in EU countries, intensify efforts for distribution of information regarding the actions of policy for IMM (SMALL AND MEDIUM-SIZED ENTERPRISES) and promote the exchange of best practices.

A concrete result of SME Envoy Network is represented by their decision of supplementing SBA WITH the programme SME-Action Programme. The programme supplies an analysis of the present situation and of the main challenges for IMM (SMALL AND MEDIUM-SIZED ENTERPRISES) from Europe. Also, this ensures the transfer of best practices within the network SME Envoy Network and delivers direction and inspiration for different political fields relevant to IMM (SMALL AND MEDIUM-SIZED ENTERPRISES) [European SME-action programme, 2017, <https://ec.europa.eu/docsroom/documents/36142>].

## **Your Europe Business Portal**

The portal was built for offering the possibility to entrepreneurs to have access to information and interactive services that allow them to extend their business abroad. This represents a practical guide available online, regarding the manner in which the business are done in Europe.

Information are offered in all official languages of European Union-with the exception of Irish and are delivered by the relevant departments of European Commission and completed by the authorities from each country. In addition of the supplied information ,on the platform there is the possibility of receiving personalized information by e-mail or telephone provided free of charge by the EU assistance services.

## **Enterprise Europe Network**

The Enterprise Europe Network was created to support IMM (SMALL AND MEDIUM-SIZED ENTERPRISES) and entrepreneurs to obtain information related to the access on market, to surpass obstacles and to indentify business partners from outside Europe.

The online platform of the network offers professional information related to the expansion and development of international market, offers support for the transformation of the innovative ideas in a commercial success and makes available expertise, contacts and events in order to offer possibility to identify business partners.

Also, the platform ensures the contact either with a connecting point of the network from a country from EU or outside EU, by selecting the state either directly with an international partner. In an easy manner the platform ensures the possibility of developing partnerships in different fields. The platform hosts also a special section where are listed offers for different collaborations of business.

## **SME Internationalization support page**

The European Commission follows to ensure the adequate information in connection with the foreign markets and to help the enterprises to extend themselves by activities of internationalization. The main instruments used for these are: Enterprise Europe Network; EU SME Centre in China (represent an initiative of EU in order to support IMM (SMALL AND MEDIUM-SIZED ENTERPRISES) to develop business in China by 5 services: Knowledge Centre, Counselling Centre, Training Centre, Platform of Advocacy for IMM (SMALL AND MEDIUM-SIZED ENTERPRISES), Hot-Desks & Meeting Rooms); EU-Japan Centre for Industrial Cooperation; Market Access Database- provides information to enterprises that export from EU ABOUT THE IMPORT conditions from the third states; Export Helpdesk-information of assistance and access at market for the import in EU; IPR helpdesk-information and advice related to the intellectual property plus other information transmitted by the published guides.

## **Portal on Access to Finance**

The last network with role in entrepreneurship promotion follows to grant support IMM (SMALL AND MEDIUM-SIZED ENTERPRISES)to receive financial support from EU part by providing of information about EU funds, EU programmes and sources of financing from each EU member state.

## **Conclusions**

As shown in the Report regarding the evaluation of support services for entrepreneurs and new business published at the beginning of year 2020 by the European Commission and as results from the analysis of the initiatives developed in the direction of entrepreneurship promotion, the support networks represent a crucial size for entrepreneurship promotion, especially as regards the access at experts, business contacts, models, partnerships and providing of information in an easy manner.

The present context requests a special attention to the sizes of the support networks, as the online available support networks eliminate the barriers caused by the impossibility of travel of the persons and reduce the costs determined by information and establishing of some contacts personally.

Furthermore, it is important that these networks to be promoted adequately in such a way that EU citizens to be used to their use.

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### **COM/2011/0078 final: Review of the “Small Business Act” for Europe**

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### **Practical guide to doing business in Europe**

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### **The Market Access Database**

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### **European Commission**

<https://ec.europa.eu/>

# ACHIEVING RESILIENCE WITHIN COMMUNITIES THROUGH LOCAL CURRENCIES

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## Abstract

**Purpose** – *The paper aims to investigate the possibility that a local currency system becomes a source of strengthening the local economy in Baia Mare, in its objective to become sustainable and, in the long term a resilient community.*

**Methodology/approach** - *As an approach, the primary qualitative observation method was used, combined with the literature review.*

**Findings** – *Open innovation has the potential of reshaping the entire urban ecosystem and incentivizing local stakeholders to act towards environmental protection, climate change mitigation, social innovation, and economic development.*

**Research limitations/implications** – *n/a.*

**Practical implications** – *A viable approach that can lead to improved sustainability of a local community.*

**Originality/value** – *Introducing iLEU (immaterial Local Environmental Utility), a cryptographic coin system that rewards civic action while supporting local value chains.*

**Keywords:** *resilient communities, smart cities, local currency.*

## Introduction

As Callaghan and Colton (2008) pointed out „communities are dynamic with the ebb and flow of people, businesses, money, and ideas. They are periodically punctuated with unexpected crises, be they ‘homegrown’ or external in nature”.

The movement toward sustainable development lies neither in focusing solely on the bottom line immediate needs nor the abstract „sustainable future”, but in a middle ground that seeks to enhance long and short term community *resilience* through investments in all the various forms of community capital (Callaghan and Colton, 2008).

A widely used definition of sustainable development heralds from the World Commission on Environment and Development (WCED, 1987):

„Sustainable development meets the needs of the present generation without compromising the ability of future generations to meet their needs”.

The concept of resilience is one that has been developed around managing and responding to community crises (Paton and Johnson, 2001; Comfort *et al.*, 2004; Campanella, 2006). Resilient communities are those that can absorb and/or adapt quickly to change and crisis.

Ultimately the success of building a sustainable and resilient community depends on strong leadership, vision, and clear and open communication (Callaghan and Colton, 2008).

Achieving sustainability requires future-oriented thinking, proper long-term development strategies, and concrete action (Kettunen *et al.*, 2020). Sustainability and sustainable development mean that environmental, social, and economic aspects are all considered in decision-making (Echebarria *et al.*, 2017).

Amongst other factors, stakeholder engagement is vital for implementing effective sustainability strategies (Zeemering, 2018) and strategic thinking requires stakeholder participation (Bryson *et al.*, 2010; Zeemering, 2018). A similar observation was made by Evans *et al.* (2005), who argue that participatory governance with a broad spectrum of participants is a precondition for achieving local sustainability. Value creation, stakeholder engagement, and capability development are necessary components of this process of pursuing locally embedded sustainability (Laszlo & Zhexembayeva, 2011; Zeemering, 2018). By value creation, Zeemering (2018) means the collaboration and co-learning between local sustainability-related stakeholders, which improves their strategic thinking skills, and the provision of sustainable local services, to realize the immediate and long-term social, economic, and environmental benefits that add value. Such cooperation between diverse stakeholders provides local governments with an opportunity to steer, coordinate, and influence other actors and their capacity to participate in sustainability-related issues.

As Roseland (2012) underlined, sustainable community development requires mobilizing citizens and their governments to strengthen all forms of community capital. This includes minimizing the consumption of essential natural capital and improving physical capital, which in turn require the more efficient use of urban space. It also includes strengthening economic capital, increasing human capital, multiplying social capital, and enhancing cultural capital (Roseland, 2012). Community mobilization is necessary to coordinate, balance, and catalyze community capital.

In the years ahead, communities, enterprises, cities, and nations that learn how to strengthen all six forms of capital simultaneously are likely to be the ones that will thrive (Roseland, 2012).

The Covid19 pandemic caused lockdowns throughout Europe and forced the rediscovery of local resources, both for buyers and sellers of goods and services. Social Media Groups of local producers were rapidly created, supporting the local ecosystem. Resilience in communities increased, as external help is more difficult to provide. Climate Change, social resilience, support for NGO's and people in vulnerable situations are more efficient if organized at a local scale.

Consequently, a strong need for strategic thinking and strategic behavior occur, and local decision-makers have to deploy smart and long term envisioned strategies to ensure the communities they govern can overcome the threats that the pandemic induces, both directly and consequent.

### **Smart cities and innovative communities**

"A Smart City is a city well performing in 6 characteristics, built on the 'smart' combination of endowments and activities of self-decisive, independent and aware citizens" (Giffinger *et al.*, 2014). The United Nations, define "A smart sustainable city is an innovative city that uses information and communication technologies (ICTs) and other means to improve quality of life, the efficiency of urban operation and services, and competitiveness while ensuring that it meets the needs of present and future generations concerning economic, social, environmental as well as cultural aspects" (Recommendation ITU-T Y.4900, 2020). Ideally, a Smart Sustainable City develops instruments and automated mechanisms to monitor its progress in the previously mentioned fields, as well as automated decision-making systems based on those metrics, indicators, and data.

However, cities across Europe, and especially Romania are heterogeneous entities. Development or lack of development is not ubiquitous. Diverse communities are created within cities, on criteria such as neighborhood, social status, age, occupation, hobbies, or even political principles. The diversity raises challenges that cannot be tackled on a city scale, while solutions often work for certain groups only. Public-Private-People Partnerships are part of the innovative solution if they identify specific needs and create local responses based on the community's capacity of understanding and absorbing innovation.

Resilience against disasters in Romania is ensured at a national and local level by authorities such as the General Inspectorate for Emergency Situations, as well as municipalities and volunteer groups. The main bottleneck cities face are lack of expertise and lack of funding. Often, policies are created by

external, highly qualified experts. This increases the void of local expertise and reduces the community's capacity to react to an unprecedented crisis.

The gap can be overcome through capacity building at a local level, through strengthening ties between local resources such as companies, research centers, academia, authorities, and civil society. Ties are built over time, mainly through the creation of local ecosystems, local economies, and favoring local and regional resources.

### **Local currencies as a potential solution for overcoming the crisis**

Overcoming economic and financial crises require innovative solutions, especially in small or remote communities. Controversial theories such as Silvio Gesell's concept of „free money”, initially inspired by the 1890 financial crisis gain traction in similar depression times. In 1891, Gesell published his first important work: „Currency Reform as a Bridge to the Social State”, proposing money to have an „expiration date”. To avoid expiration, the money would have had to be stamped, which incurred a cost (or depreciation). This would render saving money costly for citizens. After World War 1 Europe's financial and political problems, the Great Depression, raised further challenges such as lack of jobs, fear of spending the little money people had, and low incomes. In 1932, Michael Unterguggenberger, mayor of Worgl, Austria, and enthusiast of Gesell's theories, decided to turn the city's 40.000 schillings into stamp money. This money was then used by the city to pay for public works. Companies used it to pay employees, which, in turn, used the Wir (local currency) to shop for their daily needs. As a result, infrastructures (road repairs, sewerage, etc.), jobs, and the overall quality of life in the city increased tremendously, concluding with advance payments of taxes. Unfortunately, The Austrian National Bank abruptly ended the successful experiment in 1933. Similar initiatives took place throughout the world in early 1930, most of them being highly successful for short periods. Modern initiatives, such as the SARDEX in Sardinia benefits from cooperation amongst local entrepreneurs sustaining one another in a supplier-credit type of mechanism. All participants have a zero balance at the beginning. They purchase goods and services on „credit”. Yearly, they must rebalance their accounts, through acceptance of the SARDEX coin or EURO compensation. Fureai Kippu, a Japanese local currency rewards people for helping the elderly and it has been successful since 1995. The coin can then be spent on paying services for one's elders or kept until the owner will need to be supported due to old age.

### **The Baia Mare Urban Innovative Action**

The city of Baia Mare has been a playground for urban innovation since early 2000. Urbact funding provided the city with strategic approaches for societal challenges such as Environment Remediation, Social Innovation, or Urban Planning. However, the former mining and metal processing capital of Romania, lost part of its glory, due to the mining and processing sector's foreclosure in late 1990, leaving the city with dozens of hectares of heavily polluted sites. Lead, Cadmium, and Arsenic soil's pollution are expensive and difficult to remediate through conventional methods such as excavation, and do not solve problems, but rather relocate them. Phytoremediation might be a slow answer, though faster than the non-action over the last 30 years. The European Commission, through the Urban Innovative Actions (UIA) initiative, has decided to support the city in finding innovative ways to address its historical and contemporary problems such as lack of entrepreneurship initiatives in high-added-value fields, population aging and outwards migration, and community disengagement. Phytoremediation not only cleans soils, but helps to landscape and generates usable vegetal resources, that can provide heating, thermal insulation for buildings, or innovative materials. At the same time, citizens' mindsets and resilience to climate change need to be addressed more abruptly. iLEU (immaterial Local Environmental Utility) is the city's transversal transformational tool and liaison amongst the fields, a cryptographic coin system that rewards civic action while supporting local value chains.

Oversimplified, the iLEU quadruple helix stimulates citizen-centric services from the public and private sector, while empowering citizens, business, and NGOs to support the co-creation of public services. The Business sector benefits from the iLEU as a local economy booster (iLEU can only be spent locally) while shaping itself according to specific local needs of citizens, NGO's, and authorities. NGO's' actions are sponsored through iLEU, with the condition they answer specific challenges within the city.



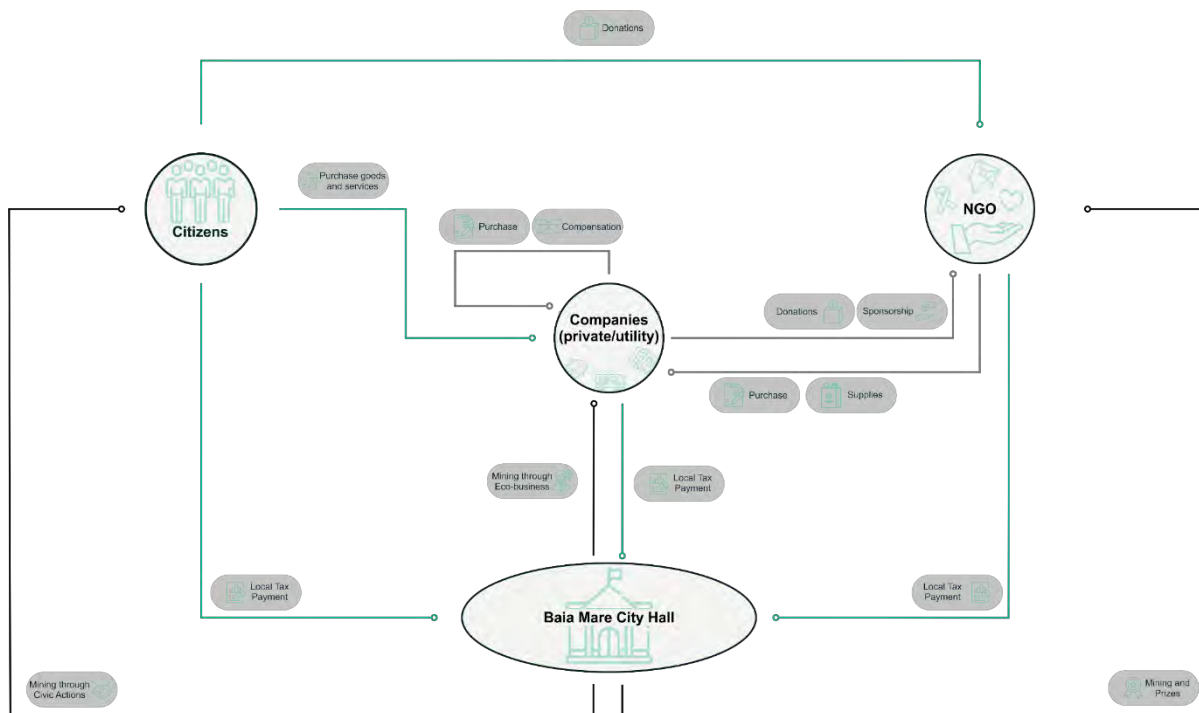


Figure 1 - iLEU community model

Just like any local coin or currency, the iLEU is only usable within the Baia Mare Metropolitan Area. This implies that only locals can benefit from it.

iLEU has several unique features, separating it from „traditional” cryptocurrencies, as well as from electronic money, as follows:

- iLEU cannot be purchased or transformed into real money
- iLEU usage is voluntarily
- iLEU can only be used at an equivalent value of 1 iLEU pe 1 RON
- iLEU is „mined” through environment-friendly actions such as walking or using a bike to work, participating in phytoremediation events called „plantathlons”, involvement in the SPIRE project actions, etc.

iLEU is expected to generate new business opportunities, support companies’ cash flow, as it merges the supplier credit, and direct/indirect compensation mechanisms. As it can only be used to purchase goods and services, we consider it should have increased velocity, as saving iLEU would not grant any interest to the user.

It all works through a simple mobile phone App, whose main qualities are usability and simplicity. Users can instantly transfer iLEU from one’s wallet to another.

### Future steps and envisaged outcomes

iLEU’s relevance is bound to the number of acceptors. Acceptors will be rewarded both through intrinsic and extrinsic means.

Getting users on board is conducted by a three-fold strategy. On one side, getting accepting parties on board is the main challenge, considering the pandemic-generated crisis. Initial acceptors of iLEU to be involved are The City of Baia Mare, museums, theatre, utility providers, and private operators.

Second, getting iLEU into the market is done by rewarding desirable actions, such as alternative mobility, participation in SPIRE Hub events, plantathons and competitions

The third, and most difficult is the transformation of iLEU into innovation and environmental vouchers, supporting entrepreneurs to develop green business and processes, as well as use renewable energy and materials. Implementing cradle-to-cradle policies for their products or supporting environmental regeneration. For natural persons, this step coincides with vouchers for green business, selective garbage collection, energetic home enhancements, usage of ecologic materials for building, etc.

As iLEU gets released to the public, citizens, entrepreneurs, or NGO's will have limitless opportunities to create new, innovative usages for it. iLEU, as an innovative tool for digital transformation, empowers its users to creatively create new business and sustainability models, such as funding social innovation, creating participatory budgeting initiatives, redesigning commercial cooperation. It is meant as a participatory tool for urban co-creation of value chains and resilience.

Financially, an estimated 1.4 million iLEU are to be released within the Urban Innovative Action SPIRE, an amount that totals 50 percent of the online collected local taxes in 2019, respectively 5 percent of total taxes collected from natural persons in the city. Its financial justification was also correlated with the city's users (approx. 140.000).

## Conclusions

Open innovation, especially coming from the ICT sector, has the potential of reshaping the entire urban ecosystem and incentivizing local stakeholders to act towards environmental protection, climate change mitigation, social innovation, and economic development. It is a community enhancer, strengthening the ties between citizens and their city, empowering them as co-creators of public spaces, increasing their sense of belonging and ownership of their city.

iLEU reinvents the local identity and tradition of mining, through a smart transition from mining gold and silver minted into coins, towards mining crypto, minted into local tokens of modern economics.

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# INTERNET OF THINGS IN INDUSTRIAL LOGISTIC PROCESSES

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## Abstract

**Purpose** - the purpose of this article is to explore how the Internet of Things has influenced and continues to influence manufacturing firms in terms of production and inventory tracking.

**Methodology/approach** - the objectives of the study are to identify the IoT impact in the production process and prioritize the IT impact in the stages of the production process and optimal stock sizing, using the methodology of comparison between various types of advanced technologies, specific IoT and suitable mining methods to develop an easy information extraction infrastructure. implemented and easy to use, one of the purposes being to track production in real time.

**Findings** - at the same time, the connection between the IoT and Smart Factory concepts, tracking production and stocks in real time by implementing them is also addressed.

**Research limitations/implications** -the limitations of the research are that all the information was taken from the literature we studied and not from a practical application of IoT in a company.

**Practical implications** - at the same time, the connection between the IoT and Smart Factory concepts, tracking production and stocks in real time by implementing them is also addressed.

**Originality/value** - this article highlights the best solutions for tracking production and stocks using IoT and Smart Factory.

**Keywords:** Internet of Things, Smart Factory, Decision Tree

## GENERAL IoT CONSIDERATIONS

The Internet of Things (IoT) recognized as the superstar of future technology because it is gaining a lot of followers in more and more industries. IoT has brought about a paradigm shift that transforms the way we do business, allowing businesses to create value-added services to improve their sustainability. For example, the ubiquity of wireless sensors extends digital connectivity to tasks, processes and services.

Increased IoT (Lee Inn, 2019) was phenomenal in terms of the volume of sales and the number of companies and individual implementers. The IoT market will reach about \$ 520 billion by 2021, more than double the 2017 level.

In an IoT ecosystem, its components add value. Because typical IoT services require the integration of several devices and software modules often made by different providers, most companies do not have the technical expertise necessary to develop the necessary services. For example, businesses in the area of supply chain management would try to boost IOT platforms to develop services quickly and at low cost.

The IoT ecosystem of a organization consists of a variety of stakeholders, including network providers, software providers, developers, and users. Five primary actors in the IoT ecosystem are established based on field practices studies. Below figure shows the company's five key players of the IoT ecosystem.

An company should be viewed as part of a market community that spans a number of sectors, not as a leader of a particular industry. In addition, with the introduction of IoT, the change to another idea was

illuminated, that of Smart Factory, which incorporates a range of IT solutions, one of the goals being the real-time output monitoring.

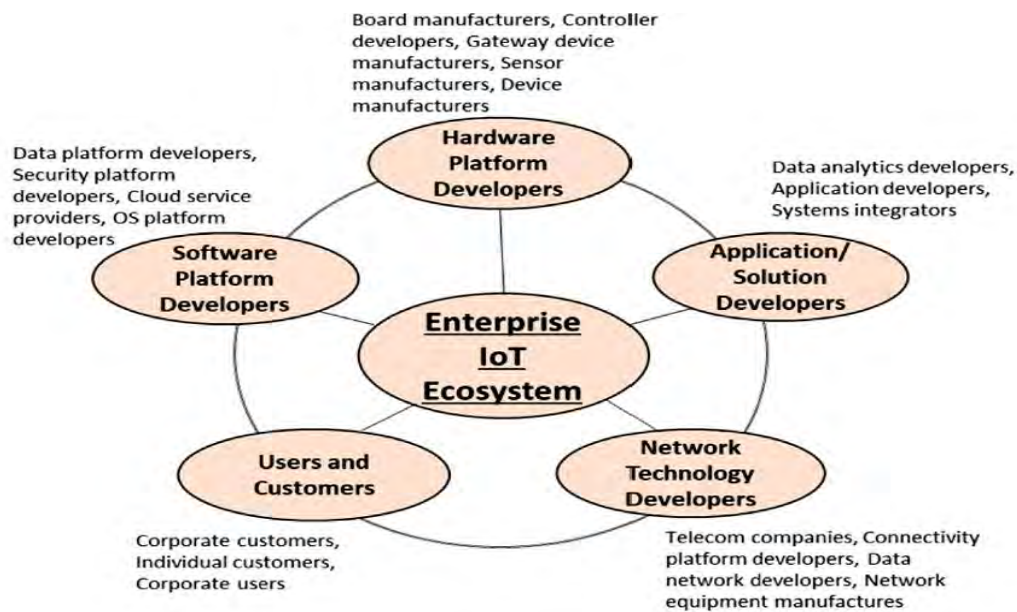


Figure 1. Scheme of the 5 key players of the IoT ecosystem (Lee Inn, 2019)

The goal of a Smart Factory is to create value for businesses and customers through IoT services. New IoT platforms are constantly developing and offering new opportunities and challenges for businesses, often being preferred to internal development.

### THE “SMART FACTORY” CONCEPT

In recent years, the manufacturing industry has undergone a dramatic change through different parallel developments. Researchers from IFF Sttgarth coordinated studies on the "Smart Factory" (Lucke, Constantinescu and Westkampfer, 2008). Globalization and the desire to produce highly personalized products have led to a greater variety of solutions and shorter product life cycles. Short product planning horizons and product life cycles reduce the size of the batch and therefore require high production flexibility. To make the correct management decisions, real-time information is indispensable.

Dynamic factory changes, caused by internal or external turbulence, such as a car malfunction or fluctuation of market orders, can often not be taken into account and therefore lead to wrong decisions at the planning levels. Thus, a great deal of flexibility is needed in terms of manufacturing resources, their planning and control (Lucke, Constantinescu and Westkampfer, 2008)

The coordination of several heterogeneous subsystems that provide the resources, materials and information used in the workplace is necessary to ensure a constant consumption of resources. To achieve this synchronization, numerous specialized systems and software applications, such as resource management systems, MES or ERP systems are used. Even the slightest difference between real and digital saved data, for example, initiated by a malfunction, leads to planning discrepancies and errors in the optimal workflow.

Smart Factory design and development requires the definition of the concept as a first step. After the development of digital and virtual factories, the next step in the evolution of factories is the fusion of the physical and virtual worlds under a so-called smart factory.

The "Smart Factory" applications have to address the following three issues, which come from many challenges:

1. How is an object identified?
2. Where is an object in the factory?
3. What is the situation or state of an object?

## Identification

Identifying items is one of a factory's essential problems, it assigns knowledge regarding the simulated environment as the operation phases of certain real-life artifacts. Thus, in an highly dynamic manufacturing setting, identifying techniques, marks, indicators, sensor readers and contact facilities unique to their mission have to be identified and selected.

## Location

To optimize processes and minimize downtime inside the Smart Factory, localization is needed to have clear knowledge of the objects' location. The precision of a positioning device will vary from 0,15m - 1m, depending on the goal. Furthermore, a positioning device used in a manufacturing setting must work systematically and be resilient to environmental factors, electromagnetic fields, dust noise etc.

## Status Knowledge

Assistive devices need to know the role or condition of artifacts in a smart factory and give context-aware knowledge and patients. Extremely complex data such as an object's location, should be changed every 10 to 30 seconds.

## IOT AND PRODUCTION PROGRAMMING

Recent research in the field of smart enterprises focuses on real-time tracking of production data and the coordination of inventories and production planning according to possible exceptions (errors) that may occur during the production process.

The developments in wireless technologies provide opportunities for intelligent manufacturing, with real-time traceability, visibility and interoperability in production planning, execution and control. However, during the production phase, exceptions often disrupt the operations of a manufacturing system. These studies were completed by a group of Chinese researchers (Zhang, Wang and Wu, 2016).

This is mainly due to the fact that the management team cannot obtain information on the dynamic changes of the execution process in a timely manner and there is no real-time performance analysis and diagnostic service (PAEDM). When an exception occurs, it gradually spreads due to the lack of timely, accurate and consistent manufacturing information and the exceptional diagnostic model, which further aggravates the production process. Therefore, it is essential for companies to improve their production management mode with advanced technologies and models to improve quality and efficiency. By extending IoT technologies, such as RFID and barcode to the production environment, real-time and multi-source manufacturing data has become ubiquitous.

In general, when a manufacturing process is monitored in real time, the data obtained can be mined and appropriate information can be discovered so that production performance analysis can be performed. In doing so, the performance of a manufacturing process can be continuously improved. Petri nets (PN) are known to be powerful for process modeling (graphical or mathematical) and formal verification. Thus, they are widely adopted for modeling, analyzing and controlling discrete event systems. Tree Decision is a supervised data extraction technique and can serve as an effective tool for multivariate data analysis. It is a discovery-based approach based on data from rich sources, to be used in knowledge discovery and decision support analysis.

As an attempt to combine IoT, PN, and DT technologies for real-time data analysis, an IoT-compatible performance and error diagnosis (PAEDM) model can be developed. The purpose is to answer the following two important questions:

- 1) how to model the dynamics of the system using HTCPN so that production performance analysis can be done in real time?
- 2) how to dynamically provide information of qualitative and quantitative exceptions, so that the analysis is persuasive and objective?

## Applying Internet of Things to manufacturing lines

Using RFID devices, wireless networks, and mobile sensors, the IoT is recognized to be crucial in many industrial applications. Thus, IoT, is becoming more and more attractive both from an industrial and academic point of view.

For example, to address production planning, a real-time RFID enabled execution system is presented. This is achieved by systematically implementing RFID devices in the "shop-floor" to track manufacturing objects and collect real-time production data.

By using IoT, the dynamic problem of synchronized logistics production (PLS) for a manufacturer is investigated. Cloud and IoT infrastructures are systematically integrated to enable an intelligent PLS control mechanism with dynamic multi-level adaptability.

### **Petri nets (PNS)**

Nowadays, Petri Nets have been successfully used for modeling, controlling, and analyzing discrete systems and are characterized by competition, parallelism, asynchrony, interlocking, conflict and event-driven processes. PNS is defined as a bipartite graph. directed with two types of nodes called places and transitions. The status is described as "tokens" also called bookmarks or tokens. During execution, the number of bookmarks and their distribution reflects the change of the state of the object being tracked. In the graphic representation, the places are drawn as circles, the transitions in the form of rectangles or bars, the marks are represented by black dots and the arcs by arrows.

For modeling dynamic behavior, a colored Petri Nets System with intelligent marking (token) is proposed for modeling and controlling reconfigurable manufacturing systems. In the model, the markings presenting the places (P) have real-time information about the state of the system through a system identical to the smart cards. Given this advantage, the dynamic changes of the system can be easily interpreted. A method for optimal control of Petri nets can be proposed. Thus the legal markings are classified into several subsets

Also developed a new modeling method based on Petri Colored Networks based on RFID sensors where colored markings are used to describe the dynamic evolution of the state of the products in real time. A new colorful PN model can be proposed for real-time programming of chip-based multi-processor platforms.

### **Decision trees**

DT is one of the most popular machine learning techniques due to the ability and ease with which immediate production decisions can be made. This can be used to explore the relationships between a large number of input attributes and output targets. There are three main phases of rules in DT learning.

Phase1: create a tree rule as large as possible from a set of inputs based on attribute measurement;

Phase 2: cutting the branches that have little statistical validity in the tree type rule;

Phase 3: processing the data from the cut tree to improve its understanding.

Over the years, a series of classification algorithms have been proposed for DT input values, such as ID3, Fuzzy-ID3, C4.5, EC4.5 and CART. Among them, C4.5 deserves special attention for its advantages, offering good classification accuracy. Similarly, Fuzzy-ID3 also proved to be powerful for the ability to generate a decipherable fuzzy decision tree by using fuzzy sets.

For analyzing exceptions on the production line, DT is one of the most comprehensive methods. With data provided by RFID from the production line, a mined (data extraction) approach (DT-based model) was proposed to estimate the standard operating time.

## **IMPLEMENTATION ON THE PRODUCTION LINE**

To be well-operated, a manufacturing company should achieve real-time, seamless connectivity and interoperability between physical manufacturing systems and enterprise information systems (EIS).

It is imperative to find the most appropriate form of transmission of information from the production line to the basic application, which controls the production scheduling of the entire production line but the volume of information would be huge, which is why it is filtered through a model described below.

To do this, real-time performance analysis and exception diagnostics (PEDM) aims to apply advanced Internet of Things technologies and data mining methods to develop an easy-to-implement and easy-to-deploy information extraction infrastructure. to be used. The overall architecture of the proposed integrated model is shown in Fig. 2. It consists of three modules, namely the intelligent storage module activated for IoT, the module for analyzing the performance in real time and of the production based on events and PN and the third module: DT. - how to extract the exception and diagnose the causes. These are explained below.

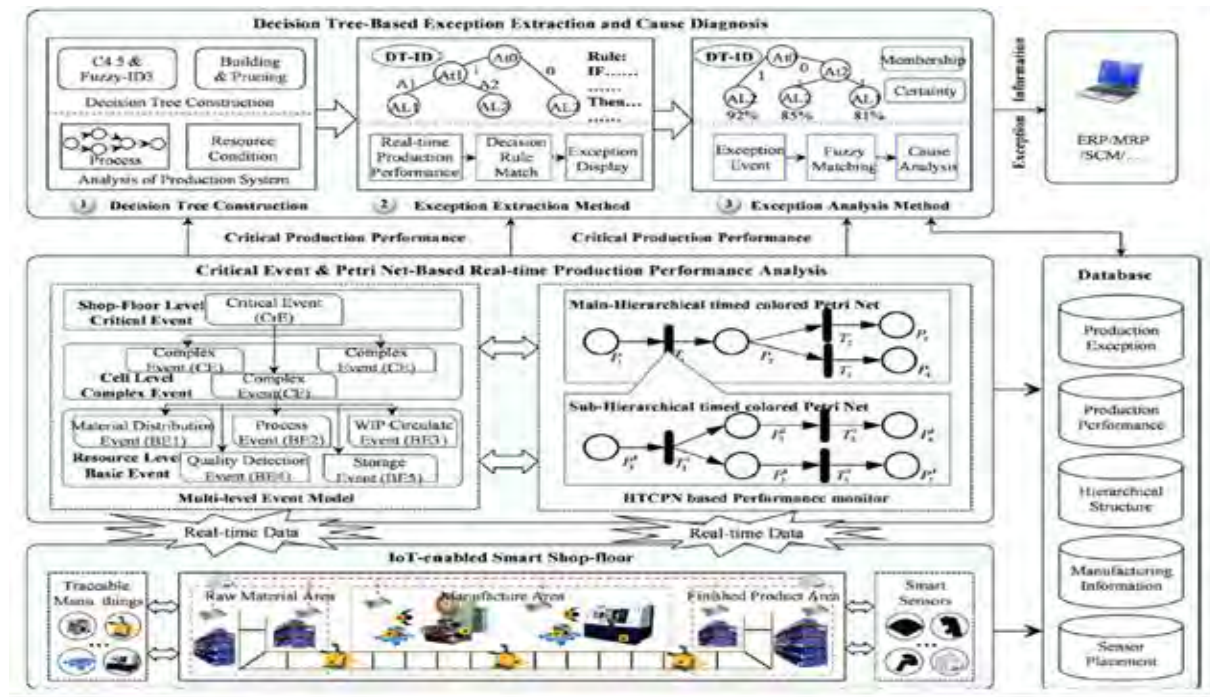


Fig. 2. Schematic of the Real Time Production Planning Tracking Model (Zhang, Wang and Wu, 2016).

### Smart store-floor smart store module IoT

The objective of this module is to build an intelligent production line based on IoT technologies. It aims to create a link for the communication of information between physical manufacturing systems and the process of information multiplication. IoT technologies (RFID, or Wireless Networks) are configured to form a physical manufacturing system based on the required information. Based on the configuration, a manufacturing environment with low cost and reliable sensors is built.

### How to analyze the real-time performance of production based on critical events and CPN

This module is responsible for modeling the dynamic behavior of a manufacturing system and processing the insignificant data captured by sensors for critical production events. As shown in the middle of Figure 2, the multilevel event model and HTCPN technology (“Hierarchical Timed Colored Petri Net”) are combined to analyze the production performance in real time.

HTCPNs are built on the multilevel event model. In Petri Nets, places are used to represent the state of resources in the system; Transition to represent activities and macro transitions are used for subsystem modeling; I/O functions to represent the relationship between transitions and places; adding time delays to I/O transitions and functions; colored markers to represent a certain type of product. This system in which IoT is implemented can be updated according to the information on the manufacturing line in real time. As a result, information on production performance, such as production progress, quality distribution, etc. can be accessed.



## **Decision Tree(DT)- Based Exception Extraction and Cause Diagnosis Module**

An exception-event defines an abnormal state of an object or system. This occurs, for example, in a manufacturing stage and disrupts the normal or planned production plan, for example, an exception occurs when production progresses with a slight deviation from the plan. Exception diagnostics aims to detect exceptions and find the causes once they occur. It provides important information in order to avoid system errors, which lead to maintaining the efficiency of the production.

The working logic of this module is presented at the top of Figure 2. First of all, the DTs for extracting the exceptions and diagnosing the causes are constructed taking into account the conditions of the process. Algorithm C4.5 is used in the construction of the DT for the exception extraction. Because there is a lot of vague and uncertain information during data collection, the interactive Fuzzy Dichotomizer 3 algorithm is used to diagnose causes. Then, when information on production performance is obtained, the extraction of DT exceptions is accessed according to the process. As a result, the production conditions are analyzed based on these rules. Finally, if an exception is detected, the DT diagnosis of the exceptions is applied.

### **Production performance analysis**

Once the model is built, and the tokens and their colors are set to be associated with real-time resources, the performance of the production line can be analyzed as follows:

- 1) The intermediate marking for the inventory and the state of the raw materials under processing is monitored in real time.
- 2) Add additional places for each transition in order to record the frequency of their changes as well as their result so that the maximum technological loading of the machines can be achieved.
- 3) The performance analysis is performed to measure the time required for the parts to wait in line for production, the size of the waiting times, the production cycle time and so on.

With these measurements, the simulation is done to obtain production performance and to transmit the report to the basic application. In doing so, we extract key information for decision making, which is much better than transferring a large volume of events to your attention.

## **IOT AND STOCK TRACKING**

The optimization of information on deposits plays a decisive role in managing the supply chain with goods and only through a simple procedure of acquisition, inventory control and shipment in warehouse management, we can efficiently reduce the cost of the enterprise and improve the quality and competitiveness of the services. With the development of the warehouse management technology, stock records are functioning faster and faster, at the same time, warehouse operations and management control have become more and more complicated. It is difficult for manual operations to process a huge amount of data due to the low efficiency and time consuming, even more, there will be huge losses if there are errors. Therefore, the use of intelligent warehouse management tools has become an urgent need for today's businesses. One of the simplest methods has as technical basis the reading of the labels with the help of the hand readers (Ding, 2013).

The intelligent warehouse management program based on Internet of Things, in terms of hardware, consists of electronic labels, bar code readers and fixed readers; from the software point of view, it consists of: - a management system and electronic labels on the shelf. The overall structure of the system is shown in

The portable tag barcode reader represents recording equipment in operation in / from storage in the warehouse management system and is also the basic equipment of the entire system. Staff use the handheld reader to scan the goods barcode, then write the storage information on the RFID tags to complete the goods inventory.

However, this method involves quite frequent operator interventions, which is why human errors can occur. Other methods have been developed to take this into account, one of them being the WSN - a wireless sensor network, that is, a network of wireless sensors that can identify at any time the position of a pallet with cargo on the shelf and its contents, as well. to make it easy to keep track of the number of pieces in each product.

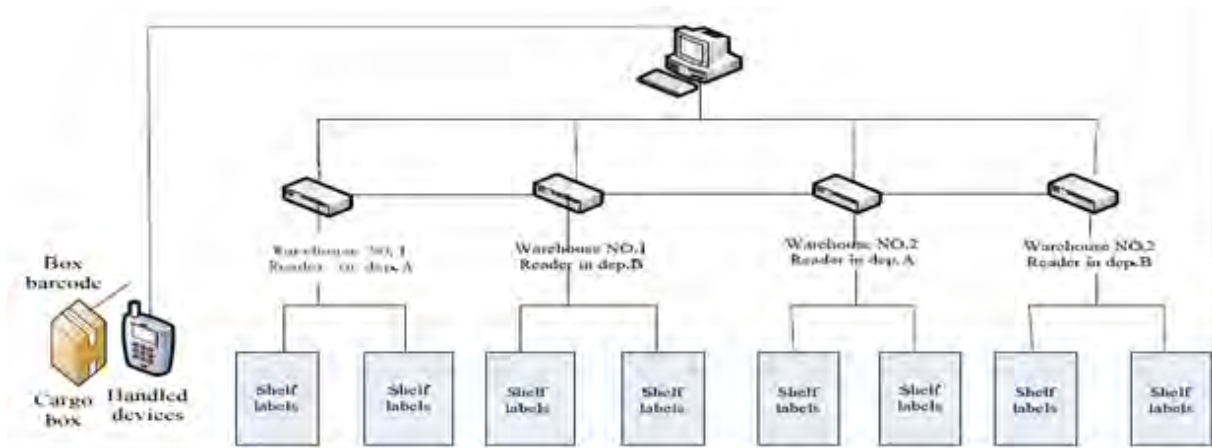


Fig. 3. General structure of hand-reader based systems (Ding, 2013)

**Wireless Sensor Networks (WSN)** (Falkenberg, R, s.a. 2017) have been a major research topic in recent years, a method that covers a diverse area of research, for example routing algorithms, energy harvesting, management, security and confidentiality. According to this versatile range of works, wide variations of WSN tests have been developed. In addition, there are federations of WSNs that combine multiple installations into a single widespread platform. Some of the most popular platforms are (Falkenberg, R, s.a. 2017):

- a) MoteLab - wireless network developed by Harvard and published in 2005. It was one of the first fully developed WSNs. MoteLab is an open source tool that is accessible on the Internet. Its web access facilitates remote programming and user programming.
- b) Future Internet of Things: FIT/IoT-Lab - is a large-scale erogenous research facility, with a federation of over 6 locations and over 2000 nodes in total. In order to interact with the nodes, it has command line interfaces through the user's virtual machines.
- c) Indriya - is a low cost WSN 3D testing platform implemented at the National University of Singapore. The 127 wireless nodes are connected with active USB cables. This USB infrastructure provides a back channel for remote programming and powering of sensor nodes.
- d) WISEBED - is a IoT research facility with a heterogeneous implementation in which each partner maintains its own testbed. There is also an overlay network that provides access to all test bases as a single large IoT implementation for analysis.

A possible alternative may be the one provided by **PhyNet lab** as shown in Figure 4.



Figure 4. PhyNet containers (Falkenberg, R, 2017)

It is located in a large warehouse, providing space for a considerable amount of containers. Each container carries a PhyNode module on the front, which allows the communication with the infrastructure. The modules function as internet access points and are equally distributed in the warehouse. A brief description of PhyNetLab and its components is presented below (Falkenberg, R, s.a. 2017).

## Hardware

PhyNode (see figure below) consists of two parts, a main network board for management and the actual experiment platform, which is a "swappable" (SSB) board.



Figure 5. PhyNode hardware (Falkenberg, R, 2017)

The management platform is based on the backbone of the ZigBee network and can be used, for example, to update the firmware of the board. The SSB heart is a FRAM (ferroelectric) memory. Compared to conventional RAM, the 64 kB FRAM is very durable in terms of memory access and energy efficient. Radio Communication is achieved with low Power Consumption Sub - 1 GHz Transmission for Short Range Devices (SRD). In addition, the board includes sensors that capture accelerations, temperature, color, infrared rays and ambient light. Interaction is possible using buttons and a small LCD. The SSB can be programmed to be energy neutral. It is designed to allow switching to an alternate power source if energy storage is exhausted.

## Software

To enable rapid development of applications in low energy systems, we have developed an IoT in Kratos operating system. It supports developers with a complete set of libraries and C ++ functions, which can be "tailored" to suit the needs of a distinct application and thus save resources by implementing the necessary system components.

Kratos was developed primarily with PhyNetLab and therefore offers full support in the PhyNode platform. Furthermore, PhyNetLab and Kratos allow mutual research on hardware and software design for various low-energy IoT deployments. By doing so, PhyNetLab provides us with information on how to design power and network software components for an operating system as we have difficult to manage resources. In the other direction, software requirements for enabling maintenance and deploying applications for PhyNetLab have influenced the choice of hardware components used in PhyNode.

This working method allows the efficient management of a raw material warehouse by the method described above on the PhyNetLab platform, a platform that is in the process of being developed through the Kratos operating system.

Such a network created leads to real-time tracking of stock management based on the above research.

## CONCLUSIONS

The development of the "Smart Factory" based on the new IoT technologies allows to obtain in real time the information necessary for the production management. The monitoring and planning of the production in real time by the methods described in the present report, as well as the management of the stocks provide extremely relevant information to the management team and come in its aid in maintaining the competitiveness of the economic operator under current market conditions.

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# QUICK MARCH OF HUMANITY TO A GLOBAL SOCIETY. WHAT CAN THE MAIN WORLD'S RELIGIONS PROVIDE FOR ATTAINING A FAIR STATE?

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## Abstract

**Purpose** – The paper is aiming to identify and delinate the content of globalization and the responses of the main world religions facing with the challenges of globalization.

**Methodology/approach** - The present paper is a bibliographical study of globalization from the perspective of the main world religions.

**Findings** – Globalization has major political, economic, social, cultural, religious and environmental implications, some beneficial, others detrimental for a good part of individuals, local communities, regions and nations.

**Research limitations/implications** – The research was limited by the speculative aspect of the approach from the spiritual outlook of Buddhism, Christianity, Islam, Judaism and Hinduism.

**Practical implications** – Attracting religion to building a "fair" and pluralistic global society can contribute to a better understanding between the followers of the great world religions, and to the genesis of a new ethos of a global society, beneficial for all stakeholders involved in globalization.

**Originality/value** – The new vision, of a globalization based on competition and not adversity, as main principle of world's order is opening opportunities to religion in providing an important contribution through its set of moral values and through the material and spiritual perspective on the human being.

**Key words:** globalization, spiritual outlook, world religions

## Introduction

Expressed either by several competing but related terms, such as "globalization", "globalism", "globality" [(Beck (2003), Marin (2004)], "mondialisation" [Marin (2004)], or even through one of its extreme forms of "globalution" [Friedman (2001) apud Marin (2004)], or through metaphorical formulations such as "global village", "second modernity" [ (Marin, 2004)], "think global, act local" etc., the process that humanity is going through today towards a "global", "postmodern", "post-industrial" or "post-capitalist" society and of course "post-communist" for several European countries and those of the former Soviet Union [Marga (2004), Soros (2002) apud Marin (2004)] is, according to the cited authors, has certain and irreversible course [Bauman (1999), Marin (2004), Dima (2004)].

Based on an extensive bibliographic research, by delineating the key aspects of the "phenomenon of globalization", i.e. tracing its historical milestones, the semantic of the various terms being used, its course of action, and also its impact on political, economic, social, cultural, religious, environmental level, the research results have led to the conclusion of the current transition to a global society, based on new principles and mechanisms of operation [Marin (2004)].

As an ongoing process in which the search for realistic solutions is in full swing, the idea that the world's major religions could provide a contribution, along with other forms of human knowledge and experience in science, technology, philosophy, etc. [Marga (2004)], through their spiritual outlook on world and man, respectively through the moral values they promote, is not to be neglected.

The authors' approach does not prove to be useless, on the one hand, due to the revival of religion, reported by several authors [Kepel (1993), Berger (1999) in Kadir & Maufur (2011), p. 399, (Marga, 2004)], and on the other hand and perhaps even due to this fact, the relationship between religion and the phenomenon of globalization being the subject of several studies and researches, published in the form of books, respectively scientific papers [Grigore (2003); Marga (2004); Beyer (2007); Ranganathananda (2010); Herrington (2013); Roudometof (2014); Juergensmeyer (2014); Miu (2020)], covering a wide range of world religions: Judaism, Christianity, Islam, Buddhism, Hinduism, Jainism, Shikism and Zoroastrianism.

### **Globalization. A brief literature review**

The first main section of the paper contains answers to a set of key questions on the subject, that are referring to issues as to when has globalization begun and how can we define it? If there are several competing terms that are circumscribed to the phenomenon of globalization, and what are the differences in their semantic content? What are the characteristics and manifestations of globalization and what actors are behind it? What is the constellation of the consequences associated with the phenomenon of globalization?

Turning now to tracing the origins of globalization in time, the interest on the subject, arouse by several scholars and researchers, gave valuable syntheses. So, Steger divides the history of globalization into 5 periods: prehistoric (10,000 - 3,500 B.C.E.); premodern (3,500 B.C.E. - 1,500 C.E.), early modern (1,500 - 1,750 C.E.), modern (1,750 - 1,970) and contemporary (from 1970 onwards) [Steger (2003)]. In turn, criticizing the approaches that reduce the beginnings of globalization to the present times, categorized as "presentism" and an "Euro-centrist" vision, marked by "the rise of the West", which neglects the evolutions of the non-European world, Pieterse proposes a palette of perspectives for the periodization of globalization, which takes into account the unit of analysis, as a key variable of analysis, but also the time horizon of the perspective, that of "Breitsicht" and "Langsicht" [(Elias (1994) , in Pieterse (2012)]. Thus, the outlook may target globalization as "part of planetary evolution (4000-3000 B.C.E.); as a commercial revolution (ca. 1000 B.C.E.); as a world economy (taking shape at 500 C.E., 1100, 1200 or 1500); as modernity (starting with 1800); and as a recent trend (the 1960s)" [Pieterse (2012), p. 17]. Finally, a group of Russian authors proposes, based on the combination of the "connectivist" approach with the "institutional" one, as "phases" of the history of globalization: archaic, proto-modern, early modern, modern and postmodern [Zinkina (2019), p 225].

The second aspect of interest in the bibliographic synthesis that makes the subject of this section of the article is, on the one hand, to identify a comprehensive definition of globalization, and on the other hand, to capture the competing terms, together with the presentation of their differences in semantic content. In terms of definitions, the bibliographic study undertaken by the authors showed a multitude of formulations, which makes it difficult for those who try to identify a comprehensive definition. On this line of investigation, in the only extensive analysis of the definitions of globalization, elaborated by Al-Rodhan and Stoudmann, shows that the diversity of perspectives from which globalization can be defined or interpreted is determined by the "individual's political ideology, geographic location, social status, cultural background, and ethnic and religious affiliation" [Al-Rodhan & Stoudmann (2006), p. 3]. Moreover, the same authors argue that the diversity of points of view in defining globalization also reflects the perspective of the areas of interest: economic, social, political, etc. Continuing Kumar's line of thought [Kumar (2003), apud Al-Rodhan & Stoudmann (2006)], Al-Rodhan and Stoudmann emphasize that the criterion for validating the definition of globalization is, ultimately, its ability to capture reality. So, Al-Rodhan and Stoudmann provide an integrative definition capturing the causes, development and consequences of globalization, from the perspective of several human activities ("linguistic, cultural, economic, political") and non-human aspects ("bird flu, as well as natural disasters such as tornadoes, tsunamis, earthquakes, and hurricanes") [Al-Rodhan & Stoudmann (2006), pp. 5-6].

Going further, globalization benefits from a number of competing terms, which sweep, in terms of their semantic content, the whole range of positive, neutral or negative connotations. For example, Marin distinguishes between "globalution" (with a negative connotation and understood as "a process of ex-stretching from the center to the periphery of the values of the single global model, in the sense of external revolution, import of standards by which innovation becomes preeminent over tradition and forces modernization as cultural uniformity" [Marin (2004), p. 18]); "globality" (with neutral connotation, which "captures nationally constructed interdependencies,...., a form of internationalism, [having] as

working method intergovernmental cooperation [and at the same time] a solution that preserves state sovereignty" [Marin (2004), p. 20]; "globalism" (with a negative connotation, belonging to the "notional class of imperialism, as a formula of force endorsed by the principle of adversity, [in the deviant forms of] mondialization and hegemony, [promoting] the production model, as a model of success, and a way of life of cultural and behavioral typification" [Marin (2004), p. 21]; "globalization" (positive connotation), which the author considers rather a prone stage of human history [Marin (2004), pp. 23-26], whose characteristics will be the subject of analysis in the following sections of the article.

Other competing terms of globalization, encountered in the bibliographical research have more or less metaphorical formulations, such as "global village" [McLuhan (1997) apud Marin (2004)], "the second modernity" [Marin (2004)], "global", "postmodern", "post-industrial", or "post-capitalist" society [Marga (2004), Marin (2004), Tofană (2007)], "glocalization" [Robertson (1995); Roudometof (2014)], "westernization", "Americanization", or even "McDonaldization" [Kadir & Maufur (2011), p.397], "deceptive face of universality" [Mantzaris (2002), p.6].

The approach to the complex phenomenon of globalization reveals a multitude of "facets" or perspectives from which it can be seen, approaches that also present overlapping areas. Thus, Steger talks about the economic, political, cultural and ideological dimensions [Steger (2003)], while Makhoul develops the aspects derived from "the politics, the economics, the sociology and the psychology of globalization", proposing an integrated model of understanding it [Makhoul (2014)].

We will further deal with the presentation of the relevant aspects of globalization following the definition proposed by Al-Rodhan & Stoudmann [Al-Rodhan & Stoudmann (2006)], which encompasses causes, processes and consequences. So, the bibliographic study reveals that at the root of the complex phenomenon of globalization are laying multiple causes, of a very diversified nature. Thus we can talk about political causes (global and regional agreements between states) [Makhoul (2014)], politico-military (NATO alliance) [Dima (2004)], politico-institutional (International Monetary Fund, the World Bank, World Trade Organization, Organization for Economic Co-operation and Development, etc.), technological (unparalleled progress in human history in the fields of communication and transport technology - a cause unanimously reported by authors), economic (liberalization of markets for goods, services and of capital) [Garrett (2000)], the expansion of the great world religions [Herrington (2013)].

Certainly, between the causes and effects of globalization are laying the processes that took place, and the agents that stood behind. Starting with the agents of globalization, Marin differentiates between "global institutions: the World Bank, the International Monetary Fund, the Bank for International Settlements, the World Trade Organization, the United Nations Group of Developed Countries, the World Health Organization" [Marin (2004), p.71] and "global factors (agencies): global firms, hypermarkets, risk funds, virtual space operators, non-governmental organizations, associations of intellectual environments and spiritual practices, bodies of international standards, personalities of global notoriety" [Marin (2004), p.75].

Finally, another analysis portrays the "process of mondialization" by "the global nature of science and technology, global marketing, the global financial system, communications infrastructure and the global institutional framework" [Bran & John (2009), p. 48], and distinguish between the "dimensions of globalization": "the economic dimension, highlighted by neoliberal measures, the power of multinational companies and the institutional involvement of the World Bank and the International Monetary Fund"; "the political globalization, highlighted by the individualization of institutions and supra-territorial associations, united by the same norms and interests"; and the "ideological globalization, seen as a system of ideas shared on a large scale, beliefs, norms, values and ideals accepted as valid, true, by a group of people". The identified five major ideologies related to the process of globalization are "liberalization and global market integration; its inevitable and irreversible character; no one is responsible for the phenomenon of globalization; everyone benefits from it; it contributes to the spread of democracy in the world" [Bran & Ioan (2009), pp. 51-56].

The consequences of globalization represent perhaps the fiercest field debated in the voluminous body of studies and research dedicated to the phenomenon, from a wide range of perspectives: political, military, economic, social, cultural, religious, ecological, etc. They are both positive and negative, Al-Rodhan and Stoudmann emphasizing "the ambivalence of the impact of globalization on security and stability, both individually and collectively (globally)" [Al-Rodhan & Stoudmann (2006), p. 6]. In economic terms, for example, globalization have created "winners and losers" [Kadir & Maufur (2011), p. 395]. Of course, advocates of globalization will argue that the beneficial effects prevail, while opponents will

argue that the situation is the other way around. Thus, in the chapter that takes up the rhetorical question in the title of his book, whether "globalization is good or bad" Nicholas Dima introduces the labels of "globalists of the market" for its proponents, respectively, "globalists of justice" and "nationalists" or patriots", for its opponents. Those in the first category, "support free and unrestricted international trade and worship consumerism; ... [argue that] the traditional state is a temporary arrangement that must be abolished; ... globalization is inevitable and irreversible, ... it propagates democracy and benefits everyone, ... if not now, then in the future", and in a concentrated form, taken from Business Week (1999), "globalization represents the triumph of markets over governments" [Dima (2004), pp. 116-117]. Opponents of globalization on the other hand, accuse "the disparities and social polarization caused by globalization, [which] is bad because it enriches a small minority and impoverishes the majority; advocate an equitable redistribution of the wealth of power between the states of the world, by establishing a new economic policy [(Steger (2003) in Dima (2004), p. 117; Dima (2004), pp. 116-117). They have also established the World Social Forum, in response to the World Economic Forum. Last but not the least, "nationalists" or "patriots seek to preserve the nation-state and its prerogatives, ..., believe in God and defend respect for national traditions" [Dima (2004), pp. 116-117].

In another condensed and well balanced synthesis on the "facets of globalization" presented above, Makhoul lists among the positive effects of globalization, "the reduction in the prices of consumer and capital goods, the free movement of capital, rationalization of production, the emergence of global brands, an increase in the world gross domestic product (GDP), reduction in income inequality between high and low income countries, bringing down the barriers to the transfer of technology". Among the negative ones, the author enumerates "benefits from globalization are not shared equally between all trading partners, workers in the old industrialized countries lose their jobs, the increase in the power of multinational firms, the struggle of infant industries in developing countries for survival, currency manipulation tactics to increase products' competitive advantages in the global market, continuation of some of the advanced countries' barriers to the import of agricultural and other products" [Makhoul (2014), p. 61].

For his part, in his analysis based upon statistical data on the "distributive consequences" of globalization, though limited only to the economic perspective of the "international integration of markets for goods, services and capital," Garrett lists the "increasing the income gap between rich and poor countries, income inequality within nations, volatility in economic activity, and with it, economic insecurity among citizens" and "reducing the capacity of the state to redistribute wealth and risk" [Garrett (2001), p. 1].

Our synthesis cannot be widowed by the social, cultural and ecological aspects, which will be touched on anyway, but only tangentially in the second part of the article, because the discussion about religion and globalization cannot avoid them. Beyond the space limitations of the article, we must emphasize, however, as Harrington rightly points out, the discourse on globalization is "economic-centric" and "western-centric", hence the perception of non-Western cultures of the process of "westernization", as a cultural dimension of globalization" [Harrington (2013), p. 146].

So, at the social level, the "financial and economic liberalization, the processes of restructuring, mergers and acquisitions, mediated mainly by Transnational Companies (TNCs), have led to the closure of enterprises, ..., globalization has added tens of millions of people to the unemployed, thus contributing to accentuating poverty" [Bran & Ioan (2009), pp. 56-57]. Moreover, globalization led to the segregation between "center and periphery", in which the beneficiaries of globalization enjoy "global mobility" as an expression of "freedom of movement", while at the antipodes, the poor have to endure "their imprisonment in the locality" [Bauman (1999), p. 6]. These negative aspects of globalization are confirmed by perhaps the most knowledgeable author of studies on its consequences, who is the former chief economist and vice president of the World Bank, Joseph Stiglitz, who speaks of "the devastating effect that globalization has on countries in development and especially on the poor populations of these countries" [Stiglitz (2005), pp. 9-10].

Finally, analyzes of the relationship between globalization and the environment reveal complex interactions on multiple possible levels of analysis (economic, knowledge, and governance) [Najan et al. (2007), in Bran & John (2009), pp. 75]. After Stead and Stead, economic growth is accompanied by population growth, the two leading to increased production but also consumption, which naturally lead on the one hand to depletion of resources and increased pollution, and hence the wide range of adverse consequences on the environment: climate change, wetland loss, ozone depletion, deforestation, species extinction, acid rains, human health problems and reduced quality of life, and environmental



and political activism [Stead & Stead (1996), Bran & Ioan (2009), pp. 63]. Finally, Bran and Ioan present four perspectives from which the globalization-environment relationship can be viewed: the liberal perspective (argues that economic growth, in terms of production and consumption, will generate high incomes ultimately leading to improved environmental conditions); the institutionalist perspective (promotes the idea of the need to increase institutional and regulatory power at global and national level); the ecological perspective ("globalization promotes economic growth, but contributes to environmental degradation by universalizing the Western model of consumption"); the green socialist perspective ("supports the strengthening the autonomy of local communities, ..., capitalism being the main cause of social and environmental injustice, weakens the authority of the local community and imposes the domination of Western cultural paradigms, emphasizes the domination of rich and marginalized women, indigenous peoples and poor") [Bran & Ioan (2009), pp. 146-149].

Summarizing what is shown in the sub-section dedicated to the consequences of globalization, we can say, that they are multiple. Besides the salient advancements in communication and transportation technologies, making the world a "global village", we cannot overlook also its drawbacks, of a political nature, among which we mention on one hand the loss of power of nation states over TNCs, respectively the partial loss of sovereignty in the face of new forms of association between states (as in the case of the European Union) [Dima (2004)]; those of an economic and social nature [Bauman (1999), Stiglitz (2005)], shown in more detail above; those on the environment [Bran & Ioan (2009)], or the cultural ones [Tomlison (2002), Cârjă (2012)]. However, resuming Dima's rhetorical question, "is globalization good or bad?" [Dima (2004)], we would like to emphasize Stiglitz's statement that "globalization must not be abandoned", this being "not feasible or desirable. It is not globalization that is the problem, but the way it has unfolded so far" [Stiglitz (2005), pp. 329-340], the author proposing in the same time a reform plan, including the creation of international public institutions. Perhaps more answers will come from the analysis of the relationship between religion and globalization, which we will discuss in the next section.

### **Religion in the face of globalization**

The study of the interplay between religion and globalization is gaining an increasing interest among scholars and researchers and we believe that there are a number of arguments to justify this upward trend. Firstly, according to the 2015 PEW Research Center Report, adherents of the world's major religions were approx. 5.7 billion, including here only the Christians, Muslims, Hindus, Buddhists, Jews, which means that out of a total of approx. 7.8 billion of the world's population today, 73% of the planet's inhabitants belong to a certain religion, a fact not to be neglected. Secondly, there are studies that are taking into account among the dimensions of globalization, the religion and culture, along with new technologies in the fields of communication and transport, the political and military, and of course, economic and environmental [Stahl (2007), pp. 336-339, in Kadir & Maufur (2011), p. 396]. Thirdly, despite the lack of attention from sociological theories to aspects of religion, as a component part of the complex phenomenon of globalization, prevailing its political, economic and military aspects (Turner (2007), pp. 345- 348, in Kadir & Maufur (2011), p. 396], perhaps and in the same time due to the focus of sociologists' attention almost exclusively on the topic of secularization [Roudmetof (2014), p. 151], one can identify a trend in countercurrent, that of desecularization, or a revival of religion [Kepel (1993), Berger (1999) in Kadir & Maufur (2011), p. 399], and contrary to modernity's predictions of "its exit from history", according to Hegel, Ferbach, Marx, Comte, Nietzsche [Marga (2004), p.9]. This is also demonstrated by the fact that in the post-communist and post-capitalist phase, people no longer identify with the ideology they were attracted to before, but in addition to nationality - which itself undergoes transformations in the case of emigrants - identity their is rather ethnic and religious [Kadir & Maufur (2011), p. 401]. Fourth, there is a parallelism between the journey of religion in the history of humanity and the history of globalization, its action as a driving force, but also as an opponent of globalization, which outlines according to Herrington a paradoxical relationship of "agent - opponent" one [Herrington (2013), pp. 145].

Given the above arguments regarding the rationality of debating the topic of the interaction between religion and globalization, we intend to answer, in delineating this topic, a few questions as to what is religion and how do the world's major religions relate to the challenges of modernism and globalization?

Overcoming the lack of general consensus on the generic definition of religion pointed out by Beyer, understood as "some reference to supraempirical beings or transcendent dimensions beyond the everyday world of the five senses", things become much more concrete in the case of "institutionalized religions" [Beyer (2008), pp. 444]. However, we provide a neutral definition from the Merriam-Webster dictionary, which states two meanings: "(1) the service and worship of God or the supernatural and (2)

commitment or devotion to religious faith or observance" [<https://www.merriam-webster.com/dictionary/religion>].

It should also be noted that the analysis of the phenomenon of secularization in recent decades has been accompanied or maybe generated by a reluctant attitude especially in the corporate environment to use the term religion with the meaning of an "institutionalized religion" in favor of spirituality, considered as being less ritualistic and not belonging to a specific religious doctrine [Lungu & Lungu (2012)].

Regarding the second aspect, of the way the main world religions are relating to the phenomenon of globalization, the bibliographic study pointed out both common and specific elements, the latter belonging to their specific spiritual outlook towards humans and world (see Table 1), but never overlooking both beneficial and detrimental aspects of the process of globalization, most of them identified in the above more "secular" studies and researches.

### **Discussion, conclusions, limitations and further research**

Reviewing what has been shown so far, we emphasize that globalization is a complex phenomenon, considered by some as inevitable, natural and irreversible [Bran & Ioan (2009)], while others perceive it as an economic expression of the "New World Order" [Dima (2004), pp. 116; pp. 9]. Then, seen from a historical perspective, globalization seems to have its origins in ancient times, and there can be isolated distinct phases or stages, among which the last decades are characterized by the most accelerated dynamics.

Apart from its used terms and definitions, this paper has first outlined, the causes, processes, actors and consequences of globalization, according to various authors. It was highlighted that the phenomenon of globalization can be analyzed from a multitude of points of view, including political, military, economic, social, cultural, ecological demographic, etc.

A second goal of this paper was to analyze how the world's major religions relate to the phenomenon of globalization. Due to the inherent space limitations, but also of the time constraints devoted to the bibliographic research, the paper was limited to only five of the major world religions, namely Buddhism, Christianity, Islam, Judaism, and Hinduism (in alphabetical order), following as in the future the analysis should be extended to other religions.

In the debate on the interaction between religion and globalization, the authors were interested in identifying the beneficial and harmful elements of globalization for humanity, respectively, from the perspective of the spiritual outlook of each religion. Here, an extensive analysis would go far beyond the scope of a single article.

The innovative element that this article brings with, is the identified niches in which religion, or "institutionalized religions" [Beyer (2008)] can intervene in structuring a "fair" globalization for all parties involved. In this endeavor, it was particularly useful for us to differentiate between the two "principles of world order" [Marin (2004)], one based on adversity, in which "one part tries to impose itself by force on the whole"; the second, based on competition, in which "the whole is more than the sum of the parts" [Marin (2004)]. Starting from this point forward, one can outline the idea of a globalization based on the second principle, which allows to imagine a vision, as a state of the future, in which religions find ways to contribute to building a "global society", through the set of moral values they promote and through the dichotomous perspective on the human being, material and spiritual. Such a vision is ultimately what was promoted by the famous Catholic theologian, Hans Küng, who advocated a new ethos of the world, an ethos that would be reflected on all three coordinates political, economic and scientific [Küng (2000, 2002, 2004) in Marga (2008)] of a "global society". No less true is that such an approach would also contribute to the rapprochement of religions that would be involved in a common effort to build a "fair" and "pluralistic" global society, taking into account their common ground, but also each specificity. In our opinion, this reconciliation should go beyond the paradigm of the "Jerusalem, Athens, Rome triangle, for healing the neuroses of history" [Marga (2008)], in a broad sense. We are not overlooking here also the intra-confessional cleavages (in the case of Christianity between the Orthodox, Roman-Catholic and Protestant Churches, among Shiites and Sunnis in the Islamic world and perhaps not so pronounced between Reformed, Orthodox, and Conservative Judaism). It remains for this thesis to be deepened and elaborated in the future. A development of Marin Marin's Thesis about globalization resting on two

principles of world order stated above [Marin (2004)], by incorporating authors' vision on integrating religion in the process of globalization for attaining a fair state is presented in Fig. 1.

Table 1. The benefits and detriments of globalization from the main world religions' outlook

<b>Religion</b>	<b>Benefits</b>	<b>Detriments</b>
<i>Christianity</i>	Fostering rapprochement between people and facilitating communication by removing dividing barriers [Mantzaridis (2002), p.6]; internationalization of scientific research results, expansion of communications worldwide, dissolution of economic protectionism [Tofană (2007), p.7]	The homogenization of the world and the loss of the concept of man as a person, the rule of money [Mantzaridis (2002), p.7]; „the annihilation of the personal diversity of individuals, the leveling of traditional cultures, the particularity of Christian spirituality and the removal of any trace of eschatological responsibility, individually or in community” [Tofană (2007), p.10]
<i>Buddhism</i>	Modernity brought „impressive achievements ... in transport, communication, electronics, health, human rights”; [Dhammananda (2010), p.58]	Though increase in material and physical welfare development the decay of morality and spirituality reflected in our behavior to the environment, wars and cruelty to our fellows, all attributable to greed [Dhammananda (2010), p.58]
<i>Islam</i>	Integration of time and space, ... increasingly reduced importance of the 'imaginary boundaries' of state territories ('global village'), ..., intensified and accelerated religious and cultural exchange among people, making them interdependent to each other” [Kadir & Maufur (2011), p.397]; Through globalization religion filled the economic gap between developed and developing countries and led to “the unsecularization of the world” or “the revival of global religion”, ..., generated a stronger feeling of religiosity than nation-states [Kadir & Maufur (2011), p.399]	Threat of cultural homogenization and imposing the western style of life to non western civilization; less impact in rural areas than in urban ones [Engineer (2010), pp.91-101]; Globalization promoted „certain ideologies like capitalism (McDonaldization or Americanization), ..., it is imperialism of the Capitalism of the West (like colonization and its new forms), ..., is rooted in modernity and neo-liberalism that follow from the greedy-Western philosophy, immorality, individualism and capitalist domination” [Kadir & Maufur (2011), pp.397-401]
<i>Judaism</i>	Globalization provides with “unprecedented opportunity” [Odenheimer (2009)]; Due to „Internet, satellite television, computers, cell phones, email and out-sourcing, the world became smaller and more interconnected than ever before in its history” [Schulweis (2004)]	Globalization is promoting a „market centered vision of social life”, in which „ politically powerful multinational corporations control and dominate the world's economy”; impoverishing the „farmers living in semi-communal villages [that] have been forced off their land by a combination of violence, trickery, and the degradation of their environment and have been forced to sell their labor to factories, mining companies, or plantation owners”; plundering the developing countries of their non renewable resources, accompanied by a devastating pollution and environment damage; globalization led to „maximizing the accumulation of wealth by multinational corporations”, knowing that „concentration of wealth that inevitably leads to abuses of power” [and] „the nexus of political and economic power that perverts justice in order to serve the greed of the wealthy” [Odenheimer (2009)]
<i>Hinduism</i>	„Greater affluence, better communication and advancements in technology”; „global advancement in science, technology and business”; attainability for well educated persons in getting jobs in developed countries; increased „planetary” consciousness [Shastri (2010), pp.79-90],	Damaging effects on environment (but also the rise of the concern for it from the part of the opponents of globalization), poverty of vulnerable nations, increasing gap between rich and poor, cultural homogenization instead respect for culture diversity, new form of colonialism („continued projection of western and European civilization and its values for everyone”), „misuse of Hindu tolerance” from the part of Christianity and Islam; promotion of a materialistic way of life, a culture penetrated by sex and violence and offering false human models (athletes and movie stars), promotion of the thesis of „clash of cultures” as a threat against multiculturalism, “cultural chauvinism and isolationism” [Shastri (2010), pp.79-90]

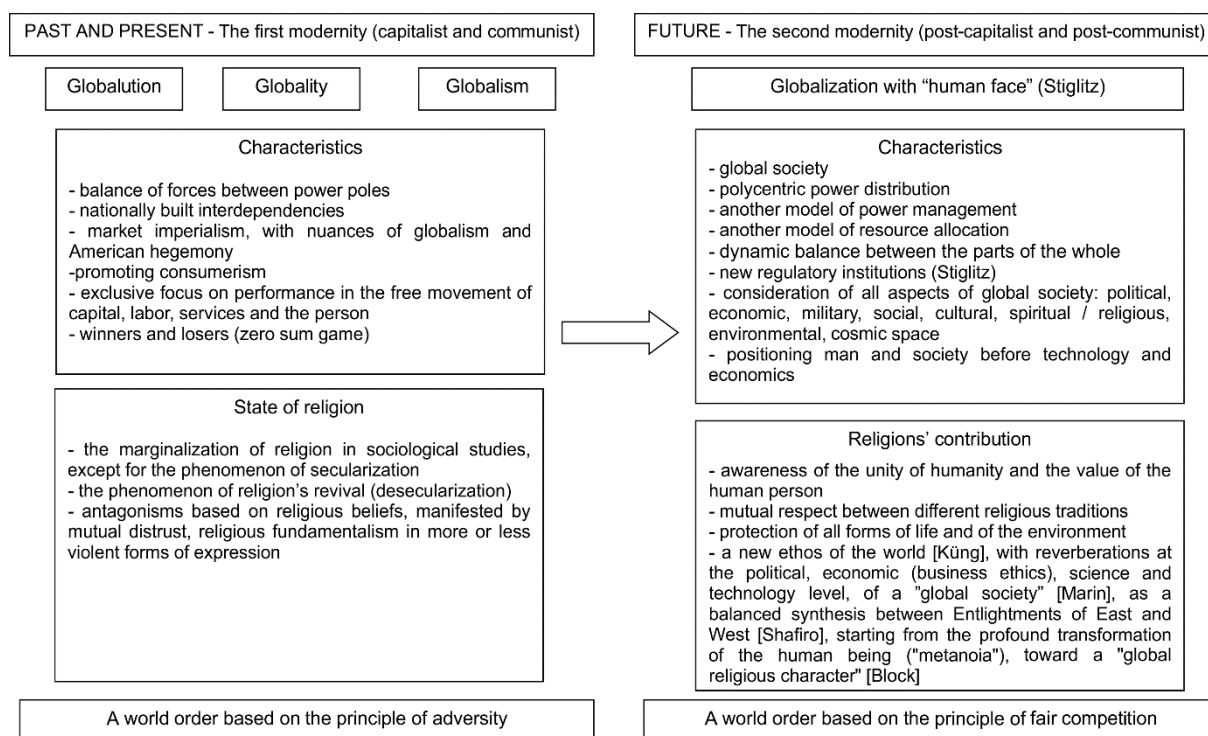


Fig.1. A transition model from globalism towards globalization

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