IX INTERNATIONAL CONFERENCE

QUALITY SYSTEM CONDITION FOR SUCCESSFUL BUSINESS AND COMPETITIVENESS

PROCEEDINGS

ASSOCIATION FOR QUALITY AND STANDARDIZATION OF SERBIA

KOPAONIK, 26/05 -28/05/2021

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P R E F A C E

Dear colleagues, admirers of quality,

It's my pleasure on behalf of organizing committee of the Association for Quality and Standardization of Serbia in welcoming you to the 23rd National and 9th International Scientific Conference on QUALITY SYSTEM CONDITION FOR SUCCESSFUL BUSINESS AND COMPETITIVENESS.

In November 2020, at the end of 22 conference, I announced the possibility of organizing the conference in May, but at that moment, I did not know whether it would be 23 traditional conference or another gathering with the aim to exchange new knowledge and hand over the awards. Certainly, the greatest pleasure for us will be to tighten each other's hands and realize that we have survived Corona.

I hope that it will be so, as I write this preface 30 days before the beginning of the conference, with the hope that adequate conditions will be created for the organization of this gathering.

To all those who beat corona want to be even stronger and more successful.

Unfortunately, one of the admirers of quality, former dean of the Faculty of Veterinary Medicine, prof. Vlado Teodorović PhD lost the battle with the Corona. Let him eternal glory and thank him for all he has done for quality and standardization in Serbia.

Important for the organization is the fact that every year we have an increasing number of individuals and organizations who want to get involved and to help us in this our mission.

This year we are organizing the 23rd National and 9th International Scientific Conference in cooperation with:

- *Faculty of Veterinary Medicine, Belgrade University – co-organizer*
- *Scientific Veterinary Institute of Serbia*
- *Sumadia academy of professional studies*
- *Quality Centre, Faculty of Engineering Sciences, Kragujevac University*
- *Quality Centre, Faculty of Mechanical Engineering, University of Montenegro, Podgorica*
- *AQP consulting agency and*
- *Middle and South East European Countries Quality Initiative*

With the support of

- *Ministry of Economy of the Republic of Serbia*
- *Ministry of Education, Science and Technological Development*
- *Faculty of Business Economics and Entrepreneurship*
- *Serbian Association of Employers*
- *Serbian Chamber of Commerce*
- *Accreditation Body of Serbia*

The media sponsors of the conference are the magazine Kvalitet & Izvrsnost and the Portal Kvalitet.

There has always been a great interest in participating in previous conferences, but the interest for this year's conference is the greatest so far. Whether the reason for this is the fact that we have not seen each other for a long time or because we are eager to share new experiences in the field of quality systems, the gathering itself will confirm.

A large number of papers were submitted for the 23rd National and the 9th International Conference, and the reason is always current and interesting areas such as:

- *Quality system condition for successful business and competitiveness*
- *Improving quality infrastructure*

- *Management system: quality, environment, occupational health and safety, energy, food safety, information security…)*
- *Engineering and quality management*
- *Knowledge management*
- *Audit and certification*
- *Global quality*
- *Quality culture*
- *Quality, risks and opportunities*
- *Information system in the function of management system development*
- *Quality improvement tools;*
- *Etc.*

Organization of this event continues the tradition of last year, when the conference was organized through round tables dedicated to one area in which it is given the opportunity to involve more participants through questions, comments and suggestions. Our ultimate goal is to actively involve as many participants as possible in the discussions.

On this occasion, on the first day, we are organizing a round table called "FOOD SAFETY IN DIFFERENT BUSINESS CONDITIONS" with a special focus on food safety in university campus in different conditions.

On the second day, we impose the topic "HIGHER EDUCATION AND THE ECONOMY - NEED AND CHALLENGE". What is the main reason for this topic? Most employers want quality staff, but on the other hand they are not ready to accept students for internships, and they do not want to enable us to educate them through dual studies. If we don't feed the fishing spot together, we will hardly have a good catch. The Ministry of Economy, the Ministry of Education, Science and Technological Development, the Serbian Association of Employers and higher education institutions will also take part in this discussion.

Another important topic on the same day is "ENVIRONMENT AND CLIMATE - FROM GLOBAL TO LOCAL AND BACK". We all agree that the environment should be protected, but it often happens to us that we pollute it the most. For many, profit comes first, while what life means to us is often left aside.

A large number of papers will be presented at the conference through round tables and sessions. Due to limited time, many quality papers (judging by the reviewers' reports) will not be presented.

I take this opportunity to thank all the authors, co-authors, co-organizers and we owe a great gratitude to the reviewers as well as to all those who have given us support to persist in the organization of this conference.

Let's adhere to all recommendations and measures of the crisis headquarters for the prevention and spread of infectious diseases Covid19

I wish us successful work and a good time at the largest gathering dedicated to quality.

Welcome to Kopaonik

Yours sincerely,

Professor Zoran Punoševac, PhD
Organizing Committee Chairman

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ASSOCIATION FOR QUALITY AND STANDARDIZATION OF SERBIA
23rd national and 9th international conference
QUALITY SYSTEM CONDITION FOR SUCCESSFUL BUSINESS AND COMPETITIVENESS
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INTELLIGENT QUALITY MANAGEMENT SYSTEM

Matija Kovačić, mag.ing.traff.[1]

Prof.dr.sc. Krešimir Buntak[2]

Petra Tišler, mag.oec.[3]

Abstract: *The digital transformation results in the development of new technologies that organizations implement in their business, which increase the serviceability of the system. As the complexity of the system increases, so does the challenge of managing a complex system, due to physical and capacity constraints that people face. Given this, there is a need to develop an intelligent quality management system in the organization that will be based on artificial intelligence, which is similar in nature to the way of thinking of man. By combining artificial intelligence and other technologies within Industry 4.0. an intelligent management system is created. An intelligent management system becomes a mechanism by which compliance with the requirements of management system norms can be much more easily ensured, as well as a basis for developing a competitive advantage in the long run. The paper describes a model of an intelligent quality management system as well as the possibility of combining individual technologies of Industry 4.0. The aim of this paper is to point out the need to include artificial intelligence in the management of the organization, all because of the increasing complexity of the system due to digital transformation.*

Keywords: *digital transformation, intelligent control system, control system, artificial intelligence;*

***JEL Klasifikacija**:O33*

1. INTRODUCTION

Digital Transformation and Technology Development Industry 4.0. results in the emergence of new solutions in production. The consequence of this is the development of smart factories, i.e. a different way of organizing production, which allows to increase flexibility and interoperability. [4] Therefore, there is a need to develop new models of quality management of such a system. One of the technologies that has a very large impact on the development of quality management systems, but also management in general, is artificial intelligence.

Artificial intelligence in combination with sensors and big data analysis, i.e. data mining techniques can be used for quality management of the organization through identification of patterns in the

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[4] Oztemel, E. (2020). Introduction to Intelligent Quality Management. Quality Control in Intelligent Manufacturing.

collected data and detection of trends that could affect the system.[5] In other words, through artificial intelligence and learning techniques used by artificial intelligence, such as machine learning and neural networks, and through statistical analysis, it is possible to predict future developments in the process and acquire new knowledge. Once acquired, the knowledge that can be gained, through data mining techniques used on big data, can be stored in the organizational knowledge base and used later in decision making. However, one of the prerequisites for the use of mining techniques as well as the application of artificial intelligence in business is the implementation of digital business transformation.[6] Digital transformation implies a paradigm shift in business aimed at the application of digital technologies in product creation, production, sales and stakeholder relations management.[7] Also, there is a change in organizational culture, reduction of bureaucracy, which allows to increase the flexibility and efficiency of the organization as a whole.

When talking about the impact of digital transformation in the quality management system, the inclusion of artificial intelligence created a new concept, intelligent quality control system. Intelligent quality management system provides a systematic approach to management, which includes data collection, data analysis, development of predictive models to be used for management, etc. The aim of this paper is to show the need to develop the concept of intelligent quality management and capabilities of such a system. The need to develop such a model is the impact of digital transformation on the organization as well as the opportunities that digital transformation provides in the management of complex systems.

2. ARTIFICIAL INTELLIGENCE AND MANAGEMENT SYSTEM

Artificial intelligence is a term that describes a system that is very similar to human intelligence in its way of functioning, i.e. it enables the acquisition of new knowledge through repeated analysis of the environment in which it is located, i.e. collecting and analyzing data from the environment. [8] The ability to analyze large amounts of data in a short time and conduct complex simulations, which includes simulating possible outcomes, discovering organizational knowledge, controlling information collected and even interacting with customers when solving simpler queries, makes artificial intelligence increasingly attractive for implementation and use in business.[9] Considering the ability to learn and detect patterns, artificial intelligence finds special application in the health system where it can be used for the analysis of X-rays, ie the analysis of individual diagnostic examinations and disease detection. [10]

Likewise, the use of artificial intelligence is increasingly common in banking transactions where the specific features of each person can be used to perform a banking transaction without authorization by pin, credit or debit card.[11] A special application of artificial intelligence is in supervision, i.e. in corporate security, where it can be used to analyze risky behavior or authorize entry into business premises.[12] In other words, artificial intelligence in organizations enables much more efficient implementation of activities carried out by people so far with the possibility of storing their

[5] Ansari, F., Fathi, M., & Seidenberg, U. (2011). Evolution of Intelligent Quality Management Process Based on Using Performance Quality Indicators. Wissensmanagement, str. 149-160.

[6] Buntak, K., Kovačić, M., & Martinčević, I. (2020). Impact of digital transformation on knowledge management in organization. Advances in Business Related Scientific Research Journal, str. 36-47.

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[10] Bohr, A., & Memarzadeh, K. (2020). The rise of artificial intelligence in healthcare applications. Artificial Intelligence in Healthcare, str. 25-60.

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acquired knowledge in organizational knowledge bases, which allows future application of acquired knowledge in decision-making and management of the organization. However, despite the advantages and opportunities that artificial intelligence has, there is a risk associated with the application of artificial intelligence in business, which concerns the disruption of organizational culture in terms of a different understanding of the human component in the organization.[13] In other words, artificial intelligence can significantly increase the efficiency of the organization but on the other hand can also harden interpersonal relationships as all decisions and all activities begin to be observed through statistical analysis, ie analysis of efficiency and the ability to replace the human component in the organization with automated systems.

A particularly important area of application of artificial intelligence is product quality cycle management, as artificial intelligence enables, in combination with other technologies such as digital twins (DT), which enables the creation of a virtual copy of the product, i.e. virtual design, reducing the time required to develop new products. is of particular importance in market conditions that require high speed product development, especially if it is the IT industry. Furthermore, the possibility of use of AI in the client software can be greatly speed the response to the request and the ability to acquire knowledge of the problems and disadvantages that are commonly related to the product or service.

3. INTELLIGENT QUALITY MANAGEMENT SYSTEM

The digital transformation of business as well as the introduction of digital innovations in factories significantly increases the complexity of the system. Through the possibility of mutual communication of different technologies implemented in the organization, the need for employee intervention is significantly reduced. [14] However, this does not mean that employees as such are no longer needed in the organization but that their educational structure as well as their competencies are changing significantly. Likewise, employees are a necessary component of the system since the system, given its current development, cannot sustain itself.

Since the digital transformation allows the implementation of sensors that will monitor the state of machines and devices in the production process, which means that they collect a large amount of data stored in databases, there is a need to use tools that will analyze the collected data. Number of data using current analysis techniques requires a lot of time and specific knowledge and skills of employees who would analyze such data.[15] Given the complexity and long period of training of such staff, artificial intelligence is emerging as a solution that in the long run can provide the organization with a foundation for the development of competitiveness.

Sensors and the ability to monitor the performance of machines and equipment used in production to monitor and analyze the efficiency and effectiveness of such machines as well as the identification of the period in which it is necessary to conduct regular maintenance or replacement of certain parts.[16] Also, collecting a large amount of data, or using some of the learning methods used by artificial intelligence, allows the development of a system that can predict failures and possible failures of machines and devices that will result in production downtime or possible non-compliance of finished products.

Furthermore, by connecting various technologies, such as IoT (Internet of Things), CPS (Cyber physical system), DT (digital twins), etc., allows mutual communication between the machines and devices in the manufacturing plant. However, communication and information exchange between

[13] Canhoto, A., & Clear, F. (2020). Artificial intelligence and machine learning as business tools: A framework for diagnosing value destruction potential. Business Horizons, str. 183-193.
[14] Oztemel, E. (2020). Introduction to Intelligent Quality Management. Quality Control in Intelligent Manufacturing.
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[16] Çınar, Z., Abdussalam Nuhu, A., Zeeshan, Q., Korhan, O., Asmael, M., & Safaei, B. (2020). Machine learning in predictive maintenance towards sustainable smart manufacturing in industry 4.0. Sustainability, str. 8211.

machines and devices need to be managed and given the physical limitations of man in the speed of information processing compared to artificial intelligence, artificial intelligence is emerging as one possible way to manage such a system. Human physical limitations in the form of working time limitations, workplace efficiency, specific competencies that an employee needs to possess in order to perform a particular activity in the workplace, impose the need to find a more efficient system that will allow faster and more efficient activities.

3.1. Planning and development - activities prior to production

Intelligent quality management system is based on artificial intelligence but also on all the principles that the quality management system emphasizes, which are described in the norm of class 9. However, due to the increasing complexity of the environment and increasing complexity of the system, monitoring and managing such a system. Also, there are a number of advantages that automated systems have compared to humans, and the basic advantages relate to the ability to perform multiple operations in a shorter time, the ability to store and analyze large amounts of data, the ability to quickly predict trends, the ability to communicate with stakeholders and learn based on implemented communication, etc. Thus, an intelligent quality management system, the system is based on artificial intelligence that allows integration and mutual communication of automated systems, collection, analysis and predictive simulation of future movements in the system.

However, one of the basic preconditions for the implementation, i.e. the creation of an intelligent management system, is organizational competence, i.e. technical and technological competence. Technical and technological competence implies the existence of technical assumptions such as infrastructure and technological assumptions, i.e. knowledge of how to use the technique.[17] On the other hand, in addition to technical and technological competence, it is necessary to ensure the competence of human resources, which, despite the digital transformation and its physical limitations, are still a necessary component of the system. In addition, the connection of technical competence, technological competence and human resources competence is carried out through structural competence, which also represents the backbone of the organization. In other words, an organization that does not possess the described competencies cannot carry out the digital transformation in a satisfactory way just as it cannot implement an intelligent quality management system.

An intelligent quality management system consists of three basic components: activities carried out before the start of production, activities carried out during production and activities carried out after production.[18] In other words, the activities carried out before production primarily relate to the product quality development cycle, which includes the analysis of stakeholder requirements, product design and product construction, product testing and product presentation to the customer. On the other hand, the operationalization of the created specification, i.e. the activities carried out during production are related to the monitoring and control of production as well as the management of the entire production process. In the last group of activities, post-production activities, communication with customers is carried out, i.e. analysis of stakeholder satisfaction, analysis of the process cycle and definition of measures for improvement.

3.2. Realization of planned activities - activities during production

Product planning and development is based on gathering stakeholder requests as well as converting stakeholder requests into specifications. Also, in this phase, the analysis of competition, customer satisfaction with the competition product is carried out, production plans are defined, and suppliers are selected who will supply the organization with all the resources needed for production. The ISO 9001: 2015 standard defines several requirements related to these activities, most of which are defined in point 8 of the standard.

[17] Buntak, K., Kovačić, M., & Martinčević, I. (2020). Impact of digital transformation on knowledge management in organization. Advances in Business Related Scientific Research Journal, str. 36-47.
[18] Oztemel, E. (2020). Introduction to Intelligent Quality Management. Quality Control in Intelligent Manufacturing.

Specifically, point 8.2. sets management requirements for products and services, and as a mechanism to meet these requirements can be used, among other things, artificial intelligence that can effectively analyze in a short time a large number of different requirements that customers submit and can be used to respond to customer inquiries if implemented in a customer support system.[19] Likewise, the implementation of artificial intelligence allows the creation of knowledge about the most common complaints, customer requirements, as well as general feedback that customers send to the organization.

Also, as an example, digital twins (DT), virtual reality (VR), or artificial intelligence should be mentioned as some of the mechanisms by which compliance with point 8.3 can be ensured. which is related to the design and development of products and services. In this context, with the help of AI it is possible to construct the product much more efficiently, i.e. to design it and conduct a simulation of its functioning. Likewise, a product prototype can be presented to a customer.[20] On the other hand, DT enables the creation of a digital replica of an existing product and its manipulation[21] i.e. adaptation to customer requirements as well as the possibility of virtual presentation using virtual reality (VR). On the other hand, augmented reality allows interaction with the product being created and its testing which can serve as a basis for creating improvements on the product.[22] It should be emphasized that the use of all described technologies is exclusively a mechanism by which compliance with the requirements of the standard can be ensured and that it is necessary to ensure the competence of human resources that use the described technologies.

3.3. Customer service and process analysis - activities after production

The largest number of technical and technological innovations in Industry 4.0. refers precisely to the activities performed during production, such as monitoring the operation of machines and managing the operation of machines, control of manufactured products and testing compliance with customer requirements, etc. When it comes to the requirements of ISO 9001: 2015, which are related to activities during production, some of the requirements are set out in point 8.5. in which the requirements related to production and traceability are described. In this context, the implementation of sensors on machines and devices used in production allows monitoring of their performance as well as identification of a possible problem. On the other hand, data collection creates a database based on an analysis that can predict future process trends.[23] On the other hand, the interaction between machines and devices in production can be achieved through IoT, which also enables the exchange of information between machines. Sharing information can make it easier to track production and the stage at which production is.[24] On the other hand, CPS enables remote plant management as well as the ability to solve simple production downtime without the need for employee intervention, and AI allows monitoring compliance with customer requirements and the

[19] Hopkinsona, P., Perez-Vegab, R., & Singhala, A. (2018). Exploring the use of AI to manage customers' relationships. Academy of Marketing Workshop: Artificial Intelligence in Marketing–The field, research directions, and methodological, str. 7.

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[23] Dubey, R., Gunasekaran, A., Childe, S., Bryde, D., Giannakis, M., Foropon, C., . . . Hazen, B. (2020). Big data analytics and artificial intelligence pathway to operational performance under the effects of entrepreneurial orientation and environmental dynamism: A study of manufacturing organisations. International Journal of Production Economics, str. 107599.

[24] Boyes, H., Hallaq, B., Cunningham, J., & Watson, T. (2018). The industrial internet of things (IIoT): An analysis framework. Computers in industry, str. 1-12.

ability to separate non-compliant products from the batch before the batch is delivered to the customer.[25]

In other words, the implementation of sensors in the production line enables realistic monitoring of production and the possibility of extracting all products that do not comply with the requirements. On the other hand, employees who are directly involved in carrying out certain activities in the process can use technologies such as augmented reality to carry out the activities for which they are in charge much more efficiently. Given this, augmented reality allows the display of activities that the employee must perform on a visor located directly in front of the employee's eyes, which reduces the risk of performing activities inappropriately and reduces the risk of non-compliance due to employee error.

The development of smart factories opens the possibility of using RFID chips that are placed directly on the semi-finished product, and which contain information about the necessary activities that need to be carried out. Such chips also enable the display of information to the employee, which may be related to the personalization of the product.

3.4. Intelligent quality management system model

Post-production activities primarily relate to the provision of serviced services to customers or users as well as customer relationship management. At this stage, there is also the possibility for customers to advertise the product or report any non-compliance that the organization needs to analyze. On the other hand, after the production, i.e. the end of the process cycle, it is necessary to analyze the performance of the cycle and identify places where it is possible to implement improvements. Since there is a possibility of implementing sensors on machines and devices used in production, it is possible to collect many different information, or a large amount of data that can be analyzed and from which different days of mining techniques can identify pattern or organizational knowledge. Such activities can be carried out by artificial intelligence, which can also signal a possible pattern that can result in non-compliance. Furthermore, the use of artificial intelligence in answering customer or user inquiries can replace the need for employees working in call centers or help via chat.

Figure 1 shows the proposed conceptual model of an intelligent quality management system. The model is divided into three types of activities with an overview of the possible interconnection of different technologies to shape the management system.

[25] Long, G., Lin, B., Cai, H., & Nong, G. (2020). Developing an Artificial Intelligence (AI) Management System to Improve Product Quality and Production Efficiency in Furniture Manufacture. Procedia Computer Science, str. 486-490.

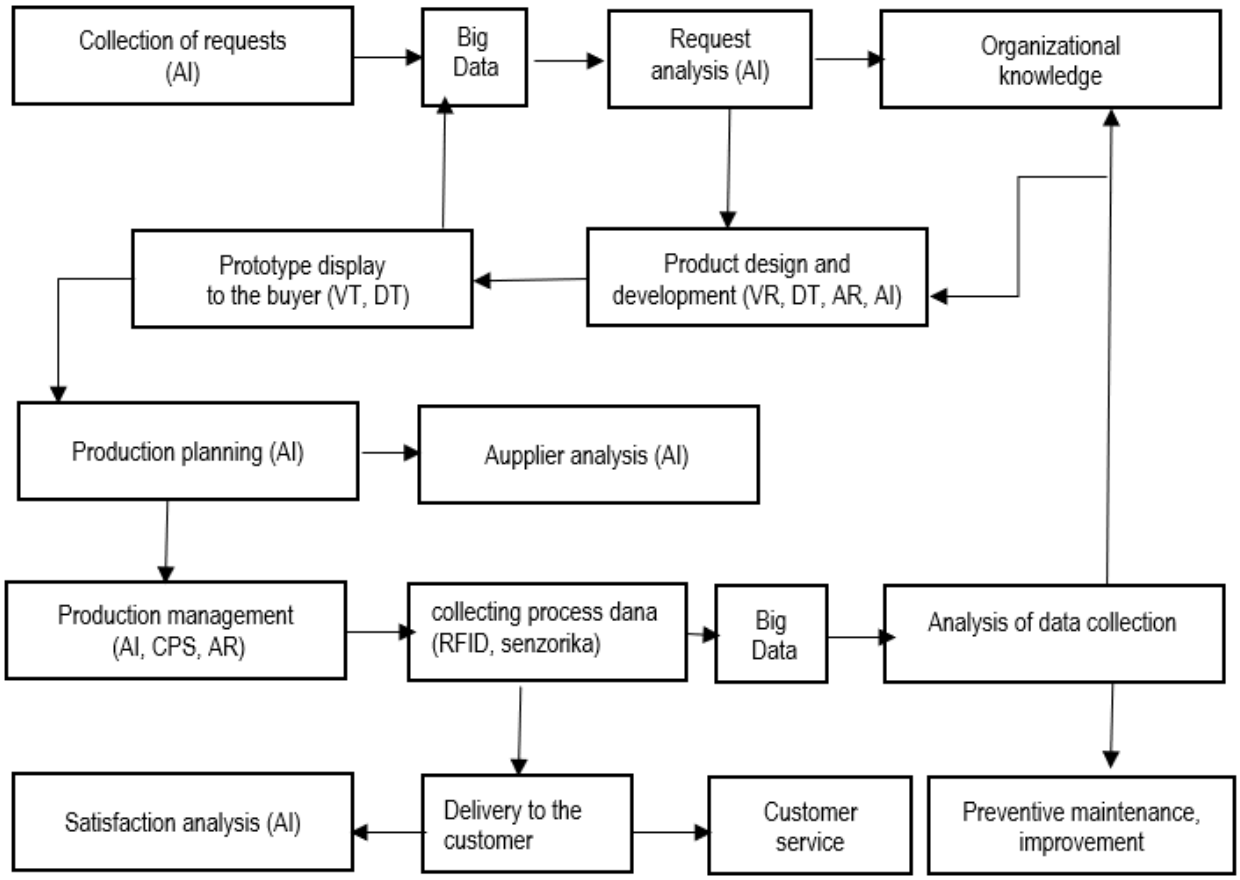

Figure 1: Model of intelligent quality management system

Source: Author

Although the model is based on artificial intelligence, artificial intelligence as such cannot function on its own and cannot manage the organization independently. In other words, employees use artificial intelligence to use it to carry out intended activities in communication and product development. Also, technologies using CPS that allows remote control, DT that allows the development of a digital copy of physical reality, virtual reality (VR) and augmented reality (AR) that allow interaction with the digital version of the product, or its prototype. By collecting information and analyzing it, it is possible to create or identify organizational knowledge that can later be used in a new cycle of product development. On the other hand, all collected information is contained in big databases from which using mining techniques and AI can identify the trend, or pattern as well as the need for improvement, or preventive maintenance of machines and devices used in production. On the other hand, AI can be used to solve simpler customer inquiries as well as to analyze non-compliance, which can become the basis for creating organizational knowledge about the problem, or customer complaint.

4. CONCLUSION

The intelligent quality management system is based on all the principles that the quality management system according to the ISO 9001: 2015 standard emphasizes. However, technologies developed within Industry 4.0, and in most cases artificial intelligence, are used to meet the requirements defined in the standard. Intelligent quality management system starts from the quality paradigm that sees the management aspect, and less technical aspect, which means that it is necessary for quality management to analyze suppliers, analyze the requirements of all stakeholders, analyze competition and their products and services, collect and analyze process performance and manage organizational knowledge. The described technologies become a mechanism, i.e. they become a resource that organizational employees use in management. However, for the implementation of an intelligent quality management system, it is necessary to

ensure technical and technological competence, and then to ensure human resources competence and ultimately structural competence. The described model can become a destructive technology that can provide the organization with a competitive advantage in the long run. On the other hand, the model requires the organization and change of the educational structure of employees since employees must possess specific competencies that will enable them to handle and manage the described technologies. Otherwise, the implementation of such technologies will not result in the development of a significant competitive advantage in the market.

In the presented model, it is possible to implement a much larger number of technologies. However, the aim of the paper is to point out the possibilities offered by Industry 4.0. and artificial intelligence in general as well as point out the need for the current understanding of management to change the paradigm due to changes related to the opportunities offered by new technologies such as artificial intelligence as well as opportunities to develop a competitive advantage due to the implementation of such technologies. Also, due to the use of new technologies in production as well as due to the collection of a large amount of information, man due to his limitations is not able to conduct complex analyzes in a short time as well as unable to manage a complex system without technology. Given this, the digital transformation brings with it the need to develop an intelligent quality management system.

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АСОЦИЈАЦИЈА ЗА КВАЛИТЕТ И СТАНДАРДИЗАЦИЈУ СРБИЈЕ
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SISTEM KVALITETA USLOV ZA USPEŠNO POSLOVANJE I KONKURENTNOST
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QUALITY AS A DEVELOPMENT STRATEGY

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Abstract: *Numerous organizations, including countries, make considerable efforts to establish a general development strategy. Strategy defined as the manner of achieving a goal, as the main direction of the organization's activity, is one of the documents in which commitment of the organization is defined and it forms integral part of the first structural element of the organization's management system. It is derived from the vision and materialized through the organization's policy and its general and specific management goals. The subject of research in this paper is quality as a development strategy. The problem researched in this paper is the characteristics of quality as a development strategy and the possible achievements of such an approach. The basic hypothesis of the research presented in the paper is that quality has the potential and can be a development strategy. Strategy is hierarchically structured. In studying the social and economic reality, its causes and consequences, it may be concluded that "(non)quality" is the cause of any imbalance, resulting in crises, conflicts, wars and other manifestations of destruction. There have been attempts to solve the problem of this imbalance, both at the global and at the micro level of organizations: profit maximization strategy, strategy of low input costs, continuity strategy, outsourcing, etc. Quality as a development strategy in any organization and sector may significantly contribute to development of organizations' competitiveness, and in this way also of the economy as a whole. This is especially important for weaker economies and countries, which have no significant impact on global economic and political developments. The prerequisite for this is accepting quality as a business philosophy, as a pragmatic approach and as a way of life. In this paper, using general and specific scientific methods of cognition, the author researches the phenomenon of quality as a possible developmental strategy. The research results confirm the basic hypothesis that quality as a phenomenon has the potential of a development strategy.*

Key words: *quality, development strategy, management system, competitiveness.*

JEL Classification*: L15; O11*

1. INTRODUCTION

One of the most important development issues for any country is how to increase the competitiveness of the economy and society as a whole. The competitiveness of the economy means "... the country's ability to produce goods and services that pass the test of the international market in free and equal

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market conditions, while retaining and increasing the real income of the population in the long run.“[2] The ranking of countries (economies) according to the criterion of competitiveness constitutes a global scale of competitiveness, and is carried out on the basis of a number of criteria. In the absence of a comprehensive development strategy and the search for a direction of development, it is difficult to make a significant positive shift on this scale. One of the reasons for many years of stagnation or lagging behind of a country in terms of competitiveness is the lack of a development strategy, and the other is the fact that other countries are working better to improve their competitiveness. And they do that by conducting the so-called structural reforms in key sectors, thus changing the structure of the management system in all its structural elements and thus increasing its quality. A resource that exists in every country and has not been sufficiently used in efforts to improve its competitive position is quality.

The subject of research in this paper is the phenomenon of quality as a possible development strategy. The problem that this research seeks to solve is to design a development strategy that will be acceptable to all market participants and all social groups and acceptable to all regardless of their political affiliation and role in society. The basic hypothesis of this paper is that quality as a business philosophy and pragmatic approach and way of life, has the potential to become a general development strategy at all levels.

2. METHODS

In the paper, the author has applied general and special scientific methods of cognition. The real dialectical-materialistic method as a general philosophical method of cognition was applied to reach an objective understanding of the problem of quality phenomenon in the context of finding a general development strategy.

From the general scientific methods of cognition, the system theory method is applied to understanding the management system and its very complex structure.

The comparative method was applied in the research and comparison of different types of strategies.

Of the special scientific methods of cognition an analysis was used to research the strategy context.

The deduction method was applied when deciding about opportunities for quality as a business philosophy and pragmatic approach and way of life to be a development strategy.

3. DEFINITION OF STRATEGY

„Strategy "(Greek stategia) means the science of warfare, the art of war, the book of the art of war.“[1] „It can be defined as a plan, pattern of behaviour, competitive position and (or) perspective that integrates the main goals, policies and sequence of actions of the company into a cohesive whole....“[2]

„The strategy in the economy means determining the long-term goals of the company and / or the economy as a whole and defining the ways of achieving them. It is the science and even the art of using the political, socio-economic and psychological forces of support in the realization of strategic tasks. ... The strategy also means scientific knowledge and expert skill in managing the business process and company development.“[3]

The strategy should provide an answer to the question of how the organization will achieve the established general managerial goals, materialize policies and contribute to the realization of the vision of the organization.

„The strategy is to determine the basic long-term goals of the company, to adjust the directions of business activities, ie to determine the concepts and the choice of resources needed to achieve the set

[2] OECD – The Organisation for Economic Cooperation and Development.

goals."[3] From the above definition, the basic questions to be answered by quality as a strategy can be identified:

- what are the goals of the organization, primarily thinking about long-term goals;
- what is the plan, ie what should be done and how should we act;
- what resources need to be provided and engaged to achieve these long-term goals.

Furthermore, "Strategy is a set of managerial skills, which do not aim to reduce surprises and increase the level of foresight, in terms of improving the ability of top management, but rather to deal with unpredictability and its use and familiarity with non-complementary cultures, such as lack of consensus, contradiction, conflict and inconsistency."[4]

„The economic development strategy is a set of coordinated measures for achieving the set strategic goals of economic development within the general social development of a given country in a given period and with adequate changes in the system of functioning of the economy."[3]

Given its definition and importance to the organization, the strategy is in the area of responsibility of the organization's management. The strategy can and should change, depending on the internal and external context of the organization.[5] Each generation of managers has the right to their own vision and strategy on average every five to seven years, should be given the right to their own vision, and that means establishing a development strategy in response to a change of context. It should be borne in mind that the strategy usually changes more often than the vision

4. POSITION OF STRATEGY IN MANAGEMENT SYSTEM

The strategy is located within the first structural element of the management system, which is actually the documentation basis that determines the commitment of the organization.[6]

The strategy is most often adopted for the medium or long term. It is in the function of realizing the vision and carrying out the mission of the organization. „Mission and strategy are the two most important factors of any company. Through a commitment to the contribution that defines the identity of the enterprise, the mission determines the purpose of the existence of the company. The company's strategy sets goals and sets the rules for achieving them. Both the mission and the strategy must be ambitious, but also a source of motivation that inspires and encourages people."[7]

Figure 1 shows the management system and its structural elements: 1) documentation base consisting of strategic documents (mission, vision, strategies, policies, general and specific objectives); 2) organization; 3) processes; 4) resources; 5) partnership; 6) information and communication. It is characteristic of all organizations regardless of their activity and physical size. The same structural elements make up the management system in a production company, in a hospital, in a sports society, at a university or an institution in the field of culture.

[3] Definition by Alfred DuPont Chandler Jr., which quotes Marin Buble, Management, Faculty of Economics, Business and Tourism Split, Split, 2000, p. 167.

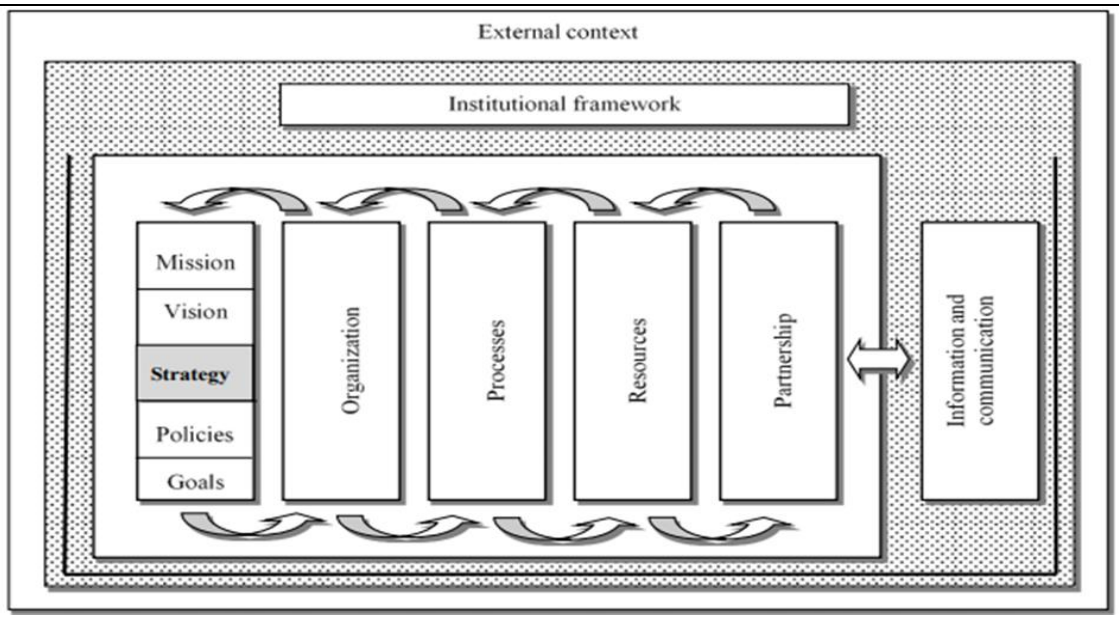

Figure 1. Structural elements of the management system

Source: Author

The interaction between structural elements is constant and intense, regardless of the level of awareness of management and employees. The essential question is about the level of knowledge about the management system, that is, to what extent the system is managed.

5. TYPES OF STRATEGY

Strategies can be divided in several ways. It depends on the scope of the strategy, ie the area to which it refers. Thus, the strategies can be divided, as shown in Table 1, into:

- general strategy,
- special strategy.

A general strategy can be transnational, such as "EUROPE 2020 - A European strategy for smart, sustainable and inclusive growth," which refers to EU member states. The general strategy, if we are talking about the level of the state or the national economy, refers to the overall development of a country.

Special strategies derive from the general strategy of the state or the economy and according to the scope they refer to the so-called sectoral strategies. So, we can talk about:

- Industrial strategy,
- Transport development strategy,
- Public administration development strategy,
- Tourism development strategy,
- Health development strategy,
- Sustainable development strategy, etc.

Table 1. Coverage strategies

Given the coverage					
General	Transnational				
	National				
		General	Industrial strategy		
			Transport development strategy		
			Public administration development strategy		
			Tourism development strategy		
			Health development strategy		
			Sustainable development strategy, etc.		
					- production
					- finance

Given the coverage					
General	Transnational				
	National				
Special	Sector	Special	Enterprise strategies	Economic functional	- accounting
					- procurement
					- sales
					- marketing
					- human resource
					- information
					- information system
					- research
					- development
				Management functional	- planning
					- organizations
					- application of selected solutions
					- control of selected solutions
					- motivation
					- communictions
					- business decision making
					- improve
					- quality management

Source: Author

A further division of special strategies relates to enterprise strategies. Namely, within certain sectors such as transport, tourism, industry, there are a number of companies of different sizes and forms of ownership. Regardless of the size and form of ownership, companies have their own functional strategies that can be divided into:[7]

- economic functional strategies, and
- management functional strategies.

According to the time coverage, general and special strategies can be divided into:

- short-term,
- long-term strategies.

Thus, in the name of the strategy as a document, one can see the period to which the strategy refers. The periods for which strategies are adopted are different: five, six, eight, ten years.

Table 1 shows that according to the scope of the strategy, they are divided into six levels: 1) general and special, from which they arise; 2) supranational, national and sectoral, which are further divided into; 3) general and special where they are; 4) general are those related to sectors, and they are made, for example, by ministries, and special ones are related to companies, they are further divided into: 5) economic functional and managerial functional, and they are further divided into; 6) economic functional on business function strategies, and managerial functional on management function strategies.

6. STRATEGY CONTEXT

When defining a strategy, whether it is a country, sector, company or business function, it is necessary to determine the internal and external context. This is because the state, sector or company, operates in the environment and that environment significantly affects them. Therefore, the developments in the environment and the characteristics of the environment of the company, sector or state, form the external context, which should be determined when making a strategy. Internal context refers to events and characteristics within, in this case, the company, sector, state.[5]

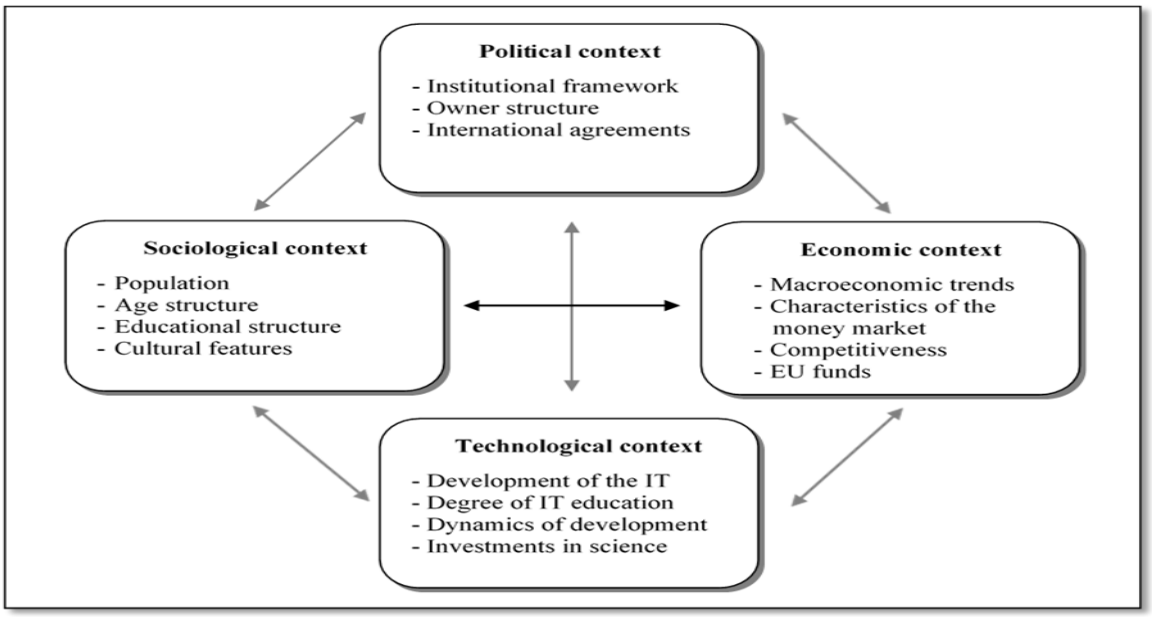

Figure 2. Example of PEST analysis for a company

Source: According to the criteria of PEST analysis, prepared by the author.

PEST analysis can be applied in determining the context of the strategy, as shown in Figure 2. It is necessary to thoroughly analyse:

- Political context,
- Economic context,
- Technological context, and
- Sociological context.

As part of determining the political context, it will be necessary to qualitatively analyse the institutional framework in the country in which the company operates. This refers to laws and other regulations governing business, such as tax regulations, international agreements with other countries or within economic and political integrations (EU, NATO, CEFTA, OECD etc.).[4] It will also be necessary to analyse the ownership structure of potential partners and trends.

When analysing the economic context, it is first necessary to perform a thorough analysis of macroeconomic indicators such as: gross domestic product (GDP), interest rates, national currency exchange rate, stock exchange indices, industrial production, consumption, wages, etc. Then it is important to look at the money market, supply and demand, the situation in the banking sector, the movement of interest rates on loans, the range of banking products, financing models and more. It is necessary to get acquainted with the characteristics of partners (customers, suppliers, financial institutions, educational institutions, etc.) with whom they will enter into partnerships during business. Also, EU funds can be used as a form of financing, so it is necessary to get acquainted with the criteria and get acquainted with the methodology of preparing documentation.

The technological context needs to be well analysed. This especially refers to the development of the IT sector, which refers to: infrastructure, equipment, educated staff, the dynamics of infrastructure and staff development and software solutions. It is also important to get acquainted with investing in research and development, ie science.

The sociological context is also important. It is necessary to analyse data about the population, both the number of inhabitants in an area and the age and educational structure, because it depends on consumer habits and interests that should be taken into account when determining the strategy of

[4] NATO – North Atlantic Treaty Organisation; CEFTA – Central European Free Trade Association; OECD – The Organization for Economic Co-operation and Development.

production, marketing and others. It is also important to get acquainted with the cultural characteristics of the population, habits, traditions, stereotypes and prejudices, etc.

Furthermore, it is necessary for each of these segments within a particular context, or for each circumstance, in further analysis, to identify the manifestations with respect to: effect, significance, duration and frequency and quantify them to determine their significance.[5] There is a constant intense interaction between these four contexts. They are interdependent.

Approaching the development of a strategy for a company, sector or country, without determining the context, is a frivolous job and it is to be expected that it will not lead to the desired result, which is an established strategy that serves the vision and mission. In addition to PEST analysis, in the process of determining the strategy, other methods can be used such as: SWOT analysis,[5] Portfolio analysis.[8] analysis and assessment of the competence of the management system, etc.[9]

7. QUALITY AS A DEVELOPMENT STRATEGY

Figure 3 shows a hierarchy of strategies, from general state strategy to specific strategies at the company (organization) level. The strategic goal is to increase the competitiveness of a country's economy. At the state level, there should be a general strategy that clearly sets out public policies and general goals. Thus determined policies and set general goals should, taking into account the specifics, be taken into account in the development of sectoral strategies (industry, transport, tourism, public administration, environment, etc.). Sectoral strategies are adopted at the level of ministries and represent the starting point for the strategy adoption of development strategies at the level of local government and regional self-government. These strategies should operationalize the policies and general objectives of the sector strategies. Individual companies (organizations), when developing their development strategies, rely on the sectoral strategies of those sectors to which they belong, ie on the strategies of local government units and regional self-government, in whose area they operate.

The hierarchy (Figure 3) set up in this way has two constants:

- constant subordination, which means setting public policies and general goals within the general development strategy at the state level, and
- constant harmonization of general goals and policies from the level of the company (organization) to the level of the state, ie the general strategy.

In order for these constants to be established and to be able to operate, it is necessary, first of all, to establish a general development strategy at the state level. It is also necessary to adopt all sectoral strategies and at the level of local government units and regional self-government.

Until the existing gap in terms of the lack of individual strategies at individual levels is filled, it is not possible to fully establish subordinates and harmonization constants.[9] At the same time, this means that it will not be possible to significantly increase the competitiveness of the national economy on the Global Competitiveness Scale, which will have an impact on the realization of the state's mission.[6]

[5] Strengths – Weaknesses – Opportunities – Threats.

[6] The mission of the state can be found in the Basic Provisions of the Constitution. „The mission of the state is to ensure the material well-being, freedom and equality, safety and democracy of all its citizens.“

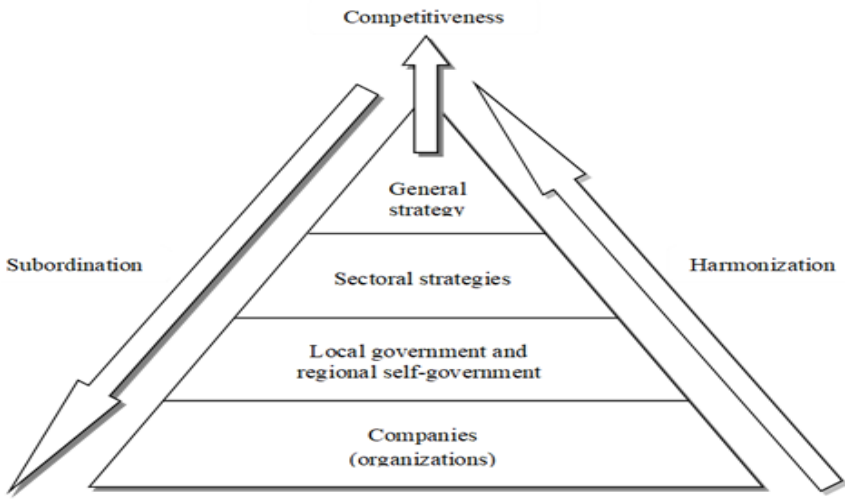

Figure 3. Hierarchy of strategies

Source: Author

The competitiveness of the national economy is a complex phenomenon, as shown in Figure 4. It is conditioned by numerous of factors that can be divided according to the definition of the state:

- as political communities of people organized in a territory under sovereign authority; a sovereign and independent entity capable of entering into relations with other such entities, which has international legal personality,[11]
- the state as a management system[10] which has the same structural elements such as any organization.

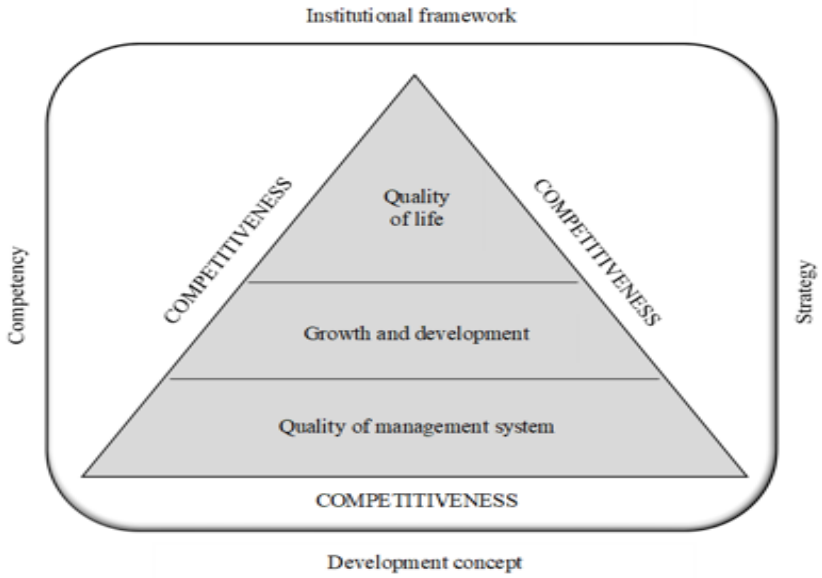

Figure 4. The phenomenon of competitiveness

Source: Author.

The factors of the state as a political community are:

- *Institutional framework*: it consists of international norms and directives, treaties, the constitution and national laws, sub-legal acts and other regulations that regulate relations within the state (economy),
- *Strategy*: represents a way to achieve the goal (master plan of development), the answer should be given to the question how, in what way will the vision of the state (economy) be realized?
- *Development concept*: represents a plan to increase the competitiveness of the economy; draft and projection of measures aimed at increasing the competitiveness of the economy; the

ability to understand the need to increase the competitiveness of the economy as a function of the quality of life of citizens; the idea of quality of life and the importance of raising the level of quality of life of citizens.

- *Competence:* means "…competence, recognized expertise, ability that someone has"[12] Competence is necessary, both at the level of strategic decision makers, and at the tactical and operational level, because strategic decisions are operationalized in public and business policies at the tactical level and are realized through operational activities at the operational level. Personnel competence is only one of the necessary competencies. Competence in the broadest sense should also be considered here, as the competence of the management system.[13]

The factors of the state as the management system are:

- *Quality of the management system*: implies the quality of all structural elements of the management system and the application of the principle of continuous improvement as one of the basic principles of quality management.[10]
- *Growth and development:* as a positive consequence of the quality of state factors as a political community and the quality of the state as a management system, where growth means physical increase in production of goods (product, service, capacity) and financial effects, while development means developed ability to maintain positive growth at rates of 5-7%[14] per year and higher investments in the field of social infrastructure. In the process of developing the factors of the state as a political community and the factors of the state as a management system, a synergistic effect materializes in increasing the competitiveness of the economy. And these are the circumstances in which, in parallel with the development of human freedoms and democracy, the level of quality of life of citizens is rising. It can be concluded that "competitiveness" is a complex phenomenon whose understanding requires consideration: economic, legal, political, sociological and technological aspects.

Quality as a development strategy, unlike other possible development strategies, has the following significant characteristics: universality, comprehensiveness, acceptability, measurability, intelligibility.

- *Universality* – refers to the circumstance that quality as a development strategy can be applied to all economic sectors and activities, organizations regardless of activity and physical size, to any part of the world.
- *Comprehensiveness* – refers to the circumstance that quality as a development strategy can cover all functions and all business processes of any organization. This is of particular importance because it opens up the possibility of involving the maximum number of people and all available resources that can contribute to the implementation of quality as a development strategy in their workplaces on a daily basis, regardless of where and what they do.[15]
- *Acceptability* – quality as a development strategy can be acceptable to all stakeholders, which is not the case with any political program.
- *Measurability* – the contribution of quality as a development strategy and the development of quality as a strategy can be measured. For this purpose, it is necessary and possible to build a toolkit of indicators by which this contribution can be measured on a daily basis, periodically at appropriate agreed intervals and the like. This is important for the reason that the trend of achieving the achieved goals could be determined at any time and, if necessary, to intervene for the purpose of improvement without possible non-compliances manifesting as the end result. The toolkit of indicators should contain, first of all, indicators on the level of competitiveness of the economy and indicators on the level of quality of life of citizens. In addition, it is possible to measure and consider the specific contribution of each individual in the organization and each member of the community.
- *Intelligibility* – the basic features of quality as a development strategy and the goals of acceptance and implementation of this strategy are simple and understandable to every

member of the organization or community. Development based on the principles of quality as a development strategy should result in increased competitiveness of the economy, growth and development of production, increased exports, more balanced balance of payments, higher GDP, higher wages, infrastructure development, etc. and increased quality of life (material well-being in terms of providing sufficient material resources for a dignified life of every citizen), safety, equality, democracy, education, health, happiness.

Figure 5 shows the impact of quality as a development strategy on the economy through action on and within individual economic sectors. This impact should result in an improvement in the level of competitiveness of the overall economy, which is manifested through an increase in the quality of life of all citizens.

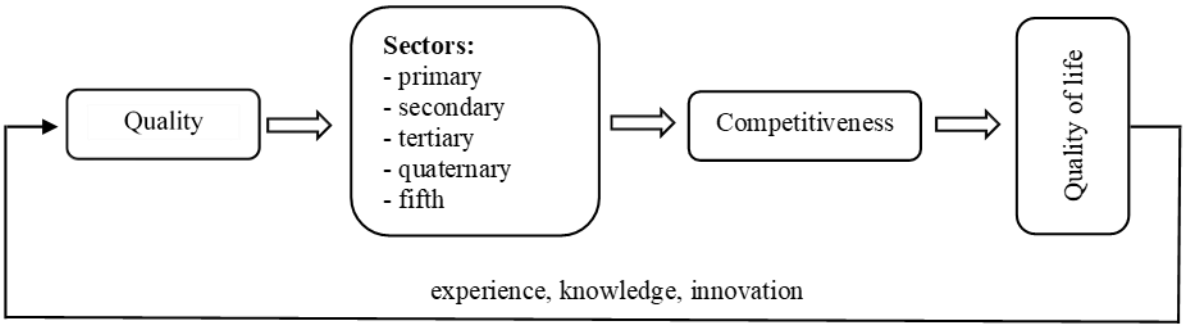

Figure 5. Quality as a development strategy[7]

Source: Author.

This is not a one-way street. Through this process which results in a higher level of quality of life, people gain new knowledge, experience. All of this affects competence for innovation. Innovations generate the progress of an organization, a social community, a civilization.

7.1.Which means "quality" as a development strategy

Quality, according to ISO 9000, is defined as a “degree to which a set of inherent characteristics fulfils requirements.“ This refers to a product, service, process or management system, too. What requirements? Requirements of the customer or when it comes to public administration, citizens. We should strive to ensure that these and such requirements are always met from the first. This will not always be possible, but the path is the goal. The trend of continuous improvement is important.

All organizations, all units of local government units and regional self-government, all ministries and states in all their functions, should have quality as a common denominator of their strategies. Quality needs to be understood and it needs to become a plan, a main goal and a way for all these entities, from organization to state, to meet their general and specific goals, implement their policies and thus realize their visions in carrying out their missions. Having quality as a development strategy means the following:

- at the level of the company (organization) to put the quality of the product or service in the first place, before the profit;

[7] The **Primary** sector consists of the following activities: agriculture; fishing; forestry; mining; ... The **Secondary** sector consists of the following activities: manufacturing; production and distribution of electricity, gas and water; construction equipment; crafts; ... The **Tertiary** sector consists of the following activities: service - trade; transport and traffic; tourist catering; hospitality; logistics services; ... The **Quaternary** sector consists of the following activities: educational; scientific; cultural; health; social care; sport; housing and communal services; non-profit organization services; ... The **Fifth** sector consists of the following activities: logistics services (financial intermediation; real estate; renting; IT; research and development; public administration; defence; judiciary; public security; public order and peace; firefighting; ...).

- at the level of local government units and regional self-government, to put the quality of life of citizens and business conditions of companies (organizations) in their area, in front of politics and particular interests of political parties, individuals or interest groups;
- at the level of ministries (sectors) to put the quality of laws and regulations and projects before the interests of political parties, individuals or interest groups and to finance those projects that bring the greatest benefit to the quality of the context in which companies (organizations) operate and to the quality of life of citizens;
- finance through budgets at all levels those projects, programs and organizations that put the quality of work and life ahead of other interests of any interest group;
- quality is the cause, everything else (profit, market position, degree of competitiveness, GDP, etc.) are consequences;
- quality is not the job and task of an individual or a group, but the interest and task of everyone, every day, in every job or other place where people work.

7.2. What needs to be done to make "quality" a development strategy

In order to be able to proclaim quality as a development strategy, it is necessary to carry out a series of activities in order to create assumptions. In this sense, at all levels, from the company (organization) to the state, it is necessary to do the following:

- make a political decision to make quality a development strategy of society at all levels;
- reach a consensus on several strategic projects important for the development and quality of life of citizens, both at the state level and at the level of local government units and regional self-government, around which there is no politicization and which continue regardless of the change of government;
- build a new system of values that will be based on: work, honesty, knowledge, quality, competence, inclusiveness, transparency, social responsibility, business ethics;
- adopt a general development strategy at the state level in order to create a precondition for the application of continuity of subordination and continuity of harmonization with the lower, ie lower with the general strategy;
- develop all sectoral strategies;
- define the methodology for modelling a development strategy so that they are not written too extensively, but focus on policies and general goals;
- integrate the principles of quality management into every business process and project;
- intensify quality education at all levels;
- build a system of rewarding the most successful in the implementation of quality as a development strategy, at all levels;
- communicate quality as a development strategy to all stakeholders, primarily citizens as the most interested party;
- to give up behavior according to the principle of "double standards", which means that quality should always be emphasized, both when we are in the role of customer, but also when we are in the role of the one who produces or provides service for the customer.

Quality as a development strategy, in terms of implementation, is everyone’s job, on a daily basis, in every place where people work and live. Every individual, no matter what they do, how educated they are and what position they are in, can contribute to improving the quality of what they do on a daily basis. This is especially important for psychological reasons. This concept does not allow shifting responsibilities to someone else. The responsibility for quality is non-transferable. This approach makes it relatively easy to measure an individual's contribution to the realization of the concept of quality as a development strategy. Quality as a development strategy is not a state but a process. Elements of this concept exist in many countries, but they take place mostly spontaneously. If you want quality as a development strategy, you need a decision and commitment.

8. CONCLUSION

Making a political decision about quality as a development strategy of a society will stimulate discussion on the broadest basis. The profession should be given tasks in terms of creating preconditions for the application of the phenomenon of quality as a development strategy at all levels. A more serious implementation of this concept can be measured by the achieved GDP, but the only real measure is the degree of competitiveness of a country on the Global Competitiveness Scale. Significant improvement in this regard ensures the development of material and social infrastructure, through the provision of new investments, new jobs, new funds in local and state budgets, a greater degree of the country's defence capability, a higher level of quality of life.

Implementing the concept of quality as a development strategy costs nothing. What it costs is not the quality that causes stagnation on the Global Competitiveness Scale. The resulting losses are many times higher than the investment in quality. The ultimate goal of the concept of quality as a development strategy is to increase competitiveness, which will enable the realization of the state's mission at a higher level of quality, which means providing all its citizens with material well-being, freedom and equality, high safety and democracy.

The research results presented in this paper confirm the basic hypothesis of this paper that quality as a business philosophy and pragmatic approach and way of life, has the potential to become a general development strategy at all levels.

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АСОЦИЈАЦИЈА ЗА КВАЛИТЕТ И СТАНДАРДИЗАЦИЈУ СРБИЈЕ
23. nacionalni i 9. međunarodni naučno stručni skup
SISTEM KVALITETA USLOV ZA USPEŠNO POSLOVANJE I KONKURENTNOST
Kopaonik, Kraljevi Cardaci, 26.05 - 28.05. 2021

POSSIBILITIES OF USING BIOMASS WASTE FOR COGENERATION PLANTS IN WASTEWATER TREATMENT PLANTS AND WASTE LANDFILLS

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Abstract: *Using waste wooden and agricultural biomass as renewable energy sources has in recent years become a practical and reliable way of obtaining energy in most EU countries. Numerous scientific and practical researches are focused right on those possibilities of using wooden biomass and plant biomass from different sources not only for energy purposes, but for other needs as well. Gasification of waste wooden and agricultural biomass for production of heat/electricity which is applied cogeneration plant CHP (wood-cogeneration plant) uses and preserves optimally available resources. Gas which is obtained through gasification in cogeneration plant is used in gas engine which has asynchronous generator for electricity production mounted on its axis. A well-planned supply chain of waste wooden and plant biomass, with appropriate preparatory technologies, can significantly influence on rational use of available resources. Wooden and plant residues can be used as raw materials for: heating (30% cheaper than gas from gas pipelines, 50% cheaper form electricity or heating oil), production of electricity, as well as for compost production.*

Keywords: *Wooden Biomass, Plant Biomass, Landfill gas, Cogeneration*

JEL Klasifikacija:*Q4 Energy*

1. INTRODUCTORY CONSIDERATIONS

In recent decades, a significant increase in temperature on Earth has been observed. The international consensus accepted that the emission of greenhouse gases "FSB" these gases are: carbon dioxide CO_2 methane CH_4, nitrous oxide N_2O, HCF, PFC and SF6, is one of the main culprits for such a situation. According to various international agreements, each country should reduce the emission of harmful gases into the atmosphere. Various projects can achieve a reduction in emissions of harmful gases into the atmosphere, and they are:

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A) Energy supply
- Renewable energy sources,
- Biomass (for obtaining electricity and / or heat, cogeneration),
- Increasing energy efficiency, replacing old and inefficient technologies with modern technologies,
- Reduction of transport and distribution costs,
- Change of fuel (eg switch from coal or fuel oil to biogas).

B) Energy needs
- Replacement of existing "home equipment" (eg use of energy efficient light bulbs, etc.),
- Improving the energy efficiency of existing equipment.

C) Transport
- More efficient transport engines (eg replacement of old locomotives),
- Change of mode of transport (eg train instead of plane),
- Change of fuel (eg public or electric public transport buses).

D) Waste management
- "capture" and use of methane emissions from landfills,
- use of waste and wastewater.

E) Afforestation
- afforestation of urban areas,
- afforestation of rural areas.

2. USE OF UNCONVENTIONAL FUELS IN THE FUNCTION OF REDUCING THE EMISSION OF HARMFUL GASES INTO THE ATMOSPHERE

When it comes to biogas, we usually mean gas with a large amount of methane in it, which is formed by fermentation of organic substances, such as manure, sewage sludge, municipal solid waste or any other biodegradable substance, under anaerobic conditions (Figure 1.)

Names such as bog gas, landfill gas, wetland gas and the like are often used for biogas, depending on the place of origin. Each variant has different levels of methane and carbon dioxide in it (Table 1), along with a smaller proportion of other gases.

Biogas production processes are becoming increasingly popular for the treatment of organic waste, because it provides a convenient way to convert waste into electricity and / or heat, which reduces the amount of waste and the number of pathogenic substances in the waste. Also, the use of biogas is encouraged, because in that way energy is obtained, and the amount of carbon dioxide in the atmosphere is not increased. Also, methane burns leaner than coal. The processing of biodegradable substances takes place in an anaerobic digester, which must be strong enough to withstand the increased pressure, as well as to provide anaerobic conditions for bacteria in the interior. Digesters are usually built near the source of organic input, usually several next to each other, in order to ensure constant biogas production.

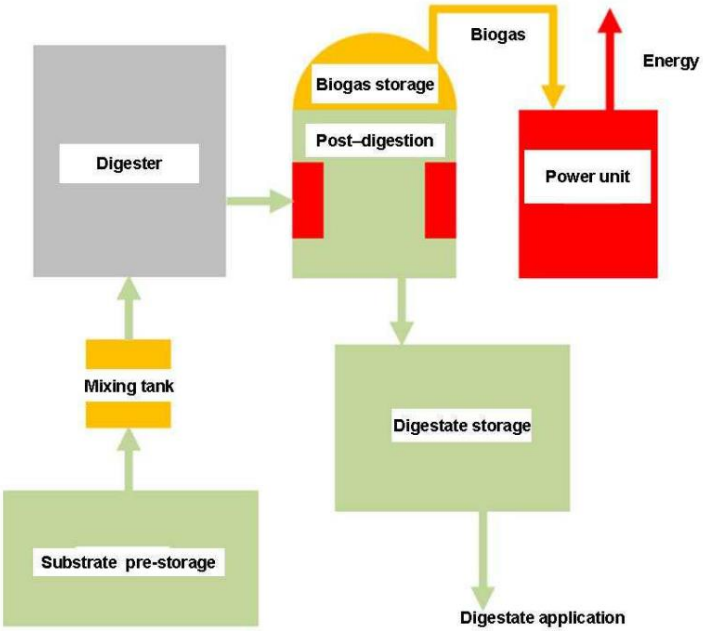


Figure 1. Main components and general process flow of biogas production, BIOGAS Handbook [7] pages 61

In recent times, the use of biogas obtained from landfills and wastewater is increasing. Even when not used to generate heat and / or electricity, landfill gas must be properly disposed of and purified, as it contains hazardous flammable substances, many of which produce smog. Biogas digesters use biodegradable substances, from which two useful products are obtained: biogas and fermented biofertilizer of the highest quality. Biogas purified to purity levels for the pipeline is called renewable natural gas and can be used in any application in which natural gas is normally used. This includes the distribution of such gas through pipelines, electricity production, heating, water heating and use in various technological processes. Compressed, biogas can also be used as a fuel for vehicles. Biogas is a mixture of methane and carbon dioxide, which is obtained during the decomposition of organic matter under anaerobic conditions. It is a quality fuel that can replace fossil fuels, and it is also CO2 neutral. At a time when fossil fuel reserves are declining, energy costs are rising and the environment is threatened by improper waste disposal, finding solutions to biowaste and treating organic waste, becomes a matter of the utmost importance. Biogas is a metabolic product of methane-producing bacteria, which cause decay. In addition to the absence of oxygen, the necessary conditions are a constant temperature and a pH value of 6.5 to 7.5.

Table 1. Amount of biogas emitted per ton of waste

PRODUCTS / BY – PRODUCTS	*m3* BIOGAS */t*
Corn	200
Orphan	145
Sunflower	175
Triticale	160
Barley	140
Ljulj	130
Grass	120
Beef manure	80
Beef liquid fertilizer	30
Pork liquid fertilizer	20
Sheep manure	60
Rabbit manure	40
Chicken manure	60

Corn cobs	295
Cereal straw	220
Citrus pulp	120
Olive pomace	85
Tomato shells	130
Onion	100
Sugar beet pulp	130
Potato	130
Fruit and vegetable waste	100
Wastes from beer production	100
Solid municipal waste	80/110
Bakery Products	650
Expired sweets	670
Used cooking oil	550
Classic waste	100
Whey	25

Source: STUDY - LOGISTICS INFORMATION SUPPORT FOR COGENERATION PLANTS OF THE REPUBLIC OF SERBIA [5], 2012, 41-42 pages

Decomposition is most effective at 15 ° C (psychrophilic bacteria), 35 ° C (mesophilic) and 55 ° C (thermophilic). In practice, a retention of about 10 days has been shown to be most effective for thermophilic bacteria, 25 to 30 for mesophilic and 90 to 120 for psychrophilic. Most of the plants that operate today operate in the mesophilic temperature range. Because biogas is produced where organic material is degraded without air, there is a wide range of organic matter that is suitable for anaerobic digestion.

Some of these substances are: liquid and solid manure, specially collected biological waste from residential areas, renewable materials, such as corn silage, non-food seeds, etc., sewage sludge and grease, used lubricants, grass (eg uncultivated land in the EU), biological waste from> slaughterhouses, brewery, distillery, fruit processing and wine production, dairy, pulp industry, sugar factory.

The key parameter is the volume of biogas in Nm^3/ t (normal cubic meter of gas at 0° C and pressure 1004 mmHg) per ton of liquid material: biological waste: 100 - 200, food waste, 120 – 150, collector grease 80 – 150, used oil, grease 1000, distillery 20, whey 25, slaughterhouse waste 100, liquid waste, dung 20 – 70.

Note: wood is not suitable for biogas production, because bacteria that produce methane cannot digest lignin, which is present in wood. Pesticides, disinfection and antibiotics also have a negative effect on bacteria.

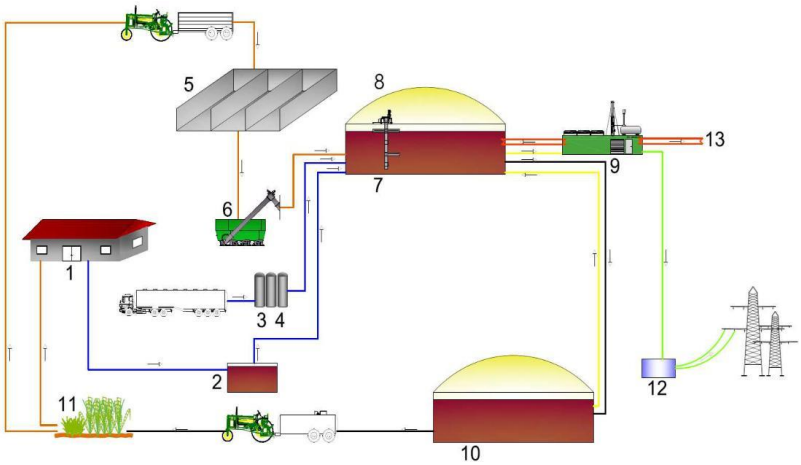
2.1.Biogas obtaining

There are two basic types of digestion (fermentation):

- aerobic digestion, ie fermentation in the presence of oxygen in which case carbon dioxide, ammonia and other gases are produced in small quantities, a large amount of heat and the final product that can be used as fertilizer,
- anaerobic digestion (without the presence of oxygen, putrefaction, decomposition), producing methane, carbon dioxide, some hydrogen and other trace gases, very little heat and a final product with more nitrogen than is produced during aerobic fermentation, which can be used as fertilizer. Such fertilizer contains nitrogen in mineralized form (ammonia), which plants can absorb faster than organic nitrogen, which makes it especially suitable for improving arable land. This process also takes place in nature, in

ponds, in wetlands, in the digestive tract of ruminants or in a controlled manner, in devices for fermentation of biogas production plants.

The configuration of the biogas plant mostly depends on the type and characteristics of the substrates used, although numerous variants of equipment combination are possible for a given combination of substrates. Substrates can be divided into liquid and solid. After temporary storage in tanks, liquid substrates are subjected to the pasteurization process and sent to a digester. Solid substrates are stored in the so-called trench silos, and after previous manipulation and preparation are transported to the digester. In the anaerobic digester or fermenter, all the necessary biological and chemical processes take place, which results in the last phase of digestion, the so-called methanogenesis, ie the separation of biogas. In order for anaerobic bacteria, which are in charge of biogas production, to have as ideal conditions as possible, it is necessary to ensure continuous mixing and maintaining a constant temperature inside the digester in addition to adequate and regular nutrition with biological waste. The average retention time of the substrate in the digester is 30-60 days, after which the liquid substrate is transported to a special open lagoon for storage of the *fermented substrate. Before discharging into the lagoon, the substrate passes through a separator,* which separates the solid and liquid fractions (Figure 2).



Legenda: 1 Stalls, 2 Liquid manure tanks, 3 Collection bins for biowaste, 4 Sanitation tank, 5 Drive-in storage tanks, 6 Solid feedstock feed-in system, 7 Digester (Biogas reactor), 8 Biogas storage tank, 9 CHP plant, 10 Digestate storage, 11 Agricultural fields 12 Greed, 13 Heat utilisation

Figure 2. Agricultural co-digestion biogas plant using manure and maize silage BIOGAS: Handbook [7]) pages 62

The biogas obtained in this way is not suitable for direct use, but a treatment that removes sulfur, water and other harmful impurities is necessary. After treatment, the biogas is ready for use in a boiler or cogeneration plant. In the case of excessive biogas production, biogas is burned on a flare, which is an absolutely harmless process when it comes to atmospheric pollution. Important assumptions for the fermentation process are: lack of air, humidity> 50%, heat supply, lack of light.

A digester is a device for biogas production. Because it undergoes various chemical and microbiological reactions, it is also known as a fermenter, bioreactor or anaerobic reactor. It must be impermeable to air and water. The process of anaerobic fermentation itself takes place in three phases, according to literature [3]:

- Hydrolysis - in this phase there is a decomposition of large molecules into smaller ones and the beginning of the development of acid bacteria,
- Acid phase - in this phase, molecules of proteins, fats and carbohydrates break down - into organic acids, carbon dioxide, hydrogen, ammonia, alcohols, etc. The breakdown of molecules is caused by acid bacteria,

- Methane phase - in this phase, further decomposition of organic matter and intensive production of methane and carbon dioxide (and to a lesser extent other gases) continues.

2.2.Division of biogas by place of origin

Conditional division of biogas by place of origin: Landfill gas, Biogas from agriculture, Biogas from wood waste, Biogas from wastewater.

2.3. Energy balance calculation

The starting value for this calculation is the fact that per ton of municipal waste, an average of 200 Nm^3 of landfill gas is generated in a period of 20 years. For an annual amount of 50,000 tons (a city of 150,000 inhabitants) and a landfill filling time of 20 years, 200 million cubic meters of landfill gas would be generated at the landfill. If the gas collection system and quality control would make about 50% of the stated amount of gas available to gas engines, it would mean that for the calculation of the energy balance can be calculated with about 100 million Nm^3 of landfill gas, ie. average annual 5 million Nm^3, ie. 625 Nm^3 / h. This amount of gas with Hu = 5 kWh / Nm^3 through GE Jenbacher gas engines enables an annual production of 9 million kWh of electricity and 12 million kWh of heat. The amount of electricity produced covers the needs of 2,500 family houses. With this production of electricity, about 18,000 tons of lignite are saved in one lignite power plant. In this way, 300 Nm3 / h of methane contained in the landfill gas (ie 300 x 0.718 = 215kg / h) is not released into the atmosphere, which is an important environmental aspect of the use of gas engines in the preservation of the ozone layer (one ton of methane has a negative effect on ozone). envelope and climate as 21 tons of carbon dioxide). On the basis of such an electric and heat balance and the necessary investments, an economic calculation can be performed which shows that the investments are quickly compensated, so that the further operation of the plant makes a profit.

Biogas, which is a very interesting source of energy, is produced on wastewater treatment plants with anaerobic stabilization of sludge. The efficiency of biogas production is ensured by maintaining the temperature (around 35°C), maintaining the pH value, mixing and removing oxygen and toxic substances. In anaerobic reactors (digesters) biogas is produced as a mixture of combustible and non-combustible gases of average composition (in volume%): methane 55-75%, carbon dioxide 25-45%, and other gases such as hydrogen, oxygen, carbon monoxide, nitrogen, hydrogen sulfide, ammonia and water vapor.

Biogas production can be estimated on the basis of the following practical and experiential data: in industrial wastewater (sugar mills, molasses processing, potato processing, fruit juice production, dairies, breweries, paper and pulp) the average methane production is 0.20 - 0.40 m^3 /kg PRC with a methane content in biogas of 60 - 80%; on livestock farms, the expected production of biogas varies depending on the animal species and farming method and ranges from 20 to 40 m^3 of biogas / m^3.

3. ENERGY POTENTIAL OF LANDFILL GAS

Landfill gas (LFG) is a product of anaerobic decomposition of biodegradable components of municipal waste residues at the landfill and contains on average about 50-55% methane (CH_4) and 45-50% carbon dioxide (CO_2). The energy value of landfill gas is in the range of 16-30 MJ / m3. Apart from the energy potential, landfill gas is also important from the point of view of environmental protection. Methane belongs to the group of greenhouse gases (GHG) and has 21 times higher global warming potential than carbon dioxide. It is estimated that about 18 percent of methane emissions into the atmosphere come from landfills.

Methane emissions generated in the process of biodegradation of waste in landfills have the characteristic of a large time delay. Namely, the decomposition of waste has a slow dynamics and the generation of methane from only one kilogram of biodegradable municipal solid waste is a process that can take up to 30 years. Landfill gas is the product of a bioreaction that takes place in the body of the landfill almost immediately after disposal. Relative biogas yields, depending on temperature and retention time is shown in the figure 3.

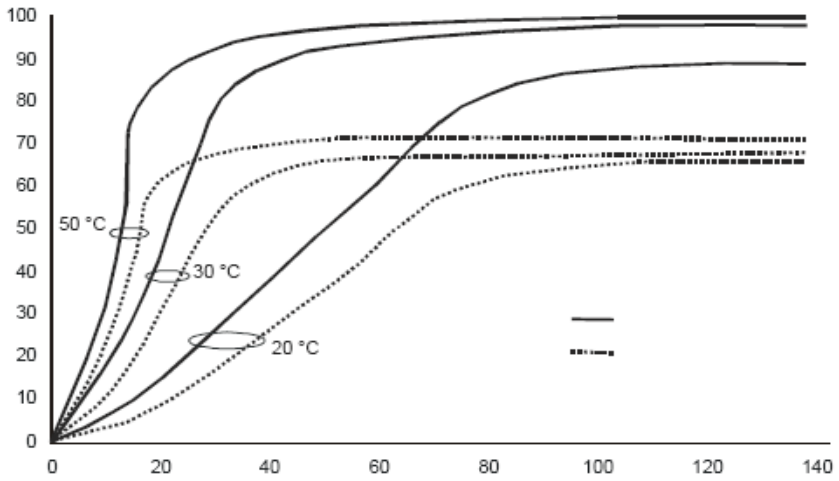


Figure 3. Relative biogas yields, depending on temperature and retention time, [7]) pages 25

In the first phase, which begins immediately after waste disposal, aerobic decomposition of waste into carbon dioxide and water occurs, with the release of heat. At this stage, the oxygen present in the waste is consumed. The next phase is the non-methanogenic, anaerobic phase in which acidic compounds, hydrogen and carbon dioxide are formed. The third phase is the nonequilibrium methanogenic phase, in which there is a decrease in carbon dioxide production due to the shift of the decomposition reaction of waste from aerobic to anaerobic conditions. The fourth phase is the equilibrium methanogenic phase and during it 40-70% of the total amount of methane is formed. In typical conditions, this phase is established after the second year of waste disposal. Landfill gas can be generated within a landfill for several decades, and in some cases up to one hundred years from the time the waste is disposed of at the landfill.

The formation of landfill gas is influenced by various factors, and they are: waste composition, waste density, temperature, humidity, pH, harmful elements, age of the landfill and its cover.

Landfill gas is lighter than air and naturally leaves the landfill into the atmosphere. The movement of landfill gas can be inhibited by dense compaction of waste or regular covering of the landfill surface (daily cover). The gas then tends to migrate horizontally to other areas within the landfill or to areas outside the landfill, where it can continue its upward trajectory. The movement of landfill gas is influenced by several factors: permeability, geological conditions, groundwater level, landfill cover and impermeable layers, barometric pressure. By covering the waste with a material that has low permeability (permeability), the generated gas is retained inside the body of the landfill and is distributed in horizontal directions.

The deposition of landfilled waste takes place constantly and the landfill will settle during its life cycle of 25 - 50% depending on several factors. About 15% of landfill subsidence takes place due to the decomposition of organic molecules in the process of landfill gas formation.

Figure 4. shows an example of a complex landfill gas recovery system consisting of the following subunits: collection and incineration system, purification system and recovery system.

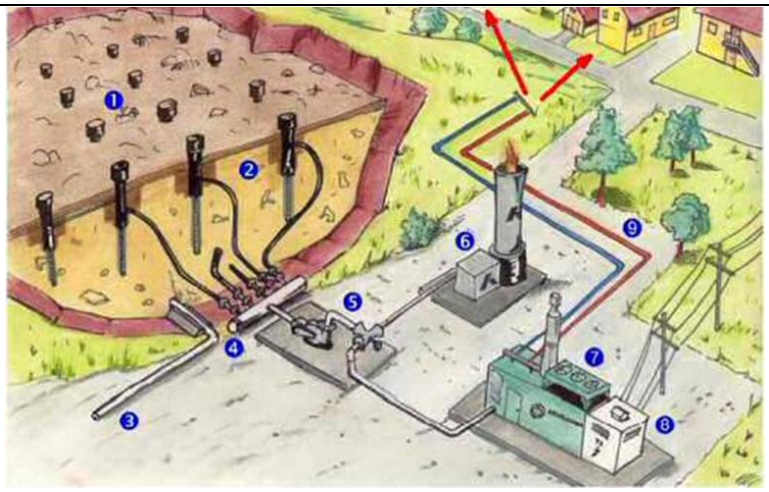


Figure 4. Landfill gas treatment system Source: Srećko Ćurčić, Sandra Milunović: STUDY - LOGISTICS INFORMATION SUPPORT FOR COGENERATION PLANTS OF THE REPUBLIC OF SERBIA - Faculty of Technical Sciences in Čačak [5], 2012, 48 pages

Legend: 1 Landfill, 2 Gas probes (thorns), 3 Leachate collection pipe, 4 Gas collectors, 5 Gas suction compressor, 6 High temperature torch, 7 Cogeneration engine, 8 Transformer station, 9 Heat pipe.

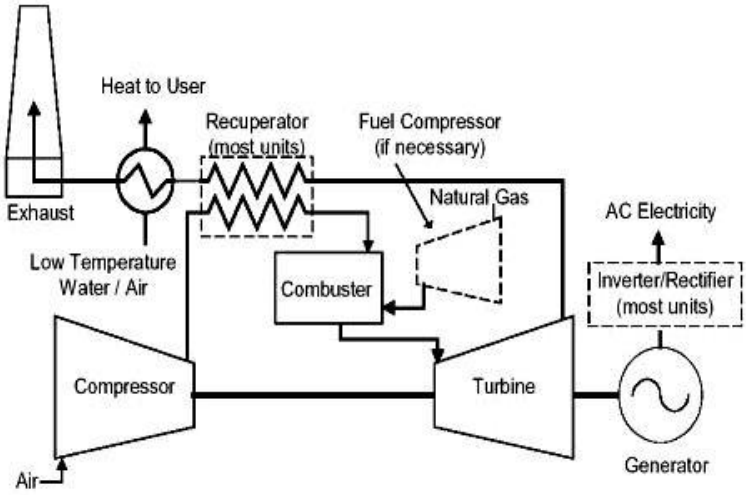


Figure 5. Micro-turbine structure, BIOGAS: Handbook [7], pages 45

3.1.Collection and incineration

Collection of landfill gas and its incineration is a legal obligation of every landfill in Serbia. Collection usually begins after the landfill or individual cassette is closed, if any. Collection systems are usually made as a network of vertical or horizontal pipes. Landfill gas combustion usually takes place on a torch. This system can be used alone for the purpose of oxidation of methane by carbon dioxide or it can be used as an auxiliary system on which landfill gas is burned which cannot be used in landfill gas recovery systems (unsatisfactory quality, insufficient flow, landfill gas flow exceeds plant capacity for exploitation and the like).

3.1.1. Landfill gas collection systems

The landfill gas collection system may consist of a network of vertical and horizontal gas wells (biothorns) that have the role of directing diffuse landfill gas emissions into directed flow. The Landfill gas recovery system is given in Figure 6.

The most common method of active gas collection is gas extraction through vertical perforated pipes, which is the simplest method where a landfill has already been established. The biothorn is usually drilled with a probe with a diameter of 50-100 cm into the depth of the landfill body at the projected place. After drilling, the holes are covered with an annular perforated concrete lining, in the center of which a perforated polyethylene or PVC pipe with a diameter of 10-30 cm is placed. The space between the concrete ring and the pipe is filled with gravel. Vertical wells are usually placed at a distance of 40-80 meters from each other. Depending on the depth of the landfill, they fall from 50-90% of the height of the body of the landfill, and up to a depth of 30 meters. It is recommended that the biothorn has a concrete base, but in practice this is only possible with new landfills. On average, closed landfills have gas collection systems that tend to accept about 84% of the gas produced, compared to about 67% for open landfills.

Figure 10

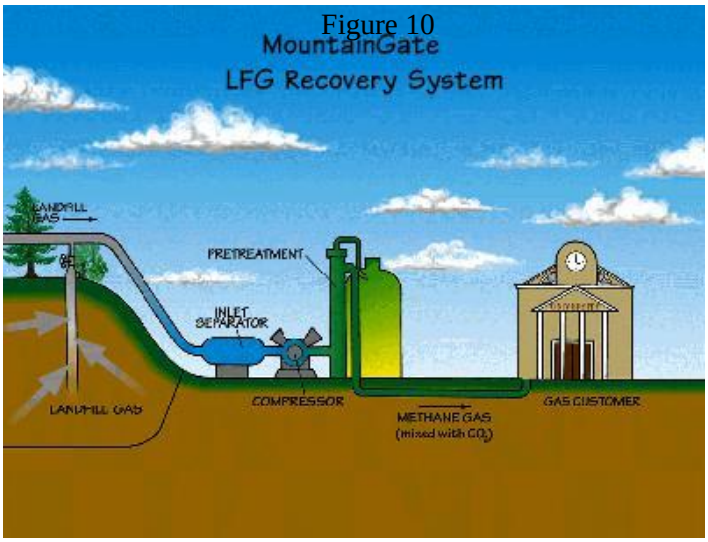


Figure 6. Landfill gas recovery system, BIOGAS: Handbook [7] pages 40

4. CONCLUDING REMARKS

The growth of the world's population, industrialization instead of marked enter the following: technological progress and and the increasing volume of transport, have caused the need for energy to be under increasing pressure nowadays. The world energy market can no longer be blindly based on fossil-derived fuels whose reserves are limited. The scarcity of conventional fossil energy reserves has created great interest in the use of alternative energy sources, one of which is biomass. Agriculture is a branch that generates the possibility for meaningful and efficient use of biomass. Compared to the use of other renewable energy sources, the use of biomass is increasing day by day.

Energy can be produced using different technical and technological solutions, where there are significant differences in capital investment and production costs depending on the type and power of the plant. Because based on the results of comparative analysis of biomass plants and biogas plants concluded that it is justified to invest in these facilities , where the variation in annual profit is mostly caused by changes in operating costs, ie raw material costs, given their largest share. As the nominal power of the power plant increases, the costs decrease per unit of energy obtained.

Given the fact that climate change is closely linked to patterns of energy use and can be affected by the reduced use of fossil fuels used on a daily basis, with a shift to renewables discussed in previous chapters, especially biomass energy as a source that is completely CO2 neutral, is the wide application of possible solutions for its conversion and use on the territory of the entire Republic of Serbia.

Also, in the field of business of agricultural farms, mini plants can be built on renewable energy sources for use in their own production process, ie for power supply of barns, halls and processing plants, as well as thermal energy for their heating.

In the field of biofuel production from biomass, there is also the possibility of wider application: obtaining biogas, bioethanol or biodiesel, as a supplement or replacement of increasingly missing fossil fuels. The process of obtaining biogas, in addition to energy production, also contributes to the substitution of nutrients necessary for the nutrition of plants from artificial fertilizers, as well as to the reduction of environmental pollution. European countries such as Germany, France, Denmark, the Netherlands or distant China, which have a major problem of animal waste, solve this, and environmental problem, through fermentation processes. In the United States, gasoline is increasingly a mixture of gasoline and biofuel-ethanol.

Reduction of imported energy dependence, along with the development of rural areas and the possibility of new employment of the local population, is also one of the expected benefits of this economic activity. Increasing economic activity has a direct positive impact on the country's budget, GDP growth and better positioning of the Serbian economy on world lists.

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TRAINING REGYSTRY – APPLICATION FOR MONITORING TRAINING REQUIREMENTS AND TRAINING PROCESS

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Zoran Punosevac, PhD[3]

Abstract: *Employee training is a form of investing not only in employees, but also in the company. The importance of trainings is multiple, so special attention is paid to their planning and implementation. The problem arises due to the impossibility of monitoring training requests and their connection with the HR departmant. On the basis of requests, HR department organizes trainings with internal and external coaches, monitors the training process and results of trainings. To resolve problems in training process, we have implemented the Training regystry application in the company, in order to have a better insight in monitoring of training requests, implementation of trainings and their evaluation.*

Keywords: *Employee Trainig, Application, Data base, LEAN*

JEL Classification*: I210*

1. INTRODUCTION

Because of the rapid development of technologies in the world economy and the growing importance of knowledge, the need for additional education of employees is growing. Employee training is a form of investing not only in employees, but also in the company[4]. The importance of trainings is multiple, so special attention is paid to their planning and implementation. Many companies have adopted the concept of knowledge management as a way to provide better customer service, to innovate products and services, to attract new employees opening space for learning and developmen[5].

In order to achieve required results, but avoid negative consequences, and in order to solve problems in the training process, we have implemented the Training Register application in the

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company. The Training Register monitors training requests, implementation of trainings and their evaluation. Based on requirements, HR department organizes trainings with internal and external coaches, monitors the training process and results of trainings[6].

Management is increasingly realizing that continuous education and training of employees is one of the most effective ways to achieve a competitive advantage, basis for entry into the market competition. Education of employees means changes in specific knowledge, abilities, skills, attitudes and/or behavior of employees in order to prepare them for better performance of their work. The market economy is based on knowledge because knowledge enables it to survive on the national and international market, and new ways of production require not only a higher level of education but also different ways of thinking[7]. The knowledge-based economy depends on creativity, initiative, research, the ability to communicate, critical thinking, the ability to make quick decisions, respect for ethics and ethical values. The rapid development of technology requires constant education of employees. New sectors are being created in the economy that are looking for new educational profiles, and human knowledge has become capital and without it cannot be possible to continue. Due to the globalization of the world economy and the growing importance of knowledge, the need for additional education of employees is growing. As the business environment is turbulent and uncertain, these are important people and their potential[8].

Education is not only the privilege of people in high positions in the organization, but it becomes the obligation of everyone. Great organizations invest in the continuing education of workers. In parallel, society should act in the direction of connecting education and the economy, and to provide education for a lot of people in socially and economically relevant skills and competencies[6].

2. CONTENT OF APPLICATION

Application has four modules:

- Training request
- Training plan
- Reports
- Archive

2.1. Training request

After analizing gaps in Radar Chart for each employee, manager is creating plan for education to eliminate gaps in the skills.

Following plan for training, manager creates request in application (picture 1.). In the Name and Surname field, he selects the employee for which he needs training. Then manager selects the Department to which the employee belongs. After that, he chooses the training code. In regard to traning code, list of the training topics is updated (on the list are only topics which are conected with exactly this training code). Human resouces is responsible to insert a new training codes and new topics in data base. Next, for the required term, with double-click on the field next to field „Required term“ calendar, modul is opened. After this action manager enters his name as the training requester. Also, he has to choose the name of the coach for internal training or name of the institution for the external training. On the end, requester inserts the forecasted number of scheduled hours for both internal and external training (for external training, insert the price from the offer) to folow cost of education process.

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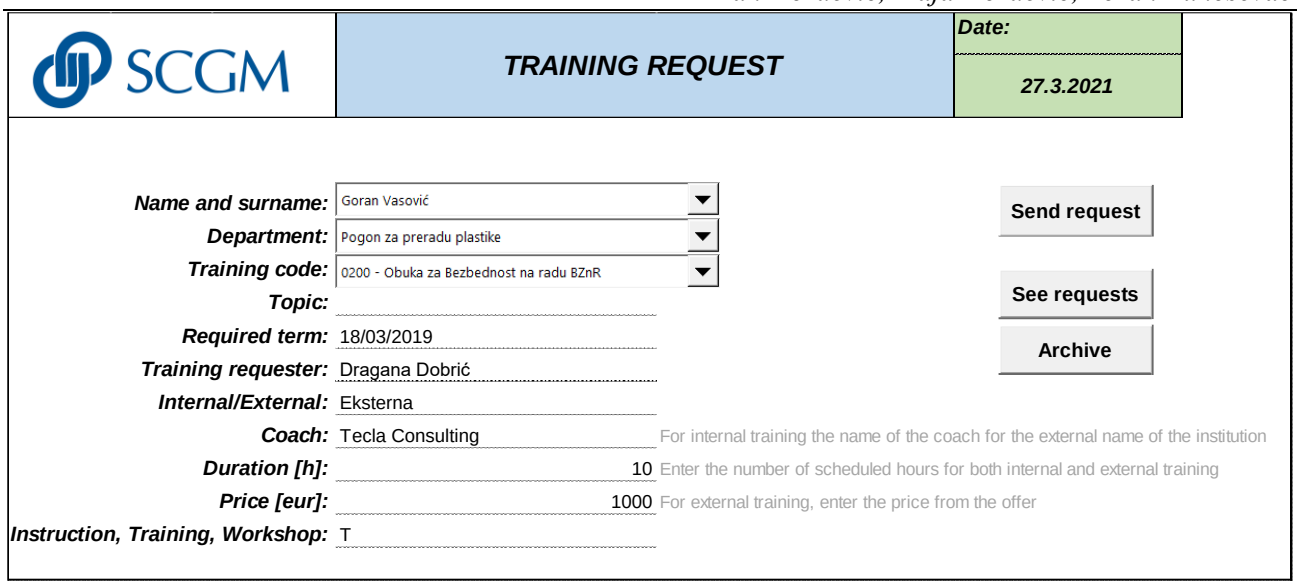


Picture 1. Training request window

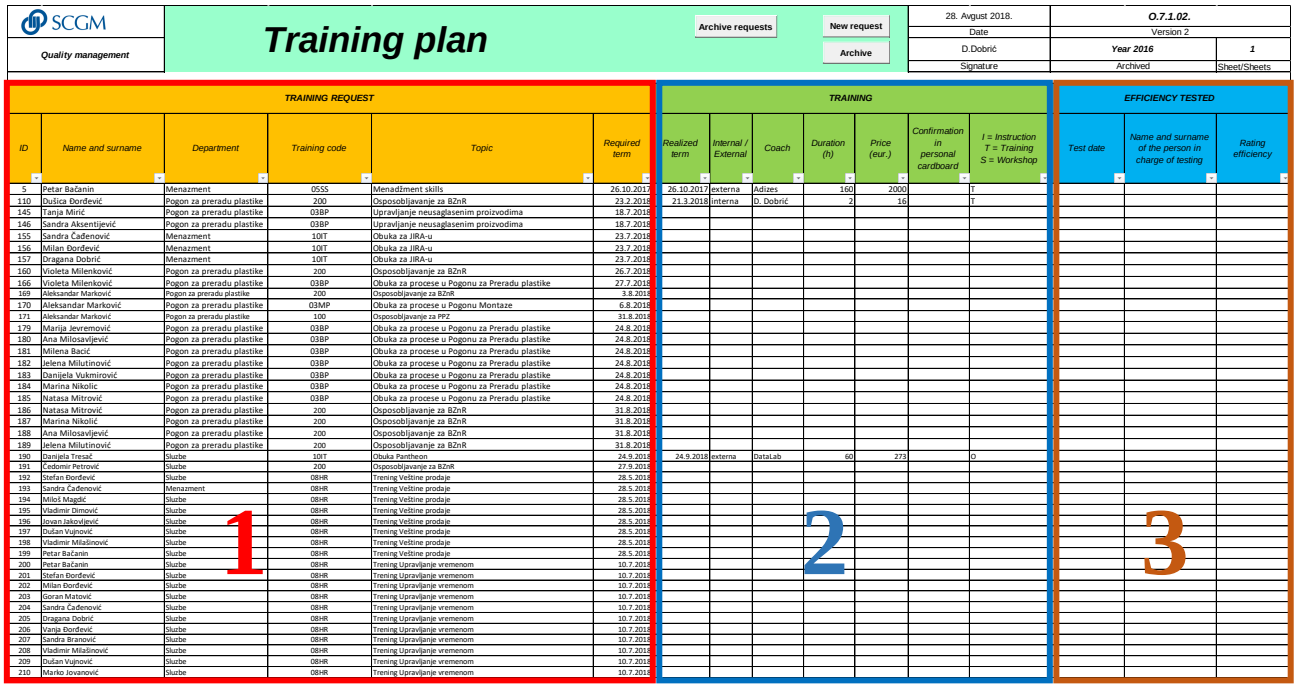
When manager is finished with input data in request form, he has to press „Send request“ button and application will send automaticaly e-mail to Human resources departmant and insert new line in the data base of requsted trainings (Module „Training Plan“).

2.2. Training plan

Module „Training plan“ has three parts (picture 2):

- Data from training request module
- Data about realized training
- Efficiency tested

In „Data about realized training“ HR department insert data: realized term, training internal or external, name of coach, training duration and price, confirmation in personal Cardboard, and type of training (instruction, training, workshop). These group of data we will use in the future to create reports of training and to analize the cost of trainings in Module reports (picture 2.).



ID	Name and surname	Department	Training code	Topic	Required term	Realized term	Internal / External	Coach	Duration (h)	Price (eur.)	Confirmation in personal cardboard	I = Instruction T = Training S = Workshop	Test date	Name and surname of the person in charge of testing	Rating efficiency
5	Petar Bačanin	Menazment	05SS	Menadžment skills	26.10.2017	26.10.2017	externa	Adizes	160	2000		T			
110	Dušica Đorđević	Pogon za preradu plastike	200	Osposobljavanje za BZnR	23.2.2018	21.3.2018	interna	D. Dobrić	2	16		T			
145	Tanja Mirić	Pogon za preradu plastike	03BP	Upravljanje neusaglasenim proizvodima	18.7.2018										
146	Sandra Aksentijević	Pogon za preradu plastike	03BP	Upravljanje neusaglasenim proizvodima	18.7.2018										
155	Sandra Čađenović	Menazment	10IT	Obuka za JIRA-u	23.7.2018										
156	Milan Đorđević	Menazment	10IT	Obuka za JIRA-u	23.7.2018										
157	Dragana Dobrić	Menazment	10IT	Obuka za JIRA-u	23.7.2018										
160	Violeta Milenković	Pogon za preradu plastike	200	Osposobljavanje za BZnR	26.7.2018										
166	Violeta Milenković	Pogon za preradu plastike	03BP	Obuka za procese u Pogonu za Preradu plastike	27.7.2018										
169	Aleksandar Marković	Pogon za preradu plastike	200	Osposobljavanje za BZnR	3.8.2018										
170	Aleksandar Marković	Pogon za preradu plastike	03MP	Obuka za procese u Pogonu Montaze	6.8.2018										
171	Aleksandar Marković	Pogon za preradu plastike	100	Osposobljavanje za PPZ	31.8.2018										
179	Marija Jevremović	Pogon za preradu plastike	03BP	Obuka za procese u Pogonu za Preradu plastike	24.8.2018										
180	Ana Milosavljević	Pogon za preradu plastike	03BP	Obuka za procese u Pogonu za Preradu plastike	24.8.2018										
181	Milena Bacić	Pogon za preradu plastike	03BP	Obuka za procese u Pogonu za Preradu plastike	24.8.2018										
182	Jelena Milutinović	Pogon za preradu plastike	03BP	Obuka za procese u Pogonu za Preradu plastike	24.8.2018										
183	Danijela Vukmirović	Pogon za preradu plastike	03BP	Obuka za procese u Pogonu za Preradu plastike	24.8.2018										
184	Marina Nikolic	Pogon za preradu plastike	03BP	Obuka za procese u Pogonu za Preradu plastike	24.8.2018										
185	Natasa Mitrović	Pogon za preradu plastike	03BP	Obuka za procese u Pogonu za Preradu plastike	24.8.2018										
186	Natasa Mitrović	Pogon za preradu plastike	200	Osposobljavanje za BZnR	31.8.2018										
187	Marina Nikolić	Pogon za preradu plastike	200	Osposobljavanje za BZnR	31.8.2018										
188	Ana Milosavljević	Pogon za preradu plastike	200	Osposobljavanje za BZnR	31.8.2018										
189	Jelena Milutinović	Pogon za preradu plastike	200	Osposobljavanje za BZnR	31.8.2018										
190	Danijela Tresać	Sluzbe	10IT	Obuka Pantheon	24.9.2018	24.9.2018	externa	DataLab	60	273		O			
191	Đedomir Petrović	Sluzbe	200	Osposobljavanje za BZnR	27.9.2018										
192	Stefan Đorđević	Sluzbe	08HR	Trening Veštine prodaje	28.5.2018										
193	Sandra Čađenović	Menazment	08HR	Trening Veštine prodaje	28.5.2018										
194	Miloš Magdić	Sluzbe	08HR	Trening Veštine prodaje	28.5.2018										
195	Vladimir Dimović	Sluzbe	08HR	Trening Veštine prodaje	28.5.2018										
196	Jovan Jakovljević	Sluzbe	08HR	Trening Veštine prodaje	28.5.2018										
197	Dušan Vujnović	Sluzbe	08HR	Trening Veštine prodaje	28.5.2018										
198	Vladimir Mlašinović	Sluzbe	08HR	Trening Veštine prodaje	28.5.2018										
199	Petar Bačanin	Sluzbe	08HR	Trening Veštine prodaje	28.5.2018										
200	Petar Bačanin	Sluzbe	08HR	Trening Upravljanje vremenom	10.7.2018										
201	Stefan Đorđević	Sluzbe	08HR	Trening Upravljanje vremenom	10.7.2018										
202	Milan Đorđević	Sluzbe	08HR	Trening Upravljanje vremenom	10.7.2018										
203	Goran Matović	Sluzbe	08HR	Trening Upravljanje vremenom	10.7.2018										
204	Sandra Čađenović	Sluzbe	08HR	Trening Upravljanje vremenom	10.7.2018										
205	Dragana Dobrić	Sluzbe	08HR	Trening Upravljanje vremenom	10.7.2018										
206	Vanja Đorđević	Sluzbe	08HR	Trening Upravljanje vremenom	10.7.2018										
207	Sandra Branović	Sluzbe	08HR	Trening Upravljanje vremenom	10.7.2018										
208	Vladimir Mlašinović	Sluzbe	08HR	Trening Upravljanje vremenom	10.7.2018										
209	Dušan Vujnović	Sluzbe	08HR	Trening Upravljanje vremenom	10.7.2018										
210	Marko Jovanović	Sluzbe	08HR	Trening Upravljanje vremenom	10.7.2018										

Picture 2. Training plan window

In third part of training plan modul we insert data: date when we tested person after training, name of the person in charge of testing, and rating efficiency.

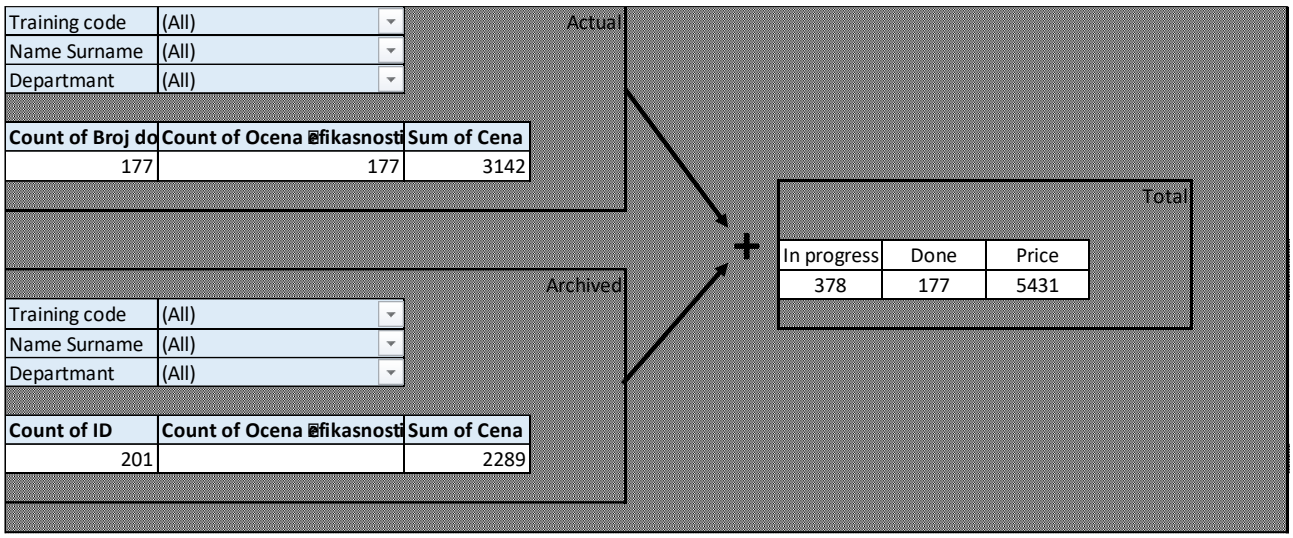
Idea is also to devide trainings which are in progres and training which are done. If we will not do that, after few months we will have several hundred requsted trainings and will have problem to manage with him. This is reason why we predicted one button „Archive requests“. When we press this button, every row which has data in columns „Efficiency tested“ (means that training is done), will be archived and copy from modul „Training plan“ to module „Archive“. On this way we have in „Traning plan“ only active requests and in „Archive“ realized requests.

2.3. REPORTS

Last modul „Reports“ genarate several reports as:

- analysis by training code
- analysis by employee
- analysis by Depertmant

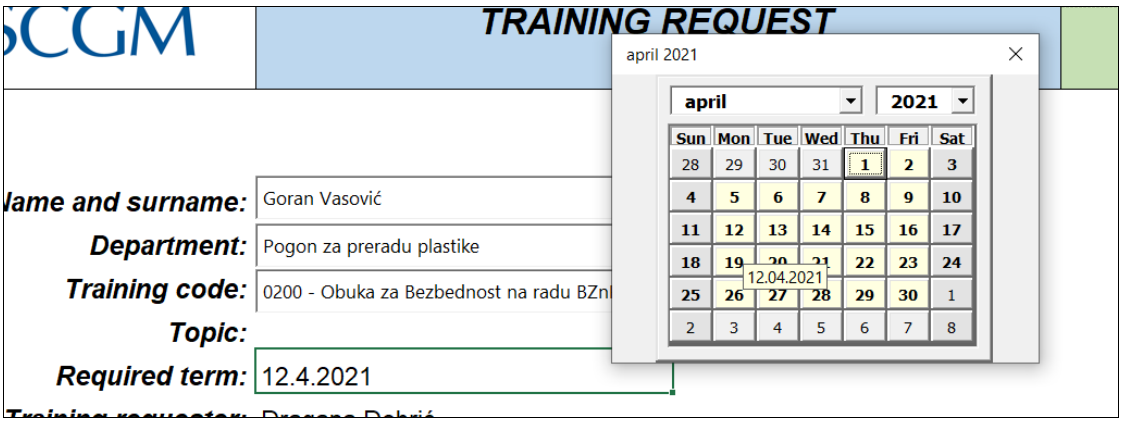
For example, very quickly we can take information how many training is in progress for one department, how many trainings is done for this department and how much costs training process (picture 3.).



Picture 3. Window with reports

3. APPLICATION CODING

Application is coded in Visual Basic through four modules and one form. We are using form for input date (picture 4) and part of code is presented on picture 5.



Picture 4. Calendar Form

With calendar form everyone will insert date in the system in the same format. This is important for creating reports, sending emails etc.

```
Private Sub UserForm_Initialize()
    Application.EnableEvents = False
     'starts the form on todays date
    ThisDay = Date

    ThisMth = Format(ThisDay, "mm")
    ThisYear = Format(ThisDay, "yyyy")
    For i = 1 To 12
        CB_Mth.AddItem Format(DateSerial(Year(Date), Month(Date) + i, 0), "mmmm")
    Next
    CB_Mth.ListIndex = Format(Date, "mm") - Format(Date, "mm")
    For i = -20 To 50
        If i = 1 Then CB_Yr.AddItem Format((ThisDay), "yyyy") Else CB_Yr.AddItem _
        Format((DateAdd("yyyy", (i - 1), ThisDay)), "yyyy")
    Next
    CB_Yr.ListIndex = 21
     'Builds the calendar with todays date
    CreateCal = True
    Call Build_Calendar
    Application.EnableEvents = True
End Sub
```

Picture 6. VB code for Calendar form initialization

One of four modules is created for sending emails through Outlook e-mail services (Picture 7).

```
Sub zahtev_za_obuku()
    Dim iMsg As Object
    Dim iConf As Object
    Dim strbody As String
        Dim Flds As Variant

    Set iMsg = CreateObject("CDO.Message")
    Set iConf = CreateObject("CDO.Configuration")

        iConf.Load -1    ' CDO Source Defaults
        Set Flds = iConf.Fields
        With Flds
            .Item("http://schemas.microsoft.com/cdo/configuration/sendusing") = 2
            .Item("http://schemas.microsoft.com/cdo/configuration/smtpserver") _
                        = "webmail.obiettivoimpresa.it"
            .Item("http://schemas.microsoft.com/cdo/configuration/smtpserverport") = 25
            .Update
        End With

    strbody = "Postovani, " & vbNewLine & "Imate zahtev za obuku" & vbNewLine & vbNewLine & _
              "Radnik: " & Worksheets("O.7.1.01. Zahtev za obuku").Cells(7, 5).Value & vbNewLine & _
              "Odeljenje: " & Worksheets("O.7.1.01. Zahtev za obuku").Cells(8, 5).Value & vbNewLine & _
              "Sifra Obuke: " & Worksheets("O.7.1.01. Zahtev za obuku").Cells(9, 5).Value & vbNewLine & _
              "Tema: " & Worksheets("O.7.1.01. Zahtev za obuku").Cells(10, 4).Value & vbNewLine & _
              "Zeljeni termin: " & Worksheets("O.7.1.01. Zahtev za obuku").Cells(11, 4).Value & vbNewLine & _
              "Narucilac: " & Worksheets("O.7.1.01. Zahtev za obuku").Cells(12, 4).Value & vbNewLine & _
              vbNewLine & _
              "Zahtev za obuku je upisan u registar." & vbNewLine & _
              vbNewLine & _
              "Pozdrav."

    With iMsg
        Set .Configuration = iConf
        .To = "mdjordjevic@scgm.com" '"mdjordjevic@scgm.com"
        .CC = "mdjordjevic@scgm.com" '"mdjordjevic@scgm.com"
        .BCC = ""
        .From = """Upravljanje obukama"" <m.djordjevic@obiettivoimpresa.it>"
        .Subject = "ZAHTEV ZA OBUKOM"
        .TextBody = strbody
        .Send
    End With
```

Picture 7. VB code for sending emails

4. RESULTS

Main benefits which we took is managing more then 2000 trainings on transparent way. System reduce time for requesting, scheduling, and following training for 60%. Automaticaly e-mails,

which application create, eliminate human error in HR department but also in all departmants from where is coming requests.

Also, a lot of reports is present quality and cost of trainings and managment can use for making strategic decisions.

5. CONCLUSION

The system confirmed the requirements for solving the problem expressed by HR at the beginning of the project. We solved the problems and achieved many benefits by using the Training Register application. On this way we connected employee, manager and HR department via this application. Also, we can very quickly take information how many trainings are in progress for one department, how many trainings are done for this department and how much costs training process.

Further development will be through monitoring of mandatory trainings in the field of health & safety and fire protection. Application will automatically send e-mail for employees which we need mandatory renewal of training before the date expires.

Also, it is possible to make a similar application that it will automatically inform by e-mail to which workers the mandatory physical will expire in the next few days.

Therefore, this or similar application could have a wide use in the field of health & safety and fire protection (mandatory physical, physical by an ophthalmologist...), in quality control department (periodic calibration of measuring equipment), everywhere where we need monitoring mandatory or periodic processes.

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CONTEXTUALLY INTELLIGENT MANAGEMENT – AN IMPERATIVE FOR SUCCESSFUL BUSINESS

dr Milica Žarevac Bošković[1]

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***Abstract**: Uncertainty, as a dominating characteristic in business in 21st century, is a consequence of a variable, complex, and resource-limited internal and external environment. The goal of this paper is to indicate the seemingly never greater significance of contextual intelligence as the familiarity with the group of prevalent intellectual beliefs, attitudes and ideas that generate sociological, economic, political and cultural climate and ethics of a certain time and area. On a "seismic" market ground such as this one, only by understanding the essence of the "spirit" of time and new "game rules" it is possible to choose a course of action leading to organizational success, as well as to the improvement of quality of products and services. Since during the previous period the tourism-catering economic sector of the Republic of Serbia and the world has been especially exposed to market risks and instabilities, the paper will analyse the level of presence of key factors of success in national tourism agencies and catering facilities for the purpose of determining the probability of their survival and defining potential measures for overcoming future market challenges. Concerning context, consideration of positive and negative factors is also the starting requirement of the ISO 9001:2015 standard.*

***Key words**: context, management, uncertainty, success factors*

***JEL Classification:** L83*

1. INTRODUCTION

The contextual subtheory defines intelligent behaviour in terms of purposive adaptation to, shaping of, and selection of real-world environments relevant to one's life.[4] Meyo and Noria define contextual intelligence as the ability to feel one's time period and to understand its possibilities. According to these authors, the success of the greatest legends of the business world was not in having exceptional personal characteristics (willingness to take risks, clear vision, thirst for innovation, infectious charisma, etc.), but in applying those characteristics to a certain contextual set.[5] Thus, according to

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prof Punoševac, the most significant factor of a successful organization are managers with leadership qualities.[6]

Organizational external environment represents the total factors outside of a company, which may influence it. According to the broken balance theory,[7] the companies go through long, simple periods of stability (balance) and occasional changes, after which come the short, complicated periods of dynamic, crucial changes (revolution periods), which end by returning to stability (new balance). Environment scanning is important since it contributes to organizational performance and it helps managers to notice changes and problems in the environment before they cause a crisis for the organization.[8]

A problem may appear if there is a need to adapt a consistent or strong organizational culture, after determining and interpreting external changes. Organizational culture comprises the attitudes, experiences, beliefs, and values of the organization, acquired through social learning, that control the way individuals and groups in the organization interact with one another and with parties outside it.[9] According to Lui and Johnston there are organizations with:[10] group cultures - employee-centric, providing a friendly and warm family-like environments; rational cultures - results-oriented, encouraging a competitive and effective atmosphere to aim at gaining market share; developmental cultures - focusing on innovation and entrepreneurship, encouraging constant changes and risk-taking behaviour throughout the company and hierarchical cultures - rules-oriented, promoting standardized timely procedural outputs guided by internal procedures and policies.

Aithal thoroughly explains organizational vision as:[11] statement that contains the broad view and the most important goal of the institution by keeping the aim of the organization in mind, an institution's clear depiction of what it aims to develop into, the answer of institution's strategic position in the prospect and a provider of an idea about the future evolution of the company. Styhre and Sundgren define organizational creativity as variety of activities in which new ideas and new ways of solving problems emerge through a collaborative effort by promoting dialogues that involve multiple domains of scientific knowledge to produce value for the organization's mission and market.[12]

2. METHODOLOGY

The research was conducted in December 2020, with all respondents being, at the time of research, employed in ten companies in the Republic of Serbia, five of which were tourism agencies and five catering facilities, with randomly assigned numbers from 1 – 10. In relation to the level of conclusion generalization, it was an operational research since a relatively small sample of 10 respondents was used (one respondent – manager per company). In addition, for obtaining additional information, a parallel examination of 20 employees of these companies was conducted (two respondents – employees per company). An empirical-experimental method was used since the research implied acquiring data in the field, while a closed-ended survey was used as the research technique. The survey was also completely anonymous, which contributed to sincerity and objectiveness of respondents while providing answers.

[6] Punoševac, Z., (2013), Leader and business excellence, Trendovi u poslovanju, 1(2), 17-22.
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Considering the significance of contextual intelligence in the business world, and analysing external environment, it can be unequivocally concluded that uncertainty is a dominating characteristic of a contemporary business environment. In this sense, the authors formulate four survey questions, related to four logical key factors of a company's success, as follows: the ability to understand changes in the environment, to create adaptable organizational culture, to define clear visions and to encourage the employees' creativity. The goal of the survey was to determine the probability level of survival of the examined companies by examining the degree of presence of success factors. The respondents – managers were required to choose a mark from 1 – 3, with the marks 1, 2 and 3 signifying absolute absence (very low), moderate, and absolute (very high) presence of the examined factors, respectively. Additionally, in the same manner, the respondents – employees were required to evaluate the presence of creativity encouragement for employees, with the purpose of obtaining more precise results, since interactive relationship between managers and employees is especially dominant for this factor.

3. RESULTS AND DISCUSSION

The authors of this paper rank a company's level of survival probability according to the number of points gained for the presence of the examined factors, as follows: from 1 – 4, from 5 – 8, and from 9 – 12, being a low, moderate and high survival probability for the companies, respectively. Research results are provided as absolute values in tables 1 and 3, while in tables 2 and 4 they are provided as percentages. Regarding to Quality Management System[13], examined factors have great role in implementation of the ISO 9001-2015 standard and refer to its several subclauses, which is presented in Table 1.

Table 1. Results of examination of managers about the level of presence of key factors of success (absolute values)

Success factors		Understanding environment changes			Creating adaptable organizational culture			Defining a clear vision			Encouraging the creativity of employees			Total points per company	Average number of points per answer type and companies
ISO 9001:2015		4.1, 6.1, 7.2			4.1, 5.1, 7.3			5.1, 5.2			4.2, 7.1.2, 7.2, 7.3, 10.3				
Marks / Companies		1	2	3	1	2	3	1	2	3	1	2	3		
Tourism agencies	1			x			x		x			x		10	2.5
	2			x			x	x			x			8	2
	3	x			x			x			x			4	1
	4	x			x			x			x			4	1
	5		x			x			x			x		8	2
Catering facilities	6	x			x			x			x			4	1
	7			x			x			x			x	12	3
	8		x		x				x				x	8	2
	9		x			x				x			x	10	2.5
	10			x			x		x				x	11	2.75
No. of companies per answer type		3	3	4	4	2	4	4	4	2	4	2	4	79	19.75

Source: Authors, 2020, Serbia

In Table 1, according to the managers' answers, organizations 3, 4 and 6 have a very low probability of survival, since their average number of points per answer is only 1, i.e., the total number of points for the level of presence of all four factors is 4. The survival probability for companies 2, 5 and 8 is slightly higher (moderate) because of the higher number of total points, 8, or the higher average number of points, 2. The other examined companies, 1, 7, 9 and 10 have a high survival probability,

[13] Institut za standardizaciju Srbije, (2015), Standard SRPS ISO 9001:2015 – QMS, Zahtevi, Beograd.

since their points are above 9, and their average points are 2.5 and higher. The company number 7 especially stands out in this group, since their number of points is at the maximum of 12. Companies 10, 1 and 9 have slightly lower amounts of points, 11, 10 and 10, respectively.

Concerning the number of companies per answer type, the ability to understand environment changes was assigned the highest mark by the greatest number of respondents (4), 3, while two respondents assigned the marks 1 and 2. Creating adaptable organizational culture was assigned two marks of 2, while four respondents marked this success factors with 1 and 3, two for each mark. Only two respondents believe that the visions of their companies are clearly defined, while the remaining 8 assessed this success factor with 1 and 2. Regarding the encouragement of employees' creativity, the number of the lowest and the highest mark is equal, 4 for each, while two respondents believe that the presence of this factor is relatively moderate.

By adding total points per company and reaching the final result of 79 points (out of maximum of 120), or the average result of 7.9 (out of maximum of 12 per company), it can be concluded that the research sample is on the very border between moderate and high probability of survival on the market.

Table 2. The number of examined managers per answer type for the level of presence of key success factors in % (relative values)

Understanding environment changes			Creating adaptable organizational culture			Defining a clear vision			Encouraging the creativity of employees			Total no. of managers per success factor
30	30	40	40	20	40	40	40	20	40	20	40	100

Source: Authors, 2020, Serbia

Since Table 2 shows relative values, the relation between the number of examined managers per answer type can be seen even more clearly. While assessing the presence of ability to understand environment changes, 40% of respondents gave the mark 3, and the remaining 60% gave marks 1 and 2. The lowest number of respondents, only 20%, assessed the presence of creating adaptable organizational culture and encouraging the creativity of employees as moderate, while the equal percentage, at 40% each, assigned marks 1 and 3 to this success factor. Defining a clear vision is the lowest graded factor, since 80% of respondents assigned marks 1 and 2 to this factor, i.e., only 20% assigned the mark 3.

Table 3. Results of employee examination on the presence of encouragement of creativity in employees (absolute values)

Examined companies		Employees / Marks	Encouragement of employee creativity			Total number of points per employee
			1	2	3	
Tourism agencies	1	1	X			1
		2	X			1
	2	1	X			1
		2	X			1
	3	1	X			1
		2		x		2
	4	1	X			1
		2	X			1
	5	1	x			1
		2		x		2
Catering facilities	6	1			X	3
		2			X	3
	7	1			X	3
		2			X	3
	8	1			X	3
		2			X	3
	9	1			X	3
		2			X	3
	10	1			X	3
		2			X	3

Examined companies	Employees / Marks	Encouragement of employee creativity			Total number of points per employee
		1	2	3	
Number of employees per answer type		8	2	10	42

Source: Authors, 2020, Serbia

In table 3, according to answers obtained from employees in tourism agencies there is almost absolute absence of encouragement of employee creativity as a success factor, since 8 of 10 tourism employees assigned the mark 1 to this factor, and only two employees gave the mark 2. On the other hand, in the remaining five catering facilities, the employees graded the examined factor as very high, since all ten catering employees assigned the mark 3. The total number of points of all employees is 42 out of the maximum 60, while the average number of points per worker is 2.1 out of the maximum 3. The comparison of the obtained results based on the answers of managers and employees in relation to encouragement of employee creativity showed no significant deviations, which is likely due to the anonymity of the conducted survey.

Table 4. Number of examined workers per answer type for the presence of encouragement in employee creativity in % (relative values)

Encouraging employee creativity			Total number of employees
1	2	3	
40	10	50	100

Source: Authors, 2020, Serbia

Table 4 presents relative values, according to which almost half of the respondents (40%) believes that the management does not do enough about encouragement of employee creativity, while exactly ten workers (50%) assigned this factor the highest grade.

Standard ISO 9001:2015 requires analysis of internal and external factors, but also of stakeholders. Among other elements, these segments represent significant input for analysis of risks and opportunities in tourism organizations. Table 5 represents important external stakeholders for travel agency.

Table 5. External stakeholders of travel agency

External stakeholders		Relevant requirements
Stakeholder	Needs and expectations	QMS
Final consumers	High quality of travel arrangements – Satisfaction of travellers	Yes
	High quality of accommodation	Yes
	High quality of transport	Yes
	Low prices	Yes
	Reservations throughout the year	Yes
	Numerous of sale spots in their environment	No
	Health safety	Yes
	Respects of: General terms of traveling, Rule book of protection of personal data, Security act and data privacy	Yes
Suppliers of products/services	Customer orders	Yes
	Planning orders	Yes
	Advance payment	Yes

	Clear specification during order	Yes
	Clear tasks	Yes
	Enough time for realization	Yes
	Payment by arrangement	Yes
Regulatory organizations	Respecting regulations	Yes
Subagents	Respecting the contract of subagent, Implementation of arrangement subagent application	Yes
IATA	Implementation of standards	Yes
Health institutions and tariffs	Respecting COVID-19 measures	Yes

Source: Travel agency Euroturs, Internal documentation QMS, 2020, Serbia

In addition, by analysing the environment in the previous year, risks and opportunities were determined, as well as a response plan within control process of Euroturs, a tourism agency from Niš:[14] unstable political situation – response plan for the unstable political situation; taking over new markets, arrangements and destinations – visits to fairs, presentations, additional research of market requests, client animation; departure of professional staff (drivers, guides) – better work conditions, better communication and development of interpersonal relations; significant increase in EUR value – reservation plan for accommodation capacities and carriers; inability of payment – liquidity check for customers, advance payment; improvement of company image – improvement of QMS; inability to fulfil legal provisions – following legal provisions and timely implementation of measures for their fulfilment, subscribing to a website for law tracking; possibility of fire in a transport vehicle – preventive maintenance of the vehicle, external engagement of adequate means of transport; improvement of the company's IT systems – introduction of IT technology and optimization of business processes; strong competition on the market – constant monitoring of the competition, research of new markets; short time for request realization – tracking the market and trends, maintaining good business relations with associates and partners; rolling stock improvement – incentive funds, personal financial resources for purchase of new vehicles and adaptation of old ones; cancelling a reservation – payment in instalments, discounts, promotions, *last minute* and *first minute* offers; non-fulfilment of risk regulation provisions on the work place (COVID-19 pandemic) – naming a representative for work safety.

4. CONCLUSION

Since the results obtained through the research indicate that in the management there is moderate presence of the ability to understand environment changes, creating adaptable organizational culture and encouraging employee creativity (only 40% of managers have assigned the highest grate to these factors), and very low grading of the presence of clearly defined vision (80% of managers assign grades 1 and 2, i.e., only 20% of managers assign the grade 3), as well as the presence of encouragement of employee creativity graded as insufficient by the employees (42 of the maximum 60 points for the entire sample and 2.1 of the maximum 3 points per employee, i.e., 50% of employees assigned the grade 3, 10% assigned the grade 2, and 40% of them assigned the grade 1), and finally, the total amount of 79 points for the entire sample, or 7.9 points per company, we can observe a concern of possibility of improving the presence of key success factors for the purpose of minimizing the effects of market uncertainty, considering the determined moderate survival probability of the tourism-catering sector in the Republic of Serbia.

[14] Turistička agencija Euroturs, (2020), Interna dokumentacija QMS, Niš.

Apparently, managements of 21st century should always keep these words in mind:

"You will never come up with the right answer if you ask the wrong question."

Robert Sternberg, Yale psychologist

Organizational culture is assumed a key factor in large-scale and avoidable institutional failures.[15] Additionally, Enz emphasizes that if an organization's strong culture prevents it from adapting to the external environment, such strong organizational culture would decrease rather than increase its performance.[16] The creator of corporate culture, Schein, wrote about the importance of changes and risks of doing extremely wrong if management behaves the same way it has before.[17]

Especially low assigned grades in relation to success factors such as defining a clear vision and encouraging employee creativity impose a need on the management to redefine the purpose of the organization's existence and to develop a more creative work environment. According to Bogler and Nir,[18] the most important thing about the vision is the necessity that it be realistic and credible, and that it projects a future attractive enough to convince the followers to invest efforts in pursuing it, rather than simply continuing with the status quo. Moreover, according to Lipton, controlling a vision can benefit a company in these ways:[19] enhancing a wide range of performance measures, promoting change, providing essential elements for strategic planning, motivating individuals and keeping decision making in context. According to Trudy, DiLiello and Houghton,[20] individual creativity has been measured in a number of different ways, ranging from the assessment of the characteristics and personality traits of highly creative individuals to the measurement of creative products and achievements. Creativity backing device might be helpful in: assembling data through seeking and browsing aptitudes and visualizing data and the process, relating information, creating by thinking through free associations, exploring explanation, building crops and performances, and reviewing histories and disseminating derivatives to relevant parties.[21]

Kutz determined that an intuitive clump of relevant past events, intense attention of present contextual variables and attention of the desired future, interact so that the professional can apply influence and make optimal choice as three essential elements of contextual intelligence.[22] The same author defines contextual intelligent management as knowledgeable about how to do something, but more importantly is wise enough, based on intuition and experience, to know what to do.[23] Finally, every system of today must have a thorough knowledge and understanding of its environment, the people and devices that exist in it, their interests and capabilities, and the tasks and activities that are being undertaken, which is the context itself.[24]

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MOTIVATION OF THE PROJECT TEAM AS A KEY PERFORMANCE OF THE PROJECT SUCCESS

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Abstract: *Project management is widespread in almost every organization, however poor project implementation is still common. In this regard, it is necessary to identify which are the key performances that affect the success of the project. Maintaining the motivation and engagement of employees in the organization can help create a more profitable and dynamic business, and create a positive climate in the organization. Based on the literature review so far, the paper analyzes motivators and demotivators, which have a significant impact on motivation, which is considered as a key performance of project success.*

Keywords: *Project, Project success, Project team's motivation*

JEL Classification*: L (Industrial Organization)*

1. INTRODUCTION

Lately, a lot of attention has been paid to projects, which are a means to achieve the business goals of an organization. As a consequence, the importance of project management increases, with the aim of their successful and efficient implementation, which can be achieved only if all activities, resources and participants are rationally harmonized and all possible deviations are avoided or eliminated.

The research and review of the literature concluded that different authors, depending on the type of project, ie the field in which it is implemented, list different performances. But all of them, as one of the more significant, cite human resources, where the focus is on the motivation of project team members, noting that motivational factors include motivators and demotivators.

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Although different things motivate different people, the goal is to discover what are the modalities and strategies that can influence their behavior, since it is a big challenge and problem for the organization.

The right choice of motivation strategies increases the productivity and efficiency of project team members, which results in the achievement of its goals, and thus the goals of the organization as a whole. In order to operate successfully, every company should find the optimal combination of material incentives for its employees, which will depend on numerous factors: the sector in which it operates, competition in the labor market, the nature of work, employee structure, etc., and intangibles.

2. PROJECT PERFORMANCES

Today, there are a number of ways and criteria to assess the development and success of a project. One of the oldest is based on the so-called. iron triangle, which contains the principles of cost, time and quality, that is, the three main aspects that must be achieved and which characterize the projects are: scope, cost and time. In this regard, a project that would not deviate too much from the primary budget, meet the timeframe and requirements set by stakeholders, would be considered as successful[4] [1].

When we talk about project management, different project managers have different definitions of success, depending on their experience, knowledge, and the context in which they work. Some consider the number of projects completed on time and within the available budget, which results in achieving customer satisfaction, while others consider efficient communication, successful cooperation, and stakeholder involvement as criteria for success. Researching the literature, it was concluded that the list of project performance is large, and some key performances are given below [5] [6] and [7] :

- costs,
- time,
- shortcomings,
- customer satisfaction with the product,
- customer satisfaction with the service provided,
- profitability,
- productivity,
- human resources, within which the motivation of the project team can be singled out as a special performance,
- sustainability,
- quality,
- involvement and cooperation of stakeholders,
- clear goals,
- proper selection of resources for project execution,
- efficient use of material and human resources,
- use of new technologies,

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- efficiency of decision-making,
- risk management,
- innovation,
- successful communication, etc.

3. MOTIVATORS AND DEMOTIVATORS OF THE PROJECT TEAM

Identification and contextualization of motives for the application of BIM (Building information modeling) processes in construction projects, an empirical study in China, is the title of the work of Dongpin Cao et al.

The results of the factor analysis, with survey data collected from China, provide support for a theoretically developed model of motivation that consists of four categories: image motives, reactive motives, project-based economic motives, cross-economic motives. The results of hierarchical regression indicate that although project participants will have stronger economic motivators to improve project performance, their increase does not necessarily require a parallel reduction in the desire to improve social image. The results of the regression also suggest that the motives for the implementation of BIM relate to the type of organization and characteristics of the project[8] .

By researching and comparing the previously mentioned four categories of motivators, it was concluded that image motives and economic motives are the strongest reasons for designers and general contractors to apply BIM in construction projects[9] .

Luo Lu et al. they researched how long working hours affect employees in China. The research indicates a lack of separation after long working hours to the key work result, ie work performance. In its study, which lasted 6 months, where Chinese employees participated, it was shown that low separation mediates the relationship between working hours and work results, so that long working hours make it difficult to relax after work, resulting in exhaustion and difficult work measures. It is also important to emphasize that the results are mixed for employees who seek motivation in active interaction with a group of norms, values and goals. The authors conclude that long working hours deprive the employee of the opportunity to recover, which in turn leads to impaired well-being and work performance, in the long run[10] .

Tatiana Andreeva and Anastasia Sergeeva researched which motives influence the exchange, ie the sharing of knowledge with teachers. The results of the survey, which included 329 teachers from 22 high schools in Russia, reveal contradictory effects of different human practices on mediating the role of intrinsic motivation (refers to the employee's sense of intrinsic satisfaction and enjoyment when involved in the knowledge sharing process) and external motivations (refers to external benefits) for knowledge sharing and later behavior, in the exchange of teacher knowledge. The study makes a significant contribution, showing how certain combinations of human practices, aimed at improving knowledge exchange can in fact be an expensive solution for an organization [11].

According to the research, it was concluded that there are indirect effects between rewards and knowledge sharing (mediated by external motivation), and effects, ie the link between autonomy and knowledge sharing (mediated by internal motivation)[12] .

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[8] Cao, D., Li, H., Wang, G., Huang, T., Identifying and contextualising the motivations for BIM implementation in contruction projecrs: An empirical study in China, International Journal of Project Management, available at: http://dx.doi.org/10.1016/j.ijproman.2016.02.002

[9] Ibid

[10] Lu, L., Yi Chou, C., Yi Zeng, Y., Cooper, C. L., Personal and social resources in coping with long hours of the Chinese work condition: the dual roles of detachment and social motivation, The International Journal of Human Resource Management, available at: https://doi.org/10.1080/09585192.2020.1779778

[11] Andreeva, T., Sergeeva, A. (2016) The more the better...or is it? The contradictory effects of HR practices on knowledge-sharing motivation and behaviour, Human Resource Management Journal, Vol 26, no 2, pp. 151-171

[12] Ibid

Delaj Young et al. they questioned non-economic motivators that influence the behavior of employees working on large, mega construction projects. The study examined primary non-economic motivators, using a survey questionnaire, which found that the search for social value, and firm development, and political attractiveness have a significant impact. Non-economic motivators, without a clear guarantee of agreement can result in a high level of positive behavior. Also, the authors point out that a positive industrial climate can be promoted to discourage subjective intentional passive behavior of employees[13] .

Lorenzo Bizi researched whether human resource managers should allow employees to use social networks at work, or whether this could be one of the motivating factors for them, which will influence behavior. The question addressed by the researcher does not have an easy answer, as there are many conflicting views on this topic, which can be partially resolved insofar as we focus on who the individual is communicating with, using social networks. The author points out that during his research, he discovered another problem, and that is that the connection of employees with individuals, through social networks, who do not work for the organization, negatively affected the internal work motivation and proactive behavior. Also, the author proposes a solution to this problem, which is to involve employees in communication with their colleagues, which makes the negative effects positive[14] .

Wei Chi and a group of authors analyzed incentives for promotion, that is, whether differences in salaries, between levels, could have an effect on employees. The authors point out that employees of a certain rank are motivated by the difference in salaries between them and the level above (comparison upwards), and the differences in salaries between them and the level below (downwards). One of the authors' hypotheses was that comparing upwards has a greater impact, ie that it represents a greater motivating factor than comparing downwards, which was confirmed on the basis of research results[15] .

The leadership, focus and progress of the project team were researched by Chia-Yu Lai et al. They state that the basic function of a leader is to motivate his followers to achieve the goals of the project. Based on this, actors can aspire to an optional situation (promotion focus) or try to avoid not meeting the minimum requirements (prevention focus). The paper focuses on exploring the impact of leadership styles (transformational and transactional) on the collective focus of the project team, and on the relationship between that focus and the results of the project team. The authors conclude that the transformational leadership style has a positive effect on the promotional focus, while the transactional style has a positive effect on the preventive focus[16] .

The influence of motivation on achieving the goals of the project was investigated by John Larson et al. The authors believe that often, due to unpredictable problems, it can be impossible to meet project goals, and that team motivation has a strong influence on achieving pre-set goals, which is one of the hypotheses, which is based on the experimental part and confirmed. Also, the authors emphasize that the application of strict planning, combined with the timely collection and

[13] Yang, D., He, Q., Cui, Q., Hsu, S. C. (2020) Non-economic motivations for organizational citezenship behavior in construction megaprojects, International Journal of Project Management, vol 38, pp. 64-74

[14] Bizzi, L., Should HR managers allow employees to use social media at work? Behavioral and motivational outcomes of employee blogging, The International Journal of Human Resource Management, available at: http://dx.doi.org/10.1080/09585192.2017.1402359

[15] Chi, W., Liao, H., Wang, L., Zhao, R., Ye, Q. (2019) Incentives to move up: Effects of pay gaps between levels on employee performance, Human Resource Management Journal, vol. 29, pp. 238-253

[16] Lai, C. Y., Shih-Chieh Hsu, J., Li, Y., Leadership, regulatory focus and information systems development project team performance, International Journal of Project Management, available at: https://doi.org/10.1016/j.ijproman.2017.11.001

dissemination of relevant information, in the so-called procedures. "Hard" management encourages a high level of team motivation, thus increasing the ability to achieve project goals[17] .

Human resource management and ability, motivation, and the ability to continue working is the name of the work of Karen Pak et al. Organizations are faced with the task and challenge of retaining older workers, however the knowledge of how to do so is quite scattered. The aim of this paper is to integrate knowledge about the activities that organizations can undertake to enable the extension of working life, and to identify and examine the effectiveness of human resource management activities, aimed at deepening working life. The results of the research show that by offering resources for work, it is possible to positively influence the ability, motivation and opportunity to continue working. Also, challenges in work and development practices are mentioned as motivators. Then, it was found that work ability is most negatively related to job requirements, while employment opportunities are most positively related to development practices [18].

Employee exchange and their creativity were researched by Wen Pan et al. The authors state that there is a critical omission in the literature, related to the creativity of employees, ie that there is an obvious lack of clear understanding of why and how an organization can influence their creativity by exchanging employees, ie. whether it can be one of the motivating factors that will become and enhance creativity. The paper also points out that the impact of meeting needs on creativity is less pronounced among employees in top management, while the motivational potential of meeting needs is becoming more pronounced and more important internal driver of employees of lower hierarchical level. Also, the authors state that the research results indicate that one motivating factor could supplement or compensate for the weaknesses of another factor[19] .

Anik Van Rosem explored the introduction of a cognitive approach to the study of generational differences: the case of motivation. When analyzing the results, and looking for an answer to the question of how much the respondents value individual motivators, the authors did not find significant results, except for one motivator, which can be said to be significant, and that is "employee training". Although labeled as significant, it is important to determine which group of employees, out of the three that were surveyed, take this motivator into consideration. As far as Generation Y is concerned, they view training as a valuable and motivating factor if it contributes to their personal development and advancement, while Generation X considers training to be very important for the company and as a means to achieve autonomy. The third group of respondents were "baby-boomers", who were not particularly interested in training, ie. training[20] [15].

For a simpler overview of motivators and demotivators, they are shown in the following table 1.

[17] Larsson, J., Erik Eriksson, P., Pesamaa, O., The importance of hard project management and team motivation for construction project performance, International Journal of Managing Projects in Business, available at: https://doi.org/10.1108/IJMPB-04-2017-0035

[18] Pak, K., T. A. M. Kooij, D., H. De Lange, H., J. P. M. Van Veldhoven, M., Human Resource Management and the ability, motivation and opportunity to continue working: A review of quantitative studies, Human Resource Management Review, available at: https://doi.org/10.1016/j.hrmr.2018.07.002

[19] Pan, W., Yun Sun, L., W. Lam, L., Employee-organization exchange and employee creativity: a motivational perspective, The International Journal of Human Resource Management, available at: http://dx.doi.org/10.1080/09585192.2017.1331368

[20] Van Rossem, A., Introducing a cognitive approach in research about generational differences: the case of motivation, The International Journal of Human Resource Management, available at: https://doi.org/10.1080/09585192.2019.1616592

Table 1. Motivators and demotivators

PAPER	MOTIVATORS	DEMOTIVATORS
[5]	economic motivators, type of organization, project characteristics	not specified
[6]	active interaction with a set of norms, values, and goals	long working hours
[7]	reward, autonomy	not specified
[8]	social value, firm development, political appeal, positive industrial climate	not specified
[9]	communication of employees, with their colleagues, through social networks	communication of employees, with individuals, through social networks, who do not work for the organization
[10]	the difference in salary, in relation to the level above	not specified
[11]	leadership style, ie leadership style	not specified
[12]	application of strict planning, timely collection and dissemination of relevant information	not specified
[13]	business challenges, development practices	not specified
[14]	employee exchange	not specified
[15]	employee training, training	not specified

4. CONCLUSION

Previous analysis of scientific papers shows that there is a strong link between project management and human resource management, in terms of employee motivation, ie project team motivation, where improving this factor can increase the effectiveness and productivity of team members, and thus performance, which directly affects to the success of the project.

Motivating employees is not easy, but it is necessary insofar as the organization wants to progress, and to create a highly productive and efficient resource from its employees. What makes happy is that the function of human resources in today's organizations is slowly gaining in importance, and it is beginning to perform its true function, where one of the activities is certainly the motivation of employees.

As can be noticed, based on Table 1, although employees consider economic, ie material, motivation important, non-economic ways of motivating employees, ie. intangible motivation, occupy a high place on the scale and special attention should be paid to them.

As for some future directions of research, related to this very attractive topic of today, they could go in the direction of analysis and discovery of demotivators, because, as can be concluded, based on Table 1, they are not sufficiently researched.

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[8] Yang, D., He, Q., Cui, Q., Hsu, S. C. (2020) Non-economic motivations for organizational citezenship behavior in construction megaprojects, International Journal of Project Management, vol 38, pp. 64-74

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[10] Chi, W., Liao, H., Wang, L., Zhao, R., Ye, Q. (2019) Incentives to move up: Effects of pay gaps between levels on employee performance, Human Resource Management Journal, vol. 29, pp. 238-253

[11] Lai, C. Y., Shih-Chieh Hsu, J., Li, Y., Leadership, regulatory focus and information systems development project team performance, International Journal of Project Management, available at: https://doi.org/10.1016/j.ijproman.2017.11.001 (Accessed: 03. 07. 2020)

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[13] Pak, K., T. A. M. Kooij, D., H. De Lange, H., J. P. M. Van Veldhoven, M., Human Resource Management and the ability, motivation and opportunity to continue working: A review of quantitative studies, Human Resource Management Review, available at: https://doi.org/10.1016/j.hrmr.2018.07.002 (Accessed: 04. 07. 2020)

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URBAN QUALITY OF LIFE AND TYPOLOGY OF HOUSING IN THE SETTLEMENTS OF NOVI SAD

Doc. Dr Katarina Stojanović[1]

Abstract: *Quality of life may be measured by objective and subjective indicators. The quality of design and planning can be seen as a quality of service provided to their customers. In the past few years, increasing attention has been given to the role of place in shaping people's quality of life. Urban quality of life need a multi-dimensional concept requiring the description of several life domains and their interplay. This paper investigates residents' perception of quality of life in cities. The urban quality of life in the settlements of the city of Nobog Sad, which differ in housing density, is being investigated. Based on a literature review on quality of life in cities, subjective indicators of citizens' satisfaction on living quality in Novi Sad were identified and quantified using empirical results from a field survey. The concern about the quality of urban life in cities has led to an increasing interest in findings from surveys aiming to measure the quality of life in particular places. understanding of the place and recognition of its value are important in future planning to promote local development, which will contribute to global quality.*

Keywords: *Urban quality of life, Quality of service, Typology of housing, Place, Sustainability;*

JEL Classification*: Z32, L26, Q13*

1. UVOD

Quality of life is a complex, abstract, and multidimensional concept. It should not be confused with the concept of standard of living, which is based primarily on income and employment status. Instead, standard indicators of quality of life include not only these dimensions but also the built environment, physical and mental health, education, recreation and leisure time, and social belonging.[2] Sustainability and Quality of Life are commonly used terms and many data-based indicators, indexes, and assessment tools have been developed to measure their success, yet their usefulness for city planning policy and decision-making has been debated over the years.[3] For measuring of subjective quality of life the perceptions of individuals play a key role. Macroscopic features relating to the economic and social situation of a society are important for putting the

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[2] Carta, M.G., et al., Quality of Life and Urban / Rural Living: Preliminary Results of a Community Survey in Italy, Clin Pract Epidemiol Ment Health, 2012; 8: 169–174.

[3] https://www.cmu.edu/metro21/projects/urban-quality-of-life-indicators.html (assesed: September 23rd, 2020).

findings at individual level into their proper context, but the key is the subjective perception of well-being of a person.[4]

Higher density urban housing has been linked to a range of beneficial social, economic and environmental outcomes. Increasing the provision of this housing is enshrined as a goal in policies in many countries. It is likely that policy-makers will continue to support higher density housing as climate change and other environmental pressures add to the pressures on the demand for land.[5]

This research began as a survey of sustainability and quality of life indicators to identify which could successfully measure these attributes with the idea that there may be select indicators that are more reliable than others. Definitions were sought, indicators surveyed, and assessment tools and indexes researched to find those that are universally identified as true measures or best practice assessment tools for creating city planning policy and decision-making.[6]

The trend of the type of housing has changed often throughout history and in some periods the choice of residents, ie. users who could choose their living space, varied. In the past, people flocked to cities, especially in the age of industrialization, leaving their single-family farms, often from rural areas, and moving to urban collective housing. Later, in the second half of the last century, when the city centers became overcrowded, single-family housing in the suburbs developed again. Such a tendency seems to exist even today, especially after the global coronary virus pandemic, which has put urban life on the trajectory, especially the multifamily type of housing.

The capability approach offers a theoretical framework with which to explain how individual perception of quality of life in cities develops. In the present work, the residents' perception of quality of life depends on personal characteristics, the presence of amenities and the actual use of those amenities.[7] In the article we focused on incorporating sustainability into the concept of quality of life in response to the current accelerating environmental problems.[8] The principles set up in this way are comparatively analyzed in the selected examples, the results are then tabulated, on the basis of which conclusions and recommendations.

[4] Carta, M.G., et al., Quality of Life and Urban / Rural Living: Preliminary Results of a Community Survey in Italy, Clin Pract Epidemiol Ment Health, 2012; 8: 169–174.

[5] Winston, N., Dwelling type and quality of life in urban areas: evidence from the European Social Survey. 2014. https://researchrepository.ucd.ie/handle/10197/6150. (assesed: Octomber 3rd, 2018).

[6] https://www.cmu.edu/metro21/projects/urban-quality-of-life-indicators.html (assesed: September 23rd, 2020).

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2. URBANISM AND ARCHITECTURE AS A QUALITY OF SERVICE

Since the beginning of twenty-first century, urban development worldwide has successively deviated from our ideal design and original plans. There have subsequently accompanied numerous urban problems, such as congestion, serious air pollution, urban endlessly sprawl and inappropriate land development with low urban density. All of these features we often called urban illnesses significantly created negative influence to our urban life.[9]

Cities play a vital role in local development providing a high education level, specialized jobs and advanced services. When assessing living conditions and wellbeing in cities, economic indicators alone are generally unable to evaluate the inherent complexity of the 'quality of life' issue in urban environments. With rapid urbanization, shortage of infrastructures and services emerged in metropolitan regions of developing countries, leading to disadvantaged settlements, urban poverty, lower citizens' satisfaction, and an overall decline in life quality. Based on these premises, the present study illustrates a subjective investigation of life quality in an emerging economy.[10]

The logical question that follows is how to define a service that is acceptable to all? The answer can be found in the fact that quality is achieved only if it has met the expectations of the user, and the quality assessment is largely transferred from the one that provides quality to the recipient of the service.[11] Urbanism and architecture can also be viewed as a service provided to their users, ie. residents. From that aspect, it is necessary to satisfy the quality of service, in this case, urban life.

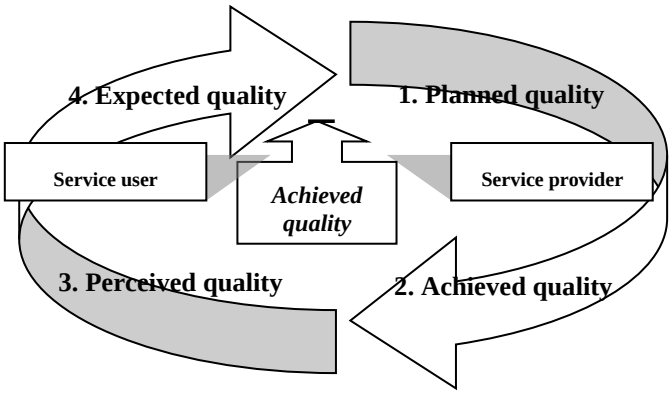

Figure 1. Quality of service from the aspect of the company and users according to the requirements of ISO 9000: 2000
Source: Vojnović, B., Upravljanje kvalitetom usluga, Ekonomske teme, XLVI, br. 3, 2008, str. 181-194. (translated by the author)

In the context of that, and in the direction of achieving good quality, the expectations of users should be met, which is only possible by getting to know their needs, habits, social environments they come from, lifestyle, standard of living, and so on. Therefore, providing and controlling the quality of service is one of the key tasks.[12]

3. METHODS AND CRITERIA OF ANALYSIS

Residents of town were surveyed via structured interviews. The main findings indicate that residents' perception of quality of life in cities is highly dependent on the choices people can

[9] Wey, W.-M., Constructing urban dynamic transportation planning strategies for improving quality of life and urban sustainability under emerging growth management principles, Sustainable Cities and Society, Volume 44, January 2019, Pages 275-290.
[10] Pazhuhan, M., et al., Factors Underlying Life Quality in Urban Contexts: Evidence from an Industrial City (Arak, Iran), Sustainability, Volume 12, Issue 6, 2020, pages 1-16.
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[12] Ibid.

actually make, with the accessibility to services, individual allocation of time, and the social interactions people enjoy.[13]

The researched areas Banatić, Adice and Novo naselje (Fig. 2) differ from each other in dwelling density. The paper reviews findings covering 180 respondents living in four neighborhoods which represent the four different growth patterns and differ in terms of their social-spatial character and their housing types.[14] Citizens were asked to express their views on various aspects of urban life. How do they assess the quality of services such as public transport, health care, education, cultural and sport facilities? Do they consider migration as an asset for their city? How do they perceive job availability or affordable housing in their cities? Are people satisfied with the place they live, the life they lead, or the financial situation of their household?[15]

Figure 2. Banatić, Adice and Novo naselje
Source: The author; https://upload.wikimedia.org/wikipedia/commons/thumb/c/c3/Adice03.jpg/800px-Adice03.jpg (assesed: September 23rd, 2020); https://www.dnevnik.rs/sites/default/files/2018-01/Novo%20naselje%209.jpg (assesed: September 23rd, 2020).

Based on the literature review, it can be deduced that nine main dimensions which contribute to realization of the urban quality of life are: environmental urban quality of life, physical urban quality of life, mobility of urban quality of life, social urban quality of life; psychological urban quality of life, economic urban quality of life, political urban quality of life. These dimensions are interrelated and dependent on each other, as is reflected.[16] Cultural urban quality of life and housing situation is of great importance.[17]

The survey was conducted on a random sample of citizens. It was formulated on the basis of Eurobarometer Flash, "Quality of life in European cities" (No 366), which was conducted at the request of the Directorate-General for Regional and Urban Policy to get a snapshot of people's opinions on a range of urban issues (Quality of life in cities, Perception survey in 79 European cities, 2013 Flash Eurobarometer 366 Luxembourg: Publications Office of the European Union).

The respondents were asked the following questions: „Generally speaking, please tell me whether you are very satisfied, quite satisfied, rather unsatisfied or not at all satisfied with your city neighbourhoods as a place to live?" and „In your opinion, among the following issues, which are the three most important for your neighbourhood? Safety / Pollution / Noise / Public transport / Health services / Social services / Socializing/ Urban design /Education and training / Unemployment / Housing / Road infrastructure / DK or NA (don't know or no answer)."

[13] Biagi, B., Ladu, M.G. and Meleddu, M., Urban Quality of Life and Capabilities: An Experimental Study, Ecological Economics, 150, 2018, pp. 137-152.
[14] Oktay, D., Rüstemli, A. and Marans, R. W., Neighborhood satisfaction, sense of community, and attachment: Initial findings from Famagusta quality of urban life study, ITU A|Z, VOL: 6 NO: 1 6-20 2009-1.
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4. RESULTS AND DISCUSSION

Tabele 1. The data: Banatić, Adice and Novo naselje (settlements of Novi Sad)

	Banatić	Adice	Novo naselje
Number of residents	10.558	7.635	40.000
Natural aspects	5.00%	5.00%	6.00%
Land use, type	Mixed	Single-family	Multi-family
Infrasructure	Good value	Good value	Good value
Accessibility	No ramps	No ramps	No ramps
Traffic	0,4 parking place/apartm.	0,5 parking place/apartm.	0,5 parking place/apartm.
People interactions	Several Squares	No public places	Squares
Paricipation of citizens	/	/	/
Identity of the place	Sill not deffined	Sill not deffined	Sill not deffined
Economic activites	Bank, Post office	/	Bank, Post office
Implementation of city policies	Plans data do not correspond to the actual physical condition in space	Plans data do not correspond to the actual physical condition in space	Plans data do not correspond to the actual physical condition in space

,Source: The author

Tabele 2. People's satisfaction with their neighborhood

	Very satisfied		
Public transport	Not at all satisfied	Not at all satisfied	Rather unsatisfied
Health care services	Not at all satisfied	Not at all satisfied	Not at all satisfied
Sports facilities	Rather unsatisfied	Not at all satisfied	Fairly satisfied
Cultural facilities	Not at all satisfied	Not at all satisfied	Rather unsatisfied
The state of the streets and buildings	Fairly satisfied	Fairly satisfied	Fairly satisfied
Public spaces	Rather unsatisfied	Not at all satisfied	Fairly satisfied
Green spaces	Fairly satisfied	Very satisfied	Fairly satisfied
Schools and other educational facilities	Rather unsatisfied	Fairly satisfied	Fairly satisfied
Availability of retail shops	Very satisfied	Very satisfied	Fairly satisfied
The quality of the air	Not at all satisfied	Rather unsatisfied	Not at all satisfied
The noise level	Fairly satisfied	Very satisfied	Rather unsatisfied
Cleanliness	Rather unsatisfied	Fairly satisfied	Rather unsatisfied
Safety	Not at all satisfied	Fairly satisfied	Not at all satisfied

Source: The author

People who live in single-family houses are more satisfied with their neighborhood than those who live in apartments. The paper reveals that those living in multi-family dwellings have a number of important concerns regarding housing and neighbourhood quality. Multi-unit housing is less likely to be designated as very good quality compared with detached housing. Compared with those living in detached dwellings, residents are less likely to feel safe in their neighbourhoods.[18]

[18] Howley, P., Sustainability Versus Liveability: An Exploration of Central City Housing Satisfaction, International Journal of Housing Policy 10(2): 173-189, 2010.

This research has shown that life satisfaction is lower for those living in multi-family dwellings than it is for those in detached dwellings. This highlights the importance of this and other housing variables being included in future research on urban quality of life.[19]

5. CONCLUSION

Results of our study show that the overall satisfaction for living quality in Novi Sad is rather low, reaching the lowest rank in the issues of environmental sanitation and public transportation. Lack of investments in urban infrastructure justifies the low citizens' perception of life quality in Novi Sad city. The paper concludes outlining the urgent need of homogeneous and comparable macro- and micro-data on multiple aspects of quality of life at both city-level and metropolitan-level in emerging economies.[20]

It is imperative to adopt a new universal methodological structure with an emphasis on transdisciplinary research approach, which can respond to the demands of dynamic spatial and cultural transformations and encourage the development of collaborative knowledge in various forms of action in urbanism and architecture, from education, science to professional activities.[21] An integrated planning method is applied in developed countries that monitors the dynamic changes of the city, always bearing in mind the environmental, economic and social aspects. Problems are addressed systemically.

Without constant contact with the culture and ethos of difficulty we are hard pressed to make ourselves better than dilettantes.[22] The experience of a place on the part of its inhabitants also depends on urban quality of life.

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SYSTEM OF INTERNAL CONTROLS IN THE PUBLIC SECTOR OF THE REPUBLIC OF CROATIA

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Abstract: *The system of internal controls in the public sector is defined as a complete system of controls established by the heads of budget users with the aim of successful management and accomplishment of tasks. Pursuant to the Law on the System of Internal Financial Controls in the public sector, internal audit is part of a comprehensive internal control system, as an independent and objective activity of providing expert opinion and advice with the aim of adding value and improving the business of budget users. and improving the effectiveness of risk management, control and management processes. The system of internal controls in the public sector of the Republic of Croatia is based on the concept of PIFC (Public Internal Financial Control) developed by the European Commission to assist candidate countries in reforming their internal financial control systems. The concept is based on international standards of internal control and practices of European countries. Due to their complexity, internal control systems require monitoring and assessment of their adequacy and functionality through a system self-assessment conducted by management through internal and external audit activities. The self-assessment of the system is important in the process of determining the risks that threaten the achievement of certain goals and enables timely and adequate response and the establishment of certain controls. The system of internal controls is in the function of ensuring proper, legal, economical, efficient and effective management of budget funds, ie good financial management. The aim of this paper is to analyze the system of internal controls of the public sector and to explain and present the process of conducting internal control in the public sector of the Republic of Croatia.*

Keywords: *control, internal control, system of internal controls, audit, public sector*

JEL Classification *M20, M40, M42*

1. INTRODUCTION

The system of internal controls in the public sector of the Republic of Croatia is based on the concept of PIFC (Public Internal Financial Control) developed by the European Commission to assist candidate countries in reforming their internal financial control systems. The concept is based on international standards of internal control and practices of European countries. The process of the

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internal control system requires constant monitoring and assessment of adequacy and functionality, which is carried out through self-assessment by management, but also by internal and external audit activities. Self-assessment of the internal control system in the public sector is of great importance in order to identify potential risks that may jeopardize the achievement of the set goals. The system of internal controls in the public sector of the Republic of Croatia is accompanied by a statement on fiscal responsibility which confirms that the work of the public sector ensures legal and purposeful use of funds and efficient and effective functioning of the internal control system. In order for the entire system of internal controls in the public sector to function properly and adequately internal audit is responsible, which provides public sector leaders with clear and reliable information on whether the internal control system is established and satisfactory and whether the established controls are implemented and effective. Internal audit also provides recommendations for improving the internal control system. The aim of this paper is to present the system and functioning of the system of internal controls in the public sector of the Republic of Croatia and to present the procedure of performing the internal audit process in the function of quality management.

2. PURPOSE AND CHARACTERISTICS OF THE INTERNAL CONTROL SYSTEM

The system of internal controls is defined according to the Manual on the system of internal controls for budget users (2019) as a set of principles, methods and procedures of internal controls established by the responsible person of the institution for successful management and achievement of general objectives, such as: ethical, economical, efficient and effective manner, compliance of laws and other regulations, protection of funds from losses, abuse and damage, strengthening responsibility for achieving business goals and reliability and comprehensiveness of financial and other reports. The system of internal controls is in the function of ensuring proper, legal, economical, efficient and effective management of budget funds, ie good financial management. The system of internal controls in the public sector of the Republic of Croatia places emphasis and is aimed at monitoring business processes with recording and monitoring of revenues and receipts, expenditures and expenses, tender procedures and contracting, and monitoring of assets and liabilities. In accordance with the mentioned areas and their monitoring, the final consequences of the financial effects of operations, ie undertaken or non-undertaken activities, implemented decisions, implemented investment projects in the public sector are visible. The basic feature of the system of internal controls and good financial management in the public sector of the Republic of Croatia includes managing based on the principle of "value for money", management responsibility at all levels of management and a systematic approach and view of controls. Given that the system of internal controls in the public sector is regulated by the Manual on the system of internal controls for budget users, the manual itself very clearly and precisely emphasizes that the internal control system should be adaptable to changes in the environment and that changes do not require additional budget if the system itself can direct and control the financial effects of business in the function of achieving business goals. „Value for money" management should ensure that quality standards are met in the provision of services to citizens and other activities carried out by institutions and that this is done in an economical, efficient and effective way, ie that as little financial resources as possible are spent, and provide quality service. (Manual on the system of internal controls for budget users, 2019). In order for the public sector to be managed and function according to the principle of "value for money", it is necessary that the business goals be clearly defined as well as the way of their realization with a clear definition of the working group that will work on the realization of goals and performance verification. In order for the defined goals to be successfully realized in the public sector, it is necessary to establish a clear line of authority and responsibility that will be based through transparent and consistent management. „Value for money" management with developed management responsibility at all levels of management requires an adequate system of internal controls. The provision of the Public Sector Internal Control System Act (Official Gazette 78/15) defines the interconnected components that make up the internal control system, namely the control environment, risk management, control activities, information and communication, monitoring and evaluation of the system (table 1).

Table 1. Internal control system components

Internal control system components	Description	Internal control system based on the components of the internal control system
Control environment	“The control environment consists of personal and professional integrity, ethical values of employees and their competence, and way of leadership and management style”	"It focuses on considering whether the mission of the organization is clearly defined and whether there is a vision of business and a planned approach to business, with an analysis of the organizational structure, which includes how to share powers and responsibilities and the reporting line."
Risk management	"Risk management is a complete process of identifying, assessing and monitoring risks, taking into account the objectives of budget users, and taking the necessary measures to reduce risk”	"The internal control system deals with identifying risks that may be a threat to the realization of set goals and taking measures to prevent the activation of risks, or minimize their effects."
Control activities	"Control activities are written rules, procedures and measures established to achieve the objectives by reducing the risk to an acceptable level"	Through the system of internal controls, control activities imply “separation of duties in the part of giving authority for preparation, processing, recording and payment; double signature system; rules that ensure the protection of property and information; procedures for complete, accurate, correct and up-to-date recording of all business transactions; documentation rules and the like "
Information and communication	“An important component of the internal control system is the information and communication system given the importance of business information for management and control functions. "	The system of internal controls requires "effective communication at all levels in the organization, building an appropriate information management system and the establishment and development of an effective, timely and reliable reporting system"

Monitoring and evaluation of the system	"Monitoring and evaluation of the internal control system shall be carried out in order to assess its proper functioning and ensure timely updating. "	"Monitoring and evaluation of the system is performed through continuous monitoring, self-assessment and internal audit. "

Source: author's according to the Manual on the Internal Control System for Budget Users, 2019., p. 10-11, Croatia

A very important feature of the internal control system is the so-called. systematic approach and view of controls, in which "classic" control activities represent only one of the components of the internal control system" (Manual on the internal control system for budget users, 2019). The system of internal controls of the public sector of the Republic of Croatia in practice integrates different areas of business, so in order to function properly, it is necessary to constantly assess and harmonize with the needs of the system itself.

3. CENTRAL HARMONIZATION UNIT

The Sector for Harmonization of the Development of the Internal Control System (Central Harmonization Unit) is an organizational unit of the Ministry of Finance of the Republic of Croatia, in charge of coordinating the development of the internal control system in the public sector.

Coordination of the development of the system of internal controls in the public sector in the Republic of Croatia includes:[4]

1. "preparation of laws and sub-legal regulations for the development of the internal control system,
2. coordination of the development of the internal control system with the ministries responsible for structural reforms, administrative reforms and other institutions,
3. development of guidelines for the development of the internal control system and methodology of internal audit work,
4. organization of training for managers and persons involved in coordinating of the development of internal control systems and internal auditors,
5. cooperation with professional organizations and other bodies in order to promote the system of internal controls in the public sector,
6. preparation of a consolidated annual report on the system of internal controls in the public sector,
7. keeping the register of internal audit units and the register of certified internal auditors for the public sector,
8. checking the application of the framework for the development of the internal control system in order to adequately monitor the development of budget users and gather information for its improvement".

The central harmonization unit is an organizational unit in the Ministry of Finance of the Republic of Croatia in charge of coordinating PIFC (Public Internal Financial Control) in the public sector of the Republic of Croatia. PIFC introduces a systematic approach to management through: "strategic planning, program planning, risk management, powers and responsibilities for the achievement of objectives and budget management, records and reporting systems, self-assessment of financial management and control systems (Statement of fiscal responsibility, questionnaire for self-assessment of financial systems management and control) and internal audit".[5] As already mentioned, the system of internal controls in the public sector of the Republic of Croatia is based on the concept of PIFC (Public Internal Financial Control) developed by the European Commission, which

[4] https://mfin.gov.hr/istaknute-teme/sredisnja-harmonizacijska-jedinica/107

[5]https://mfin.gov.hr/istaknute-teme/sredisnja-harmonizacijska-jedinica/pifc/219

continued the further development of this system with the accession of the Republic of Croatia to the European Union. In order to more clearly and better connect the development of the internal control system with the existing Budget Act and the Fiscal Responsibility Act, in 2015. the Public Sector Internal Control System Act was adopted, which regulates the "system of internal controls in the public sector of the Republic of Croatia which is in the function of ensuring the application of the principles of sound financial management and creating preconditions for strengthening fiscal responsibility and internal audit as part of that system which is in the function of independent and objective assessment of internal control and consulting systems in order to improve the institution's operations"[6]. Given the breadth of the area covered by the internal control system, its systematic development requires active cooperation of the Central Harmonization Unit with key actors: with ministries responsible for structural and administrative reforms, with institutions involved in the management and implementation of EU-funded projects and others key participants in the development of this system. Their functioning in practice depends primarily on the budget users themselves, who are responsible for applying and developing certain elements of the system in their daily operations (Manual for Financial Management and Control, 2019). The system of internal controls is being developed for a reason, and that is that public sector institutions improve and improve their business through this system.

4. ROLE AND PURPOSE OF AUDIT IN THE PUBLIC SECTOR

Generally speaking, audit means researching, verifying or examining accounts, financial documentation and checking their accuracy (Crnković, 1997). the word audit itself comes from the latin word "revidere" which means to see again and accordingly audit represents a subsequent review and review of business processes and conditions (Tepšić et al., 1984). The audit includes examination of documents and reports, internal control systems, accounting and financial procedures and other records to determine whether the financial statements present a true financial position and results of financial activities in accordance with accepted accounting principles and standards. The control of the system of internal controls in the public sector of the Republic of Croatia is performed by internal auditors who obtain their certificate for performing internal audit activities in the public sector at the Ministry of Finance of the Republic of Croatia. The control of the system of internal controls in the public sector of the Republic of Croatia is performed by internal auditors who obtain their certificate for performing internal audit activities in the public sector at the Ministry of Finance of the Republic of Croatia, which conducts basic training of internal auditors, but also continuous training of internal auditors who already have the certificate in question. External audit activities under the jurisdiction of the State Audit Office are indispensable procedures in the development and control of the internal control system in the public sector. According to Article 54 of the Constitution of the Republic of Croatia (Official Gazette 85/10), the State Audit Office is the highest audit institution for the public sector of the Republic of Croatia, which is independent in its work. The State Audit Office was established in 1993. under the State Audit Act and began operations in November 1994. The system of internal controls in the public sector is defined as a complete system of controls established by the heads of budget users with the aim of successful management and accomplishment of tasks while their control is performed by the internal audit of the public sector of the Republic of Croatia while the overall oversight of the competence is under the state audit. Pursuant to the Law on the System of Internal Financial Controls in the Public Sector, internal audit is an independent and objective activity of providing expert opinion and advice with the aim of creating added value and improving the operations of budget users and assists the user in achieving objectives by applying a systematic and disciplined approach to evaluating and improving the effectiveness of risk management, control and governance processes. In addition to supporting all budget users to achieve budget objectives through the definition and development of strategic and annual plans, public sector internal audit is based on objective risk assessment, evaluates the effectiveness of financial management and control systems to ensure reliable information and business efficiency.

[6] Ibidem

5. PLANNING AND PROCESS OF PERFORMING INTERNAL AUDIT IN THE PUBLIC SECTOR OF REPUBLIC OF CROATIA

Internal audit planning is a fundamental function of the management process for all budget users. The internal audit planning process in the public sector of the Republic of Croatia is carried out at two levels: at the level of the internal audit unit and at the level of the individual audit process. According to the Manual for Internal Auditors (2019), audit planning implies the development of strategic and annual internal audit plans, and planning at the level of the individual audit process implies the development of the Individual Audit Plan and Program. The link between them stems from the fact that strategic and annual plans form the basis for the development of individual audit plans. The planning of the internal audit process, as already mentioned, implies the definition of a strategic and annual internal audit plan, which is based on the risk assessment of the relevant business unit. The mentioned strategic plan is reviewed and adjusted every year in order to give a clear picture of business and to reflect significant changes in the goals, priorities and activities of the institution and institutions within its competence and the results of the risk assessment. The strategic and annual internal audit plan is proposed by the head of internal audit and adopted by the responsible person of the institution. The annual internal audit plan should clearly and logically explain the connection with the strategic internal audit plan on the basis of which it is adopted. Using defined strategic goals, internal auditors analyze programs and assess the significance of each individual program in relation to the achievement of strategic goals. When conducting the internal audit procedure, the internal auditors determine the objectives for the three-year period, ie define in which way and in which areas the internal audit unit plans to contribute to the improvement of the business system. It is also necessary to identify key areas of audit by assessing their significance. In order to assess the significance of the selected key areas, it is necessary to determine the categories by which the significance is considered and their method of evaluation. Furthermore, by defining potential ie. key audit areas, internal auditors also identify risk factors and assess the effects and likelihood of risks. Risk identification means identifying events or problems that may arise and affect the implementation of goals, priorities, functional activities, the implementation of programs, projects and the like. The strategic and annual plan when planning the internal audit process are the key and starting points for the planning itself and later the implementation of internal audit. The strategic plan sets out the objectives of the internal audit and the strategic direction for the internal audit unit in terms of resources and its future development, and it is submitted to the Central Harmonization Unit of the Ministry of Finance of the Republic of Croatia. The annual plan, on the other hand, implies and contains general and specific objectives and proposes audits to be performed in the next year, and is prepared by the head of the internal audit unit on the basis of the strategic plan. The process of performing internal audit is a systematic process that is manifested through organized and purposeful planning, performance and reporting of work results. The task of internal audit is to assess internal controls and provide an independent and objective expert opinion on their adequacy, application and effectiveness. Internal audit assesses the established system of internal controls and depending on the results of the assessment, recommendations for improvement are given. The internal control process consists of the following methodology: preparatory activities and preliminary risk assessment, assessment of the internal control system, reporting on results, monitoring the implementation of recommendations (table 2).

Table 2 . Methodology of performing individual internal audit

Methodology of performing individual internal audit	Description	Phase/Activities

Preparatory activities and preliminary risk assessment	“It is carried out to collect information on the area / process / activities to be audited and to gather information on the basis of which a preliminary risk assessment is carried out, the objectives and scope of individual internal audit and the program of individual internal audit are determined”	1. Collecting information on the area / process / activity being audited 2.Preliminary risk assessment 3. Development of a plan and program for performing individual internal audit
Assessment of the internal control system	"It is carried out in order to collect audit evidence on the basis of which internal auditors determine the actual situation in the area / process / activity being audited, determine the causes of deviations from the actual situation, ie the causes of identified deficiencies, weaknesses and / or problems	1.Conducting audit procedures 2.Formulation of draft audit findings, opinions and recommendations
Reporting on results	"The purpose of the reporting phase is to communicate the results of the individual internal audit to the audited entities and management, ie the responsible person of the institution and other interested organizational units in the institution"	1. Drafting an audit report 2. Coordinating the draft audit report with the audited entities 3. Preparation of the final audit report 4. Distribution of the final audit report
Monitoring the implementation of recommendations	"Monitoring for the purpose of gathering information on whether the activities for the implementation of recommendations are carried out in accordance with the established deadlines and on the basis of which the internal audit can measure its added value"	-

Source: author's, according to the Manual for Internal Auditors, p.33 - 45, 2019, Croatia

The Head of the Internal Audit Unit is responsible for monitoring the entire internal audit process in order to ensure efficiency in the allocation and use of resources and consistency with audit objectives and scope. Irregularities and fraud have a negative impact on the work of all bodies, and internal auditors have an important role to play in preventing and detecting irregularities in the conduct of internal audit.

6. CONCLUSION

The presented system of internal controls in the public sector of the Republic of Croatia is based on the concept of PIFC (Public Internal Financial Control) developed by the European Commission to assist candidate countries in reforming their internal financial control systems. The system of internal controls is in function and organized with the aim of successful and quality management and to achieve the set goals and tasks of the public sector. In order for the internal control system itself to function in an adequate and proper manner, and whether the established controls are implemented and whether they are effective, internal audit is in charge. Internal audit is an independent and objective activity that provides expert opinion and advice on the functioning of the internal control system in the public sector of Republic of Croatia and contributes to the creation of added value and business improvement. System of internal controls and internal audit in the Republic of Croatia is strictly regulated through a number of laws, regulations, procedures, manuals that regulate this area of activity. The functioning of the internal control system in the form of a report is submitted to the Government of the Republic of Croatia with the purpose of comprehensively review of the level of development and to determine activities for further development of the internal control system and internal audit. A well-organized and set up system of internal controls leads to the quality functioning of the public sector, which ultimately leads to successful and transparent operations, achievement of goals and plans and leads to quality planning and realization of the public sector budget of the Republic of Croatia.

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IMPACT OF CORPORATIVE SAFETY ON SUSTAINBILITY OF THE ORGANIZATION

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Abstract: *Organizational sustainability is a term that is often associated exclusively with the environment and the negative impact that the organization has on the environment. However, one of the challenges that the organization faces are the threats that affect the organization from the environment and can disrupt its sustainability in the long run. To reduce the negative impact that threatens the organization from the internal environment, the organization can develop a corporate security system that addresses risks related to the environment, safety and employee protection, etc. In other words, corporate security can affect the sustainability of the organization. The aim of the paper is to show how corporate security can affect the sustainability of the organization and point out the need to create and design a new standard that will become a certification standard based on which the organization will be able to prove its sustainability. Also, the aim of this paper is to show how it is necessary to approach the development of an integrated model of security and protection, i.e. an integrated approach to corporate security.*

Keywords: *sustainbility, corporative seafty, competitive advantage;*

JEL Classification*: L20*

1. INTERDUCTION

Sustainability can be defined as the ability of the future generation to satisfy economic, social, and ecological needs. In other words, future generation must satisfy all needs in the same way as the current generation do.[4] When it comes to organizational sustainability, sustainability can be seen as the ability of an organization to respond to stakeholder requirements related to environmental, social, and economic issues. Ensuring sustainability and reducing the negative impact on the social, economic, and ecological component is imperative associated with the development of corporate

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security. The main reason for this is the consideration of corporate security through the aspect of environmental protection, protection of life and health of employees as well as the protection of the organization as a system.[5] Through corporate safety and security, an organization can, directly and indirectly, affect business sustainability.[6] An organization that recognizes the importance of sustainability and also safety and security of the organization is ISO organization that develop a different kind of norms for managing systems in the organization like environmental management system that addresses environmental issues, information management system that addresses issues related to the unauthorized access to the data in the organization, etc. So, all mentioned norms can be related to corporate safety and security. Besides, the United Nations defines health as one of the components of sustainability through the defined 17 goals of sustainable development, which can be directly related to corporate security, i.e. security and protection of employees, and their health. In other words, an insufficient level of employee security can endanger employee health.[7]

This paper aims to show how corporate security can affect the sustainable operation of the organization and show how corporate security can be the basis for quality management but also a result of quality management of the organization. The results of the research can be used as a basis for reflection and development of future concepts related to corporate security.

2. IMPORTANCE OF CORPORATIVE SEAFTY AND SECURITY

Corporate security can be defined as a systematic approach to protecting the person, property, and business.[8] Within itself, corporate security contains several functions, i.e. activities that are regulated by international norms. In other words, corporate security combines employee safety and health, environmental protection, information protection, business continuity, and other activities.[9] If corporate security is viewed from the aspect of quality management of the organization, corporate security can be associated with risk and risk-based approach, which is the basis of the quality management system ISO 9001: 2015 since risk identification is one of the bases that organization management should consider when decision making and organization management. Insufficient risk identification and analysis can result in critical and dangerous risks that can jeopardize the organization's business, i.e. its business continuity, employee safety, and health can result in a negative impact of the organization on the environment, etc. Therefore, for quality management, it is necessary to analyze risks. and risks can also affect corporate security which can result in repercussions for the entire organization.

Corporate security should be approached in an integrated way, which implies the need to analyze the context of the workplace and analyze the risks associated with the work being analyzed. Based on the conducted analysis, the risk is evaluated, and measures aimed at reducing them are defined. However, an integrated approach to corporate security implies the need to implement a process approach since full integration can only be implemented through a process approach.[10] Likewise, a process approach is one of the more cost-effective approaches to integration as it avoids unnecessary compliance with management system requirements, provided the organization has a

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[7] Orzes, G., Moretto, A., Moro, M., Rossi, M., Sartor, M., Caniato, F., & Nassimbeni, G. (2020). The impact of the United Nations global compact on firm performance: A longitudinal analysis. International Journal of Production Economics, str. 107664.

[8] Beus, J., McCord, M., & Zohar, D. (2016). Workplace safety: A review and research synthesis. Organizational psychology review, str. 352-381.

[9] Bazan-Bulanda, A. (2019). Impact of occupational health and safety regulations on the employee's decision to take up employment. System Safety: Human-Technical Facility-Environment, str. 141-148.

[10] Buntak, K., Kovačić, M., & Micek, B. (2019). Integration of the management system using process approach of the organization,. vii international scientific conference "quality system condition for successful business and competitiveness" - proceedings, str. 63-72.

management system in place and ensures compliance only with those requirements that will reduce risk. On the other hand, the process approach is the basis of quality management of the organization, which is emphasized in the standard of quality management system ISO 9001: 2015. Through a process approach and the integration of corporate security in a systematic way, the risk of negative impact on the environment is reduced. On the other hand, corporate security in this context can be one of the foundations for ensuring business continuity and ensuring business continuity be the basis for the sustainability of the organization.

3. SOCIAL RESPONSIBILITY AND SUSTAINABILITY OF THE ORGANIZATION

Corporate social responsibility and corporate social responsibility are becoming one of the fundamental paradigms of business in the 21st century due to the growing challenges associated with environmental pollution and the need for a different view of scarce resources and ensuring that future generations have the same needs as current generations. In other words, organizations are beginning to adopt the principles of social responsibility since focusing solely on profit can lead to a decline in interest in the organization's products and services in the long run.[11] In addition, sustainability should be considered through the aspect of the possibility of achieving long-term business of the organization, since sustainability refers not only to the environmental component but also to the economic component. Thus, the management of the system on the principle of fiscal responsibility to ensure rational spending and management of available financial resources and to reduce the risk of undermining the economic viability of the organization in the long run. Business sustainability is of special importance for all organizations whose activities ensure the smooth running of social processes and can be linked to the imperative of ensuring business continuity.[12] Through ensuring business continuity, organizations develop procedures and mechanisms by which they seek to ensure their sustainability in business and to protect the system in the event of a threat. Also, ensuring business continuity is one of the components of corporate security as it addresses the procedures that will be activated if adverse events occur.

4. SEAFTY AS PART OF CORPORATE SOCIAL RESPONSIBILITY

Corporate security is also a component of socially responsible business, since socially responsible business is based on social responsibility as one of the components. Likewise, employee safety and health is one of the components of a social responsibility report. The increase in awareness of the importance of safety and protection of organizational employees is also visible from the research, ie analysis of reports on corporate social responsibility in which the number of reports reporting on safety and protection of employees in 2008 was 26% compared to 2012. a total of 36% of organizations reported on safety and security.[13] However, one of the problems encountered in the analysis of safety and protection as a component of the organization's social responsibility is the differently presented level of safety and protection in the report on social responsibility concerning the actual situation in the organization.[14] In other words, organizations can resort to presenting the situation in the safety management system and employee protection significantly differently in the social responsibility reports concerning the actual situation in the organization.

The link between corporate social responsibility and employee safety and security, ie corporate security in price, is based on the fact that corporate security can correlate with the security of the environment in which the organization is located. Thus, an insufficient level of corporate security

[11] Murray, K. a. (2019). The Necessary Paradigm Shift in Sustainable Business Practice. J. Mgmt. & Sustainability, str. 93.

[12] Miller, H. (2011). Integrating sustainability into business continuity planning. International Journal of Business Continuity and Risk Management, str. 219-232.

[13] Nagata, T., Nakata, A., Mori, K., Maruyama, T., Kawashita, F., & Nagata, M. (2012). Occupational safety and health aspects of corporate social responsibility reporting in Japan from 2004 to 2012. BMC public health, str. 1-11.

[14] Ruiz-Frutos, C., Pinos-Mora, P., Ortega-Moreno, M., & Gómez-Salgado, J. (2019). Do companies that claim to be socially responsible adequately manage occupational safety and health? Safety Science, str. 114-121.

can result in the risk of adverse events such as injuries at work that could impair the quality of life of employees, the release of hazardous substances, the possibility of insufficiently defined and designed corporate security to jeopardize the continuity of the organization. disrupt the normal course of social processes concerning the interruption in the activities of the organization. Given this, safety is becoming one of the foundations of socially responsible business.

5. CORPORATIVE SEAFTY AS FUNDATION FOR ORGANIZATIONAL SUSTANBILITY

Corporate security contains several components, and some of the most important components are environmental protection, protection of employee safety and health, as well as information security. Since the environmental component is one of the basic components of sustainability, defining measures that will be aimed at reducing the negative impact on the environment becomes imperative for any organization whose core business can cause damage to the environment, such as medical devices, petroleum industry, chemical industry, etc. On the other hand, since corporate security also applies to employee security and protection which is a social component of sustainability, ensuring a safe working environment for all employees is imperative.

However, a particularly sensitive area for the organization is information security, which refers not only to the protection of information that is documented in the organization but also to information that is stored in digital form. Access to such information by third parties may result in the risk of violating the trade secret organization, ie from leaking information related to the customer to third parties, which may endanger the privacy of the customer or user of the service. Such a risk can significantly jeopardize the viability of the organization as access to information classified as confidential may result in economic unsustainability.

Since risk is one of the factors that can significantly jeopardize corporate security as well as all components of corporate security, it is necessary to identify and analyze all risks that may jeopardize corporate security, and thus directly the sustainability of the organization.[15] Furthermore, when it comes to risks and minimum requirements that an organization must meet in terms of corporate security, the Legislator through several legal regulations such as the Environmental Protection Act (NN 80/13, 153/13, 78/15, 12/18, 118 / 18), the Occupational Safety and Health Act (NN 71/14, 118/14, 154/14, 94/18, 96/18) as well as several Ordinances such as the Ordinance on the preparation of risk assessments (NN 112/14 and 129/19) defines the basic conditions that an organization must meet in terms of security to operate in the territory of the Republic of Croatia. However, ensuring compliance with legal regulations alone may be insufficient as organizations are market-oriented and driven by efforts to ensure greater competitiveness by implementing and certifying various management systems such as employee health and safety management system, environmental management system, information security management system, etc.

However, the implementation of different management systems presents the challenge of increasing the complexity of the system as well as the management of the organization itself. Likewise, one of the challenges that may arise is the need for optimization since meeting all the requirements of all management systems will not result in maximum security. One of the models that can be used is the integration model using a process approach.[16] Also, it should be emphasized that corporate security through the aspect of sustainability should not be seen only through the perspective of the negative impact of the organization on the environment but should also be seen through the aspect of the possible negative impact of organizational employees in the workplace on sustainability as organizational employees can also be seen as a threat to the viability of the organization, and in

[15] WORK, W. (2012). Risk assessment: A neglected tool for health, safety, and environment management. Indian journal of occupational and environmental medicine, str. 57.

[16] Buntak, K., Kovačić, M., & Micek, B. (2019). Integration of the management system using process approach of the organization,. vii international scientific conference "quality system condition for successful business and competitiveness" - proceedings, str. 63-72.

particular because of the risk associated with the possibility of their maliciousness. Furthermore, in addition to the external environment, the organization should focus on the internal environment and the possible negative impact that the organization as such has on its employees. The negative impact of the organization on employees can disrupt the social component of sustainability, and in the long run can result in the risk of employee dissatisfaction, which can be reflected in the appearance of malice, self-organization of organizational employees into groups.

Through corporate security, an organization can reduce risks and address existing risks to reduce them, i.e. to develop procedures that will increase the organization's resilience to the threat to sustainability. Sustainability should not be seen solely through the impact on the environmental component as well as through the prism of the unilateral impact of the organization on the external environment but should also consider the possible impact of the internal environment on the organization and its sustainability. Therefore, the sustainability of the organization should be seen through a systematic approach and the analysis of the relationship organization - external and internal environment - the organization. Only a systematic and risk-based approach, as emphasized in the quality management system standard, can ensure organizational sustainability.

One of the bases for ensuring the sustainability of the organization and corporate security is the quality management system, ie the ISO 9001: 2015 standard as well as the ISO 9004: 2018 standard which emphasizes the sustainability and sustainable management of the organization. However, to ensure sustainability, it is necessary to consider the quality management system as a foundation on which to build an integrated management system, and an integrated management system can be the basis not only to increase the competitiveness of the organization but also to increase the sustainability of the organization.

6. CONCLUSION

The sustainability of the organization becomes imperative given the growing demands related to the protection of organizational environments from the negative impact of the organization. However, in addition to the negative impact of the organization on the environment, there is also the risk of a negative impact of the organizational environment on the organization, which can also impair the sustainability of the organization. Therefore, the sustainability of the organization should be seen through the economic, social and environmental component, but also on the other hand understood as the ability of the organization to exist in the market in the long run. With this in mind, an organization can reduce the possible negative impact of forces from organizational environments by defining business continuity plans that define how the organization will act if a threat arises.[17] On the other hand, it is necessary to change the paradigm of corporate security so that corporate security begins to be seen through the aspect of the possible negative impact that employees may have on the organization, and not only through the aspect of the negative impact of the organization on employees.

Furthermore, the basis for ensuring corporate security is a quality management system. A quality management system can be the basis for implementing the integration of management systems that directly and indirectly determine corporate security. Likewise, a quality management system can be the basis for creating a corporate security system as well as a system that will be sustainable, but the re-certification of the organization should be based on a standard that will assess the sustainability of the organization and assess the organization against the system's readiness to meet sustainability requirements.

Corporate security, along with the quality management system, is the basis for ensuring business sustainability, ie the ability for the organization to minimize all risks associated with impaired sustainability. Also, sustainability must be viewed through a much broader aspect, i.e. through the

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ability of the organization to operate in the long run and to have developed mechanisms by which to cancel or reduce the negative impact of risk on its business.

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АСОЦИЈАЦИЈА ЗА КВАЛИТЕТ И СТАНДАРДИЗАЦИЈУ СРБИЈЕ
23. nacionalni i 9. međunarodni naučno stručni skup
SISTEM KVALITETA USLOV ZA USPEŠNO POSLOVANJE I KONKURENTNOST
Kopaonik, Kraljevi Čardaci, 26.05 - 28.05. 2021

TECHNOLOGICAL CHANGES IN THE PRODUCTION PROCESS AS A PREPARATION FOR INDUSTRY 4.0: EXAMPLE OF PPT HYDRAULICS TRSTENIK (SERBIA)

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Abstract: *Companies that want to remain competitive in the global world market must go through the transformation of all production segments. This includes both product design and the complete technological process. Modern production, today, cannot be imagined without digital transformation, in order for it to become a part of Industry 4.0. However, it makes no sense to digitize outdated and inefficient production processes. That is why, using the experience of successful companies, all methods are applied that should eliminate all the long-standing inherited problems. Such an approach raises the productivity and efficiency of processes that are then digitized. The result is a more productive and financially successful company. The term "Industry 4.0" is an organization whose technology-based production processes and devices communicate with each other autonomously, creating virtual computing environments. The emphasis is on innovation, which is used using the latest technologies, which significantly increases productivity, competitiveness, which is a market advantage over other industries. The first five-year-old from Trstenik, once a well-known manufacturer of hydraulic devices and systems, shares the fate of the Serbian machine industry. In recent years, everything seems to be employing production capacities and at the same time modernizing production by purchasing modern CNC machines. In addition, both the development of new products and the redesign of existing ones are trying to catch up with competing manufacturers. As gear pumps have a significant application in solving various operating requirements, in this paper the authors will show that despite all the problems, PP Hidraulika a.d. can produce a competitive product both in price and performance. This analysis will be supported by the analysis of the design and production characteristics of the high-pressure gear pump, from the typical production group ZPB.*

Keywords: *Globalization, market, product design, industry 4.0, gear pump.*

JEL Classification*: Q55, L52*

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1. INTRODUCTION

Globalization and competition in the market, flexibility, productivity, efficiency, increasing profits, reducing costs are terms that can be heard every day from people who work in any production activity[4] [5]. This points to the fact that the times when business entities created business conditions are over and now it is the customer who sets his own conditions and imposes rules. For that, we can use the example of Prva petoletka from Trstenik, once a well-known manufacturer of hydraulic components and systems both in the former Yugoslavia and outside the borders of our country. It should be noted that in the 80s of the last century, it was a real example of a successful company, by all standards. Confirmation of this claim are the opinions of foreign partners and their affirmation that technologically it does not lag behind the then industrialized economies of Western countries[6]. As Petoletka, at that time, was license dependent from the German industry, that was the claim of their managers as well. However, what is expected from the company is that these requirements are met as soon as possible and with a high degree of quality of both products and related services. It goes without saying that the buyer is ready to pay for all that. Nevertheless, there is a huge amount of competition on the market, so that in addition to meeting these conditions, companies are under pressure to meet customer requirements at a very high level and, more importantly, better than the competition[7] [8] [9] . In order to achieve all this, there must be an extremely well-organized system that works flawlessly and resists, i.e., adapts to all changes that occur in the environment at an extraordinary speed and constantly works to improve its business while reducing costs[10]. This means that companies must constantly improve their production, organizational and management structures, introduce innovations, improve technology, but also invest in training their employees to be able to keep up with these changes and adequately respond to new tasks and challenges[11] [12] [13]. In this paper, the authors will give a picture of the current situation in PPT Hidraulika SC analysis of evident problems in all production segments (from development to production). On the example of the production of a gear pump for high pressures, the authors will show that even in such conditions, a quality product can be produced, which in terms of technical characteristics does not lag behind the known manufacturers of the same.

2. BASIC ASSUMPTIONS OF MODERN PRODUCTION

It is well known that product design as well as the technological process itself have a great influence on the production cycle, production time, production costs, delivery times and, generally speaking, on the competitiveness of the production company[14] [15]. However, a well-defined

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[15] Ibid [13]

technological process plan has a direct impact on productivity, efficiency and quality. In order to shorten the time of product design, design of technological processes, it is necessary to introduce appropriate computer-supported applications. The technology, which includes the use of computer systems for CAD geometry analysis and simulation, makes it possible to observe how the product will behave, so that the model can be redefined and optimized. Thanks to the available programs, it is possible to perform the following for cutting technology and machining systems:

- Static analysis (structure, mass, moment of inertia),
- Dynamic analysis (linear and nonlinear),
- Finite element method (FEM) analysis - optimization of the structure in accordance with the set goal function.

There is a large number of connections between the CAD/CAM systems so that the CAD system provides product and construction information and this is the input for the CAM system (Fig. 1). The connection between CAD and CAM systems can be realized in several ways.

1. The first way is to make connections between CAD and CAM systems using documentation,
2. The second way is to connect the CAD/CAM system with a permanent connection via the appropriate interfaces and
3. The third way is by integrating CAD/CAM systems through a database.

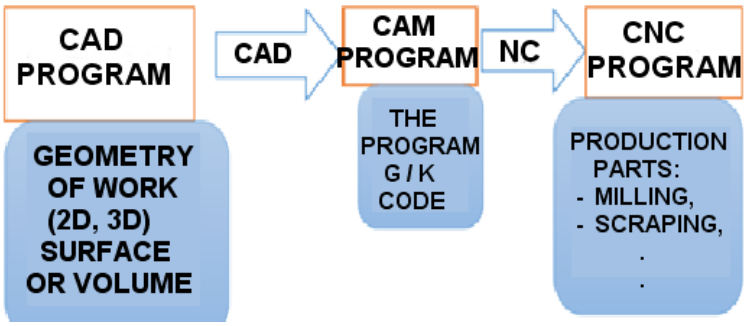

Figure 1. Connection between CAD/CAM systems

CAD (Computer **A**ided **D**esign) is the use of computer programs to help create, modify, analyze and optimize designs. CAD programs are used in the design or improvement of product design from design to documentation. CAD programs support the design process in creating a geometric presentation of what is being constructed, sizing and tolerances, managing design changes, archiving and exchanging information about parts and assemblies. Computer-aided design (CAD) systems are also used in the development, modification, analysis and application of optimization design methods. This means, at all stages of project development, implementation and monitoring.

These systems have been evolving since the 1960s and have experienced a major expansion with the advent of personal computers. From then until today, CAD systems are constantly evolving and contributing to the automation of the design process. The benefits of using a CAD system are multiple: it increases the productivity of design, improves the quality of designed parts and accuracy, enables easier changes to models, as well as their exchange in electronic form, etc.

Possible problems and impacts for the use of CAD systems are (Fig. 2):

- The need for additional training for employees;
- Purchase price;
- Heterogeneity of development platforms, and
- The issue of compatibility of software versions and platforms, etc.

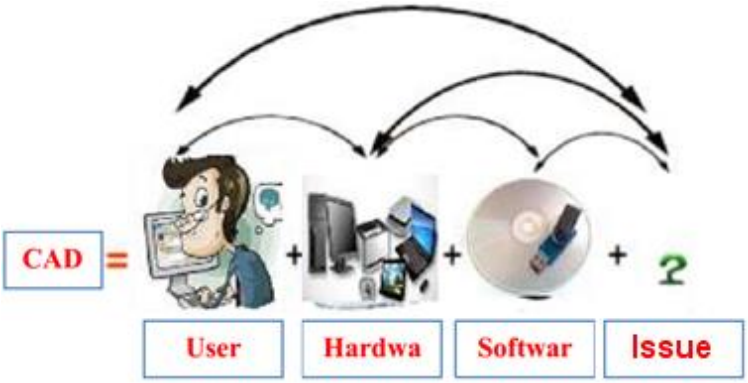

Figure 2. Display of connections within the CAD system

CAM systems are software tools that support the intensive use of computers for planning and design of production and technological processes, operations and management of production, or production processes. CAM systems in automation of design and product development are an important factor, because they establish a connection between CAD models and numerically controlled machines (NCMT). The basic functions of the CAM system are related to the planning of production - technological processes, the connections of which are shown in Fig. 3. Among them are characteristic commands:

- ✓ generation of semi-finished products,
- ✓ generation and optimization of tool paths,
- ✓ creation and use of databases and catalogs of tool modes,
- ✓ budget of production time,
- ✓ generating NC programs,
- ✓ simulation and visualization of the production process,
- ✓ generation of production documentation,
- ✓ rapid prototyping "Rapid Prototyping",
- ✓ embedding and using the knowledge of "Knowledeware",
- ✓ management of production processes.

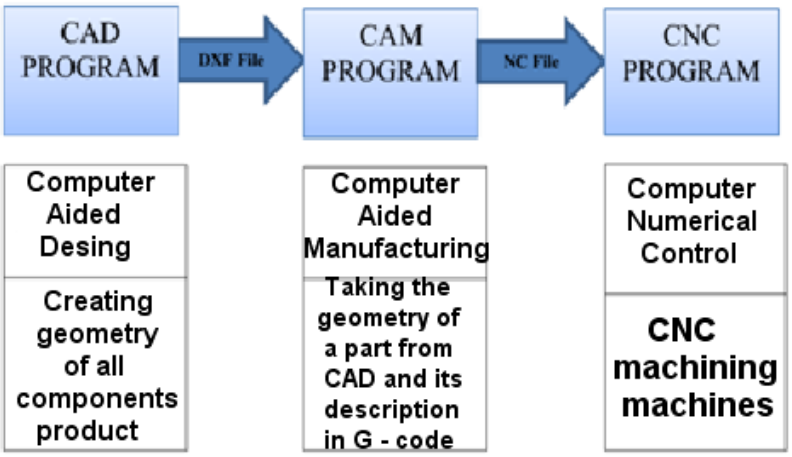

Figure 3. Display of connections within the CAM system

3. PRVA PETOLETKA THEN AND NOW

The program orientation of PPT Hidraulika SC, once a well-known manufacturer of hydraulic devices and systems outside the borders of our country, is the development, production and placement of devices for both mobile and stationary hydraulic systems. It satisfied various areas of application, all with the aim of mechanization and automation of machines, plants and processes[16]. In competitive conditions, the factory with its production program met and covered domestic needs,

[16] Ibid [6]

for all these areas of application, both assimilative and quantitative. By the end of the 1990s, PPT Hidraulika exported a significant part of its production to the West as well as to third world countries, so according to available data from 1987, PPT Holding achieved a total export of 117 million dollars,[17]. The events from that period influenced the loss of the acquired positions, which caused a structural and technological lag behind the producers of a similar production program. Production programs, then and now, are characterized by some indicators[18]:

- Large range of products with a tendency to expand and develop new product families;
- High frequency in quantities and product range, with the demand for new design solutions with, almost as a rule, short delivery times;
- Seriality is dictated by market requirements and, today in PPT Hidraulika, they range from 10 to 50.000 pcs/year.

All this raises some questions and seeks answers:

- Delivery prices imply satisfying the price of competition with the realization of a minimum profit!
- All this results in low accumulation and thus low personal incomes!
  - How to increase the seriality of products and thus provide a basis for installing a rational and modern organization of the production process, as well as the application of progressive methods of work and investing in the procurement of modern production equipment?
  - How to increase efficiency by adopting modern production systems and procedures and thus reduce production costs?
  - How to invest in research and development of modern solutions of hydraulic components since political and economic circumstances have caused the loss of, once, acquired positions in the domestic and foreign markets.

The experience of developed economies shows that every company must invest in new technologies and production management programs in order to survive in the market and be competitive. For these reasons, it is necessary to choose a technological system and technologies that ensure high reliability and minimal costs (Fig. 4).

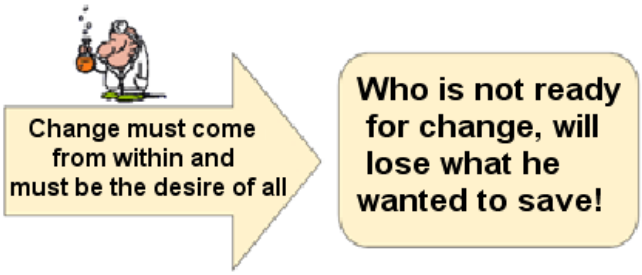

Figure 4. Pictorial presentation of the consequences of not understanding internal changes today

In order to increase productivity and efficiency, companies can choose a strategy of continuous improvement through the elimination of losses. An efficient production process, together with a quality control system, guarantees the delivery of products on time and the satisfaction of all customer requirements. The placement of jobs in the plant is very important for the course of any production. It involves simply transporting from one workplace to another. The goal is to achieve such an arrangement that the total length of the product, through the production process, is as short as possible. This means that the given numerical quantity of parts should be transported by optimal transport routes. Scheduling work orders answers the question of how to allocate limited resources over a period of time in the most efficient way, respecting delivery deadlines, and on the other hand taking into account the optimization of technological systems, labor, materials and other resources. Figure 5 shows the losses, characteristic of most of our production companies, where PPT Hidraulika SC is an indicator of such a situation.

[17] Ibid 6
[18] Ibid

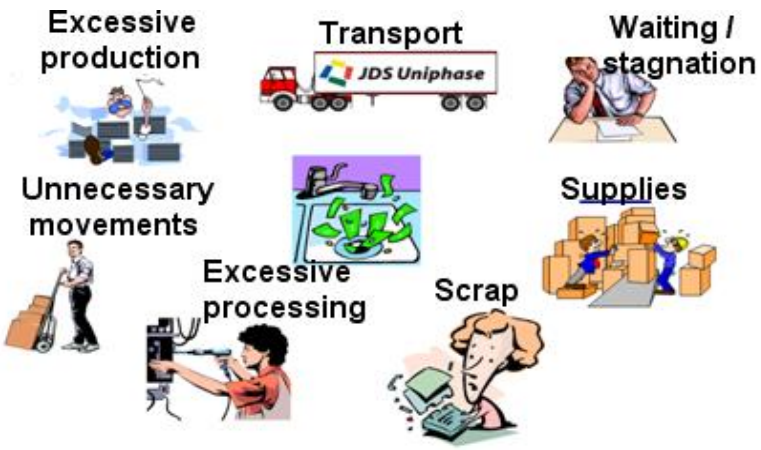

Figure 5. Seven types of losses

On the example of the production of gear pumps for high pressures, deliveries for well-known manufacturers from the west, a different approach to organizing the complete production process and all its segments is proposed. The paper gives a critical review of the current situation and gives a proposal for reducing production costs and thus achieving possible profits. Significant investments are proposed in the redesign of the technical system, which is used for the production of all its vital parts as well as for the assembly, the final stage in the production of each product.

The proposed change of the technological system is based on the principles of linear (resource-saving) production. Literature data show that many companies, today, are trying to achieve linear production by abandoning the concept of mass production and all in order, [19]:

1. Quality improvements,
2. Elimination of production losses,
3. Reductions of the main production time and
4. Reductions in total production costs.

Through linear production, the prevention of possible losses is emphasized, such as:

- additional time,
- workforce or
- consumed materials paid by the customer that do not contribute to increasing the value of the product.

In order to avoid them, it is necessary to approach the changes as stated above, i.e., for the introduction of Industry "4", whose approach and necessary conditions, on the example of the assembly line, are shown in Fig. 6 [20] [21] [22]. As a continuation of this phase in Fig. 7 shows the approach for Industry 4.0[23] [24] [25] [26] [27].

[19] Ibid [11-15]
[20] Ibid [9]
[21] Ibid [11]
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[26] Koleva, N.: Industry 4.0's opportunities and challenges for production engineering and managemnet. International Scientific Journal "Innovations", Vol. 6, Issue 1 (2018), pp. 17–18. ISSN 1314-8907
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Figure 6. Conditions and layout of the assembly line for industry 3.0

Figure 7. Required conditions and layout of the assembly line for industry 4.0

At the end of last year, PPT Hidraulika SC invested significant financial resources in the procurement of new software production machines (lathes and machining centers):

- Vertical machining center CMX 600 V (DMG) (3 pcs),
- Vertical machining center CMX 1100 V (DMG) (1 pc),
- CNC lathe CLX 550 (1 pc),
- CNC lathe CLX 350 V1 (1 pc),
- CNC lathe CLX 350 V3 (1 pc),
- SPRINT 20/5 Automata (2 pcs).

Figure 8 shows an example of the operation of the machining center CMX 600V, when making a gear pump cover (from the ZPB group) and Figure 9 shows the drilling operation (in the clamping tool) of the cover, and the appearance of the machine workplace (radial drill) on which they have been made so far.

Since the newly purchased machines are in the phase of inclusion in production, the effects of their application can already be seen. Only on the production of the rear cover of the gear pump, the savings in the production time are greater than 50%, and significantly better quality of the sealing surfaces is achieved, as well as the accuracy of all installation measures, Fig. 8. Their significant inclusion in the serial production of other parts of gear pumps should give even more significant time savings and improvement of the quality of processing expressed by the parameters of roughness as well as the accuracy of measurements.

Fig. 8 Demonstration of CMX 600 V machining center operation (when machining gear pump cover)

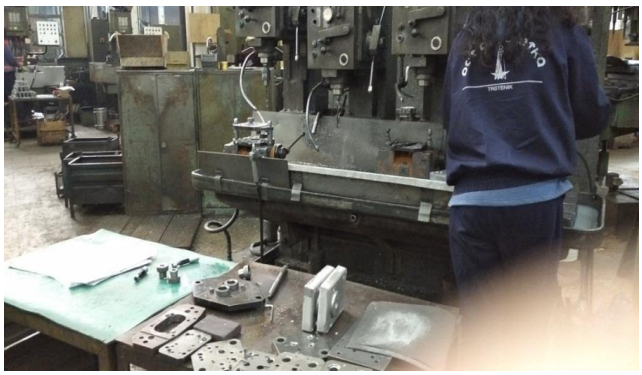

Figure 9. Appearance of the workplace where the drilling operation of the gear pump cover is performed

Hydraulic gear pumps, as mentioned above, are characterized by a relatively simple construction, and for that reason, they are among the devices that are most commonly found in hydraulic systems. They are characterized by a small number of parts, which allows to obtain a relatively reliable source of hydraulic energy (power) for a relatively small price. The flow is achieved by forced rotation of the drive gear, which is in conjunction with the driven one, thus it is possible to suck the working fluid, which, through a system with extremely narrow mechanical gaps, between the gear tooth tips and the pump housing, is pushed towards the discharge point. Thanks to that, they are used in a significantly large number of application examples. Figure 10 shows the design characteristics of gear pumps and Figure 11 shows the advantages of their application, which only shows the reasons for their significant application in hydraulic systems[28 29 30 31 32].

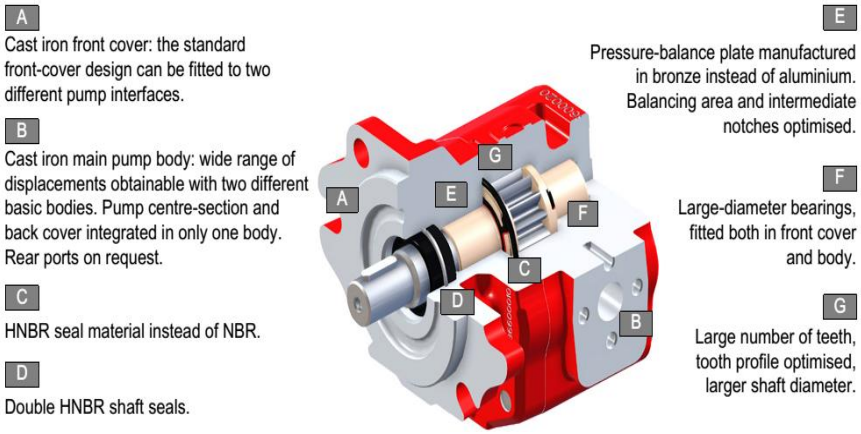

Fig. 10 Design characteristics of gear pumps

[28] PP Hidraulika (2020); Gear pumps ZPB (Prospectus documentation)

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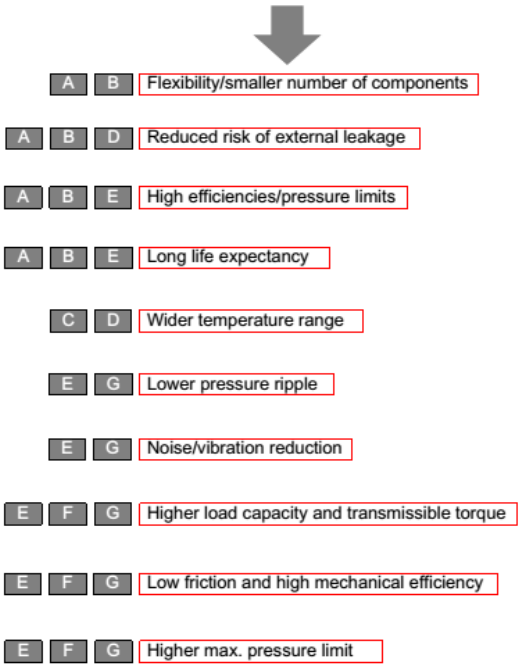

Figure 11. Comparative advantages of gear pumps

According to the CAGR, the global market for hydraulic gear pumps is expected to grow annually by ~4%, [33]. In addition, the need for infrastructural works, worldwide, increased interest in the use of renewable energy as well as the growing demand for energy efficient solutions[34] [35], to meet strict state regulations for environmental protection worldwide, is expected to significantly to influence the market of hydraulic gear pumps (Fig. 12)[36]. Increased use of construction equipment for operations such as excavation, earthworks and material handling, together with the growth of the automotive industry increases the demand for hydraulic gear pumps, as they are increasingly used in mobile machines and cars, trucks and other vehicles as a mechanism for energy production.However, the relatively high cost of manufacturing a gear pump is expected to hamper their market growth over the forecast period, so a reduction in the selling price must be significantly influenced. For this reason, due to competitiveness, all production costs must be reduced to the optimal value.

[33] Živković, M.; Nikolić, R. & Mihajlović, G.: Cirkularna ekonomija na primeru proizvodnje zupčastih pumpi. In: Scientific Conference Book of Abstracts, Scientific Conference with International Participation "Circular Economy and Environmental Labelling"; Novi Sad; 29th January 2021. Novi Sad (Serbia): Faculty of Technical Sciences, 2021, pp. 16. ISBN 978-86-6022-311-3

[34] Ibid 9

[35] Ibid 28

[36] Hydraulic Gear Pump Market Size, Share, Growth | Report, 2023, ID: MRFR/AM/5304-HCR | February 2021 | Region: Global | 100 pp. Web page: http://www.marketresearchfuture.com

Figure 12. Global market for hydraulic gear pumps

Gear pumps, produced in PPT Hidraulika from Trstenik, are competitive with world-famous manufacturers in their characteristics [37] [38] [39]. This also applies to high-pressure pumps, which this famous factory has been producing for fifteen years. Table T 1 gives the basic technical characteristics for the ZPB pump family[40] [41]. It should be said that these are pumps that, according to their characteristics, achieve pressures of piston pumps (320 bar), and Figure 13 shows all its components (which are also made standard finished goods) [42] [43] [44].

Table 1. Technical characteristics of gear pumps from the ZPB group

Specific pump flow; q [cm^3/o]		4,00	5,50	8,00	11,00	14,00	16,00	19,00	22,5
Pump speed; n [o/min]		1500							
Pressure [bar-a]	Nominal	280						250	
	Maximum	320						280	
Theoretical flow of the pump $Q = q \cdot n \cdot 10^{-3}$ [l/min]		6,00	8,25	12,0	16,5	21,0	24,0	28,5	33,75
The power of the pump; $P = \frac{p \cdot Q}{600}$ [kW]	Nominal	2,8	3,85	5,6	7,7	9,8	11,2	11,875	14,10
	Maximum	3,2	4,4	6,67	8,8	11,2	12,8	13,3	15,75
Pump weight [kg]		2,8	2,8	2,9	3,0	3,2	3,4	3,6	3,8
Weight relationship; $\eta = \frac{m}{P}$ [g/kW]	Nominal	1,0	0,73	0,52	0,39	0,33	0,30	0,30	0,27
	Maximum	0,875	0,64	0,435	0,34	0,286	0,27	0,27	0,24

Otherwise, gear pumps have been produced in Trstenik for more than 65 years. The standard sizes of gear pumps meet the standard order of specific flows and their dimensions are defined according to the pressure of 200 (250) bar in six groups. This means that for the same group, the dimensions of the housing and the gears are of the same dimensions. The designers of the hydraulic system according to the installation conditions (groove of the drive gear and the shape of the front cover) make their choice. Their delivery is conditioned, according to the specific flow, by the choice of the shape of the connection opening (suction and thrust) as well as its place, it is possible for them to be on the back cover as well. This only shows how much it is possible, for the same cubic capacity, to form variant solutions, which indicates their universality in application.

[37] Ibid 28
[38] Ibid 30
[39] Ibid 34
[40] Ibid 30
[41] Ibid 31
[42] Ibid 27
[43] Ibid 30
[44] Ibid 31

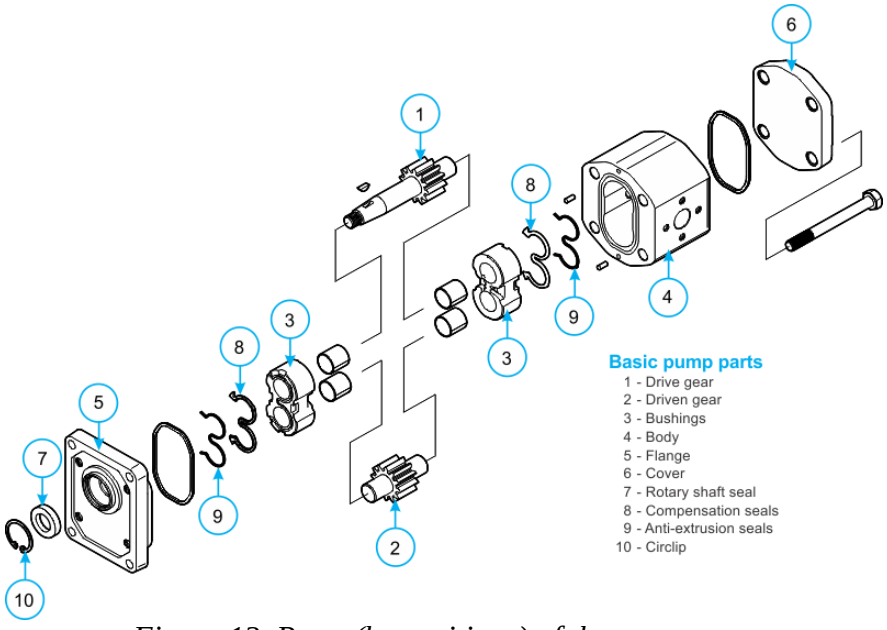

Figure 13. Parts (by positions) of the gear pump

As the circular economy has been talked about more and more in recent years, an analysis of their manufacturability has been performed, comparing the total weight of the raw material and the weight of the finished pump, for the whole family. The conducted analysis is given in the form of Table 2, which is shown in Figure 14[45 46 47].

Table 2 Comparative overview of the relationship between the weights of the finished pumps and the weight of the starting material

PUMP	DRIVE GEAR WHEEL		DRIVEN GEAR		HOUSING		FRONT COVER		BACK COVER		BED SLEEVE		STANDARD	DEVICE		MATERIAL USAGE
	Gp (kg)	Gg (kg)	Gp (kg)	Gg (kg)	Gp (kg)	Gg (kg)	Gp (kg)	Gg (kg)	Gp (kg)	Gg (kg)	Gp (kg)	Gg (kg)	kg	Gp (kg)	Gg (kg)	%
ZPB F5,5…	0,6	0,2	0,5	0,1	0,8	0,6	1,2	1,0	0,8	0,7	0,3	0,2	0,1	4,2	2,9	68,80
ZPB F8...	0,7	0,3	0,6	0,2	0,8	0,7	1,2	1,0	0,9	0,7	0,3	0,2	0,1	4,4	3,1	70,11
ZPB F11...	0,7	0,4	0,6	0,2	0,8	0,7	1,2	1,0	0,9	0,7	0,3	0,2	0,1	4,4	3,2	72,12
ZPB F14...	1,0	0,3	0,7	0,2	0,9	0,7	1,2	1,0	0,8	0,7	0,3	0,2	0,1	4,8	3,2	66,46
ZPB F16...	1,1	0,4	0,7	0,3	0,9	0,8	1,2	1,0	0,9	0,7	0,3	0,2	0,1	5,0	3,4	67,73
ZPB F19...	0,9	0,3	0,7	0,3	1,0	0,9	1,5	1,2	0,9	0,7	0,3	0,2	0,1	5,3	3,6	68,76
ZPB F22,5...	1,0	0,3	0,8	0,3	1,1	1,0	1,5	1,2	1,0	0,8	0,3	0,2	0,1	5,6	3,9	68,92

[45] Ibid 31

[46] Živković, M.; Dašić, P.; Radosavljević, M. & Anđelković, M.: Trend analysis of production and distribution of wing pumps: A case study of firm PPT-Trstenik (Serbia). Lecture Notes in Networks and Systems (LNNS), Vol. 128 (2020), pp. 730–740. ISSN 2367-3370 and ISBN 978-3-030-46816-3. doi: 10.1007/978-3-030-46817-0_83

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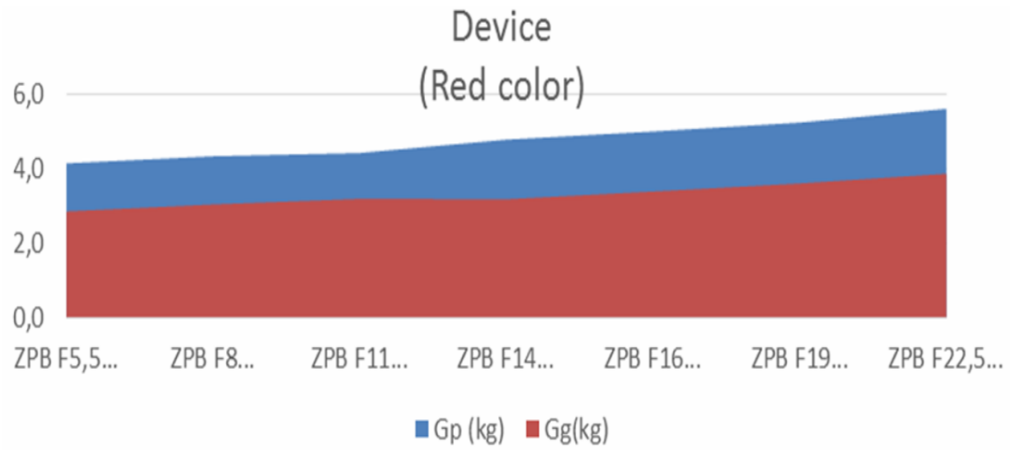

Figure 14. Comparative analysis of weight ratios (pumps from the ZPB group)

5. CONCLUSION

Industry 4.0 is no longer a term that is being talked about in the future, but it has come to life in many companies in the industrialized countries of the world. In order to achieve a successful level of implementation of Industry 4.0 in companies, it is necessary to meet certain prerequisites such as: networking and digital connectivity, skilled workforce, increasing Internet security, Lean management, etc.

The main goal of the paper was to highlight the main characteristics of Industry 4.0 with the conclusion that the connection to the Internet, i.e., networking of as many facilities in the company, and outside it, is the basis of everything. A new feature, which brings the so-called new industrial revolution will not replace humans, but some occupations, which are performed today by lower-skilled workers, will become less sought after because they will be replaced by robots. Nevertheless, the demand for a highly skilled workforce, such as engineers, is sure to grow. It is assumed that the number of employees will not decrease significantly for that reason. The biggest problem in Europe, and even in Serbia, in the future will be the lack of highly qualified workforce, especially IT professionals. Through the education reform and the adoption of the country's development strategy, Serbia has the opportunity to lay the foundations for the implementation of new industrial concepts in the foreseeable future.

Thanks to the efforts of the employees of PPT Hidraulika in Trstenik, in recent years there seems to be an effort to catch up with the producers of a similar production program. Although the term Industry 4.0 is intended to suggest that this is a new industrial revolution, only in the future will it be possible to talk retrospectively about the events of today and how revolutionary the changes that are current in the industry today were.

Finally, it can be concluded that:

- In modern industrial production, which is a feature of Industry 4, attention should be paid to: organization, workforce (employees) and technology;
- This process must be permanent and supported by all employees;
- Regarding the production of gear pumps, new investments in new production machines as well as in modern measuring and control equipment should be considered. Maximum work should be done to reduce waste material (reduce processing additives), which means that we should think about making gears (primarily) from forgings (better mechanical characteristics, reduced production time and less weight of the starting material). This also applies to the front rear cover of gear pumps. Further, it requires a reliable subcontractor, who can and must meet the required requirements of the customer.

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CREATING VALUE BASED ON RELATIONSHIP MANAGEMENT IN THE ORGANIZATION

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Abstract: *The principle of relationship management stands out as one of the seven basic principles of quality management. Relationship management is based on identifying stakeholders and analyzing stakeholders based on which organizations defines a management model. In addition to all stakeholders in the business environment, it is important to consider those from the general environment such as state, city or municipality. One of the fundamental benefits of relationship management is creating value for the organization. The organization shares knowledge, resources and competencies with its stakeholders in order to create shared value. Once created, shared value is the foundation for creating a sustainable business model, which results in the creation of economic, environmental and social value, both for the organization and for stakeholders. The paper proposes a model for creating stakeholder values based on relationship management and all the above principles.*

Keywords: *Relationship management, stakeholders, value, shared value, sustainable business model*

JEL Classification*: A13 Relation of Economics to Social Values*

1. INTRODUCTION

Organizations operate in a very changing environment, where the external environment is of great importance, which constantly places various demands on the organization, and to which the organization itself must adapt. Within the external environment, specifically the business environment, there are a number of stakeholders who influence or are affected by the organization. The former view of the organization and its business puts the customer with its requirements and needs at the center, but the requirements for organizations come not only from customers, but also from other stakeholders who are numerous.

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The principle of relationship management stands out as one of the seven basic principles of quality management. Relationship management is not just about managing customer relationships, but about managing relationships with all stakeholders who are in the organizational environment. In order for an organization to be able to manage relationships, it must first know which are the stakeholders it is influencing or which are making certain demands on the organization itself. Therefore, organizations must first identify stakeholders, after which they must identify their requirements, needs, expectations, and only then are they able to determine how to manage relationships with identified stakeholders. Relationship management is crucial for an organization because the organization's business depends on stakeholders such as customers, owners, suppliers, or employees.

For sustainable success of the organization, it is necessary to manage the relations with the interested parties. Accordingly, the aim of this paper is to describe and explain the importance of relationship management principles and to identify and describe relationship management in the context of value creation. Previous research has focused on research on customer relationship management, which is viewed through the prism of CRM (customer relationship management). This paper focuses on managing relationships with all identified stakeholders in the context of a quality management system.

This paper will describe the concept of stakeholders, as well as provide an overview of key stakeholders. Also, the principle of relationship management and its importance in quality management of the organization will be described in more detail. The paper will describe the interdependence of stakeholders and value creation in the organization.

2. THE PRINCIPLE OF RELATIONSHIP MANAGEMENT

Relationship management is one of the seven fundamental principles of a quality management system. According to Iso.org (2015) for the sustainable success of an organization it is necessary to manage relationships with stakeholders such as suppliers or partners. Stakeholders play a key role in the success of an organization. If an organization manages relationships with its stakeholders, in order to optimize their impact, it is more likely to achieve lasting success.

Iso.org (2015) highlights the following as key benefits of relationship management:

- Improved performance of the organization and its stakeholders by responding to opportunities and threats affecting each stakeholder,
- common understanding of goals and values among stakeholders,
- increased ability to create value for stakeholders by sharing resources and competencies and managing quality-related risks,
- a well-managed supply chain that ensures a stable flow of goods and services.

Furthermore, the key activities that organizations must carry out for the purpose of relationship management, as well as for the purpose of achieving these benefits, are:

- identification of stakeholders and their relationship to the organization,
- set priorities for relations with stakeholders,
- establish relationships that balance short-term gains with long-term considerations,
- exchange information and resources with relevant stakeholders,
- measure performance and provide performance feedback to stakeholders, for the purpose of improvement,
- establish collaborative improvement activities with stakeholders,
- identify and highlight the achievements and improvements of stakeholders such as partners and suppliers.

It is important to emphasize that the principle of relationship management is related to other principles of the quality management system, namely: customer focus, leadership, human involvement, process approach, improvement and fact-based decision making. The principle of customer focus refers to the recognition of the wishes and requirements of customers, as one of the stakeholders that is crucial

in the process of creating and delivering value. Unlike the principle of customer focus, the principle of relationship management emphasizes the importance of other stakeholders, along with customers, who are key to achieving the business success of the organization. To achieve these goals, leadership is crucial that aligns all available resources in order to achieve the defined goals of the organization. Through the principle of human involvement, emphasis is placed on all employees of the organization, who need to be involved in the decision-making process, as well as provide an opportunity for growth and development. From all the above, it is possible to conclude that stakeholders through several key principles are extremely important in achieving the goals of the organization and achieving sustainable success of the organization.

3. IDENTIFYING STAKEHOLDERS

To manage stakeholder relations, it is crucial to identify stakeholders. ISO 9001: 2015 defines the stakeholder, ie defines persons or groups of people interested in the business of the organization. The customer is one of the key stakeholders, and according to the process approach can be divided into internal customer and external customer.

Klochkov et al (2017) explain how the external customer buys and uses the products and shapes the technical specifications of the products, while the internal customer produces and sells the products, ie develops the production technology. The authors also emphasize that in practice there is a customer who is not able to express his opinion about the product directly to the manufacturer and his satisfaction and loyalty cannot be accurately assessed. The division of customers taking into account the so-called. "concealed customers" is shown in Figure 1.

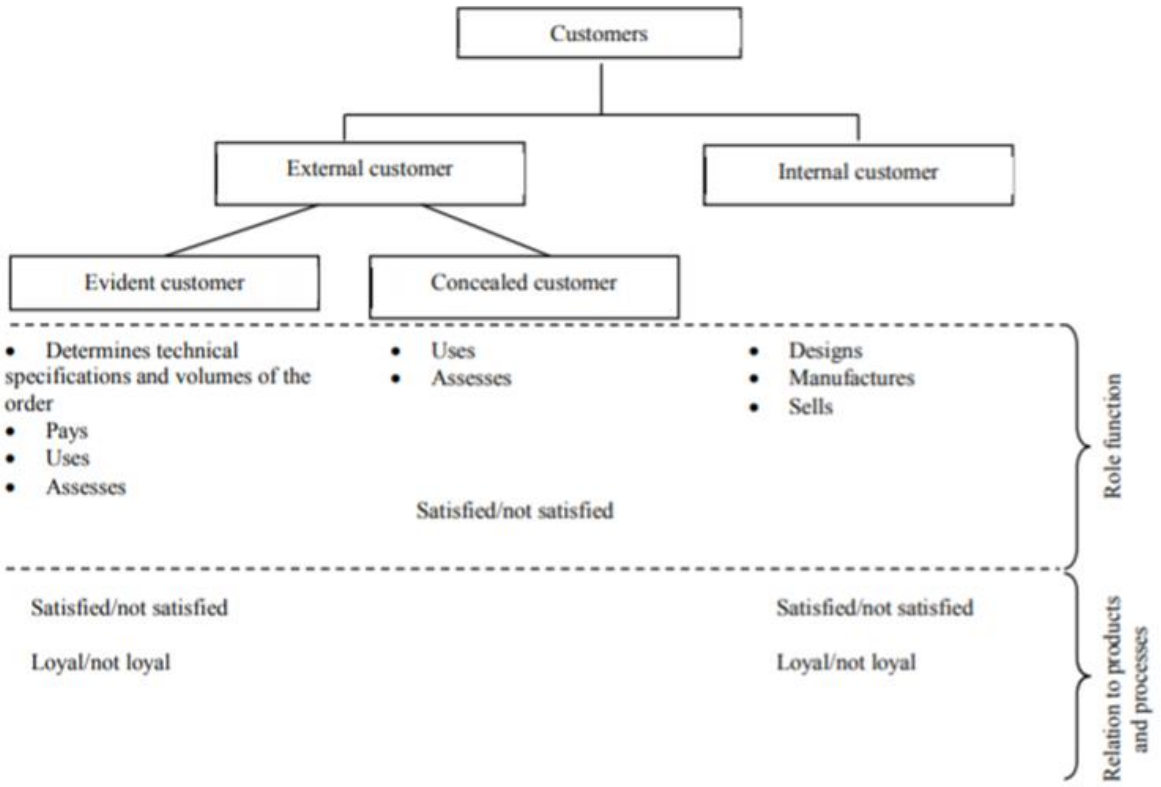

Figure 1 The difference between internal and external customers
Source: Klochkov et al. (2017) Development of external customer classification based on the analysis of interested parties. 2017 International Conference on Infocom Technologies and Unmanned Systems (Trends and Future Directions) (ICTUS). p.731

With the exception of the customer, in the context of relationship management, relationships with business partners and suppliers are crucial, as they are key links in the supply chain. Also, there are a number of other stakeholders located in the immediate environment of the organization, ie in the business environment. But in addition to all stakeholders in the business environment, it is important to consider those from the general environment. An overview of some of the key stakeholders and their requirements is presented in the following table.

Table 1 Requirements of interested parties

Interested parties	Requirements
Customers	- Product quality - Product price - Supply discipline - Product service
Owners, stakeholders, investors	- Positive profit dynamics - Return on investment - Increase in the organization's value - Increase in the market share
Personnel	- Increase in salaries - Promotion - Job satisfaction - Social employment guarantees
Suppliers and partners	- Mutually beneficial relations - Stability and increase in the book of orders
State	- Creation of additional work places - More payments to the budget and nonbudgetary funds
Region/Location of organization	- Environmental protection - Saving of energy and natural resources - Safety - Health care - Solution of social issues

Source: Adapted by the author according to Klochkov et al. (2017) Development of external customer classification based on the analysis of interested parties. 2017 International Conference on Infocom Technologies and Unmanned Systems (Trends and Future Directions) (ICTUS).

Identifying stakeholders is key to relationship management because it provides a foundation for analyzing all the actual demands and expectations that stakeholders have on the organization. In order for an organization to manage relationships with its stakeholders, it must identify specific stakeholders and their requirements. In this way, organizations can conduct an analysis and identify requirements that are equal or opposite. Based on such an analysis, organizations can optimize all requirements and find the best way to manage relationships with all identified stakeholders. In addition to stakeholders in the business environment, which are also shown in Table 1, namely customers, suppliers, owners, business partners, etc., it is very important to identify the requirements presented by the state, public administration, local or regional government in which the organization operates as well as the wider community.

Research conducted by Olkiewicz (2020) confirms the fact that organizations consider stakeholders and their role an important determinant of quality and that it is necessary to implement measures that will increase efficiency and effectiveness, related to limiting the impact of internal and external conditions on the organizational process, where the stated conditions arise from the interested parties.

4. CREATING STAKEHOLDER VALUE

Analyzing stakeholder relationships is a key step in the stakeholder value creation process. Stakeholders are involved in business processes, directly or indirectly, so it is necessary to analyze their impact and limit all negative impacts and encourage positive ones. Freudenreich et al. (2020) create a framework for stakeholder value creation that builds on stakeholder theory and emphasizes stakeholder relations as a key part. The proposed value creation framework is based on an analysis of the relationships of different stakeholders. A central element of the model is the common purpose for which stakeholders are involved in the business. The model also includes parts of stakeholder theory, which includes the value that is created in the individual relationship with the stakeholder and the way that value is created. This value creation framework distinguishes value creation activities by stakeholder groups and emphasizes the relationship in which stakeholders are recipients and co-creators of value. The flow of values is then two-way and moves from the organization to the stakeholder and from the stakeholder to the organizations. The total value created is then equal to the value created through the business model, which arises from interdependence in stakeholder relations.

Dembek et al (2018) emphasize that value is defined through numerous studies as a way of converting income into profit, but the authors emphasize that there are different types of values that are noticed by stakeholders. The authors believe that it is necessary to look at value creation through a broader prism and through the perspective of stakeholders. Building on research by Upward and Jones (2016), Dembek et al (2018) suggest that value creation and perception mechanisms are important for different stakeholders because they determine stakeholders view of sustainability of the business model. Sustainable business models must provide the organization with a foundation for creating and managing jointly created value and creating environmental, economic and socially positive values.

4.1.Stakeholder value creation model

The value creation process is focused on achieving a sustainable business model. Previous theories that viewed value creation through the creation of economic value are now equally focused on the creation of environmental, social and economic value. Windsor (2017) according to Porter and Kramer (2011) emphasizes how organizations redefine their purpose as creating shared value. In this context, the shared value refers to the generation of economic value, but at the same time the production of social value and ecological value.

Research conducted by Fiore et al. (2020) confirms the actual participation of stakeholders in the value creation process. The authors also believe that stakeholders participate in creating innovations that can create value for the organization and that these innovations are the result of the organization's relationship with all stakeholders, internal and external. Also, the authors believe that by managing relationships with stakeholders and creating shared value, it is possible to establish sustainable business systems.

According to all of the above, the following figure shows the Stakeholder value creation model.

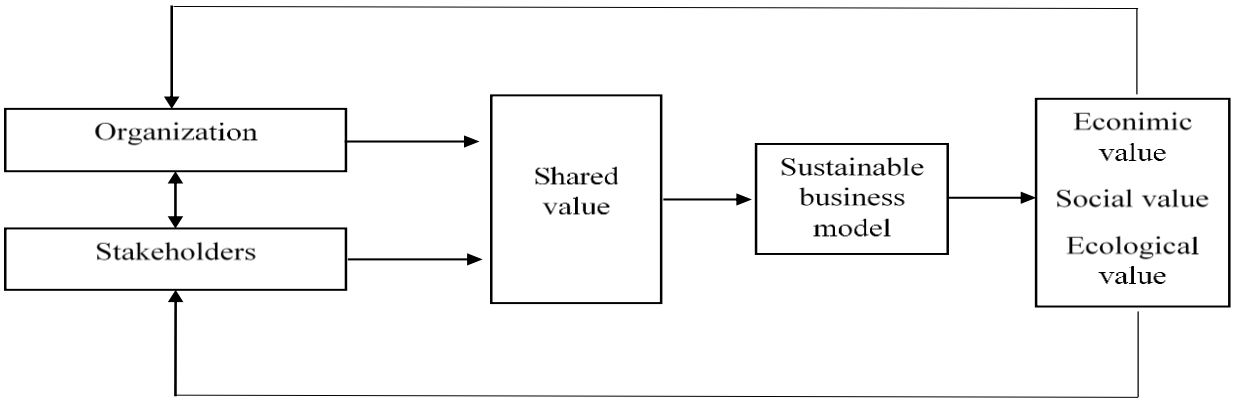

Figure 2 Stakeholder value creation model
Source: Author's work

The above model shown in Figure 2 begins with the interaction of the organization and its stakeholders. The organization must identify all stakeholders, analyze their requirements and expectations, but also communicate and identify the wishes of stakeholders in the context of expected value. Through stakeholder analysis, organizations can prioritize stakeholders and decide on the kind of communication they will conduct with stakeholders. Once established, the relationship between the organization and its stakeholders leads to the creation and definition of shared value. By identifying the shared value that both the organization and its stakeholders gain, they lead to a sustainable business model, which then brings economic, social and environmental value to the organization.

5. CONCLUSION

The paper presents the principle of relationship management within the quality management system and the importance of the principle itself in creating value in the organization. To create economic, environmental and social value in the organization, it is necessary to create a sustainable business model, which will be recognized by all stakeholders. A prerequisite for creating a sustainable business model is the creation of shared value of the organization and its stakeholders. Organizations in communication and analysis of their stakeholders can create a shared value that will then affect the competitiveness of the organization.

The research identified the importance of managing relationships with all stakeholders that are of great importance for the business of the organization. At the center of the value creation model is relationship management, because without forming a strong relationship with stakeholders, organizations are unable to be sustainable. The organization is affected by a number of stakeholders of different strengths and influences, so organizations must identify all stakeholders, as well as their strength and influence (positive or negative).

As stated by Iso.org (2015), relationship management increases the organization's ability to create value for stakeholders through the sharing of resources and competencies, but it is crucial to emphasize the importance of creating value with stakeholders and use the knowledge and competencies of stakeholders to create shared values. The emphasis of the value creation model is on the interdependence and collaboration of the organization and stakeholders.

The presented Stakeholder value creation model can be expanded through future research and elaborate in more detail on individual categories of stakeholders and their impact, as well as the concept of sustainability and the requirements presented through the mentioned concept.

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IMPLEMENTATION OF ISO / IEC 11801-1: 2017 STANDARD IN CONSTRUCTING INTERNAL AND EXTERNAL NETWORK INFRASTRUCTURE

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Abstract: *The development of information and communication technologies and their use in nearly every aspect of modern society has led to a progressive growth in the use of network services. To make the communication between the end nodes of the network continuous and efficient, it is essential to ensure functionality at all levels. It is generally acknowledged that data transmission between the end nodes of the network is performed via a transmission medium. The most prevailing transmission media are network and telecommunications cables, and the choice of the appropriate cable depends on a number of parameters, such as: binary flow, maximum length, protection against electrical and electromagnetic interference, signal attenuation per meter, price, ease of connection and many others. All the mentioned parameters are covered by the term structured cabling, which refers to the infrastructure that defines rules and methods for laying network and telecommunications cables. International standards, that define domestic standards and regulations, clearly specify all input subsystems in the structured cabling system. International standard ISO / IEC 11801-1: 2017, the latest version, states which cable systems are appropriate for a wide range of services, for data transmission of various formats, voice and video communication. This standard is developed for both home use and commercial and industrial networks.*

Keywords: *ISO / IEC 11801-1: 2017, computer networks, structured cabling*

1. INTRODUCTION

A computer network is a system of telecommunications data transmission that enables communication between several independent devices. In the last 20 years, with the rapid development of computer technology, improved performance, reduction of prices and the spread of the Internet, the number of computer network users has grown rapidly. Nowadays, computer networks have become an irreplaceable part of the business infrastructure in both large and small companies.

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Each computer network can be divided into two basic units: hardware and software. Both units have their role in ensuring a continuous and efficient data transfer at all levels of network communication. The hardware unit consists of physical connections, network nodes, and mutual shared resources. The software unit of a computer network consists of network protocols, an operating system that directly communicates with the computer system's hardware, and user network software.

The first step in building any computer network is structured cabling. Structured cabling refers to a set of rules and standards that regulate how passive network equipment is installed, including cables, sockets for workstations to which computers are connected, and switching points in rack cabinets. In addition to the rules for planning and installing passive network equipment, these standards also specify the minimum requirements that passive network equipment must meet during installation. Structured cabling is a very important step in building a computer network and in the implementation process special attention should be paid to this step. Errors and negligence frequently detected upon conducting installation tests, and not compliance with standards significantly prolong the implementation period and increase the cost of work. (*Kukec, M., 2007. Uvod u izgradnju računalne mreže za pristup internetu za male i srednje urede na sustavu otvorenog koda. Tehnički glasnik, 1(1-2), pp.59-62*).

Implementation of the passive part of a computer network in a company or a residence must be preceded by a very important decision-making process based on existing legal regulations in the field of investment construction, domestic standards and recommendations, relevant international standards and recommendations, and on-site situation. This paper brings attention to technical characteristics, description of components and construction of the passive part of a computer network, as well as technical conditions for the implementation of structured cabling prescribed by the international standard ISO / IEC 11801-1: 2017.

2. STRUCTURED CABLING STANDARDS

Over time, the telecommunications infrastructure in business facilities has become very complex. In the past, it consisted only of telephone lines, while today, in large business systems, it is impossible to imagine a workplace without a computer connected to other computer resources of the company. A well-implemented cable system infrastructure is crucial for achieving good-quality broadband telecommunications services. Technical solutions dealing with structured cabling must meet all prescribed standards and recommendations. International standards and recommendations related to the term structured cabling are usually reduced to three standards, originally prescribed in 1995:
ISO/IEC 11801, international standard;
EN 50173, European standard;
ANSI/TIA-568, American standard.

An important advantage of structured cabling is that a single cabling system is used for all installations that transmit any information. This includes not only the transmission of voice, image and control signals, but also very fast data transmission. Today, residential buildings also have an adequate connection infrastructure, which supports internal and external communication and ensures that any workstation or other device can access a connected device for information processing. It is common knowledge that improving efficiency and productivity in today’s work environment is crucial to successful business. Technology is on our side because it provides a way of working that saves time, space, money and strategically allocates resources for the benefit of the company. However, these technologies are changing every day, and the requirements for the company's network resources are increasing, so it is necessary to carefully consider ways to make optimal use of resources. The computer system must be flexible, adaptable to frequent changes and needs of a company, while meeting security standards for the purpose of protecting exchanged information. (*Dávila Andino, J., 2014. Design of a Structured Network Cabling Applying International Standards. Computer Science*).

2.1 ISO/IEC 11801 standard

The third edition of the ISO 11801 standard was published in November 2017. In terms of structured cabling, this was a very important event that brought major changes. The third edition of the ISO 11801 standard also brought a new document structure. Similar to standard EN 50173, this standard is divided into 6 parts relating to the following areas (ISO / IEC 11801-3: 2017):

- ISO/IEC 11801-1: General Requirements

Prescribe the structure, topology and distance, requirements for installation, performance and testing of general telecommunications cables.

- ISO/IEC 11801-2: Office
  - Specifies cabling requirements for business premises, which include one or more buildings on a single campus.
- ISO/IEC 11801-3: Industrial premises
  - Cabling of industrial buildings and the use of applications that include automation, process control and monitoring are specified.
- ISO/IEC 11801-4: Single-tenant homes
  - Refers to cabling at home, and refers to households with multiple buildings or a building with multiple apartments.
- ISO/IEC 11801-5: Data centres
  - Refers to cabling in the data center space and includes balanced cabling and fiber optic cables.
- ISO/IEC 11801-6: Distributed Building Services
  - Refers to a completely new standard that applies to all the above standards and which is specifically related to the concept of IoT (Internet of Things).

Basically, it can be said that the ISO / IEC 11801 standard specifies ways for generic indoor cabling, which can cover multiple rooms on a single campus. This standard is optimized for spaces with a maximum distance of 2000 meters.

3. NETWORK STRUCTURE

Structured cabling divides the entire infrastructure into control blocks and then integrates those blocks to create a high-performance network. In addition to investment protection, structured cabling also provides administrative and management capabilities. All cables that come from different workstations end, by passive cross-connection, in the central network room. Simple labeling and coloring mechanisms enable easy and quick identification of tasks (*Ricardo, A.F.F.E.R., 2018. Cabeamento Estrutrado: Da Teoria À Prática. Clube de Autores (managed)*).

The application of appropriate standards allows the architecture of the cable system to be changed without creating problems in further work, because structured cabling should be independent of the technology used. The functional elements of generic cabling are as follows (*ISO/IEC 11801-3:2017*):

- campus distributor (CD);
- campus backbone cable;
- building distributor (BD);
- building backbone cable;
- floor distributor (FD);
- horizontal cable;
- consolidation point (CP);
- consolidation point cable (CP cable);
- multi-user telecommunications outlet (MUTO);
- telecommunications outlet (TO).

Listed groups of functional elements are connected into one unit in order to form one cable system. The concept of structured cabling should enable that after the installation of cables, if the need arises,

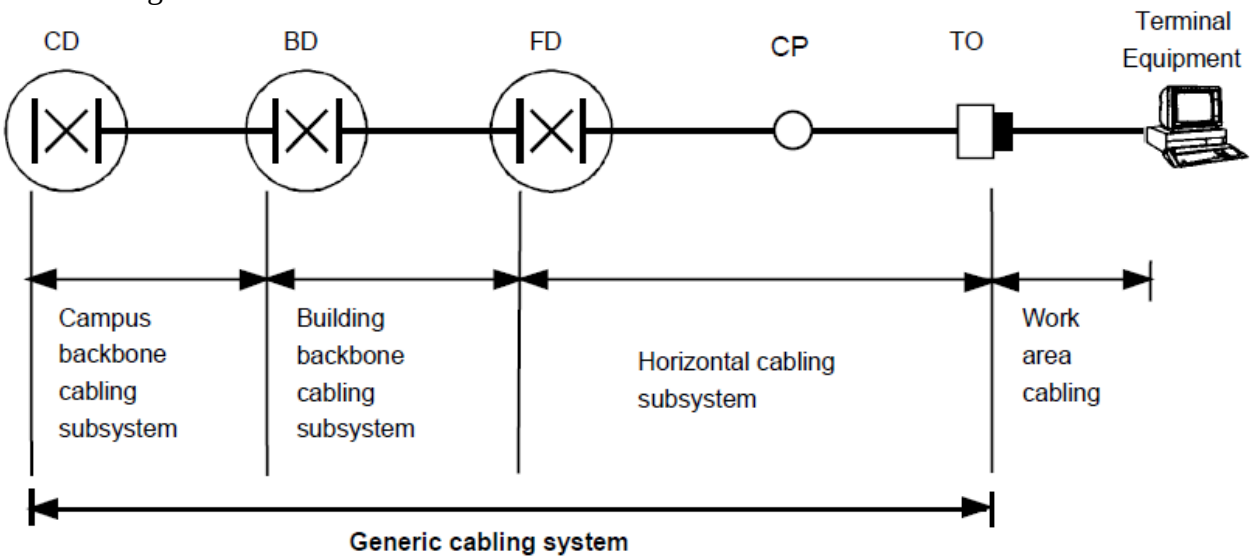
the entire network can be reconfigured in a different way depending on the needs of users, but without any intervention on the cables themselves for a longer period of time.

3.1 Cabling subsystems

The generic cabling system consists of three subsystems:

- Campus backbone cabling system;
- Building backbone cabling system;
- Horizontal cabling.

The cabling subsystems are connected together to create a generic cabling system with a structure as shown in Figure 1:



Picture 1. Structure of generic cabling
Source: ISO/IEC 11801-3:2017

The Campus backbone cabling subsystem usually involves digging and laying cables in the ground, under the appropriate conditions prescribed by ISO / IEC 11801-1. The choice of cables must allow service reliability and duration. Nowadays, as a rule, optical cables with the appropriate number of fibers are laid, while copper pair conductors are used for the transmission of alarm, control and speech signals.

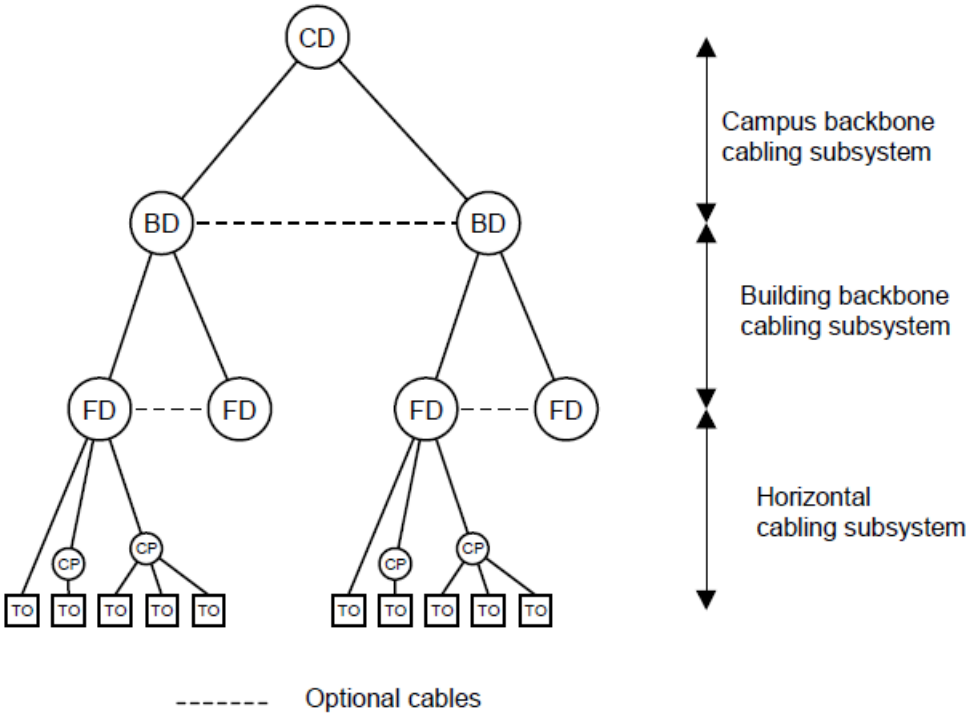
A building backbone cabling subsystem extends from building distributors (BDs) to floor distributors (FDs). As a rule, cables are chosen to last as long as the entire cable system. The number of floor nodes on one floor is not limited and depends on the dimensions of the buildings and the number of connections.

The horizontal cabling subsystem extends from floor distributors (FD) to telecommunications sockets. The chosen type of cable should enable the widest possible set of services, both current and future. Copper pair cables of category 5e (Cat5e) or 6 (Cat6) are most commonly used between the floor distributor and the wall socket, as well as optical multimode cables, where the maximum length of copper cables must not exceed 90 meters in length.

Cable routes are determined based on a series of rules, and some of these rules prescribe that all cables must be protected from physical damage and be installed at a certain distance from the source of electromagnetic radiation. Also, the standard stipulates that each port must have a permanent mark on it (port number).

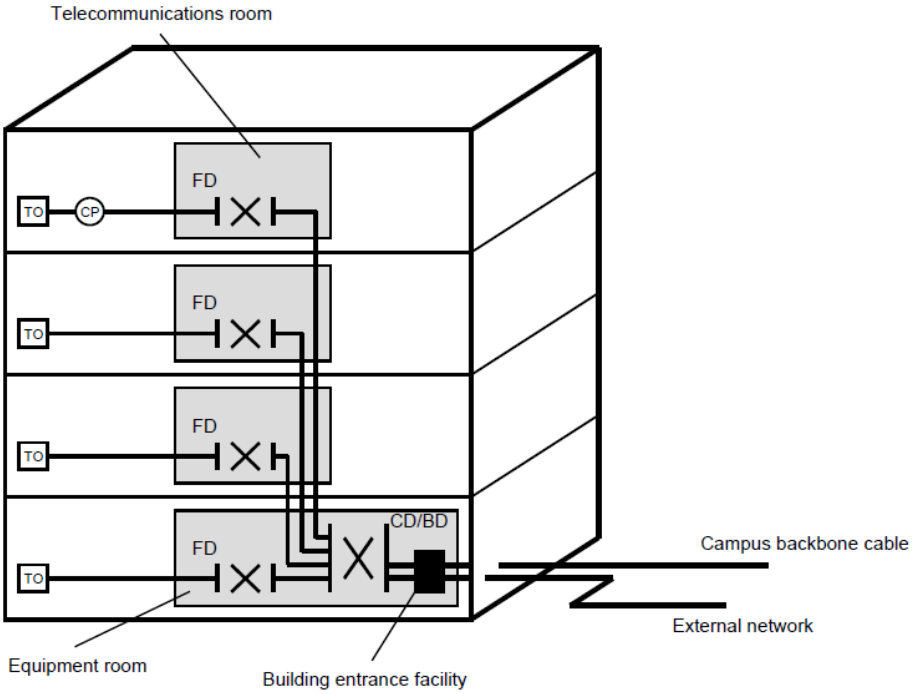
4. DIMENSIONING AND CONFIGURING

The number and types of subsystems involved in generic cabling depend primarily on the geographical location and size of the campus or building, as well as the type of telecommunications network user. The method of connecting nodes is usually of a hierarchical type, Figure 2:



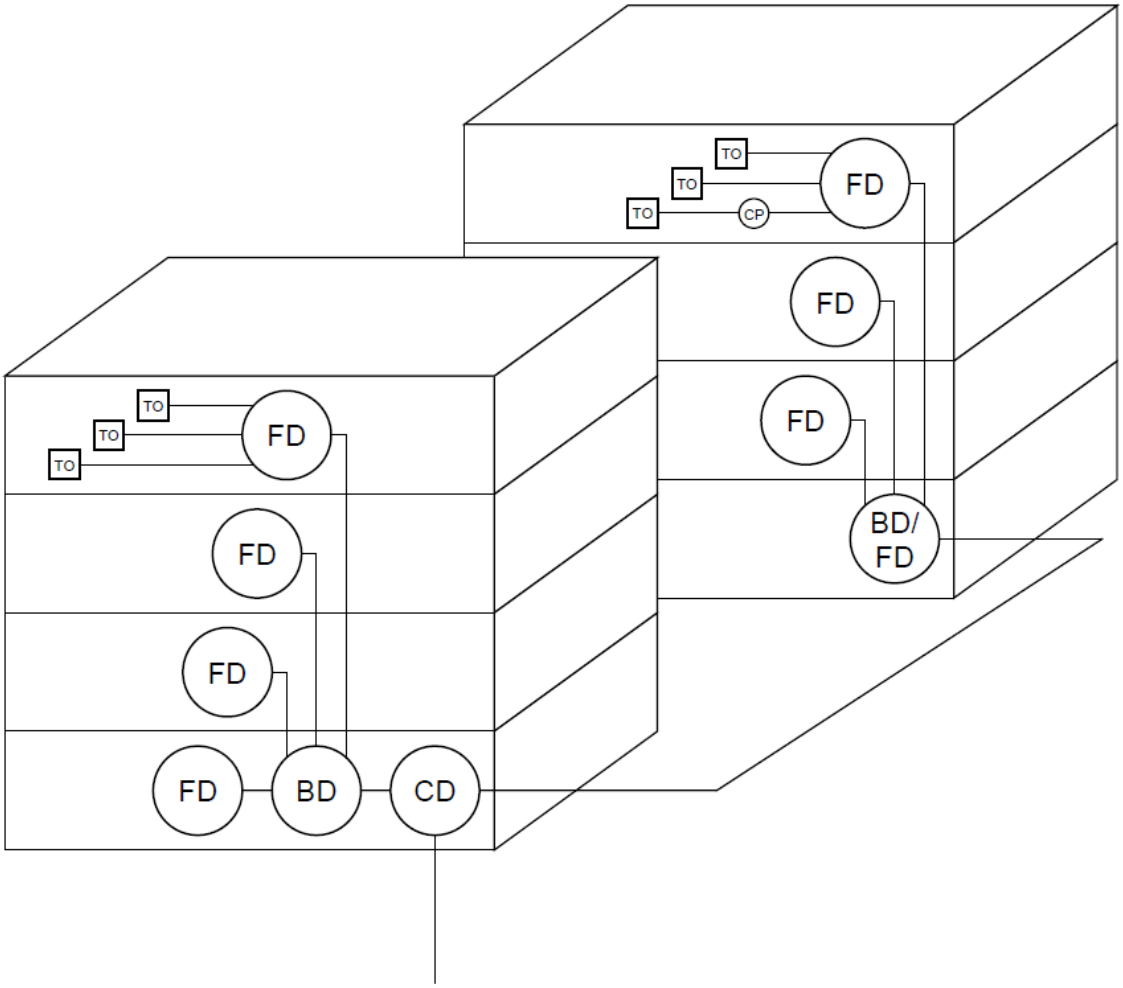
Picture 2. Hierarchical structure of generic cabling
Source: ISO/IEC 11801-3:2017

Optional cable connections are used to increase the availability of the entire network. According to the standard, they are not mandatory, however in practice users require them. In the case of computer networks, they are very often set up as double connections between nodes.



Picture 3. Accommodation of functional elements
Source: ISO/IEC 11801-3:2017

Figure 3 shows an example of how functional elements are placed in a building. Distributors can be located in the equipment room or in the telecommunications room. At least one floor distributor should be provided for each floor. For floor spaces larger than 1000 m2, it is necessary to provide at least one floor distributor. The functions of multiple distributors can be combined as shown in Figure 4::



Picture 4. Example of a generic cabling system with combined BD and FD
Source: ISO/IEC 11801-3:2017

In the foreground, the building shows an example with each distributor placed separately. In the background, the building shows an example where the floor distributor functions and the building distributors are combined into one distributor.

5. CONCLUSION

Structured cabling is an organized approach to a company's telecommunications network and infrastructure. The manner of laying and organizing cables, as well as the anciliary equipment in a structured cabling system, is regulated by some of the mentioned standards that define clear rules and regulations. A balance between industrial progress and the improvement of a standard should exist, otherwise disturbance in this balance usually leads to enormous costs for end users.

Standards for electrical and telecommunications products have been around for decades. ISO / EIC is an international standard for information technology. In particular, ISO / EIC 11801 standardizes and regulates cable systems within the IT network. ISO standards are reviewed every five years, and the last major revision of this standard was in 2017. Structured cabling contractors should comply with the prescribed standards for the layout and physical installation of cables and other ancillary equipment: rack cabinets, sockets, etc. It is crucial that these equipment and cables are laid carefully

taking into account the needs of the end user. Adding new equipment, expansion of the existing network and increase of users must be simple and should not compromise the existing system. Standards stipulate that new cables and equipment must be backward-compatible, that is, to support and be able to work with the older system.

Without a deep investment of the technology and regulations defined by the ISO / EIC 11801-1 standard, this paper gives an overview of the basic characteristics of structured cabling and the basic regulations defined by this standard.

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АСОЦИЈАЦИЈА ЗА КВАЛИТЕТ И СТАНДАРДИЗАЦИЈУ СРБИЈЕ
23. nacionalni i 9. međunarodni naučno stručni skup
SISTEM KVALITETA USLOV ZA USPEŠNO POSLOVANJE I KONKURENTNOST
Kopaonik, Kraljevi Cardaci, 26.05 - 28.05. 2021

VALORIZATION OF THE WASTE FROM WINE PRODUCTION

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Dr Marko Malićanin [2]

Dr Sanja Marković[3]

Ključne reči: *tartaric acid, tartrate, calcium salt, wine production, waste*

Abstract: *The aim of this paper is waste valorization generated in wine industry known as a „cream of tartar" to a valuable tartaric acid, whose trade demands grow every year. Procedure consists of obtaining tartaric acid solution throuhg inermediate calcium salt. As a resource of calcium ions, calcium chloride is used in the first stage of the reaction and calcium sulphate, byproduct in the final stage of the proces, is used in every other cycle of the production process. On this manner, the quantity of chemicals is reduced in significant extent, as well as the quantity of byproduct.*

Special attention was paid to obtaining as pure calcium salt as possible and a minimal excess of sulfate in the tartaric acid solution, which allowed the presence of small impurities in the crystalline tartaric acid. Depending on the purpose, this procedure can provide high purity tartaric acid without subsequent recrystallization.

Keywords: *tartaric acid, tartrate, calcium salt, wine production, waste*

JEL Classification*:Q15; Q16*

1. INTRODUCTION

Wine is consumed globally as an alcoholic beverage with an increasing demand that has reached 243 million hectoliters. According to the existing statistics, as much as 5 tons of solid waste is produced per hectare per year during the process of cultivation and harvesting of grapes. Wineries across the world generate large volumes of waste and other by-products, The waste materials

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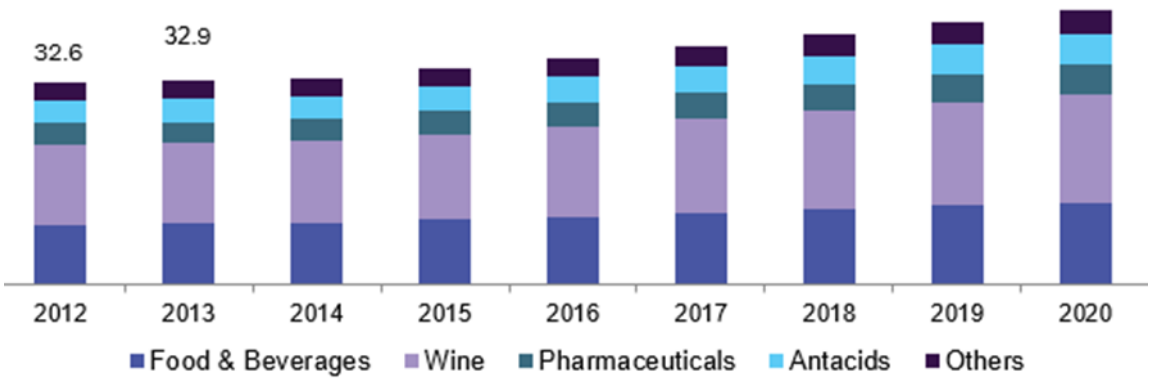
include vine prunings, grape stalks, grape pomace, grape seeds, yeast lees, tartrate, carbon dioxide and wastewater[1].

Environmentally rational utilization of these wastes and by-products is important for higher profitability and minimal environmental impact. The valuable constituents recovered from wastes could be used in pharmaceutical, cosmetics and food industries . One of the most valuable species in these wastes is tartrate. The concentration of tartrate species was reported to be 100 to 150 kg in a tonne of wine lees and 50 to 75 kg per tone of grape pomace.[2]

Tartaric acid, with its chemical (IUPAC) name, 2,3 dihydroxybutanedioic acid is a dicarboxylic acid, one of the most widely distributed plant acids.[3]

The global tartaric acid market size demand was 63.83 kilotons in 2014 and was projected to expand at a CAGR of 5.3% from 2015 to 2020. Increasing wine consumption is expected to remain a key factor driving the global market growth over the forecast period. Increasing wine consumption in emerging markets of Asia Pacific is expected to further complement the global market growth. Tartaric acid is widely used in food & beverages as a preservative and additive.[4]



Picture 1. U.S. tartaric acid market value,by application, 2012 – 2020 (USD Million)

Source: Tartaric Acid Market Size, Share & Trends Analysis Report By Application (Food & Beverages, Wine, Pharmaceuticals, Antacids), By Region (North America, Europe, APAC, Central & South America, MEA), And Segment Forecasts, 2015 – 2020, https://www.grandviewresearch.com/industry-analysis/tartaric-acid-marke)(16.03.2021)

Tartaric acid has a wide application in many industries, such as wine, food & beverages, construction, pharmaceutical, chemical, leather tanning, and metal finishing industries. It is used as an acidulant, pH control, and flavorant in wine. Tartaric acid is also used as an anti-microbial agent, anti-caking agent in bakery items and flavorant for fruit juices in the food & beverages industry. In the pharmaceutical industry, it is used as an excipient for drugs with poor solubility at higher pH levels. Tartaric acid is used as an anti-set agent in cement formulations in the construction industry.[5]

Changing lifestyle patterns have resulted in altered food habits. Growing consumption of tartaric acid in effervescent salts for antacids is expected to be the prime driving factor for its growth over the forecast period. In addition, increasing incidences of heartburn and indigestion cases in the

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[4] Tartaric Acid Market Size, Share & Trends Analysis Report By Application (Food & Beverages, Wine, Pharmaceuticals, Antacids), By Region (North America, Europe, APAC, Central & South America, MEA), And Segment Forecasts, 2015 – 2020, https://www.grandviewresearch.com/industry-analysis/tartaric-acid-marke)

[5] https://www.entrepreneurindia.co/project-and-profile details

region are expected to drive antacids demand. This trend is projected to drive the demand for tartaric acid.

Europe emerged as the leading regional market and accounted for approximately 40% of the total market volume in 2013. Increasing wine production in Italy, France, Spain and Germany coupled with rising per capita consumption in East European countries is expected to drive tartaric acid demand over the forecast period.[6]

The production of tartaric acid is performed synthetically or from natural sources, most often from the waste of wine industry, known as „cream ot tartar". The synthetic chemical route involves the production of the racemic mixture of tartaric acid from maleic anhydride.

The most processes for production of tartaric acid are mostly based on procedure where tartaric acid is formed from its calcium salt using mineral acids. The main focus of the inventors is cost reduction through the process improvement.

One of the published procedure implies a production of soluble tartarate by neutralizing initial raw material and subsequently submission to electrodialysis.[7] Another procedure is accomplished by converting pottasuim hydrogen tartrate into dipotassium tartrate.[8]

Boensch et al obtained tartaric acid from the solution of potassium hydrogen tartrate subjected to cation exchange, where potassium is removed, and eluted tartaric acid undergoes to concentration and crystallization.[9]

2. MATHERIAL AND METHODS

„Cream of tartar" was suplied from wine factory „Rubin" - Krusevac. All of the chemicals used for analytical purposes were of p.a quality. Analysis of minor impurities was performed by using Perkin Elmer Lambda 25 UV VIS Spectrometer. Quantities of potassium and calcium in potassium hydrogen tartrate and in semiproduct, calcium tartrate were detemined by atomic absorption spectrometry using Perkin Elmer 3100 Atomic Absorption Spectrometer.

Content of tartaric acid was determined by volumetric titration. Analysis was carried out by dissolving of 0.65 g dry crystals in 25 ml of water and titrated with 1 M sodium hydrohide volumetric solution to the first pink color using phenophtalein solution as indicator.

Gravimetric analysis was used for soluble sulphate determination in tartaric acid obtained after reaction of calcium tartrate and sulphuric acid. Determination of soluble sulphate is based upn its precipitation with barium ion.

3. RESULTS AND DISCUSSION

The procedure for obtaining tartaric acid is performed in two stages. In the first stage calcuim tartrate is obtained after previous treatment with calcium chloride and calcium hydroxide. The solution is treated with a neutralizing agent and calcium chloride. Calcium hxdroxide is used as a neutralizing agent.

Additional calcium compound is introduced in order to complete the conversion of the soluble tartrates into calcium tartrate.[11.] The calcium hydroxide is used as 30 % aqueous suspension and

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[6] Ibid.[4]

[7] Audinos R., Paci S., Process for the manufacture of tartaric acid from a bitartrate and applications for enhancing the value of by-products from wine production, FR2646421A1, 1989,

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[9] Stein D., Bonsch R., Erb K., Process for the continuous recovery of free tartaric acid from raw materials kontaining potassium hydrogen tartrate, United States Patent Application Publication, US 2004/0232078 A1, 2004.

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[11]United States Patent Office 3,114,770, Patented December 17, 1963.

calcium chloride as a 20 % solution. Both calcium salts involved in the production of Ca tartrate are added in stoichiometrically calculated amounts.

Concentration of the kalium hydrogen tartrate prior to introduction of the calcium compounds was maintained at about 0,4 mol per liter. The temperature was set on value of 63°C in both phases of tartaric acid production. The second stage implied obtaining tartaric acid and gypsum, as a result of reaction of calcium tartrate and sulphuric acid.

In order to minimize the amount of sulphate ions in the final diluted tartaric acid solution stoichiometric quantity of sulfuric acid, counted calcium tartrate obtained in the first stage was used to determine end point of reaction with sulphuric acid. The results of measuring conductance during the second stage of tartaric acid production are presented in the Table 1.

Table 1. Results of resistance (conductance) measurement

V_{H2SO4} (ml)	Resistance (Ω)			Conductivity (S)			
	Exp.1	**Exp.2**	**Exp.3**	**Exp.1**	**Exp.2**	**Exp.3**	**Average**
1	355	310	310	2,8	3,2	3,2	3,1
2	200	150	165	5	6,6	6,1	5,9
3	140	91	105	7,1	10,9	9,5	9,2
4	115	72	105	8,7	13,8	9,5	10,7
5	110	64	150	9	15,6	6,6	10,4
6	110	69	120	9	14,5	8,3	10,6
7	115	70	110	8,7	14,3	9,1	10,7
8	110	70	110	9	14,3	9,1	10,8
9	84	70	110	11,9	14,3	9,1	11,8
10	90	70	105	11,1	14,3	9,5	11,6
11	80	70	100	12	14,3	10	12,1
12	88	70	100	11,4	14,3	10	11,9
13	91	71	100	10,9	14,1	10	11,7
14	90	70	100	11,1	14,3	10	11,8
15	83	70	100	12	14,3	10	12,1
16	62	62	90	16,1	16,1	15,1	15,8
17	58	51	62	17,2	19,6	16,1	17,6
18	39	39	45	25,6	25,6	22,2	24,5
19	31	31	35	32,2	32,2	28,6	31,0
20	27	26	28	36,4	38,4	35,7	36,8
21	23	21	24	43,4	47,6	41,7	44,2
22	19	18	20	52,3	55,5	50	52,6

The results of conductivity measurement Table 1 and Picture 2) indicate that when reaction of the stohiometric quantities of sulfuric acid and calcium tartrate is finished conductivity raises and this

point is the end point of the reaction. By pH measurement of the such suspension we obtained value of pH = 1,4.

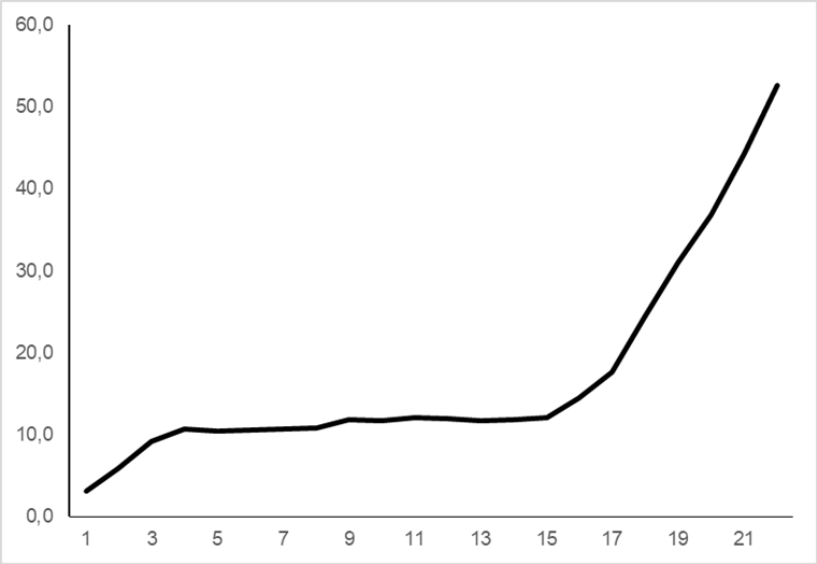

Figure 2. The end poin determination of the reaction between Ca tartrate and sulfuric acid

Numerous experiments were carried out to determine yields of Ca tartrate in the first phase of the process and tataric acid in the final stage of the manufacturing process. Ca salt producing process was conducted at around neutral or week alkaline pH value. Ca sulphate cake, after filtering the main quantity of the tartaric acid solution, was rinsed three times with water volume aproximately (0,5 – 0,6) x volume of the tartaric acid solution. The first rinse was combined with tartaric acid solution and the second rinse was used to dilute the Ca salt. The obtained results are presented in the Table 2.

Table 2. Total yields of tartaric acid and Ca salt in the stages of the production process

Exp.	pH of the suspension		Tartaric acid content					Tartaric acid yield (%)	Ca salt		Ca salt yield (%)
	First stage	Second stage	First filtrate	Filtrate from cake rinsing			First filtrate +rins (%)		Ca (%)	K(%)	
				I	II	III					
1	7,60	1,50	34,74	28,85	8,98	1,56	31,20	100,00	12,32	0,16	99,22
2	7,80	1,40	33,14	17,43	5,30	2,32	28,60	100,00	12,95	0,15	99,30
3	7,60	1,50	36,48	25,12	8,62	2,14	33,40	100,00	12,84	0,19	99,70
4	7,20	1,50	35,36	17,99	3,09	0,61	30,10	99,70	12,83	0,19	99,10
5	7,60	1,40	34,12	24,34	3,56	0,72	30,20	100,00	12,08	0,23	98,90
6	7,20	1,60	33,36	21,99	4,44	0,63	27,50	100,00	12,71	0,25	98,80
7	6,80	1,30	35,15	19,87	6,65	1,76	28,49	99,40	12,08	0,96	95,40
8	7,60	1,50	34,36	22,99	4,40	0,50	32,70	98,35	12,72	0,26	98,80
9	8,00	1,40	37,12	21,33	4,90	2,11	27,57	99,47	13,29	0,16	99,20
10	6,80	1,50	34,12	23,53	4,65	1,21	25,00	98,80	12,17	1,06	94,90
Mean value	7,42	1,46	34,80	22,34	5,46	1,36	29,48	99,57	12,60	0,36	98,33

Based on the results of measuring the concentration of the obtained tartaric acid in the firts filtrate and solutions from gypsum rinsing and the calculated yields, it can be concluded that the yields were in the range 98,35 – 100 %. Yields were calculated in relation to the obtained Ca salt. Ca salt yields were calculated on the basis of potassium determined, assuming that it was derived from KH tartrate.

It can also be observed that in experiments conducted at slightly lower pH values (6,8), a lower yield of Ca salt was achieved (experiments 7 and 10).

Tartaric acid solution obtained by combining the first filtrate and the solution from the first wash may contain between 27,50 and 33,40 % of tartaric acid.

Main impurities that could have appeared in the tartaric acid solution included calcium sulfate and coloring matters and other compounds which were present only in small amounts. Even with the careful leading of the process, calcium sulfate was present to a certain extent. The sulphates could cause precipitation in the evaporation equipment and reduce heat transfer and had to be removed from the solution, prior to contretation and crystalization processess.

The obtained tartaric acid solution had a light brown color. Sulfate precipitation was performed by mixing with the calculated amount of barium carbonate. After mixing, activated charcoal was added to the suspension to decolorize the solution from the present colors. Apon solid phase removal, a clear filtrate was obtained from which tartaric acid could be separated in crystalline form.

The tartaric acid obtained as a product was substantially chemically pure and contained a very small amount of impurities. Depending on the purpose, the resulting acid may be subjected to subsequent crystallization, if high purity is required.

4. CONCLUSION

Wine production in the world is on the rise, as well as in the Republic of Serbia, which inevitably leads to the generation of more waste. This paper proposed a procedure for obtaining a usable product from the valuable waste of the wine industry.

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THE MODERATING ROLE OF TOP MANAGEMENT TEAM (TMT) CHARACTERISTICS BETWEEN CONTINUOUS IMPROVEMENT AND FINANCIAL PERFORMANCE

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Abstract: *Developed under the Upper Echelon theory, top management team (TMT) characteristics have been analysed in many papers as significant factor that influences business outcomes. The emphasis of the research was placed on analysing the moderating role of TMT characteristics that contribute in strenghtnening the relation between continuous improvement (CI) and firms' financial performance. A survey was conducted on 113 Croatian companies that hold ISO 9001 certificate. The regression analysis was performed in order to test the set hypothesis. The results of the study showed that the link between continuous improvement system and financial performance is significant. Also, the results confirmed that TMT characteristics strengthen the relationship between continuous improvement and financial performance.*

Keywords: *TMT characteristics, continuous improvement, kaizen, financial performance*

JEL Classification*: M1, M12*

1. INTRODUCTION

The continuous improvement (CI) concept has been developing and analysing in practice and literature for more than 30 years. As one of the main principles in total quality management (TQM) and ISO 9001 Standard, continuous improvement (CI), represents organizational actions to continually improve suitability, adequacy and effectiveness of the quality management system. The continuous improvement process has always been present in human nature. It represents a natural process and the improvement result over a time represents a new and better state[4]. Further, CI activities represent improvement activities and involvement of all people on every organizational level.

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This paper contributes to the research about improving financial performance with the adaptation of continuous improvement behaviours in organizations. It presents research about CI adaptation in companies that hold ISO 9001 Standard and the moderator role of top management team (TMT) characteristics in the relation between CI and financial results of the company. The assumption is that top management team characteristics, such as experience, education or ownership position may represent significant factors in strengthening the link between adaptation of certain CI behaviours and the influence on the financial performance of the company. Further, TMT keeps a certain body of knowledge about internal and external factors of the company. This also includes the knowledge about continuous improvement and may be of a great influence in implementing and motivating people to accept the practice of CI. The findings showed that TMTs with greater tenure diversity had a stronger relationship between R&D investment and innovation performance. Also, the TMTs with greater educational diversity enhanced the relationship between international diversification and innovation performance[5]. Further, the research found that international experience is positively related to international strategic decision-making rationality in companies[6]. Therefore, we analyse the moderating role of TMT characteristics to see whether it play a significant role in the mentioned relation.

2. LITERATURE REVIEW

2.1. Continuous improvement and ISO 9001 Standard

When a company has the intention to adopt quality management, usually accepts different approaches such as Kaizen, Lean, Six Sigma (SS), Lean SS, the ISO 9001 Standard or Business Excellence Models[7]. Adopting quality, means company's orientation toward identification and satisfaction of stakeholders needs, such as customer needs.

The practice has shown that companies who implement modern quality approach most often practice continuous improvement in their companies. In Western literature, it is called "continuous improvement" (CI), while in Japanese literature it is called "*kaizen*". CI or *kaizen* represents management approach which includes values and principles such as process orientation, the support of managers and leaders, participation of all people in CI activities, approach based on searching the reason of problem and bypassing the blame culture, standardization and continuity, experimentation, the learning approach, systematic thinking and communication. It can be said that the Masaaki Imai has popularized the CI or kaizen approach with his book Kaizen: The Key to Japan's Competitive Success which was published in 1987. Back then he was teaching Japanese managers about the concept and how to raise product quality in their companies and then in the late 80'ties of the last century turned back to America and started teaching American managers about the kaizen who wanted to raise their product quality who has drastically subsided after the World War II. Even then he was talking about the kaizen as a strategy that management has to adopt together with its values, basic principles and techniques defined as umbrella kaizen.

Today, the concept of CI has matured and follows the Plan-DoCheck-Act (PDCA) circle. Further, in order for a company to continuously improve its processes, the CI process has to be documented and controlled[8]. Further, the speed of an improvement today represents a factor for assessing of improvements in the company. When having implemented ISO 9001 Standard, the improvement speed becomes shorter then in those companies who haven't adopted ISO 9001 Standard. The reason for that lies in company's investment in knowledge and involvement of all people in this process of

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ISO 9001 adaptation. Therefore, today's changing environment and constant requirements from stakeholder's, demands managing companies comprehensively by adopting quality approach in order to achieve sustainability of the company. The solution to achieving sustainability companies see in adopting International Standard ISO 9001 which can be confirmed when analysing the increasing trend of adopting ISO 9001 in many companies and sectors worldwide. However, authors[9] stated when companies adopt ISO 9001 Standard usually put minimum effort into adopting main principles (where the CI principle is one of them) just to get ISO 9001 registration. Since many companies on the market demand having quality Standard as a requirement to do business. In that way companies usually don't have significant improvements. However, with accepting Standard ISO 9001 as a way of managing all of its resources, companies do accept to manage company having in mind customer requirements, leadership commitment, engagement of people, the process approach, making improvements, making decisions based on evidence, and manage its relationships with interested parties. Accordingly, companies who implement the principle of continuous improvement and have well documented, measured and controlled processes, in the long run, change their business culture[10]. Therefore, the focus of this research was on companies that are certified according to ISO 9001 Standard as a proper basis to analyse the link between CI system and financial performance.

2.2. Top management team characteristics

The management team, plays an important role in company development. The management theory that analyses top management characteristics is called the upper echelons theory. Based on the theory, top management behaviours and choices they make will be influenced by its characteristics which will then reflect on decisions they make in companies. This theory was developed in 1984 by Donald C. Hambrick and P. Mason and states that organizational outcomes are partially predicted by managerial background characteristics. The idea of this theory lies in top managers view of the situation which they perceive differently and individually due to differences among managers in their experiences, values, personalities, and other human factors. Due to the above, the interest of scientists in the field of strategic leadership, which examines the impact of top leaders on organizational performance in an effort to respond to the challenges of globalization, growing international competition and the emergence of rapid technological and social change[11]. Author proved that psycho-social characteristics of CEOs do influence organizational performance, since strategic decisions they make, determine the success of an organization[12]. According to this theory, they are influenced by their perception, based on values and cognitive basis, of their organizational environment.

Top management team characteristics are analysed from two perspectives; personality characteristics and demographic characteristics. Personality characteristic include individual preferences, attitudes, needs, values, knowledge, while demographic characteristics include managers age, tenure, educational background, social status, etc. Demographic characteristics are most often analysed in the practice since they are easier to analyse then personality characteristics such as traits[13]. Today's researches, question processes through which this effect is achieved[14].

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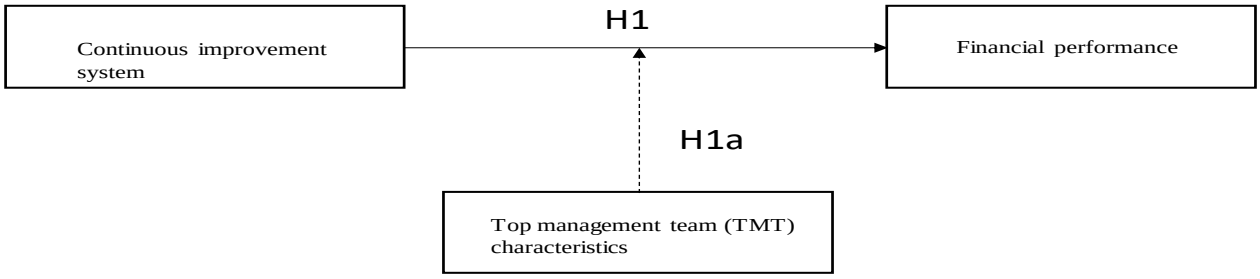
Authors researched top management demographic characteristics on decision making approach[15]. The results of the study show that the average age and education level of decision makers is positively related to the rational decision making approach and negatively to the intuitive decision making approach. While, tenure is positively related to the intuitive decision making approach, but the influence is not statistically significant. Also, the author found a difference in the decision making approach regarding gender. Authors analysed the impact of top management team on earnings management from the perspective of demographic and psychological characteristics of senior management team[16]. Regarding the CEO's age, authors found that the quality of decision-making gradually improved as CEO's age increased, while probability of making a financial restatement significantly reduced, and the reliability of the earnings quality enhanced[17]. Further research analysed data from large international firms over the period 2005–2009 (347 firm-year combinations). They found that the performance effect of knowledge-based TMT faultlines is significantly changed when the leader of the CEO: (a) socio-demographically resembles incumbent executives, (b) possesses a diverse career background, and (c) shares common socialization experience with other TMT members[18]. Furthermore, another research found that TMT tenure diversity had a negative and significant main effect on ROE but not ROA, the results also indicated that the negative relationship between TMT tenure diversity and firm performance was attenuated by having older TMTs[19].

Therefore, it seems that TMT characteristics play a significant role in achieving organizational goal, and in this paper we analysed whether managers experience, educational background or ownership position in the company moderates the relation between CI and company's financial performance.

3. RESEARCH MODEL

In this part the research model and hypothesis will be presented as well as the questionnaire that was sent to managers of companies with ISO 9001 Standard. Based on the literature review the research model was proposed as seen in the picture 1. The model consists of three constructs; the CI system and TMT characteristics representing independent variables and one dependent variable representing financial performance.

Following the research model, main hypotheses with one sub-hypothesis where proposed as follows: H1 "The continuous improvement system in ISO 9001 certified companies has significant influence on financial performance and sub-hypothesis H1a: The TMT characteristics have moderating role in the relation between CI system and financial performance in ISO 9001 certified companies.



Picture 1. Research model
Source: Author's work, 2021

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The research instrument for continuous improvement system construct is represented in the Table 1. The development of continuous improvement system in companies is measured with the model based on the Bessant's generic model of CI behaviour routines.

Table 1.Continuous improvement system construct

Variable code	Question	Measurement
UNDERSTANDCI1	People at all levels demonstrate a shared belief in the value of small steps and that everyone can contribute, by themselves being actively involved in making and recognising incremental improvements.	1-do not agree at all; 2-do not agree; 3-not agree neither disagree; 4-agree; 5-completely agree
UNDERSTANDCI2	When something goes wrong the natural reaction of people at all levels is to look for	
SUSTAINCI1	Managers support the CI process through allocation of time, money, space and other resources.	
SUSTAINCI2	Managers recognise in formal (but not necessarily financial) ways the contribution of employees to CI.	
SUSTAINCI3	Managers lead by example, becoming actively involved in design and implementation of CI.	
SUSTAINC4	Managers support experiment by not punishing mistakes but by encouraging learning from them.	
STRATCI1	The CI system is continually monitored and developed; a designated individual or group monitors the CI system and measures the incidence (i.e. frequency and location) of CI activity and the results of CI activity	
STRATCI2	There is a cyclical planning process whereby (a) the CI system is regularly reviewed and, if necessary, amended (single-loop learning)	
STRATCI3	there is periodic review of the CI system in relation to the organisation as a whole which may lead to a major regeneration (double-loop learning).	
STRATCI4	Senior management make available sufficient resources (time, money, personnel) to support the ongoing development of the CI system.	
LEARNORG1	People learn from their experiences, both positive and negative	
LEARNORG2	Individuals seek out opportunities for learning / personal development (e.g. actively experiment, set their own learning objectives.	
LEARNORG3	Individuals and groups at all levels share (make available) their learning from all work experiences.	
LEARNORG4	The organisation articulates and consolidates (captures and shares) the learning of individuals and groups.	

Source: Author's work based on Bessant et al. 2001

The research instrument for financial performance construct is represented in the Table 2 and respondents had to rate their company from 1 (we lag far behind the competition) to 5 (we are distinctly better than the competition) in relation to the competition.

Table 2. Financial performance construct

Variable code	Question	Measurement
FINANC1	Profitability	1-we lag far behind the competition; 2- we are somewhat behind the competition; 3-we are about the same; 4-we are somewhat better than the competition; 5-we are distinctly better than the competition
FINANC1	Profit	
FINANC3	Return on investment	

Source: Author's work based on Kim and Rhee, 2012

The research instrument for the construct of top management team characteristics is represented in the Table 3.

Table 3. Top management team (TMT) characteristics construct

Variable code	Question	Question
EXPER	Did you have any other career experience other than your current job, answer which one?	1. Non- managerial position 2. President, vice president of the board and/or functional manager, or functional manager
EDUCAT	Education of respondent	1. Secondary school 2. Bachelor study 3. Graduate study 4. Post-graduate study or doctoral study
OWNER_POSITION	Position of the respondent according to ownership	1. Sole owner/co-owner of the company, at which respondent is employed 2. Does not have an ownership share in the company

Source: Author's work, based on Buyl et al, 2011, Croatia

4. METHODOLOGY AND RESEARCH RESULTS

In order to prove the set hypotheses, an empirical study was conducted in the Republic of Croatia on organizations that have ISO 9001 certification, of various sizes and industries. For the purpose of the research, a questionnaire was developed based on previous research in the field of continuous improvement, financial performance and TMT characteristics. The survey was conducted in 2018 electronically, by sending questionnaires to 400 randomly selected companies addressing top managers with the most experience in continuous improvement (a total of 113 questionnaires were received, 28% return rate). The Likert scale from 1 to 5 was used in the research. These scales were derived from previous studies. In order to prove the set hypotheses, the multiple regression method was used. The research sample consists of 58% of small and medium size companies, 18% where micro companies and 24% big size companies. Regarding the industry, the largest percentage of surveyed companies are in the production sector (53%). The rest of the companies are in the service

sector (38%) and 9% is in retail and wholesale. Regarding the ownership structure, most of the companies are domestically owned (81%) and 19% are foreign-owned.

4.1. Testing hypothesis H1

Table 4 shows the representativeness of the model that tests the given hypothesis H1. That is, the relationship between the dependent variable (FINANC), and the independent variable, which consists of the continuous improvement variables (REGR factor score UNDERSTANDCI, REGR factor score LEARNORG, REGR factor score SUSTAINCI, REGR factor score STRATCI). According to the model, 19.2% of the variance of the dependent financial performance variable is explained by the continuous improvement variables: REGR factor score UNDERSTANDCI, REGR factor score LEARNORG, REGR factor score SUSTAINCI, REGR factor score STRATCI.

Table 4. Model summary for testing H1 hypothesis

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
H1	0,438	0,192	0,104	0,83874
Predictors: (Constant), REGR factor score UNDERSTANDCI, REGR factor score LEARNORG, REGR factor score SUSTAINCI, REGR factor score STRATCI				
Dependent Variable: FINANC				

Source: Author's work, 2021, Croatia

Table 5 presents Anova analysis of model for testing hypothesis H1. Anova results show that the significance of the test was less than 0.05 (sig=0,021), which means that the zero hypothesis is rejected and alternative hypothesis is accepted. This indicates that at least one independent variables has statistically significant impact to dependent variable in the model.

Table 5. Anova analysis of model for testing hypothesis H1

ANOVA[a,b]						
Model		Sum of Squares	df	Mean Square	F	Sig.
	Regression	16,886	11	1,535	2,182	0,021**
	Residual	71,051	101	0,703		
	Total	87,937	112			
Dependent Variable FINANC						
Predictors: (Constant), REGR factor score UNDERSTANDCI, REGR factor score LEARNORG, REGR factor score SUSTAINCI, REGR factor score STRATCI						

Source: Author's work, 2021, Croatia, Note: ** Statistically significant at 5%

Table 6 represents coefficients of model for testing hypothesis H1. The highest beta has independent variable REGR factor score STRATCI (sig=0,007) and is statistically significant at 1%. So this value represents a statistically significant contribution to the prediction of dependent variable FINANC. Other independent variables (REGR factor score SUSTAINCI, REGR factor score LEARNORG, REGR factor score UNDERSTANCI) have no statistically significant impact to dependent variable FINANC.

Table 6. Coefficients of model for testing hypothesis H1.

Coefficients						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
H1	(Constant)	2,950	0,375		7,875	0,000
	REGR factor score SUSTAINCI	0,107	0,082	0,121	1,303	0,195
	REGR factor score STRATCI	**0,237*** **	**0,085**	**0,268**	**2,778**	**0,007*** **
	REGR factor score LEARNORG	0,055	0,081	0,062	0,680	0,498
	REGR factor score UNDERSTANDCI	0,145	0,086	0,163	1,682	0,096
Dependent Variable FINANC						

Source: Author's work, 2021, Croatia; Note: *** Statistically significant at 1%

4.2. Testing sub-hypothesis H1a

Table 7 represents change statistics for representativeness of models for testing hypothesis H1 and sub-hypothesis H1a. Sig. F change is statistically significant at 10% (0,089) and R square change is 0,087 representing that top management team characteristics account for a significant amount of variance in the model for variable FINANC.

Table 7. Change statistics for representativeness of the models testing H1 and H1a sub-hypothesis [1]

Change Statistics					
Model change	R Square Change	F Change	df1	df2	Sig. F Change
H1 → H1a	0,087	1,901	6	95	0,089*

Source: Author's work, 2021, Croatia; Note: * Statistically significant at 10%

Table 8 represents summary of testing hypothesis H1 and sub-hypothesis H1a. The significant beta coefficient has variable STRATCI (beta=0,237), for H1 model and also for H1a, beta is significant for STRATCI 0,260, and also variable EXPER has significant beta 0,410 representing high mediator role in the model. R-square coefficient explains that 19,2% of total variance of the dependent variable Finance is explained with variable STRATCI, and by adding top management team characteristics variable EXPER, 28% of total variance in the model can be explained by this variable. Therefore, based on the statistical evidence it can be stated that hypothesis H1 and sub-hypothesis H1a can be accepted.

Table 8. Summary of testing hypothesis H1 and sub-hypothesis H1a

Variables	**Unstandardized Coefficients (B)**	**H1**	**H1a**
	(Constant)	2,950	2,784
Independent variables (CI	REGR factor score SUSTAINCI	0,107	0,091

Variables	Unstandardized Coefficients (B)	H1	H1a
system)	**REGR factor score STRATCI**	**0,237*** **	**0,260*** **
	REGR factor score LEARNORG	0,055	0,059
	REGR factor score UNDERSTANDCI	0,145	0,137
Top management team characteristics (TMT) variables	**EXPER**		**0,410** **
	EDUCAT_2		-0,338
	EDUCAT_3		-0,400
	EDUCAT_4		-0,064
	OWNER_POSITION_1		-0,151
	OWNER_POSITION_2		0,042
R-square		**0,192**	**0,279**
Conclusion		**Accepted**	**Accepted**
Dependent variable: FINANC			

Source: Author's work, 2021, Croatia; Note: *** Statistically significant at 1%, **5%

5. CONCLUSION

In this paper, we analysed the influence of CI system on financial performance in companies with ISO 9001 Standard on Croatian theritory. Findings presented in the paper showed that companies benefit from having implemented CI system because it positively influences financial performance of the company and this relation is significant. Managers and their employees adopt certain CI routines and learn about improvement techniques which then lead to improving processes in the company. The final results of improvements may be seen in increasing financial performance. Regarding questions about financial performance, the respondents had to estimate their company in relation to competition. This can be perceived as a limiting factor since managers often want to present their company's business better than it is. For future research some financial indicators should be included and calculated from company's financial statements. H

Further, we analysed the moderating role of top management team characteristics and the results confirmed the significance of manager's experience in the relation between CI and financial results. The fact is that managers broad experience brings many opportunities to companies which may be in terms of acknowledging and understanding the role of CI system and its benefits for firm's performance. Further, education variable and ownership position in the company did not represent significant impact on this relation. In future research other TMT characteristics should be analysed such as tenure, socioeconomic background, etc.

Croatia has a great number of companies that adopted ISO 9001 Standard and it would be logically that accordingly many of those companies achieve competitiveness on the market but when referring to the report of European commission in 2016 it is noticed that Croatian economy stagnates in productivity and competiveness when compared to its peer countries. Therefore, the comprehensive approach to quality management, and adopting practice of CI routines efficiently by educating and awarding people for CI activities may results in companies' culture change which can lead company closer to sustainability.

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