VII INTERNATIONAL CONFERENCE

QUALITY SYSTEM CONDITION FOR SUCCESSFUL BUSINESS AND COMPETITIVENESS

PROCEEDINGS

ASSOCIATION FOR QUALITY AND STANDARDIZATION OF SERBIA

KOPAONIK, 27/11.-29/11/2019

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P R E F A C E

Dear Colleagues, Ladies and Gentlemen,

I take great pleasure in welcoming you to the 21st National and 7th International Scientific Conference on QUALITY SYSTEM CONDITION FOR SUCCESSFUL BUSINESS AND COMPETITIVENESS, organized by the Association for Quality and Standardization of Serbia.

We have entered our third decade and are proud of our commitment and successful performance in the field of quality in the Republic of Serbia and the region

We use our rich two-decade experience to further improve the quality status of Serbia in all spheres increasingly involving new actors in our work.

This year we are organizing the 21st National and 7th International Scientific Conference in cooperation with:

- *Faculty of Veterinary Medicine, Belgrade University – co-organizer*
- *Quality Centre, Faculty of Engineering Sciences, Kragujevac University*
- *Quality Centre, Faculty of Mechanical Engineering, University of Montenegro, Podgorica*
- *Middle and South East European Countries Quality Initiative*
- *Technology College of Applied Studies, Krusevac,*

with the support of

- *Ministry of Economy of the Republic of Serbia*
- *Ministry of Education, Science and Technological Development*
- *Ministry of Environmental Protection*
- *Ministry of Trade, Tourism and Telecommunications*
- *Accreditation Body of Serbia*
- *Serbian Association of Employers*
- *Serbian Chamber of Commerce*
- *Chamber of Commerce and Industry of Serbia*
- *Institute for Standardization of Serbia*

The large number of papers submitted for the presentation at the conference cover a wide range of topics: Quality system condition for successful business and competitiveness; Improving quality infrastructure; Management system: quality, environment, occupational health and safety, energy, food safety, information security…); Development and establishment of a management system (in theory and practice); Models of business excellence; Engineering and quality management; Knowledge management; Product and service quality; Audit and certification; Global quality; Quality culture; Management systems in the public sector; Quality, risks and opportunities; Information system in the function of management system development; Motivation and quality; Organizational behaviour, leadership and management; Quality – theory and practice; Quality and social responsibility; Innovations and quality; Measurement, control and quality in production; Quality improvement tools; Quality 4.0 and industry 4.0. After the conference, all papers will be submitted for indexing.

On this occasion, sticking to our roundtable tradition, we will organize discussions as follows:

- *Development of Quality Infrastructure in Serbia - Risks and Opportunities, aimed at forming the Quality Infrastructure Council of the Republic of Serbia that would consist of experts on quality and represent an advisory body for state institutions in order to improve the current situation;*

- *Quality and crisis management, with the aim of preventing the emergence of a crisis by preventive actions, and if it does occur, to recognize and adequately and successfully manage it in a timely manner*
- *Food and beverage quality in Serbia, with special emphasis on the quality of wines and rakias on the Serbian market*

The Association for Quality and Standardization of Serbia strives to award its deserving members or organizations through the recognition criteria, but unfortunately, not always unmistakably.

This year, as well as every subsequent year, we will give recognition to those who have contributed to the success of the conference.

For the next year, we announce the award for those organizations with the most training hours per employee, since the success of an organization mostly depends on its knowledge. The award criteria will be published in a timely manner so that those interested can participate in the competition.

The success of a conference depends on all the participants, therefore, I take the opportunity to thank all the authors and co-authors of the papers, the co-organizer, those whose cooperation over many years has meant a lot to us, those who have given us support, the general sponsor – the Faculty of Business Studies and Law, Belgrade, other sponsors and donors, media patrons, as well as all the participants from Serbia and abroad.

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

Yours sincerely,

Professor Zoran Punoševac, PhD
Organizing Committee Chairman

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METHODOLOGICAL APPROACH TO APPLICATION OF PORTER'S VALUE CHAIN

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Abstract: *All activities carried out within an organization represent one chain. These activities give a certain value to the final product. Porter's value chain represents the foundation for the analysis of processes of the organization. It breaks down the organization, its suppliers and consumers into specific but interrelated activities. In order to determine which activities have a negative impact on the business outcome, ie which activities add value and which generate costs, it is necessary to conduct a value chain analysis, which gives an insight into the individual activities of the organization, which ultimately leads to the determination of one of the generic strategies. Organizations must, at the very beginning of their business, carry out analyzes and decide what and how to produce and whether it will represent value to the customer. Therefore, it can be said that the concept of value chain represents one of the highest levels of observation of business activities within the organization. The example of Omco Croatia d.o.o illustrates the methodological approach of applying Porter's value chain.*

Keywords: *Porter, Value Chain, Strategic Management, Competitiveness*

JEL Classification*: L1 Market Structure, Firm Strategy, and Market Performance*

1. INTRODUCTION

Organizations operate for the purpose of generating higher revenue and they conduct an analysis of their organization, that is, carry out process analyzes to understand which processes have a positive impact and which have a negative impact on their revenue. The greatest attention is paid for the activity of production. It gives organizations the greatest results, and thus provides the foundation for the highest revenue. The production creates a product that will meet the needs and desires of customers. Thus, the goal of each organization is to identify how the organization adds value to the product. Michael Eugene Porter introduced the term Value Chain in 1985. The value chain concept breaks down an organization into its strategically important activities for the purpose of facilitating the monitoring and understanding of cost trends and for monitoring potential sources of

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differentiation. In this way, by performing these activities more efficiently, the organization achieving a competitive advantage over its competitors. The value chain is the easiest to spot in manufacturing industries, but it is also present in other industries. The main objective of the value chain is to identify what are the most valuable activities for the organization and to take steps to improve them and to use their potential for competitive advantage.

2. VALUE CHAIN AND ACTIVITIES OF THE VALUE CHAIN

An organization's value chain is embedded in a larger set of activities, and they relate not only to the activities of the organization, but also to the activities of its suppliers, intermediaries, and ultimately customers. According to Porter, such a set of activities is called a value system (Porter,2008). From a competitive standpoint, value is the amount that customers are willing to pay for a product and / or service and is measured in total revenue. Total revenue shows the relationship between the price determined by the organization's product and the number of units of products that the organization can sell. An organization's value chain is the relationship between the supplier and the organization and between the organization and the distribution channels (intermediaries). The cost effectiveness of the entire value chain system depends not only on the costs that are integral to the internal value chain, but also on the costs of the activities that belong to the value chain of suppliers and customers.

Buble states that value to the customer is derived from three main groups of activities, namely: activities that distinguish one product from another same product, activities that affect the lower costs of that product relative to another same product, and activities that enable rapid meeting customer needs (Buble et al,2005).

Figure 1 shows the concept of the value chain. Porter states that the value chain can see the total value of an organization consisting of value activities and profits. Value activities refer to the physically and technologically diverse activities carried out by an organization and include those elements by which an organization creates a valuable product to the customer, while profit represents the difference between the total value and the total cost of performing value activities (Porter,2008).

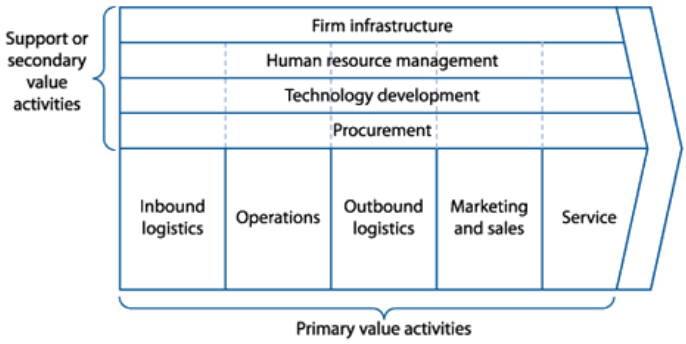

Figure 1 Value chain
Source: https://kfknowledgebank.kaplan.co.uk/business-strategy/strategic-analysis/porter's-value-chain

Primary activities, sometimes called line functions, are visible in the lower part of the value chain (*Figure 1*) and are directly related to the creation, sale, support and maintenance of a product or service. These include inbound logistics, production/operations, outbound logistics, marketing and sales, and services. Support activities, or more commonly referred to as secondary activities, in *Figure 1* are above the primary activities and are divided into four groups: infrastructure, human resources management, technology development and procurement. The activity description is shown in *Table 1*.

Table 1 Description of primary and support activities

Activities	Activity description
Inbound logistics	Activities related to the selection of suppliers of resources needed to produce, receive, store and distribute inputs towards production facilities
Production/Operations	Activities related to converting inputs into the final product form
Outbound logistics	Activities related to the collection, storage and physical distribution of products to customers
Marketing and sales	Activities related to providing customers with the means to buy a product and encouraging them to do so
Service	Activities related to the provision of services aimed at improving or maintaining the value of the product
Firm infrastructure	Includes general management, planning, finance, accounting, legal affairs, public relations and quality management
Human resource management	Activities relating to recruitment, hiring, training, development and activities concerning the compensation system for all groups of employees
Technology development	Every activity carried out by an organization has technology, it can be know-how technology, procedures or technology that is the basis for equipping the process
Procurement	Buying inputs, which the company uses in the company's value chain

Source: Authors according to Porter, M. E. (2008) Konkurentska prednost: Postizanje i održavanje vrhunskog poslovanja. Zagreb: Masmedia d.o.o.

The groups of primary and secondary activities listed in *Table 1* include three different types of activities that represent different roles in competitive advantage, namely: direct activities (directly involved in customer value creation), indirect activities (equipment maintenance and handling, determination deadlines, etc.) and quality assurance activities (Porter,2008).

3. CREATING VALUE CHAIN

In order to make it easier for the organization, or its executives, to apply the value chain, they need to think of the organization as an activity chain within a broader value system that leads to overall results. Therefore, it is necessary to divide the activities of the organization into those primary, which directly produce and deliver products, and support activities that enable the realization of the primary (Presutti,2013). In such a division, a certain level of managerial knowledge is important, which depends mostly on managers past experience. Therefore, nine teams and their representatives should be formed for each of the nine activities in the value chain. In other words, each team needs to carefully analyze the default value chain activity (McGrath and Bates, 2013). After defining primary activities and support activities, it is necessary to determine for each activity what specific sub-activities create value. For example, this could be an analysis of how human resource management adds value to inbound logistics or production. Links should be identified between identified values. Links are defined as "the relationship between how one value activity is performed and the cost of performing another value activity" (Porter,2008). There are two types of links, which are links within the value chain and vertical links. Thanks to the links within the value chain, there are two ways to achieve a competitive advantage, through optimization or coordination. The optimization is done in such a way as to create trade-offs between activities in order to achieve more successful results, while the coordination of activities often contributes to reducing costs or enhancing differentiation (Porter,2008). Vertical links are very similar to those within the value

chain in the way the activities of a supplier or intermediary are performed, which affects the cost of doing business, and vice versa. When a supplier configures its value chain, it often happens that it affects both the supplier and the organization, and there is a common optimization of activities or coordination between the organizational and suppliers value chains.

The last step in creating a value chain is to look at all the sub-activities and links identified in the previous steps and think about how they can be modified or improved to maximize the value offered to customers. An organization's value chain should reflect its general business strategies. There are two different strategies that depend on the type of competitive advantage the company wants to create. These are: differentiation strategy and cost advantage strategy (S.M.Insight,2013).

4. CASTE STUDY: OMCO CROATIA'S VALUE CHAIN

Methodological approach to the application of Porter's value chain is presented throughout the case study made on Omco Croatia Ltd. Omco Croatia Ltd. is an organization from Hum on Seattle, which is a leading European but also a worldwide manufacturer of molds for glass packaging. In 1997, it became part of the Omco International Group based in Belgium, with sections in the United Kingdom, Turkey, Romania and the Republic of Croatia, branches in Belgium and Slovenia, and with offices in the United States, Russian Federation and the Far East. Omco Croatia is one of the best equipped factories in the region for metalworking with the latest technology and equipment and currently employs 720 people. Information on how Omco Croatia d.o.o. applies the value chain are obtained by talking to the Head of Finance, Head of Human Resource Management, Head of Marketing and Sales, and Production Manager. Typical aspects of the supporting and primary value chain activities of Omco Croatia are shown in the tables below. They represent a clear picture of how support and primary activities take place within the organization process.

Table 2 Creating support activities for Omco Croatia Ltd.: Infrastructure

Typical aspects of infrastructure	Creating typical aspects
Department of General Management	The strategy is implemented at the group level. Depending on the capabilities of Omco Croatia the director seeks to accomplish strategic goals to accomplish the organization's strategy. The director communicates the strategy and strategic goals to heads of departments who further communicate with the workers. This way, everyone in the organization is informed about the goals and is working to achieve them.
Planning	The strategic plan is implemented at all levels of the organization. Also, tactical and operational plans are implemented at the organization level. In order to monitor the implementation of the plans, a cost analysis is carried out several times a month and they are in accordance with the plans. Also, an analysis of the manufactured products is performed and how much it deviates from the expected production.
Finance	The Finance Department takes care of payments to suppliers and billing to customers.
Accounting	The accounting department works on monthly payments to employees, drawing up a balance sheet, profit and loss account and accounting for business events.
Controlling	Controlling monitors the costs, prepares additional reports, monitors the cost of materials, complaints. This is an analysis of the actual and planned costs, as well as the actual made products with the planned number of products. The controlling department is closely linked to other departments so that they can jointly conclude what individual departments mean, given that different products are manufactured differently and require different costs.

Typical aspects of infrastructure	Creating typical aspects
Legal department	The head of each department is required to follow the laws and legal changes that affect his department. For example: the accounting manager takes care of employee pay laws and financial statements.
Quality management	A separate department is responsible for quality control. There are two types of quality in Omco: • Quality in the production process, where the worker checks the quality and credibility of the product together with the head of the department, during the creation of the product. • Final controls where a team of people checks the quality of the final product.
Aspect of government / state action	Use of European funds for various projects. A project on the use of European funds for energy efficiency and the construction of new premises has been implemented.

Source: Authors, 2019., Croatia

In the area of infrastructure, the aspects of general management, planning, finance, accounting, controlling, legal, quality management and government are distinguished. Each of these aspects serves to support the primary aspects mentioned below.

Table 3 Creating Support Activities for Omco Croatia Ltd.: Human Resource Management

Typical aspects of Human Resource Management	Creating typical aspects
Recruitment and employment	Due to the knowledge of Omco's work, numerous CVs and job applications are received. Therefore, most often, Omco organizations do not need job vacancies. When it is necessary to hire someone for a specific position, it is a matter of checking these CVs and choosing the best few who are invited to the interview based on that. Together with the head of the department looking for an employee, the HR manager attends the interview and through it decides on the most suitable employee. If necessary, a knowledge exam is also done.
Training	All employees are offered a foreign language course. However, three-shift production workers are usually unable to arrange weekly attendance at such courses. Accordingly, courses are most often attended by employees of different offices. Since the organization applies ISO standards, frequent training and education are being conducted on changes and their implementation. During 2018, software changes were made to all CNC machines and all workers working on them participated in courses on how to apply the new software.
Development	For different employees to better handle different clients, can use different communication benefits. If the head of a department thinks that an employee of his department, depending on his competencies, would be more successful in another department, then the head of the department where the employee is currently located and the head of the department, which is more appropriate to the employee, find and decide together on employee rotation. Of course, it is necessary that the head of the human resources department supervises this rotation to avoid improper rotation.
Compensation	Through each assignment, each head of department monitors his or her employees and their commitment to solving the task. For those who are best, there are informal acknowledgments in the form of an interview with an employee and a manager who praises him and thus motivates him to continue working. Such recognition applies

Typical aspects of Human Resource Management	Creating typical aspects
	throughout the organization. Also, if the employee contributes to the improvement of his team throughout the entire period of time, he receives a simulation money on his salary. Also, if an employee happens to deliberately sabotage their job or do something that does not comply with company rules (for example, using a cell phone at work), a warning is given. Three reprimands can be obtained, and the third is often a reason for dismissal. Of course, if the worker apologizes and his behavior is visibly improved, he remains in the workplace.

Source: Authors, 2019., Croatia

In the field of human resources management, the organization recognizes the aspect of recruitment and employment, employee training, development and compensation. Human resource management activities are a support to almost all primary activities as they relate to employees who directly influence processes in the organization.

Table 4 Creating Support Activities for Omco Croatia Ltd.:Technology development

Typical aspects of technology development	Creating typical aspects
Product research and development	Omco applies regular research and technology development to produce the highest quality products possible. The development of technology, its automation and robotization are done with the aim of reducing human error and increasing the production and quality of products. Applies one of three technology development investment programs: 1. procurement of new 2. replacement of the old one 3. automation and robotization projects
The implementation process	The application of new technologies involves internal or external training. Internal training takes place when new technologies for that part are introduced in a certain part of the production, but it already exists in the organization. Then those who are familiar with it do the training of those with whom technology is being introduced. External training is most often conducted when introducing new technology that the organization is not familiar with. For example, the organization introduced laser manufacturing and training was provided by people outside the organization.
Service process	The organization currently performs corrective servicing for the most part - the failure is resolved when detected. Its purpose is to carry out preventative servicing (replacement of filters, oils, lubrication) as much as possible to prevent possible failures. Also, as it introduces Industry 4.0 and plans to fully implement it by the end of 2020, predictive maintenance is expected, with the machine reporting the error itself (most often by sending an email).

Source: Authors, 2019., Croatia

In the area of technology development, research and product development, technology implementation process and servicing process are emphasized. This group of activities and sub-activities is a direct support to the production process.

Table 5 Creating Support Activities for Omco Croatia Ltd.: Procurement

Typical procurement aspects	Creating typical aspects
Procurement by Procurement	Procurement is done as needed given that the organization works according to clients' orders. Requests are made - a certain type of

Development	material is required by the organization to be procured and supplied by the supplier. The price / quality ratio is taken into account, i.e. the supplier is evaluated, graded and marketed for the same raw material or other material. Also, the delivery time is very important for the organization to start production as soon as possible.
Procurement by other departments	Other materials, such as office supplies, on which the flow of production is independent, the organization has in stock, and need to send a request for them to be shipped from the warehouse to the office.

Source: Authors, 2019., Croatia

Procurement activities are divided into procurement by procurement development and procurement by other departments. These activities support the primary activities in the field of internal logistics.

Table 6 Creating the primary activities of Omco Croatia Ltd.: Inbound logistics

Typical aspects of inbound logistics	Creating typical aspects
Receiving and storing inputs	The communication between procurement and inbound logistics is carried out through SAP request forms (Business Program for SMEs). The warehouse manager receives inputs and is further stored by employees at the designated locations. Each commodity entering the warehouse is defined by its number and the state of the warehouse is entered in the program.
Classification of inputs into different departments of the warehouse	Since inputs are a raw material, they are classified in the raw material storage. The warehouse is arranged so that it can be found according to the raw material code. As it is a line production company, it is seen that the raw materials are well separated depending on the line they need to cover.
Warehouse	There are three main warehouses for the organization (mold, throat and raw material storage). For their organization in charge are warehouse workers who place the products by code to help them locate and deliver the required part of production.
Inventory management	The organization in storage holds the materials needed for production, but very briefly. Specifically, the organization orders the quantities needed to produce the quantity ordered by the customer. The organization always has in stock the necessary office supplies (paper, envelopes, staples, pencils, etc.) and protective equipment for employees (departments, shoes and hats). These stocks are monitored and there is a minimal amount and when approached, the warehouse manager orders the necessary.
Return to suppliers	If the goods of the supplier do not meet the qualifications, the goods are usually replaced. In other words, the organization contacts the supplier about the wrong goods and they change it. The same is possible because the organization usually deals with long-term suppliers. In case the goods do not meet the agreed quality, a clearance is required.

Source: Authors, 2019., Croatia

Internal logistics is the organization's first primary activity and consists of receiving and storing inputs, sorting inputs, warehousing, inventory management and returns to suppliers. As a support activity to this primary activity, it is important to single out procurement activities and infrastructure.

Table 7 Creating the primary activities of Omco Croatia Ltd.: Production/Operations

Typical aspects of production	Creating typical aspects
Machining	On CNC machines, 60% of the milling process are performed, followed by turning, deep drilling and detailed processing - particle separation processing. The organization has four manufacturing plants: Three mold production business units, one throat production business unit - it is focused on detail. It is a line production in which one worker usually serves two CNC machines. Accordingly, production monitors the flow of materials to minimize waste of time.
Compilation	The molds are made in 14 positions and some of them are carried out in cooperation with the organization. Omco Croatia plays a major role in planning these activities.
Testing	There are three product options: 1. Correct product - goes on packing 2. Defective product - repair option 3. Scrap - a product that can no longer be repaired During production, an intermediate control is carried out in which the head of department with each individual operator checks the quality and credibility of the product. When the product is finished the final control is performed in the 3D coordinate laboratory. It is an extremely detailed analysis in which it is almost impossible to not see the error.
Packaging	There are six employees in the shipping and packaging department who are familiar with the detailed requirements of all customers. They have the tables that the client requires, and if the requirements have changed - they must act on them. The packaging is extremely important for clients because it is a heavy and expensive product and it is important for them to be of good quality. Some are looking for oil lubrication, specific boxes, lined boxes with special materials, etc.
Equipment maintenance	Equipment maintenance is done by the internal maintenance department. It is divided into electronic and mechanical maintenance.

Source: Authors, 2019., Croatia

Manufacturing is a core activity of the organization and is divided into machining, compilation, testing, packaging and maintenance of equipment. All support activities directly support this primary activity.

Table 8 Creating the primary activities of Omco Croatia Ltd.: Outbound logistics

Typical aspects of outbound logistics	Creating typical aspects
Storage of the finished product	The organization does not produce products for the purpose of storing them, because each order is unique, and they cannot make a universal product that would fit more customers. Therefore, after production of one batch of products is completed, it is rarely stored, and is already delivered to the customer.
Order processing	Order processing is closely related to the previous aspect. Since the product is very rarely stored and is unique to each customer, the order is processed right at the beginning - after its processing, the production process begins.

Planning	Deliveries in the organization are planned in advance. When an organization receives a customer order, it arranges a delivery period with it and a work order is created. If for some reason the organization is not able to deliver the goods to the customer within the planned period, it should be notified to the customer a few days before, and usually a new agreement is reached about the delivery time. In the event that no new agreement is reached, the organization must pay penalties to the client, which were also agreed in advance.
Delivery	The customer delivery system is usually organized by the organization itself unless otherwise requested by the customer. The organization arranges outsourcing to another organization that does delivery to the client. Most often, these are long-standing collaborations with outsourcing organizations.

Source: Authors, 2019., Croatia

External logistics includes finished product storage, order processing, planning and delivery. These activities support infrastructure and technology development activities.

Table 9 Creating the primary activities of Omco Croatia Ltd.: Marketing and sales

Typical aspects of marketing and sales	Creating typical aspects
Advertising	Because it is a specific market, the organization does not conduct standard advertising. Namely, organizations in the glass industry are very familiar with Omco, and if they need its services, they contact the company. Therefore, advertising is unnecessary and would require unnecessary costs. The only way to advertise is brochures and catalogs for current and potential clients.
Promotion	Annual exhibitions at European and world fairs (for example: Düsseldorf and Moscow).
Choice of distribution channels	Omco implements a direct distribution channel without intermediaries.
Price decision	On average, Omco products are more expensive than their competitors (about 10% more expensive). The pricing decision is made on the basis of internal calculations, comparing the costs and the labor and time required for production. Also, a comparison is made with similar products that an organization has produced before and looks at pricing as being in a similar box.
Sale	The organization applies direct sales - the product of the organization is delivered directly to the customer under predefined conditions. They vary from client to client and need to be addressed.

Source: Authors, 2019., Croatia

Marketing and sales include advertising, promotion, channel selection, pricing and sales. The primary activities related to the services include the after-sales activities the organization provides to its customers and Omco Croatia does not do it. Namely, the organization sends products to customers, and it is a consumable product that, depending on the type of mold, can produce more than 300,000 glass bottles. Considering the product itself being supplied there is no need for assembly. Should any of the products be defective, it allows the organization to replace it.

Through the analysis of the primary and secondary activities, links between specific activities that improve the overall functioning of the organization and that reduce costs are found. The first link is between the implementation process of new technologies and training activity. Because employees go through the training process when new technology is presented, they can adapt faster to the

changes and that will reduce unnecessary costs. There are also links between planning, controlling and all the production activities, as well as planning and procurement, development, and also planning, price decision and order processing. Planning is an important activity and if every part of the organization is well planned it can have a positive impact on costs, and it can add value. Link is also found between technology development, procurement and receiving and storing inputs. Procurement activities as well as inbound logistics activities can be faster and more efficient if there is a specific software implemented. With that kind of technological development, more activities can be optimized, not just the activity of storing inputs. Technology is an integral part in any value creating activity today. Technological variations impact competitive advantage either to completely enhanced levels or by adding configurations to the existing Value chain to the extent that the technology affects cost driver or differentiation (Bhargava et al, 2018). There is a link between warehousing and delivery. If the communication between the organization and affiliate organizations is improved, significant value can be added. Other direct links are between inventory management and procurement, testing and quality management, storage of the finished products and delivery, order processing and packaging. Those activities add value to the overall performance of an organization. Through the analysis of all activities, it was concluded that the key task is to improve communication between affiliate organizations and to optimize and implement software systems in business processes.

5. CONCLUSION

The value chain as observed by Michael Eugene Porter is a set of interdependent activities, which are divided into those primary that are considered key activities and support activities that support the primary. It is only through their joint action that the goal of the value chain is achieved, which is to make a profit. The main source of competitive advantage for an organization is the difference with the competitors' value chains, so it is extremely important to identify the benefits and to highlight them so that they are visible to end customers. Understanding the value chain enables the organization to have real-time information that it can use to generate profit over its competitors and to determine where activities that have a negative impact on business goals may be located within the organization for the purpose of eliminating all potential threats. Value chain analysis, as one of the tools for analyzing the internal environment of an organization is important for determining the context of an organization, which is a demand set by ISO 9001. This analysis does not only meets the requirements of the quality management system and creates value for an organization, but also helps to improve and to enable sustainability of an organization. Presented through the case study, it can be concluded that this type of analysis is applicable to every organization and that it helps in determining the value of each of the activities that are carried out in a specific organization.

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THE IMPACT OF THE MICROCLIMATE PARAMETERS ON THE LABOR PRODUCTIVITY

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Abstract: *During the work, which is about one third of an average day, man is exposed to the environment, people, and environment is surrounding him. Under the influence of the environment, which can affect him, even adversely, the performance and productivity of the employees is reduced, while on the other hand, the energy consumption, required for the execution of the work, is increased. So far, research has shown that the greatest impact on workers' performance, and often on its health, have microclimate parameters, such as temperature, humidity and air flow, and also dustiness, smoke, pollution, gases and various radiation.*

The paper presents the analysis of microclimate parameters, where, as the object of the research, was shown the Swisslion Industrija alata a. d. Trebinje. During the research, the method of questionnaire was used, where it was attempted to include as many jobs as possible. At the same time, the values obtained by the measuring instruments were also shown, and a comparison with the results, obtained by the survey method, was made.

Keywords: *employees, microclimate parameters, productivity*

JEL Klasifikacija: *J24 Human Capital ,Occupational Choice, Labor Productivity*

1. INTRODUCTION

Optimization of working conditions is a general principle and a prerequisite for mitigating hazards that can endanger the life and health of employees at work. Optimal working conditions, to a large extent, depend on the type of work, but also on other factors conditioned by production processes, individual characteristics, and the like.

Temperature, humidity and air flow are interacting. Thus, if there is a rise in temperature, at the same level of humidity, but with increased air flow, the person's experience will not change. Consequently, there is a need for a comprehensive treatment of the impact of the aforementioned microclimate

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parameters, which is achieved by the effective temperature. The aim of the paper is to show how the parameters of the microclimate (temperature, humidity, air flow) affect the productivity of workers.

2. MICROCLIMATE; DEFINITIONS AND BASIC TERMS

Microclimate is defined as a climate of small non-geographical sizes (climate in a refrigerator, apartment, office, hospital, etc.). Microclimate conditions are determined by thermal comfort. It is a widely accepted definition that thermal comfort is a condition of consciousness expressed by satisfaction with the heat of the environment. Awareness concludes whether the conditions of thermal comfort or discomfort have been reached, based on the temperature and moisture of the skin and the temperature of the body core [1].

The climate of a space, or microclimate, consists of the following meteorological elements: solar radiation, Earth's radiation, air temperature, air pressure, humidity, wind, evaporation, snow cover, vegetation, etc. The study of the microclimate refers to the ground layer of air, because in the air lower than two meters the turbulent air movement is low and the speed is small, while the vertical gradients of air temperature and humidity are high. During the day and during the year, the microclimatic parameters are variable, and depend significantly on the observed location, such as latitude, altitude and terrain configuration. For the study of meteorological elements in a closed object, the term cryptoclimate can be found instead of the term microclimate [2].

In a closed facility, the most important meteorological elements, ie microclimate parameters, which have an impact on the exchange of heat energy between humans and the environment are [3]:

- air temperature,
- air humidity,
- air flow rate.

Adverse microclimate conditions in work-related facilities have a direct impact on human health, thermal comfort and productivity. Cold microclimatic conditions, ie. low air temperatures cause frostbite, and warm conditions, ie. high air temperatures can lead to heat stress [2].

2.1.Air temperature

The degree of warming of a body is characterized by a known parameter, ie. temperature. In physics, temperature is introduced as a measure of the mean kinetic energy of the translational motion of a single particle, with the following bond, which is given by the following expression [2]:

$$\frac{m v_{ksk}^2}{2} = \frac{3}{2} k_B T,$$

where are:
m - mass of the particle (molecule), [kg],
v_{ksk} - root of the Cretaceous square of the velocity of the molecule, [m/s],
k_B - 1,3809 · 10^{-23} J/K - Boltzmann constant,
T - absolute temperature, [K].

When performing tasks different in severity, the temperature of the working environment is an additional factor, which impedes or facilitates the normal functioning of the organism, that is, its adaptation. When performing tasks of different weight, the human body warms up more when performing physically difficult work, and less in light work, and it seeks to compensate for negative influences from outside by activating thermoregulatory synergies [3].

Research to date indicates that no single value of air temperature can be considered acceptable, which will satisfy all persons and provide optimal transfer of heat energy from the skin surface to the environment. Thermal sensation is also influenced by other factors, in particular the thermal radiation of the surrounding surfaces, the humidity of the air, the rate of airflow, the intensity of metabolism, and the thermal insulation of clothing [2].

In certain situations, exposure to excessive heat can lead to heat stress, which manifests in the form of exhaustion, excessive sweating, fainting and heat stroke.

Table 1, according to the Regulations on Preventive Measures for Safe and Healthy Operation, shows the recommended indoor temperature values for individual outdoor air temperature values.

Table 1. Recommended indoor temperature values for individual outdoor air temperature values

TYPE OF WORK	OUTDOOR AIR TEMPERATURE		
	to +5 ˚C	from +5 to +15 ˚C	more than +15 ˚C
	Recommended internal temperature value [˚C]	Recommended internal temperature value [˚C]	Recommended internal temperature value [˚C]
EASY PHYSICAL WORK	18-28	18-28	maximum 28
MEDIUM PHYSICAL WORK	15-28	15-28	maximum 28
HEAVY PHYSICAL WORK	15-28	15-28	maximum 28

Source:https://www.paragraf.rs/propisi/pravilnik_o_preventivnim_merama_za_bezbedan_i_zdrav_rad_na_radnom_mestu.html (accessed: 11 June 2019)

2.2.Air humidity

In realistic environmental and work conditions, people are exposed to atmospheric air, which contains some amount of water vapor. The atmospheric air that surrounds a human being is a mixture of dry air and water vapor, called humid air. Dry air, air in which there is no moisture, as one component of moist air, is itself a mixture of gases. Table 2 shows the composition of pure dry atmospheric air [2].

Table 2. Dry air composition

GAS	FORMULA	MASS FRACTION,%	VOLUME FRACTION,%
Oxygen	[1] O_2	[2] 23,01	[3] 20,93
Nitrogen	[4] N_2	[5] 75,51	[6] 78,10
Argon	[7] Ar	[8] 1,286	[9] 0,9325
Carbon dioxide	[10] CO_2	[11] 0,04	[12] 0,03
Hydrogen	[13] H_2	[14] 0,001	[15] 0,01
Neon	[16] Ne	[17] 0,0012	[18] 0,0018
Helium	[19] He	[20] 0,00007	[21] 0,0005
Krypton	[22] Kr	[23] 0,0003	[24] 0,0001
Xenon	[25] Xe	[26] 0,00004	[27] 0,000009

Source: Žarko Bojić, Uticaj parametara mikroklime, buke i osvjetljenja na toplotni komfor u radnoj sredini, doktorska disertacija, Univerzitet u Novom Sadu, Fakultet tehničkih nauka u Novom Sadu, 2018, Novi Sad

Humidity primarily affects the exchange of thermal energy between humans and the environment. The high moisture content of the air has the effect of reducing the resistance of heat from the surface of the skin to the clothing and then to the environment. Low moisture content in the air, ie low partial pressure of water vapor in the air, has a positive effect on the evaporation of sweat, ie. exchange of thermal energy from the surface of human skin to the environment. The main effect of high humidity in the air is that the sensations of cold and heat in a person are more pronounced. At high air temperatures and the ambient temperatures of the surrounding surfaces, humidity plays an important role in the exchange of thermal energy, since then there is increased evaporation and sweating [2]. The relationship between temperature, humidity and performance is given in Table 3 [5].

Table 3. Relationship between temperature, humidity and performance

TEMPERATURE	HUMIDITY WORKING		PERFORMANCE
21 ˚C	[28]	40 %	Very good.
	[29]	85 %	Work and rest change well.
	[30]	91 %	Reduced, there is fatigue and depression.
26 ˚C	30 %		Very good.
	65 %		Reduced, rapid fatigue.
	80 %		Difficult, need for frequent rest.
32 ˚C	[31]	25 %	Very good.
	[32]	50 %	Highly reduced performance.
	[33]	65 %	Work is almost impossible.
	[34]	81 %	Exhausting, it leads to an increase in body temperature.
	[35]	90 %	Work threatens health.
	[36]	100 %	Work is impossible.

Source: Andrejiova M., Kralikova R., Wessely E., Sokolova H., Assessment of the Microclimate in the Work Environment, DAAAM International Scientific Book 2012, Chapter 42, pp. 509-516, available at: https://www.daaam.info/Downloads/Pdfs/science_books_pdfs/2012/Sc_Book_2012-042.pdf

2.3.Air flow rate

Like in the atmosphere, in objects there is a movement of air mass, which is due to unequal heating of the air above the surfaces, so that there is a change in air pressure and the air starts flowing from areas with higher temperature and pressure, towards areas with lower temperatures. and air pressures. These air movements in objects with good thermal insulation, on average, have much lower velocities than those of air masses outside the objects. The movement of air masses resulting from unequal heating may be horizontal and vertically and by its character: directed and swirling [2].

Air movement can be caused by natural and forced ventilation. Natural ventilation in the building is the result of different values of the air pressure in front and in the building, so that natural convective airflow occurs. An increase in the velocity of the air in objects can be caused by the use of a fan, where forced convective airflow is produced. Air movement is a vector magnitude, which has its direction, direction and intensity. It is characteristic that the movement and minimum air masses have oscillations in time, space and direction [2]. A summary of the values for each type of working class is presented in Table 4 [5].

Table 4. Summary of values for each type of working class

WORKING CLASS	TEMPERATURE *[˚C]*			
	PERMIT AIR FLOW SPEED *[ms^{-1}]*		MOISTURE PERMIT *[%]*	
	WARM SEASON	*COLD SEASON*	*WARM SEASON*	*COLD SEASON*
sitting at work, administration	< 0,25	< 0,20	30 - 70	30 - 70
standing at work	< 0,30	< 0,25	30 - 70	30 - 70
mechanical work, work in the steel industry	< 0,30	< 0,30	30 - 70	30 - 70
working on operating machinery and construction industry	0,1 - 0,3	< 0,30	30 - 70	30 - 70
intense	The value is not determined.			
very intense work				

Source:https://www.paragraf.rs/propisi/pravilnik_o_preventivnim_merama_za_bezbedan_i_zdrav_rad_na_radnom_mestu.html (accessed: 11 June 2019)

3. HEAT BALANCE

Microclimatic conditions affect, to a large extent, the health, subjective sense of comfort and working capacity of people. Taken together, or individually, they affect the flow of thermoregulatory processes in humans and in certain cases can cause disease in humans exposed to these conditions. Adverse microclimate conditions have a negative effect on psycho-physical fitness and productivity. However, it has been proven that humans can still adapt and live in conditions with very high temperature differences, differences in relative humidity, air velocity, and other physical and climatic changes, but it takes some time to adjust, ie. for acclimatization [1].

3.1.Thermoregulation

Man is a homeotherm. Mechanisms of thermoregulation, physical and chemical, maintain a constant body temperature of 36.5 degrees Celsius. Physical thermoregulation is the release of heat in the conditions of its increased formation in the body or being in the middle with high temperature. Radiation can be done by radiation, convection, conduction and evaporation. Chemical thermoregulation is the process of regulating the combustion of matter in the body. Total heat production is influenced by basal metabolism and skeletal muscle physical activity [1].

The human body normally functions under conditions of maintaining normal body temperature. The abnormal increase or decrease in the temperature of the working environment causes unfavorable conditions for the functioning of the human body. In an effort to maintain a normal body temperature, the human body, at rest, within the basal metabolism, takes measures: accelerating or slowing down chemical processes aimed at energy production, sweating, shivering, etc. [6].

3.2.Thermal comfort

Thermal feeling of man is a physiological term, and thermal comfort can be defined as a state of consciousness of man, by which he expresses satisfaction with the thermal regulation of the organism in all parts of the body. A person will be in a state of thermal comfort only if the physical conditions are indifferent to his body [2].

Factors that cause local heating or cooling of a part of the body can cause thermal discomfort, ie. thermal discomfort on that part of the body by causing vasoconstriction or vasodilation on that part of the body. If the larger surface of a person's skin is exposed, thermal discomfort will occur in this case, ie. thermal discomfort for the whole body of man. The sensation of heat in a human being is mainly related to the thermal equilibrium of his body, and is realized if the internal generation of heat energy is equal to the amount of heat energy transmitted to the environment. If there is a disruption of the heat balance, the person will feel discomfort, ie. thermal discomfort, and body temperature regulation mechanisms will be triggered [2].

4. EXPERIMENTAL RESEARCH, RESULTS AND DISCUSSION

The study was performed in Swisslion Trebinje, a confectionery organization. Up to 2018, the company has established itself as a leader in the food industry for the region of Southeast Europe, with over 400 employees of various profiles.

The research part is divided into two parts. First, an overview of the values of the observed parameters, obtained by measurement, was given, and then an overview of the results obtained by the questionnaire method was presented, where the aim was to cover as many different jobs as possible.

Subsequently, by means of a comparison method, the aforementioned two parts were analyzed, with the aim of determining whether there were significant discrepancies between the objective and subjectively obtained results.

The values of microclimate parameters at different workstations obtained by objective measurement using measuring instruments are given in the following table.

Table 5. Measured values of microclimate parameters

NUMBER OF MEASUREMENT	*WORKPLACE*	*THE TIME OF MEASUREMENT*	*TEMPERATURE VALUE [˚C]*	*VALUE OF RELATIVE HUMIDITY AIR [%]*	*VALUE OF AIR FLOW RATE [ms^{-1}]*
1.	Glazer	7.00 a.m.	20,9	28,1	0,0
2.	Gingerbread pack	7.00 a.m.	21	28,9	0,0
3.	Cocoa milling	7.00 a.m.	22	26,8	0,0
4.	Cocoa packing	7.00 a.m.	18,6	31,5	0,1
5.	Mass preparation	7.00 a.m.	20	32,5	0,0
6.	Raw material warehouse	7.00 a.m.	16,1	33	0,1
7.	Kneading the waffle	7.00 a.m.	24	28,9	0,0
8.	Cutting waffles	7.00 a.m.	23,8	28,6	0,0
9.	Waffle packaging	7.00 a.m.	24	29,2	0,0
10.	Robot - Waffle	7.00 a.m.	24	29,2	0,0
11.	Knead	7.00 a.m.	28,9	48,6	0,0
12.	Cooking jelly	7.00 a.m.	28,2	40,8	0,0
13.	Depository - ver	7.00 a.m.	29	35,1	0,0
14.	Depository - biscuit	7.00 a.m.	29	35,3	0,0
15.	Packing - ver	7.00 a.m.	25	45,5	0,1
16.	Packing - biscuit	7.00 a.m.	24	10	0,0
17.	Packing - coffee machine	7.00 a.m.	24	48	0,0
18.	Depository - coffee machine	7.00 a.m.	28,2	48	0,1
19.	EKT	7.00 a.m.	28,2	36	0,1
20.	EKB	7.00 a.m.	27	38	0,0
21.	EKB - Packing	7.00 a.m.	24	44	0,1
22.	Mass preparation	7.00 a.m.	28,9	35,4	0,0

As can be concluded, from previous Table 5, there are generally different values of all microclimate parameters, and in particular temperature, which implies that the temperature of the workplace is precisely dependent on the workplace, and is controlled based on the demands that the workplace requires.

As noted above, the second part of the research concerns the subjective feeling of employees, where the results were obtained by the survey method. The following table describes the descriptive statistical characteristics of the respondents.

Table 6. Descriptive statistical characteristic of the respondents

DESCRIPTION	**NUMBER OF RESPONDENTS**	
	ABSOLUTELY	*RELATIVLY [%]*
GENDER:		
M	10	50
F	10	50
AGE:		
to 25	1	5
26-35	4	20
36-45	11	55
46-55	4	20

56-55	-	-
66 +	-	-
LEVEL OF EDUCATION:		
unqualified	-	-
semi-qualified	1	5
qualified	3	15
secondary education	14	70
highly qualified worker	1	5
higher education	-	-
university degree	1	5
mr/master	-	-
PHD	-	-

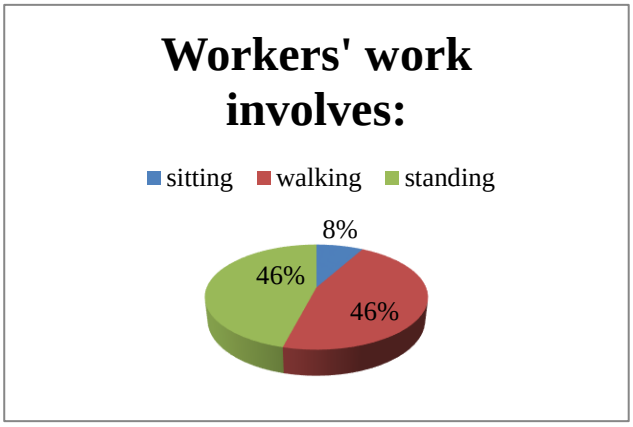
As can be seen from Table 6, both genders were equally represented in the survey. The majority of the workforce is middle-aged and is in the age range 36 to 45. Regarding the level of education, the workforce with secondary education is mostly represented, since the requirements of the work that employees perform do not insist on a higher level. Only one worker, who is from the administration sector, has a university degree.

All workers spend full time at their workplace, i.e. 8 hours a week.

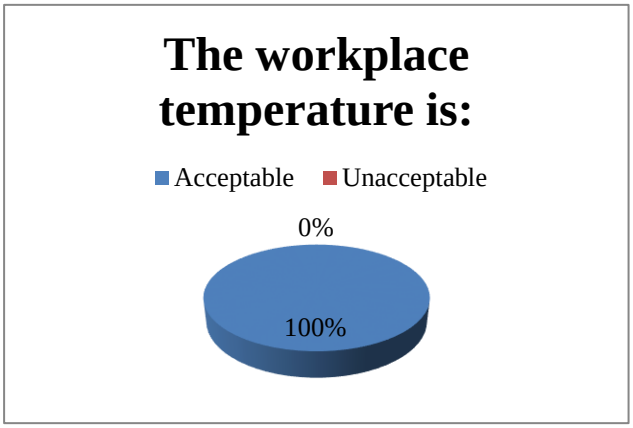
When asked what their work entails (sitting, walking, standing, something else, or a combination of the aforementioned options), the respondents answered in the manner shown in the following Figure 1.

As can be seen, from Figure 1, employees' work generally requires standing or walking, as these are mainly jobs related to the maintenance of, or supervision and control of, work centers.

The fact that it does not work is that only 10% of respondents have a window or aperture, up to 2 meters, near their workplace. However, even though all respondents said that the air temperature was acceptable at their workplace, which is a rejoicing piece (Picture 2).



Picture 1. Description of work of workers



Picture 2. Respondents' answer to the 4th statement

The fifth question was about how much the respondent thinks the current temperature is at his workplace. All subjects had a different, subjective feeling than the values actually measured, obtained and presented in Table 5. For comparison, Table 7 shows objective and subjective values. The causes of deviation can be different (gender, place of residence and adaptability to high / low temperatures, age, etc.).

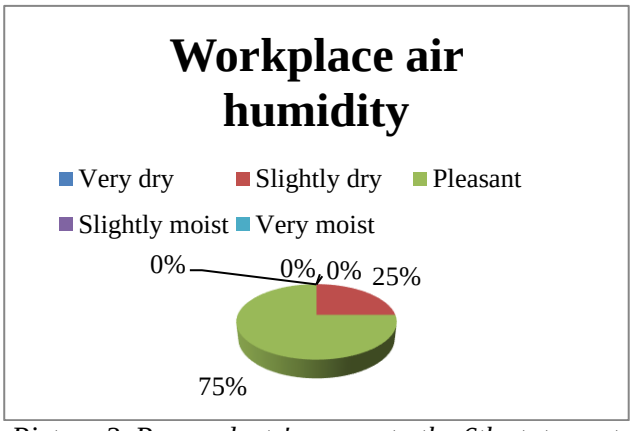
Table 7. Comparison of objective and subjective values of temperature

NUMBER OF MEASUREMENT	*WORKPLACE*	*THE TIME OF MEASUREMENT*	*OBJECTIVE VALUE OF TEMPERATURE [˚C]*	*SUBJECTIVE VALUE OF TEMPERATURE [˚C]*
1.	Glazer	7.00 a.m.	20,9	21
2.	Gingerbread pack	7.00 a.m.	21	28
3.	Cocoa milling	7.00 a.m.	22	25-26
4.	Mass preparation	7.00 a.m.	20	24
5.	Raw material warehouse	7.00 a.m.	16,1	20
6.	Kneading the waffle	7.00 a.m.	24	27
7.	Waffle packaging	7.00 a.m.	24	26
8.	Knead	7.00 a.m.	28,9	30
9.	Cooking jelly	7.00 a.m.	28,2	30
10.	Depository - ver	7.00 a.m.	29	30
11.	Packing - biscuit	7.00 a.m.	24	25
12.	Packing - coffee machine	7.00 a.m.	24	30
13.	EKT	7.00 a.m.	28,2	25
14.	EKB	7.00 a.m.	27	28-29
15.	EKB - Packing	7.00 a.m.	24	27
16.	Mass preparation	7.00 a.m.	28,9	29

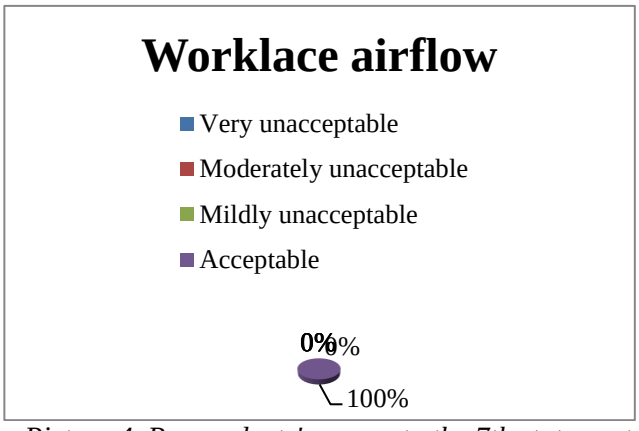
The estimation of air humidity is represented by a five-step scale, from very dry to very wet (Picture 3), while the flow rate is represented by a seven-step scale, from very unacceptable to very acceptable (Picture 4).

As can be observed, based on Picture 4, respondents mostly find the air to be comfortable, while on the other hand, they perceive airflow 100% acceptable, in the workplace.

The last question concerned the assessment of thermal comfort, where the possible answers are represented by a seven-point scale, from very cold to very warm. Picture 5. illustrates the answers.

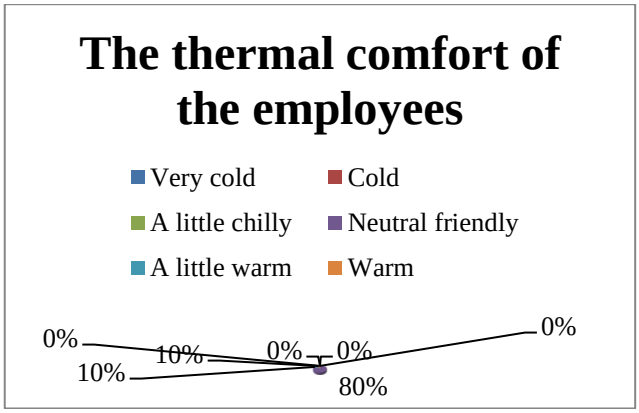


Picture 3. Respondents' answer to the 6th statement



Picture 4. Respondents' answer to the 7th statement

Based on Picture 5, it can be logically concluded that the respondents generally feel neutrally comfortable, while 20% of the respondents stated that their thermal comfort was slightly higher than expected.



Picture 5. Assessing the thermal comfort of the subjects

5. CONCLUSION

Based on the experimental results obtained by objective measurement, using measuring instruments and subjective ones obtained by the survey method, it can be concluded that, although the values of all microclimate parameters are within the reference, allowed limits, the employees still perceive them somewhat higher than the actual value. There are many reasons for such an opinion, e.g. sex, age, endurance and adaptability of the organism to high / low temperatures, etc.

Based on the previous, if the organization wants satisfied and motivated employees who are highly productive and who will achieve the goals of the organization, management should monitor, in addition to objective values, the subjective feeling of employees, and take corrective measures in terms of setting windows or openings for ventilation (if possible) or the introduction of an efficient cooling and heating system.

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METHODOLOGICAL APPROACH TO APPLICATION OF DMAIC METHOD ON IMPROVEMENT OF BUSINESS PROCESSES

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Abstract: *The need to optimize business processes stems from the increasing demands of stakeholders as well as the turbulence of organizational environments. To meet the newly identified requirements, an organization must adapt and continuously improve its business processes, which is also one of the requirements of the ISO 9001:2015 standard highlighted in point 10. The organization for process improvement and optimization has a large number of tools, methods, and methodologies at its disposal. the method is also DMAIC. The DMAIC method is an acronym of five phases through which a process or project passes, namely the definition phase, the measurement phase, the analysis phase, the improvement phase and the control phase. During improvement and optimization, organizations face challenges related to employee resistance to improvement, as well as the duration of optimization that is determined by the complexity of the organizational system. But to improve business processes, they need to be identified, which is one of the challenges organizations face.*

Keywords: *business processes, DMAIC, Lean, 6 sigma, optimization*

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1. INTRODUCTION

A constant process improvement is a requirement that arises from changes in organizational environments. However, changes in the environment are not the only reason for the continuous improvement of the process. The ISO 9001:2015 standard in point 10 as one of the requirements for the organization to put constant improvement of processes (Buntak, Kovačić, Mutavdžija, 2019). On the other hand, organizational growth and development in the organization accumulates business processes that can slow down the current way of functioning which occur the need for process optimization.

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In the 1990s, engineering of process emerged as a response to the need for redesigning and adapting to new conditions in organizational environments. Engineering of the process implied the externalization of all activities that are not part of the core process. Externalized processes are entrusted to external suppliers, i.e. service providers. Although the engineering process had several advantages, it also faced major challenges, such as the resistance of organizational employees to the rapid changes that are one of the characteristics of process engineering.

Drastic changes in the organization bring with them the risk of their disagreement, which has led to the need for a different way for improvement. The Japanese philosophy of quality through the Kaizen philosophy has enabled the constant, every day, improvements that involved and encouraged the proactive involvement of all organizational employees, which affected their additional motivation. By combining the Lean philosophy and the 6 sigma methodology, Lean 6 sigma methodology arises and includes all the benefits of Lean philosophy with the elimination of the variability of the process which significantly influenced the improvement of the performance.

In this secondary research, the main objective is to demonstrate the applicability of the DMAIC methodology in improving business process performance.

2. METHODS OF OPTIMIZATION AND IMPROVEMENT OF BUSINESS PROCESSES

To improve and optimize organizational processes, there are several tools available. The choice of the optimization approach depends primarily on the competence of organizational employees as well as on the awareness of organizational management about the needs for improvement (Buntak, Zlatić, Kovačić, 2018). A lean philosophy focuses on the elimination of process waste, which implies all activities that do not add value to the customer. Eliminating such activities increases the efficiency of the process, which reflects on overall organizational performance. On the other hand, the 6 sigma methodology is aimed at reducing the variability of the process, resulting in a lower probability of the production of a non-compliant product. In synergy, Lean and 6 sigma eliminate unnecessary activities in the process by increasing the number of manufactured co-products.

2.1. Lean philosophy

Lean philosophy is a part of TPS (Toyota production system) and is considered one of the most widely used, philosophies that shape the system of quality improvement. It contains a set of tools and methods that are directed towards improving the flow of resources through the process or increasing the efficiency and effectiveness of the process (Buntak, Kovačić, Mutavdžija, 2019). Process waste that lean try to eliminate from the process is MUDA (Japanese term for process waste), MURI (Japanise term for overburdening equipment) and MURA (Japanese term for unevenness in a process). However, the focus of organizations is primarily the elimination of MUDA which contains unwanted activities such as unnecessary movements, unnecessary transport, unnecessary processes, non-conforming products, unnecessary supplies, unnecessary waiting, and excessive production.

Organizations that adopt the Lean philosophy achieve several advantages such as reducing the production cycle time, reducing labor costs, and reducing the number of non-conforming products quoted by Leite and Vieira (2015) in their research (Leite, Vieira, 2015). Further, Lean's philosophy emphasizes the importance of timely planning, securing a safe working environment for all employees in the organization, as well as learning, ie educating all employees, reflecting organizational performance in the long run (Gupta, Kumar Jain, 2013).

The adoption of Lean philosophy is carried out in four steps. The first step in identification is process waste that reduces the efficiency of the process. Particular attention must be paid to hidden waste that can only be identified by a more detailed analysis of the process. In the second step, it is necessary to identify the cause of the process waste. Elimination of process waste as such will not result in performance improvement if the cause of its occurrence is not eliminated. The next step is identifying solutions that must prevent possible recurrence of process waste while the last step is to

implement the identified solution (Gupta, Kumar Jain, 2013). Improving the process and eliminating the causes of process waste can be accomplished using some of Lean's philosophy tools such as Just in Time, Poka Yoke, Jidoka, etc. The implementation of one of these solutions depends primarily on the context of the organization and the organizational process.

2.2. 6 sigma

The 6 sigma methodology was created in Motorola to reduce the number of nonconforming products that are the result of process variability. The 6 sigma process optimization and improvement is based on a team approach that seeks to identify stakeholder requirements and eliminate non-conformities from the process (Tjahjono et.al., 2010). The primary goal of the 6 sigma methodology is to reduce the variability in the process that is detrimental to its stability which affects the manageability and process capability. Furthermore, the main goal of applying the 6 sigma methodology is to bring the process up to 6 sigma level, which implies the occurrence of 3.4 nonconformities on a million produced products or services provided (Montgomery, Woodall, 2008).

The 6 sigma team consists of four specific roles that team members have; that is; a white belt, a green belt, a black belt, and a black master belt. The white belts are introduced to the 6 sigma methodology as well as to all the tools and methods used in it. The green belt is the backbone of the improvement project and it has a leadership role in the team. The black belt is normally the optimization manager and manages all the green belts in the organization, while the master black belt is the highest authority in the overall improvement project.

For the implementation and preparation of the 6 sigma project, the organization must provide the supreme management assurance as well as providing all the resources needed. In addition, the organization must provide competent employees who can contribute to optimizing and improving their processes through their knowledge and skills. The last component that needs to be provided is the infrastructure and superstructure in the organization (Gupta, Kumar Jain, 2013). The 6 sigma methodology is based on the DMAIC (acronym: Define, Measure, Analyse, Improve, Control) approach, which is the acronym described in Chapter 3. The DMAIC method itself contains a large number of different tools and methods that are used depending on the need and the project phase. In practice, decision-making tools are often used. Table 1 shows the sigma level of the process with the associated number of nonconforming products that are characteristic of the individual sigma process level. Additionally, the table also shows the yield percentage that depends on the process sigma.

Table 1: Sigma process level and number of nonconformities in the process

Sigma level	The number of non-conformities on the milk product / service	Yield
1	690,000	31
2	308,537	69
3	66,807	93.3
4	6,210	99.38
5	233	99.977
6	3.4	99.99966

Source: Authors according to Vivekananthamoorthy, N. and Sankar, S., 2011. Lean Six Sigma. In Six Sigma Projects and Personal Experiences. IntechOpen

2.3. Lean 6 sigma

The Lean 6 Sigma Approach to Process Improvement and Optimization emerged in the 1990s, it was identified that Lean Philosophy and 6 sigma methodology are complementary and how their joining results in significant effects in the context of improving organizational processes (Dave, et.al., 2015). The similarities between Lean philosophy and 6 Sigma methodology are shown in Table 2.

Table 1: The similarities between Lean philosophy and 6 Sigma methodology

Lean philosophy	6 sigma
Defining the methodology of improvement	Defining the methodology application policy
Focus on customer's request	Measurement of customer requirements
Understanding the Existing Situation	Discovery of knowledge
Documentation of the current course	Mapping the existing process
Evaluation of Opportunities	Analysis of causes and consequences
Collecting Product Data	Collecting Process Data
Reducing the cycle time, eliminating the possibility of failure of the equipment	Seven basic management tools, seven basic quality management tools, designing experiments

Source: Premužić, B. (2019). Metodološki pristup primjene DMAIC metode na poboljšanje poslovnih procesa. Diplomski rad. Sveučilište Sjever. Koprivnica

As can be seen in Table 2, Lean's philosophy is focused on customers and understanding of the existing state in the process before the start of the improvement project. Besides, Lean focuses on products as well as reducing process cycle time, while 6 sigma is focused on the process and the use of tools and methods for identifying the cause of non-compliance as well as identifying the place in the process where improvements can be made.

In other words, 6 sigma as a goal has reduced process variability as well as increased process robustness. Besides, the 6 sigma is directed to identifying optimal process conditions. On the other hand, Lean is focused on improving the flow of resources through the process. In synergy Lean and 6 sigma is aimed at eliminating all types of process waste as well as reducing the duration of activities that do not add value to the process and reduce the process cycle time (Snee, 2010).

3. USE AND APPLICABILITY OF LEAN 6 SIGMA METHODOLOGY IN PRACTICE

There is a large number of professional and scientific researches on the benefits of using the Lean 6 sigma methodology to improve and optimize the process. Antony et al (2007) study the benefits that Lean 6 sigma methodology uses in the service sector. Furthermore, Antony et al. identify that the application of the said methodology in practice in an unpublished health organization resulted in a reduction in radiology costs by 22% or a 33% increase in resource flow through the radiological process. The same author for the Lean 6 Sigma methodology in the banking sector cites a significant increase in the satisfaction of clients using bank services, reducing the process cycle time, as well as increasing the efficiency of the process (Antony et.al., 2007).

Pinjari (2017) in his research speaks of the benefits that the manufacturing organizations have been using through the Lean 6 sigma methodology. In its research, it presents a case study that outlines the range of benefits the automotive industry achieve by using Lean 6 sigma methodology, which are reflected in increasing employee productivity, as well as reducing inventories of raw materials and materials that the organization uses in their manufacturing processes (Pinjari et.al., 2017).

Further, there are a number of other examples of good practices describing the benefits of Lean 6 sigma methodology implementation. One such example is mentioned in the research Oguz (2012), referring to the application of the said methodology in the production of concrete products and the reduction of the variability in the production process (Oguz et.al., 2012).

Challenges that facing organizations when using Lean 6 sigma relate to the huge resistance from employees who do not want to change the way they are doing the job. In addition to resistance, organizations face the challenge of carrying out education or investing in the development of human resources that are necessary to make improvements. Furthermore, there is a need for financial investments aimed at implementing one of the identified improvements in the process. As a rule, it can be said that the challenges the organization face depend on its context and the state of affairs in the process.

4. DMAIC

The DMAIC method is used within the Lean 6 sigma methodology for improving and optimizing the process. The method is actually an acronym for process improvement phases, namely the defining phase, measurement phase, phase of analysis, phase of improvement and phase of control. Each phase must be closed before it commences with the next phase, and each delivery of a particular stage must be presented and approved by the management.

The DMAIC method is applicable in all organizations because of the fact that it is a generic approach to improving and optimizing the process. Speaking about professional and scientific papers, DMAIC has been studied and investigated in the manufacturing sector in most cases (Srinivasan et.al., 2016). However, Lean 6 sigma in practice has shown particularly good results in the healthcare sector, which, by applying the same, increases the quality of life by reducing waiting lists due to the inefficiency and efficiency of the process (Buntak, Zlatić, Kovačić, 2018).

Before starting to improve and optimize the process, it is necessary to identify problems in the process from which the project will be created. Brainstorm is commonly used to identify problems as well as the weighting of generating ideas to initiate improvements. However, this is not the only prerequisite for improvement, given the fact that it is necessary to provide competent employees who will be members of the improvement team.

4.1. Define phase

The Phase of Defining is the first phase of the DMAIC in which is investigating existing states in organizational processes. An organization creates a project charter that contains all the information needed to carry out the project. In addition, it is approaching defining the requirements of the interested parties that are leading to improving and optimizing the process in order to increase the satisfaction of the interested parties. Furthermore, the existing state of the process is created using the SIPOC (Supplier, input, process, output, costumer) diagram as well as the creation of a CTQ (Critical to Quality) diagram in which a metric defines the performance, ie the failure to improve and optimize the business process. At this stage, you are also approaching and defining teams.

When creating teams it is important to emphasize that team members are limited to a maximum of 7. In addition, the team leader must have the competencies that enable team management as well as organizational skills, the ability to delegate tasks and find out about the stage in which the team is located. Each team goes through 5 phases, the stage of formation, the intensification phase between employees where conflicts often occur, the stage of standardization in which each of the team members accepts its role, the stage of performing in which the harmony prevails co-operation between team members and the ending phase in which the team is disbanded and each of the team members is awarded a suitable prize that depends on his involvement in the team (Manges, 2015).

It is important to note that all data defined in the project charter can be changed during the project if necessary. The same goes for team members who can also be replaced if it is identified that their

competencies are not good enough, that is, they do not contribute to generating and finding a solution to the problem.

4.2. Measuring phase

The measurement phase is focused on identifying the existing performance of the process. At this stage, measurements are made on previously defined measurement points in the process, but also through the extraction of information from the organization's information system. All collected data must be statistically processed using basic statistical budgets ie descriptive statistics. At this stage, a process stability analysis is also developed, which is the basis for identifying possible problems in the process that result in the production of a non-conforming product.

Analyzing the collected data identifies the sigma process level, a map of the existing process is created, which is the basis for the later phase of the analysis. It is important to emphasize that the organizational team working on the improvement project must define the data form to be collected as well as the data collection plan that the operators performing the measurements must adhere to. All measuring instruments used in the measurement must be moderate in order for the data to be obtained to be relevant and to be used in the improvement project.

4.3. Analysis phase

In the analysis phase of the approach, analyzing the collected data and identifying the causes of deviation, ie non-compliance. To identify the causes of nonconformity, the organizational team can use quality management tools such as Ishikawa Diagram, 5 why, Control - Impact Matrix, Affinity Diagram, Force Field, etc. The number of tools the organization will use depends on the complexity of the problem and the process being analyzed. In addition, at this stage, the DMAIC method performs a flow analysis of the value that is the basis for identifying all activities in the value-added process as well as for defining ways by which the identified activities, ie process waste, will be eliminated from the process or reduced time to maximize the efficiency of the process.

4.4. Improvement phase

The improvement phase implies identifying and evaluating possible alternatives by trying to eliminate the identified nonconformity from the process. At this stage, tools and methods developed in Lean philosophy, such as Just in time, Just in sequence, Jidok, Poka Yoke, 5S, etc. can be used. The choice of tools to be used for improvement depends on the context of the organization as well as the context process. For creating improvements, most commonly used brainstorms are generated by ideas that are then evaluated using some of the methods such as the Walt Disney method, the world cafe method, etc. In addition, at this stage, an analysis of the desired state of the process is carried out in order to the future appearance of the process was identified. The organizational team must identify all the risks and identify the extent to which it will cancel for the identified risk. The cost-benefit analysis identifies cost-effectiveness improvements, identifies tangible and inexhaustible benefits, and makes a decision about the proposed alternative of improvements to be implemented in the process.

4.5. Control phase

During the control phase the implemented improvements are controlled, the project closes, and the process is submitted to the process owner who becomes responsible for process management as well as for corrective action if discrepancies occur. In addition, access to updating of all documentation defining new processes as well as performing all the activities in the process.

When a team is disbanded, it is appropriate to reward each member of the team, depending on his engagement in the project. Awarding and fostering relationships with employees is of crucial importance for their motivation as well as for their later proactive participation in monitoring and defining suggestions for improvement.

5. CONCLUSION

Continuous process improvement is a requirement that stems from the ISO 9001:2015 standard, but also from the increasing and turbulent changes from organizational environments. In order to be able to adapt to market trends, the organization implements a process approach that makes it more flexible and enables it to adapt more easily and quickly to new conditions. However, in practice, organizations cannot and do not know how to recognize processes and do not properly transform their existing structure to process-oriented structure. As a consequence, there are challenges related to a lack of understanding of the role that employees have in the process and a lack of understanding of the process approach as such.

Furthermore, the growth and development of an organization bring with it an increase in the complexity of the organizational system, which can affect its manageability. Fewer manageability results in non-compliance products and services, less efficient, less efficiency, but also less cost-effectiveness. Accordingly, there is a need to optimize business processes, and one method that can be used for optimization is DMAIC.

The paper describes each of the stages of the DMAIC method as well as the benefits of applying the method. It is important to note that different tools are applied within the improvement project as well as in each of the DMAIC stages, depending on the problem being solved. Each identified problem must be analyzed and its cause must be identified in order to define measures to address it.

DMAIC, furthermore, takes a team approach to improving and solving problems, addresses issues of non-compliance, less flow of resources through the process, which affects the efficiency and effectiveness of the process. Furthermore, the project optimization process and transformation of the organization into process-oriented, in case the organization is not process-oriented, the process documentation is created based on the identified processes in the organization.

The benefits of applying the DMAIC method are evident through the reduction of process cycle times, increased efficiency and effectiveness, greater customer satisfaction, cost reductions, etc. On the other hand, the challenges of implementing the method are manifested through the resistance that organizational employees can provide to optimizing and changing their present tasks in the process as well as the duration of optimization that is determined by the complexity of the organizational system.

In practice, the application of the DMAIC methodology has proven to be very successful. On a business example (company name information available to authors and not disclosed because of data protection) on the day the optimization and improvement project begins, the current state of the product launch process, which is undergoing optimization, since the adoption of the portfolio decision, there have been an average of 384 calendar days on 47 new products. After improving the process and eliminating the key causes of the problem, the duration of the process is 163 days on average. During the optimization, we noticed 4 spin off projects that will be optimized separately. The financial impact is a 1.2% increase in the company's revenue for 2019.

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DEVELOPMENT OF A TECHNOLOGY FOR PRODUCTION OF PELLETS AND BRIQUETTES OUT OF RASPBERRY AND BLACKBERRY

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Abstract: *After picking the fruits, the fruit branches of the raspberries and blackberries are pruned, and these cuttings are very little or no use at all. Available resources from pruned raspberries and blackberries, which are generated after picking in Serbia, are about 200 000 m^3 cubic meters of timber. From these cuttings, the energy potential is comparable to the energy potential of beech or oak. Using raspberry and blackberry cuttings for energy purposes would reduce the price of heating. In this paper, technologies for briquettes and pellets from raspberry and blackberry cuttings are given.*

Keywords: *raspberry and blackberry cuttings, briquette production, pellet production*

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1. INTRODUCTORY CONSIDERATIONS

After picking the fruits, the fruit branches of the raspberries and blackberries are pruned, and these cuttings are very little or no use at all. Available resources from pruned raspberries and blackberries, which are generated after picking in Serbia, are about 200 km cubic meters of timber. From these cuttings, the energy potential is comparable to the energy potential of beech or oak. Using raspberry and blackberry cuttings for energy purposes would reduce the price of heating. After picking raspberries and blackberries the native branches are pruned and these pruners have about 10 m^3 per ha of raspberries and about 10 m^3 per hectare of blackberries. The thermal energy produced from these residues would be 20 to 40 percent lower than other sources of energy (coal, firewood and natural gas).

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The use of these residues can be used primarily for energy as well as other purposes, which would significantly reduce the cost of energy from those energy residues, as well as reduce the emission of CO_2 and other harmful gases into the atmosphere, which result from the rotting or burning of said residues. Burning or rotting these raw materials does not have any metrical benefit, but only a cost, because after picking these products these residues must be pruned and removed. And so every year ... Using defined residues would reduce CO_2 and other emissions by about 30%.

The rational use of raspberry and blackberry cuttings for energy or other purposes would significantly increase the technological level in: energy, mechanical engineering, food industry, etc. Also, using these resources will influence the development of underdeveloped regions that can be achieved through: investment realization, employment of local labor force, creation of new jobs, improvement of local infrastructure and income generation through various manufacturing jobs.

a)

b)

Figure 1. a) b) shows raspberry plantations a) and blackberries b), which are pruned after harvesting.

Figure 2. Raspberry and blackberry cuttings

2. DEFINITION OF TECHNOLOGICAL SYSTEMS FOR BRIQUETTING AND PELLETING CUTTINGS RASPBERRIES AND BLACKBERRIES

After picking and collecting the raspberry and blackberry cuttings, it was necessary to transport them to the BRAĆA BABIĆ company in Čačak, where the cuttings would be crushed in a crusher that was adapted for these energy products.

Cuttings for experimentation were taken from planting plots in the villages of Miločaj near the Morava Airport near Ladjevci and the village Stančici near Čačak. The sampled plantations were grown according to the recommendations and treatment of experts from the Čačak Institute of Fruit Growing and professors at the Faculty of Agronomy in Čačak. The appearance of the tree to be pruned is shown in Figure 2. After picking raspberries and blackberries, it is best to immediately prune the raspberry and blackberry branches, among other things, to preserve maximum energy potential. The branches so cut should remain dry in the rows of raspberries and then break out of rows.

In order to obtain pellets and briquettes from raspberry and blackberry cuttings, it is necessary to grind them. The crushing is done on a crusher, which is structurally adapted and produced for the above raw materials. The preparation of the shredder for the cuttings is shown in Figure 3.

The roller to which 40 shredder blades are attached is a dimension; its length is 800 mm and its diameter is 250 mm. An 11 kW electric motor drives the roller over 2 pulleys and 4 pulleys. The crushing blades are in the shape of a recessed pile with a diameter of 40 mm and a diameter of 12 mm.

After adjusting the crusher for crushing raspberry and blackberry cuttings, they were comminuted when the humidity was about 9.5%. Humidity was measured by a mobile humidity measuring device. The humidity meter is given in Figure 4. The humidity meter is from ELECTRONIC - Fuchtomeser and can measure the humidity of 0 to 100%.

Figure 3. Layout of the attached roller on which the knives for chopping raspberry and blackberry cuttings

Figure 4. Humidity measurement device

3. DEFINITION OF RATIONAL MODES FOR THE PRODUCTION OF BRIQUETTE AND PELLETS FROM RASPBERRIES AND BLACKBERRIES

3.1. Briquetts and briquetting technologies

Technological and technical procedure for the production of energy briquettes from biomass has been practically solved in the world and here, but the question of its cost-effectiveness and competitiveness in relation to other energy sources is still uncertain. Therefore, the biomass briquetting process is still in the process of being refined and proven to be put into practice.

Biomass briquetting is mainly done by a continuous pressing process using primarily so-called piston presses. In doing so, the press material is partially compressed and inserted into a cylindrical press channel in which the piston moves. This piston is operated either mechanically or hydraulically. The extruded material is pressed against the already compacted material so as to form a continuous line of pressed material falling from the compression space in the rhythm of the piston stroke. The required counter pressure is developed by friction in the compression channel. It can be regulated via adjustable tapering in the back of the compression duct. Friction and pressure (up to about 1200 bar) lead to strong heating of the pressed material, which sometimes requires cooling. Therefore, for larger briquetting plants, a cooling water circulation system is installed through special cooling pipes at the outlet of the briquette forming duct. An additional cooling line can be added at the outlet of the pressed material, which can have a total length of up to 40 m. At the end of that line, the pressed material is generally cut, or separated to a predetermined length. Thus, depending on the dimension, products that can be manipulated or packaged in bulk are obtained. To

achieve the highest density and abrasion resistance, pre-grinding (below 10 mm) and drying (water content below 15%) of the starting material is required. In the company "BRAĆA BABIĆ" for the production of briquettes and pellets of raspberries and blackberries, the humidity of the input raw material is (9.1-9.8)%. Under these conditions, densities (1.1 - 1.25) g / cm^3 are achieved. For briquettes, the diameter is between 40 and 100 mm, and the range between 50 and 80 mm is particularly common. In the company "BRAĆA BABIĆ" the diameter of the briquettes is 80 mm. The humidity of the exit briquettes, with or without the addition of beech shavings, is (7.1-7.5)%. In addition to the circular cross-section, rectangular shapes with or without rounded edges can be produced. Also, the inlet material can be pressed using a worm gear. Here the briquetting is done by compression using a snail. In addition to the pressing lines, there is a chamber-assisted pressing process, but compaction is done here continuously.

The dimensions of the briquettes resulting from the input raw materials are 80 mm in diameter and about 80 mm in length. The weight of the produced raspberry and blackberry briquettes is about 300 g, about 80 mm in length. The weight of briquettes made from raspberry and blackberry cuttings, with the addition of beech shavings, is about 3% greater than the weight of raspberry and blackberry cuttings. Several combinations were made in the company "BRAĆA BABIĆ" for the production of briquettes with different percentages of raspberry or blackberry cuttings and beech shavings. The best quality was shown by the participation of 50% of raspberry or blackberry cuttings and 50% of beech wood chips.

The produced briquettes in the company "BRAĆA BABIĆ" in Čačak, from raspberry cuttings are shown in Figure 5.

a) b) c) d)

a) Raspberry cuttings briquettes
b) Blackberry cuttings briquettes
c) Raspberry cuttings briquettes with beech shavings
d) Blackberry cuttings briquettes with beech shavings
Figure 5. The produced briquettes in the company "BRAĆA BABIĆ" in Čačak

3.1.1. Cost of producing briquettes from raspberry and blackberry cuttings

The briquette production price is formed on the basis of investment costs, plant and maintenance costs, transportation costs, fees and business profits. Operating production costs consist of: costs for the procurement and transportation of wood and plant biomass residues, energy costs (electrical and thermal), wage costs, and other production costs. For the determination of the cost of briquette production in the defined production facility, the information given in Table 1 was taken. Due to the lack of cuttings, the plant will produce briquettes from the available briquette raw materials from the firm's production program and also from other possible raw materials for briquette production. The procurement of briquette cuttings is rational within a radius of up to 20 km from the company.

Table 1. Costs for briquette production

Serial number	CHARACTERISTICS	VALUES
1.	Capacity	0,3t/h
2.	Investment costs of production equipment	close by 30000 €
3.	Investment costs of buildings and business premises (MAINTENANCE)	close by 8000€/god
4.	Price of raw material for briquettes	20 – 35 €/t
5.	The cost of transportation to the facility	6 €/t
6.	The cost of transportation in operation	1€/t
7.	The cost of electric Energy	8-10€/h
8.	Number of shifts	1
9.	Number of employees	3 per shift

The data given in Table 2 were taken to determine the profit from briquette production in the defined production plant.

Table 2. Briquette production revenue

Serial number	CHARACTERISTICS	VALUES
1.	Price of briquettes in Serbia	100 €/h
2.	The price of briquettes in Europe	-
3.	Price of transport in Serbia	
4.	The cost of transportation in Europe	
5.	Percentage of placements in Serbia	100%
6.	Percentage of placements in the EU	-
7.	Annual revenue from the Serbian market (according to available raw materials available)	10000€

The briquette produced is stored in the warehouse of finished products that are part of the briquetting and briquetting plant. The forklift is used to manipulate the briquettes.

3.2. Pellets and Pelletizing Technologies

Pellets can be made from scrap wood that is pure wood and can be produced with additives, but they must meet the requirements for maximum content of harmful substances. The main motive for pellet construction and production comes from the EU. The high price of pellets in the EU market exceeding € 250 per tonne is very attractive to producers. Low wages, low electricity costs and availability of wood residues offer attractive financial conditions for the production of biomass wood and vegetable pellets. Biomass pellets are the cheapest and most environmentally friendly energy source that have their future in green energy production. The use of wood pellets will benefit local communities in the forest regions by hiring, harvesting, transporting wood residues as well as producing wood pellets.

Preferably, rotating rollers with a ring or a suitable die are used for biomass pelleting. In this process, 2 to 5 wheels (called rollers) are attached to one or more transverse shafts, which in the middle have a vertical (for presses with straight piston) or horizontal (for presses for circular mold)

rotary axis. In the case of crimping with a ring die, the roller shafts are stationary while the die is driven instead. Compressed materials that fall out at the end of the hole on the other side of the mold can be cut to the desired length with a cutting knife. In a straight die press, the rollers extend beyond the horizontal surface of the die several millimeters in diameter without touching them. Thanks to the rotational motion, the biomass is applied to the die surface and partly away from the ground, before being pressed into the pressing channel through the vertical nozzle openings. Pellet production requires accurate alignment of all process and technical components. Pelletizing often requires years of experience in manipulating variable raw material parameters (e.g., biomass type, variable water and lignin content in wood), etc. In the company "BRAĆA BABIĆ" in Čačak for the production of pellets of raspberry cuttings and purchase, the humidity was increased to around (15)%. Under these conditions, densities (1.0 - 1.15) g / cm^3 are achieved.

The dimensions of the pellets emerging from this plant are 6.5 mm in diameter and (10-30) mm in length. Several combinations for the production of pellets with different% of raspberry or blackberry cuttings and beech shavings have been made at BRAĆA BABIĆ in Čačak (Figure 6).

a) b) c) d)

a) Raspberry cuttings pellets
b) Blackberry cuttings pellets
c) Raspberry cuttings pellets with beech shavings
d) Blackberry cuttings pellets with beech shavings

Figure 6. The produced pellets in the company "BRAĆA BABIĆ" in Čačak.

3.2.1. Cost of producing pellets from raspberry and blackberry cuttings

The production price of pellets is formed on the basis of investment costs, plant and maintenance costs, transportation costs, fees and business profits. Operating production costs consist of: the cost of purchasing and transporting wood residues, energy (electrical and heat) costs, wage costs, and other production costs. For the determination of the cost of pellet production in the defined production facility, the data given in Table 3 were taken. Due to the lack of cuttings, the plant will produce pellets from available raw materials for pellets of the company's production program, as well as from other possible raw materials for pellet production. The procurement of briquette cuttings is rational within a radius of up to 20 km from the company.

Table 3. Costs for pellet production

Serial number	CHARACTERISTICS	VALUES
1.	Capacity	1t/h
2.	Investment costs of production equipment	close by 50000 €
3.	Investment costs of buildings, office space and maintenance	close by 10000/year€
4.	Price of raw material of timber with transport	20 – 35 €/h

Serial number	CHARACTERISTICS	VALUES
5.	The cost of transportation to the facility	6 €/h
6.	The cost of transportation in operation	1 €/h
7.	The cost of electric Energy	8-10€/h
8.	Number of shifts	1
9.	Number of employees	3 workers per shift

For the determination of the profit from the production of pellets in the defined production facility, the data given in Table 4 were taken.

Table 4. Pellet production revenue

Serial number	CHARACTERISTICS	VALUES
1.	Price of wood pellets in Serbia	180 €/t
2.	The price of wood pellets in Europe	250 €/t
3.	Price of transport in Serbia	6 €/t
4.	The cost of transportation in Europe	36 €/t
5.	Percentage of placements in Serbia	100%
6.	Percentage of placements in the EU	0%
7.	Annual revenue from the Serbian market (according to available raw materials available)	close by 13500€
8.	Annual revenue from the EU market (according to available raw materials available)	--

4. EXAMINATION OF BRIQUETTES AND PELLETS OF RASPBERRY AND BLACKBERRY CUTTINGS

The products obtained from raspberry and blackberry cuttings for the production of briquettes and pellets of mechanical characteristics are approximate to the briquettes and pellets obtained from beech shavings.

In the combustion processes briquettes, the combustion time per unit of raspberry and blackberry briquette, compared to the briquettes mix, the raspberry and beech cuttings is faster by about 4%. In the processes of combustion in the same pellet boilers, the combustion time per unit of raspberry pellets and blackberries in, the ratio of pellet mixes of raspberry and blackberry cuttings and beech shavings is about 2% faster.

For energy use, due to its relatively large size, the briquettes are not suitable for small and medium automatic dosing boilers. Briquettes are suitable for boilers and fireboxes with manual firing. Due to their weight and dimensions, briquettes are more prone to breakage and crumbling than pellets. For this reason, pellets are more interesting as fuel.

5. MAIN PARTICIPANTS IN THE PRODUCTION AND USE OF RASPBERRY AND BLACKBERRY CUTTINGS FOR ENERGY PURPOSES

The main participants in the production and utilization of raspberry and blackberry cuttings can be divided into two main groups: those in the cuttings production chain and those in the available cuttings utilization chain. Participants in the production chain are: owners of raspberry and blackberry plantations, those engaged in cutting raspberry and blackberry cuttings and briquette and pellet production companies.

The participants in the chain dealing with the utilization of the produced briquettes and pellets are: households, municipalities with district heating systems in schools, hospitals and other public buildings as well as wood processing companies. Households are a potential big consumer of wood pellets. For the use of pellets and briquettes made from raspberry and blackberry cuttings, it is necessary to install suitable boilers, as boilers for other fuels where the operator's influence on the proper operation of the boiler is less.

In terms of prices, the current prices of pellets on the international market are very attractive for exporting producers from Serbia, but these prices are not suitable for consumers in Serbia.

Wood pellets are acceptable for well-off households and small businesses with their own centralized heating system. They can pay for accessories for the automatic operation of these small wood pellet boilers, and also pay the relatively high cost of wood pellets.

6. CONCLUDING CONSIDERATIONS

Owners of raspberry and blackberry plantations are generally very interested in maximizing the use of cuttings after picking raspberries and blackberries.

The produced briquettes and pellets of raspberry and blackberry pellets at the "BRAĆA BABIĆ" in Čačak, plant are of approximate mechanical characteristics to beech briquettes and pellets.

The energy potential of raspberry and blackberry briquettes and pellets is close to the energy potential of beech briquettes and pellets.

As regards consumers of raspberry and blackberry briquettes and pellets, for wood processing companies should be taken first. Usually these companies use their available wood residues with the possible addition of available raw materials. However, this consumption of wood residues is out of the market. For the time being, households in the villages use firewood and other types of biomass residues collected usually on their fields and land. For raspberry and blackberry growers, the developed concept of briquette and pellet production should be very tempting, as raspberry and blackberry cuttings are produced every year.

Raspberry and blackberry pellets or briquettes should be acceptable to well-off households and small businesses with their own centralized heating system. They may pay for the accessories to operate these small pellet boilers or raspberry and blackberry briquettes automatically.

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THE IMPACT OF DIGITAL TRANSFORMATION ON INCREASING THE QUALITY OF HEALTHCARE

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Abstract: *Changes in the organizational environment as an imperative impose digital transformation of business. However, the increasing turbulence in the organizational environment does not only result in the emergence of adaptation to the new market conditions, but also the emergence of new demands from stakeholders in view of the growth of stress levels as well as other health problems that could impact the quality of life of today's society. Digitization of health processes increases the availability of health services to a large number of individuals, as well as the ability to monitor their health condition. Digital transformation of healthcare processes does not only affect the quality of life, but also the increase in the potential of the process as well as the quality of the health services provided.*

Keywords: *digital transformation, quality of life, quality, business processes, quality in health;*

JEL Klasifikacija*: O39, I15*

1. INTRODUCTION

Development of Industry 4.0, which includes the development of the Internet of Things (IoT), sensors, RFID technology, cloud computing, big data, etc., forces today's organizations to transform traditional business models into a digital model. Transformation involves all aspects of business starting from the digitization of the process with the use of digital technologies in products (Reis, et al., 2018). Digital transformation has two fundamental perspectives, economic and social. The economic perspective refers to the transformation and adaptation of current business models, increasing productivity and reducing costs. Social perspective relates to innovation and the creation of a culture of cooperation, the change of existing models of education, and the possibility of easier access to information (Ebert & Duarte, 2018).

Special application of technology based on Industry 4.0 is in the health services, hospitals and other health institutions. The application of this kind of technology enables the optimization of healthcare

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processes and resulting in increased efficiency, effectiveness, and overall improvement of clinical quality indicators. Through the digitization of healthcare processes it is possible to monitor the health status of the user in real time as well as display it on the superstructure in health organizations. In addition, using digital technologies enables easier communication with the user's health care provider, the application of it-based diagnostic-therapeutic devices, use of 3D printing technology, etc. However, the main problem in the application and implementation of these kind of technologies is primarily related to the problem of creating a secure communication link between the devices used, because of threats from cyber space (Belliger, David, 2018). By implementing Industry 4.0 technologies as well as by digital transformation of system, the health organization affects the satisfaction of the user with the service and increase the quality of life of the user.

2. INDUSTRY 4.0

Industry 4.0 is the concept that appears in 2011, when it becomes a component of the development strategy of Germany until 2020. The need and effort to implement technology in industry and production processes resulted in the development of technological innovations, which resulted in the development of Industry 4.0 (Santos, et al., 2018). By digitizing processes, organizations reduce the costs of the process, increase their efficiency and effectiveness, and the quality of products and services. Robotization and automation of the process, as well as the possibility of implementing the sensors in the process, enabled organizations to monitor the performance of the process in real time as well as the possibility of operator intervention if the need arises.

In addition, the application of artificial intelligence assisted by sensors, cyber physical systems and large data makes it possible to create information systems for support decision making (Buntak, Kovačić, Mutavdžija, 2019). The new industrial revolution marked the need to adapt existing business models to emerging market conditions, which indicated the need to develop a model of digital transformation of business.

Industry 4.0 is based on ten pillars that have enabled the development of new technological innovations, which are:

- big data: the implementation of sensors in organizational processes creates the possibility of collecting a large amount of data stored in databases. By analyzing such data organization can use it for decision making,
- autonomous systems: can be based on artificial intelligence which can be used in managing robots in processes that replace employees in jobs that are repetitive and dangerous,
- 3D printing: the use of 3D printers enables the creation of complex components that are built into machines and devices, but also offer the possibility of their use in healthcare,
- Cyber security: Considering the fact that communication between machines and devices is done via the Internet, the establishment of a secure connection between networked machines and devices becomes an imperative,
- M2M: M2M is an acronym for communication between machines that enables the transfer of information as well as the dissemination of information about the needed activities in the process,
- mobile technology: operators can operate machines and devices using smartphones and tablets without having to enter the production line,
- cloud computing: means the transfer of data and information on one server to multiple workstations, and the ability to use uploaded information on different workstations,
- RFID technology: RFID chips enable the storage of information in the memory as well as access to such information in a simple and easy way,
- IoT: internet of things technology enables the connection of several different machines and devices as well as network components that can communicate with each other. That can be used for disseminating information as well as managing networked components,

- cognitive computing: enables the simulation of man's behavior as well as the way people make decisions in an automated system (Saturno, et al., 2017).

Mentioned technologies are the foundation for developing new innovative solutions, such as a cyber physical system that translates physical infrastructure into a virtual sphere. Such technologies and technological innovations are generic which means they can be adapt to the any kind of an organization

2.1. Digital transformation

Digital transformation is the process of improvement of business processes by their digitization. It appears to be imperative due to changes in the organizational environment as well as the digital transformation by the competition and also by the growing demands of stakeholders from the environment.

The researchers have different views on the process of digital transformation. Some of them are looking digital transformation through the aspect of increasing the presence of the organization on social networks and by implementing new technologies that will enable increasing the satisfaction of stakeholders, but also increasing the quality of products and services (Reis, et al., 2018). Digital transformation extends through the entire organization and changes the organization's paradigm and business model. It primarily involves an operational strategy (which contains products, services, processes, etc.) and a functional strategy (which relates to functions in an organization such as human resources, finance and accounting, etc.). Furthermore, the application of new technologies changes the way in which the value to the products and services is added (Matt, et al., 2015).

Despite the importance and imperative of digital transformation of business, there is not enough literary references that would speak about the digital transformation as well, there is an insufficient number of case studies, which indicates that the area of digital transformation of business is still in its infancy (Dodziuk, 2016). Likewise, the problem of identifying the maturity of digitization of the organization is not sufficiently well defined, which is one of the challenges.

It is necessary to emphasize the fact that the digital transformation permeates the whole organization, as well as the quality management system. Digital transformation of quality management system is especially significant because of concept of Quality 4.0 that is based on innovations emerging from the development of Industry 4.0.

3. CHALLENGES OF QUALITY MANAGEMENT IN HEALTH CARE

Quality assurance in healthcare is a challenge given the fact that the demands of stakeholders are increasing due to a decline in quality of life. The decline in quality of life is the result of an increase in the turbulence of the environment and the impact of stress on the human organism (Duggal, 2009). Accordingly, there is an imperative of continuous improvement of the process, which is regulated by legislation, but also by standards such as ISO 9001 (Ebert, Duarte, 2018). Organizations have many tools with which can continuously improve the process. It should be emphasized that while organizations improving their processes they can also identify a place in the process where digital transformation can be performed.

Inconsistencies in health care processes may result in poor quality of life and the appearance of high costs due to lack of quality. In addition, reduced resource flows as well as insufficiently well-optimized health care processes can result in waste of resources, creating a waiting list, a drop in customer satisfaction, and so on (Ebert, Duarte, 2018). It is also necessary to mention the generation of large financial debts due to insufficiently efficient and effective use of resources, which results in insufficiently good business, results of the health organization, and consequently the inability to repay the borrowings.

A particularly challenging area is the provision of health services in urban areas where there are a large number of users who are hospitalized. Besides them, urban hospital organizations gravitate a

large number of health care users from the urban area (Garmann-Johnsen, 2018). The solution of such challenges can be found in the application of the solutions offered by Industry 4.0 which imply the application of some of the innovations such as big data, IoT, e-health, m-health, etc.

However, the implementation of such technology brings with it a challenge related to the security of communication between devices used in providing health services. But the challenges do not only come from the secure communication between devices that are being used, but also through the creation of large data as well as related activities (Ha, Hong, 2016). To menage this problem organization must establish an integrated management system consisting of a quality management system, employee health and safety management systems, an environmental management system, a risk management system, and an employee health and safety management system. By integrating management systems, organizations can respond to increasing environmental demands as well as use technological innovations, digitization to increase the quality of services provided.

4. DIGITALIZATION OF THE HEALTH SYSTEM

Digitization do not only affected the production organization, but also health organizations, as well as all other service organizations. In the past, the implementation and development of the information system in health care considered as one of the fundamental steps of digital transformation, which proved to be one of the smaller parts of the system digitization. However, the implementation of the information system enables much more efficient and effective communication, as well as increasing the flow of information resources in the system, which can result in more economical use of the available capacities (Househ et.al., 2016). However, through digital transformation organization does not only adapt to the newly emerging market conditions, but also adopts new knowledge that increases its competence. New competence can in the long run result in the creation of a competitive advantage, but also the increase in the quality of service and products.

The problem of digital transformation in practice is often seen through the possibilities offered by web 2.0 which has the effect of improving the internal communication and communication towards customers and users of services (Jahankhani, Kendzierskyj, 2019). The process of digital transformation must begin by identifying the existing situation as well as the context of the organization. Without defining the context and requirements of stakeholders, organizations cannot identify the difference between the existing level of health care and the level of health service requested by users (Lapão, 2019) However, the implementation of technological innovations must be seen from the point of view of improving the process and to improve and increase the potential of the process.

Figure 1 shows the technological innovations that are implemented in the health system through the process of digital transformation. The picture shows that there is no greater difference between the technologies implemented in the health care system and the technologies that are the basis of the development of Industry 4.0. With the technologies shown in Figure 1, the digital transformation of the healthcare system results in implementation of:

- mobile technology: the use of mobile technology enables the use of m-health technology that involves monitoring the health status of health care users via smartphones and specifically developed smarthphone applications,
- interoperability: refers to the ability to apply information generated by other systems, which is particularly useful when using information contained in other information systems,
- telemedicine: enables the provision of health care services remotely with the help of Internet technologies. In particular, it is useful in cases where there are insufficient number of health personnel,

- decision support systems: help medical personnel to make decisions based on input parameters, i.e by using big data analysis. They are based on artificial intelligence and greatly facilitate the anamnesis morbi, (Mateo et.al., 2007)
- IoMT: acronym for the Internet of medical things, implies the connection of devices used in medical procedures. IoMT provides real-time monitoring of the health status of users as well as the storage of collecting information that can be used later in diagnostic procedures,
- exchange of information: to connect the acquired knowledge of other hospital and health organizations from the region, country or world which facilitates the conduct of diagnostic procedures,
- Workflow automation: eliminates bottlenecks from the process, which increases the flow of information and resources through the process and can result in a reduction in the cycle time of the process,
- big data: contains a great deal of data about the health status of the user, his vital signs, the level of glucose, the height of blood pressure, duration of sleep, etc. It is usually collected using sensors contained in IoMT. When creating and analyzing large data, there are challenges related to the way in which the collected data will be categorized and analyzed with regard to a wide range of different data stored in the database, (Matt et.al., 2015),
- 3D printing: a technology that allows the creation of unique prosthesis and has the potential for developing approaches that will enable the printing of individual human organs, and in particular have great potential in dentistry and surgery, (Ottom, 2017),
- Expanded reality: it is especially useful in education. It implies the transformation of physical reality into virtual and real-time insights into the movements that medical staff do. In addition, it provides assistance in carrying out certain procedures by inspecting the necessary information that is displayed in front of a doctor, (Radziwill, 2018)
- virtual reality: finds application in education without the risk of possible harm to health and user safety and simulation of medical procedure,
- additive production: similar to 3D printing technology, application of implantation in dentistry, artificial tendons and cardiosurgery. It offers the ability to use a wide range of materials (Reis et.al., 2018)

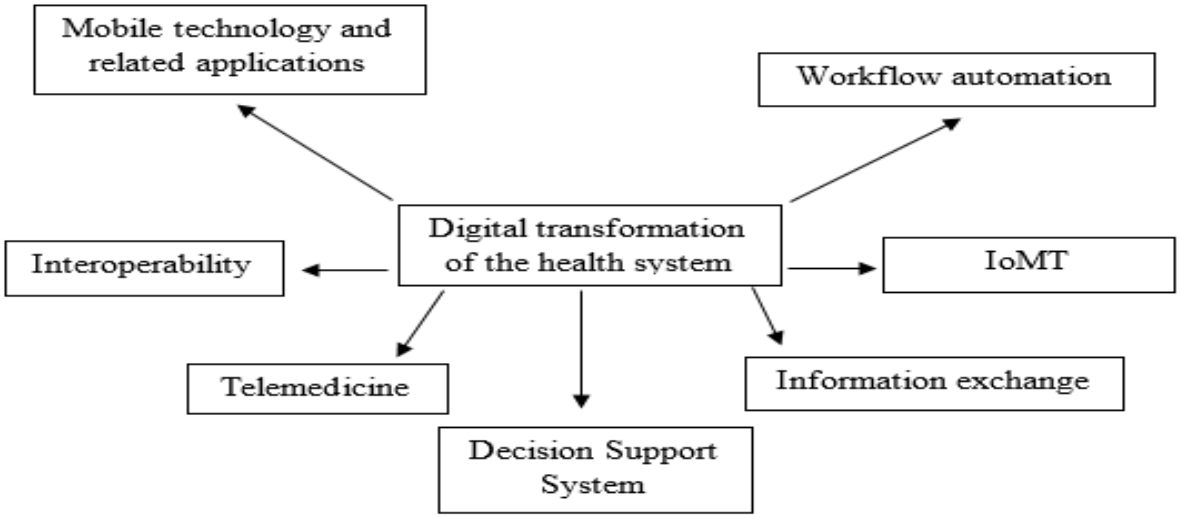

Figure 1: Technologies implemented by digital transformation
Source: Author according to Jahankhani, H. and Kendzierskyj, S., 2019. Digital Transformation of Healthcare. In Blockchain and Clinical Trial (pp. 31-52). Springer, Cham

It should be emphasized that all the technologies shown in Figure 1 require the establishment of secure communication. Also, everyone involved in the digitized process must be educated, and the

knowledge that an organization gains in the transformation process must be documented and disseminated through the organization. What technology the organization will implement in its processes depends on its context and goals that the organization strives to achieve. However, all the goals that an organization strives to achieve must be in accordance with the identified requirements of the parties.

4.1. Quality 4.0

Digital transformation not only affects the industry, but also the quality. The new technology as well as the potential that the new technology has increased the quality as such. There is a change in the paradigm of quality management resulting from an increase in the demand of the interested parties with regard to the possibility of personalizing the product as well as the ability to increase the efficiency and efficiency of business processes in the organization.

Digitization enables business transparency, it is reducing process cycle time, incorporating artificial intelligence in the process of quality control, implementation of sensors that enable real-time process performance monitoring, etc. These technological innovations result in increasing the level of quality of products and services that organizations offer to customers (Rodríguez-Salvador, Garcia-Garcia, 2018). However, the application of new technology does not mean abandoning the existing models of quality control, but a combination of traditional approaches and philosophies of quality with a new philosophy based on the use of new technology (Santos et.al., 2018).

The use of sensors greatly facilitates process performance monitoring as well as tracking the performance of the requirements that the management system norms place on the organization. However, sensory and automation results in lower process costs through their optimization and elimination of process waste such as movements, queues, etc. as well as increasing the utilization of the existing capacities the organization has available

5. THE IMPACT OF DIGITAL TRANSFORMATION ON THE QUALITY OF HEALTH SERVICES

Digital transformation has a significant impact on the performance of organizational processes. It is an opportunity for each organization to increase the potential of the processes as well as to improve all the activities that can result in cost reduction, and by increasing the efficiency, effectiveness and quality of the service provided. Considering the challenges described in Chapter 3, digital transformation becomes an imperative to meet the growing demands of stakeholders.

The quality of the health service can be identified on the basis of quality indicators that can vary depending on the health system in which quality is being examined. In the context of the Republic of Croatia, a set of quality indicators has been defined in the Manual on Quality Standards of Health Care and the manner of their application. Some of the clinical indicators, such as early cancer detection, the percentage of hypertension treatment, the timely arrival of health care users by organized transportation through emergency medical care in a health organization can be improved by digitization. Namely, IoMT enables monitoring the health status of health care users and timely warning if there are changes in vital signs such as heartbeat, sudden increase or decrease in blood pressure, etc.

In addition, the application of expanded reality can facilitate the implementation of surgical procedures and reduce the risk of possible medical error in carrying out such a procedure. The development and implementation of technology such as e-health, m-health as well as the general development of an information system that enables communication and sharing of information makes it possible to gain diagnosis much faster, since the results of the diagnostic procedure can be transferred in a short time to a specialist in each health area. Furthermore, through the ability to communicate with medical personnel remotely, the need for a physician's visit to the doctor decreases, which affects the reduction of waiting times, and hence the faster availability of

necessary medical care. This also results in a reduction in the health risks that need to be treated in a shorter time (Rodríguez-Salvador, Garcia-Garcia, 2018).

Robotization and the possibilities offered by the application of automated systems can consequently result in a reduction in costs related to the provision of competent medical personnel as well as to solve the lack of staff in general. With the application of artificial intelligence, procedures requiring high precision of medical personnel can be much more reliably performed, and that by using expert systems, diagnosis and therapy can be more effectively and efficiently diagnosed.

Digitalization of healthcare processes enables the use of high quality medical assistance in areas where such medical assistance is not available. Innovations such as machine learning make it possible to read the diagnostic findings and define the necessary medical procedures to eliminate or reduce symptoms. Likewise, health service users can themselves find answers to simple questions that would otherwise visit their medical doctor, and thus create waiting queues, which as a result may impair the quality of life of other health care users

However, the benefits of digitization and the use of digital technology in health require the upgrading of existing infrastructure as well as ensuring adequate education for health care users as well as for the medical staff provided by the health service. Infrastructure security often means high costs as well as the adaptation of an existing business model of a health organization to the digital environment, which means ensuring the competent staff to maintain the systems implemented and to familiarize and educate health service users about the possibilities and advantages of using digital technology.

6. CONCLUSION

The paper presents the need for conducting a digital transformation of a health organization that is imposed as an imperative in view of the changes in the environment that are manifested in the emergence of new requests by stakeholders.

The future of providing health services involves the application of advanced technological innovations as well as the provision of services outside the hospital, which will require greater engagement of the health care users themselves. Digitization of healthcare processes involves the use of telemedicine, big data, sensors, IoT, IoMT, automated and robotic systems [24] which require the construction of new infrastructure that will enable their use as well as the implementation of additional education of existing medical staff.

There is a revolution in health services along with the emergence of the industrial revolution and its related technologies. The concept of Health 4.0 is published, which actually means the use of technology developed within Industry 4.0 (Saturno et.al., 2017). Digital transformation of healthcare processes comes not only to the implementation of new technologies, but organizations also have the opportunity to improve existing processes which will influence the increase in the quality of health care provided. Higher quality of health services results in higher quality of life for its users.

However, given the evolution of Industry 4.0 in Industry 5.0, the development of the Health 5.0 concept can be expected in the future, which will include a pronounced collaboration of medical personnel with automated systems and artificial intelligence, which will consequently mean an additional increase in the quality of services provided or the quality of life of users.

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KPI'S CALCULATION BASED ON DEFUZZIFICATION WITH WEIGHTED AVERAGE

Snezhana Cherepnalkovska Dukovska, PhD[1], [2]

Abstract: *In order to estimate and fortify the level of implementation of strategic objectives in a company, we use measured parameters as key performance indicators. In this paper, we propose what to measure to achieve servant leadership in the company as part of good governance. We perform setting of several indicators measured in the project management process and we propose defuzzification method with weighted values to calculate these complex indicator. This system was implemented in an environment for project management, previously set according to best practices as a mandatory baseline for the measures we used.*

Keywords: *key performance indicators, KPI, strategic objectives, defuzzification, project management*

JEL Klassification*: H11, O22*

1. INTRODUCTION

Key Performance Indicator (KPI) is a metric that is one of the most important indicators of the performance level of company, department and individual, in achieving the goals. Good measure design is an important principle that should start with agreement on results we are trying to achieve. Using abstract language for results implies difficulties because it is less measureable and harder to implement. From the other side, strategic plans abound with abstract words like sustainable, innovative, reliable, leadership, effective, efficient, resilient, optimized, responsive or quality. So we should justify by translating those terms into concrete language that is sensory specific, meaning it describes things we can see, hear, smell, taste or feel presenting observable and measurable results. On the other side, this justification will create many parameters or measures for the concrete terms as a set presenting the abstract word. To create a system that will adequately monitor relevant KPIs related to strategic objectives, we should apply data analytics based on statistical methods, construct intelligent hypotheses and implement principles of experimental testing and design, including population selection and sampling, in order to evaluate the validity of data analyses. For the purpose of this paper, we covered only one part of such system consisting of one complex KPI that presented as abstract word, obtained and calculated using defuzzification method with weighted values on

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[2] This paper is the result of the author's personal views

several simplified indicators via previously designed environment. For future work, we plan to research and set the rest of the elements that define this system as a whole.

One of the most pivotal elements of a successful and implementable strategic plan is how to measure its success. To establish adequate relations between KPIs and strategy, we need the declaration of process based on convergence. So, the results of operational KPIs are input to strategic KPIs and vision indicator receives data from strategic KPIs. KPIs track whether we hit objectives and metrics track processes.

The main purpose of this paper is presenting a complex abstract KPI as strategic objective via preselected parameters or metrics. This objective is implementation of servant leadership in project management. The paper consists of 4 parts starting with introduction, followed by techniques for implementation of a model for KPI determination and KPI selection and calculation, and ends with a conclusion.

2. TECHNIQUES FOR KPIS DETERMINATION

For the purpose of our research, we use a framework dedicated to various KPIs called Logic Model[3] [1]. The main characteristic is that using this framework we can differentiate what we produce (our planned work) from what we can only influence (our intended results). This model is also helpful for separation between elements that are operational versus those that are strategic in nature (Figure 1)

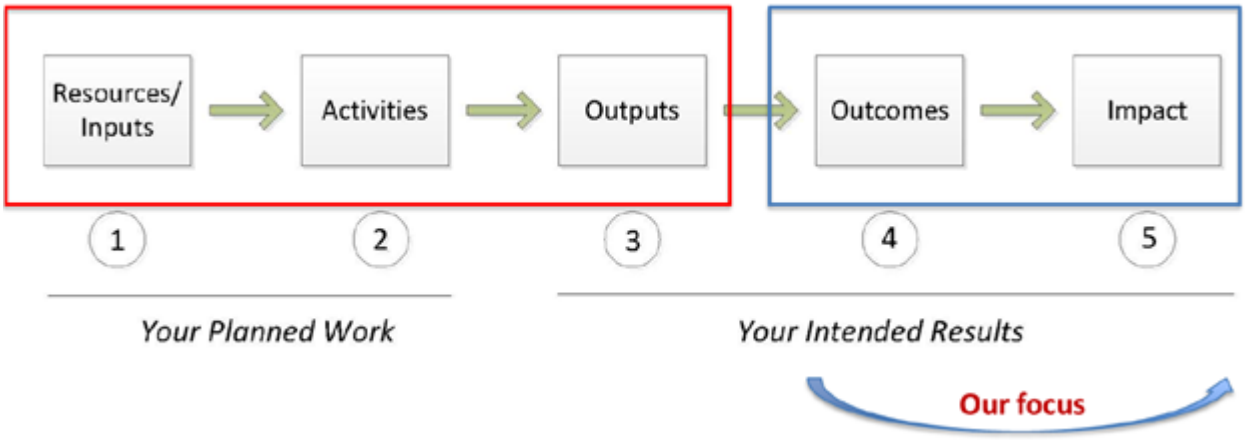

Figure1. The Logic Model

(Source: Logic Model Development Guide, Michigan, W.K. Kellogg Foundation)

For every key process, we spend resources through activities and produce outputs. In addition, with our outcomes we create impact. The outcome measures are those related to things we can influence such as the satisfaction of our customers/stakeholders. Measuring the impact is more valuable of measuring the operations, but we need a mix of both to understand performance. To understand all of the elements of strategy execution, we should add a few different categories than those characteristic for the process. Project measures monitor the progress of our improvement initiatives and can be designed to improve operations or strategic impact; employee measures, that tell us do employees are performing well and have right skills needed; risk measures that inform us if there has been important change in a risk factor that have significant influence on our organization. Using a family of measure like this integrated in adequate KPIs can broadly inform about our strategy and give relevant information for decision-making. Metrics and KPIs we are selecting presents the core components of strategic planning.

To implement a good governance monitoring process on company's strategy, we started with selection of metrics that they should follow some rules that we have organized them in several principles. So metrics should always be tied to the strategy and focus on results. They should make a

[3] https://www.wkkf.org/resource-directory/resource/2006/02/wk-kellogg-foundation-logic-model-development-guide

focus on what is important (outcomes) using common presentation and opportunity to be comparable. They provide SMART aspect. Targets help to fine tune the achievements, spend time on exceptions and undertake discussion and collective actions for desired output. Metrics and targets are likely to evolve. Metrics are not suitable for decision-making and are not part of the strategy, so we should focus on managing the strategy by identifying outcomes and indicators and declare adequate KPIs. Great strategic plans have 5-7 clear KPIs that keep the pulse on performing the strategic plan[4].

Having in mind the previous, the technique we accepted for KPIs determination is comprised of

1. Defining the measure as a clear expression of what we need and put it in one of this categories:
    a. Activity Measure that can include percentage, number, currency and activities or processes,
    b. Outcome Measure that measures progress against defined outcome often expressed as percentage increase,
    c. Project Measure measures the progress of a project often expressed as percent complete, deliverable on milestone, process that influence the strategic project,
    d. Target structure represents a numeric result against a date, for example end date of milestone or else,
2. Defining the target as a numeric value and due date setting out to achieve,
3. Outline the data source because every KPI needs to have a clear data source,
4. Define the owner and frequency of tracking meaning that someone is accountable for pulling the data and updating performance on a defined frequency.

We can conclude that the best KPIs are clear expression of our desired outcome at the end of the strategy.

3. KPI SELECTION AND CALCULATION

One of the key elements important to good governance is the leadership. As example for this paper, we propose the type of leadership as strategic objective. To create an environment to follow this strategic objective, the company should introduce KPI in relation with leadership and establish measures and targets for it. Let assume that the company wants to set servant leadership as a type to accomplish which belongs to KPI declared as abstract word. The strategic objective "Provide Servant Leadership" with a target of 3 years for implementation on key processes is a proposed KPI that is a planning to achieve in one hypothetical company.

A servant leader focuses primarily on the growth and well-being of people and the communities to which they belong. The opposite is traditional leadership that involves the power by one at the top. The servant-leader shares the power, puts the needs of others first and helps people develop and perform as highly as possible[5]. This is all about good communication.

In this paper we are going to focus on project management results that servant leader have a task to improve. We are not going to research other aspects important to servant leadership that include the service approach to various stakeholders (employees, customers, society) or their social responsibility or how they inspire followers to be creative and self-manage in order to serve others[6]. We assume that these other aspects are easily covered by questionnaires and other methods different from data analytics. From the other side, the servant leadership is area closely connected to physiological profiling which demands much more investigation and research resources.

To accomplish results for this research, we assumed that the company have established a sufficient environment for project management compliant to best practices, selected as criteria. Namely,

[4] https://onstrategyhq.com/resources/kpis-vs-metrics-tips-tricks-to-performance-measures/
[5] https://status.net/articles/servant-leadership/
[6] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5433299/

implementing the best practices for project management give us the opportunity to create levels of achievements as targets that will satisfy our strategic objective.

The above mention environment contains several phases including creation of reports[7]. These reports consist of data about objective, time and cost framework, risks, deliverables. Regular and exceptional information for the status of the project and next steps; regular reporting between team members in two directions for status, problems, deviations, solving and next steps; updates on project plan and milestones; reports on lessons learned; report on trainings, consulting and certifications, etc.

For the purpose of this research, we have defined five principles[8] that we assessed as most important for the concept of servant leadership. In short, we can define that servant leadership principles emphasize facilitation and helping employees grow and harness their maximum potential, empowering both individual team members and the company to be successful. These five principles are:

(1) Support the team meaning that the leader (project manager) ensure with support, knowledge, skills and resources that they need to their jobs. Measures that we can implement to this principle are: number of tailored training or coaching per type of employee (new, senior); number of one-on-one meeting with employee to assist or discuss current issues or challenges (confidential); number of opened topics (blogs) to encourage team members to talk about pain points in the project as ratio by frequency of inputs.
(2) Grow the people meaning that the leader encourages professional and personal development. Measures that we can implement to this principle are: number of roles per tasks per shared responsibility/accountability; number of milestones achieved (on time/over time) per team (employee); number of feedbacks per team on regular and exceptional status of target (teams reports); number of daily/weekly report per team member, number of trainings/team member.
(3) Listen to seek for opinion of your team members for big decisions particularly where those decisions involve their own work, and consider any relevant feedback. Measures that we can implement to this principle are set to: number of customer satisfaction (given gradually) related to certain functionality in the product/service; for long-term projects, we set acceptance of new ideas from the team given by input.
(4) Build a community means to share the company's goals and mission and present how everyone's efforts contribute to the bigger picture. Measures that we can implement to this principle are set to: number of weekly reports informing on transparent way for the progress and make relations to other important information in company, number of feedbacks from the team.
(5) Reflect and learn meaning to learn from experiences, both as a team and individually and the measures should contain remarks and conclusions about positive and negative suggestions from past projects per individual and team level.

To take the opportunity of the proposed system we suggest having the following functionalities supported by software application, which together with the project management environment based on best practices should provide an appropriate platform. The supported application should implement regular project status updates and company's objectives, status updates for team members by creating status feed for their particular week contribution, automated scheduled questionnaire about ways for improvement, regular and exceptional report from the leader and team members, regular report on subject lessons learned, meeting minutes, repost on milestones achieved etc.

Other parameters and indicators relevant for every project that we can integrate for our purpose follow:

The project will be included in KPI calculation if it is

[7] https://www.projectmanager.com/training/leadership-kpis
[8] https://status.net/articles/servant-leadership/

- Related to key business processes AND accounting system AND the budget is higher than x euros AND
- Among 5 (or 10) important/critical projects in the company OR
- Outsourced OR
- Requested by external parties OR
- Assessed against risks related to laws higher than moderate level OR
- Related to significant changes to the internal control system OR
- Implementing new technology OR
- Managed by leader that has more than one failured/canceled project OR
- Planned to be finished in more than one year.

The KPI calculation will include also some other indicator important for project like number of registered incidents, problems and improvements from customers; cost deviations between planned and realized costs for the project; number of project plan justifications, number of project milestones completed on time with sign off;

Every identified indicator as measure has a label with a weight in a manner to fulfil the request of strategic objective presented as fuzzy set. These presentations of fuzzy values are obtained as professional judgment. Even this operation can be very subjective it will be fine tune after obtaining the measured values. The value for KPI for servant leadership level of implementation is calculated by the center of gravity (centroid) method on fuzzy sets. It is a defuzzyfication method obtaining single number from the output of the aggregated fuzzy set and is used to transfer fuzzy inference results into crisp value[9].

The steps of defuzzyfication method with weighted average are given by the following formula and Figure 2.

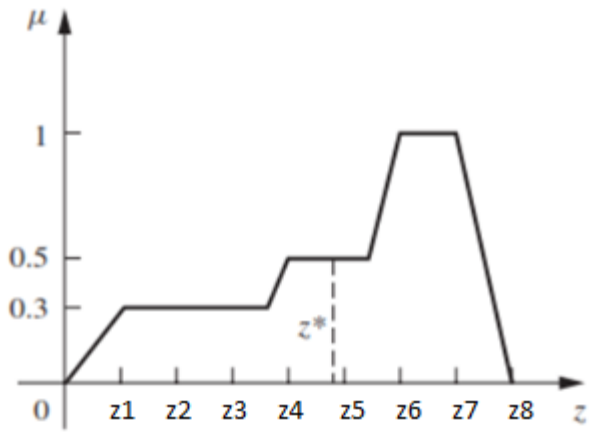

Figure2. Example of Center of Gravity defuzzyfication method

(Source: https://math.stackexchange.com/questions/1216908/defuzzification-using-centroid-and-weighted-average)

$$z^* = \frac{\int \mu B(z) \cdot z dz}{\int \mu B(z) dz}$$

The figure is presentation of *fuzzy output values* from the measured indicators. The formula is calculated via line equation as y=mx+c and m=(y2-y1)/(x2-x1). So, we will obtain:

[9]https://math.stackexchange.com/questions/1216908/defuzzification-using-centroid-and-weighted-average, https://www.sciencedirect.com/topics/engineering/defuzzification

$$z^* = [\int_0^{z1} \frac{0.3}{z1} z dz + \int_{z1}^{z3+0.6} 0.3 z dz + \int_{z3+0.6}^{z4} \left(\frac{0.5-0.3}{z4-z3-0.6} z - 1.5\right) dz + \int_{z4}^{z5+0.5} 0.5 z dz + \cdots]$$

4. CONCLUSION

As we mentioned above, to implement an overall system for KPI monitoring used to forecast and decision-making, we need data analytics based on statistical methods. Those data analytics should use the weighted word methodology that provide search on structured and unstructured data, given in reports. This paper scopes setting to such system where one complex and abstract KPI is presented and the environment and measures that this kind of system should have. The measures are given on operational level and a defuzzyfication method was used to obtain KPI value for the strategic objective which is stated that a servant leadership should be implemented for 3 years target period. So, this paper is the first step where an example for good governance is presented. For future work, besides the data analytics as the most valuable part, we should develop principles to validate algorithms used for forecast based on data analytics, implement a new technology that work with big data and make the system transparent for other types of complex KPIs.

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INTEGRATION OF THE MANAGEMENT SYSTEM USING PROCESS APPROACH OF THE ORGANIZATION

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Abstract: *The development of management system standards challenges their harmonization. Optimizing the requirements of norms of integrated management system becomes imperative because, without optimization, the organization uses its resources to meet the requirements that do not result in a direct increase in the satisfaction of the interested parties. The process approach is imposed as the optimal choice because of the ability to use KPIs to identify compliance with the set requirements, but also the requirements that ISO 9001 sets to the organization. Many models of development integrate management system have been developed. Some of them serve only as a framework for the creation of norms i.e their harmonization and some of them in an insufficient way suggest the integration of the management system. All that leads to the new requirement for developing a new model of integration*

Keywords: *business processes, integrated management system, ISO norm, optimization;;*

JEL Klasifikacija*:L25*

1. INTRODUCTION

The growing importance of sustainable development as well as the growth of the market demands forced the need for organizational adaptation. In order to meet stakeholder requirements, the organization establishes certified management systems (Abrahamsson, et al., 2010). Through the standardization of management systems, the organization strives to meet the identified requirements of the stakeholders in an optimal way, since limited resources are available to meet its requirements (Micek, 2019). One of the ways in which an organization can optimize the use of available resources is the implementation of the process approach, which is also the requirement of ISO 9001.

In order to harmonise standards for management system, the ISO organization develops annex SL that evens the content of the norms and make easier to implement once harmonized standards in the management system. Previous ISO standards that are not in compliance whit annex SL challenges the organization because of the fact that all standards are differed not only in terms of requirements

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but also in form (Integrated standards, n.d.). However, there are also a number of other frameworks that attempt to integrate the management system, and one of such frameworks is PASS 99, DS 8001, AENOR, etc. (Micek, 2019). Despite the existence of various systems that seek to create an integration framework, there is a challenge in meeting and optimizing requirements of the management system standards.

The need for optimization of the management system stems from the fact that any norm of the management system on the organization sets different requirements for fulfilling which organizations must invest resources. Fulfilling all the requirements of the norms in each process extends the process time cycle, as well as reducing the efficiency and effectiveness of the process, which is why there is a need for a different approach to design and to optimize the management system. Implementation of the process approach as well as its application is one of the possible solutions for that challenge

2. SYSTEM THEORY AND PROCESS APPROACH

The system theory sees the organization as a system that is in constant interaction with the organizational environment as well as the inner elements of the organization are in constant mutual interaction. Understanding process approach is impossible without understanding the system theory. Process are in constant mutual interaction so are the components of the system that are the part of the system theory.

In the context of a business organization, the organization consists of the following subsystems:

- Subsystem of sensors: collecting information and data from organizational environments,
- subsystem for analyzing the collected information: such as the finance and accounting department, or controlling,
- the decision-making subsystem: makes decisions related to organizational operations,
- control subsystem: who controls, goals and their compliance with the plan,
- a storage subsystem: who stores the records, procedures, and other types of documents (Johnson, et al., 1964).

Described subsystems are similar to the ISO 9001 where the subsystem of the sensors can be identified with the organization of the organizational context, a subsystem of analyzing the collected information are similar to the ISO 9001 to point 6 and 7 in which the organizational context is used for planning and defining objectives. All that applies to the storage subsystem that is similar to the ISO 9001 point 7.5 that refers to documentation while the subsystem of decision-making can be identified with points 5 and 8 of the ISO 9001 norm. The control subsystem can be identified with points 9 and 10 of the same standard.

The system consists of a series of subsystems, and system theory emphasizes that the maximum system performance is achieved with the optimal effect of its components. If the business process decomposes to subprocesses, it can be recalled parallel to the theory of the system. The optimum performance of the process steps achieves the maximum performance of the entire process. It is important to emphasize that the points of performance measurement in process need to be defined. KPI points that, in accordance with system theory, identify whether the performance of the process is in accordance with defining goals in the plan or not.

3. MANAGEMENT SYSTEM, STANDARDIZATION AND SUSTAINABILITY

The organizational management system encompasses a set of processes and policies that provide organizational management in plans to ensure the fulfillment of the goals that arise from stakeholder demand. In line with ever-increasing requirements of the environment, new management systems are being developed to ensure the fulfillment of the identified goals. Furthermore, for all management systems are developing standards to ensure efficiency of such

systems. ISO organization as the umbrella organization develops a series of standards for management systems certification and some of them are presented in table 1.

The number of organizations that implement certified management systems has grown from 1998 to 2017 by an average of 3.25% (Johnson, Kast, Rosenzweig, 1964). Accordingly, to that fact, there is a need to develop a model of system management integration as well as a model that will enable optimization of it.

Table 1: List of some of the standards that shape the management system

Standard	Management system that certificate
ISO 45001:2018	Health and safety management system
ISO 9001:2015	Quality Management System
ISO 14001:2015	Environmental management system
ISO 50001:2018	Energy management system
ISO 27001:2013	Information security management system
ISO 31001:2018	Risk management system

Source: Author

Increasing the number of standards that organizations can implement in their business as a consequence has the growing challenges of interlinking implemented standards. One way in which to strive to equalize and integrate implemented standards is by using the annex SL (Gueorguiev & Sakakushev, 2016) described in Chapter 4.

Today's organizations create management systems that are in line with the imperative of sustainable growth and development. Accordingly, organizations create environmental management systems and an energy management system that determines ecological sustainability, a health and safety management system that determines social sustainability, a quality management system that determines economic viability, etc. (Almeida, et al., 2014). Implementation of the management system depends on the context of the organization as well as the core process of organization.

The imperative of sustainable development stemming from the scarcity of organization resources and motivates organizations for implementation of standards. That leads to rational use of resources. Sustainability is viewed through three fundamental components, economic, ecological and social component. The economic component implies the achievement of a positive business result. Social sustainability implies inclusion and care for organized employees, while ecological sustainability implies care for the environment (Lele, 1991). The research carried out by Ferreira and Gerolamo (2016) has shown a positive correlation between the standards of management and sustainability, in particular ISO 14001. Norm ISO 9001 does not have a significant impact on sustainability. The relationship between sustainability and ISO 45001, or OHSAS 18001 norms are also discovered (Ferreira & Gerolamo, 2016). However, it should be noted that the research did not cover other standards of the management system.

4. INTEGRATION OF THE MANAGEMENT SYSTEM IN THE ORGANIZATION

Professional and scientific papers emphasized several different concepts of integration. Jørgensen et al. (2006) maintains alignment as a way of adopting standards-based requirements. That creates a system that is based on accountability and resulting in cost reductions. In such system all procedures are contained in the same document. Another way is to integrate all requests in all processes, thus creating a system of quality management focused on employees, customers and continuous improvement of the process (Jørgensen, et al., 2006). However, with the rise in the number of standards governing the management systems and the challenge associated with documenting, modeling and managing the system itself, there is a need for developing new ways

and approaches to integration that combines all process-based management functions (Drljača, 2019). Accordingly, the process approach is imposed as a solution to optimize and create a management system as described in Chapter 6 and due to the process properties that enable the performance measurement that the process develops in predefined points that can be used to measure compliance with the identified the requirements of interested parties.

Jørgensen et.al (2006) speaks of three levels of integration in the organization that enhances compatibility with other management systems. Coordinated and coherent integration is genuinely process oriented to tasks in the management system. Last level is a strategic and inherent, which implies the creation of a learning culture, continuous improvement of the process as well as the involvement of interested parties in addressing the challenges of the internal and external environment (Jørgensen, et al., 2006)

Which methodology of organization integration will use depends on its context:

- conversion: involves adding new processes to the existing management system, that are adapted to requirements related to health, safety, environmental protection, etc.,
- merging the System: an organization that has multiple management systems can integrate through merging documentation that describes the requirements,
- system engineering access: it involves designing and upgrading the system to meet the specific requirements set for it. The advantage of this approach is manifested through the creation of a coherent system based on organizational needs and is not strictly determined by the requirements of norms (Čekanová, 2015).

The first professional and scientific papers that talk about integration, the integration of the management system, have looked through three basic aspects: integration of goals, process integration and resource integration. Through later research, these three aspects of integration have been extended to human resources, organizational policies, records control, auditing and assessment (Simon, et al., 2012). The creation of an integrated management system provides a number of benefits that are reflected in higher employee productivity, greater efficiency, greater satisfaction level of stakeholders, increased profitability, improved relationship with suppliers, etc. (Bernardo, et al., 2015) On the other hand, there are a number of challenges and some of them are the lack of specialized auditors, specialized consultants, insufficient number of documents that can be used as a guideline for integration, diversity across standards, etc. (Simon, et al., 2012). Given that one of the requirements of class 9 ISO standards is set by organizations application process approach, this is one of the solutions that can be used for integration i.e optimizing the management system integration.

Given the challenge of a large number of standards that organizations can implement in the management system. But, whit larger number of standards the challenge of integration is also growing, given the fact that the ISO organization does not issue integrated standards, but standards that form individual management systems. But no matter, more than thirty standards are uniform in content whit annex SL, which can greatly facilitate their implementation (Kounis, 2018). Which model of organization management, system integration will depend depends on the needs and context of the organization.

5. MODELS OF SYSTEM MANAGEMENT INTEGRATION

The organization has several different options for the integration of the management system. However, some of the models described serve solely as a framework for creating a norm or a reference that directs the organization to the creation of an integrated management system. Following models for integrating management system standards are most relevant:

- systematic approach: it uses resources that comply with the same goals that are being pursued in order to create mutual compatibility between the management system

process. It helps in aligning different goals of different management systems. It can appear as an integration based on ISO 14001 or ISO 9001,

- system evolution: it is based on a comprehensive assessment of all management systems as well as the changes through which they have passed and creates a new management system based on estimates of existing management systems. This model is considered the initial integration model,
- IMS Matrix: Shows overlapping of the various functions that management systems have in the organization. The IMS matrix challenge is different in terms of the compatibility of certain functions that management systems have. On the one hand, the emphasis is on the possibility of a simple integration of the quality management system and the environmental management system,
- EFQM: a model developed by the European Quality Foundation. Model help organizations define quality management systems as well to improve the process. Defines nine criteria. It should not be seen as a model of integration, but as a reference for the creation of an integrated management system,
- ISO 72: 2001: A model that defines all common elements that management systems have as well as suggesting rationalizing and creating the order between them. This allows organizations to review, compare and revise standards. In addition, it provides guidelines for establishing and maintaining a management system to ensure compatibility. It should be emphasized that model is not used by organizations to create an integrated management system but is used in standards creation,
- integration based on process integration: the basic objective is to prepare a common documentation before organization starts with integration. The main goal is to continually improve the process. Initially, common documents are defined, resulting in process integration and partial integration of the process, after which other documentation integrates into the system. It can be used as a complement to the IMS matrix,
- individual models: PASS 99; come from the United Kingdom, the first true model for integration in the world that meets the requirements set by ISO 72: 2001 and has allowed organizations to implement a system management integration framework. DS 8001; comes from Denmark, helps transition organizations from individual management systems into an integrated management system (Başaran, 2017).

As the number of norms issued by the ISO organization grows, the challenge of their alignment and the challenge of integration is growing. Annex SL is aimed at eliminating differences in the content of a particular standard. The ISO organization with Annex SL defines a form that consists of ten characteristic points that must contain each norm: scope, normative references, terms and definitions, organizational context, leadership, planning, support, leadership, operationalization, performance evaluation and improvement. The organization has significantly fewer challenges it faces because of annex SL which implies much easier implementing and creating of integrate management system (Bsigroup, n.d.) However, despite the advantages offered by the SL Annex, the organization can optimize its management system based on the process approach and its core features.

Despite the development of the SL annex, the large number of standards issued by the ISO organization requires considerable amount of time to harmonize standards. In addition, language-related issues are also encountered in harmonization, but there is an important shift in perception of risk and its perception in the context of decision-making (Bsigroup, 2019).

6. OPTIMIZING THE REQUIREMENTS OF AN INTEGRATED MANAGEMENT SYSTEM USING PROCESS ACCESS

Chapter 2 describes the connection between system theory and process approach, and it has been defined that business processes consist of subprocesses whit defined KPIs in which the performance measurement process is being carried out. Without measuring performance, organizations cannot identify whether stakeholder requests are met or not.

Given the fact that there are a large number of interested parties in organizational environments that set different demands of the organization, the organization must create a context based on which it can identify the strength that the interested parties have. Completely meeting all the requirements of the interested parties is not possible and for the organization means the use of a large number of resources. According to system theory, achieving optimum satisfaction will result in maximum so the organization must meet optimum satisfaction of all stakeholders. However, the demands of the interested parties are not the only ones that the organization must take into account. The organization also must identify the requirements that the norms of the management system have (Micek, 2019).

It is necessary to emphasize that the complete fulfillment of the requirements of the management system norms of an organization is not economical since it also requires a large amount of resources as well as it can slow down process cycles. In depending on the organization's core process and the management systems depends the requirements of the norms that the organization must fulfill in its process. Given this fact, it is necessary to optimize the requirements of the integrated management system for which the process approach is an ideal solution due to the decomposition of the process into subprocesses, each of which may have different requirements imposed on it by the norms of the management system. Figure 2 shows a model for optimizing a management system using a process approach.

It is an imperative for an organization to create her context in order to identify the requirements that are placed on the organization. Organizational context is also used for planing in which is defined all the resources that are needed to carry out the process. In addition, the plan also defines control points in which the process will be measured in accordance with the defined plans or not. However, with the identification of compliance with the requirements of stakeholders, the organization in the KPI points identifies compliance with the requirements of the norms. The requirements of the norm that an organization must satisfy depends on the type of process, IE the subprocesses as well as the implemented management systems.

How an organization will define KPI points depends exclusively on its processes, but definitely it is not recommended to define generic KPI points. It should also be emphasized that the organization does not implement this concept exclusively on its core process, but also on support processes, i.e., management processes.

This model of optimizing the requirements of the integrated system eliminates the need to meet requirements that are not related to the context of the process, which may result in a lesser need for unnecessary spending of organizational resources.

The generic model of integrated management system is shown in Figure 3. Shown model is in accordance with the Annex SL in view of the fact that it defines the common content of all ISO norms. In addition, the generic model complies with the PDCA, which enables continuous improvement of the process, which is one of the requirements of a quality management system (Micek, 2019).

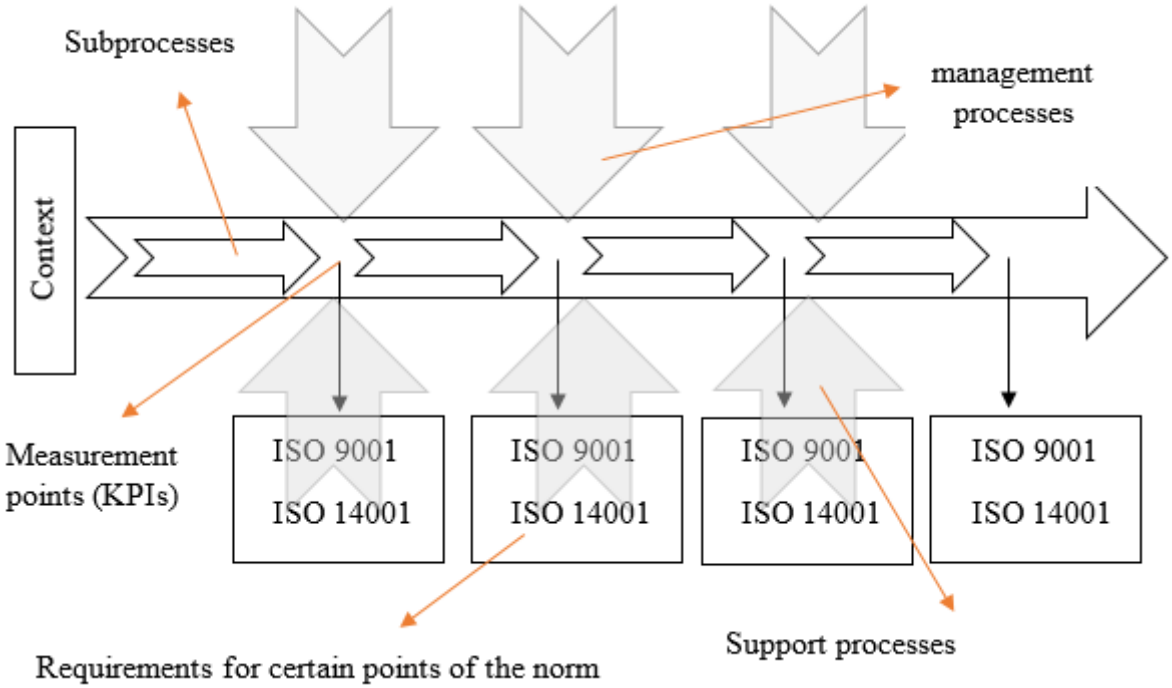

Figure 2: Optimizing Integrated Management System Requirements

Source: Micek, B. 2019. Optimiziranje integriranog sustava upravljanja pomoću procesnog pristupa – diplomski rad. Sveučilište Sjever. Koprivnica

The generic model shown in Figure 3. Start of the process requires the creation of an organizational context. This is also the first phase of the PDCA methodology, while the second phase refers to the operationalization or execution of the planned activities. The third phase of the model implies performance control and compliance checks with stakeholder requirements, while the fourth stage involves proposing improvements in accordance with measured process performance (Micek, 2019).

In the third phase, the control phase, it is imperative to measure four process parameters, efficiency, effectiveness, cost-effectiveness and process stability. Any process that is not stable is not efficient due to the fact that there are inconsistencies in the process that result in the need to invest additional resources to eliminate identified non-compliance. Accordingly, spending more resources than the planned amount means that the process is not effective, and the failure to meet targets and spending a larger amount of resources than the planned amount indicates a non-economic process (Buntak, et al., 2016)

Once adopted, the integrated management system needs to be evaluated to determine its maturity. Whit growth of the maturity of a management system its optimization is at a higher level, which results in better performance of such a system. Table 3 shows an example of possible classification of the maturity of the integrated management system.

The maturity level of an organization's integrated management system depends primarily on the organization's ability to recognize the requirements set for an integrated management system and to implement these requirements in its plans as well as the organization's ability to identify the requirements of all stakeholders and the requirements of the standard itself and optimize them (Micek, 2019).

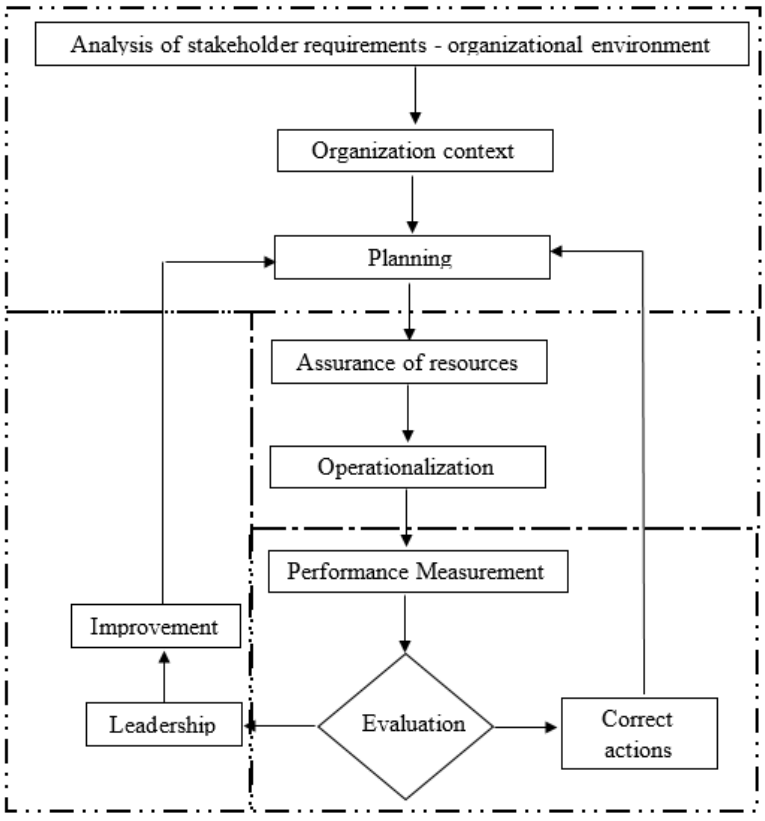

Figure 3: Generic model of integration of management system
Source: Izvor: Micek, B. 2019. Optimiziranje integriranog sustava upravljanja pomoću procesnog pristupa – diplomski rad. Sveučilište Sjever. Koprivnica.

Table 1: List of some of the standards that shape the management syste

Maturity	Description
0	There is no integrated management system
1	There is an integration of the management system but is not recognized and is not formalized
2	There is an integrated management system that has been recognized and full integration activities have been launched
3	There is an integration of the management system that is recognized and realized through the relevant documentation
4	There is an integration of a management system that is recognized, documented and implemented through processes that take place in the organization
5	There is an integration of the management system in the organization, it is recognized and documented, implemented through the process orientation and amplified in the process structure of the organization

Source: Micek, B. 2019. Optimiziranje integriranog sustava upravljanja pomoću procesnog pristupa – diplomski rad. Sveučilište Sjever. Koprivnica

7. CONCLUSION

The research is based on the results of a secondary research that pointed to the lack of an integrated model of the management system as well as its optimization. With the increase in the number of organizations that implement the norms of the management system, there is a growing need for the development of a single framework that will enable the harmonization of all norms. In addition, given the growth of stakeholder demands and the growing and faster changes in organizational

environments, organizations need to develop a model by which the identified requirements will be met, thereby maintaining the existing level of competitiveness but also increasing their potential to develop a new competitive advantage. Different models of management system integration were based on different needs at the time in which they are created. Some of the models, such as EFQM, are viewed exclusively as a guideline to the integration of the management system, but not as a way of creating an integrated management system. However, using the EFQM as a guideline for the development and creation of an integrated management system, the organization strives to develop business excellence, which is the basis of competitiveness. The process approach emphasized as an imperative in the ISO 9001: 2015 standard enables the optimization of the requirements of the integrated management system, which consequently brings in a lesser need for resource use. Optimizing the demand is based exclusively on the process under consideration, or the transformation that takes place in the process. Depending on the context of the organization as well as the context of the process, the implemented management systems and associated standards depend on the requirement of the norm that must be fulfilled in the process, that is, the subprocess which is evaluated using the KPI points. Once integrated management system has been established, it must be evaluated by the maturity of integration for which a scale of 0 to 5 is applied, where 0 is the absence of integration, and 5 is complete integration. Future researchers in this area are advised to test the proposed optimization model for the requirements of an integrated management system in an organization.

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