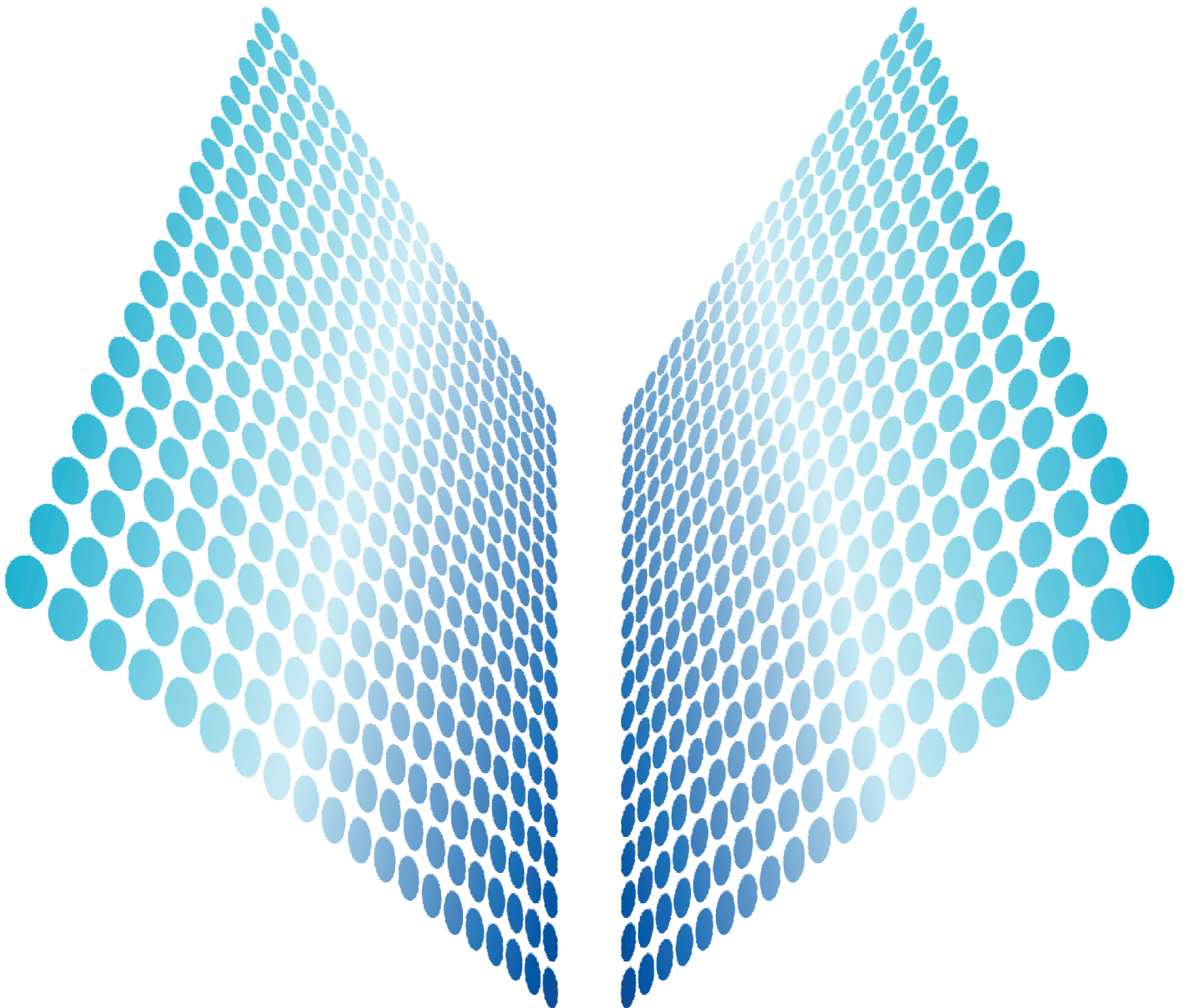


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5S – IMPROVING OPERATIONAL EFFICIENCY

Aleksandar Erceg, Predrag Dotlić, Matej Milohnoja

Abstract: *Many companies in different types of industry are applying tools of a lean manufacturing method to gain and maintain high standards demanded by their customers. One of the possible tools is 5S. This tool is usually the key component of Visual Factory Management and a part of Kaizen approach - a system of continuous improvement. 5S focuses on establishing and maintaining a visual order, organization, tidiness, standardization and sustainability. 5S is applied through 5 phases which can be translated from the Japanese as "sort", "set in order", "shine", "standardize" and "sustain" giving the method its name. Expected results are improved efficiency, service and safety thus better profitability.*

This paper looks upon the use of 5S methodology in Croatia and a scope of its implementation. In our paper, we examine the case of textile company in Croatia and how the implementation of 5S can help it improve efficiency and competitiveness.

As a conclusion, recommendations will be presented for further research on 5S methodology and ways how its application can increase the competitiveness

Key words: *Operations management, lean manufacturing, visual management, 5S, Croatia*

1. INTRODUCTION

In most companies, especially manufacturing ones, one can find employees looking for items needed for productions (tools, components), unneeded items can be found all over the production facilities cluttering production area, work in process items are hard to find. It creates problems in production, causes delays and problems in efficiency. Administrative environment is not at all different from the production one regarding the same problems and effects. Administrative employees waste their valuable time in search for missing and misplaced documents in chaotic filing systems and offices, examining piles of papers on their desks and mailboxes while looking for certain document. These everyday organization situations usually create much bigger problems such as: *longer lead times, low productivity, higher operating costs, late deliveries, ergonomic challenges, space constraints, frequent equipment breakdowns, hidden safety hazards* (Hulyalkar, 2008: 190). Thus, many production companies have chosen to follow 5S methodology of housekeeping and workplace organization as part of constant work towards business improvement or towards lean thinking methodology.

The purpose of the paper is to examine the influence of 5S methodology on companies using it. The paper consists of four chapters. After an introduction, next section introduces 5S methodology – its origins, definition and importance for companies. The case presented in section 3 shows how 5S can help company gain and maintain the competitiveness on the global market by increasing efficiency in production managers' office. In the last section, we are giving concluding remarks and proposals for further research.

2. 5S METHODOLOGY

5S methodology is one of the first and essential steps companies undertake toward implementing continuous improvement in their operations. This method originated in 1920-ties by Henry Ford in USA and it was known as CANDO program: Cleaning up, Arranging, Neatness, Discipline and Ongoing improvement. 5S was popularized during 1980-ties in Japan (Hirano, 1996). 5S methodology has been present in Japan for a long time and there is considered useful not only for improving office and company environment but also thinking processes (Ho, 1999). The method was first

Corresponding author: Aleksandar Erceg, PhD., Assistant Professor, Josip Juraj Strossmayer University of Osijek, Faculty of Economics in Osijek, e-mail: aerceg@efos.hr

implemented by production companies in Japan and during 1980-ties was introduced in western companies as a secret weapon of Japanese industrial development (Kanamori, 2016). Later it was applied into non-production environment (e.g. offices).

This method is based on an assumption that the organization, order, cleanliness, standardization and discipline in the workplace are essential conditions for the production of high quality products and services (Mlkva, et.al 2016: 331) and is often seen as common sense and low-cost approach which can be implemented by employees unrelatedly to their technical knowledge (Kanamori et. al, 2016). Sinay (2007) stated following 5S base principles:

- The cleaner a workplace is, the sooner problems can be identified
- A cleaner workplace is safer
- A frequent and well organized environment is more predictable
- Standardization and workplace organization enables faster responses
- Communication on the state of manufacturing is easier.

Table 1 5S System

<i>5S workplace organization</i>	<i>Standards</i>	<i>Corresponding actions</i>
<i>Sort</i>	<i>Sort unneeded and needed items</i>	<i>Distinguish between necessary and unnecessary items. Remove the latter.</i>
<i>Set in order</i>	<i>Put things in proper place and arrange</i>	<i>Enforce the dictum 'a place for everything and everything in its place'.</i>
<i>Shine</i>	<i>Clean up the workspace</i>	<i>Clean up the workplace and look for ways to keep it clean.</i>
<i>Standardize</i>	<i>Standardize the first three S's</i>	<i>Maintain and monitor adherence to the first three Ss.</i>
<i>Sustain</i>	<i>Make 5S a part of job</i>	<i>Follow the rule to keep the workplace 5S-right. Hold the gain.</i>

Source: adapted from Chapman (2005) and International Trade Centre (2012)

Methodology is named after five Japanese words representing implementation phases (Table 1). 5S is a process designed to organize the workplace, keep it clean, maintain effective and standard conditions. It instils the discipline required to enable everyone to achieve and maintain a world-class environment. Although 5S is an excellent starting point for improvements in company, to start with 5S implementation companies should developed language which is understandable to all employees in the organization (Gupta and Kumar Jain, 2015). Goal is to improve bottom line of company by improving services and products company is offering and at the same time lower the cost of the process. To implement 5S company needs to have self-discipline and commitment from all employees and all levels of management (Ablanedo-Rosas, 2010).

Due to the increased competition in the global market many companies are looking to improve their operations and to make them more efficient. Thus, 5S methodology is attractive to companies which have older production sites and are trying to improve their efficiency and reduce costs. The most famous statement of 5S methodology states *a place for everything and everything in its place* and it simply describes what 5S is about. Main benefits of 5S implementation can be seen in lower costs, less waste, improved efficiency, increased customer confidence, less space needed for storage, improved maintenance and safety, higher quality of products and/or services (Hirano 1996; Ho, 1999). Saricoban (2006) found that 5S has important advantages for employees while Anon (2007) grouped these advantages as follows: (i) accidents and injuries are removed; (ii) effective utilization of all work areas; (iii) increase joy of working in clean company; (iv) joint application of system by all employees. On the other side, there are risk of 5S implementation since clumsy implementation can bring serious problems to company hurt credibility of management in front of employees and make it difficult for later implementation. Anderson (2013) mentioned several pitfalls: it may not be a good

starting point in case there are some serious performance constraints and since 5S is tool without proper understanding of tool, it loses its effectiveness. Additionally, Dahlia (2008) mentioned several disadvantages of 5S methodology: lengthy implementation periods and decreases in work productivity which may occur during implementation.

Implementation of 5S methodology is prerequisite for implementation of TQM (Ahmed *et al*, 2005), as part of TPS (Schonberger, 2007), as part of lean manufacturing (Herron and Braiden, 2006), and as part of six sigma implementations (Van Iwaarden *et al*, 2008).

2.1 HOW IS 5S PRACTICED

Since 5S is used for setting the order and discipline in companies, it focuses on the simplification of work environment during all five phases of its implementation. It sets both philosophy and guiding principles which will lead to improving companies' efficiency and performance (Ablanedo-Rosas *et. al*, 2010) and implementation of 5S methodology needs commitment from all employees and top management (Ho, 1999).

In the first phase *Sort*, company employees need to distinguish between wanted and unwanted items at their working place. This will lead to less search time and increased work flow, while inventory cost of unnecessary items is reduced. Items that are not needed are red-tagged and stored at previously determined area for several days. In case they are not reclaimed, they will be moved to company's central storage for red-tagged items.

During second phase, *Set in order*, employees of the company organize necessary items so the employees' motion will be minimized – meaning less walking and less moving of items. Location for storing tools, files and machines is selected and it should be clear to everyone so it will not be a problem to find needed items at any time. Creation of visual work floor helps in creating environment which is communicating without saying words (Chapman, 2005).

Third phase, *Shine*, is focused on cleanliness of the work places. Employees and their teams target special parts of work floor to clean and they decide how and who will clean the area. This is leading to defining cleaning and cleanliness standards. Cleaning targets include environment, tools, machines, etc. During cleaning employees can and should check the equipment condition to identify potential breakdowns which can lead to unwanted and unplanned delays in work.

In the fourth phase, *Standardize*, company should establish standardized stations for 5S. Such stations usually have all cleaning equipment, different labels and tapes needed for colour coding and everything else that is needed to sustain company's visual systems and workplace organized. These stations allow employees quick access to these items. Company should make previous three phases a constant routine. In this step company's management should create 5S improvement policies which will clearly state time that should be allocated for maintaining the 5S. Also, company should post different checklists which will outline cleaning responsibilities and schedules. In this phase, visual management plays important role so every employee can act quickly (Osada, 1993).

In the fifth and last phase, *Sustain*, the emphasis is put on enabling a working place with discipline and good behaviours. This phase intends to cover improvements of the methods and this task should be commenced by management (Korkut *et.al*, 2009). During this phase importance of 5S methodology to the company should be explained to all employees and knowledge about 5S should be maintained and updated. This will allow the 5S methodology to grow deep roots into company's way of doing business and company's culture.

3. 5S IN TEXTILE COMPANY – A CASE STUDY

5S methodology is not often mentioned and used in Croatian companies although there are numerous studies (e.g. Ho, 1999, Korkut *et. al* 2009, Milkva *et. al* 2016) presenting proofs of improved operational efficiency in companies that implemented 5S. There are only few companies mostly involved in automobile parts production that have implemented 5S methodology (Pipunić, Grubišić; 2014). There are probably more examples but there were not researched or mentioned in research papers.

For this paper, we have examined the implementation of 5S methodology in one Croatian textile company. This company produces special protective and working clothes (medical, working and gastronomy) and does business both for domestic and EU market (Benetton). During 1990ties the company invested in modernization of production. This has led to complete change of production program into modern working and protective clothing with special materials designed for customer's needs and demands.

Due to the absence of IT equipment in production managers office there are problems since employee from the administrative office brings orders in several copies downstairs to production manager in production area. Papers, orders, inventory and working materials are everywhere in the office. (Fig. 1)

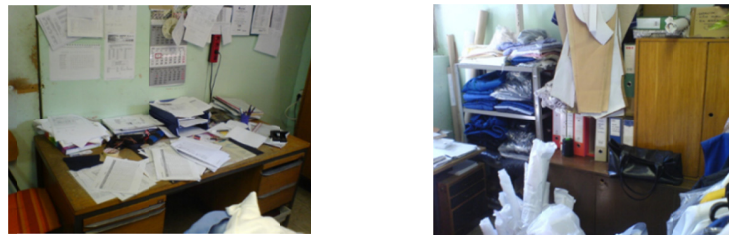


Fig. 1 *Production manager's office before 5S*

These two photos from production manager's office speak more than words. First photo is showing production manager's table and behind that table there is a shelf with inventory, bookcase with folders and different other things. This was main reason we have chosen production manager's office for 5S methodology implementation. Small space in the corner of production is crowded with papers, orders, final products' inventory, materials for tailoring and untidy folded up filling folders. Unneeded items are stacked between workers. Excess items make it difficult to improve process flow and therefore needed equipment was difficult to find.

3.1 SORT

In this first phase of 5S implementation two steps were considered: (i) reallocation of the office furniture, painting walls and dividing office from the production area with the plaster wall; and (ii) elimination of unneeded papers, documents and other equipment and finding the space for needed items.

First task was sorting working area within production manager's office and eliminating of everything that is not needed. The easiest way to do it was removing everything from office (table, chairs, bookcase, inventory). In case something was needed but not used often, it was relocated to a storage area. Working materials which were needed in production were relocated there since they don't belong to manager's office. Existing furniture were to be reallocated and IT equipment installed in the office. Additionally, whiteboard was suggested since it can be used for daily orders, plans and notes - from Monday till Friday. The Board is an excellent visual aid for everyone to see what needs to be done every day. Following furniture allocation, unneeded equipment (papers, working materials, inventory) were eliminated from the office – working materials and inventory to the production area and in the warehouse. With some items, there has been a dilemma if they were needed or not so it was red-tagged in order to label it for transportation to a pre-determined 5S-storage area. "Red-tagging" is the process of putting red tags; tape or adhesive dots on items that are not needed but which might have value elsewhere. For the items and equipment needed once a week a place was proposed within the production area and for the items needed less frequently a storage in a more distant area was proposed. Remaining items (i.e. unneeded and unnecessary) were stored in holding area. This 5S phase has resulted in eliminating of many items and this will ease next phases together with tidiness and order.

3.2 SET IN ORDER

Items in office should be organized so it would be easier to use and managers need to focus on efficient and effective storage methods. Production manager must be sure that all unnecessary items are eliminated from the workplace. Necessary things are placed near work area and 5 Why? Method has been used to decide where certain items belong. All the tools and equipment were put and should be kept near the place of usage (production area) and all processes were reorganized in a manner that eliminates unnecessary movements. In this phase, even the working tables and the drawers were set in order, so each drawer now has its purpose (e.g. one for office equipment, one for documents) and they were labelled with information what is kept inside. Shelves with filling folders in different colours should be also added to office to reduce time to find needed folder. Production manager sorted the files into filling folders and afterwards diagonal line was drawn across all folders so it is easy to put the folder back into correct place. After everything was set in order in the office it could be seen how little space was needed for all files. (Fig. 2)

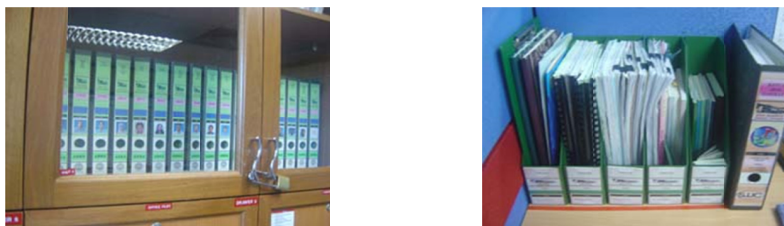


Fig. 2 Production manager's office after 5S

3.3 SHINE AND SWEEP

In a third phase, it was necessary to establish rules for regular tidying in duration of 10 minutes because some unneeded items can cause losing willingness for work. The manager needs to find the way how to prevent dirt and contamination and that would enable tidiness and attractiveness of the work area. Production area should be cleaned at the end of the working shift and all items should be put to their holding space. Maintaining cleanliness should become a part of production manager's daily work and not an occasional activity initiated only when things get to messy. Regular cleaning decreases accumulation of substances which can contaminate working processes and result in defects of final products. Production manager was to create the schedule for daily cleaning and cleaning should consist from sweeping dust from shelves, IT equipment, table, floor, putting items to their proper location and emptying waste baskets.

3.4 STANDARDIZE

The fourth step was finding the common criteria for the allocation of all items and putting documents and orders – i.e. create standards. Standardization prevents the accumulation of unneeded items at workplace. Maintenance systems for housekeeping and schedule for workplace was created. Production manager used visual aids to create schedule so it became easy for managers and all included to see who is responsible for cleaning and other activities.

3.5 SUSTAIN

Final phase is making 5S as permanent habit for production manager and employees. 5S long-term efficiency is achieved only in case of continuously keeping with agreed schedule, order and discipline. This means that all necessary items should be where they belong – all documents and orders now have exact designated location – and all rules which are set during previous phase should be followed. In case manager don't maintain order and cleanliness, his office will return to the situation as it was before 5S was introduced (Figure 1). Several visual management tools such as posters, slogans, instructions, before and after photos can be used for keeping the order and

cleanliness.

When it was completely implemented, 5S methodology increased morale, created positive impressions on everyone who come into office and which is the most important increased efficiency and organization. Implementation of 5S led to less waste, better quality, faster lead times and better approach to work of this textile company.

4. CONCLUSION AND RECOMMENDATIONS FOR FURTHER RESEARCH

5S methodology is an initial and vital component of Lean thinking. It focuses on five management techniques that are the foundation for any organization's competitive initiative. Although it was used in the production at the beginning, nowadays this methodology is used in all areas of production company and in non-production companies like hospitals. The benefits of this methodology come from deciding what should be kept, where it should be kept, and how it should be stored. This decision-making process should lead to a dialog which can build up a clear understanding between employees of how work should be done. Though 5S can bring huge benefits to companies there are potential disadvantages which are visible when the company is not prepared for 5S and when there is no support from top management.

By focusing on daily operations and help in organizing things and is easier to prepare employees for larger scale activities – establishing a quality awareness environment in the organization, ensuring adherence to standards in the process and foster the spirit of continual improvement.

Further research should be conducted to investigate if and how the 5S implementation can help other Croatian SMEs to improve their operational efficiency and consequently competitiveness.

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Q-LEARNING FOR DEVELOPMENT OF ADAPTIVE SIGNAL CONTROL ON URBAN INTERSECTION

Daniela Koltovska Nechoska

Abstract: *The intelligent agent technology represents the new approach employed in the development and design of adaptive control strategies. These are strategies that incorporate a higher level of intelligence and are capable of self-learning and experience-based decision making. In this paper, the adaptive signal control strategy on urban intersection has been developed and evaluated. The techniques of Reinforcement Learning, as well as the Q – learning algorithm, have been applied. The developed adaptive strategy has been tested under conditions of micro-simulation by applying the VISSIM simulator. In order to assess the feasibility of the designed strategy, the intelligent agent results have been compared to those obtained during the simulations in the case of fixed time and actuated control. The testing of the strategy has been performed on a real urban intersection. Both strategies reduced the average delay compared to existing fixed time signal control.*

Key words: *traffic signals, adaptive control, urban intersection, artificial intelligence, Q-learning*

1. INTRODUCTION

For a long time, it was believed that the systems responding to real time traffic would enable significant benefits. However, numerous limitations have appeared such as the existence of the models with a high level of detail precision, the uncertainty in predicting future traffic flows, the difficulty in arrival time estimation, the lack of self-adjusting mechanism [1].

The emergence of the intelligent agent concept, a significant move in the overall information science has been made. Nowadays this concept is applied in traffic when developing adaptive control strategies. The idea behind is the autonomous entities known as agents to start learning to behave in an optimal way by direct interaction with the system. By applying machine learning (ML) algorithms that are based on rewards or penalties depending on the results obtained in the actions selected by the agent, the optimal policy trying to optimize the traffic flow can be calculated [3].

The control strategy presented in this paper is performed by an agent. In order to embed the learning feature in the agent, the RL method is applied, as well as the Q- learning algorithm. The developed adaptive strategy has been tested under conditions of micro-simulation by applying the VISSIM simulator. In order to assess the feasibility of the designed strategy, the intelligent agent results have been compared to those obtained during the simulations in the case of fixed time and actuated control. The testing of the strategy has been performed on a real urban intersection. Both strategies reduced the average delay compared to existing fixed time signal control.

This paper is organized as follows. The second part describes the reinforcement learning technique (RL) and Q learning algorithm. The third section presents the Q - learning control at the individual intersection. Obtained simulation results are presented in the fourth part. Conclusions are presented at the end of the paper.

2. REINFORCEMENT LEARNING AND Q LEARNING ALGORITHM

Reinforcement learning (RL) is a technique well known in AI and machine learning (ML) communities.

Corresponding author: Daniela Koltovska Nechoska, PhD., Assistant Professor, Faculty of Technical Sciences - Bitola, email: daniela.koltovska@tfb.uklo.edu.mk

Reinforcement learning is a suitable technique for attempting to solve the traffic signal control problem, as it elegantly represents the elements of the problem - agent (traffic signal controller), environment (state of traffic) and actions (traffic signals) [3].

Variable traffic demand is a result of random choices of traffic users and computed choices of a traffic controller. The traffic controller can in each time step n change the traffic state s by applying a control input action a to the current traffic state:

$$s_{n+1} \sim p(s_{n+1} | s_n, a_n), \quad (1)$$

where p is a probability distribution function over the state action space. All processes, which can be described with (1) are Markov decision processes (MDP) and the belonging probability distribution function represents the Markov model of the whole system. In this paper, the whole system contains the traffic controller and the underlying traffic process to be controlled.

MDPs can be described by a 5-tuple (S, A, P, R, γ) where S is a finite set of states ($s \in S$), A is finite set of actions ($a \in A$), P presents the transition probability from a particular state s_n to a new state s_{n+1} if action a_n has been taken, R presents the reward received from the state transition, and γ is the discount factor ($\gamma \in [0, 1]$). The discount factor γ represents the difference in importance between future and present rewards. The reward function depends on the chosen action or of the so-called policy function $\pi(s)$ applied on a particular state ($r(s, \pi(s)) \in R$). Therefore, the problem of controlling an MDP can be defined as a problem to find the appropriate policy function that an intelligent agent (traffic controller in this case) will apply to choose the optimal action for the transition from state s_n to s_{n+1} .

One of the basic approaches to learning the needed policy function is reinforcement learning (RL). When RL is applied, the traffic controller is implemented as an intelligent agent and it enables the agent to work in a framework and gain new knowledge during operation. In this paper, the Q-learning algorithm is used to learn the policy function of the agent. Since in this paper the agent is a traffic controller, the Q-learning algorithm will learn the optimal control law for the underlying traffic process. To learn the needed control law the following learning rule is applied:

$$\hat{Q}_n(s, a) \leftarrow (1 - \alpha_n) \hat{Q}_{n-1}(s, a) + \alpha_n [r + \gamma \max_{a'} \hat{Q}_{n-1}(s', a')], \quad (2)$$

Where the learning rate α_n is defined as:

$$\alpha_n = \frac{1}{1 + \text{visits}_n(s, a)}, \quad (3)$$

and where $\hat{Q}_n(s, a)$ is the expected value of the previous defined value for a deterministic function case for an action a and state s , $\hat{Q}_{n-1}(s', a')$ is the expected value of the previous defined value for the new action a' in the next state s' , α_n is the learning rate, (s, a) presents the updated state and action during n time steps, and $\text{visit}_n(s, a)$ is the total number of visits for a state-action pair until the n^{th} time step.

Appropriate states, actions, and the reward function have to be defined according to the specifics of the underlying process to be controlled.

3. Q-LEARNING CONTROL OF INDIVIDUAL INTERSECTIONS

The set of states S was defined as [4]:

$$S = \{(\phi, g, Occ); \phi \in \{1, 2\}, g \in \{YES, NO\}, Occ \in \{0, 1\}\}, \quad (4)$$

where ϕ is the signal phase within a signal cycle of $C = 90$ seconds ($\phi = 1$ denotes a green phase, and $\phi = 2$ denotes a red phase); green time t_g falls within the interval $t_g \in [24,78]$ within a single signal cycle C ; red time t_r falls within the interval $t_r \in [12,66]$ within a single signal cycle C ; g is a binary variable receiving the values $\{YES, NO\}$ (NO denotes that there are no vehicles (signal received from the inductive loop), and YES represents the opposite); Occ is a binary variable (0, denotes that there are no vehicles present from the conflict flow (red light), and 1 denotes the opposite).

Based on the information related to the detected state, the control agent chooses an appropriate action. For each state, the agent can choose between two actions: action value of 1, which means the state remains the same (green time extension), or action value of 0, which means a change of the signal state. The rewarding function is the second key element for the agent. In this case, the goal of the rewarding function is the maximization of the total throughput. For that purpose, the following set of rewards was defined:

- 1.) Reward Function –total throughput;
- 2.) Immediate reward –number of vehicles passing at green light in the previous time interval (the length of this interval is 90 seconds);
- 3.) Discounted reward – total number of vehicles in the peak hour.

The action is taken at a shorter interval for a given time step. The vehicles are counted per one 90 second signal cycle. An action is taken per second – over the green time duration, in which case the step takes 3 seconds.

The Q-learning based signal control testing is performed on a real four-leg intersection located within the central area of Bitola, using real traffic data. Figure 1 depicts the intersection and the communication with the RL intelligent agent.

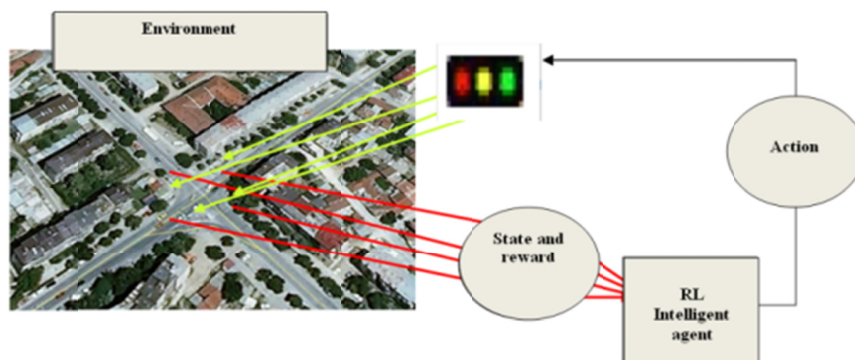


Fig.1 Description of intersection and communication with the RL agent [4]

4. RESULTS AND DISSUCION

Delay, throughput, and number of stops are analysed as efficiency measures for all types of intersection control. The results obtained from the learning intelligent agent are compared to the ones obtained through simulations in cases of fixed time and actuated intersection control. The fixed time control is selected as a base case and all the other results are estimated in relation to it.

The testing is performed after three hundred of iterations with various values regarding states and after the convergence of Q-values. Depending on the traffic flow conditions, and whether the traffic demand is known or unknown to the agent, the testing is performed in two phases. During the first phase, the testing is performed for uncongested traffic conditions with known and unknown demand. During the second phase, the testing is performed for congested traffic conditions with known and

unknown demand.

Figure 2 shows the comparison of the percentage of efficiency measure improvements for all phases of testing in case of applying fixed-time to that of adaptive control in conditions of traffic non-congestion and congestion, with known and unknown demand.

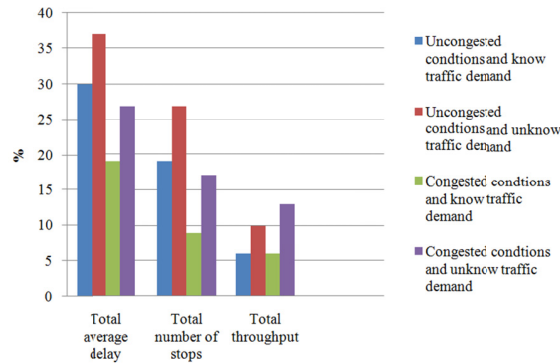


Fig.2 Comparison of percentage of efficiency measure improvements (fixed-time / Q-learning based signal control)

Figure 2 shows that adaptive strategy gives best results in cases of:

- Total average delay of vehicles (37%) and the total number of stops (27%) in uncongested traffic conditions for unknown traffic demand
- Total throughput (13%) in congested traffic conditions for unknown traffic demand

Figure 3 displays the comparison of improvements for all testing stages in cases of applied fixed-time as opposed to actuated control, in both uncongested and congested traffic conditions, for known and unknown traffic demand.

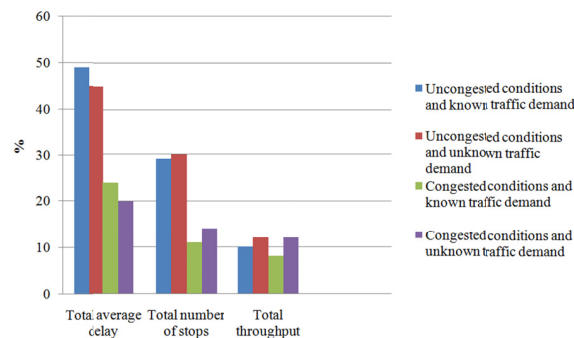


Fig. 3 Comparison of percentage of efficiency measure improvements (fixed-time/actuated control)

What Figure 2 shows is that actuated control renders best results with the total average delay in uncongested traffic conditions and known traffic demand (49%), with a total number of stops in uncongested and unknown traffic demand (30%) and with total throughput in uncongested traffic conditions and unknown traffic demand (12%).

5. CONCLUSIONS

The developed self-learning adaptive signal strategy has been tested on a real four-leg urban intersection. The intelligent agent results have been compared to those in cases of fixed-time (base case) and actuated the control. Depending on a) the traffic flow conditions and b) the known and unknown demand, the testing has been performed for non-congestion and over-capacity. Regarding the average total delay, the total number of stops and the total throughput, the best results have been obtained for unknown traffic demand and over-capacity.

Having in mind the testing results it can be deduced that the *newly designed adaptive control strategy is appropriate for controlling the traffic at isolated urban intersections*. In favour of this speaks the comparison of results obtained in every of the testing stages and scenarios.

Regarding all three efficiency measures (total average delay, the total number of stops and total throughput), there are evident improvements that are achieved by means of the newly designed adaptive control strategy for *unknown traffic demand in over-capacity congested traffic conditions*.

Based on the above, it can be concluded that the newly designed strategy for isolated intersections in urban areas is well adapted to the traffic flow conditions (a feature of adaptability) and depends on the real-time traffic demand (responds to the demand).

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IMPLEMENTING FMEA METHODOLOGY INTO INDUSTRIAL CAPACITY FROM MACEDONIA

Ivo Kuzmanov, Roberto Pasic, Oliver Slivoski

Abstract: *The basic aim of the paper is to present only a small part from an extensive research conducted into industrial entity from R. Macedonia, done into the period November 2016 – January 2017. The industrial capacity which was taken into consideration was from the metalworking industry and it's an capacity with a serious productivity of stoves and fireplaces on solid fuel. It's an entity with more than 300 employees and a production which is saled in the Balcans. The basic aim of the paper is to represent only a small part from an extensive research and application of the FMEA methodology into the entity, but also to represent some of the achieved benefits after a short period of time. Although the FMEA methodology is aplicated in all of the business processes into the business entity, the paper represents the process of cutting, shaping and drilling metal till getting a final piece – half product that is used into other processes during the production of fireplaces and stoves. The basic aim while doing the research and the implementation of the FMEA matrix was to get benefits in a short period of time, benefits that will improve the quality of the final product and the productivity into the industrial entity. It's worth full mentioning that while doing the FMEA processes a multidisciplinary team was included (persons from the science, person with previous experience while doing such FMEA implementations into industrial entities, persons from the factory, workers on direct work places and consumers into the next processes into the company). So the paper represents only a small part from the application, which if it's used on a daily base with a created procedure and a multidisciplinary team to implement and use the same one, brings benefits to every industrial entity.*

Key words: *FMEA, Quality Control, QMS, industrial entity from the metalworking industry, R. Macedonia*

1. INTRODUCTION

The basic aim of the paper is to present only a segment from a conducted research done into an industrial entity which works into a metal cutting industry and has a market share into Balkans more than 60 years. After the transformation of the capital from state to a private one, the business entity started to work with completely new production lines in the year 1996. But once more, the basic aim of the paper is to present only a segment from a conducted analyses considering the momentary state of the system and to be more precise about the processes of quality assurance and quality improvements through the implemented FMEA matrix, which in the processes of application gave us real information's about the potential problems, the potential solutions that could be implemented and could give the production system reducements of the non-conformities, problems reducement, quality improvements on one hand, and on the other achieving bigger and bigger profits through the processes of continuous reducements of the non-conformities in any stage of production.

One of the key elements which is worth of mentioning is to precise that the realization of the FMEA methodology is conducted with a precisely created multidisciplinary team conducted from persons from science (persons with a long term experience into the field of Technical sciences), persons with a long term experience into the processes of implementation of such methodologies, persons from the management team, workers from direct work places which are under review as well as workers from the following processes into the production system. Seeing the team, we could say that the same one is more than relevant to conduct such an analyses and to create real picture about the

Corresponding author: Ivo Kuzmanov, PhD., Associate Professor, Faculty of Technical Science in Bitola, email: ivo.kuzmanov@tbf.uklo.edu.mk

potential problems but also to create a solutions and ways which will bring the company to an improved situation, as well as a more quality final product. In the following part of the paper only a segment of the research and the created strategy based on the previously defined FMEA matrix.

2. PRESENTING THE METHODOLOGY THAT WAS USED

The methodology that was used while the research was FMEA methodology. The same one is known as a methodology which primarily is used for detection and analyses of potential non conformities, and is known as a method for systematically detection of potential non conformities, but also as a one that creates potential solutions. This method is worldwide knows as a FMEA (Failure Mode and Effect Analysis). The methodology most common is used for:

- Detection of potential non conformities, which has a crucial influence to the system productivity
- Evaluating the effects of each detected non conformity and its influence to the system, the influence over the functions of the elements and sub systems

FMEA is a world knows as a methodology which is based on team work and it's accepted as one of the most common methods for system improvements directly, but also as one of the methods which indirectly has an influence to the quality of processes, quality of final products, business performance and finally brings financial benefits to the entity. The same one as a method has influence to all of the production stages, with a final aim of improvements from a process to a process. Whit it's usage the same one brings the subject to a situation where all of the potential non conformities could be evaluated and could be segmented as primary, secondary ones and non-conformities as a result of human mistakes.

The methodological approach to the same one is based on a team work and created tabular views which are a multiplication of three common factors (the severity, the occurrence and the possibility for detection). Multiplication brings us to a created RPN number, shown in addition:

$$\text{RPN} = \text{severity (S)} \times \text{occurrence (O)} \times \text{detection (D)} \quad (1)$$

Each of the multiplication factors shown into the formula above are on a scale from 1 to 10, and could be exactly read from generated tables. Considering previous mentioned, the maximum RPN number could be 1000. One of the most important things to say at the moment is also the approach to the problems (solving approach). The same one is based from top to bottom considering the RPN number. The implementation of the method is developed considering several steps: team creation, defining time and place for implementation, creating structural, functional and non-conformity analyses after which the team approaches to a realization of a recommended steps and solutions after which there is an additional monitoring on the system.

3. REVIEW OF THE PRODUCTION PROCESS

Having in mind that the paper presents only a small segment from an extensive conducted applicative research with a real implementation of FMEA methodology into a real entity, and a one that brought the company real results, in addition of the paper only a one sub process is shown. The same one is a part from a production line which produces stoves, where the process is separated to the following sub processes:

- Buying raw materials
- Quality control – on the raw material
- Segmenting the raw materials into magacines
- Cutting on small and large scissors
- Making holes to the material
- Using hydraulic presses
- Delivering the final piece to magacine or to another process

While doing the analysis with an aim to detect possible non conformities, an reason – consequence

methodology was used. The same one brought the team identified, researched and graphical picture to all of the potential reason for defects. While creating the step, and before the FMEA methodology was actually created, the following characteristics of the process were also taken into consideration:

- Machines
- Methodology of work
- Material
- Human factors
- Measurement instruments
- Work conditions

Seeing things this way, the possibility to miss something is minimal. But there is always a possibility something to be missed, and that is the reason why this process is continued and improvements are aimed from a process to a process. In addition of the paper only a segment from the generated FMEA methodology is presented. In this case the presented part is the process of delivering and transporting the final piece to the magazine (or to other process if it's necessary), where the first hypothesis was that we would not find any non-conformities and there wouldn't be detected any problems.

4. PRESENTING ONLY A SEGMENT FROM THE FMEA TABULAR VIEW

In addition of the paper, only a segment from the research and segmented tabular view is presented. The same one is a presentation of the detected problems into the sub system – transferring final piece to the magazine or to other sub system (if it's necessary). Although in this part of production the expectation is to have only quality produced piece (in more than 99% of cases), some problems were detected. The tabular view is an excellent presentation of the detected problems.

Process	Potential Failure	Nus – effects	S	Reason	O	Reason	D	RP N
Transferring the done pieces into the warehouse	Damaged piece	Replacement – time sequences which are long	4	Mistakes done by workers while transfer	3	Checking piece by piece	4	48
	Long time for transfer	Production delaiment, free work force with no activities to do	5	Transport equipment which is more than old	7	Checks on every piece	2	70
	Not appropriate conditions into the warehouses	Nus products	3	Mistakes made by the warehouse workers, and the transport workers	4		6	72

After detecting most of the problems (potential and real ones, and also problems for which the employees were aware), potential solutions and practical realization of the same ones were suggested. So, after a while the process of practical implementation started and after following the results, another tabular view was created. The same one is presented into the tabular view which is given in addition.

Actions TO DO	Actions TAKEN	RESULTS FROM THE TAKEN ACTIONS – NEW RPN			
		S	O	D	RPN
Motivation on work force – control of the materials, pieces	Motivation and TEAM BUILDING actions	3	5	2	30
Replacement of the transport equipment, as well as maintaining the ones that are already in use	Done maintenance on all of the machinery which is in use	3	4	2	24
New warehouses, and taking some measures to renovate the ones in use	Generating warehouses which are with appropriate conditions for the use.	2	3	2	12

Seeing the second part of the table, result are more than visual if you see the RPN number and compare the same ones to the previous RPN numbers into the first table. But what is important to say is than the methodology could bring results to the business entity only if the same one is implemented in a long period of time. Such approach brings business and financial benefits to the entity.

5. CONCLUSION

Having in mind the previous mentioned, we could consider that the paper presents only a segment from a completely conducted applicative research from the field of quality control, or to be more precise in the field of quality assurance in this stage, into a real business entity. The basic aim of the paper is to present only a segment from the functioning of the FMEA methodology into real industrial entity, which works into Bitola's region, with an aim to present the real benefits from the practical implementation done by a multidisciplinary team. The industrial entity had some benefits in such short period of time, which could be seen into the tabular views presented into the paper. At the end we could say that the paper presents only a segment from the things which were done, and considering the fact that the same one is an ongoing process, we could say that more and more papers could be published from the practical usage of the method into the business entity.

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TRADEMARK VALUATION – MANAGING INTANGIBLE ASSETS FOR STRATEGIC COMPANY BENEFITS

Gjorgji Rafajlovski

Abstract : *The main goal of this paper is studying the concept, the context and the different forms and techniques of valuating trademarks as a part of the intangible assets portfolio, as well as valuable assets of an organization in theoretical manner, which gives a specific review of literature in that particular area.*

In today's global economic societies and open market systems, knowing the true value of a trademark can help a company in optimizing its management actions, create useful marketing strategy and gain sustainable further financial benefits.

If trademarks are to be seen as potential (added) capital to the companies, they first need to be officially registered, so they can become a useful and manageable asset. The reasons why a certain mark should be valued in first place, is also a question which is elaborated, following the procedures of extracting the value of the company, the brand and the value of the goodwill from that of the trademark. Today, there are two basic groups of approaches of valuating trademarks: 1) the quantitative approach – with it's famous: a) market; b) cost; c) income methods and 2) the qualitative approach. Additionally, in successful valuation of a certain trademark, there are many factors that must be taken in consideration, along with their variations and frequencies that are also specifically elaborated, along with the current trend and difficulties that occur in the process of trademark valuation. The main goal of this paper is to determinate the true value that a certain mark possess both to their owner and to the processes that it's used for, using scientific and empirical methods. The key findings of trademark valuation techniques can be seen as a useful tool for creating organization's strategic planning, marketing undertakings and fulfilling its long-term financial goals. Main objective of the paper is the critical review of the used literature and theoretical practices in the area of trademark valuation.

Key words: *Trademark Valuation, Trademarks, Intellectual Property, Intangible Assets.*

1. Introduction

In today modern times, trademarks are taking the huge role representing a synonym for standardized quality and known origin.

The rights that are arising from the continued use of certain trademark, as a part of the Intellectual Property (IP) rights, have a significant impact on the direct economic benefits of every economy⁶ (Hadziprokopiu, Naumovski, Stojkov, Stefanoski; 2007). The trademark or the mark itself, despite the area of usage, its specific nature, the way and the form of use, it's familiarity, or the territory of its formal registration, represents a reflection of certain company's innovation and creativity, that are no more large or multinational corporations, but more frequently SME's. Namely, small and medium businesses in their never-ending struggle for better market positioning are the ones that are taking the initiative in creating and trading with these kind of intellectual capital, and not just on a basic local or regional level, but on an global level as well.

Therefore, understanding and measuring the "values" of the s.c. intangible assets, as human & intellectual capital, business culture, or the value of the brands & trademarks are becoming more significant factors in "the new economy". From that point of view, various companies, enterprises and organisations use trademark as their bases for a continued and long-term development (Leadbeater,

Corresponding author: Gjorgji Rafajlovski, LL.M., Chief Operating Officer – COO, SEEUTechPark, SEE University, Macedonia (g.rafajlovski@seeu.edu.mk)

⁶ Hadziprokopiu M., Naumovski G., Stojkov A., Stefanoski Lj.: Understanding the Economics of Copyright, Magaziine for legal theory and practice "Legal life" issue 56, No. 13, p. 343-354, Belgrade, December 2007.

1999).⁷

In a most basic level, enterprises are tending towards using the trademarks to signalise their (potential) clients that, their goods and services are marked with certain constant quality. Having this in mind, they are actually reducing the consumer's alternative in looking-up for goods and services with similar characteristics, for which they're charging a relatively higher price. Hence, higher prices lead to higher profitability, until eventually; the pressure of the open market competition does reduce the profits to certain – more acceptable level (Landes, Posner; 1987).⁸

According to this, trademarks quite often are used as one of the strategy tools for extracting a bigger value of innovations that are undertaken in the process of their own business activities.

On the other hand, certain economists and lawyers are emphasizing the fact that there is significant difference between the value of a trademark valued from the standpoint of a company, and the value of the same mark valued from the standpoint of the general society. They are arguing that, there is always a possibility that the IP in general, and in that matter the trademarks in particular, are limiting the innovativeness through increasing the prices of the products in the markets – which is obviously positive news for the companies, but certainly unacceptable for the society in general (Greenhalg, Rogers; 2005)⁹

One of the main reasons why companies use trademarks in the everyday business is the fact that they are effectively helping them in fulfilment of their marketing, strategic and financial goals. In this way, "marks can be seen as direct communication links between the companies and their current and potential clients".

As one of the major economic functions of the trademark it certainly is its distinctiveness, which differs the products and services of one market competitor from other competitors on that same market. Hadziprokopiu, Naumovski, Stojkov, Stefanoski; 2007¹⁰ Despite this, trademarks have other function which are directly related with the quality and distinctiveness, (Gunther, 2006)¹¹ but are also indirectly related with the competitiveness, warranty, advertisement, packaging, cataloguing, and other marketing and propaganda purposes (Polenak-Akimovska, Dabovic Avanasovska, Buckovski, Pepeljgovski; 2004).¹²

But also, marks have this power for turning a common product/service into status symbols (Aldred; 2008)¹³ even if the products that are attached on haven't been specially and visibly improved. One can conclude that, this particular function justifies all the efforts spent on researching, investing and actively using the marks in organisation's everyday business matters.

By analysing the economic functions of the trademarks, one must not forget to mention the active role that certain markets and consumers have on becoming a successful (or unsuccessful) trademark. Trademark do not, end they never do exist in a vacuum, but they are only a part of one big and complex system of cognitive and emotional elements transformed into series of actions, that are in the constant shadow of different micro and macro sociological, economic, political, legal, technological, geographical and cultural changes.

In that context, trademarks are suitable for generating profits, only as a result of its own values, that clients, employees and the other stakeholders are contributing towards the visual identity of the products that they find themselves attached to (Haig, Heberden; 2003)¹⁴

2. Formal Registration of Trademarks

Because of the sheer fact that trademarks are playing significant role in commercial transactions; their owners are gaining more benefits if they formally register their marks and therefore protect them

⁷ Leadbeater C.: *New Measures For The New Economy*, OECD, Amsterdam 1999.

⁸ Landes W.M. and Posner R.A.: *Trademark Law: An Economic Perspective*, Journal of Law and Economics, 1987.

⁹ Greenhalg C., Rogers M.: *Trade Marks and Market Value in UK Firms*, Oxford Intellectual Property Research Center, 2005, p. 4.

¹⁰ Hadziprokopiu M., Naumovski G., Stojkov A., Stefanoski Lj.: *Understanding the Economics of Copyright*, 2007.

¹¹ Gunther M.: *Trademark Valuation*, The Berkly Electronic Press (bepress – www.bepress.com/ndsip/art7), 2006.

¹² Polenak-Akimovska M., Dabovic Avanasovska J., Buckovski V., Pepeljgovski V.: *Intellectual and industrial property*, 2004, p.140.

¹³ Aldred J.: *Economic Rationale of Trademarks: an Economist's Critique in Bentley L., Davis J. and Ginsburg J.C. Trademarks and Brands: an Interdisciplinary Critique* (2008) Cambridge: Cambridge University Press, p.175.

¹⁴ Haig D., Heberden T., *Doing the Numbers, TMW*, 2003, p. 156.

by the current and applicable laws.

Although, the choice to register or not to register a certain mark remains in the hand of the owner of that mark through national or international registration offices, this paper will be elaborating only registered trademark, because it is the only way that guarantees appropriate economic and moral compensation from possible offenders.

In practice, a principle says that, if one company makes investment in creating a mark that, in some later date formally protects it by registering it in the official trademarks registration offices that company can practically save time and money on eventual law-suits from the violators of the rights that are arising from the use of the mark.

Therefore, these kind of situations implies that the major part of the owners are willing to formally register a mark, because they have spend significant part of money and time to create the mark that they intend to use in the future (Yelnik, 2009)¹⁵

For the awareness of the need on formally protecting a certain trademark says the fact that in 2005, only the World Intellectual Property Organisation –WIPO have received more than 35.000 applications for trademark registration and in the USA in 1996 applications have exceeded the number of 200.000 (Sinclar, 2009)¹⁶

At the end, the sheer benefits of the formal registration of a trademark influences all sides: 1) owners – by the rights that arises from the usage of the mark; 2) consumers – by confirmation of the quality and the positive values that are represented by the mark itself and finally 3) the economic system in general – by allowing and encouraging competitive business module where innovation and creativity are rewarded.

3. Concept of valuation and application areas

Trademarks are of exceptional value for the companies, because they have that power, in correlation with other inputs and factors of production, in generating additional profits.

In an intertwined business world, trademarks are direct contributors in cutting the expenses, protecting the market position, promoting the competitive advantages, raising the market value of the company and other unlimited areas of the business actions and relations on an organisational level.

In such cases, the question isn't: do marks have their own value? but: how much of the performances have been directly linked with the value of trademark itself?

When considering the context of trademark valuation, and its undeniable role in a company's environment, one must take into account that the trademark, as input, should be observed as interdependent with the other assets correlation with it. In practice, this point of valuating similar assets is called "package" or "bundle of assets" (Martin, Drews; 2006)¹⁷ For example, the intangibles assets that are used for marketing purposes shall be valuated as "integral marketing package". In that way, beside the trademark, other assets such as: the name of the product/service, industrial design, the packaging, corporative name, the logo, and in recent times even the domain-name, (Naumovski, Popovic; 2011)¹⁸ have broad influence on the mutual intensifying of their combined meaning, and along with it – with their combined value.

In general, the process of trademark valuation isn't more different than the valuation processes of other IP elements. But, in the foundation of extracting value is defining the term "value" itself. In IP it is generally accepted that: "the value is a measurement of the benefits acquired by using the IP elements"(Martin, Drews; 2006)¹⁹

And if the value is defined as a measurement of benefits, then that same value might have more than one dimension, depending on the unique goals, different reasons, specific occasions, but also various economic and legal issues and consequences which can be arise by the valuation of the certain trademark. In that manner, the value of a mark can be its increased market share, its higher price, the

¹⁵ Yelnik A.: From the point of view of comercial value of trademarks, do current laws sufficiently protect brands from infringement?, MARQUES Annual Conference, 2009.

¹⁶ Sinclar R.: Value of Trademarks and Brands, 2009, p.503.

¹⁷ Martin, D. and Drews D.: Intellectual Property Valuation Techniques, IP Metrics, 2006.

¹⁸ Naumovski G, Dusan Popovic.: Information Technology Law, Skopje, 2011.

¹⁹ Martin, D. and Drews D.: Intellectual Property Valuation Techniques, IP Metrics, 2006.

additional revenues, or a simple cut in expenses.

There are many situations, where trademark valuation can be relevant. These situations fall into a common “set of categories” (Roosma, Kerr & Reilly),²⁰ such as: Financial securitisation and collateralisation; Insurance policy; Organisational activities (re-organisation, mergers, acquisitions and liquidation); Litigation and dispute resolution; Accounting; Commercial transfers; Management information etc.

4. Process and methods of valuation

The actual process of evaluating intangible assets along with the valuation of trademarks is not an easy task at all. The procedure itself requires a lot of time, valuable recourses and money invested, in return of rather inconclusive results which can't be always easy to measure or precisely correct. At the end, the final result must often be interpreted with the utmost caution.

Besides the purpose of the valuation and the areas of application of the valuation, the context in which a certain trademark is valued may be the single most important element of the final value of the mark (Martin, Drews; 2006)²¹. In that matter, if the mark is valued in the context of a large international company, which has well trained personnel and managers, huge capital, an effective marketing program and excellent distributive channels, it is almost certain that the trademark owned by this kind of company will have higher market value than in the “hands” of, let's say a small local business in that same business sector.

Some of the most significant methods of trademark valuations, in the same time of other intangibles as well, are considered the following basic quantitative methods (Smith; 1997):²²

The Cost-based Method – measuring the replacement value of the mark;

The Market-based Method – measuring the value of the trademark thru fair market supply and demand and

The Income-based Method (Economic Method) – measuring the value of future economic worth of the trademark.

Along these s.c. “quantitative methods” which task is to ‘simply’ measure the exact numbers (expressed in financial terms of ‘profit’ or ‘loss’), there are also other “qualitative methods” that are based on measuring the other – non-financial elements, such as: feelings, thoughts, emotions etc. Some of the authors consider such a divide inappropriate, underlining that both groups are taking into consideration more or less, all the qualitative and quantitative aspects of the valuation at the same time (Ulmer; 2003)²³

The Cost-based method

The Cost-based Method has the primary purpose to value a certain trademark thru summing all of the expenses made in the past that had led to creation of that particular trademark. This method aim is to determine the total sum of money needed in order to re-create a certain mark, or replace it with a new one, while getting the same results that the original mark originally performed (Smith; 1997)²⁴

At first glance, performing this method seems pretty simple, but in practice extracting all the direct and indirect expenses that in some time, contributed in creating or maintaining a trademark in its lifetime period is easily said then done. There are lots of real-life examples where trademarks have more of one hundred years old lifespan (such as “Coca-Cola”, “Gillette” or “Kellogg's”), and they seem to be carved into the memory of several generations of consumers as icons of the things they represent. In these cases, it is extremely difficult to determine all the inputs that had led in

²⁰ Roosma, Kerr & Reilly: Intellectual Property Lost Profits and Economic Damages Analyses, Williamette Management Associates Insights Quarterly Journal, Summer 2002, p.5

²¹ Martin D., and Drews D.: Intellectual Property Valuation Techniques, IPmetrics LLC, The licencing Jurnal, 2006.

²² Smith V. Gordon: Trademark Valuation, 1997.

²³ Ulmer M.: Latest research on the valuation on intellectual capital: Models, methodes and their evaluation, Universitat St.Gallen, 2003.

²⁴ Smith V. Gordon, Trademark Valuation, 1997, p.21.

developing the trademarks thru the years, due to present day.

The basic doctrine which this method starts from is that, it is reasonable to expect companies not paying for some sort of IP more than the cost of making it on its own (Prashar, Rashmi; 2004)²⁵ Paraphrased, it would mean that nobody would pay for some technology more than the actual costs of creating the same technology.

The Cost-based Method practically is made of two different approaches, that can determinate the real value of a trademark. They are the following:

- 1) *Trending historical costs* – or the costs used in developing the mark in current prices, including all direct and indirect (ex. consultancy, advertising, package design) expenditures and
- 2) *Re-creation costs* – or an estimate of all the expenditures and efforts made to create a new mark with the same or very similar characteristics with the original trademark (Graham; 2004)²⁶

The next table is giving an example of determination a hypothetical trademark value using the CPU (Consumers Price Index):

Table 1: Historical cost of development of a hypothetical mark (Macedonian CPI; 2010)²⁷:

Year	Expenditure (in Euros)	CPI - Factor	Net Value in 2010
2000	100	100	100
2001	300	105	315
2002	400	109	436
2003	800	110	880
2004	1.000	110	1.100
2005	1.200	110	1.320
2006	1.500	114	1.710
2007	1.900	115	2.185
2008	2.300	116	2.668
2009	2.700	118	3.186
2010	3.000	119	3.570
Total:	15.200	Total:	17.470

The Market-based method

The Market-based Method is the most direct methodological procedure in the process of valuation trademarks. Thru the methodology of the market value, we can measure the current value of all the future benefits that can be achieved by using the trademark in the future times, by reaching consensus over what other market competitors think about the true value of the mark.

Actually, the exact value of the mark is determined by the meaning of the term “fair-market value” (FMV) which represents the highest offered price for a well-informed buyer with a clearly expressed will for buying from one hand, and well informed seller with a clearly expressed will for selling on the other side, in the terms of an open and undisturbed market, with no pressure for selling or buying on any of the sides (Tairijan; 2009)²⁸

Believing that, the full market supply and demand will eventually meet each other in a timely-framed equilibrium and therefore the market itself will be the key factor of revolving the current value of the trademark took a central part of this method.

The very basics of this valuation method are laying in the opportunities in comparison of the similar mark on the market, which correspond with the value of some other mark, with similar attributes, previously bought by some other side (Gunthner; 2006)²⁹. We can find the same principle in the real-estate markets – where for example, a family house of 200m² with three bedrooms and two baths in a

²⁵ Prashar S. and Rashmi K. A.: The Intellectual Property Valuation: A case of Jet Airways, the innovative and critical times ahead, an Indian Perspective, World Academy of Science, 2009

²⁶ Graham M.: Trademark Valuation, 2004, p. 9.

²⁷ State Statistic Bireu of Republic of Macedonia, Consumers Price Index – according to the COICOP clasification 10/08/2010, Nr.4.1.10.58 (http://www.stat.gov.mk/PrikaziSooopstenie_en.aspx?rbrtx=39).

²⁸ Tairijan A.: Valuing Trademarks and Domain Names, DomainMart, 2009.

²⁹ Gunthner M.: Trademark Valuation, 2006, p.6.

relatively quiet neighbourhood is compared with another house with similar parameters in order to determine its real value. However, in order to perform such comparison, the criteria of an “existing open and active market” are obligatory.

And that’s exactly the biggest obstacle while using this particular method in determines the value of trademarks. Namely, although there are some cases when the details form transferring trademark from one side to another are well known to the general public, in reality one cannot rely on the fact that “open” and “active” market were transactions with IP truly exist, for the simple reason that, most often these type of transaction are rare and quite un-transparent. Additionally, transferring trademarks are just a part of a bigger transactions such as: acquisitions, takeovers of whole companies or sectors, or simply transferring the trademark “in a package” with other assets such as brands, the know-how technology, or franchising, so it becomes practically impossible to determine the real market value of that single element as a part of a bigger and relatively complex transactions.

Having in mind that the trademarks, along with the other parts of IP are truly unique by definition, finding a mark that has similar attributes as a comparison model can be extremely difficult task to perform, for that purpose, before even beginning the process of valuation, one must provide the key comparable elements such as: the type of the trademark, the type of the industrial/business sector, the geographical area, life-time of the mark, and etc., in order to get real and acquire end results (Martin, Draws; 2006).³⁰

The Income method

From an effective point of view, The Income (or Economic-based) Method is the most used and the most helpful indicator for measuring the value of a certain trademark. The cause for its wide application lies in the fact that practically, all types of property in the business world are evaluated by how quickly and to what extent they can deliver the return of the investment. This particular method is measuring exactly that – the assessment on returning the investment of trademarks.

The Income Method is defined as current value of all future revenues made from the use of the trademark during its lifetime, considering all the risks during the time of making those profits (Prashar, Rashmi; 2009).³¹

Some authors, (Matthew Gream, Michael Günther) consider that the Income Method is actually extracted from the older “Economic-based Method” which measures all the benefits using the trademark in the future, with the special accent to the measurements of the future fees to the owner, if he decides to license it to some other side (Gunthner; 2006)³² (Gream; 2004)³³.

The valuation of the mark using this particular method is performed through calculating the revenues which would be made using the trademark in the future business operations from its owner, reduced on a today prices level (or prices that are valid on valuation period/s), in order to determine the real (current) value of the same mark.

Estimating the future profits is based on previous owner revenues, or other comparative revenues from similar competitors on the same market.

The basic standpoint of this method is the facts that an enterprise which doesn’t have its own brand is willingly ready to pay certain amount of money that will legally allow it to put an existing trademark on its products, eventually leading to increase of the prices of its own products on the market, and making some extra profits. Therefore, the need of determination of the individual revenues which would be made by licensing the trademark is the primary objective of this method (Yelnik; 2009).³⁴

For better understanding the Income Method it is crucial to have elementary understanding of the “time value of money”. The concept of “time value” explains that an amount of money received immediately is worth more than the same amount received in the future. Apart from the influence of the inflation on the real value of money, there is a continuous earning interest on it. The term used for

³⁰ Martin D. and Draws D.: Intellectual Property valuation Techniques, 2006, p.6.

³¹ Prashar S. and Rashmi K. A.: The Intellectual Property Valuation:, World Academy of Science, 2009, p.1266.

³² Gunthner M.: Trademark Valuation, 2006.

³³ Gream M.: Trademark Valuation, 2004.

³⁴ Yelnik A.: From the point of view of comercial value of trademarks, do current laws sufficiently protect brands from infrigement?, MARQUES Annual Conference, 2009, p. 9.

the current value of money to be received in future is called “present value”. Thus, the future income, generated by a trademark, must be recalculated to the present value to yield realistic analyses. There are also several approach techniques (Martin, Draws; 2006)³⁵ that are used of performing the Income Method: Residual; Premium Price (PP) or Earnings Split (ES); Relief from Royalty (RR); Discounted Cash-Flow (DCF) and Real Options Method (ROM) In the following table there is an example of a trademark valuation using the Relief from Royalty technique (Rafajlovski; 2013):³⁶

Table 2: Income – method example: Relief from Royalty Technique

	2012	2013	2014	2015	2016	Terminal amount	
Revenue	100.000	112.000	125.440	136.730	144.933	150.731	
Growth	10%	12%	12%	9%	6%	4%	
Royalty	5%	5.000	5.600	6.272	6.836	7.247	7.537
Tax	10%	(4.500)	(5.040)	(5.644)	(6.152)	(6.522)	(6.621)
Royalty Stream	3.000	3.360	3.763	4.102	4.348	4.522	
Present Value Factor	12%	0.9434	0.8423	0.7521	0.6715	0.5995	0.5353
Present Value	2.830	2.830	2.830	2.754	2.607	2.421	
Total Years 2012-2016	12.330	Capitalized amount (12%)				23.633	
Trademark Value							
Total Years: 2012-2016	12.330						
Terminal Amount	23.633						
Total	35.963						
Rounded Total	36.000						

Qualitative methods of valuation

The so-called “qualitative” methods of valuation trademarks are direct alternative of the “quantitative”, or the monetary valuations. These types of valuations are in most cases requested by marketing and/or branding experts and they tend to throw a different kind of light on the meaning that a particular trademark has in its consumer’s eyes.

So, instead of measuring the exact financial parameters of value, the qualitative methods are focusing on the effects that some trademarks are causing in the specific target groups or market niches. Furthermore, they most importantly focus on the emotions, feelings and other high-distinctive messages that are usually transferred by using certain kind of trademark of a certain type of product on the markets the companies are competing on (Gunthner; 2006).³⁷

One research of the famous “Goodyear” – car tires made in the US, had shown some interesting results regarding the different perceptions of a trademark value among its clients (Gelb; 2010)³⁸. Namely, when one couple of focus-groups were given 125\$ and a chance to select one particular set of well-known tire marks, from a bunch of different sets, while pointing out how much would they pay for each set, the results were totally unexpected: the focus-groups which came from the north parts of the country (in which states the company had more than 9% of the market share) were ready to pay an average of 109\$ for the whole set of “Goodyear’s” tires, while in the western and south-western parts of USA, (in which the market share was under 5%), the respondents were ready to pay an average of “only” 94\$. The research concluded that, the value of a trademark, along with the brand, can actually be variable depending on geographical characteristics, but also depending on the market share of a company on a particular territory.

The previous example can led to a conclusion that the qualitative valuation techniques tend to see

³⁵ Martin D. and Draws D.: Intellectual Property valuation Techniques, 2006, p.7.

³⁶ Rafajlovski G.: Legal and Economic Aspects of Trademark Valuation, 2013, Skopje, p.45

³⁷ Gunthner M.: Trademark Valuation, 2006, p.7.

³⁸ Gelb, G.: Why a Trademark can't be valued as a Brand, 2010, p.4.

the true value of the mark linking the mutual interaction between the trademark itself, and the buyers or the end users of the product that are labelled with it (Zaichkowsky; 2006).³⁹

This exactly makes the qualitative method special by nature, and in practice, every valuation performed by these methods should be tailor-made, depending on its unique geographical, social, market, economic, cultural and other parameters. In that matter, every potential focus group may have its own and unique differences on the value of a certain trademark in both subjective and collective matter as well.

Knowing this, combining the qualitative and quantitative valuation methods may bring the best results if they are performed in tight correlation with the different type of regular market research techniques and public opinion pools (Smith; 1997).⁴⁰

Comparative analyses of the methods

As previously stated, performing a trademark valuation process in the frames of a company or any other organization is not an easy task. It requires creating and managing a whole system of human recourses, time-frames, financial inputs, and complex calculations, which at the end will result in some sort of preliminary and un-final results and conclusions. After all, measuring the value of a trademark is an ongoing and dynamical process, and it demands continues efforts and permanent performances.

The simple re-creation or re-building a trademark may be useful in certain cases, but the lack of well-established methods that can precisely determine the short-term along with the long-term consequences, most certainly shadows the further benefits of using the same mark in the future. On top of that, valuating a mark in great matter depends of the context and the reasons of its valuation, therefore certain companies tend to have different systems and procedures of valuation, and thus – different results.

The development of new technologies, as well as the never-ending change of the business trends obviously leads to up's and down's of certain companies or whole industries from the face of the markets, and inevitably to the faidement of certain well-known trademarks. Who would have known that the launching of a new iPod will increase the value of the "Apple's" trademark for incredible 44% in just 2 years (from 2003 to 2005)? If someone could predict it, today he/she would be rich, having in mind that the "Apple" shares value had increased by 360% for those 2 years period. (US Trademark Register)⁴¹ Or did someone imagine that the jump of Felix Baumgartner of "Red Bull Stratos" can increase the mark value of "Red Bull" for 106% in just 15 days? (DachisGroup)⁴²

An additional factor contributing mark value is the sensitivity of the intangibles, trademarks in particular, to the dynamics of the general surroundings. One can easily conclude that almost every single variation of one particular factor that can influence the trademark itself can play a significant role in determination the end value of its final value.

The cost-based method is relatively fast and easy to perform in cases when there aren't any big economical activities behind the valuated mark or at cases when its owner is in the start-up phase of trademark usage. This method is also suitable in cases in which the trademark should be shown with maximum value, in cases of selling or licensing.

The lack of attention devoted to the benefits of using the trademark in the future, and the much needed précised historical documentation of the expenses are generally considered as key weaknesses of this particular method.

The marked-based method on the other hand, is excellent choice when there is open and active market of trademark transfers in terms of selling or licensing certain marks. It's core advantage is the fact that one particular mark can be compared with other marks on the market that share similar characteristics, and its acceptance of determination of the value according to the market equilibrium - or the current supply and demand.

³⁹ Zaichkowsky J.L.: The Psihology Behind The Trademark Infrigement and Counterfeiting, London: Lawrence Erlabum Associates, London 2006, p.9.

⁴⁰ Smith G.: Trademark Valuation, John Wiley & Sons, 1997.

⁴¹ US Trademark Register (www.uspto.gov).

⁴² DachisGroup (<http://dachisgroup.com/2012/10/7-social-campaign-insights-from-redbull-stratos/>).

The lack of the s.c. “open and active market” in particular, is sometimes the very obvious reason why this method is not applicable in many of the real-life situations. In reality, information related to buying or selling a trademark are often not open for the general public, hence the data needed in order to perform the valuation process using this method are relatively hard to obtain.

It seems that the income-based method, along with its numerous different techniques, is currently the most useful method of determining the precise value of a certain trademark. This conclusion arises as a consequence for measuring the additional profits that its owner would have made using the valuated mark, unlike selling other – generic products on the market. Ultimately, the real value of a trademark is valuated according to the additional benefits that it brings to its owner.

On the other hand, the different kinds of forecasts and projections of “what might happen” are considered main weaknesses of the income-based method. Both internal and external factors can be unpredictable fluctuating by nature and the subjective assumptions of their occurring and frequencies can sometimes be just hard to relay on.

In most recent times, more and more experts are focusing on some kinds of combinations of the known methods in order to have more accurate results (Yelnik; 2009).⁴³ Although the income-based method is more often seen as “closest to perfect” and primary valuation method, (Yelnik; 2009)⁴⁴ (Sinclair; 2009)⁴⁵ (Greenhalgl, Rogers; 2005)⁴⁶ in some occasions it is only the best when a combination or a synthesis of various methods are being used, just to confirm the previous or bring some new results on the table.

One example on how combining methods may result in defining an approximate, but in the same time a real values can be seen in the next table of valuating the global McDonalds trademark:

Table 3: Income – method example: Relief from Royalty Technique (Saluk; 2002)⁴⁷

McDonald's Trademark Valuations (in millions of US dollars)			
	Cost-based Method	Income-based Method	Market-based Method
North America	16.750	9.270	8.136
Europe	5.089	5.820	4.938
A.P.M.E.A	7.964	3.610	1.513
Total World:	30.498	18.700	14.614

McDonald's Trademark Valuations (in percentages)			
	Cost-based Method	Income-based Method	Market-based Method
North America	54.8%	49.6%	55.9%
Europe	20.0%	31.1%	33.8%
A.P.M.E.A	25.2%	19.3%	10.3%
Total:	100%	100%	100%

5. Factors affecting the valuation

The single most inseparable way of trademark valuation process is the acknowledgement of the different factor that can affect the outcome of the valuation performance. (Groves; 1997)⁴⁸ One should have in mind that all the factor cannot be always well defined or explained, but sometimes they can be the single most important factor that can determine the value of a certain trademark both from client's or company's perspective.

The factor that can be easily seen or easily predicted are very often the ones that are more frequent and usually connected with some (or many) other factors, that its practically impossible to be categorised in that manner. In addition, those factors which have some kind of determining influence

⁴³ Yelnik A.: From the point of view of commercial value of trademarks, do current laws sufficiently protect brands from infringement?, MARQUES Annual Conference, 2009, p. 11.

⁴⁴ Same, p: 11.

⁴⁵ Sinclair R.: Trademarks and Brands, 2009, p.511.

⁴⁶ Greenhalgl C. and Rogers M.: Trademarks and Market Value in UK Firms, Oxford Intellectual Property Research Center, 2005, p.11.

⁴⁷ Saluk W.J.: Valuation of the McDonald's Trademark, 2002, p.18.

⁴⁸ Groves P.J: Intellectual Property Rights and Their Valuation: A handbook for bankers, companies and advisors, 1997, p.30.

on trademark valuation are the ones that are quite often being considered as a consequence of some other technological, social, natural or other factors, which make them obligatory to study, and impossible to predict at the same time.

Yet, there are several perspectives that allow us to elaborate the different factors that can have major influence on the valuation processes. The following s.c. 'determination factors' are considered inevitable when performing a trademark valuation: legal factors; contractual; physical; technological; functional; economical; and analytical factors.

From trademark perspective, the most important are both economical and contractual factors (Roosma, Kerr & Reilly; 2002).⁴⁹ At the end, it is always up to the owners to determine which factors and to what extent can be the real determinations' of the end value of their trademarks.

6. Current trends and practices

The valuation of IP is becoming more and more developing activity in today's economy. Primarily, because it allows the various companies and organisations that are the owners of the trademarks rights, to transfer, license or trade with this type of property, in order to make additional profits or income, optimizing their processes, cut their losses or simply make a competitive advantage on the markets they are performing on.

In such placement, trademarks are considered as a vital part of the unique IP system, and are frequently considered as a useful tool in protecting the investment linked with the marketing activities. Paraphrased, trademark today are considered to be a sort of steering-wheels, which helps companies control the development of their brands thru exploiting the exclusivity gained from the investment and any future investments inserted into the brands themselves (Sander, Block; 2011)⁵⁰ There is no doubt that marks by them, or as a part of a bigger picture of the brands they represent, have their own individual and unique value. The separation of this value and its measurement in absolute or relative terms is of a vital interest if concluded the possibilities arising from the legal, financial or other economical activities of the company or organization.

7. Conclusion and recommendations

It seems that, of all the types of IP, the trademarks are generally the most sensitive to changes, internal or external. Therefore, the process of their valuation is rather complex and very difficult to execute. According to recent theory and practice, one can conclude that the trademark are directly addicted to the different valuation methods, and that the results extracted by those valuations should always be taken with a certain dose of doubt.

In the process of evaluating trademarks, one should always have in mind the fact that the mark itself, regardless seen as dominance or negligible part of the value of a company, explicitly decreases in value when excluded out of the context of the products or the services that it is being used for. Also, the valuation steps and measures undertaken by its valuator should always reflect the willingness and the desires of the client and his best interest, but in the same time it must be according to the moral, ethical and legal prescribed norms.

There is no doubt that trademarks have value either by themselves or as an inseparable part of the value of a brand. Quantifying this value is absolutely vital for the effective execution of a wide variety of business, financial, legal and strategic activities.

It will make for a better future if all parties involved can achieve a common international focus in developing a codified and set of practices that are universally acceptable.

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ANALYSIS AND COMPARISON EXHAUST GAS EMISSIONS OF PELLET BOILER WHILE WORKING WITH THREE DIFFERENT TYPES OF PELLETS

Oliver Slivoski, Igor Andreevski, Stojance Nusev, Dragan Temeljkovski,
Vitomir Stojanovski

Abstract: *The general pellet industry in Macedonia is in its initial stage of development, growing continuously, but still very slowly. Macedonian public is not well informed on Renewable Energy technologies and their advantages and there is not enough environmental consciousness. In this paper will be presented the results of the measurements of exhaust gases of pellet boiler with a rated power of 100 kW, while working with three different types of pellets, wood pellets and pellets from straw-known manufacturer with known characteristics and pellets straw produced at pilot plant of Municipality of Mogila. The aim is to encourage the reduction of greenhouse gas emissions by finding alternatives to burning fossil fuels - renewable energy sources.*

Key words: *Pellets, Boiler, Exhaust Gases, Environment, Renewable Energy*

1. INTRODUCTION

In the current energetic situation in Macedonia, the import of energy and raw materials is taking a big portion of the total (negative) economic balance of the country. Its further increase will have a negative impact on the total economic state, thus on the developmental opportunities of all economic sectors and the future of the overall economy. Biomass is an available, technically and environmentally acceptable energy source. Using biomass decreases the need to import conventional fuels, which indirectly provides continuity in the energy supply, rise in the quality of life in rural areas, decrease in the migration from rural to urban areas and lesser dependence of the country on external pressure. Biomass is declared as an environmentally friendly fuel. Mostly because the chemical content of biomass is very favorable as it contaminates the environment far less than conventional fuels. Biomass does not produce the greenhouse effect i.e. the quantity of CO₂ emitted through the combustion of biomass, is the same quantity that is absorbed with the growth of the plants. Biomass has no sulfur, or has only traces of it.

Up to date, little is known about the usage of wood and agro pellets and their energy potential. One of the biggest obstacles in the usage of wood pellets and agro pellets is the big investment required for installing the combustion equipment for this type of fuel. This equipment has very high market prices compared to the population's standard. There is no interest among the banks to offer favorable credits for the purchase of this type of equipment. But on the other side, the Government and local governments (Bitola, Skopje) implemented specific measures to subsidize the procurement of heating systems that use pellets as substitution of old heating systems that use conventional wood and initial procurement of heating the pellets. In addition to that the Government of R. Macedonia carry out direct impact on increasing the competitiveness of pellets as fuel by reducing the VAT from 18% to 5%.

Corresponding author: Oliver Slivoski, MSc., e-mail: oslivoski@aol.com

The instable price of pellets is another obstacle, mostly depending on the importing companies and the type of the fuel itself.

2. THE PELLETING PROCESS

Pelletizing is a compacting process that produces homogenous fuel with high energy density in cylindrical shapes with dimension of 6-8 mm diameter.

The pelleting process is usually adapted to the specific biomass feedstock, but usually includes the following stages (Fig.1): reception of raw material, drying, grinding, pelleting, cooling and screening. Initial comminution is performed before drying. Round wood is typically chipped, waste wood is sorted into grades, tub-ground and screened against plastics and metals, and bales are shredded. After drying, the material is ground into fine particles using a cutting mill, usually a hammer mill [1].

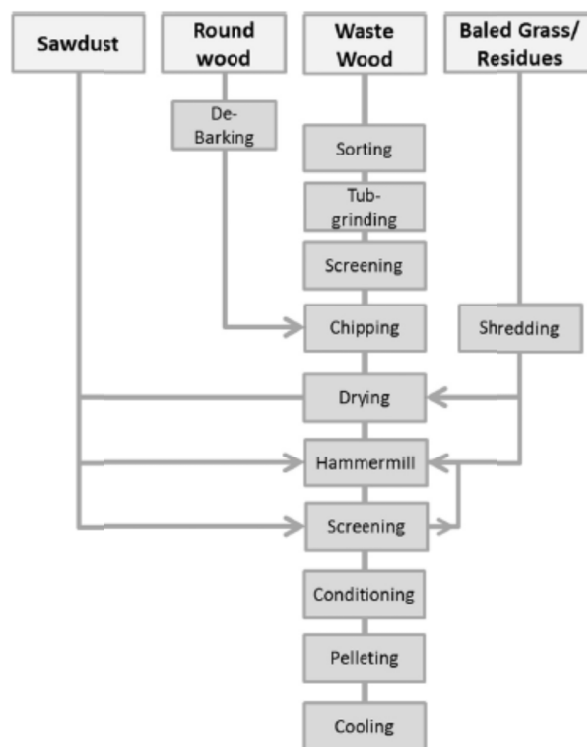


Fig. 1 Typical pelleting process flow for wood and baled biomass [1]

The hammer milled feed enters a mixing chamber where steam and additives are added. The pellet mill consists of a circular die that is perforated with holes that the biomass is forced through via the action of rollers, either by rotating the die or the rollers. Biomass is continuously fed into the pellet mill where it is steadily compressed into the pellet channels.

The pelletizing process is illustrated in figure 2. The raw material lies in a layer in front of a rolling press, which presses the material down into the die block and heat. The heating ensures that the content of lignin in the biomass is released and this contributes to the increased binding of the particles together in the final product. When the rolling press is once again rolled over the hole, new material is pressed into the hole, thereby compressing the raw material into pellets.

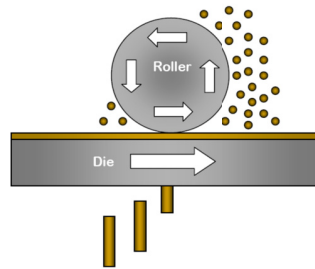


Fig. 2. Forming of pellets [2]

3. COMPARISON OF STRAW PELLETS WITH WOOD PELLETS

The data in the table show that the most frequently used biomass fuels are relatively homogenous in terms of their heat value and main elementary content (C, H, O). However, the content of moisture, nitrogen (N), sulfur (S), chlorine (Cl) and ash are differing largely. Plywood and sawdust are byproducts of forestry and wood processing industry, therefore considered waste. But, one important characteristic of this waste compared to other waste, is the relatively high level of “purity”. Wood pellets are pure and homogenous, with a low level of minerals. Contrary to that, chopped agricultural residues (such as wheat straw, shown in the table) have a high content of minerals [3].

Table 1. Typical chemical fuel content [4]:

Fuel	N	C	H	S	O	Moisture	Volatiles	Fixed Carbon	Ash	HHV*
Straw										
Pellets	0,53	43,38	5,98	0	50,11	5,22	72,33	16,63	6,15	16,87
Wood										
Pellets	0,22	48,30	6,31	0	45,17	3,94	81,76	13,63	0,7	19,61

*Channiwala, S. and P. Parikh, 2002

Dry matter left after the combustion of straw consists of less than 50% carbon, 6% hydrogen, 42% oxygen, but also of small amounts of N, S, Cl, and other minerals such as silica (Si) and alkali: sodium (Na) and potassium (K). Wheat straw shows higher concentration of N, S and Cl than wood. Potassium (K) content is also generally higher for straw than wood. Increased concentrations of the elements N, S, and Cl in straw can be a result of insecticides and fertilizers application.

4. USED FUELS, THEIR CHARACTERISTICS AND BOILER CHARACTERISTICS

Characteristics of 3 different types of pellets that are used during the test, pellets of wheat straw from own production of a pilot plant in Mogila - Macedonia, pellets from straw (mixed harvest residues) from manufacturer Victoria Starch - Serbia and wood pellet from manufacturer Sparrow - Serbia, are shown in the table. Data of imported pellets listed in the table are taken from manufacturers, while for straw pellets are listed only two parameters until the writing of the paper were known. The ash value of straw pellets produced in the pilot plant of Mogila is obtained through five monthly monitoring the burning of pellets and measuring the content of ash as a residue.

Table 2. Characteristics of the pellets:

		Fuel 1	Fuel 2	Fuel 3
		Straw Pellets	Straw Pellets	Wood Pellets
		pilot line Mogila	Victoria Starch	Sparrow DOO
		Macedonia	Serbia	Serbia
Moisture:	%	9,2	9,78	8
Ash:	%	6,5*	7,2	0,89
Bulk density :	g/dm ³	-	584	605
Low caloric value:	MJ/kg	-	16.2	17,4
Diameter:	mm	6	10	6

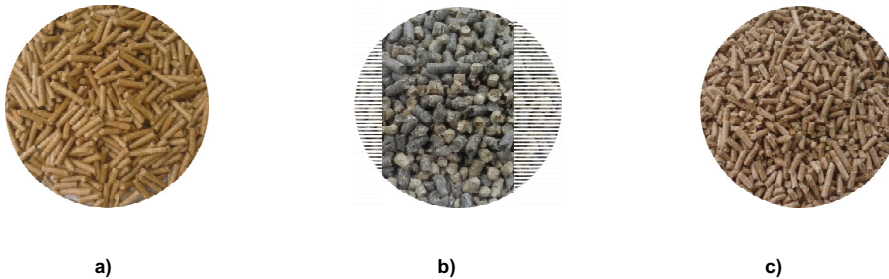


Fig.3. Biomass fuel samples tested in the feeder; a) Wheat straw pellets, b) Straw pellets (mixed harvest residues), c) Wood pellets

Research on flue gas from the combustion performed in boiler type TIG A power of 100 kW, from the manufacturer Terming Kula - Serbia. In terms of fully exploiting the heat the boiler exchanger is executed as a three stage construction. Combustion gases as they pass system of heat exchangers are taken into the chimney through the extractor hood for flue gases located at the rear side of the boiler. The boiler is equipped with a mechanism for automatic disposal of ash because is designed for combustion of agro - straw pellets that compared to wood pellets produce more ash. The postponement of the ash is regulated by a complex automatic regulation of the boiler and the worm conveyor which is part of the boiler presses the ash out. Lower door of the boiler allows extraction of ashes under the burner.

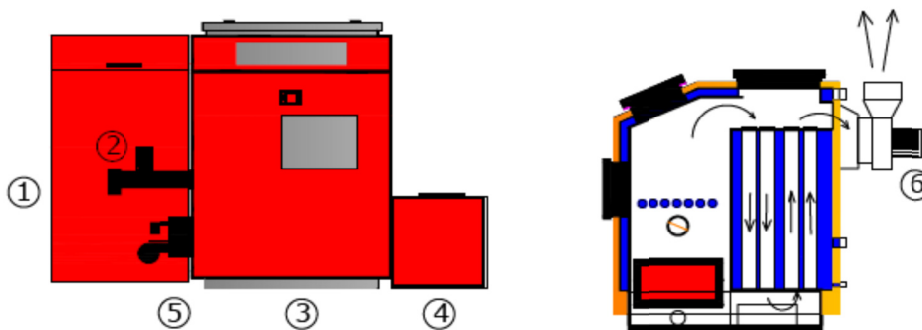


Fig. 3. Pellet boiler (1.Pellet tank, 2.Dosing auger, 3.Boiler, 4.Tank for ash, 5.Burner, 6.Extractor hood) [5]

Automatic movable grate is characteristic for this boiler. Combustion of fuel is done with primary air which comes with a fan at the bottom under the grate and secondary air that comes into flame. Air through the grate reaches the fuel in the combustion space, and to have a perfect combustion of combustible gases some amount of air touch the space of the oven [5]. In the front of the boiler is located control with display-keyboard which shows the basic parameters of operation and through which can be set specific features of the boiler.

In our case for all three types of fuel in all operating modes, parameters relating to fuel supplies, extractor hood for flue gases, the time of actuation of the sliding grille, the fan for additional air and a break in dosing, remained unchanged.

Table. 3. Technical characteristics of the boiler [5]:

Efficiency	%	> 85
Max working pressure	bar	3
Pellet dimension	mm	4-12
Voltage	V	230 (+-10%)

*For moisture up to 15%

5. FLUE GAS PARAMETERS REVIEW AND ANALYSIS

The table shows the results of the measured parameters in the flue gases at the combustion of straw and wood pellets at constant parameters of the boiler.

Table. 4. Pollutants emission of the boiler type TIG A (100 kW):

Parameters	Fuel 1	Fuel 2	Fuel 3
O ₂ [%]	18.30	18.60	18.10
CO ₂ [%]	2.65	1.43	1.99
CO [mg/m ³]	482.30	639.24	1099.78
NO [mg/m ³]	66.28	36.82	29.46
NO ₂ [mg/m ³]	0.00	0.00	0.00
NO _x [mg/m ³]	66.28	36.82	29.46
SO ₂ [%]	0.00	0.00	0.00
H ₂ S [%]	0.00	0.00	0.00
T _{gas} [°C]	178.00	138.30	169.50
T _{air} [°C]	17.30	17.10	17.10
Losses [%]	48.80	38.90	41.40
Eff. ncv [%]	54.20	61.10	59.60
Air ratio	7.84	8.74	7.40

Exc. Air [%]	684	774.00	640.00
CO [ppm/ref11%O ₂]	1559.26	2325.00	3310.34
Cross-sct. area [m ²]	0.0491	0.0491	0.0491
Flow vol. [m ³ /s]	0.450	0.367	0.489
v-flow [m/s]	9.10	7.30	9.80
Dif. Press. [hPa]	30.10	21.70	37.60

In the conversion of measured values of the CO and NO ppm in mg/m³ for the molar volume value is taken 24,45 l (at 1 atm and 25⁰C).

The manufacturer declares the boiler efficiency over 85%. But measuring performance using the three different fuels efficiency is very low (54.2%; 61.1%; 59.6%), resulting with Oxygen value from 18,10% to 18,60%. These values originate from the extra air that is supplied to the combustion. There are of course no environmental consequences from oxygen emissions, but is not allowed to work with such an excess of air. Excess of air value goes from 7,40 up to 8,74 and there is a big difference with the recommendations for optimal combustion from 1,4 to 1,6 [7]. Higher level of utilization have a second fuel which is very close to the third one.

NO_x emissions from the combustion of biomass, generally come from the nitrogen content in the fuel, unlike combustion of fossil fuels where nitrogen from the air affects to a certain degree on the level of NO_x emission. The emission of NO_x, directly represented by NO, is the lowest in fuel with No. 3 (wood pellet), which is logically derived from the elementary composition of the fuel and the lowest excess air. If we compare the first two fuels where it is expected a higher concentration in the combustion gases, the second fuel has a lower concentration as a result of low temperature combustion. That results with a smaller NO_x emission on one side, and with an increase unburned hydrocarbons and carbon monoxide on the other side. NO_x gasses are unwanted because NO_x is a greenhouse gas and at the same time NO_x contributes to the acidification of precipitation [6].

CO₂ value goes from 1,43% up to 2,65%, and the lowest value has fuel No.2. Carbon dioxide plays a significant role in the greenhouse effect and the emission of CO₂ to the atmosphere is problematic. However, when combusting wood fuel there is no more carbon dioxide released than is bound up in the wood as carbon and that in any case would have been released during the decomposition process, which is the ultimate alternative to using wood/straw for energy purposes. Thus, wood pellets and other bio fuels can be considered as being a very low fuel (only CO₂ attributable to pellets is due to production and transport).

In practise it is not possible to entirely avoid the creation of a little carbon monoxide during combustion. CO emission has higher value in fuel No.3 (wood pellets, 1099,78 mg/m³), which is related to the naturally occurring higher C in wood against straw, higher value of lignin in wood and lower efficiency firing with wood pellets. CO emission is unwanted, both because CO in the flue gas is an indicator that there is an incomplete combustion process and because CO is toxic and combustible (a health and safety risk) and finally because CO destroys the ozone layer [6].

Measured value of Sulphur oxides is zero and is normally not a problem when firing with straw/wood pellets since the naturally occurring content of sulphur in straw/wood is very low.

6. CONCLUSION

For these fuels we can say there is a few commonalities: renewable resources-combustion is

CO₂ neutral, heating value virtually the same, same delivery and storage systems, easy dosing and handling, independent from fossil fuel.

Based on the data analyzed for flue gases it can be concluded that the efficiency is very low and therefore there is increased emission of CO. There is a difference among the three fuels, but the value is far from the one declared by the manufacturer. As we mentioned parameters measurements for all three fuels were unchanged, but different from values calibrated by the factory. This has shown that is not possible to set optimal parameters only on the basis of visual and experimental data considering flame shape and coloring in the oven and according to the flue gasses exhaust temperature. In the near future it is recommended for each fuel that will be used to perform optimal tuning by controlling the flue gas, taking into account the value of the excess air and concentrations of CO₂ and O₂ and approaching the efficiency of the boiler to the declared.

The combustion of biomass does not produce large quantities of nitrogen oxides because the combustion temperatures are kept at low levels, due to the possible ash melting. The biomass ash does not contaminate land, water, plants and wildlife, and additionally, it can be used as mineral fertilizer for orchards and gardens under the condition that the floating ash from the exhaust valve is taken out, because it may contain dangerous heavy metals [3].

Fuel No.1, pellets of wheat straw waste produced in Mogila - R. Macedonia, can be said that although we don't know its characteristics (density and calorific value) it can be treated as an equal source energy with the other two.

Additionally if we take into account the fact that there is a surplus straw in the RM of 226,084 t/year (avg. 2010-2014), it should change the general perception of straw as biomass. These facts can encourage its use, thus contributing to a reduction in consumption electricity for heating and other energy fuels from non-renewable sources, i.e. imports of electrical energy and other fuels.

Recommendation for future activities in this field are the following: a full analysis of fuel-wheat straw pellet produced in pilot plant in Mogila - R. Macedonia needs to be done, to make a comparison with a national standard or equivalent, and to make a comparison of the fuel gases at the existing one with other boiler with same nominal power which is working on another type of fuel (oil, gas).

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IMPLEMENTING QFD METHODOLOGY FOR EVALUATING THE EDUCATION AND CREATING A SHORT TERM STRATEGY

Jovanka Kuzmanova, Ivo Kuzmanov, Roberto Pasic

Abstract: *The basic aim of the paper is to present only a segment from an extensive research which was done with an aim to create a short-term strategy for continuous improvements into the process of education. While doing the research a comparative approach was used, and we have created a complete QFD matrix with an aim to compare three key elements while creating the short term strategy. The key aspects were: the advantages that the subject under review has at the moment, analyzing the good sides of the competition as well as the analyses of the momentary market trends – at this case the demands from the customers. Into the process of creating the correlation matrix and also creating the priorities, all of the negative sides of the subject and the competition were also taken under consideration. Using such methodology a short term results are expected into the everyday work of the subject, but also with an everyday practicing of the created priorities we are expecting to get a better picture for the subject into the eyes of the customers – in this case the students who are involved into the process of education. The paper presents only a small segment from an extensive research, that will be published into some other occasion.*

Key words: *QFD, education, higher education, R. Macedonia*

1. INTRODUCTION

The continuous improvements into the process of education are a must for every educational institution, no matter the sector – private or state university. Actually only a quality education process is basic segment which brings the society improvements in any field. One of the key segments which should be mentioned are the following: non depending if the institution has an defined short or long term strategy, a continuous implementation of multiple methodologies is a daily routine with a purpose to create quality into the processes of education, and to create students that has the one inside them - situation where the employees are demanding such key possibilities. Seeing real experiences we could find various methodologies which have an applicative usage into educational institutions, but the one that has the “heart” inside her to create real improvements into educational processes is the QFD methodology (Quality Function Development). The things which make this methodology one of the best are the combinations of multiple criteria’s such as: the real experiences from users of the processes (in this case the students), real experience from the best practice at the moment (in this case the comparative ones – University from Skopje and a Private one also from Skopje), combination of organizational possibilities (from infrastructural ones to financial ones) and the potentials for improvements (from human aspects as well as from the aspects of future possibilities for improvements of the educational processes). Having in mind that the same methodology QFD worldwide is used as one of the methodologies for strategic planning, actually into the processes of pre-planning, the same one if applicative implemented can bring the organization and the process of education from a cycle to a cycle to a much better situation (improved).

Actually the basic aim of the paper is to present only a small segment from an extensive research in which three higher education institutions were considered, as well as more than 300 real users of the processes into the institutions which with their experience, benefits, needs, demands but also negative experiences were used to create an QFD matrix shown into the paper. The same one could be used to create future steps for the institution from Bitola, for future improvements of the processes

Corresponding author: Jovanka Kuzmanova, Primary School Professor, Primary School Kole Kaninski – Bitola, e-mail: jovanka.kuzmanova@gmail.com

into the same one. While creating the matrix all of the momentailary possibilities at the state universities were also taken under consideration, especially into the part of creating strategic future steps.

2. PRESENTING THE RESEARCH PROCESS

The main idea for such a research came from the spotted need to create much more better educational processes into a Faculty from Bitola (or to be more specific into a selected study program). The idea was to use a methodology with which the institution from a cycle to a cycle will have better results based on direct needs of the students, the environment but also regarding the business entities needs and demands. But before we could present the process of research, into the following few rows, the actual situation regarding the higher education process into R. Macedonia is presented. In this stage we have several state universities, from which the faculty that was under research is from the second largest one, and we have various private universities (more than 15) at the moment. All of them had a different infrastructural, human and other kind of opportunities. All of the educational processes are according to a previous accreditation study programs, approved by the state educational ministry. The research had in mind three faculties, or to be more precise three study programs with similarities, from which one is from Bitola, and the other two are from Skopje (one state and one private). Into the processes of research more than 300 momentaliraly students and graduated ones were interview with a purpose to get a precise picture for all of the three institutions (SWOT). The actual number of interview students gave an excellent information and picture about the institutions, their straight sides, their possibilities but also give information about the negative sides into the institutions.

While researching and interviewing the users of the educational processes, two parts of the research were used. The first one was conducted with a questioner which has questions about: the real experience of the users, their needs and demands, the potentials and the quality of the staff members included into the educational processes, their experiences and also the future steps for improvements. After creating view about the things previously mentioned, the second part of the research was done whit a usage of an open discussion sessies. While the session all of the subjective views of individuals were discussed and after more sessions an objective ones were created about all of the spotted information's. At this stage it's more than relevant to say that the ones from the prive university were included with a purpose see the side of the educational processes into institutions from that side of the educational processes into R. Macedonia. While creating the focus groups the individuals were from different stages of the process of education (graduated ones, the ones that are in the 1st, 2nd, 3rd and final stage of studies), but also while discussing the information's into the second part three focus groups were created each from representatives from one of the institutions. Also one of the criteria's which were considered was the situation of the object (infrastructural) where the processes of education were enrolled. The one from Bitola was 55 year old, the one from Skopje was more than 60 years old and the private one was exactly 10 years old. Important information which was considered was the staff member numbers (professors employed in the institutions). So considering this point of view, the Bitola one has more than 55 employees, the state one from Skopje more than 60 and the private one only 6 professors. The main focus at this stage of the research was to create a real picture about the processes of education, the curriculums, the knowledge which the staff has, possibilities for real practice into real industrial entities as well as to discuss the possibilities for future improvements.

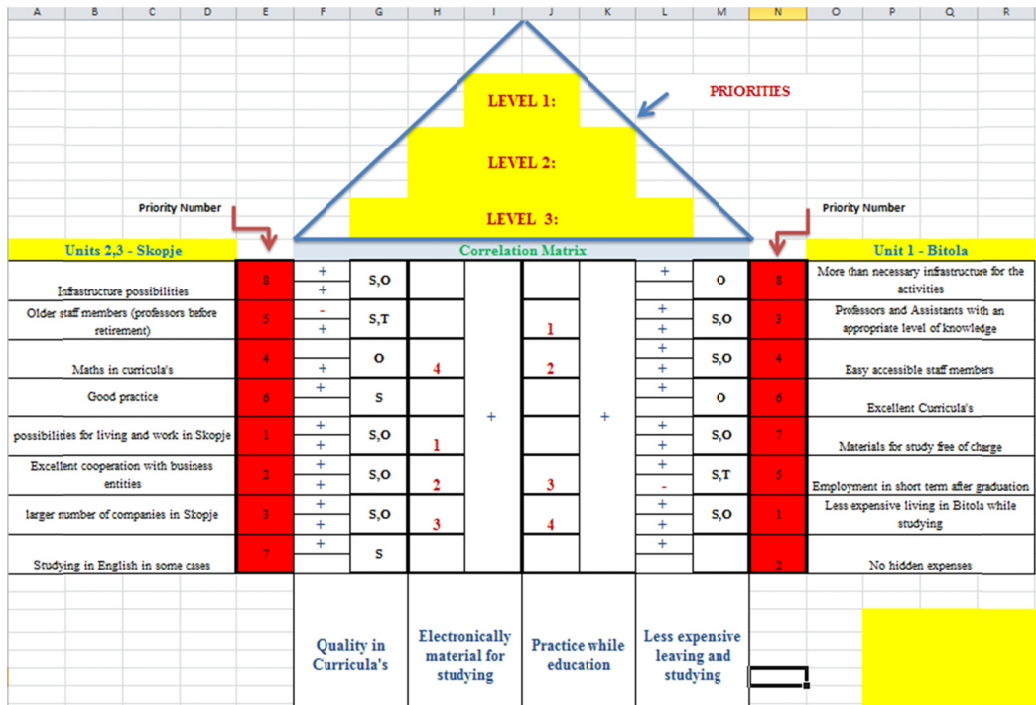
3. PRESENTING THE QFD MATRIX

Having in mind all of the information's previously mentioned (the desires of the students, their subjective thoughts about the educational processes, the opinions of the target groups, the possibilities and the potentials of the institutions under review, the real information's about the institutions) the QFD matrix was created. The same one is a correlation of multiple relevant factors with a final aim to generate priorities which will improve the situation into the institution from Bitola. At

this stage, we have presented the first QFD matrix that was created, from which several others were created. The picture presets the created matrix and after the same one a tabular view of the priorities is given also. One of the things which is worth full mentioning is to say that the information's gathered gave us real information's about momentailary situation considering better sides, opportunities, threats and negative sides of the institution, but also relevant information about the future steps which are needed to be made.

The gathered information could also be used with an aim to create a larger research on national level where all of the institutions in the field could be taken under consideration and a national agenda for improving the state university processes of education could be made.

In addition of the paper the matrix as a picture and the priorities as a tabular view are presented. Discussing about the levels of priorities we could say that at this stage we could discuss about the possibilities and the time for future improvements placed as needs into the tabular view. The same ones are real and all of them could be achieved in such short notice.



Priority	BASIC AIM
LEVEL 1	More Math's subjects in the Curricula's
	Less choosable subjects
LEVEL 2	Equipment activation in the educational processes – the subject has an excellent laboratories
	Cooperation with Business Entities
LEVEL 3	Administration staff to be put in a situation where the student are on first place
	Nonfunctional E-Systems

4. CONCLUSION

The paper presents only a segment from an extensive research done with a final aim to develop a short-term strategy for continuous improvements into the process of education, or to be more precise to create a short term strategy in a real educational institution from Bitola. While doing the research a comparative approach was used, and we have created a complete QFD matrix so we can compare three key elements while creating the short term strategy. The key aspects were: the advantages that the subject under review has at the moment, analyzing the good sides of the competition as well as the analyses of the momentary market trends – at this case the demands from the customers, the needs of business entities and the momentary trends in the environment. Into the process of creation an correlation matrix and also creating the priorities previously setted into the tabular view, all of the negative sides of the subject and the competition were also taken under consideration. So, in a situation to create an exact matrix with a real information, over 300 graduated and students which are in the process of education at the moment from the institutions undred review were interviewed. The informations were devided into two categories of evaluation, the first one with a quaetionary and the second one with an focus groups. So with the information and real aplication of the methodology, the given matrix was created and the tabular view of priorities also. Using such methodology a short term results are expected into the everyday work of the subject, but also with an everyday practicing of the created priorities we are expecting to get a better picture for the subject into the eyes of the customers – in this case the students who are involved into the process of education on one hand and on the other the business entities as an institutions that could employee some of the graduated ones. The paper presents only a small segment from an extensive research, that will be published into some other occasion. At the end we could also conclude that this paper and the created matrix could be used for future creations of such matrixes from which the entity could be improved from a stage to a stage.

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ROLE AND FUNCTION OF INTERNATIONALIZED DOMAIN NAMES IN THE BUSINESS ENVIRONMENT

Ljubisa Stefanoski

Abstract: *The development of information technology is undoubtedly important component in the business environment. In addition, there is the fact that the emergence of the Internet and its expansion in the last two decades implied opening and creating a new global electronic market place where prices are more transparent, and the trading though not perfect, but far faster and more efficient.*

Besides trademarks which represent a means of achieving of a company marketing strategy and an indication of its value, having regard to the mass use of the Internet and its global nature, the more important and valuable business means for the companies became the Internet Domain Names. This is due to the fact that Internet Domain Names unlike trademarks are territorially unlimited, unique and unrepeatable, therefore it is justifiably said that their holders enjoy the "virtual monopoly law". However, the Internet as a global medium is not designed to be multilingual, especially when it comes to Internet Domain Names. Hence, the main challenge for the Internet community is developing the existing DNS and establishing the Internationalized Domain Names, which will be available in non Latin alphabet and language used in the country or territory which introduces the specific Domain Names.

Key words: *Trade Mark, Internet, Domain Name System, Internationalized Domain Names, Internet Corporation for Assigned Names and Numbers.*

1. Introduction

Today in the world, the Internet is used by more than 3.7 billion people. According to statistics of the International Telecommunication Union, the number of internet users in the world increased from 360 million in 2000 to 3,731,973,423 by March 2017, which represents an increase of 933.8%.⁵⁹

Performing business and commercial transactions involving exchange of value (e.g. money) among the organizations and individuals or between the organizations in order to exchange goods or services cannot be possible without intervention of digital technology i.e. Internet and web net. More specifically, the emergence of the Internet and its expansion at the end of the last century influenced the change of ways of selling goods and offering services electronically. Electronic commerce and digital payments are increasingly becoming an integral part of everyday life of modern man.

2. Economic benefit from the use of the Internet

The development of information technology and use of the Internet as a well-known global communication computer network⁶⁰ has a positive effect on the economy, both at the macroeconomic and the microeconomic level. At macroeconomic level it has the influence on increasing the competitiveness and productivity of economy contributing to the creation of new jobs. At the microeconomic level, it has an effect on the organizational structure of the market through cost reduction for start of a new company, reduction of the economic impact of distance and reduction of

Corresponding author: Ljubisa Stefanoski, PhD., Assistant Professor, Faculty of Law, International Slavic University "Gabriel Romanovich Derzhavin" in Sveti Nikole and Bitola, (stefanoski_ljubisa@yahoo.com);

⁵⁹ Available at: <http://www.internetworldstats.com/stats.htm>, accessed on 25.03.2017;

⁶⁰ *Guide to the Copyright and Related Rights Treaties Administrated by WIPO and Glossary of Copyright and Related Right Terms*, WIPO, Geneva, 2003;

the cost of data access, encourage the development of new and improvement of the existing products and developing new efficient ways of delivery of services and goods.⁶¹

Basically, it can be concluded that the benefit of using the Internet is versatile; it directly affects the connection of the company with the suppliers, customers, competitors and partners, as well as the way in which marketing is used to promote their brands, the production process of its products and the like. Therefore, it is the e-commerce which creates a new electronic market place where prices are transparent, markets are global and the trade although not perfect, yet highly effective.⁶²

Therefore, technology is becoming an increasingly important component in the business environment. Today, the issue of access to information does no longer exist.

3. The value of the internet domain names in relation to trade marks

In a business environment, trademarks are not only one of the most powerful means of highlighting the value of the company, but also an important part of the marketing strategies of almost every firm.

From the aspect of economic benefits, trademarks have two primary macroeconomic functions:⁶³

- help consumers in the selection of products on the market and
- give a company an incentive to invest in the development and delivery of goods and services with the quality consumers expect

It is clear that large companies as part of their strategic plans use trademarks in business due to: an increase in individual sales, strengthening and consolidating customer loyalty, competition quality response, increase profits, expansion and maintenance of the market, product differentiation, the introduction of new products, and profit of issuing licensing, franchising and more.

So, in addition to trademarks and other distinctive signs, because of the global nature of the Internet, the Internet domain names have become the most valuable business assets of many companies. In the race for better positioning in the market, achieving higher sales of their products, and thus achieving higher profits, the choice of internet addresses (domain name) as an business identifier on the Internet has become one of the most important decisions of the all companies. Therefore, owners of trademarks and distinctive signs, in the struggle for marking places in the internet space, where to place information regarding their business activities and the tendency to choose the internet address identical to their trademarks or distinctive marks have faced numerous problems.

Achievement of economic benefits of the trademark use, to a large extent depends on their level of recognition in the global market. A mistake has been often made when making assessment that dizzying sums of money are needed to advertise and promote a specific stamp. This can be achieved with little money or for free, thanks to the advantages offered by today's modern information technology and the Internet. Specifically, this can be achieved by careful selection of domain names. Therefore, a key element of success is the careful selection of domain names (Internet address) and creation of Internet applications (Web page, banners and so on) which the search engines can easily identify and thereby without difficulty remember.

Also, given the attitude of Internet domain names and trademarks, particularly their characteristics, specifically, the fact that the domain names are territorially unlimited, unique and unrepeatable, and their meaning in cyberspace, says that the attitude theory is entirely justified, when we call them "virtual monopoly law." This is supported by the existence of the Internet as a basic fundamental infrastructure for various exchanges of data and information on a global scale⁶⁴, and the fact that,

⁶¹ *Communication from the Commission to the Council and the European Parliament - The impact of the e-Economy on European enterprises: economic analysis and policy implications* [COM(2001) 711. [online]. Available at: <http://europa.eu/scadplus/leg/en/lvb/n26040.htm>, accessed on 01.02.2008;

⁶² Laudon K. Traver.: *E-Commerce: Business, Technology, Society*, Ars Lamina LLC, (translated in Macedonian), Skopje, 2010, page VI (preface);

⁶³ Idris K.: *Intelektualnata sopstvenost mokna alatka za ekonomski rastez*, Svetska Organizacija za intelektualna sopstvenost, Drzaven zavod za industriska sopstvenost na R. Makedonija i Sojuz na pronaogaci, avtor na tehnicki unapreduvanja na Makedonija, 2006, page 129;

⁶⁴ Stefanoski Lj.: *„Nekoi aspekti za avtorstvoto, avtorskoto pravo i internetot“*, Spisanie za kultura umetnost i opstestveni prasanja „Kulturen zivot“, Ministerstvo za kultura, Skopje, No. 1-2, 2009, page 9;

tentatively speaking, the limit absence of placement of these data and information is sufficient to show that the value of domain names is several times higher than the trademarks value itself. Thus, the benefit of registering domain names is manifold.

Based on all the above, but at the same time taking into account the rapid development of information technology and the increasing use of the Internet as a global means of communication, exchange of data and information, and by that the tendency of marketing activities taking the place on the Internet, it is a logical consequence that in the early nineties of the last century, a number of companies and enterprises had shown interest in registering their trademarks and names of their companies as domain names.

Thus, the economic benefit of the Internet domain names use can be viewed in two aspects. The first refers to the benefits offered by the domain name. They offer the possibility that in the easiest, fastest, most efficient and most economical way businesses present themselves and their products in the global market, regardless of their geographic distance, or political, religious, moral or other obstacles, and thus to come into direct contact with consumers and thereby achieve higher sales.. Another aspect relates to a monopolistic character of the domain names, and builds on the first aspect. In other words, the monopolistic nature of the domain name is the logical consequence of the application of the principles for the registration of "first come, first served" and at the same time the absence of a control mechanism checks of the legal basis and the legitimate interest of the future users to use a specific domain name. It is a fact that Internet domain names are unique and inimitable, which means that there is no possibility that the two internet domain names are registered with the same name. Thus, the inability two different faces to have the same name, or the name of the internet domain further talks about their economic value, especially when two opposing parties wish to extract economic benefits from the possession and use of the disputed domain name.⁶⁵

Bearing in mind the power of the Internet, many companies, especially publishers, news agencies and the like, due to unprofitability were forced to distribute their products to their end-customers electronically or via the Internet, by not leaving several centuries' long tradition of distribution in printed form. Such was the case of the publishing house "Encyclopaedia Britannica" which is the first printed edition published in Edinburgh, Scotland in 1768, and for the first time encyclopaedia became available on the internet in 1994, thus, after 244 years of tradition in 2012 stopped publishing printed version and fully started to distribute their product in digital form on the internet at: <http://www.britannica.com/>. Another similar example of this practice is the case with The Wall Street Journal which in 1996 put into use the internet address "WSJ.com" so that in 2008, provided over one million internet subscribers and attracted over 4 million visitors who are not its subscribers thus becoming one of the most successful newspapers which are sold electronically via the Internet. The reason for the success of the sale of Wall Street over the Internet, compared to other competitors, among other things is due to the recognition of his trademark, a sign of recognition (of the brand).⁶⁶

Namely, the internet domain names can achieve high market value in relation to costs paid on their registration. In practice, such cases with domains names business.com which in 1999 were sold for 7,500,000 US dollars, sex.com in January 2006 for 14 million US dollars or the insure.com which was sold in October of 2009 to the advertising company QuinStreet for a record of 16 million US dollars.⁶⁷

Actually, this is one, if not the key reason why people register Internet domain names without having intention or need to use the registered domain. In this respect, the proof that selling of Internet domain names is very profitable business is the fact that there are more and more existing auction houses on the global level that sell Internet domain names. The largest auction houses to sell domain names are: **NameJet**⁶⁸, **Go Daddy Auctions**,⁶⁹ **SnapNames**,⁷⁰ **Afternic**,⁷¹ **Name**⁷² и **Dynadot**⁷³,

⁶⁵ Jurić M.: „Rješavanje sporova o imenima internetskih domena primjenom uniform domain name dispute resolution policy“, Zbornik PFZ 59, (2-3), 2009, page 421;

⁶⁶ Laudon K. Traver.: *E-Commerce: Business, Technology, Society*, Ars Lamina LLC, Skopje, 2010, page 10-11;

⁶⁷ A List of Some of The Top Domain Name Sales Ever -Most Expensive Domains, Posted on January 3, 2009; updated on July 1, 2011. Available at: <http://www.fka200.com/2009/01/03/a-list-of-some-of-the-top-domain-name-sales-ever-most-expensive-domains/>, accessed on 25.03.2017;

⁶⁸ <http://namejet.com/>;

⁶⁹ <http://auctions.godaddy.com/>;

⁷⁰ <http://snapnames.com/>;

Taking into account all that has been said so far, we can conclude that the value and importance of domain names in relation to the trademark is large, primarily due to the fact that the trademark is being internationalized and loses its characteristics of territoriality and specialty, so that it becomes available globally. It is also the main reason why in the beginning of the twentieth century, the registration of domain names on the Internet has become a topical issue in the sphere of business entities. In this way, the possibility has been recognised for these subjects to present their companies to the market and advertise their products throughout the world by significantly low costs.

4. Internationalized Domain Names

The Internet as a communication network is designed to be global, but is not designed to be multilingual. This limitation is most apparent at the internet domain names which may be created only by twenty-six characters of the Latin alphabet (A-Z), numbers (1-0) and hyphens (-).⁷⁴ The establishment of Internationalized Domain Names (IDNs) is a result by the Internet community to make domain names available also to those countries and territories that do not use the Latin alphabet (ASCII transcription). The objective of the Internet community was to make domain names available in non-Latin script and language used in the country represented by the Internationalized Domain Name, such as Greek, Hebrew, Japanese, Chinese, Korean, Georgian, Arabic, Tibetan, etc., so in that way it would allow the use of other signs or symbols that are not part of the Latin alphabet.⁷⁵ In fact, the term Internationalized Domain Name denotes a Top Level Domain (TLD) on the non-Latin script and language used in the country or territory represented by the internationalized Domain Name.

In November 2009, the Internet Corporation for Assigned Names and Numbers (ICANN) began an accelerated process of establishing Internationalized Domain Name for the countries concerned. The process of establishing international domain names took place in the framework of the introduction of new highest Internet domain names.⁷⁶

To this end, the Working Group of the Internet Engineering the Internet Engineering Task Force (IETF) has formed a working group for the establishment of international domain names, whose main function was aimed at clarifying the conditions for access to the international domain names and defining a standard protocol routes.⁷⁷ On September 25, 2000, the Board of Directors of ICANN adopted a resolution recognizing that it is important that the Internet evolves and becomes more accessible to those who do not use the Latin alphabet and ASCII transcription and at the same time emphasizes that the internationalization of the Internet domain name system must be fully compatible with the existing Internet model.⁷⁸

The first Internationalized Domain Names (IDN ccTLD) are activated on May 5, 2010, for three domains that use the Arabic alphabet, representing Egypt, Saudi Arabia and the United Arab Emirates. On May 12, 2010, the Russian Federation became the first country which registered the

⁷¹ <http://afternic.com>;

⁷² Available at: https://www.name.com/expired_domains.php, accessed on 21.01.2012;

⁷³ Available at: <http://www.dynadot.com/marketplace/expired/>, accessed on 21.01.2012;

⁷⁴ Enabling a Multilingual Internet, WIPO. Available at: <http://www.icann.org/en/resources/idn/multilingual-internet-01nov13-en.pdf>, accessed on 19.02.2014;

⁷⁵ *Domain Name Law and Practice- An International Handbook*, edited by Torsten Bettinger, Oxford University Press, 2005, p.945;

⁷⁶ Available at: <http://newgtlds.icann.org/en/about/idns>, accessed on 26.01.2014;

⁷⁷ Internationalized Domain Names, The Recognition Of Rights And The Use Of Names In The Internet Domain Name System, Report of the Second WIPO Internet Domain Name Process, September 3, 2001. Available at: <http://www.wipo.int/amc/en/processes/process2/report/html/report.html#5>;

⁷⁸ Singh B.: *Cybersquatting and Domain Name Dispute Under Trademark Law*, NALSAR University of Law, Hyderabad, p.3. Available at: http://www.academia.edu/1426116/Cybersquatting_and_Domain_Name_Dispute_Under_Trademark_Law, accessed on 18.02.2014;

domain in Cyrillic, with the tag “.pф”. Serbia is the second country which on May 3, 2011, received its Cyrillic domain “.cpб ” and the start of registering domains as “.cpб” commenced on January 27, 2012. Later in 2013, Ukraine had been assigned the domain “.yкp”. Particular interesting in the scientific and professional community is the case with Bulgaria whose request for registration of Cyrillic Internationalized Domain Name “.бr” was originally refused by the ICANN, because it looks too much like Brazil's current ccTLD “.br”, and the same can cause confusion among the Internet users.⁷⁹ Later, in 2014, it was finally approved. National domains in Chinese script, in several varieties were activated on June 25, 2010. Other examples of establishing IDNs ccTLD are as follows: .ไทย (Thailand), .中國 (China), .한국 (Korea) etc..⁸⁰

Characteristic IDN ccTLD is that they are exclusively available only to governments and administrations of the countries and territories listed in the ISO 3166-1 standards or their designated representatives or operators.⁸¹

Today in the world there are more than thirty international domain names of the highest Internet domain names state codes.

Although the internationalization of domain names is a very important process in the development of the DNS, there are problems that have adequate implications for intellectual property rights. So, these are problems which are quite expected, primarily due to the fact that the registration of domain names and the names of trademarks in specific cases is done in the script that a greater number of people in the world do not know.

5. Conclusion

Taking into account that the internationalization of domain names and setting up domains on non-Latin script and language is very important process in the development of the DNS, as well as problems which are quite expected, primarily due to the fact that the registration of domain names and the names of trademarks in specific cases is done in script which a larger number of people in the world do not know, the Internet community must take action in terms of deciphering, and provide all Internet users, especially for future registrants and trademark holders adequate translation of specific words, which are an integral part of the international domain, in Latin transcription. Certainly, it includes the availability of meaning of the translation to the general public, and as a mechanism WHOis database can be used.

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- [3] *Domain Name Law and Practice- An International Handbook*, edited by Torsten Bettinger, Oxford University Press, 2005.

⁷⁹ Available at: <http://domainincite.com/1009-icann-says-no-to-bulgarian-ccTld>, accessed on 29.03.2017.

⁸⁰ The full list of IDNs ccTLD is available at: <http://www.icann.org/en/resources/idn/fast-track/string-evaluation-completion>, accessed on 29.03.2017;

⁸¹ Available at: <http://newgtlds.icann.org/en/about/idns>, accessed on 29.03.2017;

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KNOWLEDGE MANAGEMENT-NEW MANAGEMENT PARADIGM AND TOTAL QUALITY MANAGEMENT, INTEGRATED APPROACH TO MANAGEMENT

Biljana Vangelovska, Ivo Kuzmanov, Silvana Angelevska

Abstract: *The development of the concept of knowledge management for providing improving the quality and success in the fierce international competition is a basic strategic goal and priority of every modern company. KM and TQM are complementary concepts, and to be successful in our environment, it is necessary to make a kind of so-called integrated approach to management, consistent with the specifics of the Macedonian companies.*

This paper includes research conducted in companies from the public and private sector in Macedonia on the basis of preset initial hypotheses with defined indicators and main hypothesis sub-hypotheses, in order to assess the attitudes of interviewed employees and managers, in order to update and affirm modern concepts and models for effective and efficient management of knowledge in the providing improving the quality of products / services in the Macedonia companies, bringing the concepts of KM and TQM and their possible combination, as well as understanding of the attitudes, knowledge, access and use of these concepts by managers and employees.

Key words: *Knowledge Management, Total Quality Management, Methodological research, Hypothesis, Research techniques, Target group.*

1. INTRODUCTION

It is indisputable that in the 21st century knowledge is promoted as a unique resource by which global competition shall be distributed to the participants, collaborators and competitors. Knowledge provides information on job performance and fulfillment of objectives according to the possibilities of a given environment. It provides information on the processes and results as an effect of the work. It provides information on how people practice and coordinate resources and requirements. Also provides information and knowledge for consumers and competition, possible obstacles and problems and quality of work.

In this context, knowledge is to harmonize the existing information technology that streamlines and improves business function of providing improve quality and productivity at work. Indisputable is the fact that in today's business world special emphasis is given to the development and implementation of intellectual capital as intangible part of the total assets of an organization, company and firm.

Knowledge management is relatively new, young discipline and its rapid progress makes the time when all the changes in the business environment worldwide have been fast and constant, so the characteristics of the concept quickly change and adapt to the working environment.

KM and TQM are complementary concepts, and to be successful in our environment, it is necessary to do so on a kind of Macedonian integrated approach to management conforming to the specifics of the Macedonian companies.

2. CONCEPT ON KNOWLEDGE MANAGEMENT (MANAGEMENT MEANING)

The concept of knowledge management is a process that helps organizations, businesses to find, select, organize and communicate relevant information and professional expertise in the function of dynamic learning, strategic planning, decision making and problem solving. He refers to the use and the increase of knowledge in organizations.

The concept of KM is quite accepted as such, and there are a number of attempts to make its implementation and integration with other already known and widely accepted concepts, such as the

Corresponding author: Biljana Vangelovska, e-mail: bile_im@yahoo.com

concept of total quality control TQM.

Knowledge management is based on the idea that the most valuable resource for the organization's knowledge of its employees. Hence, the success of the organization a lot will depend on how effectively its employees will create new knowledge, to share across the organization, and apply in the best possible way.

The main purpose of knowledge management does not consist in managing the overall knowledge, but only knowledge that is most important to the organization. It confirms that employees have the knowledge they need, where they need, when they need it - right knowledge, the right place, at the right time.

Knowledge management its attention received since 1990. For several years it has become affirmative secular concept, after the processes of reengineering work and management for total quality.

Knowledge management is the process through which the organization collects intellectual and scientific values he possesses. In this context, knowledge management affirms the processes of identification, acquisition, distribution and maintenance of knowledge that are essential for the company.

3. THE CONCEPT OF TQM (TOTAL QUALITY MANAGEMENT)

The concept of total quality management is a comprehensive concept that unites the technical, market, economic, organizational and ethical aspects of business. In its approach, the concept of TQM is the highest level of management and quality management.

The process of total quality management is a management theory (philosophy) that stresses quality and system management tools that enable the organization uses to continually improve ourselves through the involvement of its employees in all processes of quality improvement with order to fully meet the needs of internal and external customers, and thereby provide values among employees, shareholders, customers and society.

To achieve these objectives TQM utilizes an integrated system of more than one hundred management methods, models, system development of competence among employees, and follows a slew of principles, including knowledge management.

KM approach based on knowledge will inform, guide and facilitate continuous improvement and learning, and thus helping the company organization to better meet the changing needs and expectations of consumers.

It should facilitate the introduction of principles of knowledge management, their gradual implementation and turning them into a complementary process management. It should facilitate the introduction of principles of knowledge management, their gradual implementation and turning them into a complementary process management.

In other words TQM should focus on environmental changes and deal with them through improvements in the capacity and skills in knowledge management. KM and TQM are complementary concepts, and to be successful in our environment, it is necessary to do so on a kind of Macedonian integrated approach to management conforming to the specifics of the Macedonian companies, Macedonian resources and certainly the most important human resource - the employees and young people (unemployed) highly educated staff.

4. CONCEPT OF RESEARCH

4.1. MISSION AND VISION ON RESEARCH

The mission of the research is the promotion and affirmation of the concepts of knowledge management (KM) and the concept of Total Quality management (TQM) of products / services in Macedonian companies.

Vision of the research is a possibility for implementing the said two concepts through strategies of management of the new paradigm in the practice of Macedonian companies. The purpose and objectives of the survey are as follows:

Actualization and affirmation of modern concepts and models for rational management of knowledge

in the higher improving the quality of products / services in Macedonian companies.
To strengthening theoretical concepts of KM and TQM to approach the competent officers as a serious challenge for a real technological change of mutual benefit for employees and companies.
Possible combination of the concept of management knowledge and the concept of total quality control as an integrated approach to a kind of new paradigm through which they are achieved optimal effects in the overall operation companies (as a kind of theoretical guide for possible applicable model companies in the Republic of Macedonia)
Based on these objectives, the tasks that would be used in the research are following:
Assess the attitudes of employees surveyed various Macedonian companies from the public and private sectors;
Assess the attitudes of managers in Macedonian companies surveyed (managers, executives, managers, bosses);
Assess the feasibility of a possible integrated approach to the practical implementation of the concepts mentioned in the work of Macedonian companies surveyed;

4.2. THE RESEARCH HYPOTHESIS

4.2.1. THE GENERAL HYPOTHESIS

General (main) hypothesis states:

An integrated approach to the concept of KM and TQM is not present in the applied management of Macedonian companies.

To accept or reject such a general hypothesis based on research that should be conducted in the field, asking the following sub-hypotheses as real understanding and appreciation of current practice in the surveyed target group of Macedonian companies.

Sub-case 1:

"KM is a concept by managing knowledge visibly contributes to the overall development of the company but is underused in Macedonian companies"

Sub-case 2:

"TQM as a management with total quality of products / services is a top world achievement in improving the quality and productivity of work, but in practice the Macedonian companies its implementation is insufficient"

Sub-case 3:

The new management paradigm can contribute to a greater extent to improve the quality of work in Macedonian companies

4.3. DESIGN RESEARCH

The target group of the research will include employed workers, professionals and associates, managers, executives in public, state and private companies.

The sample of research will include the previously mentioned target groups in the Macedonian companies from the public and private sector:

1. Kromberg-Schubert Bitola (KSMK)
2. Mining and energy plant (REK - Bitola)
3. Clinical Hospital in Bitola
4. Public municipal enterprise "Vodovod" - Bitola
5. Public municipal enterprise "Civil Engineering"
6. State Statistical Office (SSO) - regional offices in Bitola, Ohrid, Veles.

4.3.1. METHODS OF RESEARCH

Synthetic analytical method;

Descriptive method;

Comparative method;

Statistical method;

Methodologically techniques that would be used in the research are the following

Questionnaire closed

Checklist to assess the attitudes of respondents from the target group

Ladders assessment (Likert-type) to assess the positions of the surveyed target group

SWOT analysis (strengths, weaknesses, opportunities, threats)

5. CONCLUSION

Modern organization must effectively manage the quality of their products, and in practice the management should apply all necessary knowledge. The interdisciplinary concept of KM (knowledge management) is the one that covers most of the activities of the organization.

The main field of action of KM use and development of knowledge of the organization would satisfy its internal and external purposes. Knowledge management, total quality control and leadership provide deal of flexibility in the development of the turbulent environment where you need to take into account unforeseen situations that we may face in the future. Shared leadership, where the followers are given the opportunity to develop their own ideas and initiatives in the strategy represents a paradigm upon which to build competitive advantage.

KM and TQM are complementary. Their combination forms a cycle of improvements and development that leads to organizational progress.

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DEVELOPMENT OF PORTABLE LOW COST PARTICULATE MATTER SENSOR BASED ON LASER SCATTERING TECHNOLOGY

Roberto Pasic, Aleksandar Markoski, Nikola Rendeovski, Ivo Kuzmanov

Abstract: *Particulate matter (PM) pollutants are potential threat to human health. PM are tiny airborne pollutants floating in the air from dust, smoking, automobile exhaust, charcoal power plant, etc. PM with less than 10 μm is called PM10 (the inhalable particulate matter), and PM with less than 2.5 μm is called PM2.5 (fine PM). Long term exposure to high concentration of PM leads to bronchitis, asthma, allergy, lung cancer and many other diseases. In this research, we aim at developing a portable PM sensor based on laser scattering technology to measure the PM concentration and monitor the air quality. In comparison with standard PM sensors (expensive and heavy), portable model allow to monitor the air quality anywhere, to protect users from potential exposure to the polluted air in-door or during travel.*

Key words: *Air Quality Control, Particulate Matter (PM), Laser Dust Sensor, UART communication protocol.*

1. INTRODUCTION

Air pollution has become a major concern in big cities, especially due to the particulate matter with diameter of 2.5 micrometers or less (PM2.5). This research focuses on develop and evaluation of portable low cost particulate matter sensor based on SDS011 PM sensor.

Rising air pollution in all countries has made ailments like bronchitis, asthma, allergy, lung cancer, recurrent cough and chronic obstructive pulmonary disease. While quite a few air quality monitoring stations have been built by governments in a city's public areas in Republic of Macedonia, our intention was to allow PM monitoring with portable and low cost PM sensor with possibilities for direct measurement on any location, indoor and outdoor.

2. MATERIALS AND METHODS

Particulate matter (PM) consists of a mixture of extremely small particles and liquid droplets, including organic chemicals, metals, acids and dust particles. Main sources of PM include dust, fuel combustion and mobile emissions. PM is divided into two categories: fine particles and coarse particles.

Fine particles have diameters less than or equal to 2.5 micrometers (PM2.5), while coarse particles have diameters between 2.5 micrometers and 10 micrometers (PM10). Particulate matter is one of the six common pollutants for which the EPA has National Ambient Air Quality Standards, since it can have significant negative health impacts. These impacts vary by particle size, with smaller particles permeating into different parts of the body. PM can enter the lungs and the bloodstream, causing direct adverse effect on human health.

The adverse health impacts of PM and its presence make it an essential pollutant to measure. In this paper we introduce a portable low cost system to measure particulate matter using SDS011 particulate matter sensor whose results are compared with measurements made by TurnKey DustMate nephelometer.

A microcontroller (ATMega 328) was interfaced with SDS011 and was programmed to receive the serial (UART) data from sensor. Measured PM values was displayed on 2x16 Serial LCD display. The measured output of both these devices is shown in experimental results.

Corresponding author: Roberto Pasic, PhD., Faculty of Technical Sciences, Bitola, roberto.pasic@uklo.edu.mk

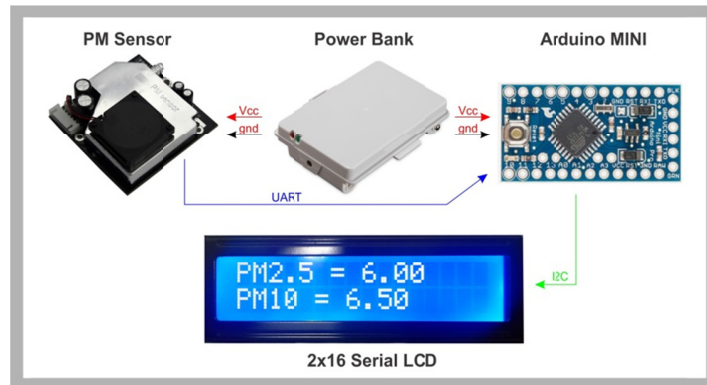


Fig. 1: Block diagram of portable low cost pm sensor

Block diagram on Fig.1 showing a way of connecting the system components. Power bank enables continuous operation of about 16 hours. PM sensor is connected to the microcontroller via UART communication protocol and 2x16 serial LCD is connected to the microcontroller via I2C communication protocol.



Fig. 2: Portable low cost pm sensor



Fig. 3: Portable low cost pm sensor (inside view)

The PM sensor use laser scattering working principle, light scattering can be induced when particles go through the detecting area. The scattered light is transformed into electrical signals and these signals is amplified and processed. The number and diameter of particles can be obtained by analysis because the signal waveform has certain relations with the particles diameter. Service life is the key parameter of laser dust sensor. The laser diode in this sensor has high quality and its service life is up to 8000 hours. If you need real-time data (such as detector), you can use the default configuration that measures at the frequency of 1 time per second. On the occasion of real-time demand is not high (such as filter, air quality monitoring, etc.), you can use the discontinuous working method to prolong the service life.

3. EXPERIMENTAL RESULTS

Measurements are performed simultaneously by using two measuring systems (Portable low cost pm sensor and TurnKey DustMate nephelometer). Results of measurements are shown in micrograms per cubic meters.

Table 1: Separated PM values for PM2.5 and PM10 measured every 5 minutes with both systems (random part from 10 hours continuous measurements)

PM2.5 (ug/m3)		PM10 (ug/m3)	
Portable low cost PM sensor	TurnKey DustMate sensor	Portable low cost PM sensor	TurnKey DustMate sensor
6.00	7.15	13.00	15.50
4.00	5.02	8.00	11.25
12.00	14.80	19.00	24.30
16.00	20.53	24.00	25.30
19.00	21.48	30.00	30.90
56.00	59.30	67.00	69.50
56.00	60.25	74.00	77.30
23.00	25.00	32.00	38.00
21.00	21.80	29.00	30.00
15.00	17.00	17.00	22.30
9.00	9.60	12.00	15.10
5.00	6.80	9.00	10.50

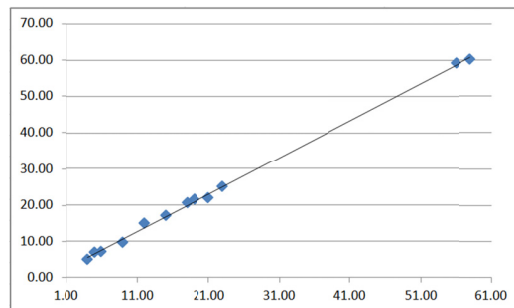


Fig. 4: Linear correlation between PM2.5 values measured using portable low cost PM sensor (x axis) and TurnKey DustMate (y axis), correlation factor 0,9992

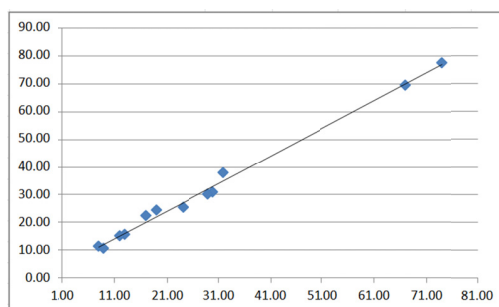


Fig. 5: Linear correlation between PM10 values measured using portable low cost PM sensor (x axis) and TurnKey DustMate (y axis), correlation factor 0,9967

4. CONCLUSION

We developed a portable low cost particulate matter sensor using SDS011 sensor. A excellent correlation was found between particulate matter measurements made by TurnKey DustMeter and the portable low cost monitoring system developed by us. As future work, we aim to develop a real-time web based platform with GPS locator for continuously monitor particulate matter. This will help to better inform people about the problem of air pollution.

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BASIC STEPS AND TECHNIQUES USING IN OBTAINING THE STRUCTURE FROM MOTION

Svetlana Mijakovska, Filip Popovski

Abstract: *Obtaining structure from motion (recovery three dimensional structure from video footage of scenes) has been a interesting area of research in computer vision. This problem is known as Structure from Motion (SfM). SfM is trying to recover, from segments of images the 3D structure of a scene and the position and pose (orientation) of camera at the moment of capturing each images (as a part of video sequences).*

This article presents the basic steps and techniques used in SfM (feature matching, structure and camera calculation, auto calibration and increase robustness).

Key words: *structure from motion, 3D model, feature matching, point matching, correspondences, essential matrix, fundamental matrix, tensor.*

1. INTRODUCTION

Structure from motion is used for recovered 3D models from video sequences. The purpose of structure from motion is getting cloud of 3D points in the scene, which in the process of feature matching and meshing, give the final 3D model.

So, given the position of a feature in one image (sequence) we need to find the corresponding position of the same feature in successive image. This is correspondence problem and is based on principles of multiple view geometry.

Features can include points, lines, and higher level primitives, for example planes. Generally most common approach is based on points (Fig.1). Points features are extracted easy from images, using corner detector. There are many corner detectors, but most used is Harris corner detector [1].

When one points of interest have been identified, then is needed some similarity to compare candidate points between the images. There are more correlation techniques for similarity measure by comparing the intensity differences between pixels.

Commonly used method is Normalised Cross Correlation (NCC) [2], because this method is invariant to global changes in illumination between the images (sequences).

Another method is KLT tracker [3], who select corner features based on the principle: a good feature can be well tracked, and the tracking should not be separated from feature extraction. This method measures the dissimilarity between feature in the first and current image and allow affine image changes.

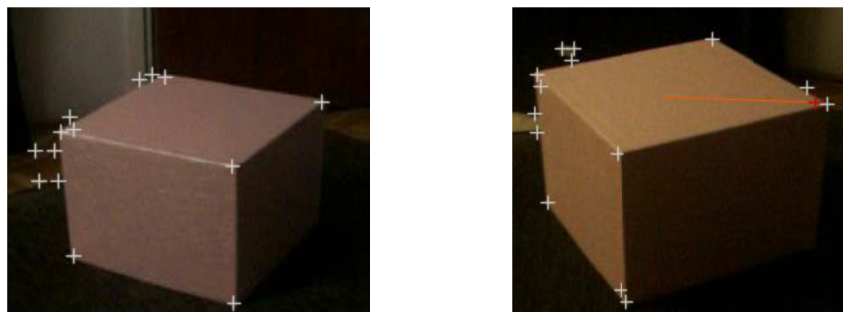


Fig. 1 Found corner points as a feature points

2. STRUCTURE AND CAMERA CALIBRATION

Structure from motion is based on principles of multiple view geometry.

The projective geometry that describes the relations between two views of a scene is epipolar geometry (Fig.2), and depends only on the intrinsic parameters of the cameras and their pose relative to each other.

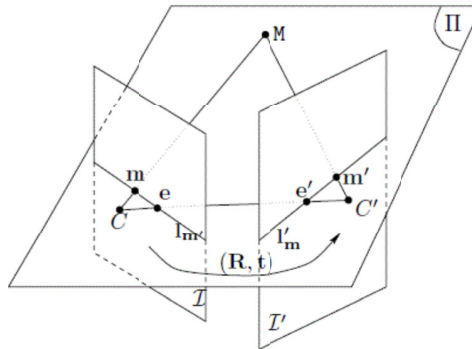


Fig. 2 Epipolar geometry

The matrix that encapsulated the epipolar geometry of two calibrated cameras is called *Essential matrix* [4]. Essential matrix can also be generalised to the case of uncalibrated cameras, and this matrix is *Fundamental matrix* [5]. This method is very useful for recover projective structure of a scena and camera motion from image correspondences, without any knowledge of the camera parameters.

The three view equivalent to the fundamental matrix is the trifocal tensor, who depends only of the relative pose of the cameras and their intrinsic parameters. Three views geometry allow a overlap of two views between successive image triplets in long sequences, and this simplifies method of stitching of a large numbers of views. (Fig.3).

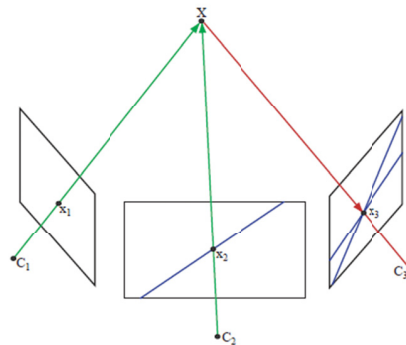


Fig. 3 Trifocal tensor

There is also quadrifocal tensor – geometry of four views. But, most cases of reconstruction from contain many more than four views and required techniques is N-view geometry [6]. Fundamental matrix are calculated separately for overlapping pairs (triplets) of all images in the sequences. Another, approach is to register all calculated tensors into the same coordinate frame.

3. AUTO CALIBRATION

For the projective reconstruction of a scene features the intrinsic parameters of the cameras must be recovered. By placing two constraints on some of intrinsic parameters, method of auto-calibration can

recover the intrinsic parameters and upgrade projective reconstruction to metric reconstruction. Most methods of auto-calibration are based on the concepts of absolute conic, which means that its relative position to moving camera is constant and images in any view depends only on the intrinsic parameters of the camera.

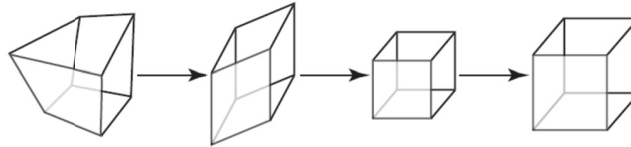


Fig. 4 Various geometric strata – projective, affine, metric, Euclidean

Fig.4 presents the relationship between the various geometric strata with their degrees of freedom:

- Projective – 15 degrees of freedom (dof),
- Affine – 12 degrees of freedom (dof),
- Metric 7 degrees of freedom (dof),
- Euclidean – 6 degrees of freedom (dof).

4. INCREASE ROBUSTNESS

Process of obtaining structure from motion are extremely sensitive to the presence of outliers and noise. Because of that, there are more techniques that are used for increase robustness, such a LmedS [7], RANSAC [8] and guided matching, where estimation of epipolar geometry is used to find more correspondences. These techniques are eliminate outliers (points that do not belong to the object) and there is possibility for adding interest points, which increases the quality of an object of the scene. Usage of these techniques are present in [9], [10], [11].

5. CONCLUSION

Purpose of this paper is to give an overview of the basic steps and techniques in obtaining the structure from motion. The automatic recovery of the three dimensional structure from video of a scene are useful for creating 3D models, which can be use in many areas, as animation, computer games, virtual reality. Process of obtaining structure from motion is composed of several steps: feature matching, structure and camera calculation, auto calibration and increase robustness. Each of these steps is a complex process, starting from finding points of interest, eliminating outliers points, matching points of interest and getting the structure of the motion. For increasing the quality of the structure, techniques of auto-calibration and increase robustness are used.

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MULTICRITERIA ANALYSIS OF ACHIVED SCIENTIFIC RESULTS AT TECHNICAL FACULTY IN BOR, UNIVERSITY OF BELGRADE

Živan Živković, Đorđe Nikolić, Predrag Đorđević, Milica Arsić, Ivan Mihajlović

Abstract: *This paper presents a comparative analysis of scientific results at the Technical Faculty in Bor (TFB), University of Belgrade (UB), during the period 2007 - 2015, based on a number of published papers in journals listed on the SCie and SSCI, as well as the number of citations registered in SCOPUS database. Analysis and ranking of the achieved results was conducted for each study program which is realized at individual TFB departments and for each narrow scientific field (NSF) within which professors are being promoted into the academic ranks at the TFB. For the purpose of ranking, multicriteria PROMETHEE - GAIA methodology was used.*

Key words: *Ranking, Technical Faculty in Bor, study programs, narrow scientific field, PROMETHEE II – GAIA*

1. INTRODUCTION

Technical Faculty in Bor is among 31 faculties and 11 research institutes that comprise the University of Belgrade. Technical Faculty in Bor was established in the year 1961 with two departments - Mining and Metallurgy. Today, TFB represents a union of four study programs: Mining Engineering (Min_E), Metallurgical Engineering (ME), Technological Engineering (TE) and Engineering Management (EM), with studies organized at all three levels (bachelor, master and doctoral). Teaching team consists of approximately 80 professors and assistants, 50 non-teaching employees and about 1 500 students at all study levels. TFB is the only faculty of UB which is situated outside of Belgrade.

UB is renowned in the world for its results. According to ARWU (Academic Ranking of World Universities), since 2012 it is ranked within the cluster of 401 - 500, and since 2014 it is highly ranked within the cluster of 201-300 of the best universities in the world [1]. Analysis of the contribution of TFB to the positioning of the UB in the ARWU list shows that TFB belongs in the top 30% of faculties in the UB [2], based on the results achieved in the period 2010 - 2015, measured according to the following AWRU criteria [3,4]:

- The number of graduates who are winners of the Nobel Prize and Medal in scientific fields (Alumni) - 20%.
- Quality of the faculty: the number of employees who won the Nobel Prize or Medals in scientific field - 20%.
- Number of highly cited scientists from 21 scientific fields (HiCi) - 20%.
- Results of scientific research: number of papers published in the journals Nature and Science - 20%.
- Number of published papers in SCie and SSCI journals- 20%.
- Achievements per teacher: the first five indicators divided by the number of employed researchers - 10%.

This study presents an analysis of the results achieved by the TFB, based on the ARWU criteria, as well as ranking of contribution to the good position of the TFB within the UB, for the each study program and NSF within which professors are being promoted into the academic ranks in the UB.

Corresponding author: Full professor, Prof. Dr Živan Živković, University of Belgrade, Technical Faculty in Bor, e-mail: zzivkovic@tfbor.bg.ac.rs

The analysis was conducted for the period between 2007, which was the starting year from which the quality of scientific papers have been measured annually at the TFB, until the year 2015 [5].

2. THEORETICAL FRAMEWORK OF CONSIDERATIONS

The criteria for the ranking of the Universities include: quality of teaching, quality of research, citation, quality of education, quality of faculty, international outlook, industry income and other [3,4,6]. Given that only ARWU criteria can be measured reliably, in order to assess the overall quality of scientific research as the basis for quality of teaching, as well as for the ranking of the results achieved in the individual TFB study programs, the following criteria were used:

- Number of publications in journals on SCIE and SSCI lists per researcher - C1,
- The number of citations according to SCOPUS database per researcher - C2,
- The number of citations per published paper - C3 and
- The number of citations per published paper and researcher - C4.

Ranking is performed by assigning appropriate weight factors to each of the following criteria: C1 – 25%; C2 – 25%; C3 – 25% and C4 – 25% using the multicriteria PROMETHEE II - GAIA methodology, which is used for this type of research, according to the literature [2,7-9]. The ratio of the weights of individual ARWU criteria was used for the assignment of the weights to the individual criteria C1 - C4 [3,4].

3. DISCUSSION OF RESULTS

3.1. RANKING OF DEPARTMENTS - STUDY PROGRAMS

3.1.1. NUMBER OF PUBLICATIONS IN JOURNALS ON SCIE AND SSCI LISTS

Generally recognized criteria for measuring the quality of papers in the world today is the publication of scientific results in journals on Thomson Reuters list: SCIE (and SCI within it), SSCI and ARTS & Humanities (for artistic disciplines without Impact Factor - IF). Journals on the SCIE and SSCI lists are ranked by the IF for each scientific discipline, hence, according to the ARWU criteria, the special emphasis is given to the journals Nature and Science because of their high IF [3,4]. SCIE and SSCI lists include scientific journals in the following areas: Social Sciences and Humanities, Medical Sciences, Science and Mathematics and Technology and Engineering Sciences. In the case of the TFB departments, Figure 1 presents the number of papers published in journals with IF, in the observed period 2007 - 2015.

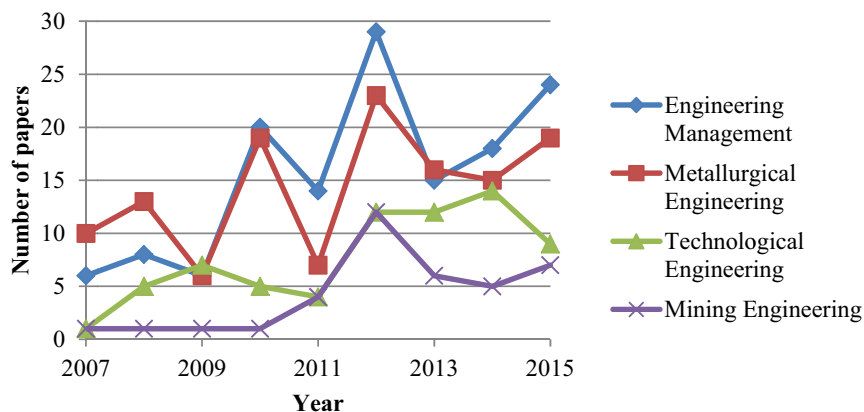


Fig. 1 Number of publications in journals with IF, for the period 2007-2015, for each TFB department (Note: Due to the involvement of three professors from ME department in IM department with 30%, their papers are allocated to the appropriate study programs with the same percentage)

The results show a trend of increase in the number of papers published in journals with IF in the considered period, while the order of the achieved results since 2009, can be presented in descending order as: EM → ME → TE → Min_E. The ratio between the best ranked EM and the worst ranked Min_E is approximately 5.

3.1.2. NUMBER OF HETERO-CITATIONS

A paper published in a journal on the SCie and SSCI lists is certainly a noteworthy result. However, the actual value of the published paper is determined in terms of the level of impact of the paper on the entire scientific community. The impact of a published scientific result on the entire scientific community can be assessed through the number of hetero-citations in journals with IF. For this estimation, SCOPUS scientific database was used because it provides reliable results in mutual ranking of the achieved results according to the citation criteria. Figure 2 shows the results of generated hetero-citations in journals with IF for the period 2007 - 2015, for each TFB department.

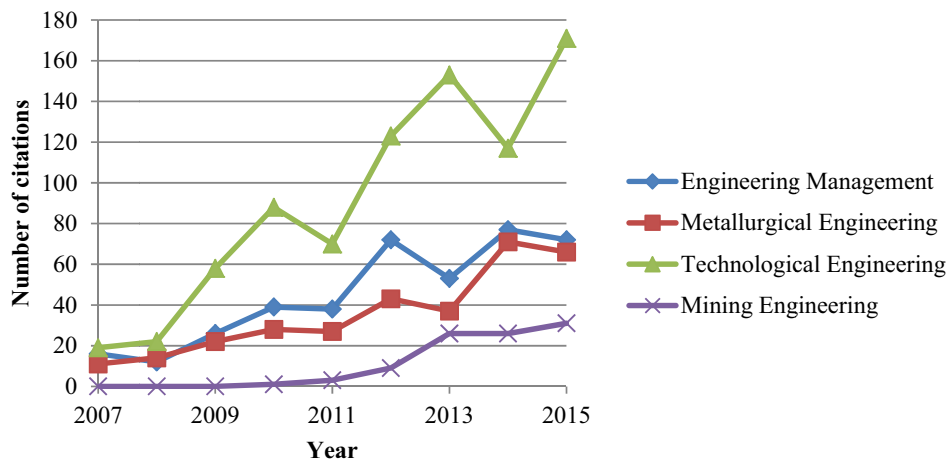


Fig. 2 Number of hetero-citations of published papers (SCOPUS database) for each TFB department, for the observed period 2007 - 2015 (Results for EM and ME are calculated in the same manner as in Figure 1).

The results show a trend of increase in the number of hetero-citations in the observed period. The largest number of hetero-citations, as well as the largest increase in the generated number of hetero-citations, can be found in the TE study program. The number of hetero-citations, generated in the observed period, is presented in the following descending order: TE → EM → ME → Min_E. The ratio between the department TE which has the greatest number of hetero-citations and the department with the lowest number of hetero-citations, which is Min_E, is about 6.

3.1.3. NUMBER OF HETERO-CITATIONS PER PUBLISHED PAPER

The overall quality of published research papers can be objectively assessed based on a number of hetero-citations per published paper, given that in the process of publishing, some non-academic paths may be taken, for instance: acquaintance with the chief editor, payment for the publication, emergence of predatory papers (for instance: Metallurgy International, TTEM, etc.). If the paper is high quality and published in the prominent journal, the most accurate assessment of its quality can be seen through the number of citations by other researchers in journals with IF. In this case, the realized hetero-citations do not apply to papers published in that year, but to the papers from the previous years, while the ratio between the number of hetero-citations and the total number of published papers realized in a department, provides a reliable picture of the quality of scientific results.

Figure 3 shows the trend of hetero-citations generated per published paper in the period 2007-2015 for each TFB department.

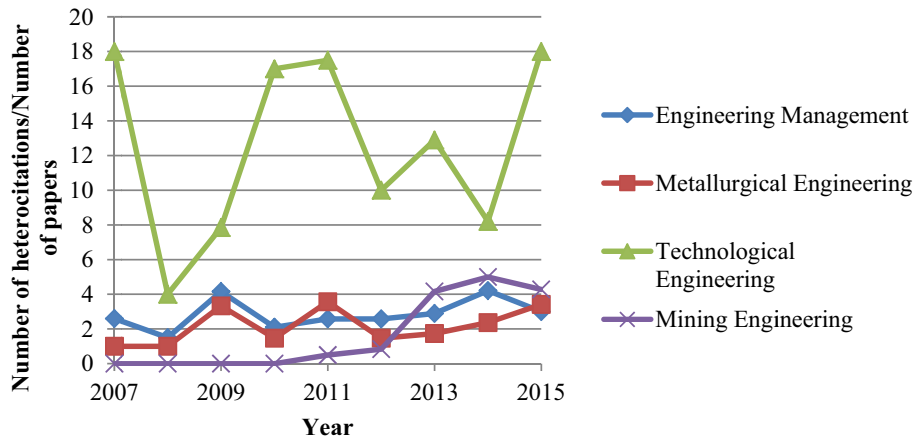


Fig.3 Number of hetero-citations per published paper in the period 2007-2015 for each TFB department

The results show that the best ratio between generated hetero-citations per published paper is on the TE department, which is in concordance with the results shown in Figure 1 and Figure 2. This results from a small number of publications and a large number of citations. Overall, the achieved results according to the criterion of the number hetero-citations/number of publications in a particular TFB department, for the observed period 2007 - 2015, is presented in the following descending order: TE → EM → MI → Min_E.

3.2. MULTICRITERIA RANKING OF ACHIEVED RESULTS

3.2.1. SCENARIO 1 - RANKING OF THE DEPARTMENTS AT THE FACULTY

In order to objectively rank the quality of a scientific paper in individual entities at an University or a Faculty, it is useful for a numerical values, which are expressed by the number of published papers, the number of generated hetero-citations and the number of realized hetero-citations per published paper, to be divided by the number of researchers. The entities (departments and TFB) have a different number of employees (potential authors) therefore calculating these numbers per researcher is a more objective way to define the quality of scientific research in a given entity. The papers published by researchers who are not permanently employed at the TFB were not taken into account while considering the obtained results, because of the specificity of their work at the institutes, in the areas that are not always related to the content of scientific work at the TFB departments.

For multi-criteria ranking of all scientific results achieved in the observed period 2007 - 2015, given that the number of employed researchers in the observed period varied within the limits of 10%, this change has no significant impact on the final ranking of the departments which was carried out by using PROMETHEE - GAIA methods [8,10].

Based on the collected data for the performance indicators of scientific research for members of the four departments within the TFB (UB), the initial table was formed for the evaluation and ranking of these departments by using PROMETHEE/GAIA methodology [7,8]. Table 1 shows the baseline results which were presented by the number of researchers per department cumulatively for the period 2007-2015.

Detailed procedure of the PROMETHEE II methodology, which was used in this study, is represented in the literature [10,11]. This well-known multi-criteria methodology was applied in this study because of its advantages, which are primarily reflected in the way of structuring the problem, the amount of

data that can be processed, ability to quantify qualitative variables, good software support and good presentation of the obtained results which can be projected on a GAIA plane [12,13].

For the purpose of ranking of the departments at the TFB, four criteria were considered, where the weight of their importance is determined so that the most important criterion in the model is the number of hetero-citations per paper and researcher which has 40% significance, then the criterion regarding the number of hetero-citations per paper with 30%, as well as criteria regarding hetero-citations per researcher and the number of papers per researcher with a significance of 20% and 10%, respectively.

Table 1. Baseline data presented cumulatively for the period 2007 – 2015

	Number of papers per researcher - C_1	Number of hetero-citations per researcher - C_2	Number of hetero-citations per paper - C_3	Number of hetero-citations per paper and researcher - C_4
Min/Max	Max	Max	max	Max
Weight	0.25	0.25	0.25	0.25
Preference function	V-shape	V-shape	V-shape	V-shape
Thresholds	Percentage	Percentage	percentage	Percentage
P	1.00	1.00	1.00	1.00
Mining_eng-Min_E	2.25	5.06	2.25	0.15
Metallurgical_eng - ME	6.94	19.00	2.52	0.15
Technological_eng-TE	4.25	51.25	12.07	0.86
Eng. Management - EM	9.27	22.00	5.18	0.29

The calculation of positive and negative preference flows, as well as the final net-flows for the analyzed departments was performed based on the initial data shown in Table 1, where V-shape preference function with the preference threshold of the $p = 100\%$ was selected for all four criteria in multicriteria model [14,15]. Results of the complete ranking based on PROMETHEE II are given in Table 2.

Table 2. Preference flows

Multicriteria flows	Φ^+	Φ^-	Φ	rang
TE	0.8470	0.1183	0.7287	1
EM	0.6145	0.2609	0.3536	2
ME	0.1995	0.4773	-0.2778	3
Min_E	0.0000	0.8045	-0.8045	4

The obtained results of preference flows for considered initial results, which are shown in Table 2,

present scientific results achieved by each TFB department in the following descending order of the preference: TE (0.7287) → EM (0.3536) → ME (-0.2778) → Min_E (-0.8045). Realized overall differences in preferences between individual departments are as follows:

- $\Delta(\Phi_{TE} - \Phi_{EM}) = 0.3751$
- $\Delta(\Phi_{TE} - \Phi_{ME}) = 1.0065$
- $\Delta(\Phi_{TE} - \Phi_{Min_E}) = 1.5332$
- $\Delta(\Phi_{EM} - \Phi_{ME}) = 0.6314$
- $\Delta(\Phi_{EM} - \Phi_{Min_E}) = 1.1581$
- $\Delta(\Phi_{ME} - \Phi_{Min_E}) = 0.5267$

Results obtained by PROMETHEE II method can be presented graphically by being projected on a GAIA plane [9]. The aim of GAIA plane is to give 2D or 3D presentation of preferences of the decision makers, in respect to each considered alternative in the model. Criteria in GAIA plane are presented as vectors, while the alternative are shown with corresponding points, where the distance of these points from the center of GAIA plane, as well as their positioning in relation to the most important criteria in the model, determines their priority during GAIA ranking. In addition, the length of each criteria vector determines the "ability" of the criteria to make the differentiation between the alternatives, where the longer a criterion vector is in the GAIA plane, the more discriminating power it has.

It is possible to design a vector weight criteria in GAIA plane, whereby this vector is called a decision stick π . In this way, the decision maker in this analysis can have relevant information on the aspects of conflicting criteria, as well as on the impact of the weight criteria on the final decision (Figure 4).

Figure 4 shows the GAIA plane with the quality of visualizations of 96.5%, which means that only 3.5% of the information is lost during projection. Furthermore, a conflict can be observed between groups of criteria C2, C3 and C4 with respect to C1 criterion.

According to the position of the decision stick π in the Figure 4, the TE department has the best position, and also in relation to the criteria C2, C3 and C4. According to the criterion C1, the EM department also holds the best position, where both TE and EM departments have a positive preference (Φ_{+}). The departments ME i Min_E are found to be opposite to the decision stick π and the group of criteria C2, C3 and C4, which, according to complete ranking of PROMETHEE II are ranked by the net-flow preferences as (Φ_{-}) departments.

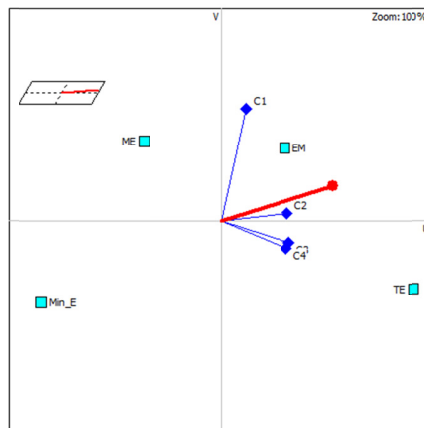


Fig. 4 GAIA plane for the ranking of the TFB study programs

3.2.2. SCENARIO 2. RANKING BASED ON THE NARROW SCIENTIFIC FIELDS

Certain entities (departments - study programs) are comprised of a variety of NSFs, according to which professors are being promoted into the academic ranks, based on specific criteria of the UB, in order to be able give lectures in their courses. For example, the NSF of mathematics requires the highest criteria, while social sciences and humanities have the lowest criteria. It is therefore

advantageous, in addition to the above ranking of the departments, to perform ranking also by NSF's according to which professors are being promoted into the academic ranks. The following NSF's are defined at the TFB:

1. Mining and Geology - M_G
2. Mineral and recycling technology The M_RT
3. Extractive metallurgy - EM
4. Manufacturing metallurgy - MP
5. Chemistry and chemical technology - C_CT
6. Industrial management - IM
7. Mathematics - Mat.
8. Informatics - Inf.
9. Automation and Computer technics - ACT
10. Electrical engineering - Elt.
11. Engineering - Mech.
12. Physics - Phys.
13. Economics - Econ.
14. Social sciences - SS
15. Law - Law
16. English language - EL

For the following NSF's: Electrical Engineering, Physics, Social Sciences, Mathematics, Mechanical Engineering, Automation and Computer technics, Computer Science and Law, the ranking was not performed because they only had one to three researchers per NSF. Also ranking was not performed for the NSF of the English language for which professors are being promoted to the position of the lecturers without a PhD degree, therefore they are not engaged in scientific work and do not publishing papers in journals with IF.

For multi-criteria ranking of the individual NSF's, PROMETHEE – GAIA multicriteria methodology was also used, with the same criteria C1 - C4 and the same size of the weight parameters as in the previous case which involves the ranking of study programs (Scenario 1). For the analyzed period, from the year 2007 to 2015, cumulative baseline data are presented in Table 3.

Table 3. The cumulative baseline data for ranking of the NSF's for the period 2007-2015

	<i>Number of papers per researcher - C₁</i>	<i>Number of hetero-citations per researcher - C₂</i>	<i>Number of hetero-citations per paper - C₃</i>	<i>Number of hetero-citations per paper and researcher - C₄</i>
<i>Min/Max</i>	<i>max</i>	<i>Max</i>	<i>max</i>	<i>Max</i>

Weight	0.25	0.25	0.25	0.25
Preference function	V-shape	V-shape	V-shape	V-shape
Thresholds	percentage	Percentage	percentage	Percentage
P	1.00	1.00	1.00	1.00
M_G	1.62	3.37	2.07	0.25
M_RT	2.57	6.14	2.38	0.34
EM	10.55	24.20	2.29	0.25
MP	2.80	3.75	1.30	0.16
C_CT	4.08	65.41	16.02	1.34
IM	9.38	25.38	2.70	0.21

Table 4 shows the preference flows and ranks of the achieved results for each individual NSF at the TFB.

Table 4. Preference flows for each individual NSF at the TFB

Multicriteria flows	Phi+	Phi-	Phi	rang
C_CT	0.9409	0.0400	0.9009	1
EM	0.3148	0.2239	0.0910	2
IM	0.3240	0.2625	0.0615	3
M_RT	0.3184	0.3216	-0.0032	4
M_G	0.0958	0.4461	-0.3503	5
MP	0.0209	0.7207	-0.6998	6

Organizationally speaking, with regard to the number of students, individual NSF's belong to one of the following departments (Min_E, ME, TE and EM). Thus, for example, among ranked NSF's, the Min_E department has M_G and M_RT, department ME has EM and MP, TE department has C_CT, while department EM has IM.

The obtained results, shown in Table 4, indicate the following descending order of achieved scientific results, according to the size of the preferences coefficients, for the observed period 2007-2015: C_CT (0.9009) → EM(0.0910) → IM (0.0615) → M_RT (-0.0032) → M_G (- 0, 6998).

The obtained difference between the preferences coefficients (Phi) of the highest HTT value (0.9009) and other NSF's in the TFB is as follows:

- $\Delta (\text{Phi}_{\text{C_CT}} - \text{Phi}_{\text{EM}}) = 0,8099$
- $\Delta (\text{Phi}_{\text{C_CT}} - \text{Phi}_{\text{IM}}) = 0.8394$

- $\Delta (\text{Phi}_{C_CT} - \text{Phi}_{M_RT}) = 0.9041$
- $\Delta (\text{Phi}_{C_CT} - \text{Phi}_{M_G}) = 1.2512$
- $\Delta (\text{Phi}_{C_CT} - \text{Phi}_{MP}) = 1.6007$

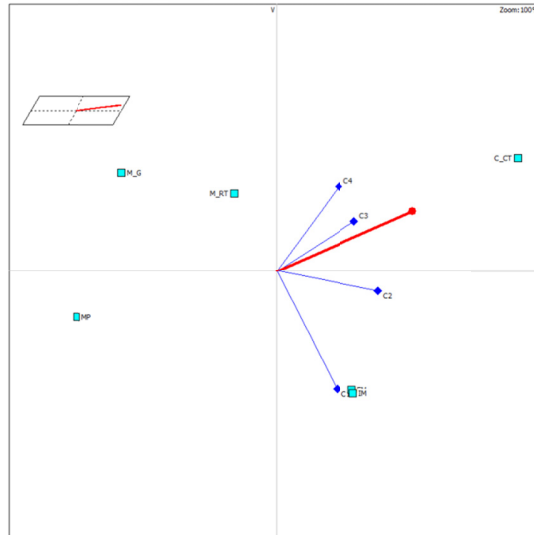


Fig. 5 GAIA plane for the ranking of the results achieved within the NSF's at the TFB

Figure 5 shows the GAIA plane for the ranking of the results achieved within the NSF's with the quality of the projection of 98.6%. This case also reveals a conflict among the criteria between the group C2, C3 and C4 in comparison to C1, where this criterion clearly indicates on the basis of its length, that it generates the biggest distinction between the observed results of the researchers sorted according to the NSF's.

As in the case of the ranking of the departments, the obtained results presented in Figure 5 show that the NSF C_CT is the nearest to the decision stick pi, and that it is also the best according to the criteria C2, C3 and C4 with a positive net flow of preference (Phi = 0.9009). Furthermore, a good orientation in relation to the position of the C1 criteria vector have the EM and IM NSF's, which also have positive net-flow preferences.

Researchers from NSF's M_RT, MP and M_G are positioned opposite in relation to the decision stick, with the significant distance from the group of the best NSF's at the TFB, thereby visually confirming that their achieved results are among the worst.

In addition to the results achieved through publication of scientific papers and their citation, the TFB has developed international cooperation and exchange of professors and students which, in its own way, contributes to the quality of teaching and the scientific work. The largest volume of educational cooperation was achieved at the IM department, via the following bilateral cooperation in the framework of the Erasmus+ programs: exchange of professors from the University RANEP, Moscow, Russia; Obuda University, Budapest, Hungary; University of Eastern Finland, Finland; American College, Skopje, Macedonia; BAS Academy, Skopje, Macedonia and University in East Sarajevo, Bosnia and Herzegovina, where four professors have been given the status of visiting professors. In the framework of student exchange, seven students spent a whole semester at the Universities of Budapest and Eastern Finland. The exchange of students and professors is also realized within the RESITA NETWORK (Funded by the German DAAD foundation). A larger number of summer schools and seminars were realized in Germany, Slovenia, Montenegro, Romania, Bulgaria, Macedonia, Bosnia and Herzegovina and Serbia. Also, the department of MI has achieved bilateral cooperation regarding the exchange of professors with the Faculty of Metallurgy in Sisak in Croatia and Ljubljana in Slovenia.

4. CONCLUSIONS

The obtained results of the ranking of scientific results for the period 2007 - 2015, for each department and NSFs within the TFB, reliably reflect the impact of its individual entities to the position of the TFB within the UB, according to the ARWU criteria. TFB is positioned in the first third among all UB faculties, which can be considered as a result which is worthy of attention [2,16]. The results obtained on the basis of multi-criteria PROMETHEE II - GAIA methodology indicate the descending order of impact, with the corresponding preferences coefficients: TE (0.7287) → EM (0.3536) → ME (-0.2778) → Min_E (-0.8045).

Results of the ranking of achieved scientific results based on NSFs, using the same methodology, presented in descending order according to the preference coefficients (Phi) are as follows: C_CT (0.9009) → EM(0.0910) → IM (0.0615) → M_RT (-0.0032) → M_G (- 0.3503) → MP (- 0, 6998).

It is obvious that individual TFB entities nurture organized scientific research endeavors as the basis for the development of quality curriculum, which is the starting point for horizontal and vertical mobility of students in a single educational space of the EU, as well as the exchange of professors which provides positive results at the TFB. In addition, the presented results provide clear guidelines for the future positioning of the TFB departments in the integrated university - UB which will be established in the future.

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