ISSN 2466-4693
UDC/UDK: 005:62

Univerzitet „Union – Nikola Tesla“
Fakultet za inženjerski menadžment

Serbian Journal of Engineering Management

Vol. 4, No. 1, 2019

Belgrade, January 2019

ISSN 2466-4693
UDC/UDK: 005:62

University “Union – Nikola Tesla“
School of Engineering Management

Univerzitet „Union – Nikola Tesla“
Fakultet za inženjerski menadžment

Serbian Journal of Engineering Management

Vol. 4, No. 1, 2019

Belgrade, January 2019
Beograd, januar 2019.

Serbian Journal of Engineering Management
Vol. 4, No. 1, 2019

Published semiannually (January and July)/Izlazi dva puta godišnje (januar i jul)

Publisher/Izdavač:
University "Union – Nikola Tesla", School for Engineering Management, Belgrade
Univerzitet „Union – Nikola Tesla", Fakultet za inženjerski menadžment, Beograd

For publisher/Za izdavača:
Prof. dr Vladimir Tomašević

Press/Štampa: Draslar partner, Beograd

Circulation/Tiraž: 300

ISSN: 2466-4693

Contact/Kontakt:
Serbian Journal of Engineering Management
Editorial Board/Uredništvo
School of Engineering Management/Fakultet za inženjerski menadžment
Bulevar vojvode Mišića 43
11000 Beograd
casopis@fim.rs
Tel. +381 11 41 40 422

CONTENT/SADRŽAJ

A Message from the Editor-in-Chief

Serbian Journal of Engineering Management is a new scientific journal, published by School of Engineering Management and Society of Engineering Management of Serbia. The Journal is cathegorized by the Ministry of education, science and technological development of the Republic of Serbia as a new scientific journal. This international Journal is dedicated to the wide scope of themes in engineering management and industrial engineering and is published semiannualy. The papers are presented in English, Serbian and other former Yugoslavian languages.

Themes included in the journal are: Engineering management, Industrial engineering, Project management, Strategic Management, Logistics, Operations management, Production systems management, Quality control, Quality management, Entrepreneurship, Risk management, Human resources management, Financial management, Information systems, High technologies management, Environmental management, Maintenance management, Creative industries management, Security management, and Marketing.

Editorial board is consisted of distinguished academics from various countries dedicated to establishing the highest academic standards and promoting engineering management principles in Serbia.

Information on the journal in English and Serbian can be found at the journal web page: http://fim.edu.rs/en/serbian-journal-of-engineering-management/.

Prof. Dr. Vladimir Tomašević, FRSA

Reč glavnog i odgovornog urednika

Serbian Journal of Engineering Management je nov naučno-stručni časopis, koji izdaje Fakultet za inženjerski menadžment i Društvo inženjerskog menadžmenta Srbije. Časopis je kategorisan od strane Ministarstva prosvete, nauke i tehnološkog razvoja kao novi naučni časopis. Ovaj međunarodni časopis je posvećen temama inženjerskog menadžmenta i industrijskog inženjerstva i izlazi dva puta godišnje (u januaru i julu). Zastupljeni jezici su engleski, srpski, kao i jezici država bivše SFRJ.

Teme zastupljene u časopisu su: inženjerski menadžment, industrijsko inženjerstvo, upravljanje projektima, strategijski menadžment, logistika, menadžment operacija, menadžment proizvodnih sistema, kontrola kvaliteta, upravljanje kvalitetom, preduzetništvo, upravljanje rizikom, upravljanje ljudskim resursima, finansijski menadžment, informacioni sistemi, menadžment u visokotehnološkim industrijama, menadžment životne sredine, menadžment održavanja, menadžment kreativnih industrija, bezbednosni menadžment i marketing.

Uredništvo časopisa čine istaknuti naučnici iz različitih zemalja sveta koji su posvećeni postavljanju visokog akademskog standarda i promocije principa inženjerskog menadžmenta u Srbiji.

Informacije o časopisu i poziv za autore, na srpskom i engleskom jeziku, nalaze se na web stranici časopisa: http://fim.edu.rs/en/serbian-journal-of-engineering-management/.

Prof. dr Vladimir Tomašević, FRSA

Review Scientific Paper/Pregledni naučni rad UDC/UDK 005:792.02(497.11)
Paper Accepted/Rad prihvaćen: 10. 1. 2019.
doi:10.5937/SJEM1901001T

Inženjering održivosti socio-ekonomskog položaja pozorišta u Republici Srbiji na primeru Beogradskog dramskog pozorišta

Srđan Tomić[1]*

[1] Univerzitet "Union-Nikola Tesla", Fakultet za inženjerski menadžment, Bulevar Vojvode Mišića 43, srdjan.tomic@fim.rs.

Apstrakt: Kako uspešno povezati umetnike, kulturne institucije i njihovu publiku? U radu će, iako se koristi teorijama biznis menadžmenta, akcenat biti na specifičnostima inženjeringa menadžmenta umetnosti i kulture. „U fokusu biznis menadžmenta je profit– proizvod je od sekundarnog značaja, jer jedna kompanija danas može da proizvodi cipele a sutra mobilne telefone. U svetu kulture to je dijametralno suprotno – u fokusu menadžmenta je delo (ili određena usluga), a profit je tek sekundarni cilj (vezan za samoodrživost, opstanak organizacije). Takođe, u svetu biznisa osnovni zadatak je „ubiti" konkurenciju, dok se u svetu kulturnog menadžmenta konkurencija u načelu prihvata pa čak i podržava (pozajmljivanjem kadrovskih, tehničkih ili informativnih resursa). Lojalnost korporaciji se u svetu biznisa obezbeđuje ugovorima (sprečavajući zaposlenog da se i nekoliko godina nakon raskida radnog odnosa bavi istim poslom u konkurentskoj firmi), dok se u menadžmentu u kulturi privrženost ustanovi gradi moralnim vrednostima ili, ako se takva vrsta lojalnosti (samopoštovanja i unutrašnjeg ugleda) ne stekne, organizacija se obično raspušta." Postoje i brojne druge razlike između menadžmenta u svetu biznisa i u svetu kulture, i te razlike postaće jasne i kada nisu eksplicitno izložene (Tomašević,Tomić 2015, str 5).

Ključne reči: Inženjerig, umetnost, pozorište, socio-ekonomski položaj.

Engineering of sustainability of the socio-economic position of the theater in the Republic of Serbia on the example of the Belgrade Drama Theater

Abstract: How to successfully connect artists, cultural institutions and their audience? In the paper, while using theories of business management, the emphasis will be on the specifics of the arts and culture management engineering. In the focus of business management, the profit-product is secondary, as one company today can produce shoes and tomorrow mobile phones. In the world of culture, this is the diametrically opposite - in the focus of management is the work (or certain service), and profit is just a secondary goal (linked to self-sustainability, survival of the organization). Also, in the business world, the main task is to "kill" competition, while in the world of cultural management, competition is generally accepted and even supported (by borrowing personnel, technical or information resources). Loyalty to the corporation is ensured by contracts in the business world (preventing an employee from engaging in the same job in a competitive company a few years after the termination of employment), while in the management of culture, commitment is built up by moral values or, if such a type of loyalty (self-esteem and internal reputation) does not get, the organization is usually dissolved. There are also many other differences between management in the world of business and in the world of culture, and these differences become clear and not explicitly exposed.(Tomasevic, Tomic 2015, page 5)

Key words: Engineering, art, theater, socio-economic situation.

1. Introduction

Management engineering in culture, arts management or a certain artistic activity, science discipline and skills that contribute to cultural and artistic practice are still not respected. His full affirmation in these areas is yet to come.

Management in culture, as part of culture, as well as modern management, starts from the view that culture is a system within which a conscious human activity can be shaped, educated, edited, managed, guided by development, the word within which the conditions of cultural and cultural , artistic creativity, forms of his placement and reception in the broadest public. Therefore, management in culture implies a man's effort to harmonize conscious activity, bring about certain relationships of human need, work and creativity in the field of culture and art, in order to make the richer and more dynamic cultural life of the community.

″The subject of management of engineering in culture (cultural management, culture management or science on the organization of cultural activities, as this applied scientific discipline was formerly called) is the study of all the forms (forms, models) of organization that occur in different societies and in different historical periods, activities in general and in certain areas of culture (theatrical activity, cinema, broadcasting, etc.). Since the goal of the management of engineering in culture and art is to find appropriate organizational solutions (models), which contribute to the development, social and market efficiency of cultural activities, this science has two basic dimensions:

- analytical-descriptive (research and description of existing forms and methods of organization);
- project-model (development and testing of new, more adequate and more efficient ways and models of organization);
- The theoretical and conceptual dimension, which develops scientific concepts, establishes periodifications and classifications, provides the basis for a comprehensive understanding of the phenomena and generalization of the model.

These three dimensions of cultural engineering management interweave and complement each other. It is obvious that describing and analyzing the existing situation is the prerequisite for designing and developing new organizational models, but vice versa, the existing one must be described through modeling which is not possible without the appropriate theoretical and conceptual basis″. (Tomasevic, Tomic 2015, page 6)

Objectives and tasks of cultural and artistic management

The goals and tasks of cultural and artistic management are: the construction of a system (model) of cultural life, which starts from a certain cultural policy; organizational system design within a state and community; planning the development of culture, which implies the setting of goals, priorities and methods of implementing the adopted cultural policy, as well as research of the existing cultural situation as the basis for the development of planned models; the construction of branch systems in cultural activities (establishing relationships between individual institutions in order to achieve optimal results) - for example, a system that will create the most suitable conditions for the development of theater art in which the various institutions will be optimally positioned: national, non-profit, commercial and amateur theaters, theater museums, agencies, theater journals, etc.;

development of models of individual cultural institutions, and management and organization of work in them - management of institutions (film productions, theaters, cultural centers); organization of the production process (project management) of a particular artistic work, within the institution of culture or independently; organizing the process of distribution (diffusion) of culture; management of "products" (sale management after premiere, organization of animation and educational activities in the institution during the program maintenance, prolongation of "duration" of work in the culture market); cultural diplomacy - establishing forms and models of international cultural cooperation (at the state level and at the level of individual institutions).

These eight tasks of management in culture and art entail a different level of training and competence of managers. They include a range of tasks that are set before:

- the highest state administrative bodies (ministries of culture and their professional services);
- Scientific institutes and research centers that will provide a basic organizational model for the development of operations and
- Cultural managers - practitioners whose task is for artists to create conditions for realizing their ideas, but also for the audience to experience already created artwork.

The activities of managers in culture include the creation of conditions for cultural creativity and the production of cultural goods (ideas and values), for their creation into works that are accessible to the cultural public and for the reception of such works in the cultural public).

″The diversity of managerial professions in the theater testifies how much about the richness of organizational models of the theater, as well as the richness of methods and ways of doing business. From the manager-volunteers who preside the councils of the theater institutions to the marketing managers who usually manage the sector within which there are still a lot of managers for certain marketing functions: marketing analysts, information system managers, managers of the theater lovers club, public relations managers (PR) , promotional activities managers, advertising sales managers, cashier managers, sales managers, card sales managers, sales managers. On this list, in fact, there are some things that need to be done in order for one theater performance to achieve its full goal - success in front of the full hall. These jobs are in the most developed market economies, within the theater as a cultural institution par excellence, represented as special interests″ (Tomasevic, Tomic 2015, page 7).

In order to understand the nature and the increasing complexity of the role of the human factor within the cultural system, it is important to recall the essential difference between the terms occupation and professions. Interest is defined, first and foremost, in economic categories - like doing some work for profit. This is also called a cultural dimension or vocation of the profession. According to this value dimension, the profession differs from occupation for which the most important criterion is that the job be done properly in order to be paid and nothing more. This does not mean that professional work is free. And he is, as a profession, a source of resources for life, but that is not its only purpose.

The sociology of the profession defined the criteria on the basis of which some human interest became a profession. By outlining them, management in culture has become a recognized profession. In the future, current cultural managers should do a lot to professionalize their profession, and above all professionalize their attitude towards the theater.

Specific professional culture and vocabulary (professional jargon). In any case, cultural managers have a professional culture that is different from that of a business manager and is based on a completely different set of managers in culture as well as the desire to contribute to the creation of artistic results, that is, the work that enters the corpus of national and civic culture.

The culture management estimates through the result in meeting the cultural policy priorities that can be related to the preservation of the heritage or the development of the audience, etc., and the financial result is far from being a decisive criterion in making a decision on the success in this domain (Tomasevic, Tomic 2015, page 10).

Socio-economic position of the theatre on the example of the Belgrade Drama Theater

The society in which we live watching from the aspect of culture is often characterized as devastated because, over the years and the development of technology, people are increasingly choosing theater as a form of cultural and social upbringing.

In the past, the theater was the center of social life in theory and practice, which is unfortunately unfortunately today. The middle layer of the citizen tends to disappear, although it was once the basis of the theater audience. New generations do not need the habit of visiting theaters because they are more attached to social media, new technologies that adapt to them. In this case, the theater is substandard, especially when it maintains its original sincere and authentic form. There are still those who are faithful to the theater and are not out of it, and they visit it because it is part of an unrealistic reality. In addition to the fact that the new generations are downgraded, the administration of the theater insufficiently works to interest the old and attract new audiences.

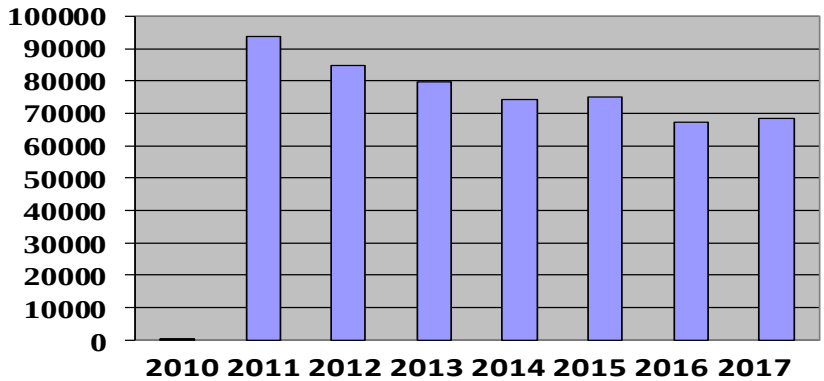
According to research by the Institute for Cultural Development Research, only 32 percent of the sample sample of 1600 respondents regularly visit the theater, and the reasons for rare visits are the lack of free time, lack of interest, family and living conditions, inappropriate repertoire, inappropriate interior, material reasons, high prices cards, distance from the place of residence, etc. Various actions were organized in order to increase interest and increase the attendance at theaters. In 2015, the Yugoslav Drama Theater organized a big reduction of tickets prices at the beginning of the year, and then the tickets cost up to two hundred dinars. The return was inconceivable, in that period 13,000 tickets were sold, and people waited up to seven hours in the endless queues. Many have then said that the reason why they had not visited the theater before was exactly the price of the tickets that had been a blow to the personal budget was unacceptable.

When it comes to the audience's satisfaction with the repertoire in theaters, many expressed their satisfaction, and on average 3% of the respondents declared themselves to be very dissatisfied. As a favorite genre, comedy expands, followed by other types of contemporary drama. Another research by the Institute for Research on Cultural Development shows that almost two thirds of the drama audience of professional theaters in Serbia are women, while men are represented with just over one third. In the Belgrade Drama Theater, this survey shows that 66.4 percent of women are visitors, and 33.6 percent of men are visitors. In the following table and graph we can see the program's attendance from 2010 to 2017. (Table 1, Graph 1). In the table and chart it can be seen that year after year the number of visitors drops with small barely noticeable variations in growth, the difference in attendance between 2010 and 2017 is over twenty five thousand viewers, which represents a huge loss of interest.

Table 1. Program awareness

Year	Total number of visitors
2010	93793
2011	93502
2012	84634
2013	79819
2014	74272
2015	75016
2016	67225
2017	68372

Figure 1. Number of visitors (2010-2017)



Economically viewed, theater in Serbia is no longer a great force as it was, and therefore the need for revenue and budgetary separation is not too great. Often potential viewers complain about the cost of tickets for theater performances, but it does not differ much from the cinema map for the projection of a 3D movie, which in fact means that the area of Serbia is economically stable when it comes to singling out for social activities only that the interest in the theater decreases , and for other social activities it is growing. Theaters once had clearly defined objectives, a strictly defined system and exact plans. Today, this is much better and it can be said that many goals change day by day. This in fact means that a lot of money has not been invested in renovating the theater for a long time, so minor repairs are very common. Further in the work we will show in greater detail the needs of the Belgrade Drama Theater, and statistics show that such types of needs are repeated every year. Through tables 2 and 3 we can see the income of the Belgrade Drama Theater.

Table 2. Belgrade Drama Theatre Income (2011-2014)

Financing	**2011**	**2012**	**2013**	**2014**
1. Budget funds				
(Program Costs, Material Costs, Investments and Investment Equipment Maintenance, Earnings) - *The city* - *- Republic*	122.667.814	127.533.368	113.937.355	106.865.245
2. Other sources				
- - Donations - - Income from program realization (tickets, membership fees and other programs) - - Revenue from services - - Other own income	30.505.565	24.451.728	26.975.525	23.719.923

Table 3. Belgrade Drama Theatre Income (2015-2017)

Financing	**2015**	**2016**	**2017**
1. Budget funds			
(Program Costs, Material Costs, Investments and Investment Equipment Maintenance, Earnings) - *The city* - *- Republic*	105.552.000	109.833.719	119.058.094
2. Other sources			
- - Donations - - Income from program realization (tickets, membership fees and other programs) - - Revenue from services - - Other own income	18.723.000	25.142.195	32.988.147

When comparing revenue with the number of visitors, it is clearly seen that the needs are disproportionate and that the number of visitors is reduced, the need for income remains the same or is increasing. As an example, we will show in 2011, during which the number of visitors was 93,502, and the income structure was 125,5718,379.00 RSD, while in 2016 the number of visitors was significantly lower (67225), and the income structure was 135,025,914.00 RSD. So in this comparison, the revenues were higher, but it should be noted that the value of money in 2011 and 2016 was not the same. In the following tables, we will show a more detailed income structure in 2016 (table no.4) and a public procurement plan for 2017 and 2018 (Table 5, Table 6).

Table 4. Structure of revenue from financing for 2016

Financing	Program costs	Material costs	Investments and investment maintenance of equipment	Earnings	In total
Income structure					144.480.010
1Budget funds					
-The city	9.951.942	24.368.956	4.800.481	72.362.458	111.483.837
- Republic	350.000			745.000	1.950.000
2. Other sources					
- Donations	1.981.214		630.660		2.611.874
- Income from program realization (tickets, membership fees and other programs)					29.289.299
-Revenue from services					
-Other own income					

Table 5. Public Procurement Plan for 2017 Year

Subject of procurement	Planned funds in the budget (shown in RSD)
Procurement of a set of scenic curtains	1.200.000
Procurement of electric energy	4.000.000
Engagement of the distributor	1.680.000
Printing services -Digital print -Print the ticket	900.000 150.000 450.000
Transportation on business trip	3.960.000
Service cleaning facility	2.500.000
Physical-technical security services	3.920.000
Replace the floor in the big scene	3.000.000

Table 6. Public Procurement Plan for 2018 Year

Subject of procurement	Planned funds in the budget with VAT
Procurement of electric energ	3.999.960
Diesel fuel	450.000
Procurement of cars	1.999.998
Printing services -Digital print - Print the ticket	150.000 50.000 300.000
Transportation on business trip	1.875.000
Service cleaning facility	3.000.000
Physical-technical security services	4.000.000

From these tables we conclude that a large part of the money from the budget is separated for repairs and supply of electricity. As already mentioned, the complete renovation of the building is not done, but is invested only in what is necessary and obsolete, such as scenic curtains and floors on the scattered, scrubbed and rotten scenes. Many of these figures are unthinkable and often there are criticisms from citizens that the city budget allocates money for the years invested in theaters, and the changes do not happen, that's because they change these and can not notice it, but they are significant for staff in the theater. When comparing the revenue structure and the needs of public procurement, there are more than enough money, but there are also a number of sudden costs that are rarely listed in the official documentation.

Conclusion

Art is characterized by the advantage of creative over ordinary productive work. What characterizes freedom of design in theatrical art is that with each performance the theater play becomes different. However, the principle of the identity of the theater work remains unchanged. This characteristic of the origin and performance of the work is also reflected in the organization of the theater.

The creative-production process and the technology of work in the theater essentially differs not only from material production, but also from other activities in the cultural-artistic sphere, so that their uniform treatment in the field of organization ignores the specificity of theatrical activity. The dynamic character of the theater activities, conditioned by frequent changes in the artistic conception of design and realization of the theater performance, requires a flexible structure and adaptation elements in the process of organizing. Therefore, there are no instruments, no solution can be normatively constituted and organizational classical (Tomasevic, Tomic 2015d).

The model of a theater organization that provides full freedom of inauguration of organizational forms and contents, the establishment of direct communication relations and links between parts and elements, and which does not impede the creative initiative of artistic personnel in setting up and performing theater performances, meets the requirements and requirements to be tested and applied. This before, as far as the open model is concerned:

a) according to modern scientific achievements in the field of organization;
b) according to the knowledge of practical solutions;
c) to innovate the internal self-structure;
d) for external influences.

In relation to practice, the theater organization model should devise a global path, while definitive shaping depends on the characteristics of a specific theater activity (Tomasevic, Tomic 2015e).

On the other hand, from a sociological point of view, fewer people are interested in theater and prefer to choose a cinema or some other way to spend their free time. The new generations have a growing need to cultivate culturally. In addition, the state devotes less attention to the school, and therefore allocates less and less money from the budget, which makes the theater more difficult for survival. Can the theater return to the form in which it was anyway? Can it become a place to connect people and lead them to the very borders between the real and the unreal world? With the development of technology, the charms are unfortunately lost and the theater slowly extinguishes, but there are ways in which it could return to its not so long lost form. First of all, as the interest of the audience falls, so is the budgetary allocation by the state less. If theaters were to focus on the active involvement of each individual and on the development of awareness of the importance of the theater and culture in that individual, then these individuals would eventually form an ever-growing and larger group of people who increasingly receive the need to visit the theater. Changing the repertoire and modernization can also positively influence the importance of thinking and removing prejudices that the theater is bored and intended only for those who live on the "high leg".

Literature

1. Селенић Слободан, (2002).“ Драмски правци XX века“, ФДУ-Институт за позориште, филм, радио и телевизију, Београд,
2. Џонсон, Х. В. (1996). „ Историја Уметности“, Просвета, Београд,
3. Британика, (2005). Обреди прелаза,
4. Владимир Јевтовић, (2010). Узбудљиво позориште,Интернет издање,Београд
5. Др. Снежана Арнаутовић, (2010). Студије уметности, Скрипта
6. Друштво лепих уметности, (2010). Гетеове мисли, Београд
7. Јасна Јојић, (2011). Тајне влашке магије, Београд
8. Јелена Јевремов, (2010). Луткарско позориште, Београд
9. Роналд Харвуд, (2015). Историја позоришта, интернет издање
10. Сања Дутина, Психо брлог, Које особине чине доброг глумца
11. Theatre project consultants, (2010). Types and formes of theatres
12. Чезаре Молинари, (1972). Историја позоришта
13. Vladimir Tomašević, Srđan Tomić, (2015). „Menadžment u umetnosti“, Fakultet za inženjerski menadžment, Beograd
14. Видосава Гловић, (2007). „Историја уметности“, 6. издање, година, Завод за уџбенике и наставна средства, Београд.
15. Марија Карла Прета и Алфонсо де Ђорђис (2004). „ Историја уметности“, МК Панонија и Прометеј, Нови Сад
16. Васиљевић. М, (1999). “*Дизајн-савремени погледи*”, Нови дани, Београд, год.
17. Васиљевић. М, (1996). “*Дизајн”,* Гора Пресс, Београд, год.
18. Asimov M, (1992). “*Introduction to Design*”, Prentice Hall, Englewood
19. Нил Грант, (2006). “Истрија позоришта“, Завод за уџбенике и наставна средства, Београд,
20. Бертолд Брехт, (1966). “Дијалектика у театру“, Нолит, Београд

Internet sources:

1. Internet site of the Belgrade Drama Theater; *History of the Belgrade Drama Theater, access page 12.09.2018* https://www.bdp.rs/index.php/o-nama/istorijat

Review Scientific Paper/Pregledni naučni rad UDC/UDK 004.738.5.056:316.62
Paper Accepted/Rad prihvaćen: 21. 1. 2019. 159.9.019.4-057.87
doi:10.5937/SJEM1901009L

Sajber maltretiranje, online ponašanje i psihološka dobrobit studenata: pristup inženjerskog menadžmenta

Nikolina Ljepava [1]*, Duško Tomić [2], Dženana Nuhodžic [3] Marko Gnjatović[4]

[1] American University in the Emirates, Dubai, UAE, nikolina.ljepava@aue.ae;
[2] American University in the Emirates, Dubai, UAE;
[3]Univerzitet Mediteran, Podgorica, Crna Gora;
[4]Fakultet za inženjerski menadžment, Beograd, Srbija.

Apstrakt: Široko rasprostranjena upotreba informacionih i komunikacionih tehnologija postala je sastavni deo naših života u proteklih dvadeset godina, posebno u okviru mlade generacijske kohorte. Kako su tehnologije integrisane u naše svakodnevne rutine, kriminalna ponašanja su takođe prešla granice fizičkog sveta, stvarajući područje koje se pojavljuje na internetu. Sajber zlostavljanje je identifikovano kao jedan od kontinuirano rastućih problema u školama i univerzitetima širom sveta i brojne studije su pokazale značajne odnose između internetskog zlostavljanja i psihološkog zdravlja, posebno mentalnog zdravlja i problema u ponašanju. Teorija rutinskih aktivnosti (Cohen & Felson, 1979) sugeriše da svakodnevne aktivnosti pojedinaca direktno utiču na viktimizaciju, što nekim pojedincima povećava rizik da budu žrtve. Sa obimnom, svakodnevnom upotrebom interneta i pametnih telefona, mladi ljudi su pod povećanim rizikom da budu izloženi nekom obliku internetskog zlostavljanja. Stoga, treba da se implementiraju preventivni programi na svim nivoima kako bi se mladi bolje obrazovali o bezbednom ponašanju na internetu i smanjili rizik da postanu žrtve internetskog nasilja.

Ključne riječi: internetsko zlostavljanje, online ponašanje, rizično ponašanje, teorija rutinskih aktivnosti.

Cyberbullying, online behavior, and the students' psychological well-being: An engineering management approach

Abstract: The widespread use of information and communication technologies became an integral part of our lives in the past twenty years, especially within the young generational cohort. As technologies are integrated in our daily routines, the criminal behaviors also crossed the boundaries of the physical world, creating an emerging area of online offenses. Cyberbullying has been identified as one of the continuosly increasing problems in schools and universities worldwide and numerous studies have demonstrated significant relations between cyberbullying and psychological well-being, specifically mental health, and behavioral problems. Routine Activities Theory (Cohen & Felson, 1979) suggests that an individual's day-to-day activities have a direct impact on victimization, placing some individuals at increased risk of being victimized. With the extensive, daily use of the Internet and smartphones, young people are at increased risk to be exposed to some form of cyberbullying. Therefore, the prevention programs should be implemented at all levels to educate youth better about safe online behaviors and decrease the risk of becoming the victims of cyberbullying.

Keywords: cyberbullying, online behavior, risk behavior, routine activity theory

1. Introduction

The impact of the technological development on our everyday life and activities has been increasing in the past twenty years. Various Internet-enabled services are used daily by billions of individuals worldwide; we live in the continuously connected society with our mobile devices serving as the primary device for gathering information and communications (Kotler, Kartajaya, & Setiawan 2017). Cyberspace, the new social environment with numerous possibilities for various activities and social interactions was created, and in a relatively short period, the Internet became a place to communicate, interact, socialize, and entertain. Nevertheless, with these advancements, criminal behaviors also crossed the boundaries of the physical world, creating an emerging area of online offenses (Jaishankar, 2011; Reyns, Hanson, & Fisher, 2011; Whitaker & Kowalski, 2015, Weulen Kranenbarg, Holt, & van Gelder, 2019).

With the continuous increase in the use of the Internet and particularly mobile technologies and smartphones, the prevalence of technology-related crimes is also quickly increasing (Jones, Mitchell, & Finkelhor, 2011, Eustace et al., 2018). From online fraud, identity theft, and computer viruses to cyberbullying, cyber harassment, and cyberstalking, a whole new area of cyber-crimes has emerged in this new online environment.

According to Jaishankar (2011), there are two types of technology-related crimes: (a) "cyber crimes" that rely on specialized knowledge (e.g., bank frauds, identity thefts) and (b) "computer crimes," which are criminal offences facilitated by using technologies, but are unrelated to technological knowledge (e.g., cyberbullying, harassment, child pornography). To explain the occurrence of the technology-related crimes, Jaishankar (2007) argued that individuals behave differently in different spaces, and that, cyberspace gives individuals an opportunity to exhibit behaviors that would not otherwise be displayed in real life.

Bullying among school-aged children is not a new trend; it is a widespread social phenomenon that has been here for generations. According to Olweys (1994), bullying was not systematically studied until the late 1970s, when social scientists in Scandinavian countries started to research the incidence of bullying among elementary school students. Soon after that, bullying was recognized as an important social phenomenon in the school environment and became the topic of research in numerous countries. Bullying can cause intense physical, emotional and psychological harm to a victim, and emotional difficulties associated with bullying can have a potential long-term adverse outcome for the psychological health and self-esteem of the bullied individuals since in many cases effects of bullying do not disappear with time. Additionally, the number of studies has shown that bullies are more likely to express criminal and ant-social behavior later in life, comparing to their peers who never bully. Olweys (1984) argued that bullies have 37% more chance to commit offenses compared to their peers.

According to the US Department of education (2018), around 20% of the school-aged children are exposed to some type of bullying in school. This number decreased within the past ten years, indicating that the number of interventions conducted systematically in middle and high schools was successful. Nevertheless, the according to the most recent Ipsos research (2018), performed with the parents of the school-aged children the prevalence of cyberbullying worldwide is continuously increasing, and more and more school-aged children have been exposed to some form of cyberbullying.

2. Cyberbullying: A New Form of Bullying

With the recent development of technology and the Internet and widespread usage of smartphones, an increasing number of young people is utilizing technology to communicate, socialize, and interact. In 2005 87% of the children in the USA, aged 12-17 years used the Internet daily and 45% owned cell phones (Lehart et al. 2005); since that time these numbers have increased both in the USA and globally. Mobile phones and social networking applications are becoming an integral part of youth and children everyday activities, used for communication, information and maintaining social relationships. According to Parasuraman et al. (2017), around 50% of teenagers think that they are addicted to their smartphones. The online environment became quickly one of the leading social settings for the youth, place where they communicate, interact and entertain. Consequently, both positive and negative social interactions crossed the boundaries of the physical to the virtual world, opening some new questions and dilemmas for parents, teachers, and researchers.

One of the anti-social behaviors that found its way into the virtual world is bullying: online activities of digital age bullying among youth, recognized in the literature as "cyberbullying." Cyberbullying is defined as "an aggressive, intentional act carried out by a group or individual, using electronic forms of contact, repeatedly against a victim who cannot easily defend him or herself." (Smith et al., 2006, pg 376). A variety of technological mediums provide some different opportunities for cyberbullying. Threatening or embarrassing emails, videos, instant messages, photos, and SMS can be sent through smartphones, tablets or computers. Additionally, social networks also provided a suitable environment for different ways of cyber-bullying. There is now the increased range of audience that can witness cyberbullying (e.g., on Facebook, YouTube, Twitter) leading to increased public embarrassment, that might intensify the impact of cyberbullying and harm inflicted on victims (Wright, 2017).

Having in mind that physical bullying is not a component of cyberbullying one can ask why cyberbullying is considered to be so dangerous. As with any other form of bullying, cyberbullying can cause emotional and psychological harm to the victim (Livingstone, Stoilova, & Kelly, 2016). However, while traditional bullying was usually limited to a particular physical environment, cyberbullying has a broader scope; with current technology devices such as cell phones and mobile Internet, a teenager can be continuously bullied.

Looking at the body of research dedicated to cyberbullying, it can be argued that cyberbullying can occur in two forms - verbal and social cyberbullying. Verbal cyberbullying is perpetrated by sending threatening, offensive, and aggressive verbal messages. Additionally, cyberstalking can also be viewed as a type of verbal cyberbullying. Social cyberbullying, on the other hand, is the form of cyberbullying targeted towards social defamation of the victim with the primary goal of either publicly humiliating the victim or inducing problems in the personal or social life of an individual. Social bullying can be perpetrated by rumours spreading, social exclusion, or by online dissemination of private photos and/or video materials of the victim. Both types of bullying can be perpetrated at the same time or separately, and they can be conducted by a single individual or by a group of individuals.

In addition to socio-demographic and psychological factors, some studies have also examined individuals' online behaviors as predictors of cyber victimization. Some online behavior such as online gaming was not found to increase the risk of cyber victimization significantly; however, participation in online social networking websites, especially Facebook, was predictive of cyberbullying (Mesh, 2009). Morrison and Gore (2010) found that individuals with symptoms of Internet addiction are more inclined to participate in social networks, online chats, and other types of online socializing. Additionally, they have found social networks users to be more likely to reveal their personal information and to engage in conversation with unknown individuals. Moreover, individuals using instant messaging (chat) programs were also more likely to become victims of cyberbullying (Maple, Short & Brown, 2011; Wright, 2017). Using a sample of 120 American undergraduate students, Walker, Sokhman, and Koehn (2011) found that the majority of respondents who had experienced cyberbullying reported that bullying was perpetrated via Facebook or instant messaging programs. Similarly, Lindsay and Krysik (2012) also reported that social network use among American university students in their sample increased students' risk of online harassment. Thus, as can be seen, the amount of time and how individuals use the Internet also need to be considered when assessing the risk of cyber victimization.

The Impact of Cyberbullying on Psychological Well-Being

In addition to associations with age, gender, education, and income, some studies have demonstrated significant relations between cyber victimization and psychological well-being, specifically mental health, and behavioral problems. Cyberbullying has, for instance, been linked with a higher incidence of depression and suicide attempt, especially among adolescents (Morison & Gore, 2010). Research conducted by Schenk (2011) on college students similarly indicated that victims of cyberbullying scored higher on depression, anxiety, and distress scales, reported feeling sad and angry more often, and endorsed significantly more suicidal planning and ideations compared to those that did not experience cyberbullying. Results from the study further indicated that cyberbullying had a negative psychological impact on victims and that exposure to cyberbullying might have serious implications for individuals' psychological health (Schenk, 2011; Cowie 2013).

Other research by Zu, Lee, Ning, and Guan (2011) predicted participants' mental health status based on the individuals' web usage behaviour using Song and Mo's (1992) Psychological Health Inventory, which measures seven dimensions of mental health, including depression, anxiety, psychopathic deviate, hypochondria, being unrealistic, and hypomania. They found all seven dimensions of mental health to be predictive of participation in online discussions, such that higher scores on the mental health subscales predicted more usage of instant messaging programs and a greater overall amount of time spent online. Similarly, in a study of 2,114 Taiwanese high school students conducted by Yen et al. (2007), mental health symptoms were found to relate to increased levels of Internet use, with depression being an especially strong predictor for girls. These results are consistent with Morison and Gore's (2010) findings from an online study conducted in the UK that explored the relationship between excessive Internet use and depression in a sample of 1,319 young people and adults. Morison and Gore (2010) found that participants who showed signs of Internet addiction exhibited significantly more depressive symptoms compared to moderate Internet users.

When considering the stressful nature of cyberbullying, all types of cyberbullying have been found to inflict a considerable amount of stress on victims. For instance, research conducted by Ybarra and Mitchell (2007) showed that 38% of participants stated that cyberbullying caused them severe emotional distress. Why is cyberbullying so stressful? Whereas traditional bullying and stalking are usually limited to a specific physical environment (e.g., school playgrounds or school buses), cyberbullying has a broader scope. That is, with present-day technological devices such as cell phones and mobile Internet, an individual can be continuously bullied. This constant bullying can inflict additional stress and pressure on victims, causing feelings of helplessness and the perception that they have nowhere to hide from the abuse. Public defamation in an online environment can affect an individual's self-perception and self-esteem, causing depression and suicidal ideation (Ruedy, 2008). In recent years, cyberbullying has resulted in many suicides in North America as well as across the globe, opening discussions among law practitioners about the introduction of specific legal repercussions against cyberbullying.

Moreover, online environments do not provide bullies the opportunity to observe their victims' reactions to the bullying behavior, thus minimizing the sense that real harm has been inflicted on their victims, and in turn, potentially making the bullying behaviour even harder to stop (Bhat, 2008). Given that there is no physical contact between the victim and the cyberbully, the seriousness of the cyberbullying is sometimes underestimated; however, there are some indications that cyberbullying behaviors can, in some cases, lead to real life violence (Bocij, 2005).

In sum, numerous studies have demonstrated a relationship between various forms of cyberbullying, online user behaviours, and poor mental health outcomes. What is perhaps most concerning about these findings is the potential for mental health problems to have indirect effects on cyber victimization by influencing patterns of online behaviour and heightening individuals' risk of being victimized by increasing the amount of time spent online. Thus, in addition to the negative impact that cyber victimization might directly have on victims' mental health, there is the potential that victims' online behaviors might also be impacted by the victimization, which in turn, could place them at further risk of future victimization and subsequent mental health problems.

Routine Activities Theory and Cyberbullying

Routine Activities Theory (Cohen & Felson, 1979) has been applied to explain cyber victimization. This theory suggests that an individual's day-to-day activities have a direct impact on victimization, placing some individuals at increased risk of being victimized. Moreover, this theory also suggests that for victimization to occur, three preconditions need to be satisfied: there needs to be a motivated offender, the opportunity for victimization (suitable target), and the absence of a capable guardian. Proponents of Routine Activities Theory argue that for a crime to take place, all three factors need to be present; if even one element is missing, violent crime cannot be perpetrated (Cohen & Felson, 1979).

Routine Activities Theory explains criminal victimization based on direct physical contact between perpetrators and victims. It emphasizes that victimization happens when motivated offenders and suitable targets are placed in environments suitable for the criminal offense. It further states that due to the routine activities of some individuals, these individuals can be at increased risk of being victimized.

Thus, because daily use of Internet has become a routine behaviour for majority of young individuals in the modern world, it could be argued that regular Internet users are increasing their risk of online victimization (Jaishankar, 2011; Reyns, 2010). While conducting these routine activities online, an individual (i.e., the suitable target) can become a victim of a motivated offender in the absence of guardianship (i.e., lack of antivirus or antispy software).

Alshalan (2006) analyzed the National Cyber Crime Victimization Survey data collected in the USA in 2004. He found measures of the routine online activities to predict both computer virus victimization and cybercrime victimization. Reyns (2010) explored the relationship between several types of online behaviors and victimization on the Internet. He found that the number of online social networks that participants used, the number of daily updates participants made on social networks (e.g., status updates on Facebook, tweets on Twitter), communication with strangers online, and engaging in any deviant online behavior significantly predicted cyber victimization.

Navarro and Jasinski (2011) found the Routine Activities Theory to be the viable explanation for cyberbullying risk among teenagers, with suitability and availability being the highest risk factors for teenagers' exposure to cyberbullying.

3. Conclusion

Although cyber safety and cyberbullying seem to be essential issues in the modern information society, with the young people spending more and more time in online activities every year, there are still no official cyber safety and cyberbullying awareness programs in numerous countries. Primary education about cybersecurity and cyberbullying should be incorporated in school curriculums as suggested in the literature (Diamanduros & Downs, 2008), and specific prevention and intervention programs that would address those problems should be developed (Ljepava, 2011). Moreover, both school and university officials and parents should be provided with additional information and training about these issues, to raise awareness about cyberbullying and minimize its negative consequences.

Some successful examples of interventions in traditional bullying in literature have shown that with appropriate intervention programme the incidence of bullying in the school environment can decrease. Having in mind the same theoretical concepts behind both cyberbullying and traditional bullying, there is no reason for cyberbullying to be different. Bullying can be reduced if it is acknowledged as a problem and if there is a specific strategy to deal with it. In the case of cyberbullying, it is the lack of knowledge about the topic, about online communication and use of technology that is a problem.

Educational institutions should adopt cyberbullying prevention programs and parents, teachers, school and university psychologist, and councilors need to pay more attention to this kind of harassment. Wider society involvement in the prevention of all forms of bullying including the cyberbullying and to involve in the problem is crucial in order to make a difference in the next period and often prevent devastating consequences of cyberbullying.

Literature

1. Agathston, P., Kowalski, R., Limber, S. (2007). Student perspective on cyber bullying. *Journal of Adolescent Health 41*, 59-60.
2. Allen, K.P., (2010). A bullying intervention system: Reducing risk and creating support for aggressive students. *Preventing School Failure 54(3),* 199-209
3. Bhat, S. C., (2008). Cyber bullying: Strategies for school counsellors, guidance officers and all school personnel. *Australian Journal of Guidance and Counselling 18(1),* 53-66.
4. Campbell, M. (2005). Cyber bullying: An old problem in a new guise? *Australian Journal of Guidance and Counselling 15(1)*. 68–76. Retrieved 01-10-2018 from: http://www.atypon-link.com/AAP/doi/pdf/10.1375/ajgc.15.1.68?cookieSet=1
5. Cowie, H. (2013). Cyberbullying and its impact on young people's emotional health and well-being. *The Psychiatrist*, *37*(5), 167-170.
6. Diamanduros, T., Downs, E. (2008). The role of school psychologists in the assessment, prevention, and intervention of cyberbullying. *Psychology in the Schools, 45 (8),* 693–704.
7. Eustace, K., Islam, R., Tsang, P., & Fellows, G. (2018). Human Factors, Self-awareness and Intervention Approaches in Cyber Security When Using Mobile Devices and Social Networks.

In *Security and Privacy in Communication Networks: SecureComm 2017 International Workshops, ATCS and SePrIoT, Niagara Falls, ON, Canada, October 22–25, 2017, Proceedings 13* (pp. 166-181). Springer International Publishing.

8. Hinduja. S., & Patchin, J. (2006). Bullies move behind schoolyard: A preliminary look at cyber bullying. *Youth Violence and Juvenile Justice. 4 (2)*148-169.
9. Kotler, P., Kartajaya, H., & Setiawan, I. (2017). Marketing 4.0: Moving from traditional to digital.
10. Kowalski, R. M., Limber, S.P., (2007). Electronic bullying among middle school students. *Journal of adolescent health 41(6),* 22 -30.
11. Lenhart, A., Madden, M., & Hitlin, P. (2005). Teens and technology. Washington, DC: Pew Internet & American Life Project. Retrieved November 14, 2018, from http://www.pewinternet.org/Reports/2005/Teens-and-Technology.aspx
12. Livingstone, S., Stoilova, M., & Kelly, A. (2016). Cyberbullying: incidence, trends and consequences.
13. Ljepava, N. (2011). Realno zlostavljanje u virtuelnom okruzenju: Prevencija i intervencija u slucajevima zlostavljanja dece na Internetu. Aktuelnosti (1-2), 22-33.
14. Mesch, G. (2009). Parental mediation, online activities and cyber bullying. *Cyberpsychology and Behaviour. 12(4),* 387-393.
15. Navarro, J. N., & Jasinski, J. L. (2012). Going cyber: Using routine activities theory to predict cyberbullying experiences. *Sociological Spectrum*, *32*(1), 81-94.
16. Nansel, T. Overpeck, M. Pilla, R. Ruan, W., Simons-Morton, B. & Scheidt, P. (2001). Bullying behaviours among US youth: Prevalence and association with psychosocial adjustment. *Journal of the American Medical Association, 285,* 2094-2100.
17. Olweus, D. (1994). Bullying at school: Basic fact and an effective intervention programme. *Promotion and Education, 1(27),* 27-31.
18. Ruedy, M. (2008). Repercussions of My Space teenage suicide: Should anti-cyberbyllying laws be created? *North Carolina Journal of Law and Technology. 9(2),* (323-346).
19. Shariff, S. (2005). Cyber dilemmas in the new millennium: School obligation to provide student safety in a virtual school environment. *McGill Journal of Education, 40(3)*
20. Smith, P.K., Mahdavi, J., Carvalho, M., Fisher, S., Russell, S., & Tippett, N. (2008). Cyberbullying: Its nature and impact in secondary school pupils. *Journal of Child Psychology and Psychiatry. 49(4).* 376–385.
21. Whittaker, E., & Kowalski, R. M. (2015). Cyberbullying via social media. *Journal of School Violence*, *14*(1), 11-29.
22. Wright, M. F. (2017). Cyberbullying: Bullying in the Digital Age. In *Handbook of Research on Individualism and Identity in the Globalized Digital Age* (pp. 50-70). IGI Global.
23. Weulen Kranenbarg, M., Holt, T. J., & van Gelder, J. L. (2019). Offending and victimization in the digital age: Comparing correlates of cybercrime and traditional offending-only, victimization-only and the victimization-offending overlap. *Deviant Behavior*, *40*(1), 40-55.

Review Scientific Paper/Pregledni naučni rad UDC/UDK 004:005.96
Paper Accepted/Rad prihvaćen: 14. 1. 2019.
doi:10.5937/SJEM1901015P

IT rešenja u upravljanju ljudskim resursima

Brankica Pažun[1], Irena Rašević[2], Ognjen Raketić[2]

[1] School of Engineering Management, University Union – Nikola Tesla, Belgrade, brankica.pazun@fim.rs;
[2] INAT Centre, Belgrade.

Sažetak: Informacioni sistemi imaju sve veći uticaj na moderno poslovanje. Brzo menjaju poslovne sisteme i postojeće poslovne modele. Upravljački pristup je od suštinskog značaja za sve poslovne sisteme i podsisteme, kao npr. ljudske resurse, ako žele da opstanu, ali danas sve faze procesa upravljanja ne mogu da se odvijaju bez podrške informaciono-komunikacionih tehnologija. Brze i velike promene u okruženju u kojem je poslovanje praćeno neizvesnošću i rizikom, dovode do potrebe za primenom adekvatnih tehnologija u cilju povećanja fleksibilnosti, preciznosti, kao i eliminisanju ili smanjenju pojave grešaka koje umanjuju vrednost poslovne aktivnosti. Sve upravljačke aktivnosti se zasnivaju na razmeni podataka između eksterne i unutrašnje sredine, tako da na osnovu tačnih informacija menadžeri mogu da kontrolišu postizanje cilja. Proces globalizacije nameće pravila igre, dok znanje i informacije određuju poslovni sistem unutar organizacija. Informaciona tehnologija je ključni faktor koji omogućava menadžerima da upravljaju rizikom i zadovolje zahteve turbulentnog okruženja. Ovaj rad ukazuje na mogućnosti primene savremenih IT rešenja u upravljanju ljudskim resursima, analizirajući njihove prednosti i nedostatke.

Ključne reči: HR softver otvorenog koda, informacione tehnologije, poslovni sistemi, upravljanje ljudskim resursima

IT solutions for human resources management

Abstract: Information systems have a growing impact on modern business. They rapidly change business systems and existing business models. Management approach is essential to all business systems and subsystems, i.e. human resources, if they want to survive, but today all phases of the management process cannot take place without the support of information and communication technology. Rapid and large changes in the environment in which business is accompanied by great uncertainty and thus a huge risk, lead to necessity for applying adequate ICT that would increase flexibility, precision and eliminate or reduce errors' occurrence that diminish the value of business activity. All management activities are based on information flow of external and internal environment, so on the basis of accurate information managers could control the attainment of the objective. Globalization process imposes game rules; further, knowledge and information determine business system within organisations. Information technology is the key factor that allows managers to manage risk and meet demands of a turbulent environment. This paper emphasizes the possibility of applying contemporary IT solutions in human resources management, analyzing their advantages and disadvantages.

Key words: business systems, open source human resource management systems, human resource management, information technologies

1. Introduction

It is a common fact that everyone in the business system should work together to meet needs of the customer (beside profit), which means that profitable business, among other things, requires money, information, human resources and ways for obtaining or producing goods and services. Information technology plays an important role because it affects the business system as a whole, as well as many other functions within the company.

With the advent of the information society, human resources management with performing managerial tasks related to personal issues, employment, training, assessment etc. (Dessler, 2015), has undergone major changes. First of all, due to the emergence of the Internet and new jobs, human resources had to evolve and transform themselves digitally. Software solutions have become an indispensable part of human resources management and have greatly accelerated the recruitment process and reduced the need for additional paperwork.

Open source software today is an ideal solution for newly-opened business ventures, as well as for small or medium-sized enterprises. Open source software (according to Opensource) are most often free solutions, i.e. (according to Free), but they can be partially free, (according to Freemium). Nowadays, the difference in the benefits provided between the licensed software and the open source software is being reduced.

Cloud computing does not represent a passing mode, nor a revolution in electronic commerce. Instead, most companies are likely to use a combined IT environment in which applications, infrastructure, and business processes will be implemented through public and private CCs, and possibly using a hybrid cloud model. In any case, the undeniable fact is that CC changes existing business models.

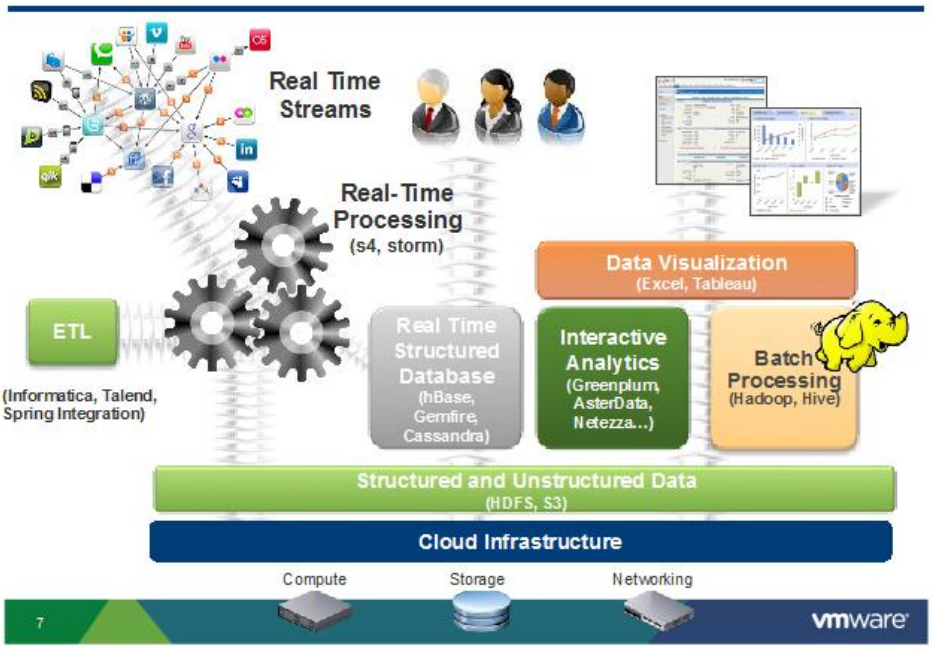
2. New technologies in business environment

The growth rate of data is large, so economy i.e. the business environment presents a very large amount of data that creates the need for strong and modern information systems. The upper layers of information systems are directly related to functions of business systems, therefore, concepts' relations Big Data, Cloud computing and IoT system, are defined.

Cloud computing is present everywhere in the modern business environment. Cloud-based HR systems give businesses the computing power and the ability to survive today. There are advantages in using cloud HR software, such as less paperwork, fast deployment of HR systems, security issues, increased employee engagement, real-time and accurate performance assessments, 24/7 access to pay and benefit information, giving companies easy access to innovation, predictive analytics that promotes employee retention and loyalty, etc.

In the business environment Big Data concept represents vast and complex amounts of data. One of infrastructure solutions of above mentioned concept is a combination of the analytical platform Hadoop with NoSQL system. Big Data provides the ability to process data in real time, with searching option using the Map Reduce framework. For example, Big Data systems allow analytical processing of data collected on planning, organizing, staffing, directing, controlling, recruiting, placement, performance appraisal, compensation and training, etc. The resulting knowledge is transferred to managers, in order to define decisions/ strategies. Big data could be a part of an complex advanced analytical system, which is a solution.

Figure 1: Big Data - holistic approach



Source: (WMware, 2016)

Further, according to the Economist Intelligence Unit, the research and analysis division of the Economist Group and the world leader in global business intelligence, it is found that 82% of organizations planned to either begin or increase their use of big data in HR before the end of 2018. (Economist Group, 2018)

As Cloud and Big Data platforms, the IoT concept (Internet of Things) becomes increasingly common in the business environment. These are devices called „things“ which in their structure have processor systems and other components, with the possibility of data exchanging. Predictions of the International Corporation for data analysis (International Data Corporation - IDC) are that by the year 2018 about 40% created IoT data will be stored, manageable and used by systems that are near or at the network edge. (Langovic, Pazun, 2016)

3. Open source software for human resource management

Nowadays open source human resource management systems (HRMS) become very popular concept even still relatively young. They give a lot possibilities or alternatives for human resource management, as well as become more competitive to Oracle and SAP, market leaders in this field.

Following open source business software applications for human resource management will be explained.

Orange HRM software. Orange HRM software is open source software, web-oriented. It has a user-friendly experience and a very wide range of tools that facilitate the work of human resources management. Given software has a trial period of thirty days, after which it should be paid. This software solution uses over 3,500,000 users. Many users state that its main advantage is its user-friendly experience.

Open source ERP software. Open source ERP software is also an open source software that is web-oriented and there is no need for installation, as well as it is designed for all types of businesses. Given software is free. Its advantages are the database and transparency of personal data. This software is mainly used by companies that are only starting up and whose number of employees is up to 100.

Odoo software. Odoo software is open source web-oriented software, which is partially free, that is, the first wanted application is free, and others are paid. In other words given software is an example of a freemium model. For human resources, it offers several solutions which cover recruitment, staffing, costs, assessment, fleet, and absenteeism. Each of these solutions has its own application. This software is ideal for all types of companies. It has 3,000,000 users.

HR.my software. HR.my open source software is completely free. This software does not require installation and it is web-oriented. It has a pleasant user experience, as well as excellent opportunities, such as electronic tracking of absenteeism, enhanced visibility of arrivals and departures from work, which greatly facilitates human resources management.

Teamdeck software. Teamdeck software is open source software that is partially free. In other words, it is free for a company that has up to 6 members, otherwise it should be paid for, and it represents a freemium form. Its advantages are that it has an excellent solution for resource planning, supervision of employee employment, etc. This tool facilitates human resources management in planning and organizing optimum work performance of employees.

4. Comparative analysis of HR software solutions

Each of these software solutions provides some benefits. Table 1 shows the most significant advantages of given five software solutions for human resources management.

Table 1. Comparison of benefits of HR software tools

Orange HRM	**Open source ERP**	**Odoo**	**HR.my**	**Teamdeck**
Role adjustment	Database resource	Planning departure	Role tracking Organization	Time tracking
Employee information	Employee information	Complete business software	Job planning	Job optimization
Time management	Time management and attendance monitoring	Salary management	Improve attendance at work	Schedule management

Source: (Pat Research, 2018 (authors' adjustment))

Introducing software solutions requires certain resources, primarily financial. If the company is small or just entering the market, ERP software such as SAP or DynamicNav can cause high costs. Each of these solutions has the option of free trial and it is recommended to test them, so that the company can identify for one of the above.

Requirements for introducing the aforementioned software solutions are presented in a comparative way in the following table.

Table 2: Comparison of requirements for the introduction of HR software solutions

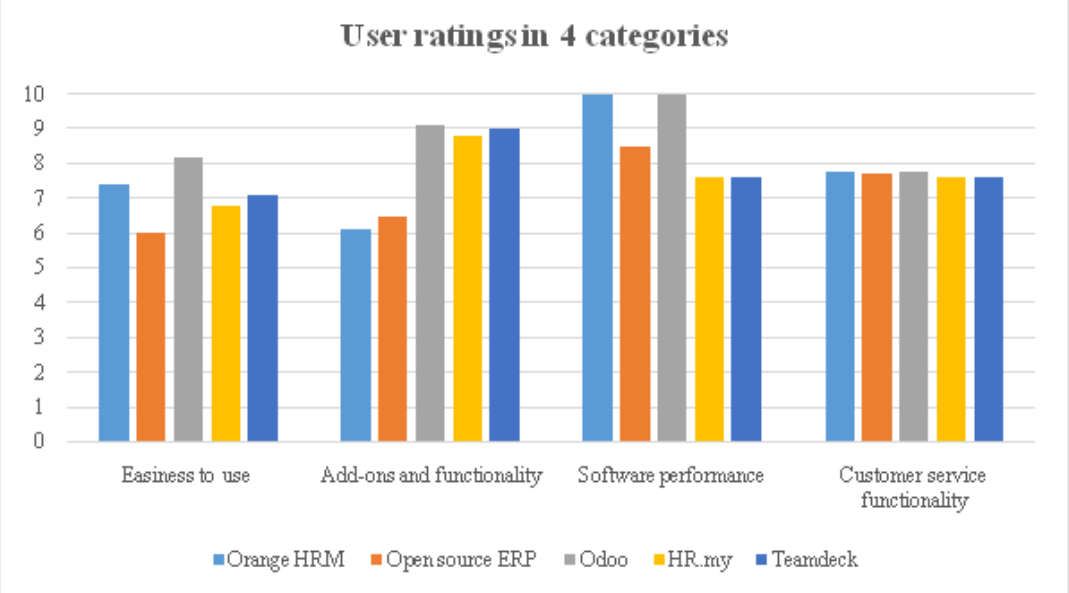
Orange HRM	**Open source ERP**	**Odoo**	**HR.my**	**Teamdeck**
- Open source software - Professional license - on request - License for the company - on request	- Open source software – completely free	- Free - one application - Online plan - paid - Company plan – paid	- Open source completely free	- Startup plan – free up to 6 - Business plan - $3.99 monthly per user

Source: (Pat Research, 2018 (authors' adjustment))

In order to select the software, it is necessary to be analyzed, or to find out whether it visually responds to human resources managers, as well as its easiness to use. The user experience should be as good as it is, therefore, the software solution is more appealing to users. In this paper four aspects of user experience are presented and compared: easiness to use, additions and functionality, performance and customer support. Based on rates, final grade is generated for each software solution.

Graph 1 shows average user ratings of the five software listed. Ratings are generated from 1 to 10, where 1 represents the worst user experience, and by grade 10 the best user experience is presented.

Graph 2. Four parameters comparison of user experience

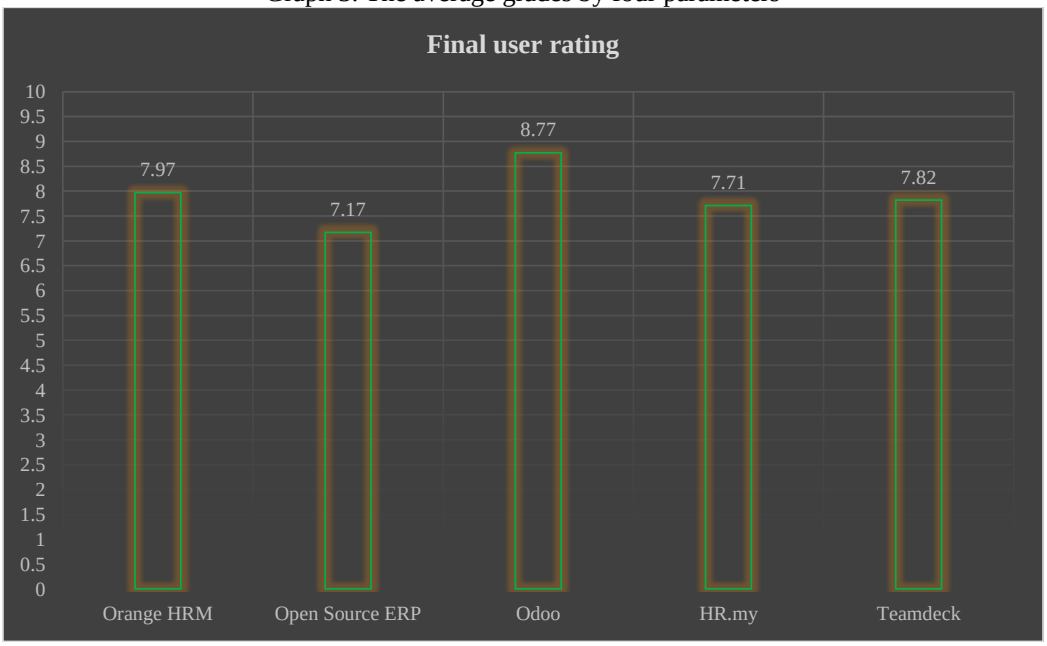


Source: (Authors, 2018)

Easiness to use aspect shows that Odoo software with rate 8.2 is the best choice for users, following by Orange HRM (7.4), as well as Teamdeck application (7.1). According to the second parameter, additions and functionality, it can be seen that the same software is leader with rate 9.1, as well, but close to it HR.my application has been noticed (8.8). Again, the best software performance, according to users' opinion and experience, is provided by Odoo and Orange HRM, both rated by 10. Finally, graph 1 shows that all presented solutions are almost equal, due to the characteristics customer service functionality (7.6-7.8). It can be concluded that due to given parameters, Odoo software is predominant.

At last, a graphical presentation of final users' grades is provided, relying on four parameters.

Graph 3. The average grades by four parameters



Source: (Authors, 2018)

Graph 2 shows that Odoo software has the best score of 8.77, three applications are almost even, while the worst average rating has Open source ERP (7.17).

5. Conclusion

Generally speaking, business systems represent a set of interrelated resources and one or more controlled operations which transform inputs into outputs. Mentioned technologies Cloud computing, Big Data and IoT represent a part of a modern information system which nowadays allow the company to survive on the market.

The human resources management, as a business subsystem, performs a wide range of tasks. For this reason, it is necessary to modernize or digitize it, so that the jobs can be done quickly and easily. The solutions presented in this paper show that in modern society there is a wide choice of open software solutions for human resources, which increasingly represent a serious competition between SAP and DynamicNav.

Open software solutions have the following benefits:

- Affordable solutions for small and medium enterprises.
- Some of them, more or less, have all the functions that are necessary for a modern manager of human resources.
- There is no need for additional investment in implantation and education of personnel.
- They can contribute to the improvement of human resources.
- The first step towards business modernization.

In this paper 5 open source software was analyzed and evaluated in four aspects in a comparative way. The average score shows that software solutions have very good grades (between 7 and 9). Finally, according to user ratings, Odoo has the best rating, while the worst one is Open source ERP.

Although the software solutions presented in this paper can be used in companies of all sizes, they are most often used in small and medium-sized enterprises, except the Odoo software solution, which is the most complete software of the offered ones, because it can be used in every function of the company.

Literature

1. Benson, G.F. (2011). Emerging Themes in International Management of Human Resources: Information Age Publishing.
2. Curtis, B., Hefley, E.W., Miller, A.S. (2010). People CMM: A Framework for Human Capital Management: Addison-Wesley.
3. Dessler, G. (2015). *Human Resource Management*. Florida International University: Pearson.
4. Langović, Z., Pažun, B. (2016). *Virtualization of information resources in tourism organizations*, 1th International Scientific Conference, Tourism in Function of Development of the Republic of Serbia, Spa Tourism in Serbia and Experiences of Other Countries, 2-4 June, 2016, Vrnjačka Banja, Serbia, Thematic Proceedings - II, University of Kragujevac, Faculty of Hotel Management and Tourism in Vrnjačka Banja, pg.536-552 [ISBN 978-86-89949-09-4; ISBN 978-86-89949-10-0].
5. Pankl, E., Theiss-White, D. (2010). Recruitment, Development, and Retention of Information Professionals: Trends in Human Resources and Knowledge Management: IGI Global.
6. Pat Research. (2018). Retrieved on November, 2018 from https://www.predictiveanalyticstoday.com/ compare/hr-my-vs-teamdeck-vs-open-source-erp-vs-orangehrm-vs-odoo/
7. Simmers, C., Anandarajan, M. (2003). Personal Web Usage in the Workplace: A Guide to Effective Human Resources Management: Information Science Publishing.
8. The Economist Group, The Economist Intelligence Unit. (2018). Retrieved on December, 2018 from http:// www.eiu.com/home.aspx
9. Torres-Coronas, T., Arias-Oliva, M. (2004). E - Human Resources Management: Managing Knowledge People: IGI Global.
10. WMware. (2016). *4 Key Architecture Considerations for Big Data Analytics*. Retrieved on November, 2018 from http://blogs.vmware.com/vfabric/2012/08/4-key-architecture-considerations-for-big-data-analytics.html

Review Scientific Paper/pregledni naučni rad UDC/UDK 502.131.1
Paper Accepted/Rad prihvaćen: 27. 12. 2018.
doi:10.5937/SJEM1901022K

Održivi razvoj - prelazak na zelenu ekonomiju – bezbednosne implikacije

Safet Korać[1], Milan Mićin[2], Danilo Čupić[3]

[1]Ministry of Interior, Montenegro;
[2]Uprava carina Republike Srbije;
[3]Mediteranean University, Podgorica, Montenegro.

Rezime: Termin "zelena ekonomija" nije nov. Zelena ekonomija se spominje u više navrata u prošlom veku, posebno imajući u vidu rastući globalni interes za ekološke probleme i klimatske promene o kojima se najviše raspravlja u svetu. Mišljenje da globalna ekonomija zasnovana na potrošnji fosilnih goriva za proizvodnju energije nije održiva ubrzano raste. Povećanje emisije gasova staklene bašte praćeno uništenjem ili oštećenjem ekosistema dovodi ljude u opasnost od izlaganja i istovremeno smanjuje sposobnost prilagođavanja. Ako želimo da naša budućnost bude sigurnija na bilo koji način, ekonomija mora da se promeni kako bi obezbedila blagostanje za ljude, ali bez uništenja ekosistema, od toga u velikoj meri zavisi dobrobit.

Ključne reči: Zelena eknomija, održivi razvoj, klimatske promene, bezbednost

Sustainable development – going over to green economy – security implications

Abstract: The term “green economy” is not new. Green economy is being mentioned repeatedly in the last century, especially considering the increasing global interest for environmental problems and climate changes taking the place of the most discussed topic in the world. The opinion that the global economy based on the consumption of fossil fuels for energy production is not sustainable is rapidly rising. The raising emission of greenhouse gases followed by the destruction or damage the ecosystem put humans at risk from exposure simultaneously reduces the abilities to adapt. If we want our future to be safer in any means, the economy must change in order to provide well-being for humans, yet without the destruction of the ecosystem, that well-being largely depends on.

Keywords: green economy, sustainable development, climate change, security

1. Introduction

1.1 What is the green economy?

We still cannot speak about a unique definition and the main constituents of green economy on the international level. Yet, if the opinion that the term of green economy should be defined by every state on its own and adapt it to its own reality prevails, there are many attempts to uniquely define this concept. The UN program for environmental protection (UNEP) defines green economy as an economy with the result to increase the well-being of people and social union, while reducing the risk for the environment and economic insufficiencies. In other words, green economy is considered an economic activity with low emissions, efficient resource use and is socially inclusive. In green economy, the growth of income and employment is achieved through public or private investments that reduce gases and other pollutants, create energetic efficiency and efficiently use resources, prevent losses of biodiversity and provide ecosystem services. These investments should aim and be supported through public expenses, political reforms and changes in jurisdiction (Stošić-Mihajlović, Đurić, 2008a).

Even though the basic idea can be traced back for years, if not decades, promotion for green economy only happened in the last couple of years (successfully, we hope) as a crucial change of mind.

While looking at the ruins of neoliberal economic paradigms, the need for something new is entirely obvious. Yet, it is not always easy to introduce something new into the practice. The neoliberal opinion has been turned into the leading (and nearly exclusive) paradigm of development, ever since the Reaganomics and Tacherism, through the affirmation of the Washington Consensus. At one point, it almost became its own religion. It is believed that this form of economic organization, implemented or imposed is one of the most successful way to achieve human well-being within the concept of human rights and freedom. The economic crisis we witnessed lead many to sober up. In the search for an economic organizational form that would not make the same mistakes like the neoliberal economy, some things become evident (Đurić, Stošić-Mihajlović, 2008).

We cannot separate economy from what represents its (economic and social) basis. On the other hand, economy must be organized in a way that economic growth simultaneously leads to new work places and new values, but also to a faster elimination of social marginalization (Đukanović, 1996).

At the same time, economic growth must be based and result in reduction of resource use and destruction of ecosystem. The ability to create new values and well-being, efficiency and competitiveness (the traditional measures of economic activities) should not be neglected (Mihajlović, Đurić, Stošić-Mihajlović, 2008).

On the contrary, these measurements should be expanded with new measures from social and environmental justice, since this is the only way to secure a future and to build up new natural capital resources as sources of public purpose, especially for the poorer population (since this population largely depends on nature). The report made by the General Secretary of the UN at the First UNCSD summit mentions four principles that represent the basics of green economy:

- Deficiency analysis of the market and the internalization of externals;
- System approach to the economic structure and its influence on important aspects of sustainable development;
- Focus on social goals (new work places e.g.) and defining politics to incorporate social goals with other goals of economic policy; Focus on the macroeconomic frame and development strategies with the aim to achieve sustainable development faster (O'Riordan, 1995).

In this regard, green economy differs from today's dominant economic paradigms used by the creators of economic policies or taught in classic economic faculties in three different ways:

- In its core, green economy is tightly connected to social justice. For traditional economists, "welfare economy" is just something peripheral, something that complements dominant economic theories. For green economists, justice and equality are in the centre of the performance and are the important parameter for traditional measures of economic values, like e.g. efficiency. Many green economists have been researching developing economies of developing countries, and even those who do not have any experience stick to the principles of equality and necessity to change the business requirements to cater to the less developed.
- Green economy has its roots in the ecological global movement. It rose from the bottom to the top and is being built based on practical experiences instead of abstract theories.
- Green economy is still not an academic field and is not largely present on universities and in academic circles. The reason being is that green economy and its followers do not have anything to offer to science that academic discussions about the economy and the role of economy, largely based on globalized economic systems (whose foundation mainly contributes to non-sustainable production and consumption) did not already offer.
- Considering the prior mentioned principles, many instruments were or are still developed, together with the policy that could accelerate the development towards greener economies. The cited report mentions following policies as the most frequent:

  a) Policies of real value and real prices, including the removal of subventions, valuing natural resources and introducing tax for everything harming the environment in order to internalize external costs, support sustainable consumption and make righteous business decisions possible. These instruments and policies are based on the source principles of environmental economy;

  b) Policies with green public procurements promoting "greener" markets and business in general;

c) Reforming environmental taxing. This is largely based on the experience of developed European states. In its core, this reform tends to change the tax focus from "positive" production factors (e.g. employment) towards "negative" factors (e.g. pollution). This way, two benefits would be achieved: more work places through reduction of extreme environmental protection costs;
d) Investment of publicly available resources into the sustainable infrastructure (including public traffic, renewable energy and improvement of existent infrastructure with the goal of better energetic efficiency) and natural capital in order to renew, keep and (wherever it's necessary) increase natural capital. This is of upmost importance now, in the aftermath of the economic crisis, where more and more states turn towards stimulation packages from public resources in order to reanimate production;
e) Leading resources from public funds into research and development of technologies for environmental protection, partially to reduce investments in these fields coming from private funds and to stimulate investment in critical sectors (e.g. renewable energy), with the potentially high economic frame. This would also reduce the participation and the importance of research in the fields of "dirty" and risky technology;
f) Strategic public investments through different support programs and partnerships in anything that can be considered as "expenses" when connected to development in order to create basics for self-efficient and sustainable process of social and ecological sustainable economic growth;
g) Social policies where the social goals would get in line with the suggested economic policies (Đurić, Stošić-Mihajlović, 2008).

What are the direct advantages of turning to green economy for society?

Green economy recognizes the values of natural capital and invests in it:

- A lower level of deforestation and renewable forests is economically possible and efficient and has a positive impact to agricultural production and better living conditions in rural areas;
- Making agriculture "greener" gives hope that in future there would be enough food for an increasing population without damaging basic natural resources needed for agricultural production;
- The increasing lack of drinking water can be adjusted through policies that implement investments in new water supply systems and increasing the efficiency of existent ones; Investments in sustainable levels of fish population will secure needed income in the long-run (Stošić-Mihajlović, Đurić, 2008a).

Green economy is needed if there is a desire for real reduction of poverty in the world:

- Turning agriculture "greener" in developing countries, based on the improvement of economic force of smaller agricultural producers influences the reduction of poverty while simultaneously investing in natural capital (since poorer households depend on it largely);
- Increasing investments in natural resources, which the poorer population to achieve their income, is using, ensures better quality of life in many parts of the world with low household income rates. In many countries, one of the most common possibility to switch to greener economy is the investment in drinking water supply and sanitary systems for the poorest members of society;
- Renewable energy can be efficient for eliminating energetic poverty; Finally, developing tourism (when projected and lead the right way) can incredibly increase the local economy and reduce poverty (Mihajlović, Đurić, Stošić-Mihajlović, 2008).

Green economy also creates new work places and increases the level of social equality:

- Switching to greener economy also means switching to new employment policies and create more work places than the traditional economic model;
- If investments would flow to green economy, agriculture, citizenship, forestry and infrastructure, there would be a significant increase of employment – in all terms (short, middle and long terms);

- Realign at least one percent of the global GDP to improve energetic efficiency and use renewable energy would additionally lead to higher employment and produce "clean" energy;
- Employment in the waste management and recycling sectors would additionally grow, just like the amount of waste due to the increasing population and consumption, yet, in this sector, there are still challenges tied to working conditions.

Greener economy also influences the replacement of fossil fuels with renewable energy and technologies with low carbon emissions:

- Many possibilities to improve energetic efficiency are self-beneficial;
- Investments in renewable energy and technologies of getting green energy today is a business branch with huge growth potential on the market, because of the fact that it has become very competitive. From 2002-2009, investment in renewable energy grew at an annual rate of 33% (Global Trends in Sustainable Energy Investment 2010: Analysis of Trends and Issues in the Financing of Renewable Energy and Energy Efficiency. Paris: UNEP/SEFI, pp.13).
- Technologies of renewable energy are additionally desired, if we consider the high costs of using fossil fuels for the society as a whole. For now, these are ignored or postponed for future generation (Stošić-Mihajlović, Đurić, 2008a).

Green economy also leads to greater resource efficiency and energies:

- The industry today meets bigger challenges and possibilities for efficient use of resources. There are many indicators that global economy still has unused possibilities to produce the same amount of well-being by using less materials and energy;
- Recycling waste and getting energy from waste becomes a more profitable industry branch and continues to increase with raising awareness about the value of waste as a recycling resource and for energy production; reducing waste and increase efficiency in agriculture and food production would lead to globally secured foods today and in the future.

Green economy brings solutions to secure sustainable cities and urban mobility based on low carbon emission technologies.

The most investments will be in cities of the future, especially in developing countries. By making our cities "greener" (projecting them to have large population density, many work places and open space for trade and entertainment, as well as better public transport), we also increase its efficiency and productivity

- A key marker of efficiency for green economy will be tied to building and reconstruction of objects with the aim to raise energetic efficiency and save resources;
- Improving energetic efficiency in infrastructure, the switch to clean fuels and better public and non-motorized transport in urban mobility must contribute to important economic and health purpose (Stošić-Mihajlović, Đurić, 2008b).

Green economy grows faster in comparison to traditional economy, while maintaining and reconstructing natural capital:

- The investment scenario in green economy on a level of 2% of the global GDP in the time from 2011-2050, being promoted by leading international development institution should lead to an economic growth equal to the growth in world economy if current trends would continue. Yet, this scenario significantly reduces the risks of climate changes, lack of drinking water and loss of biodiversity.

1.2. Does green economy replace the concept of sustainable development?

The concept of green economy does not replace sustainable development. However, today, we have more and more evidence that achieving sustainable development largely depends on movement in the economic sphere. Decades where new values and well-beings were created based on principles and by using traditional economic models have not been able to cope with social marginalization and over the top consumption of resources have lead us to still be far away from reaching millennial high development goals today (Đurić, Stošić-Mihajlović, 2008).

Sustainability is still the first class long term goal, but additional efforts must be aimed towards achieving the concept of green economy if someone wants to reach that goal.

1.3. Green economy in the context of sustainable development and the sustainability of the environment

Sustainable development is a concept and a great paradigm that connects economy, society and environmental protection, within which the strategies of green growth can be treated as an adequate frame of practical policies. With that in mind, it is clear that green economy represents something more concrete than sustainable development. The principles of sustainable development refer to long term striving, while green economy combines the striving to create new possibilities that would lead to more robust economic recovery in short terms, together with new, ecologically efficient sources of economic growth in the long term.

Most importantly, the policy of green growth especially take into account places where economic and environmental protection interests meet and overlap and try to find the best options for development in these areas. Therefore, strategies of green economic growth create better political frames, needed for achieving the concept of sustainable development and thus, contribute to sustainable development (Stošić-Mihajlović, Đurić, 2008a).

How much more will green economy cost?

Green economy does not go against economic growth. On the contrary, it should represent a new wave of growth, generate new, decent working places, and secure the necessary strategy for reducing existing levels of poverty. The opinion that the goals of environmental sustainability and economic progress are irreconcilable and it is necessary to give concessions to one or the other side can still be seen today. However, there is a lack of evidence that green economy reduces income or has any kind of impact on employment opportunities. Many sectors tied with green economy use this example to show that important investments and great economic growth and employment can be achieved in green economy. The key factor is to create better transition requirements towards green economy. There is much more to be done in that regard, mainly through creating an adequate environment and practical policies. Additionally, another myth burdens the creation of a strong green economy: Ever so often, it can be heard that this is a luxury that only the richest states can afford, or that it is just a way for rich states wants to border the development of undeveloped countries and leave them in a state of poverty. Yet, there are various examples in different sectors of developing countries showing that the transition to green economy is something beneficial to these countries and can be used in any part of the world (Radović, 2013).

However, we still cannot talk about a certain amount of money needed in order to turn the global economy green. Existing estimates mainly deal with investments for achieving the required goals of lower carbon emissions (Stošić-Mihajlović, Đurić, 2008b).

E.g., the “Blue Map scenario” of the International Environmental Protection Agency (IEA), according to which carbon dioxide emissions in energy production should be lowered until 2050, estimates the needed investments at 750 billion Dollars from 2010-2030 and 1.600 billion dollars annually from 2030-2050. The World Economic Forum and the Bloomberg Group, on the other side, estimate that investments in renewable energy must increase to 500 billion Dollars annually until 2020, if we want to reduce global warming to under 2°C.

How do we know that growth is “green”?

For this, we need objective markers and data. The estimate system, developed by OECD, bases on four internally connected indicator groups pointing towards the following:

- Energetic efficiency for consumption and production;
- Level of natural resources;
- Environmental quality of life, and
- Political and economic response.

Today, there are at least 30 sufficient developed possible indicators to follow green growth, with the representative group of "leading" indicators following the most important elements of the concepts of green economy (Stošić-Mihajlović, Đurić, 2008a).

The data we have today points to the following existing trends:

1. Pressure to the global environment is still growing, yet new increase of economic growth individually has less pressure on the environment today than in the past,

2. There are indicators that carbon gas emissions are slowly fading from OECD member states and developing countries,

3. The industry of products and services for environmental protection today play a much larger role in creating additional values and employment.

1.3. How can green economy be additionally achieved?

There are various requirements to fulfil on the way to green economy. These requirements generally mean changes in national regulations, policies, subventions and support systems, but also changes on international markets, international trade and development support.

It is clear that the existing environment leans more towards traditional models and the use of fossil fuel energy. E.g., if the subventions for fossil fuels would still exist (reaching more than 650 billion Dollars globally), it will be hard to talk about any kind of possibility switching to renewable energy sources and lean towards green economy.

The state is still the most responsible for pursuing green agenda, and the state would have to find a way to change the fiscal policy with reforms and elimination of subventions that aren't environmental friendly (energy, agriculture, industry, fishery, water supply and other spheres). After that, it is necessary to create conditions for investments through the development of new and refreshing the existing market mechanisms, improving regulations and their implementation, and direct investments in sectors contributing to green economy. A big step in this regard can be implementing policies and procedures of "green" public procurements and green bills.

A nation would have to put additional effort to clear the conditions in global markets, improve the rights of free trade and channels of international development support, as well as to encourage international cooperation (Stošić-Mihajlović, Đurić, 2008b).

Strategic eco-management planning possesses the necessary integrative potentials for managing environmental changes, long-term time horizons and positions of catalysts for merging public, social and private interests. The concept of ecologically sustainable socio-economic growth under modern conditions gets to be the foundation of development planning with influence on every type of human activity. Yet, the road to sustainability is a complex and long lasting process, requiring changes in behaviour and mindsets of all social factors. To paraphrase, it requires accepting the fact that the ecological development factor is as important as the economical (Radović, 2013).

The planning process manifests itself in very complex activities, which could have long-term effects for many people. It is very important to investigate the effects and precautions of the factors causing them, with supporting the positive and preventing or at least knowing the manifestation aspect of the negative.

The concept of sustainable development is not new, yet sometimes it fails to secure a balanced organization and space management in order to protect the environment. The contradiction of different opinions and interests regarding "social and economic development – urban planning – environmental protection" affected the creation of partial and mutually disconnected approaches to environmental protection. The existing models of strategic eco-management planning mainly involve environmental protection as a special planning sector. From a sustainable development standpoint, this will not lead to wholesome results (Stošić-Mihajlović, Đurić, 2008b).

The mentioned conditions hint that, at this moment, there is a lack of requirements for achieving the main part of eco-management planning in environmental protection. Yet, disregarding the borders and honouring the fact that planning is a key factor in the system of environmental changes; with attempts to determine frames for formulating strategies of environmental management and planning under new and changed conditions. If we want to achieve positive development of urban agglomeration, the ecological picture of cities and ecological valorisation of their surroundings. By using the experience of developed countries and signed global declarations, cities and their surroundings can find the right way to sustainable development of their regions. At the same time, it is required that sustainable development of a city does not take into account only planning decisions but also the permanent education of decision makers (locally and state wide), as well as the total (eco) information for citizens about the necessity of a healthy environment. One of the ways on how to bring these opinions closer to the citizens is an effective eco-marketing of the government and institutions, promoting a healthy mindset. All these aspects would be covered by the eco-management system. This system must be the leading role in future development of urban areas (Radović, 2013).

2. Sustainable urban development

Sustainable development secures using goods in such a way that it meets the developmental requirements of today's generations, whilst securing that the future generations also meet their requirements. Sustaining and improving the quality of life and protect the health of people is an ever so increasing necessity. Meeting goals in environmental protection requires that all actors accept the fact that, systematically, they must introduce an environmental management system (EMS) and improve it constantly (Stošić-Mihajlović, Đurić, 2008a).

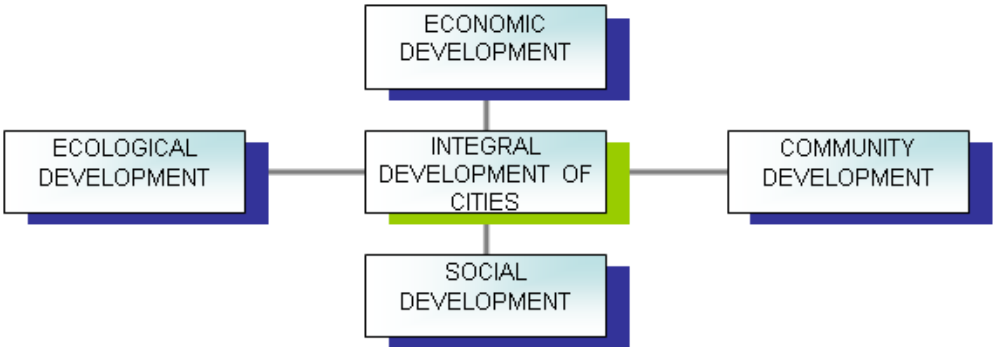
The urban environment pays a high price for its development. Without any regards for ecological laws and ecological criteria, further development simply would not have been possible. We can already witness that environmental quality in cities is getting more and more problematic. Bearing that in mind, urban areas must conduct following two activities:

1. Reconstruct the already degraded environment so that it does not get in the way of functional living.
2. Protect the existing quality of life.

Both activities cannot be achieved just by using measures and management. A system of different measures that, through the system of social organization, secures the quality of life can be defined as environmental management. When management conducts these measures in practice, their starting point must be the organizational, financial and legislative consolidation in environmental protection (Lješević, 1998).

The ecological system possesses characteristics of a dynamic and open system. Within this system, the anthropogenic influence constantly disturbs the existing balance and threatens to impose balance at the expense of humans at one point. Using existing space in the formation and development of urban settlements is one of the most important factor for humans to influence the conditions in their ecosystem (Đurić, Stošić-Mihajlović, 2008).

Figure 1: Components of sustainable development of urban settlements.



We could say that the goal of urban eco-management is to increase the environmental quality in cities. This requires the existence of several measures to secure the optimal natural and social actors who have a direct impact on the quality of urban environments and the quality of life (Filipović, 2000).

Social standards, national standards, regulations and acts of local governments define environmental quality. These laws secure norms that aim to meet the requirements of a certain environment so that it can be suited fit for living, working and resting (Radović, 2013).

3. Principles of environmental management

Eco-management must be one of the main principles in urban planning. Since the city is a complex poly functional system, elements and functions are crucial for a functioning community and the quality of life in a city. Environmental management is not only important for water, air and soil pollution, but also for securing balance in ecosystems and protect nature, managing resources, develop technological processes and equipment, perfect regulations, provide ecological education etc. (Stošić-Mihajlović, Đurić, 2008b).

The functional basics of effective environmental management systems are adapted principles, delimited jurisdictions, as well as modern and effective social and governmental measures (Filipović, 2000).

By observing the specialties in an urban environment, we can separate five activities. Interacting with each other, they result in an effective eco-management system.

1. Economic space management aspects.
2. Judicial management basics.
3. Technical and technological aspects.
4. Organizational (institutional) management level,
5. Informational Systems as a management principal.

The desired quality, environmental conditions, urban characteristics and organizational and technical possibilities of a community to perform certain measures dictates the type of above-mentioned actions they will undertake in order to improve the quality of life.

Figure 2: Activities in the eco-management system

The current passed resolutions, programs, declarations and other documents included general directions cities need to follow in their development. In ecological planning of sustainable development, a city must take care about the ecological space capacity. This concept is based on investigating and defining the capacity of certain spaces (ecosystems) to accept the emission of polluting materials and neglect the negative impact to a point where normal functioning is guaranteed. In other words, we need to determine the amount of stress an environment can take without its ecosystem being disturbed. There, we also need to take into account the measures of controlling and limiting the emission of pollutants from any source. The definition of ecological capacity, especially urban capacity, requires certain investigations including the application of system analysis methods, experimental modelling and direct observation. These complex investigations hint at the existence of a certain ecosystem and its capability to withstand load and internal pressure. The definition of ecological capacities in an urban environment is the strategical basis and a planning requirement for any sort of changes planned in a certain environment. It is also a requirement for active protection and environmental management planning (Stošić-Mihajlović, Đurić, 2008b).

Ecological standards are imperative to strategic planning of sustainable development in modern conditions. According to numerous authors, the main principles in this planning are:

1. Mutual dependence of ecological factors,
2. Tolerance limits.
3. Relation complexity in ecosystems.

It is important to mention that ecological planning of sustainable urban development must represent a qualitatively higher level of planning than the urban planning itself. Urban planners in general did not think of a city as an ecosystem, but rather gave advantage to the economic, hygienic and aesthetic principles. Without going into a detailed analysis of advantages and disadvantages of such an approach, we need to mention that, according to global standards and principles of sustainable development, the accent must be on ecological principles of urban development. This means that by applying ecological principles in planning of urban development and respecting ecological standards, there must be a synthesis between ecology, management and urbanism with the aim to keep the sustainability of urban planning. Additionally, by respecting ecological factors in planning, this would prevent the possibility of going above the ecological capacity of an environment and secure a higher quality of life for the population (Stošić-Mihajlović, Đurić, 2008b).

4. Environmental management strategies

The Environment and Development summit (Rio 1992) is a turning point in global approach of environmental protection. The concept of sustainable development was accepted as a long-term development strategy, which reforms the right of humans to a healthy and productive life within nature. The passed documents represent the basis of relations for the international community towards the environment. The document Agenda 21 as a waypoint for formulating national and local policies, strategies, plans and programs for managing the environment based on the concept of sustainable development is especially important (Stošić-Mihajlović, 2007).

For a long time, the doctrine that production is the driving force of economic growth, capital is gained through economy, natural resources are mutually replaceable and nature is free influenced modern economic ideas. New approaches replace the term “economic growth” with “sustainable development”.

Their difference is in the following: "Growth" relates to increasing the physical production frame (changes in size or number), while "sustainable development" refers to qualitative changes of physically unchanged economic systems. The main thought behind this approach is to create a new and effective way of distributing and using resources based on the principal that the use of natural resources must not reach above the regeneration limits (Radović, 2013).

Even though it seems like it, sustainability is not a final concept. Moreover, it is one goal of development. Supporting that are the facts that the EU mentions that the current economic structures need to change in order to secure the switch to a sustainable economy. The important efforts made in the last couple of years refer to define main elements, relations and approaches in the strategy of sustainable development, based on equal treatment of economic, ecological and social goals. The integral approach and treatment of mutual dependency of the mentioned factors can only exist if there is a balance of all three sustainability aspects in the developmental planning. A sustainable social community is therefore a community that secures the material and intellectual equality in one generation with the requirement that such a community can exist in future generations (Đurić, Stošić-Mihajlović, 2008).

The ecological aspect of the concept of sustainable development refers to the formula of strategies for maintaining ecological integrity. In other words, it refers to environmental protection and bases on three main factors:

1. **The relation to the use of final irrecoverable resources**. The use of irrecoverable resources should not exceed the development pace of an adequate replacement resource.
2. **The usage type of renewable resources.** The use of renewable resources must not exceed the capacity of their recovery. Many of these resources can recover within the limits of the ecosystems they originate from, like sources of drinking water, soil, forests, agriculture and animal fund.
3. **Maintaining emission frames within the limits of the absorption capacity of the environment.** The level of emitting gases, liquid and solid waste must be kept in the limits of the local ecosystem or the global ecosystem to absorb it. Otherwise, it disturbs the balance of energy and matter flow (Stošić-Mihajlović, Đurić, 2008b).

In Serbia, there is still no consensus about the choice for sustainable development. The tendency to align its own political, social and economic systems with the examples of the developed West in the transition process causes a dilemma in the formulation of ecological development strategies within the following models:

1. The model of economic development from the West must be repeated, based on the economic growth at the expense of environmental degradation.
2. Force economic priorities during transition and leave environmental protection for later.
3. Accept the strategy of environmental sustainable economic development immediately.

We should consider that a consequence of today's industrialization models in the West is the degradation and pollution of the environment due to the enormous consumption and exhaustion of natural resources. Developed countries in the West go through a phase of removing ecological hazards from the past. High prices for the recovery of damaged environments led to the opinion that it is cheaper to act preventively, develop ecologically qualitative technologies and use natural resources more rationally, together with a rational use of space (something the majority of countries did not manage adequately) (Stošić-Mihajlović, 2007).

Some transitional countries show the presence of the idea that economic and ecologic development goals need to be separated. This variant does not disregard the strategic goals of protection and improvement of the environment. Instead, it postpones the solutions for it for later, after a certain economic growth has been secured. Such an approach is not perspective at all, since new investments would not include environmental protection and calculate the cost for it. This would lead to great environmental damages and more expenses in the future (Stošić-Mihajlović, Đurić, 2008b).

Independent from the strategic choice, the cost of application must be paid through the cost of today's generation (including the transfer of the costs to future generations). Each of the mentioned alternatives

would have long-term consequences for national economy, the environment and the social status of citizens. The elements of sustainable development are included in the national investment plans, with defined goals of a rational organization and improvement of space within the capabilities and limits of the naturally created resources, aligned with the needs for long-term social and economic growth. To achieve the mentioned goals, there are definitions that include the following:

- Preventing further degradation of space and the endangerment and destruction of natural resources and goods.
- Equal spread of population, business and other activities, according to the needs of the proclaimed equal regional development of the country.
- Aligning the dynamics of de-agrarization, industrialization and urbanization.
- Environmental protection.

Environmental protection defines the following goals:

1. **Environmental quality of life.** This goal requires the following: Securing fresh air, enough drinking water, preserved arable land, ecosystems and biological diversity, healthy food, regulated settlements and living comfort at work and at home.
2. **Rational use of natural resources.** This goal is observed in the natural use of renewable and partially renewable resources, better use of resources and energy, reduction of waste and increasing recycling, safe deposits of all waste, sanitation of ecologic and space consequences from resource exploitation.
3. **Prevention of further environmental degradation**. Especially important in critically polluted urban and industrial centres and ecologically most valuable areas.
4. **Protection of natural areas, ambient and landscapes.**
5. **Support for educational programs in environmental protection** (Stošić-Mihajlović, 2007).

5. The Models of eco-management

The current approach of environmental protection did not deliver satisfying results in environmental improvement. Given that the use of soil and other natural resources have a strong connection to the condition of the environment, applying the criteria of environmental protection in planning of soil purpose, industrial activities, energy, tourism and other sectors should be the key factor for securing a higher quality of life. Hence, planning and especially the control of planned and improved documentation and activities should be the main thing for protecting and improving environment. In order to achieve this goal, it is necessary to develop and perfect instruments and methods for managing and protecting the environment in the process of planning and in the process of realizing plans. Actions include decision making, chose variants and aim towards effective choices (Stošić-Mihajlović, Đurić, 2008b).

Decision-making has following different models of classification:

- Open/closed models,
- Democratic/non-democratic,
- Rational/irrational,
- Effective/ineffective models.

The main goal is to present management as a regulated system with a known and determined order. Modelling is one of the ways of achieving the main goal. The priority is to create a rational and efficient model. Through modelling, the possibility of “deviation” from the prior determined order of priorities or unpredicted influences is included, since it is nearly impossible to create an ideal model (Radović, 2013).

The lack of a systematic method for managing the quality of the environment in eco-management is no coincidence, since each environment has its own characteristic complex natural structure and constructions. Hence, there is the variation of conditions and a stochastic protocol of natural and artificial processes in space and time (Stošić-Mihajlović, 2007).

A systematic approach for environmental management gains many interests, yet nobody has reached beyond the conceptual model, especially in regards to the complicity of environmental protection systems. This is why projecting models use combined techniques, such as:

- Conceptual models.
- Hierarchic modelling.
- Protocol diagrams.

Conceptual models are a short description for the observed part of the real world in text and picture. Such models simplify the communication between the participants in planning and decision making, since they include the main structure of the observed system, define model limits and create conditions for the further development of the model. One such conceptual model includes objects inside a system and their relations. Objects are mainly groups of separate entities with similar functional abilities. Objects have different functional ties pointing to the position of the object inside the system structure and the mutual influence of one object on another. The simplest conceptual model of a space with borders is theoretically possible with a black box model. This model aims to point at the basics of the concept and the management process of changes inside a space by using feedback between input and output system factors (Stošić-Mihajlović, Đurić, 2008b).

A projecting approach of the integral model bases on the fact that environmental transformation also involves the implementation of plans, generally depending on the following:

- Identification and analysis of the existent environment.
- Evaluation of ecological factors in planned activities and space processes.
- Means and measures for achieving protection policies and environmental improvement (Stošić-Mihajlović, 2007).

The ecological approach bases on the evaluation of the ecological capacity of space. This further requires large databases about the environmental condition, extraction of environmental indicators and, more recently, indicators of sustainable development. Especially important for environmental protection and preventive protection is the application of evaluation system for the influence of planned solutions for the environment. This allows the creation of a strategic form in order to create new conditions to align environmental protection plans on the national, regional and local level. Planned activities and actions in space could present sources of degradation and pollution of the physical parts of the environment, through changes such as energy, water, air consumption and material consumption. Disturbances in the physical environment reaching over the ecological capacities of space can cause negative consequences for people, ecosystems, natural and cultural goods. By connecting the mentioned relations between objects, we gain a wholesome flashback model for environmental management (Stošić-Mihajlović, Đurić, 2008b).

The planning process overlaps with the decision-making process. Additionally, without adequate informational system, the management process is unthinkable. Adequate decision-making based on reliable information is vital for the management process. By applying transparency, it is possible to achieve a higher level of openness and democracy of the chosen model. Internet presence with basic information, public procurement for choosing a supplier, precise and clear formulation of contract duties between the supplier and the supplied party are just the first step in a new organization system of sustainable development planning of cities (Radović, 2013).

6. Conclusion

Problems in urban development and environmental protection in Serbia have been very clear. Mainly, this is due to the dramatic political and social changes, deepening of socio-economic crisis and a large number of migrations. Limits to real development strategies (in long-terms), in regards to efficient and rational planning, using, organizing and regulating are a large insufficiency, given that nothing is happening within a space without the space itself interfering with socio-economic development processes. Since planning is a valuable factor in managing environmental changes, it is necessary to create a frame for the formulation of eco-management strategies under new and variable conditions. Additionally, we suggest an environmental managing approach in planning, securing complex solutions of environmental problems and flexibility in decision-making. Furthermore, this would enable combining preventive and sanitation measures by choosing adequate methods and instruments to be applied on different planning levels.

Strategic eco-management planning possesses the necessary integrative potentials for managing environmental changes, long-term time horizons and positions of catalysts for merging sector development policies and strategies. When the concept of sustainable development is accepted on the global level (under modern conditions), strategic planning in eco-management becomes even more important, since it is clear that the conditions of current forms of critical destinations for expenses of economic and social development and for expenses for securing higher quality of life.

The socio economic situation and the relation to the environment in our country (Serbia) hints that the country now lacks many predispositions for the goals of general urban planning. Yet, disregarding the limits, and regarding the fact that planning is a key factor in sustainable management of environmental changes, we suggested frames for formulating strategies of environmental management.

The strategies of eco management in sustainable development planning of urban environment bases on the following:

- Protection of natural and cultural values (absolute priority).
- Rational use of soil, water, energy and natural resources as a whole.
- Rational use of prevention principles for activities that could put the environment at risk or cause environmental damage.
- As a better and more elegant variant in solving ecological perplexities, we suggest the "prediction and prevention" method rather than the "reaction and restoration" method.
- Securing aligned policies and strategies of environmental protection and a higher public participation in decision making about urban and space planning development.

A new approach secures a higher flexibility in decision making, since the ecological and technical factors largely consider socio-economic questions, and therefore, through a consensus of interested parties, the interests of the state, investors, local communities and citizens will align.

References

1. Đurić, S., Stošić-Mihajlović, Lj., "*Management systems for increasing energetic efficiency"*, monograph, Sustainable space development of cities, IAUS, Belgrade, 2008., 273-783
2. Đukanović, M., *"The Environment and sustainable Development"***,** Elit, Belgrade, 1996., 172
3. Lješević, M., "*Determining sustainability indicators in cities"*, monograph, Development strategies and orderly settlements in new conditions, UUS, Belgrade, 1998. 235-248.
4. Mihajlović, P., Đurić, S., Stošić-Mihajlović, Lj., "*Managing existing alternative energetic resources in an urban environment"***,** monograph, Sustainable space development in cities, IAUS, Belgrade, 2008., 172-190.
5. O' Riordan, T., "*Environmental Science for Environmental Management"***,** Longman Group, Singapore. 1995.
6. Stošić-Mihajlović, Lj., "*Strategic aspects of economic, ecological and space development and investments"*, monograph, Industrial management and development, FIM, Kruševac, 2007., 125-142.
7. Stošić-Mihajlović, Lj., "*Strategies for local economic development"***,** monograph, Industrial management and development, FIM, Kruševac, 2007., 157-189.
8. Stošić-Mihajlović, Lj., Đurić, S., "*Economic sustainability of space planning in Serbia"*, monograph, Sustainable space planning in cities, IAUS, Belgrade, 2008.
9. Stošić-Mihajlović, Lj., Đurić, S., "*Cost and profit analysis in economical problematics of managing industrial waste, strategies of local economic development"***,** monograph, Sustainable space planning in cities, IAUS, Belgrade, 2008.
10. Radovic, Vesela, Environmental Security, EDUCONS UNIVERZITET, Novi Sad 2013.god
11. Filipović, D. (2000): *Pollution modelling of city environments – monitoring and prevention*, monograph, Andrejević foundation, Belgrade.

Original Scientific Paper/Originalni naučni rad UDC/UDK 005.6:378(497.11)
Paper Accepted/Rad prihvaćen: 15. 11. 2018.
doi:10.5937/SJEM1901035I

Inženjering modela izvrsnosti na visokoškolskim ustanovama na osnovu Boldridžovih kriterijuma i Hošin Kanri principa

Damir Ilić[2], Tatjana Ilić-Kosanović[2]

[1]Univerzitet "Union-Nikola Tesla", Fakultet za inženjerski menadžment, Bulevar Vojvode Mišića 43, damir.ilic@fim.rs
[2]Univerzitet "Union-Nikola Tesla", Fakultet za inženjerski menadžment, Bulevar Vojvode Mišića 43, tatjana.ikosanovic@fim.rs

Apstrakt: Koncept ukupnog upravljanja kvalitetom (TQM) uspešno je primenjivan u industriji od sredine 20. veka. Jedna od najčešće korišćenih metoda poboljšanja kvaliteta u visokom obrazovanju u poslednje dve decenije je TQM, a jedna od često implementiranih metoda inženjeringa izvrsnosti zasniva se na Boldridžovih kriterijumima i Hošin Kanri principima. Rad istražuje postojeću literaturu na temu primene Boldridžovih kriterijuma i Hošin Kanri principa u visokoškolskim ustanovama, analizira percepciju visokoškolskog osoblja (nastavnog i administrativnog) o Boldridžovim kriterijumima i Hošin Kanri principima na Fakultetu za inženjerski menadžment (Republika Srbija) i razvija model izvrsnosti za institucije visokog obrazovanja na primeru Fakulteta za inženjerski menadžment.

Ključne reči: Visokoškolske ustanove, inženjering modela izvrsnosti, Boldridžovi kriterijumi, Hošin Kanri principi.

Engineering an excellence model in higher education based on Baldrige criteria and Hoshin Kanri principles

Abstract: Total quality management (TQM) concept has been successfully applied to the industry since the mid 20th century. One of the used methods of quality improvement in higher education during the last two decades has been the TQM, and one of the often implemented methods of engineering excellence is based on Baldrige criteria and Hoshin Kanri principles. The paper explores the existent literature on the topic of implementing Baldridge criteria and Hoshin Kanri principles in higher education institutions, analyzes perception of the higher education staff (teaching and administrative) at the School of Engineering (Republic of Serbia) on the Baldridge criteria and Hoshin Kanri principles and develops a model of excellence for the higher education institutions on the example of the School of Engineering Management.

Key words: Higher education institutions, engineering the model of excellence, Baldrige criteria, Hoshin Kanri principles.

Introduction

Total quality management (TQM) concept has been successfully applied to the industry since the mid 20th century. The question whether the success achieved by TQM in the industry, and especially in the health sector, could be successfully applied (with the different approach) in the other fields, such as culture or education has emerged. When it comes to education, Helms and Key have come to the conclusion that the values that TQM carries with them have greater compatibility and usability in the field of higher education than in many other systems (Saraiva and Reis, 2006). Higher education in the conditions of globalization is under great pressure to show significant progress and continuous improvement in terms of quality and to somehow reduce the apparent gap between the expectations and what higher education really provides for the students, parents, employers, and legislators (Pariseau and

McDaniel, 1997). There is also a pressure on higher education institutions to create new generations of educated workforce that will meet the needs of the increasingly dynamic world economy, but also to attract the best talent because employees in teaching, scientific, and administrative positions are the key value of any higher education institution (Mazais et al., 2012). One of the used methods of quality improvement in higher education during the last two decades has been the TQM, and one of the often implemented methods of engineering excellence is based on Baldrige criteria and Hoshin Kanri principles (Quinn, et al., 2009; Menezes et al., 2018), even though the universities' administration have been sceptic about the implementation of management tools in education (Cruickshank, 2003).

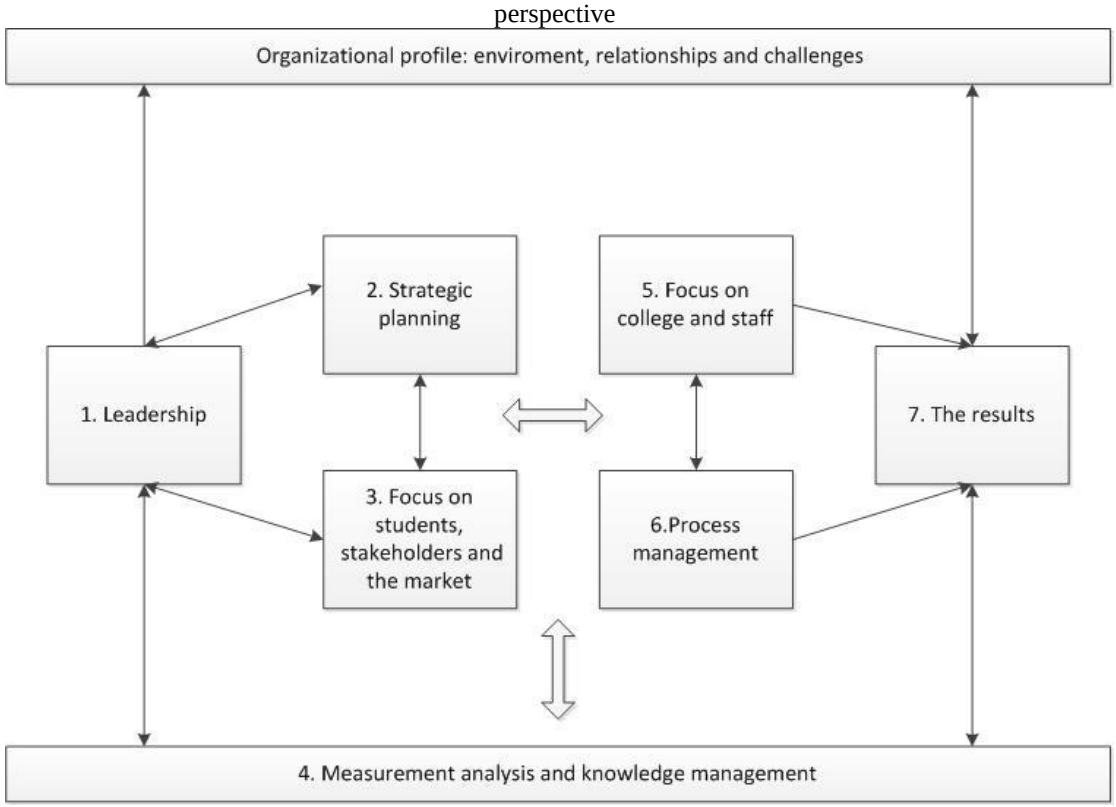
The goal of this paper is to analyze existent literature on the topic of implementing Baldridge Criteria and Hoshin Kanri principles in higher education institutions, analyze the perception of the higher education staff (teaching and administrative) on the Baldridge Criteria and Hoshin Kanri principles at the School of Engineering (Republic of Serbia) and to develop a model of excellence for the higher education institutions on the example of the School of Engineering Management.

1. Baldrige Criteria and Hoshin Kanri principles in higher education – Literature review

Baldridge criteria

The Malcolm Baldrige Award is a prestigious award for quality established by the US Congress in 1987 and has been awarded for the annual contribution regarding quality made in manufacturing, services, small entrepreneurship, and the non-profit sector (Karathanos and Karathanos, 2005; Ziegler, 2005). In the period from 1994 to 1995 Baldrige's team have started pilot criteria for education (Karathanos, 1999) and in 1995 the National Institute of Standards and Technology (NIS) has adapted the criteria for quality in business so that they can be used in education and health (Moore, 1996). In Figure 1, Baldrige's educational criteria for implementing a framework of excellence are presented.

Figure 1. Baldrige's educational criteria for implementing a framework of excellence: Systems perspective



Source: Baldrige National Quality Program, 2006

Malcolm Baldrige criteria in the field of education are based on the following values:

1. **Visionary leadership** - The management of an educational institution must create a climate-oriented learning environment, with a focus on the student. Leadership is expected to encourage readiness, learning, and creativity among staff, who are expected to be committed and willing to contribute to the goal;
2. **Learning-oriented education** - In the focus of the educational process, the student's real needs must be met. Learning-oriented education is influenced by the market circumstances and society's needs (technological development);
3. **Organizational and personal learning** - The need for permanent education and training of individuals in an educational institution would contribute not only to better educational programs and services provided by the institution, but also to a more efficient way in responding to the needs of the students, markets, and financiers;
4. **Evaluation of staff, faculties and business partners** - Educational institutions must create conditions for internal (staff, trade unions, etc.) and external partnerships (other educational institutions, suppliers, communities, etc.) in order to achieve their goals;
5. **Agility** - Developing mechanisms to quickly and efficiently meet the demands of the students and stakeholders;
6. **Focus on the future** - Creating short-term and long-term plans to make it clearer to all those factors that may have an impact on the organization or the market within which educational institutions function;
7. **Innovation management** - Innovation must become part of the educational culture and is very important for improving the educational and operational process within the institution;
8. **Facts-based management** -The educational institution should pay attention to measuring and analyzing its achievements, which directly influences the improvement of the decision-making process and the development of the educational process;
9. **Social Responsibility** - The goal for an institution is to show that it is the responsible factor of the society in which it operates and that it strictly abides laws and regulations and that it is necessary to support socially useful goals; (improvement of knowledge within the local community, socially useful work, etc.);
10. **Focus on results and value creation** - Results must be directed towards achieving value for the students and stakeholders;
11. **Systemic perspective** - The management of an educational institution must direct decision-making by taking into account the needs of the students and stakeholders. It is necessary to link strategies with the key processes that add value to the students and stakeholders (Kedem and Benshalom, 2014).

Over the years, the quality-setting framework has been changed and adapted. The author Brent Ruben has distinguished seven basic areas that define excellence in higher education:

1. Leadership;
2. Plans and goals;
3. Users;
4. Programs and services;
5. Faculty, staff, and workplace;
6. Evaluation and use of information;
7. Outcomes and Achievements (Ruben, 2006; Brusoni, et al., 2014).

By further developing the Baldrige framework for excellence, Rutgers University has come to the next model of excellence in higher education:

1. A sense of mission and vision that is generally acceptable, understandable and appreciated;
2. Strategic planning, prioritizing, and setting goals in order to pursue a meaningful transformation of predispositions into specific programs, services, and activities with the efficient and effective use of operations and resources;
3. Leadership and effective governance at all levels, taking into account mechanisms that give us feedback and criticism;
4. High quality programs and services that are carefully designed, regularly evaluated and continuously improved in accordance with established goals;
5. Gather information concerning the needs, expectations and experiences of key stakeholders with the aim of incorporating into programs and services, evaluations, promotion programs and making daily key decisions;

6. A satisfactory working environment with qualified and dedicated staff and faculty who believe that evaluations and improvements are key priorities;
7. Comparison with other institutions and leaders for evaluation and improvement process (Brusoni, et al., 2014; Ruben, 2006).

The Baldrige criteria have been implemented in the late 1990's and early 2000's in various US and international higher education institutions (Brusoni, et al., 2014; Grant, et al., 2004). The main focal points of implementing Baldrige criteria in higher education institutions are linking accreditation standards and Baldrige criteria (Ruben, 2007), enhancing the students learning through information technologies (Beard and, Humphrey, 2014).

Hoshin Kanri modelling

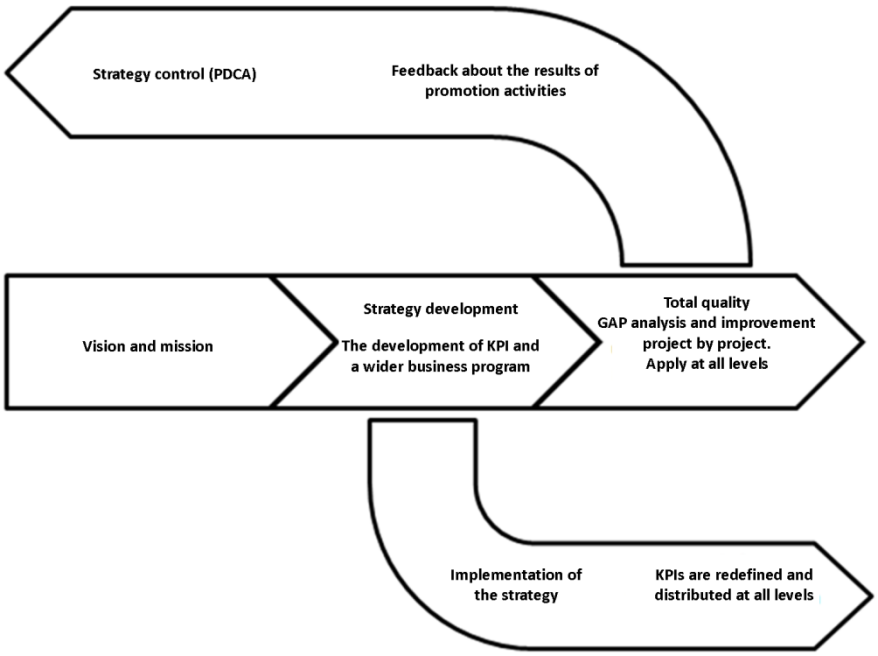
Hoshin Kanri is a Japanese managerial expression that can't be literally translated into English or any other language. The term consists of four basic elements: Ho - direction, Shin - focus, Kan - alignment, and Ri - reason. The phrase includes four elements of business management:

1. Vision;
2. Strategy development;
3. Implementation of the strategy;
4. Control of the strategy.

It should be noted that there is a connection with the fifth element that implies TQM, which represents a mean for the realization of Hoshin Kanri elements. In Figure 2, the elements of the Hoshin Kanri model are shown with the emphasis on the following categories:

1. The goals and future scope of the organization are derived from the vision;
2. It is necessary to develop a strategy and key performance indicators (KPIs);
3. The implementation of objectives must be carried out at all levels (this implies creating a strategy at each level);
4. There must be a feedback in terms of the results to complete the Plan - Do - Check - Act or PDCA cycle.
5. There are no values without TQM switching, which includes the "Do" segment of the PDCA cycle

Figure 2. The elements of Hoshin Kanri model



Source: Hutchins, 2008

Hoshin Kanri model is focused on planning and process with an emphasized need for communication and with the absolute absence of an assessment of the results of the work. The emphasis is on motivation, not on structural compliance that results in reward or penalty (McCulloch, 1993; Roberts and Tennant, 2003).

Oregon State University has developed its own model that combines Hoshin Kanri's model of planning and Baldrige's rewarding criteria. The TQM model based on these criteria consists of the following steps:

1. Define the consumer;
2. Define vision and mission;
3. Tackle fear;
4. Develop pilot teams;
5. Training;
6. Develop criteria for measurement;
7. Recognize and reward success;
8. Work continuously on improvement (Michael et al., 1997).

One of the main questions of studying the implementation of TQM methods including the Badrige criteria and Hoshin Kanri principles has been whether those criteria and principles, and the TQM itself, are still applicable to the higher education institutions in the second decade of the 21st century.

2. The scope of study and data collection

Objectives

The goal of the empirical part of the paper is to analyze the perception of the higher education staff (teaching and administrative) at the School of Engineering Management (Republic of Serbia) on the key elements of excellence in higher education based on Baldridge Criteria and Hoshin Kanri principles. The data has been collected in September 2018 through in person semi-structured interviews and the answers have been transcribed by the authors.

Survey design

The interviewees have been given the main Baldrige criteria and Hoshin Kanri principles and have been asked to identify the main focal point regarding quality for higher education institutions. The questions have been stated as follows:

1. Identify the main decisive factors for excellence in higher education institutions among Baldrige criteria;
2. Identify the main values for excellence in higher education institutions among Hoshin Kanri principles.

The participants have also been able to give additional comments on the approaches of achieving excellence in higher education institutions and the main stakeholders.

Description of the sample

For the purpose of this study fifteen professors in different fields, social sciences and STEM - (science, technology, engineering, and maths), and five administrative staff have been interviewed. The interviewees have been from the fields of social sciences and STEM, and the administrative staff from different departments (students' services, legal office, financial office), with various higher education experience.

Two full professors, eight associate professors, five assistant professors, one students' services manager and two students' services officers, one financial manager, and one legal manager have been interviewed. Among the teachers, ten of them were from the field of social science and five from STEM sciences. All of the interviewees have had various higher education experiences. The data on the demography of the sample are given at Table 1.

Table 1. Demographic variables

Code Name	Field or sector	Position	Higher education experience (years)
P1	Social Sciences	Assistant professor	6-10
P2	STEM	Full professor	16-20
P3	STEM	Associate professor	6-10
P4	Social Sciences	Associate professor	11-15
P5	Social Sciences	Assistant professor	<5
P6	Social Sciences	Assistant professor	<5
P7	Social Sciences	Associate professor	6-10
P8	STEM	Associate professor	11-15
P9	Social Sciences	Full professor	>20
P10	Social Sciences	Associate professor	6-10
P11	Social Sciences	Assistant professor	<5
P12	Social Sciences	Associate professor	11-15
P13	STEM	Associate professor	<5
P14	Social Sciences	Assistant professor	<5
P15	STEM	Associate professor	6-10
P16	Administration	Legal Manager	11-15
P17	Administration	Students' services manager	11-15
P18	Administration	Financial officer	6-10
P19	Administration	Students' services officer	<5
P20	Administration	Students' services officer	<5

3. Results

The participants have identified developing the mission, vision, and strategy of an organization as the crucial factor of engineering a model of excellence based on Baldrige criteria and Hoshin Kanri principles. The question of defining the students as the consumers have remained open, because of the dilemma should only the students be identified as the consumers, or that it should be wider community. The participants have also stated the implementation of the strategy and building and education of quality teams, consisting not only of the management and the staff (teaching and non teaching), but of the students, employers, legislators, community representatives as well. Also, the participants identified evaluation of the quality processes and the detection of the possible weak points requesting the immediate action as important elements of the commitment to quality.

The participants have recognized the importance of Baldrige criteria and Hoshin Kanri principles in achieving organizational success, especially regarding higher education institutions, and have identified the students, staff, and the wider community (employers, parents, local government, etc.) as the key stakeholders in higher education. Among the community stakeholders, the employers play one of the most important roles.

As it has been previously said, the crucial starting point for building the quality in higher education is the process of generating a mission, vision, and strategy of an institution. Higher education institutions management (rectors, deans, vice deans) has been recognized as the key factor in developing mission, vision, and the strategy of an institution. The first leaderships' goal is to set suitable strategy and to create SMART (specific, measurable, achievable, realistic, and time bound) goals. They are also the main controlling factor in strategy implementation. They are seen as the leaders whose main role is the motivation of the employees (either teaching or non teaching) for creating organizational excellence. The department heads are seen as the crucial factor in diffusion and implementation of the organizational goals. The teachers have been acknowledged as the crucial factor in creating appropriate curricula based on the strategy and the institution's goals.

Administrative staff has been established as the key factor for creating suitable services assisting the students in achieving their educational goals, but also supporting the teachers in their mission of transferring knowledge to the students and building the students' skills and abilities.

The quality teams have been accentuated as essential elements of higher education institutions' quality and strategic goals development, consisting of the teachers, administrative staff, the students, and

community representatives (employers, etc.). They are also essential for strategy implementation and evaluation.

The question of the methods in awarding the quality initiatives has remained open.

4. The model of excellence based on Baldrige criteria and Hoshin Kanri principles engineered for the School of Engineering Management

In the Republic of Serbia the starting point in developing and implementing a model of excellence for a higher education institution are the standards established by the National Entity for Accreditation and Quality Assurance in Higher Education of Serbia – NEAQA (previously Commission for Accreditation and Quality Assurance – CAQA).

According to Baldrige criteria and Hoshin Kanri principles, the requirements for higher education institutions accreditation, and the results of the interviews with the employees in teaching and administrative positions at the School of Engineering Management, the model of excellence for the higher education institutions on the example of the School of Engineering Management has been developed.

The basis for the model is creation of the mission and the vision of a higher education institution by the managers (rectors, deans, vice deans), upon which the strategy is developed and the organizational goals are set. The leaders of a higher education institution should build staff (both teaching and non teaching) commitment in order for the higher education institution to be able to comply with the set quality standards and for the gathering of all levels of employees for developing the commitment of other stakeholders (the students, parents, employers, legislators, community, etc.).

For the implementation of quality strategies all levels of employees are important, including the students and other stakeholders, especially the employers, legislators, and the community. The management should periodically evaluate the implementation of the strategy, revise basic quality principles if necessary, and suggest changes and the improvements of the implementation process. Successful quality initiatives should be rewarded regardless the "owners" of the proposed initiatives; also stakeholders involved in the implementation of quality initiatives should be rewarded.

Figure 3. Proposed model of excellence for higher education institutions

Source: Authors

5. Discussion

According to Bax, Coate has defined at least six strategies applied by higher education institutions to the TQM implementation process in higher education:

1. Elementary TQM approach (use of key elements of quality management);
2. Guru's approach (application of eminent experts in the field of quality);
3. Japanese model approach (studies analyzing the ranks of Japanese winners of the prestigious "Deming Award");
4. Model of industrial enterprises (adjusted to the achievements of companies that have successfully implemented TQM);
5. Hoshin's approach to planning (focus on successful planning, development, execution and monthly analysis);
6. Access planning based on the Baldrige award (identifying areas for successful application of improvement) (Bax, 1994).

Quality processes based on the Baldrige award and Hosihn Kanri principles have been implemented in various higher education institutions in different countries and national cultures. As the quality processes are the key elements in meeting the expectations of the students, parents, employers, and legislators (Pariseau and McDaniel, 1997), the goal of this research has been to analyze the perception of the higher education staff (teaching and administrative) at the School of Engineering Management (Republic of Serbia) on the key elements of excellence in higher education based on Baldridge criteria and Hoshin Kanri principles. The interviewees have recognized the significance of Baldrige criteria and Hoshin Kanri principles and indentified creating mission and vision as the first step in achieving the excellence of the higher education institutions.

The proposed model of excellence is in line with the quality model the Rutgers University implemented on Baldrige criteria (Brusoni, et al., 2014; Ruben, 2006), and with the quality model the Oregon State University has developed, that combines Hoshin Kanri's model of planning and Baldrige's rewarding criteria, (Michael et al., 1997).

The main focal points of implementing Baldrige criteria in higher education institutions are linking accreditation standards and Baldrige criteria (Ruben, 2007), which is also recognized by European Association for Quality Assurance in Higher Education - ENQA (Brusoni, et al., 2014), which has the significance for the building the quality of the higher education in the Republic of Serbia through the National Entity for Accreditation and Quality Assurance in Higher Education of Serbia – NEAQA. From 2006 to 2018, the quality in the higher education in the Republic of Serbia has been standardized through Commission for Accreditation and Quality Assurance – CAQA, which was formed as the body of the National Council for Higher Education.

6. Limitations and scope for further research

Like most studies, this research study has its limitations. The sample size is rather small and the topic requires wider sample and implementation of various statistical methods. Further research is needed in order to additionally explore on a wider sample the perception of the higher education staff (both teaching and non-teaching) on the key elements of excellence in higher education based on Baldridge Criteria and Hoshin Kanri principles.

7. Conclusion

The values of TQM still carry with them greater compatibility and usability in the field of higher education as many other systems of quality assurance. Some of the used methods of quality improvement in higher education have been the methods of excellence engineering based on Baldrige criteria and Hoshin Kanri principles.

According to the literature review and the results of the interviews with the employees in teaching and administrative positions at the School of Engineering Management, the model of excellence for the higher education institutions on the example of the School of Engineering Management has been developed consisting of the key elements such as mission, vision, strategy development, stakeholders commitment, implementation, evaluation, and awarding successful quality initiatives.

As the main focal points of implementing Baldrige criteria in higher education institutions are linking accreditation standards and Baldrige criteria, it can be concluded that the implantation of TQM methods including the Baldrige criteria and Hoshin Kanri principles are still applicable to the higher education institutions.

Literature

1. Baldrige National Quality Program. (2006). *Education Criteria for Performance Excellence*. Baldrige National Quality Program 5. Retrieved August 2, 2017. from http://www3.uma.pt/jcmarques/docs/info/2006_Education_Criteria.pdf
2. Bax, R. M. (1994) An Assessment of the Quality Improvement Climate as Perceived by Community College Leadership in Iowa, Iowa State University, Ames, Ann Arbor, MI, USA, p.33-35.
3. Beard, D. F., Humphrey, R. L. (2014). Alignment of University Information Technology Resources with the Malcolm Baldrige Results Criteria for Performance Excellence in Education: A Balanced Scorecard Approach. *Journal of Education for Business*, 89(7), pp. 382–388.
4. Brusoni, M. et al. (2014). The Concept Of Excellence In Higher Education, European Association for Quality Assurance in Higher Education AISBL 2014, Brussels, Belgium, p.11.
5. Cruickshank, M. (2003) 'Total Quality Management in the higher education sector: a literature review from an international and Australian perspective', *Total Quality Management & Business Excellence*, 14(10), p. 1159. doi: 10.1080/1478336032000107717.
6. Grant, D., Mergen, E. and Widrick, S. (2004). A Comparative Analysis of Quality Management in US and International Universities, *Total Quality Management & Business Excellence*, 15(4), pp. 423–438. doi: 10.1080/1478336042000183613.
7. Hutchins, D. (2008). The Strategic Approach to Continuous Improvement, Gower, Hampshire, England, UK, pp. 2-3.
8. Karathanos, D. (1999). Quality: Is Education Keeping Pace With Business? *Journal of Education for Business*, 74(4), p. 231. doi: 10.1080/08832329909601690.
9. Karathanos, D. and Karathanos, P. (2005). Applying the Balanced Scorecard to Education, *Journal of Education for Business*, 80(4), pp. 222–230. doi: 10.3200/JOEB.80.4.222-230.
10. Kedem, Y., Benshalom, E. (2014). Quality Management In Institutes Of Higher Education: The Baldrige Model, *Journal of International Scientific Publications, Volume 12*, pp. 179-183.
11. Mazais, J., Lapiņa, I. and Liepiņa, R. (2012). Process Management for Quality Assurance: Case of Universities. *Proceedings of the European Conference on Management, Leadership & Governance*, pp. 522–530. Available at: http://search.ebscohost.com/login.aspx?direct=true&db=bsu&AN=97820906&site=ehost-live (Accessed: 3 December 2018).
12. McCulloch, M. (1993). Total Quality Management: It's Relevance for Higher Education. *Quality Assurance in Education, Vol. 1, Issue 2*, p. 8.
13. Menezes, P. H. B., Martins, H. C., Oliveira, R. R. (2018). The Excellence Baldrige Criteria in the Effectiveness of Higher Education Institutions Management, *Brazilian Business Review (Portuguese Edition)*, 15(1), pp. 47–67.
14. Michael, R. K., Sower, W. E., Motwani, J. (1997). A Comprehensive Model for Implementing *Total Quality Management in Higher Education, Benchmarking for Quality Management & Technology, Vol. 4 Issue 2.* pp. 114 - 117.
15. Moore, N. (1996). *Using the Malcolm Baldrige Criteria to Improve Quality in Higher Education.* May 96 Forum of Association of Institutional Research. Albuquerque, NM. USA. p. 4.
16. Pariseau, S. E., McDaniel., J. R. (1997). Assessing Service Quality in Schools of Business, Journal of Quality & Reliability Management, Vol. 14, Issue 3 204.
17. Quinn, et al. (2009). Service Quality in Higher Education, *Total Quality Management, Vol. 20, No. 2.* p. 139.
18. Roberts P., Tennant, C. (2003). Application of the Hoshin Kanri methodology at a higher education establishment in the UK, *TQM Magazine*, 15(2), pp. 82–87. doi: 10.1108/09544780310461080.
19. Ruben, B. D. (2006). Departmental Effectiveness What Is It? Why Is It Important? How Can It Be Achieved? *Effective Practices for Academic Leaders, Vol. 1, Issue 12.*

20. Ruben, B. D. (2007). Higher education assessment: Linking accreditation standards and the Malcolm Baldrige criteria. *New Directions for Higher Education*, 2007(137), pp. 59–83.
21. Saraiva, M., Reis, E. (2006). *The Paradigm of the Total Quality Management in the Portuguese Higher Education.* International Conference on Quality Assurance in Higher education: Mission (Im)possible? 1. p. 2.
22. Ziegler, M. (2005). It Opens Your Eyes: Transforming Management of Adult Education Programs Using the Baldrige Education Criteria for Performance Excellence. *Adult Basic Education*, 15(3), pp. 169–186. Available at: http://search.ebscohost.com/login.aspx?direct=true&db=a9h&AN=19162662&site=ehost-live (Accessed: 29 December 2018).

Original Scientific Paper/Originalni naučni rad UDC/UDK 005.6:378(497.11)
Paper Accepted/Rad prihvaćen: 10. 12. 2018.
doi:10.5937/SJEM1901045B

Analiza trenda "out-of-pocket" zdravstvenih troškova u Republici Srbiji

Stanko Bulajić[1], Dejan Gojković[2],

[1]Univerzitet "Union-Nikola Tesla", Fakultet za inženjerski menadžment, Bulevar Vojvode Mišića 43, stanko.bulajic@fim.rs
[2]Srednja stručna škola Ivan Uskoković, Podgorica, Crna Gora

Rezime. U radu je data analiza zdravstvenih troškova, koje stanovništvo Srbije izdvaja iz sopstvenih sredstava, koristeći standardne ekonomske indikatore. Takva vrsta troškova se naziva i "troškovi iz džepa" (eng. Out-Of-Pocket Expenditure - OOPS). Svrha ove studije je da pokaže nivo finansijskog opterećenja građana kao i do koje mere su OOPS uticali na korišćenje zdravstvene zaštite. Posmatrane teme uključuju OOPS kao procenta ukupnog troška za zdravstvo i procenat privatnog troška na zdravstvo bazirano na podacima Svetske zdravstvene organizacije. Dobijeni rezultati ukazuju da postoji opšti trend rasta OOPS-a u svim posmatranim slučajevima.

Ključne reči: troškovi iz džepa; zdravstvene usluge; potrošnja domaćinstva; analiza trenda.

Trend analysis of out-of-pocket health expenditures in the Republic of Serbia

Abstract. In the paper is given a trend analysis of out-of-pocket health expenditures in Serbia with using standard economic statistical indicators. The purpose of the study is to show the extent to which out-of-pocket health expenditures have influenced the general access to medical services. Examined topics cover out-of-pocket expenditure, as percentage of total health expenditure and as percentage of private health expenditure based on World Health Organisation data sets. Obtained results indicate that that there is an overall growing trend in out-of-pocket expenditure in both governmental and private sectors.

Keywords: out-of-pocket health expenditure; health services; household expenditure; trend analysis.

1. Introduction

In the health care financing sector out-of-pocket health expenditures relate to the share of expenses which are paid by the individual directly to the health care provider and are not covered by medical insurance. These costs include participation, self-medication and other expenditure paid directly by private households. Costs of out-of-pocket can inflict a heavy burden to households and limit their access to medical care or in many cases prolong it. Governmental support in healthcare insurance can dramatically reduce these costs or introduce measures to lower these costs for low income households or even introduce exemptions for special cases like large families or single employed parent. Obligations of out-of-pocket health expenditures can be measured either by its share of total household income or its share of total household consumption (OECD 2011).

Available literature covers various aspects of shared health expenditure. Papers by (Habib, et al., 2016; Alsan, et al., 2015; Yogo, 2016) cover the topics of health expenditures in low-income and developing countries. Among a considerable number of out-of-pocket health expenditures research by country we can list most notable: rural-urban differences in out-of-pocket health expenditures in China (Wang, et al., 2016; Kumar et al., 2015), universal healthcare coverage in India (Kumar, et al., 2015; Sing et al., 2016), out-of-pocket payments Austria (Sanwald and Theurl, 2015), national health insurance scheme in Ghana (Kusi, et al., 2015), heterogeneity of public health insurance in Mexico (Grogger et al., 2015), out-of-pocket health expenditures in Iran (Ghiasvand, et al., 2015), medical insurance for poor in Georgia (Gotsadze, et al., 2015), consequences of high health expenditures in Korea (Choi, et al.,

2015), health expenditures in Eastern Mediterranean countries (Kazemi Karyani, et al., 2015), community based health insurance in Ethiopia (Yilma, et al., 2015), health and poverty nexus in Senegal (Sene and Cisse, 2015), out-of-pocket health expenditure in Colombia (Prada, et al., 2015) and burden of household health expenses in Vietnam (Mitra, et al., 2016).

2. Data and methods

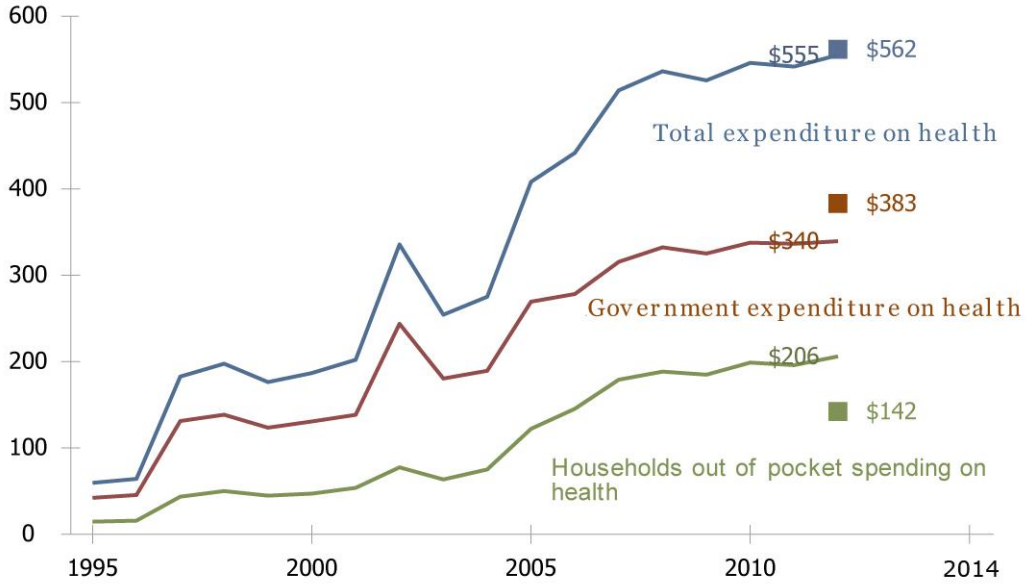
Data used in analysis originate from World Health Organization (WHO) Global Health Expenditure Data Base (GHED) (WHO, 2016.). The WHO GHED is a freely accessible database which collects data from all member states. Data collection begun as early as 1997 with efforts to cover all health related data from 1995 to present minus two years of lag which is needed for most accurate calculations and representation. Available data cover a wide variety of health related topics including expenditure on an accumulation basis, including current health spending as well as spending on capital development.

For analysis and graphical presentation of the results, the standard methods of statistical and regression analysis were used presented in paper by (Dasic, 2012). Analysis is performed using standard economic statistical indicators: Annual Growth (AG), Chain Index (CI), Average Growth Rate (AGR) and Cumulative Growth Index (CGI). Examined topics cover indicators: out-of-pocket expenditure, as percentage of total health expenditure and as percentage of private health expenditure based on World Health Organisation data sets. These are considered as the core indicators of health financing systems which facilitate better understanding of the relative weight of direct payments by households in total health expenditures. These values are essential for estimating stable and welfare economics of a country which can be used for expenditure planning. Higher values indicate an economic or uncontrolled overspending on healthcare services.

3. Statistical profile of medical expenditure of the Republic of Serbia's

According to WHO report on WHO Global Health Expenditure Atlas (Dasic, et al., 2013) Serbia belongs to mid income countries with 5.360 USD per capita compared to European up-mid income countries whose average is $9,333 per capita. Serbia spent 4 billion US dollars (562 USD per capita) on health care of which 37% was spent by households, and 61% by the government. Compared to other up-mid European countries of the region Serbia's government is spending is high as a 48% of GDP on health, share of government spending allocated to health is also high and amounts to 13%. On Figure 1 is given a graphical representation of total expenditure on health along with household and government spending.

Figure 1: Per capita expenditure in US$ (constant 2012 US$) (WHO)



4. Results and discussion

4.1. Out-of-pocket expenditure

Table 1 shows out-of-pocket expenditure for the period of 1995-2014 in million of current US dollars, with calculated values for annual growth (AG), chain index (CI) in [%], annual growth rate (AGR) in [%] and cumulative growth index (CGI) in [%]. World Health organisation defines out-of-pocket expenditure as the expenditure on health by households as direct payments to health care providers (WHO, 2016). These expenses are not covered by health insurance plans or in some countries are partially covered in special cases. Household can be considered as a single person or a group of individuals who collectively hold all income and distribute it on specific types of housing goods and services. From Table 1 and Fig. 2 can be noticed that the out-of-pocket expenditure for the period 1995-2014 in million USD had a variable trend over the observed period. Highest increase in out-of-pocket expenditure was by 501 mill. USD in 2007 year, while the highest decrease was by 252 mill. USD in 2009.

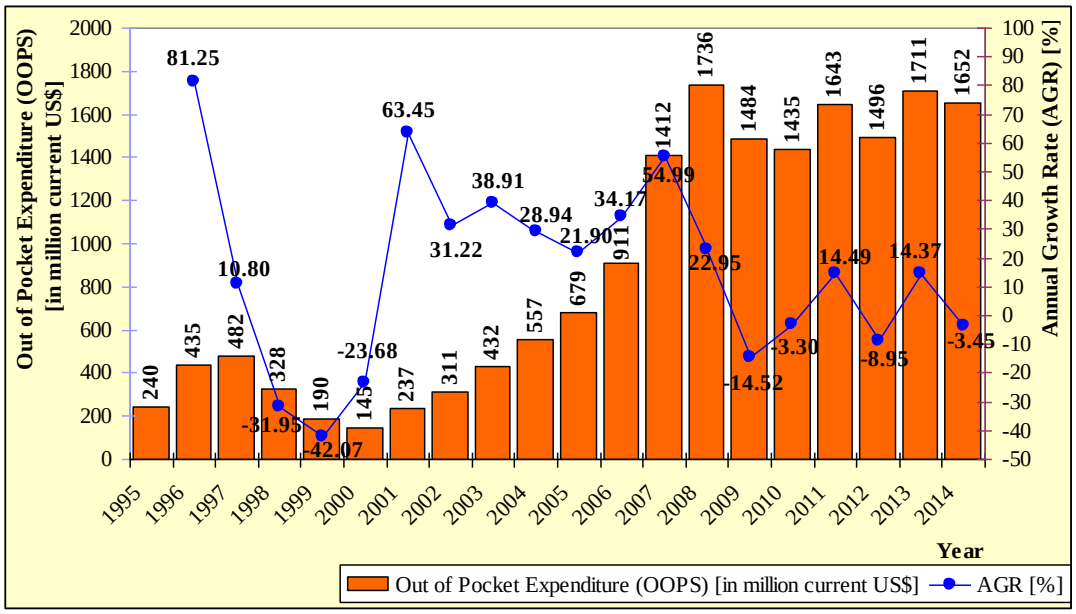
Average annual growth rate (AGR) has increased by 81.25% in 1996 year compared to the beginning of the observed period from further on begins to plummet reaching a historical minimum of -42.07% in 1999 year. This can be partially explained by unstable economic and political situation in the country for that period. This had a consequence that the general population avoided making non-urgent hospital and treatment costs resorting to house treatments. The smallest variation of AGR was recorded in 2010 year having only 3.3% decrease compared to previous year. It is noticeable that the trend of Cumulative Growth Index (CGI) shows significant increase compared to referent year (1995) with 712.92% of growth in 2013 year with 1.711 mill USD expenditure, having its minimum in 2000 year due to already mention reasons.

Table 1: Annual growth out-of-pocket expenditure (in million current US$)

Year	(OOPS)	AG	CI [%]	AGR [%]	CGI [%]
1995	240	-	-	-	100.00
1996	435	195	181.25	81.25	181.25
1997	482	47	110.80	10.80	200.83
1998	328	-154	68.05	-31.95	136.67
1999	190	-138	57.93	-42.07	79.17
2000	145	-45	76.32	-23.68	60.42
2001	237	92	163.45	63.45	98.75
2002	311	74	131.22	31.22	129.58
2003	432	121	138.91	38.91	180.00
2004	557	125	128.94	28.94	232.08
2005	679	122	121.90	21.90	282.92
2006	911	232	134.17	34.17	379.58
2007	1.412	501	154.99	54.99	588.33
2008	1.736	324	122.95	22.95	723.33
2009	1.484	-252	85.48	-14.52	618.33
2010	1.435	-49	96.70	-3.30	597.92
2011	1.643	208	114.49	14.49	684.58
2012	1.496	-147	91.05	-8.95	623.33
2013	1.711	215	114.37	14.37	712.92
2014	1.652	-59	96.55	-3.45	688.33

Notes: Out-of-pocket expenditure (in million current US$) (OOPS), annual growth (AG), chain index (CI) in [%], annual growth rate (AGR) in [%] and cumulative growth index (CGI) in [%].

Figure 2: Graphical representation of growth of OOPS and values of annual growth rate (AGR) in [%]



4.2. Out-of-pocket Expenditure (OOPS) as a percentage of Total Health Expenditure (THE)

World Health organisation defines Out-of-pocket Expenditure (OOPS) as a percentage of Total Health Expenditure (THE) as the level of out-of-pocket expenditure expressed as a percentage of total expenditure on health where (THE) is the sum of all outlays for health maintenance, restoration or enhancement paid for in cash or supplied in kind. It is the sum of general government expenditure on health and private expenditure on health (WHO, 2016).

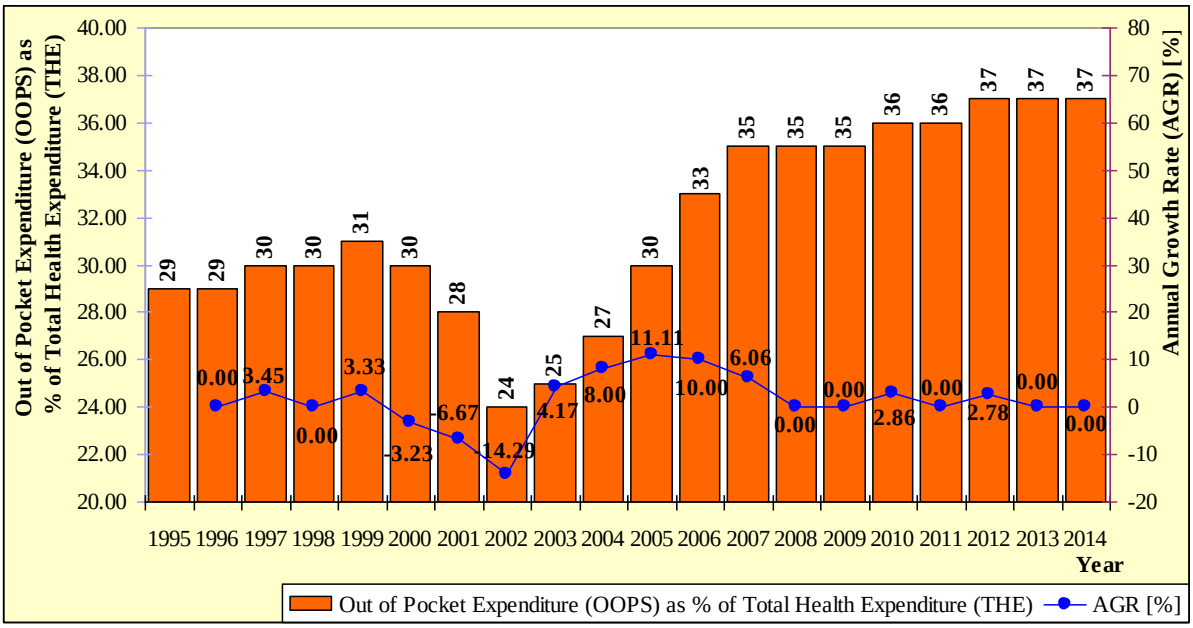
On Table 1 is given a numeric analysis of growth of out-of-pocket expenditure as percentage of total health expenditure, while on Figure 3 is a graphical representation of these calculations. Observed period from 1995 year shows that there was a steady increase in total health expenditure from both governmental and private sectors from 29% in 1995 to 37% in 2014. The only noticeable declining period is from 2001 to 2003 which again coincides with the economic instability of the period when both sectors introduced saving measures in order to survive the economic downfall. Average annual growth rate (AGR) recorded higher oscillations in the period of 1995 to 2000 and a relatively stable trend from 2005 to 2014 year.

Table 2: Annual growth of out-of-pocket expenditure as percentage of total health expenditure

Year	(OOPS) as %	AG	CI [%]	AGR [%]	CGI [%]
1995	29	-	-	-	100.00
1996	29	0	100.00	0.00	100.00
1997	30	1	103.45	3.45	103.45
1998	30	0	100.00	0.00	103.45
1999	31	1	103.33	3.33	106.90
2000	30	-1	96.77	-3.23	103.45
2001	28	-2	93.33	-6.67	96.55
2002	24	-4	85.71	-14.29	82.76
2003	25	1	104.17	4.17	86.21
2004	27	2	108.00	8.00	93.10
2005	30	3	111.11	11.11	103.45
2006	33	3	110.00	10.00	113.79
2007	35	2	106.06	6.06	120.69
2008	35	0	100.00	0.00	120.69
2009	35	0	100.00	0.00	120.69
2010	36	1	102.86	2.86	124.14
2011	36	0	100.00	0.00	124.14
2012	37	1	102.78	2.78	127.59
2013	37	0	100.00	0.00	127.59
2014	37	0	100.00	0.00	127.59

Notes: Out-of-pocket expenditure (OOPS) as % of total health expenditure (THE)

Figure 3: Graphical representation of growth of (OOPS) as % of (THE) and values of AGR in [%]



4.3. Out-of-pocket Expenditure (OOPS) as % of Private Health Expenditure (PvtHE)

World Health organisation defines Out-of-pocket Expenditure (OOPS) as % of Private Health Expenditure (PvtHE) as the level of private expenditure on health where the aggregate of costs for health by private substances, for example, families, business or shared health protection, non-benefit foundations serving families, inhabitant enterprises and semi companies with a health administrations

conveyance or financing capacity. It incorporates expenditures from all sources, so incorporates any benefactor subsidizing going through these financing operators (WHO, 2016).

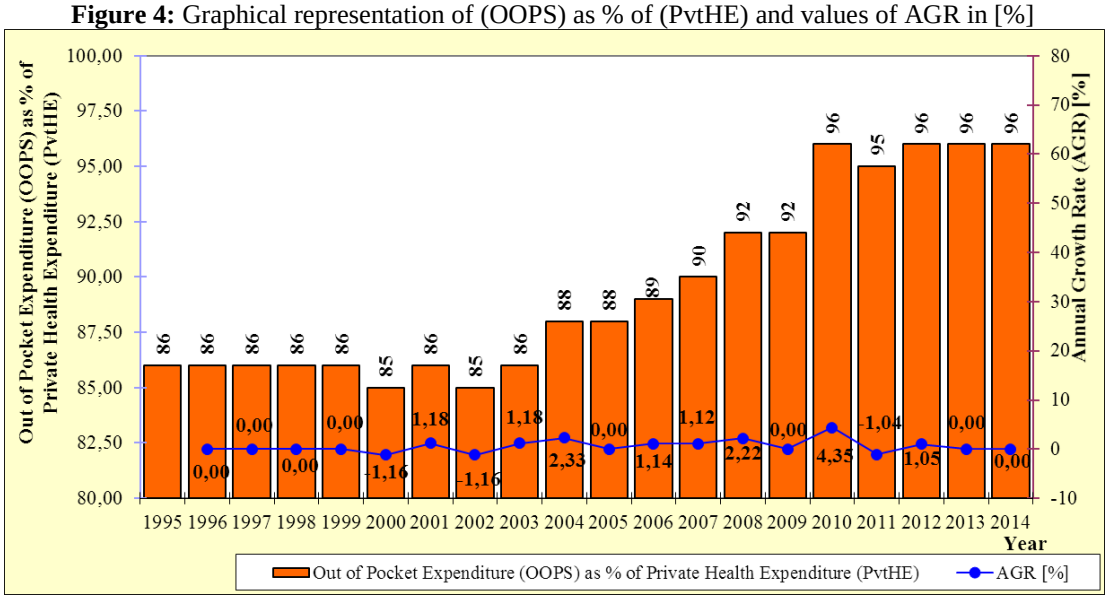
As can be seen from Table 3 and Figure 4 private health expenditure is the major part of total out-of-pocket expenditure with clear increase trend for the observed period. The results indicate that the costs of health services are mostly covered by general population and private insurance or service entities rather than state institutions and governmental health coverage. Cumulative growth index (CGI) shows that the percentage of private health expenditure increased by 11.63% in the observed period reaching a total of 96% share in total health expenditure. Annual growth rate (AGR) maintained a steady trend with slight variations of which most notable was in 2010 when the percentage of private health expenditure increased by 4.35%.

Table 3: Annual growth of out-of-pocket expenditure as percentage of private health expenditure

Year	(OOPS) as % of (PvtHE)	AG	CI [%]	AGR [%]	CGI [%]
1995	86	-	-	-	100.00
1996	86	0	100.00	0.00	100.00
1997	86	0	100.00	0.00	100.00
1998	86	0	100.00	0.00	100.00
1999	86	0	100.00	0.00	100.00
2000	85	-1	98.84	-1.16	98.84
2001	86	1	101.18	1.18	100.00
2002	85	-1	98.84	-1.16	98.84
2003	86	1	101.18	1.18	100.00
2004	88	2	102.33	2.33	102.33
2005	88	0	100.00	0.00	102.33
2006	89	1	101.14	1.14	103.49
2007	90	1	101.12	1.12	104.65
2008	92	2	102.22	2.22	106.98
2009	92	0	100.00	0.00	106.98
2010	96	4	104.35	4.35	111.63
2011	95	-1	98.96	-1.04	110.47
2012	96	1	101.05	1.05	111.63
2013	96	0	100.00	0.00	111.63
2014	96	0	100.00	0.00	111.63

Notes: Out-of-pocket Expenditure (OOPS) as % of Private Health Expenditure (PvtHE)

Figure 4: Graphical representation of (OOPS) as % of (PvtHE) and values of AGR in [%]



4. Conclusion

In the paper is given a trend analysis of out-of-pocket health expenditures in Serbia with using standard economic statistical indicators. The study showed that out-of-pocket health expenditures negatively influence general access to medical services due to the high values of domestic participation. Obtained results indicate that that there is an overall growing trend in out-of-pocket expenditure in both governmental and private sectors. Trend of Cumulative Growth Index (CGI) shows significant increase of out-of-pocket expenditure compared to referent year (1995) with 712.92% of growth in 2013 year with 1.711 mill USD. Observed period from 1995 year shows that there was a steady increase in total health expenditure from both governmental and private sectors. The percentage of private health expenditure increased by 11.63% in the observed period reaching a total of 96% share in total health expenditure.

References

1. OECD (2011), "Burden of out-of-pocket health expenditure", in Health at a Glance 2011: OECD Indicators, OECD Publishing, Paris. doi: http://dx.doi.org/10.1787/health_glance-2011-54-en
2. S.S. Habib, S. Perveen, and H.M.A. Khuwaja. "The Role of Micro Health Insurance in Providing Financial Risk Protection in Developing Countries- a Systematic Review", *BMC Public Health*, Vol. 16, No. 1 (2016). doi:10.1186/s12889-016-2937-9
3. M. Alsan, L. Schoemaker, K. Eggleston, N. Kammili, P. Kolli, and J. Bhattacharya, "Out-of-pocket health expenditures and antimicrobial resistance in low-income and middle-income countries: An economic analysis", *The Lancet Infectious Diseases*, Vol. 15, No. 10 (2015): 1203–1210.
4. M. Yogo, "Portfolio choice in retirement: Health risk and the demand for annuities, housing, and risky assets", *Journal of Monetary Economics*, Vol. 80 (2016): 17–34. doi: 10.1016/j.jmoneco.2016.04.008
5. L. Wang, A. Wang, D. Zhou, G. FitzGerald, D. Ye, and Q. Jiang, "An empirical analysis of rural-urban differences in out-of-pocket health expenditures in a low-income society of China", *PLoS ONE*, Vol. 11, No. 5 (2016). doi: 10.1371/journal.pone.0154563
6. K. Kumar, A. Singh, S. Kumar, F. Ram, A. Singh, U. Ram, and R.A. Nugent, "Socio-economic differentials in impoverishment effects of out-of-pocket health expenditure in China and India: Evidence from WHO", SAGE *PLoS ONE*, Vol. 10, No. 8 (2015). doi: 10.1371/journal.pone.0135051
7. T. Singh, P. Roy, L. Jamir, S. Gupta, N. Kaur, D.K. Jain, and R. Kumar, "Assessment of universal healthcare coverage in a district of north India: A rapid cross-sectional survey using tablet computers", *PLoS ONE*, Vol. 11, No. 6 (2016). doi: 10.1371/journal.pone.0157831
8. A. Sanwald, and E. Theurl, "Out-of-pocket payments in the Austrian healthcare system - A distributional analysis", *International Journal for Equity in Health*, Vol. 14, No. 1 (2015).
9. A. Kusi, K.S. Hansen, F.A. Asante, and U. Enemark, "Does the National Health Insurance Scheme provide financial protection to households in Ghana?", *BMC Health Services Research*, Vol. 15, No. 1 (2015). doi: 10.1186/s12913-015-0996-8
10. J. Grogger, T. Arnold, A.S. León, and A. Ome, "Heterogeneity in the effect of public health insurance on catastrophic out-of-pocket health expenditures: The case of Mexico", *Health Policy and Planning*, Vol. 30, No. 5 (2015): 593–599. doi: 10.1093/heapol/czu037
11. H. Ghiasvand, S. Naghdi, N. Abolhassani, N. Shaarbafchizadeh, and J. Moghri, "Iranian households' payments on food and health out-of-pocket expenditures: Evidence of inequality", *Iranian Journal of Public Health*, Vol. 44, No. 8 (2015): 1103–1113.
12. G. Gotsadze, A. Zoidze, N. Rukhadze, N. Shengelia, and N. Chkhaidze, "An impact evaluation of medical insurance for poor in Georgia: Preliminary results and policy implications", *Health Policy and Planning*, Vol. 30 (2015): i2–i13. doi: 10.1093/heapol/czu095
13. J.-W. Choi, J.-W. Choi, J.-H. Kim, K.-B. Yoo, and E.-C. Park, "Association between chronic disease and catastrophic health expenditure in Korea", *BMC Health Services Research*, Vol. 15, No. 1 (2015).
14. A. Kazemi Karyani, E. Homaie Rad, A. Pourreza, and F. Shaahmadi, "Democracy, political freedom and health expenditures: evidence from Eastern Mediterranean countries", *International Journal of Human Rights in Healthcare*, Vol. 8, No. 3 (2015): 187–194. doi: 10.1108/IJHRH-01-2015-0001
15. Z. Yilma, A. Mebratie, R. Sparrow, M. Dekker, G. Alemu, and A.S. Bedi, "Health risk and insurance: Impact of Ethiopia's community based health insurance on household economic

welfare", *World Bank Economic Review*, Vol. 29 (2015): S164–S173. doi: 10.1093/wber/lhv009
16. L.M. Séne, M. Cissé, "Catastrophic out-of-pocket payments for health and poverty nexus: evidence from Senegal", *International Journal of Health Economics and Management*, Vol. 15, No. 3 (2015): 307–328. doi: 10.1007/s10754-015-9170-4
17. S.I. Prada, J.L. Duarte, and R. Guerrero, "Out-of-pocket health expenditure for poor and non-poor older adults in Colombia: Composition and trends", *International Journal of Consumer Studies*, Vol. 39, No. 4 (2015) 362–368. doi: 10.1111/ijcs.12203
18. S. Mitra, M. Palmer, D. Mont, and N. Groce, "Can Households Cope with Health Shocks in Vietnam?", *Health Economics (United Kingdom)*, Vol. 25, No. 7 (2016): 888–907. doi: 10.1002/hec.3196
19. "World Health Organization (WHO)" Global Health Expenditure Data Base (GHED) accessed November 20, 2016, http://www.who.int/gho/en/
20. P. Dašić, "Application of polynomial regression models for approximation of time series", *Journal of Economic and Management Based on New Technologies*, Vol. 1, No. 2 (2012): 81-160.
21. P. Dašić, V. Stojanović, D. Trnavac, "Analysis of economic indicators of the Republic of Srpska foreign trade for the period 2001-2012", (paper presented at the first National Conference Management, sport and tourism MASTA-2013, Banja Luka, Bosna i Hercegovina, pp. 11-30, 2013).

Review Scientific Paper/Pregledni naučni rad UDC/UDK 658.5
Paper Accepted/Rad prihvaćen: 23. 12. 2018.
doi:10.5937/SJEM1901053R

Canvas biznis model

Jelena Rajković Borisavljević [1], Milinko Veličković[2]

[1]Fakultet za inženjerski menadžment, Univerzitet Union "Nikola Tesla", Beograd, jelena.rajkovic@fim.rs
[2]Sekretarijat za privredu, Grad Beograd

Apstrakt: Posmatranje poslovnog modela kao alata u savremenom poslovanju pomaže pri razumevanju i komunikaciji poslovanja. Kao takav poslovni model predstavlja izuzetno koristan koncept jer menadžeri nisu u mogućnosti da objasne kompleksnost poslovnih odrednica. Svrha ovog rada je da približi pregled najzastupljenijeg poslovnog modela Canvas sa teoretskim odrednicama. Rad je fokusiran na pregledu literature uz detaljniji pregled komparacije dveju kompanija. U radu je obrađena i anketa u vidu upitnika, kao takva je imala svrhu da detaljnije približi informaciju koji brend je zastupljeniji na našem tržištu.

Ključne reči: Canvas, poslovni modeli, Coca-Cola, Pepsi

Canvas Business Model

Abstract: Observing the business model as a tool in modern business helps in understanding and communicating business. As such, the business model is a very useful concept because managers are not able to explain the complexity of business determinants. The purpose of this paper is to draw the overview of the most common business model Canvas with the oretical determinants. The paper focuses on the literature review with a more detailed overview of the comparisons of the two companies. In the paper a questionnaire questionnaire was also processed, as such it was intended to get closer to the information which brand is more represented on our market.

Keywords: Canvas, business models, Coca-Cola, Pepsi

Introduction

A business model or BMC Program model is a graphic representation of a number of variables that show the values of an organization. A business model can be deployed as a strategic tool for developing a new organization. Furthermore, it also analyzes the (business) situation of the existing business.

The Canvas model was created by Alexander Osterwalder in 2008, the lead author of the model he wrote along with Yves Pigneur: "Business Model Genaration" (Osterwalder & Pigneur, 2010). The book has become a reference because all subsequent authors and consulting firms offering schemes rely on it without touching the starting points and only providing variations to the main underlying concept or its application. Definitions of individual areas in the Canvas model are not novel, but gain transparency, logical connectivity and consistency, which enables quick analysis and decision making. These qualities as well as comprehensibility contribute to the spread of the model, as it involves a wider range of carriers from particular functions of companies such as sales, marketing, development, production, logistics, finance. The model pays special attention because it simply breaks the so-called. the effect of a silo where each function operates on its own is justified and guilty of blaming others. The BMC is all connected. For example, in terms of cost, it must be taken into account how this will act on demand, how the financial effects are, what can be done in the production process, the shortening of the supply chain. Participants should be encouraged to compete in quality assurance, the price of the product, instead of each operating separately in their "silo" with an undefeated boss at the top. The requirement for successful cooperation is to create an atmosphere in which people will feel comfortable, and they also have the will to accept mistakes, as it encourages the necessary experimentation.

Canvas Business model

BMC elements, "canvas", consist of nine templates (a computer word template) on which special parts are to be linked and balanced. They are suitable for the initial job as well as for linking an existing business model that consists of a huge number of pages, but which are not visibly linked. In practice, it has been shown that the links that are well illustrated give the best views to the investors who need to logically connect with the situation, expectations and the necessary requirements. The model is particularly suitable for introducing innovations, whether about technical, functional changes, strategy change, branding, slogan, distribution, and the other that arises as a solution to the problem in a new way. For the success of innovation, companies must create an innovation culture, develop and adopt the so-called. an innovation map, a procedure that foresees graduation, but also a stimulus for improving business, launching a new one, finding new uses, markets, consumers. All this in the success of successful companies results in a reasonable price. If there is an intention to enter the market with low prices, then we underestimate the drive to innovate.

A. Ostenwalder's scheme is rounded up to nine connected areas:

1. Customer segments, consumers (CS - Customer Segments)
2. Value Proposition (VP)
3. Channels (CH - Channels)
4. Customer Relationship (CR - Customer Relationship)
5. Cash Flows - Revenue (RS - Rewenue Streames)
6. Key activities (KA - Key Activities)
7. Key Resource (KR)
8. Key Partners (KP - Key Partnership)
9. Costs (CS - Cost Structure).

It starts from the segments we deliver to goods and services. These are the value propositions we give them, then the channels to which they are delivered. Infrastructure is marked in terms of key activities, resources, partners in the business. The following are financial implications in terms of cash flows and costs. "Canvas" implies interdependence, entanglement in which everyone involved is in the process. The related elements make a consistent approach to strategic decision-making.

Consumer Segmentation:

Who does a particular job do and to whom are the values delivered? "We should know current and potential consumers, know where they are, what are their habits, attitudes (why?), Purchasing power. According to them, products are designed and advertising is made, which must be understandable for them, acceptable. Segmentation approach can be related to segment characteristics, location, specific interests (niches), such as: sport, adventure, recreation, youth, students, professions, social status, etc. The second segmentation can relate to any part of the world, and it is defined roughly - those who like to be creative, advanced in communications, save time and dedicate themselves to the family, be "in" in fashion ... The car requires security or speed or economy and the like. The most exemplary example of such a segmentation is Nike who says - "Just do it!". It is a call to everyone - you have a body, you train the equipment as well as M. Jordan and - runs ... The most demanding area in which marketing people are in the field of positioning is the code marked as insight, which denotes an insight into the "soul" of consumers, his views on the category, emotions towards the brand (Magretta, 2010). Insights must be defined in short terms in one or two sentences that are crucial for positioning, and on the canvas there is a good knowledge of it and an optimal ranking is formed. The perception falls within the field of consumer understanding and extends a circle called consumer behavior. How many consumers have, what kind of potential they have, affects all the further stages, costs, and expected revenues. " (Osterwalder, Pigneur, In Clark & Smith, 2010)

Value propositions:

What do we offer to consumers, what kind of advantages do we have, why are we different from the competition? "It largely depends on the first phase - to what extent do we meet consumers, their needs, wishes, ideals, aspirations, behaviors, attitudes, feelings (Slávik, 2011). The offer can go to functionality such as better performance, new features (mobile devices), new applications (mobile phone today and internet and tv and instagram ...). The offer can be individualized ("caste") which

creates immediacy. It can also be emotional, such as experience, status, social effects within a product category. Example - beer is with us socializing, joy, pleasure ... soup is a warm home, Kinder is a world of creativity and imagination. These are also food supplements ... The tangible benefits are products, intangible banks and insurance, and virtual as part of the online area." (Osterwalder, Pigneur, In Clark & Smith, 2010)

Channels:

Osterwalder (and other authors who take it) under "channels" means a whole block ("block") that includes ways for the company to communicate and reach consumers, deliver value propositions, goods and services to them. "In the communication mix, the consumer comes to know about the brand, creates an interest in it, a desire for shopping and use is born (Rappa, 2010). The efficacy of a communication mix in classical advertising is a complex in which an interest is generated through the media, and then reappears at the point of sale through the so-called " Mild advertisers. In direct sales it is important that the seller discovers the interest of the buyer, the need, the desire and to enter into communication, communion with him. Emotionality, understanding and empathy play a crucial role in this. In the modern world, the importance of the digital approach is growing, which must involve clients, initiate them into action. Physical delivery depends on the character of the goods, the environment, the cocoon position. There are frequent changes in this world. Amazon delivers directly. This was followed by not only bookstores that introduce parallel sales (for example, Barnes & Noble), but also sales chains. Konzum has e-sales in parallel, and Croatian "Amazon" - Abrakadabra is also being introduced. Some companies that go through the store as intermediaries, introduce special direct deliveries. That's what Nestle tried to do with the introduction of espresso coffee Dolce Gusto." (Osterwalder, Pigneur In Clark & Smith, 2010).

Customer Relationship:

CR has a major impact on how the customer will experience the brand, the product and the company. This is especially expressed in the personal service of goods and services, the creation of communities through which the clients are involved on the basis of common interests (Mullins & Komisar 2009). For example, Amazon invites you to submit book reviews. Individualization in the digital world is gaining in importance. Relations are also created through self-service tailored to customers - designing self-service outlets, designating exhibition spaces, studying what is being bought impulsively, and with preconceived intentions. (Osterwalder, Pigneur In Clark & Smith, 2010).

Cash income:

Cash income is generated from selected customer segments. Already in the definition of segments, it must be clear how much they are expected to earn, how much they are willing to pay. "Revenue is derived from one-off payments (permanent goods) or permanently from consumer goods Fast-moving consumer goods (FMCG). Payment models depend on the nature of goods and services, so it is chosen from the example of the sale or transfer of ownership, billing of goods, leasing, fees, etc. We should emphasize the popularity of popular brands. Examples are, Kinder, Vegeta, Cokolino, Coca-Cola in our country, they have the status of "fat have", so they must have them. Collection compared to lesser known is more favorable, which means that it is very worthwhile to invest in the brand." (Osterwalder, Pigneur In Clark & Smith, 2010).

Key resources:

Key resources are equipment, finance, people, intellectual property (knowledge, brand, patents). "Each activity, product, and brand require resources. From the skill of business management and strategy it depends how they will be deployed. The basic orientation can be the Boston Matrix in which the areas are divided into "Cows of the Mussolini", "Stars", "Questionnaires" and "Dogs". These latter have no prospects, so resources that would be better used if they focus on those who carry revenue, play an important role in the portfolio and have a perspective are wasting on their maintenance. These successful organizations solve without a sentiment. "That's why they are successful.

Key activities:

KA were created for the creation of value propositions. They should not be explicitly explained because they are the most important part of company operations, but it is necessary to define what is most important, crucial in production, supply chain, development, marketing, etc. "In the service area, the success of the activity is to solve customer problems. Success depends on skills, training, optimization and rationalization of goods flows, integration into optimal planning ".

Key partners:

According to Paret's rule, a small proportion of customers make up most of the turnover. That's why companies share customers with importance to A., B, and C. By these criteria, they allocate activities. Similarly, the key factors in the entire supply chain ("chain of supply") are chosen. "With some partners, strategic alliances are being created. Purchasing partners are not selected only according to the criteria of lower prices, but in the alliance are those with whom joint efforts in development, permanent supply, improvements in production and channels are invested. Instead of competition, competition with competitors arises, and this phenomenon is called co-repetition. It is most visible in the Category Management category where competitors co-operate in the area of selling goods at the point of sale according to the objective criteria obtained by market research, where the highest authority enjoys AcNielsen. "

Cost structure:

Products and services require the budget needed for development, key activities, fixed and variable costs. "The criteria are very consistent, and are developing and applying more and more, and in the area of the brand Rule 80/20 is applied in many spheres of activity. Examples - 80% of the results are achieved with 20% of the time or cost. Stores can also be shared the same - 20% carry 80% of the traffic. It is intended that each company formulates key marketing indicators - KPI, taking into account the increasing importance of the digital domain of operations. Examples, as well as the investment, are the formulation marketing return of investment (MROI), to gain insights on how to return investment in the field of marketing. In communications, each area has its own price according to how much the consumer reaches, what is appropriate for them, and so on. Investments do not always achieve instant profitability, and therefore, in a graph that crosses costs and traffic, plans to link those two lines to the point where the Best Efficiency point (BEP) occurs. Benefit in the portfolio of products and services is measured directly by profession and indirectly as far as the strength and development of the brand, relationship with customers and the overall offer. The portfolio can be divided into carriers of traffic, profit, image and protection from competition. When the whole business model is understood, then the concept of costs can be formed. "

Figure 1: A schematic view of the Canvas business model

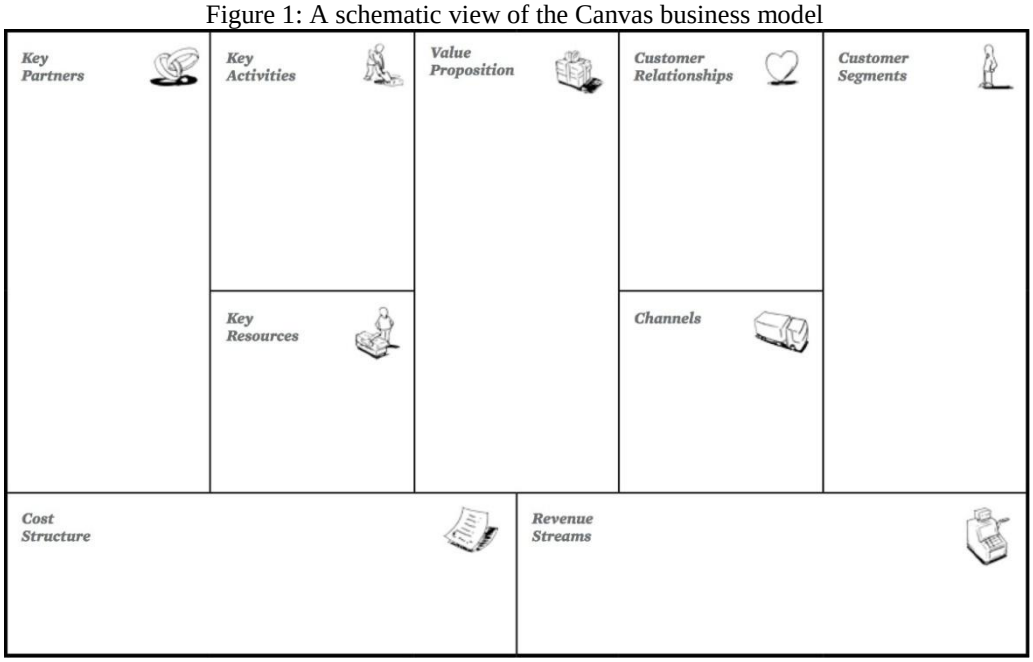


Table 1. Coca-Cola on the Canvas business model

KEY PARTNERS	KEY ACTIVITIES	VALUE PROPOSITION	CUSTOMER RELATIONSHIPS	CUSTOMER SEGMENTS
Sabco (bottler) Manual Distribution Centre Owners	Bottling Distribution Producing and supply syrup Marketing	Drink	Displays and fridges Advertisement to consumers Resident account developer	Larger retail outlets Small shops/restaurants
	KEY RESORCES		**CHANNELS**	
	Secret recipe Bottling plant and distribution center Syrup factory Bottles and crates		Large scale distribution Manual distribution centers	
COST STRUCTURE			**REVENUE STREAMS**	
Marketing Producing syrup Bottling and distribution			Bulk sales Retail price/crate (fixed margin for MDC)	

Table 2. Pepsi on the Canvas business model:

KEY PARTNERS	KEY ACTIVITIES	VALUE OF PROPOSITION	RELATIONS	USER SEGMENTS
Distributor **Food and drink** Products All over the world International Food and drink Customers Mass media	Bottling Distribution Production Marketing	Nutritional food and drinks	Healthy food and beverage	Companies Young people around the world Ordinary people Athletes
STRUCTURE OF COSTS	**KEY RESOURCES**		**CHANNELS**	**RELATIONS WITH BUYERS**
Marketing tools Designing a product Ingredients and materials	Product Brand Staff Partner and retail networks		Advertising Global sales	Sales of products Widespread sales
COST STRUCTURE			**INFLOWS**	
Data center costs General and administrative			Free Arrivals Revenue from the gameplay	

Conclusion:

Canvas business model is the most widespread model, and companies most often opt for its implementation. It consists of nine elements (templates) to which the specific parts we connect are glued together. Canvas is suitable for initial jobs, new organizations, and for linking an existing model that is not sufficiently connected. Through the Canvas model, certain transparency, distinct connectivity, consistency and comprehensibility are obtained, which contributes to the spread of models, such as sales, marketing, production, development, finance and logistics. There is no optimum use of the business model, but it is constantly being modified.

Literatura:

1. Alexander Osterwalder & Yves Pigneur, 2010, book " Business model Generation", pp.87.
2. Magretta, J. (2010). Why Business Models Matter. Harward Business Review on Business Model Innovation. USA: HBR Publishing Corporation.
3. Osterwalder, A., Pigneur, Y., In Clark, T., & Smith, A. (2010). *Business model generation: A hibook for visionaries, game changers, i challengers, pp.26-27*
4. Slávik, Š. (2011). Komparatívna analýza podnikateľských modelov. Ekonomika a manažment, 11(3), 23-43.
5. Osterwalder, A., Pigneur, Y., In Clark, T., & Smith, A. (2010). *Business model generation: A hibook for visionaries, game changers, i challengers,pp.28-31*
6. Rappa, M. (2010). Business Models on the Web, pp65
7. Osterwalder, A., Pigneur, Y., In Clark, T., & Smith, A. (2010). *Business model generation: A hibook for visionaries, game changers, i challengers,pp. 32-33*
8. Mullins, J. & Komisar, R. (2009). Getting to Plan B: Breaking Through to a Better Business Model. USA: Harvard Business Press.
9. Osterwalder, A., Pigneur, Y., In Clark, T., & Smith, A. (2010). *Business model generation: A hibook for visionaries, game changers, i challengers,pp. 34-35*
10. Osterwalder, A., Pigneur, Y., In Clark, T., & Smith, A. (2010). *Business model generation: A hibook for visionaries, game changers, i challengers,pp. 36-39*
11. Pressburg, A. P. (2010). Čína prestáva byť ultralacnou dielňou sveta. Trend, No. 30
12. Osterwalder, A., Pigneur, Y., In Clark, T., & Smith, A. (2010). *Business model generation: A hibook for visionaries, game changers, i challengers,pp. 40-41*
13. Johnson, W. M., Christensen, C. M. & Kagerman, H. (2008). Reinventing Your Business Model. Harvard business review, 86(12), 57-68.
14. Osterwalder, A., Pigneur, Y., In Clark, T., & Smith, A. (2010). *Business model generation: A hibook for visionaries, game changers, i challengers, pp.42-43*
15. Osterwalder, A., Pigneur, Y., In Clark, T., & Smith, A. (2010). *Business model generation: A hibook for visionaries, game changers, i challengers,pp. 44-45*
16. Baden-Fuller, CH. & Morgan, M. S. (2010). Business Models as Models. Long Range Planning, 43(2), 156-171
17. Osterwalder, A., Pigneur, Y., In Clark, T., & Smith, A. (2010). *Business model generation: A hibook for visionaries, game changers, i challengers,pp. 46-47*
18. https://blog.kvv213.com/2016/03/postroenie-biznes-modelej/

Review Scientific Paper/Pregledni naučni rad UDC/UDK 005.334:621.311
Paper Accepted/Rad prihvaćen: 21. 1. 2019.
doi:10.5937/SJEM1901060S

Upravljanje održavanjem na bazi rizika u elektroenergetskim sistemima

Dr Velimir Strugar[1], MSc Edin Garaplija[2]

[1]Elektroprivreda Crne Gore AD Nikšić, Crna Gora, velimir.strugar@epcg.com, EPCG ad Nikšić, Vuka Karadžića 2, Nilšić, Crna Gora
[2]INZA Beograd, Srbija, edin.garaplija@inzagroup.eu, INZA Beograd, Bul. Vojvode Mišića 43, Beograd, Srbija

Apstrakt: U ovom radu je predložena inovativna metoda upravljanja održavanjem elektroenergetskih sistema zasnovano na procjeni rizika od otkaza. Na konkretnom primjeru se posebno tretira elektrodistributivni sistem kao primjer vrlo složenog tehničkog sistema. Otkaz elektrodistributivnog sistema ili nekog njegovog dijela uvijek za posljedicu ima direktne i indirektne štete, koje posebnu dimenziju za operatora distributivnog sistema ili operatora mreže i operatora mjerenja (u zavisnosti od organizacije elektrodistributivne djelatnosti na specifičnoj teritoriji) ima u uslovima otvorenog tržišta električnom energijom. Ova okolnost ima posebnu težinu uvažavajući činjenicu da su mrežne usluge regulisana djelatnost.

Kvalitet isporučene električne energije uz obezbjeđenje potrebnog nivoa pouzdanosti isporuke je u direktnoj korelaciji sa odabirom kvalitetne i efikasne strategije upravljanja održavanjem elektrodistributivnog sistema u cjelini (sistema vodova, sistema transformatorskih stanica, sistema mjerenja električne energije kao i ostalih tehničkih sistema podrške – informaciono komunikacionih sistema, sistema daljinskog nadzora, sistema pomoćnog napona, sistema za proizvodnju vazduha pod pritiskom itd.). Adekvatan odabir strategije održavanja u redovnim i vanrednim okolnostima je od neprocjenjivog značaja za sigurnost obezbjeđivanja vršenja javne djelatnosti kakva je distribucija električne energije i javnog snabdjevača, ali i za obezbjeđivanje zaštite ljudi i imovine i zaštite ukupnog poslovnog interesa kompanija koje se ovom djelatnošću bave.

Inovativna metoda uključuje upotrebu i savremenih GIS rješenja koja operatoru sistema treba da pruže puni uvid u stanje tehničke opreme na terenu i obezbijedi pravovremenu i ispravnu odluku.

Ključne riječi: elektroenergetski sistem, procjena rizika, GIS, kritična infrastruktura, registar rizika

Management of risk-based maintenance in power systems

Abstract: In this paper an innovative method of managing the maintenance of electric power systems based on the assessment of the risk of failure is proposed. On the concrete example, the electrical distribution system is especially treated as an example of a very complex technical system. The failure of the power distribution system or part of it always results in direct and indirect damages, which in the open electricity market conditions have a special dimension for the distribution system operator or the network operator and the measuring operator (depending on the organization of the electricity distribution activity in the specific territory). This circumstance has special weight, taking into account the fact that network services are regulated bussines.

The quality of delivered electricity with the provision of the required level of delivery reliability is in direct correlation with the selection of a quality and efficient strategy for managing the maintenance of the power distribution system as a whole (line system, transformer station system, electrical energy measurement system as well as other technical support systems - information communication systems remote control, auxiliary voltage system, pressure air production system, etc.). Adequate selection of the maintenance strategy in regular and extraordinary circumstances is of paramount importance for the security of ensuring the performance of public activities such as the distribution of electricity and public supplies, but also for securing the protection of people and property and protecting the overall business interests of the companies engaged in this business.

An innovative method involves the use of modern GIS solutions that give the system operator full insight into the state of the technical equipment in the field and provide a timely and correct decision.

Key words: power system, risk assessment, GIS, critical infrastructure, risk register

1. Uvod

Savremeno upravljanje elektroenergetskim sistemima kao vrlo složenim tehničkim sistemima, zahtijeva posjedovanje relevenatnog nivoa inžinjerijskog iskustva uz poznavanje potrebnih vještina upravljanja od kojih značajno mjesto zauzima poznavanje metoda procjene rizika i upravljanje zasnovano na riziku. Savremeni menadžment počiva na osnovnim pretpostavkama PDCA ciklusa (P-plan, D-do, C-control, A-act) [1], koji podrazumijeva planiranje, realizaciju planova, kompetentnu kontrolu i na kraju reagovanje u smislu popravke nepravilnosti uočenih tokom kontrole. Sve ove aktivnosti, a naročito planiranje, su direktno povezane sa procjenom rizika od pojave nepovoljnih radnih stanja koja stanja izazivaju veći ili manji nivo negativnih posljedica sa kojima kompanija treba da se suoči. Ponekad je i sam reputacioni rizik dovoljno negativan da o njemu jako treba brinuti unaprijed.

2. Analiza postojećeg stanja elektrodistributivnog sistema sa aspekta procjene rizika od otkaza

Održavanje tehničkih sistema ili sredstava za rad na bazi rizika podrazumijeva donošenje odluka o održavanju i inspekcijama na osnovu procjene nivoa rizika koji otkaz sistema ili dijela sistema sa sobom nosi. Da bi se objasnio koncept održavanja na bazi rizika nužno je definisati pojam ne samo održavanja nego i pojam rizika. Rizik je kvantitativni i kvalitativni opis opasnosti tj. mjera opasnosti ili nivo opasnosti. Pošto je otkaz neke komponente u suštini statistički proces (vjerovatnoća pojave), kvanitifikovanje rizika je korisna veličina koja može da posluži kod odlučivanja u pogledu rangiranja prioriteta aktivnosti u sistemu održavanja. Upravljanje rizikom je stoga našlo svoje mjesto u održavanju tehničkih sistema [2].

Rizici poslovanja su prisutni u svakoj kompaniji i svakom tehnološkom procesu, pa tako i u procesu snabdijevanja i distribucije električne energije. Neadekvatno sagledavanje rizika u elektroenergetskom sistemu uvijek rezultira neplaniranim troškovima za oporavak sistema, a često i nekontrolisanim izdacima za namirenje direktnih i indirektnih šteta koje operator distributivng sistema mora alimentirati.

Rizik se definiše na sljedeći način:

RIZIK = VJEROVATNOĆA (V) x POSLJEDICA (P)

Dakle, potrebno je izračunati vjerovatnoću neželjenog događaja i njegove posljedice. Nakon određivanja rizika pojedinih neželjenih događaja pažnja se usmjerava na pojačanje održavanja elemenata visokog i srednjeg rizika. U područjima niskog rizika redukuje se obim radova održavanja na strukturiran i opravdan način [3].

Jasno je da je za određivanje prioriteta održavanja pored posljedica bitna i vjerovatnoća pojave otkaza. Pojedini kvarovi u sistemu distribucije električne energije mogu rezultirati ekstremno velikim štetama kako za sistem u cjelini tako i za potrošače kao korisnike sistema. Postoji mnogo različitih uzroka koji mogu izazvati enormne štete zbog otkaza. Analiza zasnovana na utvrđivanju svih mogućih uzroka, njihovo rangiranje u smislu vjerovatnoće pojave i stavljanje u korelaciju sa mogućom štetom je aktivnost koja mora biti povjerena iskusnim ekspertima u elektrodistributivnim kompanijama.

Filozofija održavanja na bazi rizika jasno determiniše kriterijume za određivanje prioriteta : što je rizik veći to je i viši rang aktivnosti na listi prioriteta. Dakle, ukoliko je vjerovatnoća pojave nekog štetnog događaja ekstremno mala tada će najvjerovatnije biti prilično nizak i prioritet reagovanja u pogledu održavanja elementa opreme koji može biti uzrok štetnog događaja, čak iako je šteta koju otkaz tog elementa može izazvati prilično visoka.

Dilema u vezi gornjeg praga prihvatljivosti rizika je uvijek aktuelna. Posmatrano sa nivoa ukupnog elektroenergetskog sistema, radi dobijanja ukupnog rizika kompanije pukim sabiranjem svih rizika koji se mogu predviđeti, sigurno bi se došlo do ekstremno visokog troška koji bi za najveći broj kompanija bio apsolutno neprihvatljiv. Mudrim menadžerskim pristupom odlučivanja mora se na bazi poznavanja svakog dijela sistema ponaosob i sagledavanjem sistema u cjelini, prepoznati skup neuralgičnih tačaka i tu informaciju uzeti u obzir kod sastavljanja liste prioriteta odnosno registra rizika.

Dalje, održavanje sistema nije aktivnost koja se sprovodi samo radi eliminacije materijalnih šteta koje mogu nastati u sistemu. Bezbijednost je faktor koji se permanentno mora nadgledati i inkorporirati u funkciji minimizacije rizika. Stalni i organizovani monitoring u tom smislu se zahtijeva.

Održavanje na bazi rizika ima za cilj spriječavanje katastrofalnih otkaza. Da bi se ovaj cilj ostvario, moraju se identifikovati sastavni djelovi jednog postrojenja, čiji otkaz može dovesti do povrede ljudstva i velikih finansijskih gubitaka. U ovoj metodologiji se, kao kriterijum za ocjenjivanje, primjenjuju monetarne veličine kao i potencijalni uticaj na zdravlje ljudi (zaposlenih i drugih).

Kvalitetno sprovođenje održavanja na bazi rizika zahtijeva u prvom redu kvalitetne podatke o tehničkom sistemu. Troškovi prikupljanja i obrade podataka su uglavnom vrlo značajna kategorija, posebno u elektrodistributivnim kompanijama sa kompleksnom mrežom i velikim brojem korisnika sistema (velikim brojem čvornih mjesta). Relevantni tehnički podaci su uglavnom nesistematizovani i samo u rijetkim slučajevima podaci su dostupni u elektronskoj formi i organizovani u kvalitetne baze podataka. Aktivnost na digitalizaciji svih relevantnih tehničkih podataka o elektrodistributivnom sistemu (GIS podaci o elementima sistema i potrošačima, tehnički podaci o vodovima i transformatorskim stanicama, podaci o energiji i snazi u različitim tačkama sistema dobijeni mjerenjem, podaci o opterećenosti vodova i transformatora u različitim vremenskim uslovima i sezonama, itd.) su od vitalnog značaja za kvalitetnu analizu i potrebno je projekte posvećene organizovanju ovih podataka pokrenuti što prije. Ova aktivnost je kompleksna, zahtjevna i skupa, ali se sprovodi jednom u životnom vijeku sistema i nadalje se samo nadograđuje. Takođe, realizacija ove aktivnosti predstavlja prekretnicu u eksploataciji sistema i bitno doprinosi prirodnoj odbojnosti zaposlenih kad god su bilo kakve promjene aktuelne. O ovoj okolnosti se kroz upravljanje ljudskim resursima treba povesti posebna briga. U svakom slučaju, danas je na tržištu dostupno mnoštvo specijalizovanih računarskih aplikacija za upravljanje distributivnim sistemima (DMS – Distribution Management System) koje u sebe uključuju i GIS (geografski informacioni sistem) aplikacije koje su opremljene moćnim bazama podataka i kao takve mogu biti koristan alat za akviziciju svih relevantnih tehničkih podataka o sistemu.

Takođe, korišćenjem ovakvih alata moguće je predviđati moguća radna stanja sistema i sagledati moguće posljedice koje nastankom tih radnih stanja mogu da se dese. Naravno, ponekad ove aplikacije nisu u mogućnosti da analitički prikažu elemente podsistema (elemente transformatorske stanice npr.) od čije pouzdanosti zavisi rad podsistema kao cjeline. U takvim slučajevima je potrebno varijantnu analizu zasnovati prvo na svakom podsistemu pojedinačno, a kasnije te rezultate koristiti za globalnu analizu sistema kao cjeline.

Korišćenje generičkih mreža - modela je takođe dobar metod za predikciju rizičnih radnih stanja sistema. Ipak, izrada generičkih mreža mora biti povjerena odličnim poznavaocima prirode elektrodistributivnog sistema i ekspertima sa relevantnim iskustvom u specifičnim oblastima (mjerenje, relejna zaštita, ekspolatacija transformatorskih stanica i dalekovoda itd.).

Troškovi koje otkaz specifičnog dijela sistema može izazvati moraju biti kompetentno procijenjeni. U tom smislu je važno angažovanje eksperata iz oblasti finansija, nabavki i knjigovodstva. Ipak, dobra je okolnost da je često dostupnost ovih podataka veća od dostupnosti podataka o vrsti i obimu kvarova u sistemu.

Pri analizi je potrebno voditi računa da određeni dio sistema može da otkaže na različite načine. Posljedično troškovi održavanja koji su povezani sa njihovim otkazom moraju biti ocijenjeni sa uslovnom vjerovatnoćom određene vrste otkaza, odnosno treba da se uzmu u obzir prilikom određivanja rizika. Analiza ovog tipa i relevantni proračun se ne može ručno uraditi, pa čak i za elektrodistributivne sisteme sa minimalnim brojem čvorova i elemenata opreme. Za ove namjene treba koristiti raspoložive računarske alate dostupne na tržištu.

Nakon determinisanja veličina i obima posljedica i izračunavanja vjerovatnoća otkaza svake komponente sistema, izračunavaju se odgovarajući rizici. Konačno, ovom metodom će se dobiti jasna slika stanja sistema sa aspekta vjerovatoće nastanka otkaza i obima štete koju će taj otkaz uzrokovati, odnosno moguće je sačiniti grafik rizika za cjelokupno postrojenje odnosno za cio sistem. Ovaj grafik prikazuje uređene parove tačaka određenih vrijednostima predpostavljenih posljedica i vjerovatnoća pojava otkaza. Analitička predstava ovog grafika je matrica rizika. Predikcija budućih stanja sistema se može dobiti korišćenjem modela matrica vjerovatnoće prelaza i lanaca Markova.

Ako stanje fizičkog sistema X u momentu n označimo sa X_n i ako u svakom momentu n (n=0,1,2,3,...) fizički sistem može da se nađe u jednom od stanja x_i (i=1,2,...k), pri čemu broj stanja može da bude konačan ili prebrojivo beskonačan, dobijamo niz stanja fizičkog sistema X_1, X_2, ... Ovaj niz stanja formira lanac Markova ako vjerovatnoća da se sistem u trenutku (n+1) nađe u jednom stanja stanja x_i (i=1,2,...k) zavisi samo od stanja sistema u sadašnjem trenutku, a ne zavisi od ponašanja sistema u prošlosti (prije trenutka n). Dakle ako je sistem u momentu n bio u stanju $X_n=x_i$, onda je uslovna vjerovatnoća $p_{ij}^{n,n+1}$ da će sistem u momentu n+1 biti u stanju $X_{n+1}=x_j$ jednaka [3]:

$$p_{ij}^{n,n+1} = P(X_{n+1} = {}^{x_j}/_{X_n = x_i}) \qquad (1)$$

Vjerovatnoća da se sistem u momentu n+1 naći u stanju x_j, ako se u prethodnom momentu n nalazio u stanju x_i, naziva se vjerovatnoća prelaza (za jedan korak).

Potpunu karakteristiku mogućih prelaza iz jednog stanja sistema u drugo neposredno nadolazeće stanje (prelaz za jedan korak) predstavlja matrica vjerovatnoće prelaza:

$$P = P(1) = \begin{bmatrix} p_{11} & \cdots & p_{1k} \\ \vdots & \ddots & \vdots \\ p_{k1} & \cdots & p_{kk} \end{bmatrix} \qquad (2)$$

Zasnovano na unaprijed definisanim kriterijumima, kroz postupak proračuna rizika može se utvrditi da li su u konkretnim slučajevima rizici prihvatljivi ili nijesu. Za mitigaciju rizika potrebno je definisati odgovrajuće korektivne mjere čijom primjenom će izračunati rizik biti moguće smanjiti na nivo niži od gornjeg limita prihvatljivog nivoa rizika. Naravno, u postupku determinacije korektivnih mjera se, pored tehničkog pristupa, mora konsultovati i finansijski aspekt. Ovaj postupak svakako mora rezultirati odabirom optimalnog broja i vrste tehno-ekonomski prihvatljivih radnji kojima će se stanje sistema sa aspekta rizika dovesti na unaprijed ustanovljen i standardizovan nivo.

U tom smislu se definiše i učinak primijenjenih mjera kroz Troškovno – Korisni faktor [3]:

TK = Cijena rizik bez mjera / (Cijena remanentnog rizik nakon primjene mjera + Troškovi primjene mjera)

Bez sprovođenja definisanih korektivnih mjera ovaj faktor ima vrednost 1. Ali, ako se primijene efikasne mjere održavanja, dolazi do mitigacije rizika, odnosno TK faktor raste i dostiže svoj maksimum. Daljom primjenom mjera, odnosno daljim ulaganjem, TK faktor opada i korist od tog ulaganja je sve manja. Optimalni nivo ulaganja je zapravo mjera pametnog upravljanja kompanijom i cilj je svakog racionalnog menadžmenta. Dakle, potrebno je odabrati takve korektivne mjere i sprovesti takve postupke u održavanju koji će dovesti do najpovoljnijeg TK faktora.

U osnovi proračuna rizika je zapravo dobijanje što je moguće više na mjerenju zasnovanih dijagnostičkih informacija o realnom eksploatacionom stanju određenog elementa postojenja ili opreme.

Svaka dijagnostička inspekcija nam daje informacije o stepenu oštećenosti (npr. mjerenje dielektrične čvrstoće izolacije, mjerenje prelaznog otpora kontakata prekidača i spojeva uzemljivača, termografsko ispitivanje toplih mjesta itd.). Sačinjavanje adekvatnog plana dijagnostikovanja elemenata sistema i akvizicija tih podataka je od presudnog značaja za kvalitet primjene ove metode. Inspekcija je utoliko efikasnija ukoliko je dobijena informacija preciznija. Bez sprovođenja dijagnostičke kontrole pojava otkaza (kvantifikovana pomoću vjerovatnoće otkaza) zasnovana na proceni eksperata je krajnje

subjektivna i može biti vrlo nepouzdana. Dijagnostika je postupak koji treba da eliminiše nepouzdanost.

Ipak, ako je rizik izračunat primjenom podataka dobijenih dijagnostičkim mjerenjem i dalje neprihvatljiv može se pribjeći alternativnim mjerama zasnovanim na ekspertskim znanjima, pri čemu je primjena ovih mjera najčešće povezana sa povećanjem troškova (npr. ugradnja redudantnih sistema za obezbjeđivanje potpune pouzdanosti napajanja). Ponekad je ovakva investicija opravdana bez obzira na trošak, naročito kad su u pitanju specifični korisnički sistemi (bolnice gdje se traži stalno prisustvo napona, napajanje osjetljivih potrošača kojima je garantovana pouzdanost isporuke i kada prekid isporuke rezultira visokim penalima, što može biti slučaj kod zatvorenog distributivnog sistema).

Sa aspekta činjenice da je finansijski neopravdano i fizički nemoguće planirati kontrolu svakog elementa sistema u kontinuitetu jasno je da pristup zasnovan na riziku omogućava procjenu vjerovatnoće da će se kvar desiti na unaprijed prepoznatom dijelu sistema, pa sa tim u vezi moguće je kreirati i adekvatni akcioni plan održavanja. Visokorizične komponente sistema treba kontrolisati češće i na njima treba sprovoditi adekvatne aktivnosti koje će značajno smanjiti rizik od pojave kvara na njima. U tom smislu se izrađuje odgovarajući program kontrole zasnovan na unaprijed definisanim kriterijumima koji su u direktnoj korelaciji sa pragom prihvatljivog rizika od otkaza.

2.1. Pristup dijagnostičkom procesu

Za sagledavanje aktuelnog stanja opreme i postrojenja u pogledu moguće ranjivosti i podložnosti otkazu potrebno je sprovesti egzaktna mjerenja kvantifikatora stanja.

Dijagnostikovanje stanja sistema je aktivnost koja je planska i organizaciono je sprovode inženjeri koji su u dovoljnoj mjeri upoznati sa karakteristikama elektrodistributivnog sistema ili nekog njegovog dijela.

Aktuelna praksa i relevantni propisi na kojima se ta praksa zasniva nalažu odgovarajuće periodične preglede elemenata postrojenja i sa tim u vezi dokumentovanje zatečenog stanja, a naročito stanje slijedećih elemenata sistema:

- Stanje energetskih transformatora
- Stanje razvodnih postrojenja i komandi
- Stanje stanje relejne zaštite, elektroautomatike i telemehanike
- Stanje sistema pomoćnog napona i stanje akumulatorskih baterija
- Stanje stubova i ovjesne opreme nadzemnih vodova
- Stanje kablovskih vodova
- Stanje uređaja za zaštitu od prenapona

Ovi propisi [4] se ne ograničavaju samo na kontrolu stanja elektromehaničkog dijela postrojenja već zahtijevaju i periodičnu kontrolu građevinskog dijela potrojenja, kontrolu pristupa i kontrolu stanja okruženja koje može dovesti do prekida (vegetacija u okruženju postrojenja ili nadzemnog voda, radovi trećih lica u okruženju postrojenja u nedozvoljenim gabaritima u smislu sigurnosnih visina i udaljenosti). Takođe, kontrola ambijentalnih uslova, naročito sa aspekta vrijednosti temperatura, vlažnosti, prašine i vibracija je vrlo važna u pogledu dobijanja vjerodostojne slike o uslovima u kojima elementi elektrodistributivne opreme i postrojenja funkcionišu. Sa aspekta ukupne bezbijednosti funkcionisanja elektrodistributivnog sistema, a značajno sa aspoekta predikcije kvarova, mjerenje prelaznih otpora uzemljivača i mjerenje vrijednosti kapacitivnih struja zemljospoja u mrežama sa izolovanom neutralnom tačkom daće kvalitetnu informaciju i definisati buduće kratkoročne i dugoročne mjere koje u sistemu trebaju biti preduzete.

Nažalost, dugotrajna opšta neregularnost, koje su svjedoci sve elektrodistribucije u okruženju, u pogledu poslovanja dovela je do značajnih odstupanja sa aspekta poštovanja propisanih rokova za periodičnu kontrolu. Nedozvoljena gradnja je ugrozila mnoge dalekovode, prekinula mnoge kablovske vodove i dovela do mnogo neregularnih stanja koja su se moguće odrazila na otkaz dijela sistema mnogo kasnije u odnosu na momenat nastanka neregularnog događaja. Sve ovo zahtijeva vrlo ozbiljnu, plansku i temeljnu rekonstrukciju u pogledu organizacije aktivnosti na sagledavanju aktuelnog stanja ukupne opreme elektrodistributivnog sistema.

Dalje, stanje elektrodistributivne opreme, kako kablovskih i nadzemnih vodova tako i opreme u transformatorskim stanicama, često je značajna prepreka uvođenju novih tehnologija i sistema za daljinsku komunikaciju i nadzor. Uspješna implemenatacija sistema brojila sa kojima se komunicira kroz niskonaponsku mrežu često je jako otežana zbog činjenice da su niskonaponski vodovi loš medijum za prenos kvalitetnog signala upravo zbog postojanja mnogo loših spojeva i velikog broja tačaka sa nedopustivo visokim nivoom prelaznog otpora. Ova situacija onemogućava kvalitetan prenos podataka od brojila do centralnog sistema i otežava urednu akviziju podataka i upravljanje brojilima. Ipak, saznanje o postojanju ovakvih tačaka, njihovo geografsko lociranje i identifikacija na terenu, bitno doprinosi kvalitetnijoj spoznaji o realnom stanju dijela sistema. Prelazni otpori na kontaktnim mjestima duž niskonaponske linije nijesu samo remetilački faktor za komunikacioni signal, već su direktno uzrok prekida na duži ili kraći rok, uzrok su ubrzanog slabljenja izolacije i svakako direktno utiču na kvalitet isporučene električne energije.

Dakle, pored koraka predviđenih aktuelnim pravilnicima i procedurama koji regulišu periodično održavanje u elektrodistributivnom sistemu, potrebno je vršiti stalna planska mjerenja odgovarajućih parametara koji će biti korišteni za kvantifikaciju stanja dijela sistema, a posljedično će dati i sliku o nivou vjerovatnoće pojave otkaza specifičnog dijela sistema. Upravljanje rizikom od pojave kvara, uvažavajući i projekciju šteta koje ti kvarovi mogu da izazovu, moguće je jedino na osnovu relevantnih kvantifikatora dobijenih mjerenjem. Zapravo, mjerenje je ključ za identifikaciju svih problema koji utiču na kvalitet isporučene električne energije i rizik da taj kvalitet bude narušen. Upravljanje rizikom je moguće jedino ako se rizik može izmjeriti. Propadi napona, pojava viših harmonika u mreži, kratkotrajni prekidi, disbalans struja i napona itd., često mogu biti posljedica stanja u mreži koje prethodi kvaru.

Uzimanjem u obzir svih parametara dobijenih mjerenjem i njihovim stavljanjem u korelaciju sa značajem konkretnog dijela postrojenja ili sistema u smislu obima štete koji ispad tog elementa može prouzrokovati, kao i definisanjem sljedećeg mogućeg neregularnog stanja u lancu događaja kao posljedice prethodnog stanja, moguće je kreirati matricu rizika kao alat kojim ćemo rangirati sve prepoznate rizike.

Procedura analize rizika zasniva se načelno na slijedećim koracima:

1. Sistematska procjena prijetnji za sistem ili dio sistema od značaja, urađena na jednom od dva raspoloživa principa
    a. *Kvalitativnom*
    b. *Kvantitativnom*
2. Procjena težine posljedica
3. Procjena vjerovatnoće otkaza
4. Formiranje matrice rizika

U najjednostavnijem obliku izrada matrice rizika se zasniva na dobro definisanom skupu prijetnji i korespondentnih posljedica u slučaju nastanka predefinisanih prijetnji, bilo da se radi o pojedinačnoj pojavi ili pojavi grupe prijetnji. Definisanje skupa prijetnji dakle zasniva se na ekspertskim znanjima i dobrom poznavanju fizikalnosti sistema čijim održavanjem se želi upravljati.

U smislu izrade matrice rizika, kao jednostavnog alata za rangiranje rizika, za svaki predviđeni kvar, potrebno je vjerovatnoću pojave kvara, na elementu sistema izraziti kroz [3]:

- Kvantitativno predviđanje prijetnji:
    - Matematička definicija vjerovatnoće – realni broj sa vrijednostima između 0 i 1, koji se pridružuje slučajnom događaju.
    - Može se odnositi na relativnu frekvenciju pojavljivanja nekog događaja ili na stepen izvjesnosti da će se događaj dogoditi.

ili

- Kvalitativno predviđanje prijetnji:
    - V (velik); S (srednji); M (mali), H (high); M (medium); L (low)
    - C (Critical); S (Serious); Mo (Moderate); Mi (Minor); N (Negligible)
    - Pridruživanje brojčane vrijednosti konkretnom uticaju u zavisnosti od ranga: 5; 4; 3; 2; 1

Tabela 1. Kvalitativni i kvantitativni opis izloženosti prijetnjama

Izloženost opasnostima / štetnostima u % tokom ekspolatacionog perioda (nedjelje, mjeseca, godine)	Kvalitativni opis izloženosti opasnostima / štetnostima	Kvantitativno rangiranje izloženosti opasnostima/štetnostima
		Rang
0 – 20 %	vrlo rijetko	1
21 – 40 %	povremeno	2
41 – 60 %	često	3
61 – 80 %	veći dio vremena ekspolatacije	4
81 – 100 %	stalno	5

Sličan postupak se sprovodi i za određivanje težine posljedice zbog nastanka specifičnog kvara.

Vrste kvarova, njihove vjerovatnoće pojave kao i vrste i ozbiljnost posljedica uzrokovanih pojavom tih kvarova, kavantifikovanih odgovarajućim težinskim faktorima, potrebno je organizovati u odgovarajuću matricu.

U tom smislu potrebno je prethodno izvršiti rangiranje izloženosti štetnostima ili opasnostima koje prijete sistemu ili njegovom dijelu u toku unaprijed definisanog eksploatacionog perioda.

Takođe je potrebno definisati odgovarajuću listu detalja (ček lista) koje je potrebno provjeriti, a koji rezultati bitno determinišu stanje opreme za koju se rizik od nastanka kvara procjenjuje.

Jedan primjer ove liste koji se odnosi na provjeru stanja stubnih mjesta dat je u Tabeli 2:

Tabela 2. Lista za prikupljanje podataka za dalekovodno stubno mjesto

Pregled na osnovu čl.26 Pravilnika o tehničkim normativima za pogon i održavanje elektroenergetskih postrojenja i vodova													
čl.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	
Redni broj stuba	**Oštećenje provodnika**	**Povećanje ugiba provodnika**	**Oštećenje Izolatora**	**Oštećenje ovjesne opreme**	**Korozija konstrukcije**	**Oštećenje stuba (drveni ili betonski)**	**Oštećenje konzola vijaka i zemljovoda**	**Oštećenje uzemljenih mjesta**	**Tablice za upozorenje i oznake**	**Izgradnja objekata ispod i u blizini**	**Nepropisna ukrštanja**	**Rastinje ispod i u blizini**	**POSEBNE NAPOMENE**

Stanje ispunjenosti tehničkih zahtjeva definisanih odgovarajućim pravilnikom o održavanju elektrodistributivnog sistema determiniše i kvanitativni rang koji se dalje može koristiti u proračunu rizika (Tabela 3):

Tabela 3. Tabela ispunjenosti tehničkih zahtjeva

Ispunjenost tehničkih zahtjeva u %	**Kvalitativni opis ispunjenosti zahtjeva**	**Kvantitativno rangiranje ispunjenosti zahtjeva**
		Rang
81 -100 %	Zadovoljavajuće – nastaviti sa radom	1
61 - 80 %	Preduzeti srednjoročne potrebne mjere	2
41 – 60 %	Preduzeti kratkoročne potrebne mjere	3
21 – 40 %	Trenutno potrebne mjere	4
0 - 20 %	Mjere za trenutni prekid rada	5

Na osnovu ovih kvantifikatora moguće je kreirati matricu vjerovatnoće nastanka neželjenog događaja kao proizvod odgovarajućih rangova za svako polje ponaosob (Tabela 4):

Tabela 4. Matrica vjerovatnoće nastanka neželjenog događaja

Izloženost opasnostima/ štetnostima		**Tehničko stanje sistema**				
		Zadovoljavajuće – nastaviti sa radom	Srednjoročne potrebne mjere	Kratkoročne potrebne mjere	Trenutno potrebne mjere	Mjere za trenutni prekid rada
		1	2	3	4	5
vrlo rijetko	1	**1**	**2**	**3**	**4**	**5**
povremeno	2	**2**	**4**	**6**	**8**	**10**
često	3	**3**	**6**	**9**	**12**	**15**
veći dio vremena ekspolatacije	4	**4**	**8**	**12**	**16**	**20**
stalno	5	**5**	**10**	**15**	**20**	**25**

Rangovi vjerovatnoće nastanka neželjenog događaja u posmatranom slučaju su iskazani u opsegu od 1 do 25, a kvalitativni opis vjerovatnoće i kvantitativni rang su prikazani u Tabeli 5.

Tabela 5. Rang matrica vjerovatnoće nastanka neželjenog događaja

Kvantifikator stanja sistema	**Kvalitativni opis vjerovatnoće pojave kvara**	**Kvantitativni rang vjerovatnoće**
1,2	Zanemarljiva (N)	1
3, 4, 5	Mala (Mi)	2
6, 8, 9	Srednja (Mo)	3
10, 12,15, 16	Ozbiljna (S)	4
20, 25	Kritična (C)	5

Značenje kvalitativnog opisa vjerovatnoće pojave kvara iz gornje tabele je kako slijedi:

• C (Critical): Ako se štetni događaj dogodi, sistem će obustaviti rad. Neće se ostvariti minimalni zahtjevi prihvatljivosti – funkcionisanje sistema je onemogućeno (minimum acceptable requirements).
• S (Serious): Ako se štetni događaj dogodi, sistem će imati veliko povećanje troška i/ili značajno kašnjenje u postizanju pune funkcionalnosti, ali ostvariće se minimalni zahtjevi prihvatljivosti (minimum acceptable requirements).
• Mo (Moderate): Ako se štetni događaj dogodi, sistem će imati umjereno povećanje troška i/ili kašnjenje u postizanju pune funkcionalnosti, ali minimalni zahtjevi prihvatljivosti (minimum acceptable requirements) biti ostvareni.
• Mi (Minor): Ako se štetni događaj dogodi, projekt sistem će imati malo povećanje troška i/ili kašnjenje u postizanju pune funkcionalnosti, ali će najveći broj funkcionalnih zahtjeva prihvatljivosti (minimum acceptable requirements) biti ostvaren.
• N (Negligible): Ako se štetni događaj dogodi, on neće imati uticaja na funkcionalnost sistema. Svi funkcionalni zahtjevi će se ostvariti.

Naredni korak u procjeni rizika obuhvata kvantifikaciju i kvalitativni opis posljedica koje štetni događaj (kvar) na specifičnom dijelu sistema može da uzrokuje (Tabela 6).

Krajnji rezultat postupka procjene rizika je kreiranje matrice rizika. Primjenom matrice rizike određuje se rang rizika kao proizvod nivoa rangiranja vjerovatnoće nastanka neželjenog događaja i nivoa

rangiranja težine mogućih posljedica. U matrici rizika prikazan je način ocjenjivanja rizika koji se sastoji od ova dva faktora.

Tabela 6. Rang težine posljedice izazvane neželjenim događajem

Opis posljedice	**Kvalitativni opis težine posljedice**	**Kvantitativni rang težine posledice**
Nema opasnosti za sistem niti za okruženje. Beznačajno oštećenje djelova sistema. Funkcija održana. Nema posljedica po korisnike sistema	mala	1
Nema opasnosti za sistem niti za okruženje. Lako oštećenje djelova sistema. Privremeno ograničenje funkcije sistema. Posljedice po korisnike kratkotrajne i popravljive	srednja	2
Potencijalna opasnost za život i zdravlje ljudi. Značajno oštećenje sistema. Privremena nefunkcionalnost sistema, kasnije funkcionalnost moguća uz bitna ograničenja	velika	3
Stvarna opasnost za život i zdravlje ljudi. Ogromno oštećenje ili uništenje djelova sistema ili sistema u cjelini. Dugotrajna nefunkcionalnost sistema.	teška	4
Potpuna havarija sistema. Trajna nefunkcionalnost.	katastrofalna	5

Korisno je definisati pet nivoa rangiranja za vjerovatnoću i za posljedice. Kvalitativan opis vjerovatnoće i posljedice prikazan je u Tabeli 7.

Tabela 7. Matrica rizika

Vjerovatnoća nastanka neželjenog događaja		**Težina moguće posljedice**				
		mala	srednja	velika	teška	katastrofalna
		Rad se nastavlja bez ikakvih posledica	Kratkotrajan zastoj u funkcionisanju, korisnik ima neprijatnost bez registrovanja materijalnih šteta	Značajan zastoj i ograničena funkcionalnost Korisnik trpi umjerene štete	Ogromna havarija, zastoj u funkcionisanju, velika ograničenja, velike štete kod korisnika	Potpuna havarija, apsolutna nefunkcionalnost, trajne štete kod korisnika
		1	2	3	4	5
Zanemarljiva	1	**1**	**2**	**3**	**4**	**5**
Mala	2	**2**	**4**	**6**	**8**	**10**
Srednja	3	**3**	**6**	**9**	**12**	**15**
Velika	4	**4**	**8**	**12**	**16**	**20**
Izrazito velika	5	**5**	**10**	**15**	**20**	**25**

Svaki rang vjerovatnoće i posljedice korespondira sa unaprijed dodijeljenom brojnom vrijednosti. Uočava se da jedan isti rang rizika korespondira sa više rangova vjerovatnoće pojave kvara, jer se kvantifikatori rizika dobijaju kao proizvodi ranga vjerovatnoće i ranga posljedice, a na osnovu definicije rizika.

U zavisnosti od kvantitativnog ranga rizika (od 1 do 5) treba odrediti i korpus aktivnosti koje je potrebno sprovesti za svaki rang posebno. U Tabeli 8 se nalazi jedan od predloga akcija.

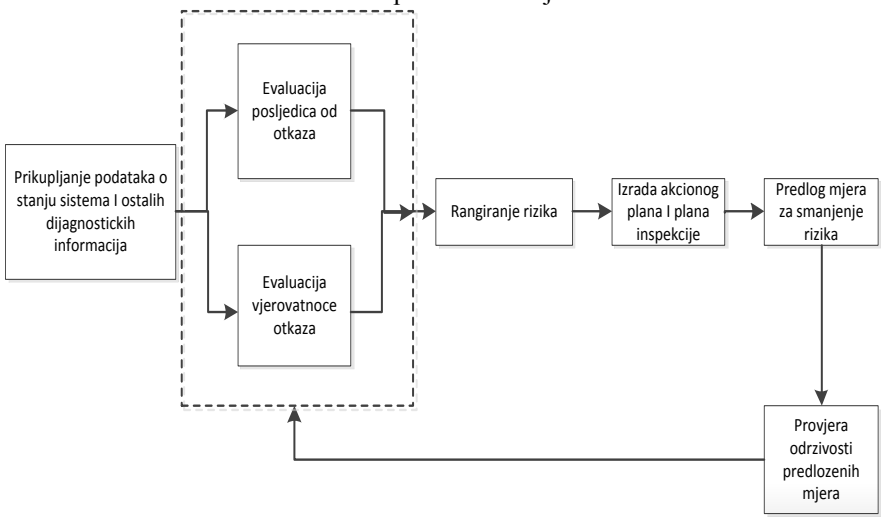
Tabela 8. Rang matrica rizika

Brojčana vrijednost rizika	Kvalitativni opis rizika	Kvantitativni rang rizik	Način i mjere za otklanjanje, smanjenje ili spriječavanje rizika
1, 2	Beznačajan	1	Optimalni uslovi rada, rizik od nastanka kvara beznačajan. Nije potrebna nikakva specifična aktivnost
3, 4, 5	Mali	2	Zadovoljavajući uslovi rada. Postoje minorna odstupanja od tehničkih propisa bez nužnog ograničavanja funkcionalnosti sistema. Potrebno je izvršiti usklađivanja sa tehničkim propisima. Bezbjednost zaposlenih i okruženja nije ugrožena, funkcionalnost sistema je zadovoljavajuća.
6, 8, 9	Srednji	3	Sistem funkcioniše u stanju mogućeg rizika od nastanka kvara i ograničenja funkcionalnosti manjih razmjera. Potrebni su konkretni zahvati na usklađivanju performansi sistema sa tehničkim propisima.
10, 12, 15, 16	Visok	4	Rad sistema bitno odstupa od tehničkih normative i propisa uz visoko izraženu mogućnost od nastanka kvara i prekida funkcionisanja i nastanka povrede ili oštećenja zdravlja zaposlenih. Pristupiti hitnom remontu uz ograničenje funkcionalnosti.
20, 25	Ekstremni	5	Tehničko stanje sistema potpuno nezadovoljavajuće. Drastično narušena usklađenost sa propisima u pogledu tehničke ispravnosti i bezbjednosti. Sistem apsolutno nestabilan sa vrlo izvjesnom havarijskom situacijom. Ugrožena bezbijednost zaposlenih i okruženja. Neophodna zabrana rada i potpuna rekonstrukcija ili zamjena.

Važno je napomenuti da ne postoji linearna zavisnost između kvantitativnog ranga rizika i brojne vrijednosti rizika izračunatog iz definicije rizika. U tom smsilu i jeste izvršeno grupisanje rizika u odgovarajuće razrede, za koje sve vrijednosti rizika važe iste korektivne mjere ukoliko se radi o istom rangu rizika. Istina, ovaj pristup može značajno ograničiti potpuno upravljanje rizikom ukoliko je stvarno stanje takvo da traži primjenu različitih korektivnih mjera za slučaj rizika iskazanih različitim brojnim vrijednostima ali koje se nalaze u istom rangu. Ipak, ovaj model je primjenljiv u uslovima gdje je ekspertsko znanje raspoloživo i gdje postoji kvalitetna iskustvena baza u ljudskim resursima.

Naravno, nakon ovog koraka se aktivnost na identifikaciji prijetnji i rangiranju rizika ne završava. Na Slici 1 se nalazi algoritam permanentnog funkcionisanja procesa procjene rizika od otkaza sistema [5].

Slika 1. Postupak određivanja nivoa rizika



Identifikacaja mogućih kritičnih situacija, štetnosti i opasnosti koje prijete sigurnosti u radu sistema i održavanju njegove pune funkcionalnosti su osnovno polazište ove metode. Upravo je tu, uz punu podršku saznanjima dobijenim iz dijagnostičkih izvještaja, ključna uloga visokostručnih i na iskustvu

izgrađenih kadrova u svakoj elektroenergetskoj kompaniji. Zaključuje se da je njegovanje ljudskih resursa u ovoj oblasti od vitalnog značaja za prosperitet svake kompanije.

3. Održavanje elektrodistributivnih sistema u svijetlu rizika od elementarnih nepogoda

Elementarne nepogode (poplave, suše, požari, oluje, enormne sniježne padavine itd.) su prirodne pojave na koje događaje svakako nije moguće uticati ali čiju pojavu je današnjim meteorološkim modelima moguće prilično dobro predvidjeti. Doduše, iako prognoza pojave ovih nepogoda može biti prilično dobra u pogledu predviđanja intenziteta, trajanja i lokacije, ta prognoza je pouzdana uglavnom za nedovoljno duga vremenska razdoblja, u kojima bi se mogla preduzeti značajna aktivnost ad hoc u smislu zaštite i umanjenja posljedica. U tom smislu planiranje razvoja mreže uz uvažavanje rizika od nastanka ovakvih poremećaja je vrlo važno.

Poučeni lošim iskustvom u vezi sa klimatskim promjenama i kako smo u regionu bili izloženi ekstremnim poplavama, požarima i sniježnim nepogodama u prilično dugom trajanju, sve države regiona su donijele odgovarajuće nacionalne programe i strategije kojima će obezbijediti dovoljan stepen spremnosti za eventualne nove slične događaje i pokušati da štete nastale u takvim situacijama svedu na minimum, a stanovništvo liše životne ugroženosti i obezbijede im minimum životnih potreba. Jedna od osnovnih životnih potreba danas je i upotreba električne energije. Nažalost, sve elementarne nepogode bitno uplivišu na stanje stabilnosti elektroenergetskog sistema kao sistema koji je prilično eksponiran u spoljašnjem ambijentu. Kad je o elektrodistributivnom sistemu riječ, dominantni su dalekovodni strubovi naponskih nivoa 110kV i 35kV kao i objekti transformatorskih stanica koji mogu biti izloženi uticajima stihije. S tim u vezi, sastavni dio dokumenata koji tretiraju stanje prije i tokom elementranih nepogoda je i akt kojim se vrši procjena rizika od nastanka šteta zbog elementarnih nepogoda kao i obim i nivo šteta koje tom prilikom mogu nastati. Kao kritična infrastruktura sa stanovišta pojave elementarnih nepogoda i drugih nesreća svakako se prepoznaje i elektrodistributivni sistem.

Tradicionalan pristup zaštite imovine u slučaju elementarnih nepogoda je zaključivanje odgovarajućeg ugovora o osiguranju imovine u slučaju elementarnih nepogoda. Ova polisa osiguranja u osnovi treba da pokrije direktne štete pričinjene sistemu kao i štete koje su nefunkcionisanjem sistema nastale kod korisnika sistema.

U smislu zaključivanja što povoljnijeg ugovora sa osiguravačem kritično je poznavanje dijagnostičkog stanja elektrodistributivnog sistema i poznavanje frekvencije i dužine otkaza sistema u redovnom stanju kao i posljedica koje se ispadom nekog dijela sistema mogu pojaviti. Ova spoznaja će omogućiti i modelovanje hipotetičkih stanja kod elementarnih nepogoda i sticanje slike kroz različite scenarije o mogućim razmjerama havarija u specifičnim meteorološkim uslovima. Vrlo često zaključivanje polise osiguranja sa neprimjereno visokim nivoom učešća u šteti osiguranika dovodi do toga da se za najveći broj šteta koje se dešavaju u redovnom stanju ne može naplatiti nikakav iznos od osiguravača. U tom smislu je , naročito u neredovnom stanju izazvanom elementarnim nepogodama, potrebno pravilno odmjeriti nivo učešća u šteti i obezbijediti mogućnost naplate štete za optimalan nivo šteta koje se mogu desiti.

Sa druge strane, dio sistema koji nije postao nefunkcionalan, u stanju izazvanom elementarnim nepogodama je dodatno napregnut i od njega se zahtijeva više i više. Istovremeno, pažnja se usmjerava na povratak oštećenog dijela sistema u funkcionalno stanje i tada je potrebno učiniti sve da se sistem reaktivira u najkraćem mogućem roku. Neplansko ponašanje i nepripremljenost za ovakva stanja ima visoku cijenu. Svako iscrpljivanje sistema preko nazivnih vrijednosti u regularnom stanju znači nemogućnost dobijanja dodatnih kapaciteta u neredovnim okolnostima.

Dakle, u cilju što većeg nivoa spremnosti da se na adekvatan način odgovori mogućem poremećaju u radu sistema izazvanog elementranim nepogodama ODS mora biti aktivno uključen u izradu svih strateških dokumenta iz ove oblasti. Pored toga, u postupku izgradnje djelova sistema treba posebno voditi računa i o riziku od nastanka prirodnih poremećaja koji mogu izazvati bitan poremećaj u funkcionisanju ili kolaps sistema. Takođe, izrada odgovarajućih akcionih planova djelovanja za različite scenarije koji se mogu modelovati značajno će pomoći efikasnijoj pripremi i organizovanijoj

akciji koja treba da uslijedi nakon što se elementarna nepogoda desi i kad se uslovi za sprovođenje rekonstruktivnih aktivnosti na terenu obezbijede.

4. Zaključak

Elektroenergetski sistemi, distributivni ili prenosni, dio su kritične infrastrukture. Upravljanje ovakvim sistemima, planiranje njihove ekspoloatacije i održavanja, ne može se zamisliti bez adekvatne procjene rizika za sve događaje kojima sistem ili neki njegov dio može biti izložen, uz sagledavanje obima i vrste posljedice koja će nastati nakon izlaganja štetnom događaju. Pravovremena spoznaja i predikcija štetnih događaja ima neprocjenjiv značaja na brzinu odgovora i oporavak sistema. Pravilnim investiranjem u prevenciju smanjujemo direktne i indirektne štete prema algoritmu 1:7:40[3] sa čime stvaramo preduslove za neometano funkcionisanje sistema kritične infrastrukture, a posebno kontinuiranog snadbjevanja stanovništva električnom energijom kao jednim od najpotrebnijih resursa čovječanstva.

Prikazana metodologija procjene rizika može pomoći ako se želi dati kvantitativan iskaz nivoa rizika koji sa sobom nosi otkaz dijela sistema ili sistema u cjelini. Tada će se menadžerska pažnja usmjeriti na akciju koja će prevencijom doprinijeti smanjenju na najmanju moguću mjeru mogućnosti pojave štetnog događaja koji je procijenjen kao rizičan.

Sličan algoritam može biti primijenjen i u slučaju analize potencijalne pojave prirodne nepogode. Analiza podataka mora sadržavati matrice rizika i obavezna najmanje dva scenarija, najvjerovatniji i najgori mogući scenario. Preporučuje se i izrada SWOT analize snaga, slabosti, prilika i prijetnji, kao podloge za donošenje zaključaka i preporuka. Takođe, radi lakšeg prepoznavanja međusobno zavisnih procjena, potrebno je uraditi i dodatke u kojima se prepoznaje relevantni zakonski okvir, te uticaj na životnu sredinu, kao i eventualni prekogranični uticaj na druga područja. Vrednovanje podataka je kruna integrisanog sistema upravljanja rizicima, a pravilno upravljanje vrednovanjem može donijeti niz primarnih i sekundarnih benefita korisnicima ali i širem lokalnom stanovništvu. Ovdje se prije svega misli na pravilnu klasifikaciju podataka pri čemu se mora uvažavati EUROSTAT klasifikacija i kategorizacija rizika po osnovu Smjernica EU i ISO 31000. Da bi lakše i pravilnije upravljali podacima, potrebno je izraditi odgovarajuće baze na AutoCad i AutoDesk (CAD), Building Information Managment (BIM) i Geographical Information Sistem (GIS) platformama [6].

5. Literatura

[1] ISO - Quality management systems — Requirements . ISO 9001:2015. i ISO - Risk management — Principles and guidelines ISO 31000:2009.
[2] Marvin Rausand, Risk Assessment: Theory, Methods, and Applications ISBN: 978-1-118-28110-9, June 2013
[3] Prof. dr Živoslav Adamović, Mr Goran Nestorović, Mr Mileta Radojević, Mr Ljubivoje Paunović, *Menadžment industrjskog održavanja*, Univerzitet u Novom Sadu, Tehnički Fakultet "Mihajlo Pupin"Zrenjanin, 2008.
[4] Savezni propisi, Zbirka propisa iz elektrotehnike, prva knjiga, Službeni list SRJ, Beograd, 1996.
[5] Shinsuke Sakai, Risk-based Maintenance, JR EAST Technical Review – No. 17, http://www.jreast.co.jp/e/development/tech/pdf_17/Tec-17-01-04eng.pdf
[6] Tomić D., Šećerov P., Garaplija E. *Menadžment kritične infrastrukture.* Beograd, 2018.

[3]Kelman, I. and C.M. Shreve (ed.). 2014. Disaster Mitigation Saves. Version 6, 13 November 2014 (Version 1 was 30 October 2002). http://www.ilankelman.org/miscellany/MitigationSaves.doc

Guidelines for the Preparation of Papers for Publication in the Serbian Journal of Engineering Management

Title of Paper in Serbian

Authors' Name and Surname[1]*, Name and Surname[2], Name and Surname[3] [in this stage leave it empty for the peer review purpose]

[1] Institution and E-mail address [in this stage leave it empty for the peer review purpose]
[2] Institution and E-mail address [in this stage leave it empty for the peer review purpose]
[3] Institution and E-mail address [in this stage leave it empty for the peer review purpose]

Summary in Serbian: This document is a template for formatting the papers in order to prepare them for printing. This summary provides briefly the information related to the content of the article so that the reader can rapidly and accurately assess its relevance. Authors should explain the goals of research or state the reason (reasons) why they have written the article. Then, it is necessary to describe the methods used in the study and briefly describe the results they have obtained in the research. The abstract should be between 100 and 250 words long.

Keywords: 3-5 keywords for indexing and search purposes

Title of Paper in English

Abstract in English: This document presents a template for preparing the print-ready papers that will be included in the Serbian Journal of Engineering Management. The abstract briefly summarizes the article and gives the reader the opportunity to assess its relevance. The authors should elaborate the goals of the research or state their reason (reasons) for writing the paper. It is additionally required for them to describe the methods used during the research and give a brief description of the results and conclusions of the research. The abstract should be between 100 and 250 words long.

Keywords: 3-5 keywords for indexing and search purposes

1. Introduction

The paper should be written using MS Word for Windows (on Serbian Cyrillic, Latin or English – UK keyboard). The length of work should not be more than 10 pages including text, diagrams, tables, references, and appendices.

The format is **A4**. Use **2 cm** for the lower and upper margin and **2.5 cm** for the left and right margin. The spacing within one paragraph should be one (single), while the spacing between paragraphs is double. To format the text, it is recommended to use font Times New Roman.

2. Structure of the paper

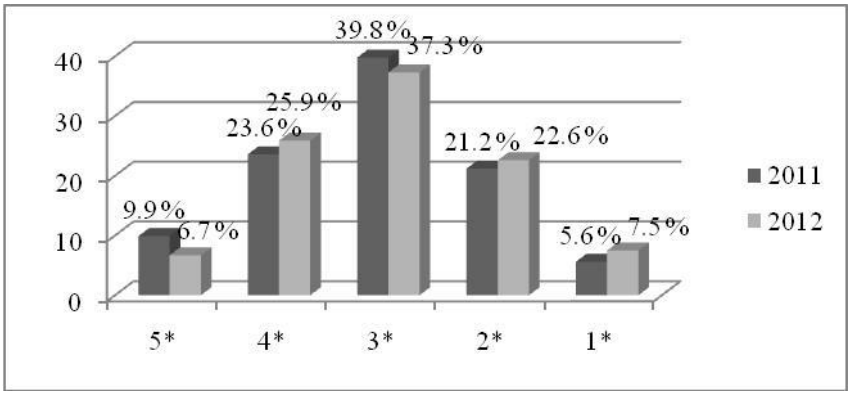
In the first line of the first page the title should be written in Serbian language (16 pt). Under the title of the paper the spaces for name(s) of the author and the names of the author's institutions should be indicated as specified and aforementioned in this Guideline. After the space for the institution of the last author, leave one blank line and write the short summary (10 pt) in Serbian. After the summary, provide an overview of key words. After the paper title you indicated, include the summary and key words in the Serbian language, whereas they should be indicated in English like above.

Numbered subtitles of the first level must be formatted using the font 12 pt bold, a second-level sub-titles should be 10 pt bold. The text, and a list of references should be formatted using the font 10 pt.

3. Graphs, tables and formulae

All illustrations, regardless of whether they are diagrams, photographs or charts are referred to as images. The name and number of images should be displayed as centred.

Figure 1: Accommodation units according to the structure of hotel capacities in 2011 and 2012, written in the form of percentage



Source: (The Ministry of Finance and Economy, 2013)

The title and number of the table should be presented above the table as centred

Table 1: Accommodation units according to the structure of hotel capacities in 2011 and 2012, written in the form of percentage

Category	2011	2012	Number of accommodation units (2011)	Number of accommodation units (2012)
5*	**9,9**	**6,7**	1452	990
4*	**23,6**	**25,9**	3486	3911
3*	**39,8**	**37,3**	5895	5636
2*	**21,2**	**22,6**	3102	3420
1*	**5,6**	**7,5**	1133	1132
total	100	100	15068	15089

Source: (The Ministry of Finance and Economy, 2013)

Submit your article, including tables, images, etc., as a single file. In addition, you should submit all figures and tables (which are entered in black and white) as separate files in TIFF or JPF format with a minimum resolution of 300dpi.

Formulae should be centered on the page and properly numbered, as in the following example. It is recommended that you format the rows with formulae in Microsoft Word (using MathType).

$$\mathrm{PVo} = \frac{\mathrm{FVn}}{(1+i)^n} \quad (1)$$

4. Conclusion

In conclusion, the authors should summarize the results they have obtained in the research.

5. Literature

When quoting the literature, the APA referencing system should be used. For more information, see the Publication Manual of the American Psychological Association (6th ed.).

When quoting within the text, as in the sentence where you mention the author and specify his words, then after the author's name you should indicate the year of publication of the quoted text in parentheses, at the end of the sentence there should be the number of page in which the text should be indicated: according to Čerović (2012) ,,quoted text''(p.10). When the author is not mentioned in the sentence, then his last name, the year of publication and the number of page should be indicated in parentheses at the end of a sentence, and if the quote was created by paraphrasing or summarizing, then data about the page number is not required: (Čerović, 2012). If there are two or more references by the same author, but they were published at the same time in the same year, the referencing should look like this (Harish, 2008a; Harish, 2008b). When two authors wrote the paper together, the surnames of both authors are written as follows (Petković and Pindžo, 2012), or (Tew & Barbieri, 2012). The call for references in the text requires working with more than two authors and should be stated as follows (Luque-Martinez et al., 2007). When citing a source that does not show the number of pages (such as electronic sources) use the author's name and year of publication if the author is known, and if the author is a corporation or an organization, write down the organization name and year of publication (Ministry of Finance and Economy, 2013).

References should be given at the end of the main text in alphabetical order, following the last name of the author. Below are shown examples of using APA style for citations appearing in various forms (books, journal articles, proceedings, electronic resources, etc.).

A book with one author:
Example: Hrabovski, Tomić, E. (2009). *Health tourism destinations.* Novi Sad: Prometheus.

A book with several authors:
When you have multiple authors, all of them are supposed to be mentioned, but as soon as the last surnames are added and if there are more than seven authors, mention the first six and then write … at the end of the last author.

Example: Barrows, C. & W. Powers, T. (2009). *Introduction to the Hospitality Industry.* 7th edition. Hoboken, New Jersey: John Wiley & Sons, Inc.

A book which was translated from a foreign language:
Example: Spic, E. H. (2011). *Art and psyche: a study of psychoanalysis and aesthetics.* (A. Niksic, prev.). Belgrade: Clio.

A book with an editor for a collection of papers; proceedings:
If the book is a collection of papers on the appropriate topic, the authors should mention the editor of their work with the surname and first initial in parentheses as they add "edit" if the person is editor, or "Ed." as editor if the book is written in a foreign language.

Example: Đurković, M. (ed.) (2007). *Serbia 2000-2006: state, society, economy, Belgrade:* Institute for European Studies.

Papers in the proceedings:
Example: Cerovic, S. (2012). *Modern concepts of strategic tourism destination management.* Scientific conference with international participation "Tourism: Challenges and Opportunities", Trebinje.

Papers published in the journal by one author:
Example: Harish, R. (2008). Brand Architecture and its Application in Strategic Marketing. *The Icfai University Journal of Brand Management,* 7 (2), 39-51.

Papers in a journal with two authors:
If the article to which you refer has a DOI number, references need to be added.

Example: Tew, C. Barbieri, C. (2012). The perceived benefits of agritourism: The provider's perspective. *Tourism Management*, 33 (6), 215-224. doi: 10.1016 / j.tourman.2011.02.005

Papers in a journal with more than two authors:
Example: Luque-Martinez, T. Castaneda-Garcia, A. J., Frias-Jamilena, D. M., Munoz-Leiva, F. & Rodriguez-Molina, M. A. (2007). Determinants of the Use of the Internet as a Tourist Information Source. *The Service Industries Journal*, 27 (7), 881 to 891. doi: 10.1080 / 02642060701570586

Newspaper article with the aforementioned author:
Example: Muscle, M. (days 1 February 2012). US Steel has reduced its losses. *Politika,* p. 11

Newspaper article with no author specified:
Example: Straževica ready in two months. (Days 1 February 2012). *Politika*, p. 10

Thesis in the printed version:
Example: Dewstow, R. A. (2006). *Using the Internet to enhance teaching at the University of Waikato* (Unpublished master's thesis). University of Waikato, Hamilton, New Zealand.

Document or database from the Internet, the private or official web page for which we know the database author:
Example: Kraizer, S. (2012). Safe child. Retrieved on 29 October 2012, from http://www.safechild.org/

Document or databases from the Internet, the official web page for which we do not know the author:
Example: Penn State Myths. (2006). Retrieved December 6, 2011, from http://www.psu.edu/ur/about/myths.html

Document or databases from the Internet, private or official web page where the author is a corporation or organization:
For example, the Ministry of Finance and Economy. (2013). Information on tourist traffic in Serbia. Retrieved on 06 February 2013 from http://www.turizam.mfp.gov.rs/index.php/sr/2010- 02-11-17-24-30

The sources which were not used in the paper should not be included in the list of references. References should be cited in the language in which they are published without translating them into the language of paper.

Obrazac za pripremu radova za objavljivanje u časopisu
Serbian Journal of Engineering Management

Naslov rada na srpskom jeziku

Ime Prezime[4]*, Ime Prezime[2], Ime Prezime[3] [ostavite u ovoj verziji prazno za potrebe recenzije]

[1] Institucija i i-mejl adresa [ostavite u ovoj verziji prazno za potrebe recenzije]
[2] Institucija i i-mejl adresa [ostavite u ovoj verziji prazno za potrebe recenzije]
[3] Institucija i i-mejl adresa [ostavite u ovoj verziji prazno za potrebe recenzije]

Apstrakt: Ovaj dokument predstavlja obrazac za formatiranje radova tako da izgledaju kao da su već spremni za štampu. Sažetak predstavlja kratak informativni prikaz sadržaja članka koju čitaocu treba da omogući brzu i tačnu ocenu njegove relevantnosti. Autori treba da obrazlože ciljeve istraživanja ili navedu razlog (razloge) zbog koga pišu članak. Zatim, potrebno je da opišu metode korišćene u istraživanju i ukratko opišu rezultate do kojih su došli u istraživanju. Sažetak treba da sadrži od 100 do 250 reči.

Ključne reči: 3-5 ključnih reči za indeksiranje i pretraživanje

Title of Paper in English

Abstract: This document presents a template for preparing the print-ready papers that will be included in the Serbian Journal of Engineering Managment. The abstract briefly summarizes the article and gives the reader the opportunity to assess its relevancy. The authors should elaborate the goals of the research or state their reason (reasons) for writing the paper. It is additionally required for them to describe the methods used during the research and give a brief description of the results and conclusions of the research. The abstract should be between 100 and 250 words in lenght.

Keywords: 3-5 keywords

1. Uvod

Rad pisati koristeći MS Word za Windows (tastatura za srpsku ćirilicu, latinicu ili engleski jezik - UK). Dužina rada treba da bude najviše 10 strana uključujući tekst, slike, tabele, literaturu i ostale priloge. Format stranice je **A4.** Koristite **2 cm** za donju i gornju marginu, a **2,5 cm** za levu i desnu marginu. Razmak između redova u okviru jednog pasusa je jedan, dok je razmak između paragrafa dvostruki. Za formatiranje teksta preporučuje se korišćenje fonta **Times New Roman.**

2. Struktura rada

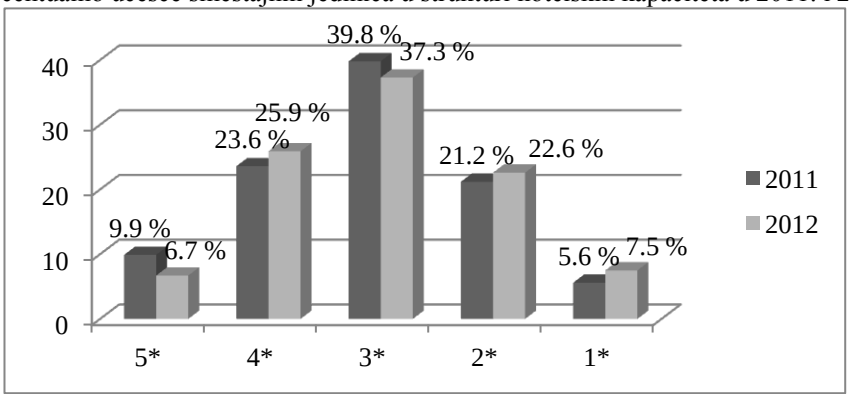
U prvom redu na prvoj strani treba napisati naslov rada na srpskom jeziku (16 pt). Ispod naslova rada treba ostaviti mesto za navođenje ime(na) autora, nazive institucija autora onako kako je naznačeno u ovom Obrascu. Nakon institucije poslednjeg autora, ostaviti jedan prazan red i u sledećem napisati kratak sažetak (10 pt). Nakon sažetka sledi pregled ključnih reči. Nakon prikazanog naslova rada, sažetka i ključnih reči na srpskom jeziku, potrebno je i na engleskom jeziku naznačiti prethodno navedeno.

Numerisane podnaslove prvog nivoa treba formatirati korišćenjem fonta 12 pt boldovano, a podnaslove drugog nivoa 10 pt boldovano. Tekst, kao i spisak literature treba formatirati korišćenjem fonta 10 pt.

3. Grafički i tabelarni prikazi i formule

Sve ilustracije, bez obzira da li su dijagrami, fotografije, grafikoni nazivaju se slike. Naziv i broj slike treba prikazati na sredini reda iznad slike.

Slika 1: Procentualno učešće smeštajnih jedinica u strukturi hotelskih kapaciteta u 2011. i 2012. godini



Izvor: (Ministarstvo finansija i privrede, 2013)

Naziv i broj tabele treba prikazati iznad tabele na sredini reda.

Tabela 1: Procentualno učešće smeštajnih jedinica u strukturi hotelskih kapaciteta u 2011. i 2012. godini

Kategorija	**2011.**	**2012.**	**Broj smeštajnih jedinica (2011)**	**Broj smeštajnih jedinica (2012)**
5*	**9,9**	**6,7**	1452	990
4*	**23,6**	**25,9**	3486	3911
3*	**39,8**	**37,3**	5895	5636
2*	**21,2**	**22,6**	3102	3420
1*	**5,6**	**7,5**	1133	1132
ukupno	100	100	15068	15089

Izvor: (Ministarstvo finansija i privrede, 2013)

Pošaljite svoj rad, uključujući tabele, slike itd, kao jednu datoteku. Pored toga, treba dostaviti sve slike i tabele (koje se unose u crno-beloj tehnici) kao posebne fajlove u JPF ili TIFF formatu sa najmanje 300dpi rezolucije.

Formule treba centrirati na stranici sa numeracijom, kao u narednom primeru. Preporučuje se formatiranje redova sa formulama u Microsoft Word-u (MathType).

$$\mathrm{PVo} = \frac{\mathrm{FVn}}{(1+\mathrm{i})^{\mathrm{n}}} \qquad (1)$$

4. Zaključak

U zaključku autori treba da sumiraju rezultate do kojih su došli u istraživanju.

Literatura

Prilikom navođenja literature, treba se pridržavati uputstva APA sistema navođenja literature. Za više informacija pogledajte *Publication Manual of the American Psychological Association* (6th ed.).

Prilikom citiranja unutar teksta, kada u rečenici spominjete autora i navodite njegove reči, onda posle imena autora treba navesti godinu izdanja citiranog teksta u zagradi, a na kraju rečenice potrebno

je navesti broj strane na kojoj se nalazi rečenica u tekstu iz koga navodite: prema Čeroviću (2012), „citirani tekst“ (str.10). Kada se autor ne spominje u rečenici onda njegovo prezime, godinu izdanja rada i broj strane u radu navesti u zagradi i na kraj rečenice, a ako je citat nastao parafraziranjem ili rezimiranjem, onda podatak o broju strane nije neophodan: (Čerović, 2012). Ukoliko se navodi dve ili više referenci istog autora, a pri tom su objavljene u istoj godini, poziv na reference treba navesti na sledeći način (Harish, 2008a; Harish, 2008b). Kada su dva autora rada, navode se prezimena oba autora na sledeći način (Petković i Pindžo, 2012), odnosno (Tew & Barbieri, 2012). Poziv na reference u tekstu za radove sa više od dva autora treba navesti na sledeći način (Luque-Martinez i sar., 2007). Kada citirate izvor koji ne prikazuje broj strana (kao što su elektronski izvori) koristite prezime autora i godinu objavljivanja, ukoliko je autor poznat, a ukoliko je autor korporacija ili organizacija, naziv organizacije i godinu objavljivanja (Ministarstvo finansija i privrede, 2013).

Reference treba navesti zajedno na kraju glavnog teksta azbučnim redom po prezimenu autora. U nastavku su prikazani primeri korišćenja APA stila za citiranje u raznim oblicima pojavljivanja (knjiga, rad u časopisu, zbornik, elektronski izvori itd.).

Knjiga sa jednim autorom:
Primer: Hrabovski, Tomić, E. (2009). *Destinacije zdravstvenog turizma.* Novi Sad: Prometej.

Knjiga sa više autora:
Kada imamo više autora navodimo ih sve, s tim što pre poslednjeg prezimena dodajemo i, odnosno &, ako imamo više od sedam autora, navodimo prvih šest, zatim pišemo pišemo tri tačke, i na kraju poslednjeg autora.

Primer: Barrows, C. W. & Powers, T. (2009). *Introduction to the Hospitality Industry*. 7th edition. Hoboken, New Jersey: John Wiley&Sons, Inc.

Knjiga, prevod dela:
Primer: Spic, E. H. (2011). *Umetnost i psiha: studija o psihoanalizi i estetici.* (A. Nikšić, prev.). Beograd: Clio.

Knjiga sa urednikom ili priređivačem, zbornik radova:
Ako je knjiga zbornik radova na neku odgovarajuću temu, kao autora navodimo priređivača tog dela i uz njegovo prezime i inicijal imena u zagradi dodajemo "ured." ako je urednik, ili "prir." ako je priređivač, ili pak "Ed." kao editor ako je knjiga pisana na stranom jeziku.

Primer: Đurković, M. (ured.) (2007). *Srbija 2000-2006: država, društvo, privreda, Beograd:* Institut za evropske studije.

Rad u zborniku radova:
Primer: Čerović, S. (2012). *Savremeni koncepti strategijskog upravljanja turističkom destinacijom.* Naučni skup sa međunarodnim učešćem "Turizam: izazovi i mogućnosti", Trebinje.

Rad u časopisu sa jednim autorom:
Primer: Harish, R. (2008). Brand Architecture and its Application in Strategic Marketing. *The Icfai University Journal of Brand Management,* 7(2), 39-51.

Rad u časopisu sa dva autora:
Ako članak na koji se pozivate ima DOI broj, treba ga dodati referenci.

Primer: Tew, C. & Barbieri, C. (2012). The perceived benefits of agritourism: The provider’s perspective. *Tourism Management,* 33(6), 215-224. doi:10.1016/j.tourman.2011.02.005

Rad u časopisu sa više od dva autora:
Primer: Luque-Martinez, T., Castaneda-Garcia, J. A., Frias-Jamilena, D. M., Munoz-Leiva, F. & Rodriguez-Molina, M. A. (2007). Determinants of the Use of the Internet as a Tourist Information Source. *The Service Industries Journal,* 27(7), 881-891. doi: 10.1080/02642060701570586

Članak iz novina sa navedenim autorom:
Primer: Mišić, M. (1. feb. 2012). Ju-es stil smanjio gubitke. *Politika,* str. 11.

Članak iz novina bez navedenog autora:
Primer: Straževica gotova za dva meseca. (1. feb. 2012). *Politika,* str. 10.

Teza-štampana verzija:
Primer: Dewstow, R. A. (2006). *Using the Internet to enhance teaching at the University of Waikato* (Unpublished master's thesis). University of Waikato, Hamilton, New Zealand.

Dokumenta ili baze podataka sa interneta, privatne ili zvanične internet stranice kojima se zna autor:

Primer: Kraizer, S. (2012). *Safe child*. preuzeto 29. oktobra 2012, sa http://www.safechild.org/

Dokumenta ili baze podataka sa interneta, zvanične internet stranice kojima se ne zna autor:
Primer: *Penn State Myths*. (2006). Preuzeto 6. decembra 2011, sa http://www.psu.edu/ur/about/myths.html

Dokumenta ili baze podataka sa interneta, privatne ili zvanične internet stranice kojima je autor korporacija ili organizacija:
Primer: Ministarstvo finansija i privrede. (2013). *Informacije o turističkom prometu u Srbiji*. preuzeto 06. februara 2013. sa http://www.turizam.mfp.gov.rs/index.php/sr/2010-02-11-17-24-30

Izvori koji nisu korišćeni u radu ne treba da se nalaze u popisu literature. Reference treba navoditi na jeziku na kome su objavljene bez prevođenja na jezik rada.

Instructions for Authors

The Journal Committee strives to maintain the highest academic standards. The submitted papers should be original and unpublished until now. Also, it is forbidden that papers are in the process of reviewing in some other publication.

The papers would be subjected to check. The paper should fit the outlined academic and technical requirements.

Paper Types

Original unpublished scientific paper:

- Original scientific paper;
- Plenary lecture and paper presented at the conference;
- Review;
- Scientific review; discussion.

Original unpublished professional paper:

- Original professional paper;
- Contribution
- Book review.

Papers may be written in Serbian and English for authors from Serbia and the region or English for authors from other countries.

Submitted papers must be in alignment with guidelines for authors. In case they have not followed these guidelines, they would be reviewed for correction.

All manuscripts are subject to *double blind review*, i.e. the process of double "blind" anonymous reviewing. The papers must not contain any references which may indicate the author(s).

Paper Submission

Authors should send their papers via email casopis@fim.rs in .doc or .docx format.

The application consists of two separate attachments:

- Attachment 1, which contains the following data: the title of paper, author's name (without professional title), institution and address (email, postal address, phone number), as well as the asterisk next to the author in charge of correspondence;
- Attachment 2, which contains the paper with the following elements: paper title, abstracts, key words, the middle part of the paper, tables, graphs, references and attachments.

Authors, who pass the *double blind* anonymous review, will receive the document called the Author's Statement of Originality, which will be filled in, signed, scanned and sent to the email: casopis@fim.rs.

Paper content

All papers should contain: introduction, which elaborates on the aim and subject of the research, main hypothesis, work methods and paper structure; middle part of the paper where research is outlined (it is further divided into sub-headings) and conclusion, which represents summed up results and implications for further research.

Author's rights

After accepting the paper and signing up the Author's Statement of Originality, the author signs the statement according to the Author's Rights of the Journal.

Author's editions

Authors of published papers will receive one print version of the paper for their personal usage.

Paper submissions:

Papers should be submitted via email: casopis@fim.rs.

Uputstvo za autore

Uredništvo časopisa nastoji da održi visok akademski standard. Radovi, koji se podnose, treba da budu originalni i do sada neobjavljeni. Takođe, radovi ne smeju da se nalaze u postupku recenzije u nekom drugom časopisu. Radovi će biti podvrgnuti proveri. **Tekst rada mora da odgovara akademskim i tehničkim zahtevima.**

Tip rada

Originalni naučni rad, koji nije objavljen:

- Originalni naučni rad;
- Plenarno predavanje i rad prezentovan na konferenciji;
- Pregledni rad;
- Naučna kritika, odnosno polemika.

Originalni stručni rad, koji nije objavljen:

- Stručni rad;
- Informativni prilog;
- Prikaz knjige.

Jezici radova mogu biti srpski i engleski za autore iz Srbije i engleski za autore sa drugih govornih područja.

Podneti radovi moraju biti usaglašeni sa uputstvom za autore. U slučaju da nisu usaglašeni, biće vraćeni na ispravljanje.

Svi rukopisi podležu tzv. *double blind* recenziji, odnosno procesu dvostruko „slepe“, anonimne recenzije. Tekst rada ne sme da sadrži bilo kakve reference koje mogu da ukažu na autora/e rada.

Prijava radova

Autori treba da pošalju svoje radove elektronski, putem i-mejla casopis@fim.rs u vidu priloga u .doc ili .docx formatu.

Prijava se sastoji iz dva odvojena priloga:

- Prilog 1, koji sadrži sledeće podatke: naslov rada, imena autora (bez titula i zvanja), institucija/e i adresa/e (i-mejl, poštanska adresa, broj telefona), kao i zvezdicu kod imena autora koji je zadužen za korespondenciju;
- Prilog 2, koji sadrži rad sa sledećim elementima: naslov rada, apstrakt/i, ključne reči, središnji deo rada, slike, tabele, grafikoni, reference, prilozi;

Autorima, koji prođu dvostruko anonimnu recenziju, biće poslat dokument Izjave autora o originalnosti rada, koji će popuniti, potpisati, skenirati i poslati na i-mejl casopis@fim.rs.

Sadržaj rada

Svi rukopisi treba da sadrže: uvod, koji čine cilj i predmet istraživanja, osnovna hipoteza, metode rada i struktura rada; središnji deo rada u kome se prikazuje istraživanje (dalje podeljen na potpoglavlja) i zaključak, koji predstavlja sumiranje rezultata istraživanja kao i implikacije za dalja istraživanja.

Autorska prava

Po prihvatanju rada i potpisivanje izjave o originalnosti, autor potpisuje izjavu kojom prenosi autorska prava na Časopis.

Autorski primerci

Autori publikovanih radova će dobiti primerak štampane verzije časopisa za lično korišćenje.

Dostavljanje radova:

Radovi se dostavljaju putem i-mejla casopis@fim.rs.

List of Reviewers/Spisak recenzenata

Prof. dr Ajda Fošner, Slovenia
Prof. dr Bljerim Haljilji, Serbia
Prof. dr Dušan Borić, United Kingdom
Prof. dr Duško Tomić, UAE
Prof. dr Ioan Bacivarov, Romania
Prof. dr Jasna Brujić, USA
Prof. dr Jelena Buha, Switzerland
Prof. dr Karmen Erjavec, Slovenia
Prof. dr Marija Najdić, Serbia
Prof. dr Marios Panagiotis Efthymiopoulos, UAE
Prof. dr Milica Gerasimović, Serbia
Prof. dr Mirjana Kranjac, Serbia
Prof. dr Nehat Madžuni, Serbia
Prof. dr Simon Muhič, Slovenia
Prof. dr Slađan Milosavljević, Serbia
Prof. dr Slobodan Vasović, Serbia
Prof. dr Slobodan Živković, Serbia
Prof. dr Srđan Tomić, Serbia
Prof. dr Tatjana Ilić, UAE
Prof. dr Veselin Dickov, Serbia
Prof. dr Vladica Stojanović, Serbia
Prof. dr Zlatko Langović, Serbia
Doc. dr Dejan Milenković, Serbia
Doc. dr Dejan Viduka, Serbia
Doc. dr Igor Zorić, Serbia
Doc. dr Ivona Zenović, Serbia
Doc. dr Hatidža Beriša, Serbia
Doc. dr Jasmina Đurašković, Serbia
Doc. dr Marina Letonja, Slovenia
Doc. dr Milan Dimitrijević, Bosnia and Herzegovina
Doc. dr Mina Jovanović, Serbia
Doc. dr Mirjana Stevanović, Serbia
Doc. dr Mitja Jeraj, Slovenia
Doc. dr Nemanja Maček, Serbia
Doc. dr Nikolina Ljepava, UAE
Doc. dr Proda Šećerov, Serbia
Doc. dr Tanja Kranjac, Serbia

Editorial Board concluded this issue on January 31, 2019.
Uređivački odbor je zaključio ovaj broj 31. januara 2019.

ISSN: 2466-4693

Contact/Kontakt:
Serbian Journal of Engineering Management
Editorial Board/Uredništvo
School of Engineering Management/Fakultet za inženjerski menadžment
Bulevar vojvode Mišića 43
11000 Beograd
casopis@fim.rs
Tel. +381 11 41 40 422

CIP - Каталогизација у публикацији
Народна библиотека Србије, Београд

005:62

SERBIAN Journal of Engineering Management /
glavni i odgovorni urednik Vladimir Tomašević. - Vol.
1, no. 1 (2016)- . - Beograd : Univerzitet "Union -
Nikola Tesla", Fakultet za inženjerski menadžment,
2016- (Beograd : Draslar Partner). - 30 cm

Polugodišnje.
ISSN 2466-4693 = Serbian Journal of Engineering
Management
COBISS.SR-ID 224544524