ISSN 2466-4693
UDC/UDK: 005:62

Univerzitet „Union – Nikola Tesla“
Fakultet za inženjerski menadžment

Serbian Journal of Engineering Management

Vol. 2, No. 1, 2017.

Belgrade, January 2017

ISSN 2466-4693
UDC/UDK: 005:62

University „Union – Nikola Tesla“
The School of Engineering Management

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Serbian Journal of Engineering Management

Vol. 2, No. 1, 2017.

Belgrade, January 2017
Beograd, janauar 2017.

Published semiannually (January and July)/Izlazi dva puta godišnje (u januaru i julu)

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
Fakultet za inženjerski menadžment
Bulevar vojvode Mišića 43
11000 Beograd
casopis@fim.rs
Tel. +381 11 41 40 422

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Serbian Journal of Engineering Management
Vol. 2, No. 1, 2017.

A Message from the Editor-in-Chief

Serbian Journal of Engineering Management is a new scientific journal, published by The School of Engineering Management. This international journal is dedicated to the wide scope of themes in engineering amangement 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.

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Information on the journal in English and Serbian can be found at journal web page: http://fim.rs/centri-za-razvoj-i-saradnju/izdavacka-delatnost/naucno-strucni-casopis/.

Prof. Dr. Vladimir Tomašević, FRSA

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Serbian Journal of Engineering Management je nov naučno-stručni časopis, koji izdaje Fakultet za inženjerski menadžment. 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.

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Prof. dr Vladimir Tomašević, FRSA

Originalni naučni rad UDK 005.336.3:656.2/.4
Rad prihvaćen: 14. 12. 2016.

Praćenje i evaluacija kvaliteta u uslugama železničkog saobraćaja kao element menadžmenta kvaliteta

Vasko Vassilev[1*], Emil Velinov[2]

[1] Transport University "T.Kableshkov", Sofia, Bulgaria[1],
[2] Riga School of Economics and Business Administration (RISEBA), Latvia

Apstrakt: Članak ima za cilj da objasni proces realizacije usluga u makedonskom železničkom poslovanju kroz preko potrebno uspostavljanje kriterijuma za praćenje i vrednovanje kvaliteta usluga kao efikasne zaštite javnog interesa. Članak dalje ukazuje na viši kvalitet u uslugama prevoza, bolje uslove za sve zainteresovane strane učestvuju u životnom ciklusu usluga prevoza. Osim toga, studija tvrdi da sa primenom posebnih kriterijuma za kvalitet, možemo stvoriti preduslove za uspostavljanje mehanizama za razvoj i optimizaciju rezultata kao sistem za kazne zbog neispunjavanja uslova ugovora. To proizilazi iz činjenice da prikupljeni podaci treba da budu zasnovani na adekvatnom sistemu prikupljanja, analizi podataka i rad predlaže određeni pojednostavljeni model za analizu i procenu kvaliteta saobraćajnih usluga. Ovaj drugi model se sastoji od kvalitativnih i kvantitativnih varijabli sa tehničke tačke gledišta i sa stanovišta nivoa kvaliteta transportnih usluga do krajnjeg kupca.

Ključne reči: Kvalitet, menadžment kvalitetom, železnički transport

Monitoring and Evaluation of Quality in Rail Transport Services – An element of Quality Management

Abstract in English: The paper aims to explain the process of realization of the services in the Macedonian railway business through necessary set up of criteria for monitoring and evaluation for the services quality as an effective protection of the public interest. The paper further suggests that higher quality in the transport services leads to better conditions for all stakeholders who take part in the lifecycle of the transport services. Moreover, the study argues that with applying particular criteria for quality, we create pre-conditions for setting up a mechanism for developing and optimizing the results as the system for penalties for not meeting the contract conditions, as well. It stems from the fact that the collected data should be based on adequate collecting system, whereas data analysis and the paper propose certain simplified model for analysis and assessing of the transport services quality. The latter model consists of qualitative and quantitative variables from technical point of view and from the perspective of quality level of the transport services that are provided to the end customer.

Keywords: quality, public interest, qualitative parameters, quantitative parameters, transport services

1. Introduction

The quality of railway transport services is effected primarily from the decisions taken by the competent authorities in the name of responsible for rail transport person/entity. The regulatory function is implemented through a specially created system of quality control (Evans & Lindsey, 2002). This control is achieved through the following measures:

- Control of the quality process which is formed as a control variable in the set of quantitative and qualitative indicators;
- Control of carried out service is provided by identifying and analyzing deviations and violations of quality of service;
- Control system for quality management;
- Policy and quality objectives are introduced in order to provide direction in the management of the organization.

[1] vvasilev@vtu.bg

It is an imperative to determine the desired results and assist the organization to use its resources to achieve better results (Flyvbjerg, 2013). Quality objectives must be consistent with the policy and the desire for continuous improvement, while using measurable indicators for reporting. The achievement of quality objectives can have a positive impact on product quality, the efficiency of operations and financial performance and thus - rely on the satisfaction and confidence of consumers of rail transport.

On the basis of what the paper formulates, there are following objectives for the process of strengthening the system of quality management:

- Formulating and maintaining the policy and quality objectives in the field of railway transport;
- Introduction of policy and quality objectives throughout the organization to increase awareness, motivation and involvement;
- Definition and presentation of stipulated requirements;
- Ensuring that appropriate processes enable people to meet the requirements of customers and other stakeholders and to achieve quality objectives;
- Ensuring the construction, implementation and maintenance of the effective and efficient system of quality management.

2. Methodology

In order to form a better functioning system in the railway business, it should be developed based on the following principles (Flynn, et.al., 1994):

- Customer orientation – Railway companies depend on their customers and therefore we should understand their present and future business needs. This leads to understanding their requirements and striving statistics of their expectations.
- Effective management - The main objective of the operation of the railway is improving quality. State authority plans and takes all possible measures to ensure the necessary conditions to achieve specific objectives, i.e. for tasks, and hence the overall objectives. The working methods are aimed at clearly defining responsibilities, clarifying the issues and seeking options for their solution.
- Involvement of all stakeholders - state body as a way of placing tasks and building information arrays, including discussions on all important issues, allowing significant possibilities for improvements.

Measurement of the status quo

The model deals with the measurement of the activity as a separate procedure from the control process in rail transport. It focuses on the key role as an element of feedback in the management process. The assessment is expressed in a set of activities related to the studies of the tasks of the centers of responsibility (described in the reports) resulting from the annual objectives of rail transport undertakings. In the procedure the deviations are defined so that it makes sense to take corrective action (significant deviations).

The assessment procedure is the penultimate operation procedure of the control process (Montgomery, 2007). It has a direct connection with the two procedures of the process - pre- and post-January The assessment procedure is preceded by a procedure of analysis of variance for the period. The analysis of deviations ends with a detailed classification of variations in species and in relation to their causes. The procedure for analyzing information comes in total with (cumulative) unacceptable deviations of the evaluation procedure. Based on these deviations the estimates of activity are generated for the reporting period in the eponymous procedure. They are the product of the evaluation procedure. The information from the assessment procedure and the procedure for the analysis of variance was used in the final process procedure (procedure "reaction"). The reaction in the management of railway consists of:

- Reporting of various entities in the organization of the results of the analysis of deviations and evaluation
- Taking corrective action with respect to operations.

In creating the rating two types of data are applied. The unobjective data is applied in order to understand the data that do not depend on anyone's judgment. Such data typically are applied periodically by authorized persons in the administrative registers, forms or official databases. Then all these pieces of information are aggregated and processed at different levels and are then available to certain users in the form of reports, statistical publications, databases and more. The rating system of quality indicators is used from several sources - data from administrative databases of the Ministry of Transport and Communications, data from railway companies,

international statistical database rail. If the data is subjective, it depends on one's judgment. Such data is typically collected through sociological methods of collecting information, then summarized and analyzed. Purely subjective information concerns itself with respondent's personal experiences, feelings, judgments about how somebody likes it, is useful or valuable to him. With regard to this information respondent authority of last resort in the sense that there can be more authoritative judgment. For example, managers of railway companies and external assessors can agree that rail transport services were of sufficient quality.

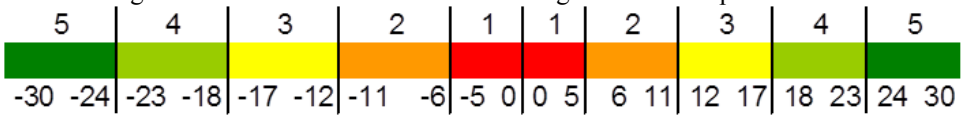
If customers are convinced that this mode of transport has been insufficiently accessible to people with special needs and they have experienced difficulties in using it, we have to evaluate the transport service as insufficiently accessible. When it comes to facts, the survey is normally alternatively used when data cannot be collected otherwise. For example, if there is no record that describes cases of impossibility of transporting persons with special needs, one way to get objective information that otherwise is to ask customers to tell us whether they are witnesses of such cases. There is probability of a hard measurable error associated with recall of facts willingness to share it and more. But in all cases the inability to use this mode of transport remains a fact that is potentially verifiable and otherwise.

Choosing a scale for measuring

At the beginning it is important to clarify what the paper aims to explain by rating and what is in experts and practitioners 'opinion the difference between rating and ranking system. The rating is a type rating that ranked arranges objects (quality indicators) for some relatively enduring characteristics. In this type of rating the rating differs from the rankings as a result of specific, individual event. It is necessary to make a difference between the results of a particular event and long-term performance of the business based on predefined indicators. The rating system is a generalized method of producing sustainable charts called rating. Of course, much of the new rating is not arranged indicators in a new way, just because performance must have (and actually has both shows of our rating system) defined sustainability. So if a railway undertaking is good at something, it is very likely to be good at other things.

Measurement of the scale and the rating of individual performance have 5 rates:
1-dissatisfied
2-happy
3-best
4-very good
5-excellent.

Figure 1: Measurement scale and the rating of individual performance



Source: Authors

Defining the object of study in our rating system has all possible rankings within the key areas of activity.

- Movement of trains operating perspective;
- Movement of trains from a commercial perspective;
- Safety;
- Opportunities for realization of transport service;
- Availability of transportation for persons with special needs;
- Status of the rail market;
- Ability to accomplish the capacity of the railway network;
- Transport service for people with special needs;
- Status of the rail market;
- Ability to accomplish the capacity of the railway network.

The idea of the team was to compare only comparable things. In purely computational plan, of course, there is no problem to do some rock which ranks indicators as a whole. The numbers and ranks cannot give a sense of order. Only people can. We never thought how we can interpret an arrangement in which they are mixed in their various meaningful features rail activities. It could be argued that in this case can be compared to the

management of railway undertakings and their activities, their prestige in society, the quality of administrative and other activities.

The paper tries to develop a system that offers leader boards only within business lines. In this case, the interpretation is quite simple, as there are separately identified enterprise infrastructure and railway operators. This provides an opportunity to assess the pros and cons of different services in different activities. For this purpose the following coefficients have been built regarding weight/importance/ performance. The weight refers to the distribution in each group and the sum of the coefficients in the group is equal to 1.

Effective demand in our system requires more effort than "reviewing" an indicator of the quality of rail services, but we are convinced that they are worth. It is at least a basic knowledge of the structure of the railways to allow information seekers to navigate the numbers and the logic of classification of activities and services.

Methodology for assessing the quality of railway transport

For the purposes of assessing a comprehensive method which is based on the use of complex quality indicators. The system works with a total of 36 indicators divided into 10 groups for a total of two players on the rail market. The indicator system was made after a review of international experience and the experience of other countries that have developed a system for evaluating the quality of rail services. Similar groups of indicators can be found in most ratings of varying severity in different combinations.

The assessment is done by the state regulator of rail transport services and for the purpose of self-control from the transport company. In the absence of information about the outcome of the averaging used assessment 1, aligned on a scale of 1 to 5, where 1 means "poor" or lack of assessment 2 - "unsatisfactory" 3 - "average" 4 - "satisfactory" 5 - "very good".

Source of information: Accounting and statistical reports of railway undertakings and national statistics.

The ratings are based on information available and is functionally linked to its security. The choice of weights is the most delicate task in complex assessments (evaluations that include more than one indicator). Most of the possible marks in our rating system, including standardized, are precisely of this type. The choice of appropriate weights is for us one of the most demanding tasks.

The main logic in the choice of weights is that important (relevant indicators) for which there is reliable information must obtain a relatively high burden. By reducing the importance of the indicator and the reliability of data is reduced and gravity. Less important indicators receive less weight even when they vary and are reliably measured simply because their importance for quality assessment as a process and product is great. Even the most important indicators may also receive a lower weight when their measurement is not reliable enough, simply because the information obtained in this way lies within great uncertainty and it is not good to make it crucial.

For all railway companies in this situation there are several options, whereas the bottom direction of activity uses the same system of weights.

Each rating system has its limitations. This is no exception. It provides information for railway companies that have published statistical yearbook. Others, as well as potential participants in this market have not been evaluated. Another circumstance of what we want to pay attention to is that in cases where the information gathered for an indicator of activity is not sufficient to allow us to make reliable conclusions, we are removing them "below the line". This means data on individual indicators for these. For the purposes of assessing the paper a comprehensive method is included which is based on the use of complex quality indicators, obtained by the following algorithm:

1. Definition of the system of quality indicators
2. Determining absolute indicators
3. Choosing a benchmark / base year /
4. Determination of relative changes in performance compared to the base year
5. Decision on acceptance of the results of differentiated evaluation Final
6. Defining parameters of significance indicators
7. Restatement based on the parameters of significance
8. Determination of the integrated quality indicator

Table 1: Weight of the factors in the process of quality control

INFRASTRUCTURE		WEIGHT	DESCRIPTION
PRECISENESS		**0,25**	
Ratio -amount of passengers trains to number and category of tracks	**%**	0,042	The indicator represents the average assessment of commitment of the trips execution by the trains
Ratio -amount of freight trains to number and category of tracks	**%**	0,042	The indicator represents the average assessment of commitment of the trips execution by the trains
Maximum technical velocity of the railway network	km/h	0,042	The indicator represents the average assessment of technical level of the infrastructure
Permanent and temporary reduction of the train speed	h - annually	0,042	The indicator represents the average assessment of railway network efficacy
Plan of reconstruction works of the infrastructure	h - annually	0,042	The indicator represents the average assessment of rational utilization of the railway network
Average commercial speed of the trains	km/h	0,042	The indicator represents the average assessment of technology utilization of the train stations
SAFETY		**0,35**	
Total amount of incidents	Number per annum	0,07	The indicator represents the average assessment of the total number of accidents
Incidents caused by the infrastructure manager	Number per annum	0,07	The indicator represents the average assessment of the total number of accidents caused by the train stations dispatchers
Freight trains	Number per annum	0,035	
Passenger trains	Number per annum	0,35	
Technical issues during train movement	Number per annum	0,07	The indicator represents the average assessment of technical issues during train movement
Derailment	Number per annum	0,07	The indicator represents the average assessment of derailments.
Annual grade for safety provided by the inspector	Grade 1 to 5	0,07	

ACCESS TO INFRASTRUCTURE		**0,15**	
Total amount of train tracks	Amount	**0,05**	The indicator represents the average assessment of available capacity of the railway network.
Access to passengers trains		**0,05**	
Demanded railway lines	Amount	0,01	The indicator represents the average assessment of demanded railway lines
Offered railway lines	Amount	0,01	The indicator represents the average assessment of railway lines offers to the passengers
Completed railway lines	Amount	0,01	The indicator represents the average assessment of completed railway lines
Uncompleted railway lines due to infrastructure failure	Amount	0,01	The indicator represents the average assessment of extension railway network utilization
Uncompleted railway lines due to commercial provider failure	Amount	0,01	The indicator represents the average assessment of extension railway network utilization
Access to freigh railways		**0,05**	
Demanded railway lines	Amount	0,01	The indicator represents the average assessment of railway lines demand
Offered railway lines	Amount	0,01	The indicator represents the average assessment of railway lines supply
Completed railway lines	Amount	0,01	The indicator represents the average assessment of constructed railway lines
Uncompleted railways lines due to infrastructure failure	Amount	0,01	The indicator represents the average assessment of extension railway lines utilization
Uncompleted railway lines due to carrier failure	Amount	0,01	The indicator represents the average assessment of extension railway lines utilization
ACCESSABILITY		**0,1**	
Services access for disabled people		**0,1**	
Railway services access	Amount of trains	0,05	The indicator represents the average assessment of accessibility from stand point of transport equipment according to disabled passengers needs
Train stations accessibility	Amount of train stations	0,05	The indicator represents the average assessment of accessibility for disabled people
RAILWAY MARKET		**0,1**	
Productivity		**0,033**	
Cost per train per km	Value	0,017	
Dotation per train per km	Value	0,017	
Status of assets	**Value**	**0,033**	
Costs for railway network works	Value	0,011	
Infrastructure amortization	Amount of planned interruptions of railway constructions	0,011	
Trains delays due to railway lines works	h - annually	0,011	
Financial situation		**0,033**	
Costs deviation year-to-year	Value	0,017	
Income/Costs	%		
Infrastructure access taxes		**0,05**	
Average taxes for access to railway lines per km	Value	0,05	

Source: Authors

Conclusion

The proposed model for quality assessment was implemented by the Ministry of Transport for the needs of rail transport in the Republic of Macedonia, used by the Agency for regulation of rail transport (Mitreva, E, et.al., 2016). Results are reliable and represent the basis for making a number of decisions to improve rail transport service.

Using a system of quality management leads to significant changes in public transport by clarifying the responsibilities and opportunities of all stakeholders in the process. To sum up the result of a specific event; they are highly dependent on momentary random factors such as rating ranks based on stable, long-term results. This is one of the ways to increase customer satisfaction and railways.

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Originalni naučni rad UDK 579.67
664:543.6

Rad prihvaćen: 1. 12. 2016.

Procena uticaja temperature tokom hladnog lanca

Slobodan Vasović[1], Jelena Z. Rajković[2], Aleksandar Milin[3]

[1] Univerzitet "Union-Nikola Tesla" Fakultet za inženjerski menadžment, Bulevar Vojvode Mišića 43, Beograd,[4]
[2] Univerzitet "Union-Nikola Tesla" Fakultet za inženjerski menadžment, Bulevar Vojvode Mišića 43, Beograd,
[3] Exsspres Cargo, Beograd

Sažetak: Prediktivna mikrobiologija ima za cilj da proceni broj bakterija u zavisnosti od parametara u okruženju uz korišćenje matematičkih modela. Za ispitivanje su izabrana tri psihrotrofna mikroorganizma: Bacilus Cereus, Clostridium Botulinum i Listeria Monocytogenes. Primenjen je prediktivni model u softverskom paketu ComBase, koristeći temperaturu i vreme kao osnovne parametre hladnog lanca. Raspon korišćenih temperatura za sva tri ispitivana mikroorganizma bio je od 5° C do 22° C. Korišćene temperature su 5,7,12 i 22° C.

Ključne reči: mikroorganizam, prediktivni model, temperatura, vreme, rast, hladni lanac.

Cold Chain Temperature Infuence Assessment

Abstract: Predictive microbiology aims to estimate the number of bacteria, depending on the parameters of the environment using mathematical models. For the purposes of testing, three psychotroph microorganism were chosen: Bacillus cereus, Clostridium botulinum and Listeria monocytogenes. The predictive model was provided in the software package Combase, using temperature and time as the basic parameters of the cold chain. The temperature range used for all three tested microorganisms was 5° C to 22° C. The used temperatures were 5,7,12 and 22° C.

Keywords: microbe, predictive model, temperature, time, growth, the cold chain.

1. Uvod

U okviru programa bezbednosti hrane u poslednje vreme se koristi prediktivno modeliranje kao alat koji može biti korišćen kao pomoć pri odlučivanju prilikom kreiranja efikasnijih sistema upravljanja hladnim lancem. Glavni cilj prediktivnih modela je da matematički opiše verovatnoću rasta ili preživljavanja specifičnih patogena u hrani (ukupna flora kvara ili patogene populacije) pod određenim uslovima. Modeli mogu da se koriste radi predviđanja verovatnoće rasta, vremena potrebnog do pojave rasta ili stepena samog rasta mikroorganizama. Dobijeni rezultati omogućavaju da učesnici hladnog lanca rukuju hranom na određeni način stvarajući prihvatiljivo okruženje (vreme/temperatura), a što ima naučne osnove. U slučaju odstupanja, ovi podaci se mogu koristiti za određivanje efikasnih korektivnih mera, i što je još važnije na ovim podacima se mogu zasnivati i preventivne mere koje postaju sastavni deo sistema menadžmenta bezbednosti hrane (Vajda i saradnici 2016; Nuin i saradnici 2008).

Primena prediktivne mikrobiologije može da ima veliki značaj i specifičnu ulogu u osiguranju bezbedne hrane u svim sektorima prehrambene industrije, a samim tim i u industriji smrznute hrane koja teži unapređenju svojih tehnoloških znanja i tome pojača svoje napore za pronalaženje rešenja i strategije najbolje proizvođačke prakse koja bi osigurala bolje upravljanje bezbednošću prehrambenih proizvoda.

2. Materijal i metod rada

Mikrobiološka analiza rizika je nova disciplina u sektoru bezbednosti hrane. Ova disciplina pokušava da odredi broj mikroorganizama u datom vremenu. U zavisnosti od čuvanja, prerade i rukovanja hranom, broj bakterija će se menjati. Prediktivna mikrobiologija ima za cilj da proceni broj bakterija u zavisnosti od parametara u

[4] slobodan.vasovic@fim.rs

okruženju uz korišćenje matematičkih modela. Da bi ti modeli mogli da se pouzdano naprave i validiraju podrebni su pre svega kvalitetni ekspeerimentalni podaci. U tu svrhu izabrana su tri psihrotrofna patogena mikroorganizma, Bacilus Cereus, Clostridium Botulinum i Listeria Monocytogenes. Primenjen je preduktivni model u softverskom paketu ComBase, koristeći temperaturu i vreme kao osnovne parametre hladnog lanca.

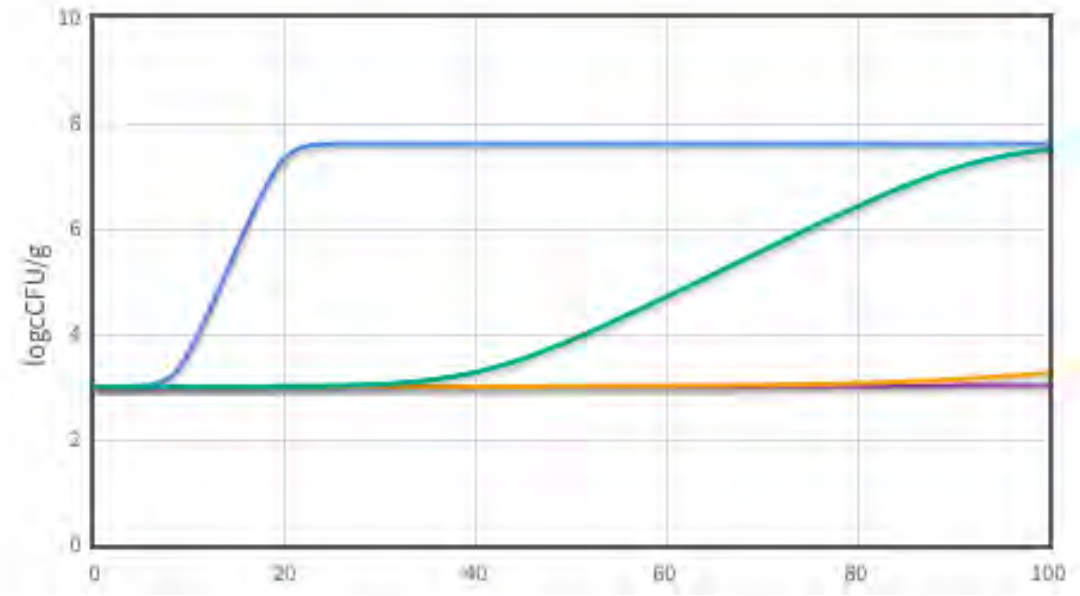
Temperatura je jedan od najvažnijih parametara koji utiče na rast mikroorganizama. Ćelije rastu u okviru potpuno određenog raspona temperature rasta. Taj raspon rasta određen je minimalnom temperaturom, ispod koje su ćelije metabolički neaktivne, i maksimalnom temperaturom, iznad koje ćelije ne rastu. Između tih ekstrema je optimalna temperatura rasta pri kojoj ćelije nsjbrže rastu i razmnožavaju se. Stoga, temperatura okruženja ne određuje samo brzinu razmnožavanja, već i mikroorganizama koji će se razvijati i stepen aktivnosti mikroorganizama. Raspon korišćenih temperatura za sva tri ispitivana mikroorganizma bio je od 5°C do 22°C oponašajući temperature između gornje preporučene temperature frižidera u domaćinstvima (5°C) i sobne temperature (22°C). Korišćene temperature su 5,7,12 i 22°C.

3. Rezultati istraživanja

Boucillus cereus je jedan od najznačajnijih patogena mikroorganizama u hrani koja se stvalja u grupu takozvanih Reaoly-to-Eat proizvoda. Upravo zbog toga je u sistemu upravljanja bezbednošću hrane koja se proizvodi blagim termičkim tretmanima radi očuvanja prirodnih senzornih i nutritivnih svojstava i koja se mora čuvati na hladnom, posebno važna prevencija rasta Bacillus cereus i proizvodnja toksina.

Na grafikonu 1 prikazana je kriva rasta B.cereus na temperaturama 5,7,12 i 22°C. Iz grafikona se jasno uočava ključan uticaj temperature na rast.

Slika 1: Rast Bacillus cereus u uslovima pH7, aw 0,997, sa početnim brojem od 3 log CFU/g na temperaturama od 5 (ljubičasta linija), 7 (narandžasta linija), 12 (zelena linija) i 22°C (plava linija).



Iz slike se vidi da temperature od 5 i 7°C ne dozvoljavaju rast Bacillus Cereus tokom 80 sati i da se sve vreme posmatranja (100 sati) ne prelazi kritičan broj Bacillus Cereus (broj za koji se smatra da ugrožava zdravlje potrošača) od 5 log CFU/g. Međutim, na temperaturama od 12 i 22°C rast počinje već nakon 37 sati, odnosno nakon 7 sati. Kritičan broj se dostiže već nakon 60 sati, odnosno nakon 15 sati. Dobijeni podaci jasno pokazuju kako se rok trajanja i menadžment bezbednosti i kvaliteta proizvoda mogu unaprediti korišćenjem hladnog lanca. U tabeli 1 su izneti podaci koji potvđuju ove nalaze,a u kojoj je prikazana maksimalna brzina rasta i genraciono vreme Baocillus Cereus na korišćenim temperaturama.

Tabela 1: Maksimalna brzina rasta i generaciono vreme Bocillus cereus na temperaturama 5,7,12 i 22°C

Temperatura (5°C)	**Maksimalna brzina rasta (log.conc/h)**	**Generaciono vreme (u satima)**
5	0,023	12,891
7	0,035	8,658
12	0,088	3,431
22	0,414	0,726

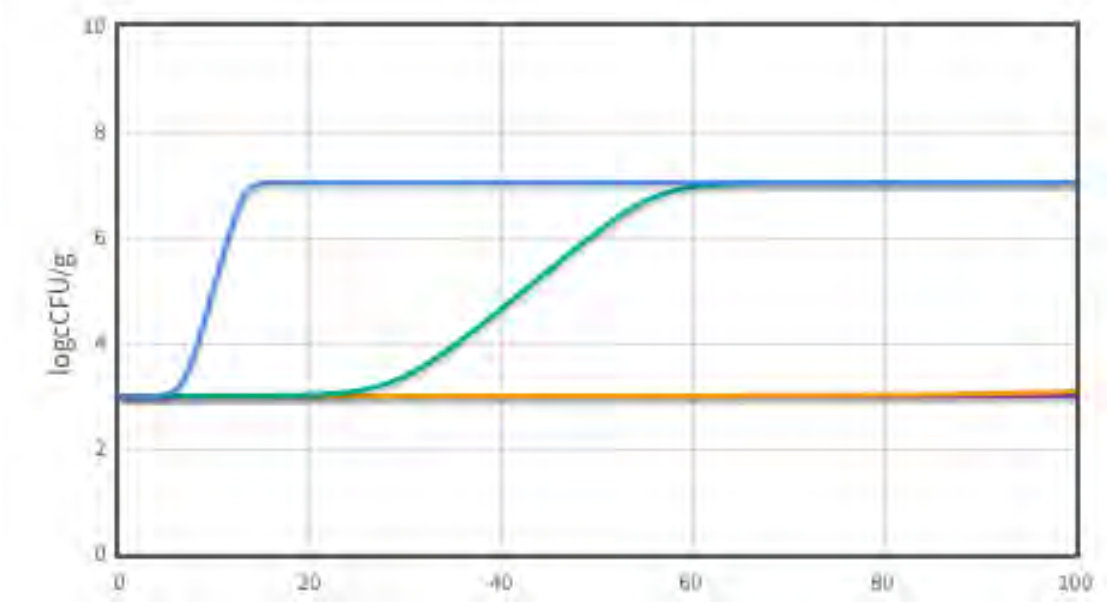
Izvor: Autori

Veoma je važno istaći da je svaki prediktivni model okarakterisan određenom nesigurnošću, kao i svako drugo predviđanje. Tako se vrednosti u slici 1 trebaju posmatrati kao prikaz statistički najverovatnijih vrednosti, dok su u tabeli 1 prikazane srednje vrednosti.

Prikazani rezultati potvrđuju krucijalnu ulogu niske temperature što je u saglasnosti sa istraživanjima Doyle i Beuchat (2007), Jaquette i Beuchat (1998) i Mahakarnchanakul i Beuchat (1999). Trend povećanja potrošnje minimalno obrađene hladne hrane predstavlja nove rizike u pogledu trovanja hranom. Pasterizacija smanjuje broj neželjenih vegetativnih ćelija patogenih mikroorganizama i mikroorganizama kvara u hrani, produžuje rok trajanja, pospešuje bezbednosti hrane, ali mikrobiološke spore koje uvek preživljavaju pasterizaciju moraju biti kontrolisane, korišćenjem hladnog lanca tokom lagerovanja i transporta (1-8°C) i ograničenjem roka trajanja.

Na slici 2 prikazane su krive rasta Clostriolium botulinum na temperaturama 5,7,12 i 22°C odakle se, kao i kod Boucillus cereus jasno uočava ključan uticaj temperatura na rast. Minimalna temperatura rasta neproteolitičnih slojeva Clostriolium botulinum je 3,3°C dok je kof Baucillus cereus to oko 4°C.

Slika 2: Rast Clostridium botulinum u uslovima pH7, aw 0,997, sa početnim brojem 3 log CFU/g na temperaturama od 5 (ljubičasta linij), 7 (narandžasta linija), 12 (zelena linija) i 22°C (plava linija).



Iz prikazanih kriva rasta i ovde se uočava da temperatura od 5 i 7°C ne dozvoljavaju rast Clostriolium botulinum tokom 100 sati. Međutim, na temperaturama od 12 i 22°C rast počinje već nakon 22 sata, odnosno nakon 5 sati. Ovo potvrđuje da se i u slučaju Clostriolium botulinum rok trajanja i menadžment bezbednosti i kvaliteta proizvoda mogu unaprediti korišćenjem hladnog lanca. Podaci iz slike 2, gde su prikazani maksimalna brzina rasta i generaciono vreme Clostriolium botulinum na temperaturama 5,7,12 i 22°C, potvrđuju ove nalaze.

Tabela 2: Maksimana brzina rasta i generaciono vreme Clostriolium botulinum na temperaturama 5,7,12 i 22°C

Temperatura (5°C)	Maksimalna brzina rasta (log.conc/h)	Generaciono vreme (u satima)
5	0,019	16,024
7	0,037	8,106
12	0,15	2,01
22	0,647	0,465

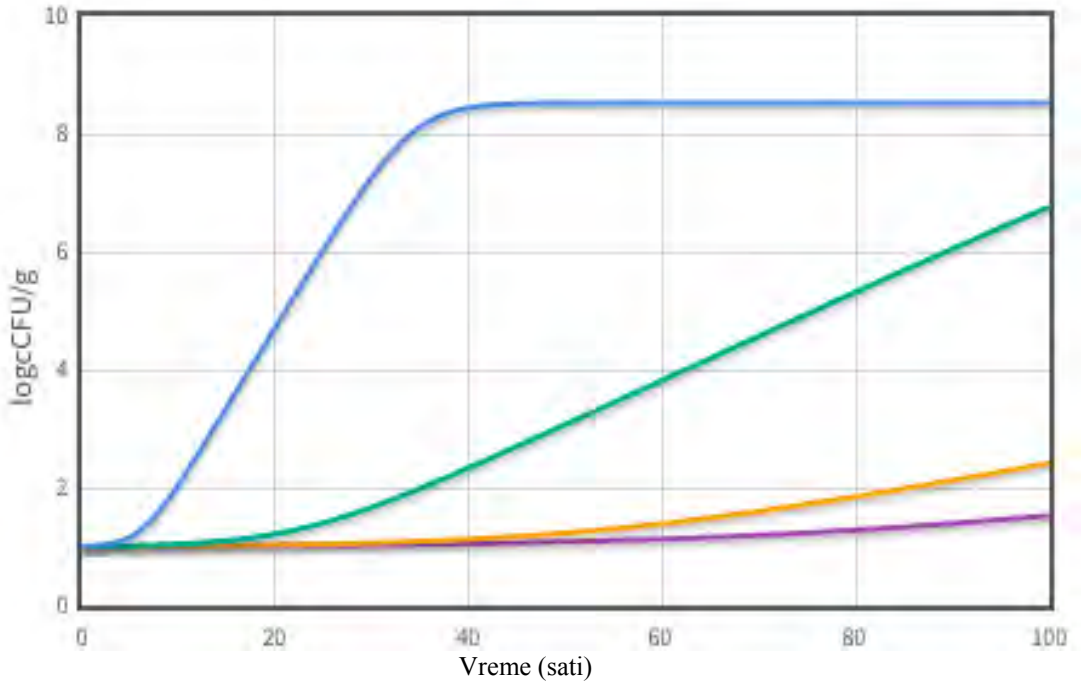
Izvor: Autori

Podaci koji su dobijeni se mogu posmatrati u odnosu na podatke koje su objavili Reskm i saradnici (2008) gde se vidi da je pri temperaturama čuvanja proizvoda ispod 7°C broj uzoraka koji su sadržali toksine znatno manji nego na višim temperaturama čuvanja proizvoda.

Zbog sposobnosti razmnožavanja na niskim temperaturama Listeria monocytogenes se može naći i u namirnicama čuvanim čaki i u zamrzivaču. Otuda je poštovanje hladnog lanca od izuzetne važnosti u kontroli rasta Listeria mnocytogenes, čija je minimalna temperatura rsta -1,5°C i tiče se svih strana uključenih u lancu proizvodnje i prerade hrane. Od proizvodnje do potrošnje rashlađene i smrznute namirnice treba stalno da bude na odgovarajućoj temperaturi (Perez-Tralllero i saradnici 2014; Daelman i saradnici 2013).

Na slici 3 su prikazane krive rasta Listeria monocytogenes na temperaturama 5,7,12 I 22 °C odakle se jasno vidi ključni uticaj temperature na rast. Pri modeliranju rasta L. monocytogenes u ovom radu korišćene su niže vrednosti inicijalne kontaminacije (1 log CFU/g).

Slika 3. Rast Listeria monocytogenes u uslovima pH7, aw 0,997, sa početnim brojem od1 log CFU/g na temperaturama od 5 (ljubičasta linija), 7 (narandžasta linija), 12 (zelena linija) i 22°C (plava linija).



Zakonski maksimalan dozvoljen broj Listeria monocytogenes u jelima spremnim za upotrebu je 2 log CFU/g koji se na temperaturi od 22°C dostiže za oko 10 sati, na 12°C za oko 35 sati, na 7°C za oko 80 sati, a na 5°C za više od 100 sati što je potvrđeno rezultatima iznetim u tabeli 3 i radovima Wu i saradnici (2015), Kovačević i saradnici (2013), Osaili i saradnici (2014) i Wang i saradnici (2015).

Tabela 3: Maksimalna brzina rasta i generaciono vreme Listeria monocytogenes na temperaturama 5,7,12 i 22°C.

Temperatura (5°C)	Maksimalna brzina rasta (log.conc/h)	Generaciono vreme (u satima)
5	0,021	14,566
7	0,031	9,743
12	0,075	4,005
22	0,27	1,113

Izvor: Autori

Tokom distribucije hrane realno je očekivati da temperatura fluktuira. Otuda je stalna kontrola temperature tokom transporta i distribucije, kao i od maloprodaje do potrošača od ključne važnosti za sprečavanje rasta ovih patogenih mikroorganizama.

Zaključak:

Bezbednost hrane osigurava se prvenstveno preventivnim pristupom, kao što je primena dobre higijenske prakse i primena postupaka utemeljenih na analizi opasnosti i principima sistema kritičnih kontrolnih tačaka (HACCP). Mikrobiološki kriterijumi se mogu koristiti za validaciju i verifikaciju postupaka HACCP-a i drugih mera kontrole higijene, imajući u vidu minimalne temperature rasta relevantnih mikroorganizama. Stoga je važno utvrditi mikrobiološke kriterijume kojima se definiše prihvatljivost procesa, kao i mikrobiološke kriterijume bezbednosti hrane kojima se postavlja granica iznad koje se hrana treba smatrati neprihvatljivom za ljudsku upotrebu. U poštovanju ovih kriterijuma temperatura na kojoj se hrana čuva ima ključan, odnosno presudan uticaj.

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Originalni naučni rad UDK 331.103:621.311(497.11)
005.591.1:331.1

Rad prihvaćen: 19. 1. 2017.

Optimalan broj zaposlenih u elektrodistributivnoj delatnosti

Dragoljub Tica[1]*, Aleksandra Vidović[2], Andrej Kurtović[3]

[1]Vojvode Bojovića 8, Novi Sad,[1]
[2]Singidunum Centar NoviSad
[3]Technische Universitat Wien Ostereich

Apstrakt: U Javnim preduzećima kao i Javnim komunalnim preduzećima došlo je do pojave većeg broja zaposlenih radnika što po pravilu uzrokuje njihovo loše ekonomsko stanje. Namera ovog rada jeste da se pokuša dati odgovor koliko ima viška zaposlenih u elektrodistributivnoj delatnosti a na konkretnom primeru Elektrovojvodine. U radu je analizirano Javno preduzeće Elektroprivrede Srbije, i to samo njen elektrodistributivni deo. Do sada je u praksi primenjivan takav model da se napravi organizaciona šema preduzeća koja je po pravilu bila glomaznija pa se vremenom popunjavala sa novozaposlenim radnicima. Ovde primenjujemo model koji je sasvim drugačiji. Videćemo za analizirani konzum koliki je optimalan broj zaposlenih radnika, pa se na osnovu tog broja pravi organizacija preduzeća. Analiza rada se završava samo na optimizaciji broja zaposlenih radnika a organizaciona šema preduzeća može biti predmet istraživanja nekog budućeg rada. Rad se zasniva na korelaciji pondera mađarske elektrodistribucije koja je privatizovana i Elektrovojvodine. Mađarska elektrodistribucija je najsličnija Elektrovojvodini jer imaju: sličnu konfiguraciju zemljišta, kao i broj stanovnika po km2 i kupaca po km2 koji su samo za 20 % veći u Mađarskoj u odnosu na Vojvodinu. Analiza obuhvata četrnaest važnijih pondera koji većim delom obeležavaju elektrodistributivni konzum. Nakon iznalaženja pondera na praktičnom primeru Elektrovojvodine urađena je optimizacija broja zaposlenih radnika bez održavanja srednjenaponskog i niskonaponskog postrojenja a nakon toga i sa održavanjem.

Ključne reči: optimizacija, elektrodistribucija, ponderi, korelacija, javna preduzeća, uslovni radnik, zaposleni radnici i organizacija preduzeća

Optimal Number of Employees in Electric Power Distribution Companies

Abstract: In public companies, as well as in public utility companies, a recent common trend is a larger numbers of employees, which often causes their poor economic condition. The intention of this paper is to try to answer the question - what is the extent of overstaffing in the power distribution activities and this will be done through the case study of Elektrovojvodina. This paper analyses the situation in Elektrovojvodina public utility company, or more precisely - in its electric power-distribution sector. The previous model involved the design of an organisational scheme of the company, that was much larger, and then later - the employment of workers based on the requirements of the scheme. In this paper, a different model is used - an optimal number of workers is determed with regard to the consumption analysed and the organisational scheme of the company is subsequently designed based on this number. The aim of this paper is limited only to the optimisation of the number of employees, whereas structural organisation might be the subject of another research paper. This paper presents the correlation weights of Elektrovojvodina and the Hungarian power-distribution system that has been privatised. The Hungarian electric power-distribution system is similar to the system of Elektrovojvodina having the similar configuration of the land, the number of inhabitants per km^2 and the number of customers per km^2, which are only 20% higher in Hungary compared to Vojvodina. This analysis involves fourteen major weights that mark most of the electrical consumption. After the weight analysis in the example of Elektrovojvodina, the optimisation of employees is suggested.

Key words: optimisation, electro-distribution, weights, correlation, public companies, employees, company organization

[1] dragoljub.tica@yahoo.com

1. Introduction

In public companies, as well as in public utility companies, a recent common trend is a larger numbers of employees, which often causes their poor economic condition. Reasons for overstaffing are usually organisational or, quite often, political - having won the election, a ruling political party obtains a public company in redistribution and assignes itself rights to fully control it. If before the election, a company 'belonged' to another political option, the number of employees usually became even higher since the workers employed by a previous ruling party were not dismissed.

This paper analyses the situation in Elektrovojvodina public utility company, or more precisely - in its electric power-distribution sector. The model used before involved the design of an organisational scheme of the company, that was much larger, and then later - the employment of workers based on the requirements of the scheme. In this paper, a different model is used - an optimal number of workers is determed with regard to the consumption analysed and subsequently, based on this number, the organisational scheme of the company is projected containg not larger, but a smaller number of workers than it used to.

This analysis involves fourteen major weights that mark most of the electrical consumption. The case study of Elektrovojvodina is presentred.

The paper consists of eight parts:

- the design of the model of optimal number of employees;
- the definition of the most important physical parameters;
- the percentage of physical parametres in the model;
- the calculation of the weights of the analysed electro-distribution in relation to the number of employees (current situation);
- the choice of the most similar electro-distribution that has already been privatized;
- the calculation of the weights of the chosen electro-distribution in relation to their number of employees;
- the calculation of the optimal number of employees in Elektrovojvodina (future situation, without the maintainance of medium and low voltage);
- the correction of the weights of the chosen elctro-distribution (to a higher value owing to the difference in the supplies) and finally the calculation of the optimal number of employees in Elektrovojvodina (future situation with corrections that take into account the maintenance of medium and low voltage).

2. The Optimal Number of Employees

2.1. Human Resources

The model is done in such a way that it takes into account the experiences in some European privatized electric utilities, the long working experience of the author gained in the power distribution segments such as: development, energy, investment, data collection, the analysis of electrical power distribution and consumption as well as the experience in introducing and implementing a quality system according to ISO 9000 standards in Elektrovojvodina. The number of employees is directly related to the scope of work that has to be done so that the defined production processes and service delivery can be achieved. The tasks to be performed within the Company are the following: development, investment management, system maintenance, repairs on medium and low voltage facilities, activities related to the purchase and sale of electricity to customers, collection and monitoring of billing for electricity delivered.

The tasks that should be left to other companies engaged through agreements and contracts at transparent public procurement can be: keeping buildings, cleaning facilities, vehicle maintenance, design, construction of new facilities and reconstruction of existing facilities of all voltage levels, refurbishment of objects having 35 and 110 kV voltage level, calculation and distribution of electricity bills to customers as well as lawsuits and enforcement of payment for the delivered electricity. All objects that belong to Elektrovojvodina and deal with catering, recreation, hotel industry and other non-distributive activities should be excluded from the company scheme or left to the parts of the enterprise that are out of the distribution activities.

The public utility company Electric Power Industry of Serbia (EPS hereafter) should consist of the power distribution parts that will have approximately the same physical parameters. The assumption in this paper is that one of these parts might be the whole of Elektrovojvodina.

With such business structuring, we should identify the physical parameters that will be the object of our analysis and comparison with other electric utilities.

2.1.1. The model of optimal number of employees

The formula used for calculating the optimal number of workers is the sum of the fourteen physical parametres and the corresponding weights of the physical parametres. Since we want to calculate the optimal number of employees using the potential workers for each weight, the weights must have a unit of measure: number of employees divided by a number of customers, the total energy consumption, peak consumption and eventually the fourteenth weight – the length of 0.4 kV cable lines expressed in kilometers. When the weights of a privatized Hungarian electro-distribution company are included into this formula as well as the percentage of the physical parameters of the analyzed electro-distribution company (Elektrovojvodina), then the result expresses a required employee number (e.g. 0.2 x 930,633 x 0,00064 = 120 required employees, where 0.2 is the share of this weight being 20%, 930,633 is the number of consumers of Elektrovojvodina and 0.00064 – the weight of electo-distribution of Hungary divided for the number of employees / number of customers). When, for each of the given weights, the number of required employees is calculated, their sum represents the optimal number of employees for the electro-distribution activity.

If the methodology described above is applied, the optimal number of employees can be calculated by using the following formula:

$$ONE = \sum_{i=1}^{14} \prod_{j,\kappa=1}^{14} a_i PP_j K_\kappa = a_1 PP_1 K_1 + a_2 PP_2 K_2 + a_3 PP_3 K_3 + a_4 PP_4 K_4 + a_5 PP_5 K_5 + a_6 PP_6 K_6 + a_7 PP_7 K_7 + a_8 PP_8 K_8 + a_9 PP_9 K_9 + a_{10} PP_{10} K_{10} + a_{11} PP_{11} K_{11} + a_{12} PP_{12} K_{12} + a_{13} PP_{13} K_{13} + a_{14} PP_{14} K_{14} \quad (1)$$

where:
ONE –optimal number of employees
a_i – the percentage of physical parametres
PP_j – physical parameters
K_κ –weights of physical parameters

2.2. Physical Parametres and Their Percentage

2.2.1. Physical Parameters

The analysis of the electro-distributive part should include the following physical parameters:

- PP_1 = number of consumers — number of consumers of the analyzed electro-distribution
- PP_2 = total of delivered energy — total of delivered electrical energy per year, expressed in GWh
- PP_3 = total of peak consumption of electricity — peak load of consumption expressed in MW
- PP_4 = consumption area — consumption area expressed in km2
- PP_5 = density of the consumption — number of inhabitants
- PP_6 = configuration of the consumption — plain / mountainous
- PP_7 = number of transformer substations 110/35 and 110/20 kV/kV — number of TS 110/x items
- PP_8 = number of transformer substations 35/x kV/kV — number of TS 35/x items
- PP_9 = number of transformer substations 20/0,4 kV/kV — number of TS 20/0.4 items

- PP_{10} = number of transformer substations 10/0,4 kV/kV number of TS 10/0.4 items
- PP_{11} = length of 35 kV cables expressed in km
- PP_{12} = length of 20 kV cables expressed in km
- PP_{13} = length of 10 kV cables expressed in km
- PP_{14} = length of 0.4 kV cables expressed in km

2.2.2. The percentages:

Based on the experience gained in the electro-distribution activities and according to the priority levels, the following percentage of the physical parameters is determined:

- a_1 = 20% for PP_1
- a_2 = 13% for PP_2
- a_3 = 5% for PP_3
- a_4 = 7% for PP_4
- a_5 = 3% for PP_5
- a_6 = 2% for PP_6
- a_7 = 10% for PP_7
- a_8 = 2% for PP_8
- a_9 = 9% for PP_9
- a_{10} = 4% for PP_{10}
- a_{11} = 2% for PP_{11}
- a_{12} = 9% for PP_{12}
- a_{13} = 4% for PP_{13}
- a_{14} = 10% for PP_{14}

The share of physical parameters that represent energy values (the first six) is 50% , whereas the share of physical parameters that represent technical values (the remaining eight) is also 50%, which makes the total of 100 %.

2.3. Weights Derived from Physical Parameters

2.3.1. Weights of physical parameters

Since this model should result in the optimal number of employees, the weights of physical parameters must be: the number of employees divided by the physical values of the consumption analyzed.

- K_1=number of employees/number of consumers of the employee/customer analyzed electro-distribution)
- K_2 = number of employees/ total of delivered electricity p.a. (employee/GWh)
- K_3 = number of employees /peak load of consumption (employee/MW)
- K_4 = number of employees /consumption area (employee/km^2)
- K_5 = number of employees /number of inhabitants (employee/1,000 inhabitants)
- K_6 = configuration of the consumption (%plain/%mountainous)
- K_7 = number of employees /number of transformer substations 110/x kV/kV (employee/TS 110/x)
- K_8 = number of employees /number of transformer substations 35/x kV/kV (employee/TS 35/x)
- K_9 = number of employees /number of transformer substations 20/0.4 kV/kV (employee/TS 20/0.4)
- K_{10} = number of employees /number of transformer substations 10/0.4 kV/kV (employee/TS 10/0.4)
- K_{11} = number of employees /length of 35 kV cables (employee/km 35 cables)
- K_{12}= number of employees /length of 20 kV cables (employee/km 20 cables)
- K_{13} = number of employees /length of 10 kV cables (employee/km 10 cables)
- K_{14} = number of employees /length of 0.4 kV cable (employee/km 0-4 cables)

3. number of employees in the electro-distribution system, current situation

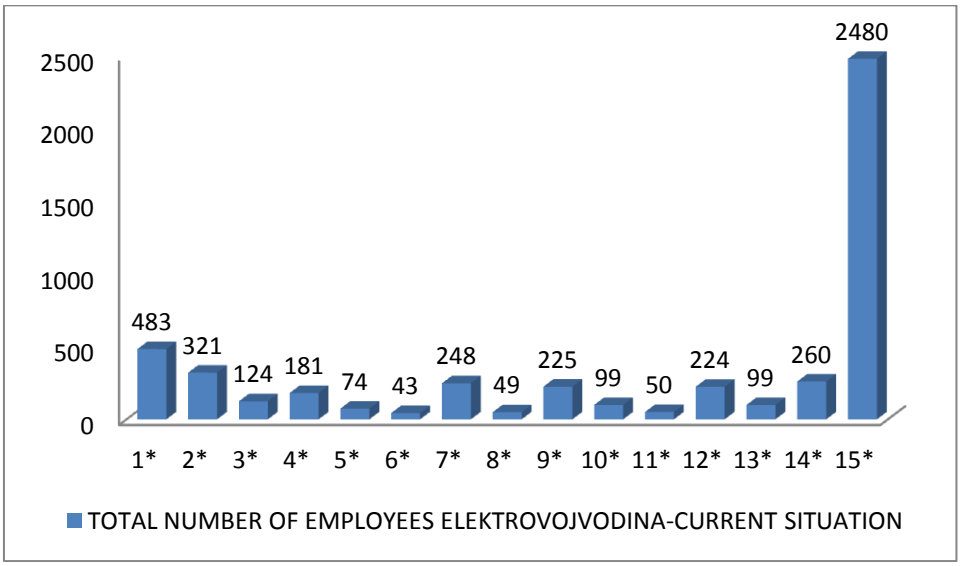
The analysis of the employed workers with the selected weights (Elektrovojvodina – current state) is presented here. Taking into account physical parameters and the total number of employees, the weights are calculated as well as the number of required employees for each physical parameter and it is presented in Table 1.

Table 1: Physical parameters, weights and the number of employees in Elektrovojvodina without Department for Design (current state)

Physical parameters	PP_1	PP_2	PP_3	PP_4	PP_5	PP_6	PP_7	PP_8	PP_9	PP_{10}	PP_{11}	PP_{12}	PP_{13}	PP_{14}
Values of PP	930,63: custom	8,534 GWh	1,457 MW	21,506 $км^2$	1,917 /1,000 inl	80/20 %/%	61 TS110/x	75 TS35/x	9,588 TS20/x	1,477 TS10/x	1,359 DV35kV	9,212 DV20kV	952 DV10kV	14,433 DV04kV
Weights	K_1	K_2	K_3	K_4	K_5	K_6	K_7	K_8	K_9	K_{10}	K_{11}	K_{12}	K_{13}	K_{14}
Values of weights	0.0026	0.29	1.7	0.12	1.29	0.095/0.1	40.66	33	0.26	1.68	1.83	0.27	2.6	0.18
Factor-required emp	a_1	a_2	a_3	a_4	a_5	a_6	a_7	a_8	a_9	a_{10}	a_{11}	a_{12}	a_{13}	a_{14}
Share - perce	20	13	5	7	3	2	10	2	9	4	2	9	4	10
Number of required emp	483	321	124	181	74	43	248	49	225	99	50	224	99	260
	1^*	2^*	3^*	4^*	5^*	6^*	7^*	8^*	9^*	10^*	11^*	12^*	13^*	14^*
Total of empl														2,480
														15^*

Taken from: www.elektrovojvodina.rs/sl/.../energetski pokazatelji za 2013. 4. March 2015.

Figure 1: Total number of employees in Elektrovojvodina, current situation



Source: The authors listed below Table 1

4. Number of Employees in the Electro-Distribution System of Hungary, Current Situation (After Privatization)

Why was Hungarian electro-distribution chosen for this analysis? It is due to its similarity with Elektrovojvodina that can be observed after the analysis. The configuration of land is almost identical – these are two plain areas through which two rivers flow: the Danube and the Tisa. The population density per km2 as well as the number of customers per km2 is higher by 20% in Hungary. Elektrovojvodina is a part of the public utility company Electric Power Industry of Serbia (EPS), whereas the Hungarian electro-distribution has already been privatized and consists of six parts covering different regions: Budapest with the surrounding area (ELMU), North-West part (EADSZ), South-West part (DEDASZ), North-East part (EMASZ), East part (TITASZ) and South-East part (DEMASZ) of Hungary (Table 2).

Table 2: Hungarian regional electro-distributions and the companies providing supplies

Company	Region	The area in км^2	Number of customers
ELMU	Budapest and the surrounding area	4,050	1,317,000
EADSZ	North-West	18,230	882,582
DEDASZ	South-West	18,414	675,500
EMASZ	North-East	15,505	695,100
DEMASZ	South-East	18,235	730,000
TITASZ	East	18,728	700,000
Total:		93,158	5,000,182

Taken from: www.oecd.org/regreform/2510584.pdf, 4. March 2015.

Both systems distribute electricity only, unlike some other companies that deal with the electricity and gas distribution or gas and water. The tasks they perform are similar except that Elektrovojvodina is engaged in designing facilities of the power system as well as maintenance and overhaul of facilities of medium and low voltage. This is the reason why from the total number of employees in Elektrovojvodina, a number of employees working in the Department for Design (around 34 workers) was subtracted so that the companies can be comparable and therefore 2,480 is taken as the total number of employees in Elektrovojvodina. At the end of this analysis, in its last step, the total required number of employees increases by the number of assemblers if maintenance and repair of medium and low voltage is still kept.

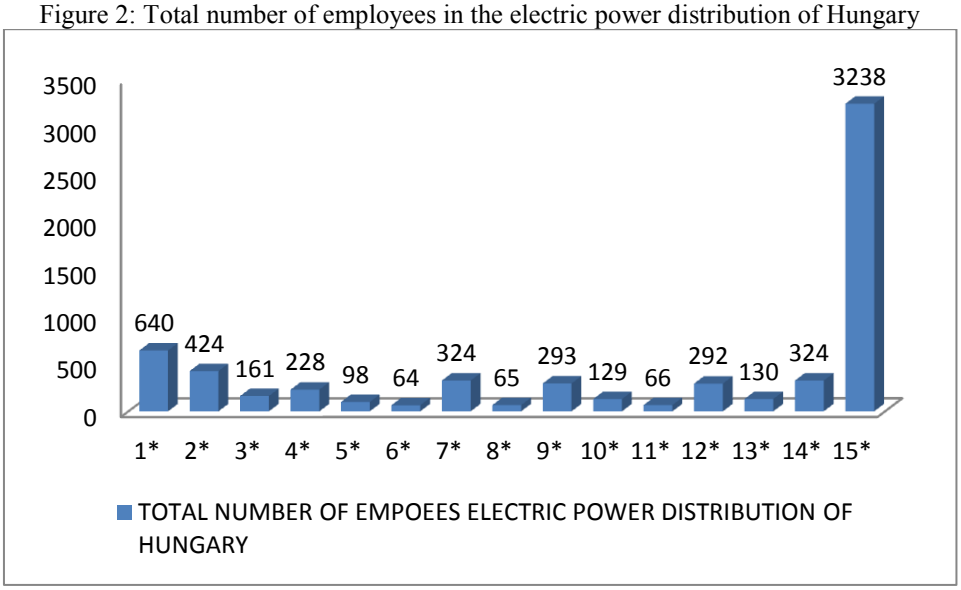
According to the physical parameters of the electric power distribution of Hungary, the weights are calculated and then, subsequently, the required number of employees. The calculated summation fits into the total number of employees. After processing and systematization, these parameters are presented in Table 3, while Figure 2 presents the number of required employees according to the physical parameters and the total number of employees of the electric power distribution of Hungary.

Table 3: Physical parameters, weights and the number of employees in the electric power distribution of Hungary – current situation

Physical parameters	PP_1	PP_2	PP_3	PP_4	PP_5	PP_6	PP_7	PP_8	PP_9	PP_{10}	PP_{11}	PP_{12}	PP_{13}	PP_{14}
Values of PP	5,000,182 Customers	36,269GWh	6,307 MW	93,158 км^2	10,198/1,000 inh	80/20 %/%	251 TS110/x	231 TS35/x	40,750 TS20/x	5,902 TS10/x	8,655 DV35kV	62,315 DV20kV	6,924 DV10kV	95,204 DV04kV
Weights	K_1	K_2	K_3	K_4	K_5	K_6	K_7	K_8	K_9	K_{10}	K_{11}	K_{12}	K_{13}	K_{14}
Values of weights	0.00064	0.09	0.51	0.035	0.32	0.095/0.124	12.9	14	0.08	0.55	0.38	0.052	0.47	0.034
Factor – potential employee	a_1	a_2	a_3	a_4	a_5	a_6	a_7	a_8	a_9	a_{10}	a_{11}	a_{12}	a_{13}	a_{14}
Share - Percentage %	20	13	5	7	3	2	10	2	9	4	2	9	4	10
Number of potential employees	640	424	161	228	98	64	324	65	293	129	66	292	130	324
	1*	2*	3*	4*	5*	6*	7*	8*	9*	10*	11*	12*	13*	14*
Total number of employees														3,238 15*

Taken from: www.oecd.org/regreform/2510584.pdf, 4.March 2015. for: PP_1 and PP_4
www.mekh.hu/adatok-statiszkak-2, 4.March 2015. for: PP_2, PP_3 and PP_6 and the total number of employees
: bs.wikipedia.org./wiki/Mađarska, 4.March 2015. for PP_5
www.elmu.hu; www.eadsz.hu; www.dedasz.hu; www.emasz.hu; www.demasz.hu. www.titasz.hu,04.March 2015. for: PP_7, PP_8, PP_9, PP_{10}: PP_{11}, PP_{12}, PP_{13} and PP_{14}

Figure 2: Total number of employees in the electric power distribution of Hungary



Source: The authors listed below Table 3

If we compare the electric power distribution of Hungary (without the maintenance of medium and low voltage) and Elektrovojvodina (with the maintenance of medium and low voltage) in terms of: the number of customers, consumption area, number of inhabitants, total consumption of electricity per annum, achieved peak consumption, the total number of transformer substations, the total length of the distribution network and the total number of employees as well as their percentage ratio, we get data presented in Table 4.

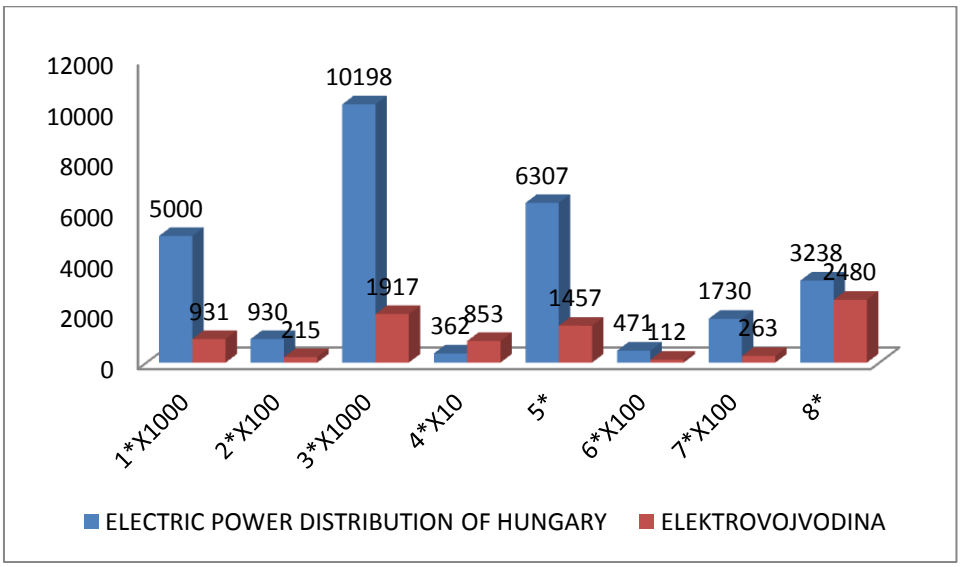
Table 4: Percentage ratio of the physical parameters of electric power distribution of Hungary and Elektrovojvodina

	Number of customers	Area in km^2	Number of inhabitants	Energy consumed GWh	Peak consumption in MW	Number of TS	Lengths of cables	Number of employees
Electric power distribution of Hungary	5,000,000	93,030	10,198,000	36,269	6,307	47,134	173,098	3,238
Elektrovojvodina	931,000 1*	21,500 2*	1,917,000 3*	8,534 4*	1,457 5*	11,201 6*	26,334 7*	2,480 8*
Ratio: Hungary/ Vojvodina	537%	432%	532%	425%	433%	427%	665%	31%

Source: Authors listed below Table 1 and Table 3

It can be observed in Table 4, that the distribution companies of Hungary (without the maintenance of medium and low voltage) compared to Elektrovojvodina (with the maintenance of medium and low voltage) have a larger number of customers by 537%, a larger area of consumption by 423%, that the number of inhabitants in these areas is higher by 532%, that the annual consumption of electricity is higher by 425%, with a peak consumption higher by 433% and with the use of the number of substations higher by 427%; finally – we see that the increase in the distribution network that is higher by 665% is achieved with the number of employees that is higher only by 31%. Figure 3 shows a diagram of the physical parameters of the electric power distribution of Hungary without the maintenance of medium and low voltage and Elektrovojvodina with the maintenance of medium and low voltage.

Figure 3: Comparative physical parameters of the electric power distribution of Hungary without the maintenance of low and medium voltage and Elektrovojvodina with the maintenance of low and medium voltage



Source: Authors listed below Table 4

5. Number of Employees in Elektrovojvodina Without the Maintenance of Low and Medium Voltage According to the Model of Hungarian Power Distribution (Future Projection)

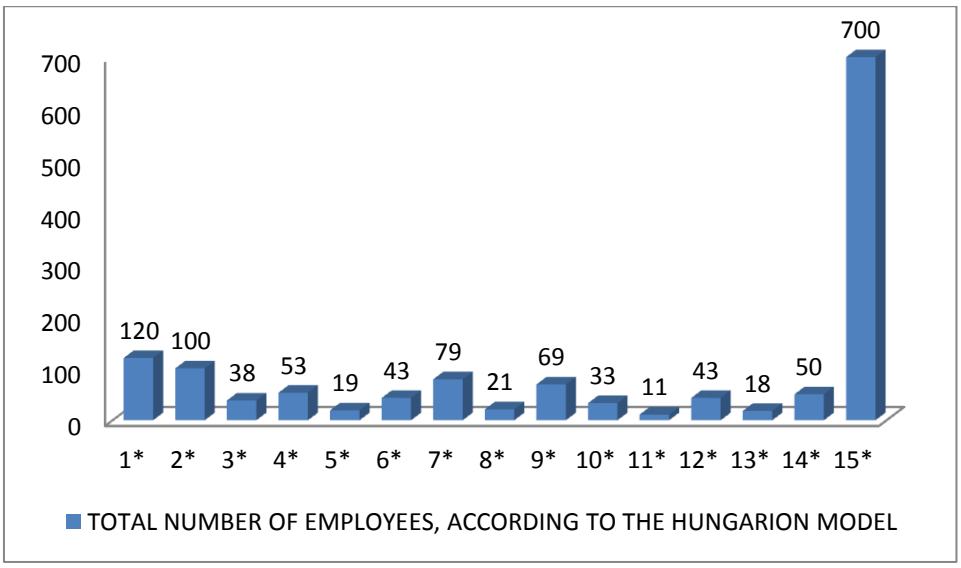
After analyzing the electric power distribution system of Hungary and finding weights that are associated with the number of required employees, we can move on to the next stage which is calculating the number of required employees in Elektrovojvodina according to its physical parameters and with the use of the weights for the required number of employees in Hungarian companies; the last stage is – according to formula (1), calculating the optimal number of employees in Elektrovojvodina without the maintenance of medium and low voltage.
Table 5 presents these data.

Table 5: Physical parameters, weights, number of employees in Elektrovojvodina, with the maintenance of low and medium voltage, according to the Hungarian model (estimated situation)

Physical parameters	PP_1	PP_2	PP_3	PP_4	PP_5	PP_6	PP_7	PP_8	PP_9	PP_{10}	PP_{11}	PP_{12}	PP_{13}	PP_{14}
Values of PP	30.63 customers	8,534 GWh	1,457 MW	21,506 $км^2$	1.917 /1.000 inh	80/20 %/%	61 TS110/x	75 TS35/x	9,588 TS20/x	1,477 TS10/x	1,359 DV35kV	9,212 DV20kV	952 DV10kV	14,433 DV04kV
Weights	K_1	K_2	K_3	K_4	K_5	K_6	K_7	K_8	K_9	K_{10}	K_{11}	K_{12}	K_{13}	K_{14}
Value of weights	0.00064	0.09	0.51	0.035	0.32	0.095/0.124	12.9	14	0.08	0.55	0.38	0.052	0.47	0.034
Factor – necessary employee	a_1	a_2	a_3	a_4	a_5	a_6	a_7	a_8	a_9	a_{10}	a_{11}	a_{12}	a_{13}	a_{14}
Share - percentage %	20	13	5	7	3	2	10	2	9	4	2	9	4	10
Number of necessary employees	120	100	38	53	19	43	79	21	69	33	11	43	18	50
	1*	2*	3*	4*	5*	6*	7*	8*	9*	10*	11*	12*	13*	14*
Total number of employees														700
														15*

Taken from: www.elektrovojvodina.rs/sl/.../energetski pokazatelji za 2013. 4.March 2015.

Figure 4: Total number of employees without the maintenance of low and mediumvoltage, according to the Hungarian model (estimated situation)



Source: Authors listed below Table 5

6. Number Of Employees In Elektrovojvodina with the Mainatainance of Low and Medium Voltage, According to the Hungarian Model – Corrected

It can be seen that the number of employees needed for Elektrovojvodina, according to the Hungarian model, should be significantly smaller than it is currently. Certain redundancies seem to be inevitable and quite likely, particularly in privatization processes that might happen soon. The differences between the activities of Elektrovojvodina and the Hungarian electricity distribution are primarily in maintenance and repairs of medium and low voltage - in Elektrovojvodina, these tasks are performed within the company, while in Hungary, they are carried out exclusively out of the distribution company.

Due to the differences mentioned above, the Hungarian model will be corrected in the analysis of Elektrovojvodina and the weights will be increased by 30%. This increase applies only to assemblers who maintain the system of medium and low voltage. According to the official data, from the year 2007-2014,

Elektrovojvodina (on average) has had 636 employees that are highly qualified, skilled and semi-skilled workers - assemblers engaged in the maintenance and repair of medium and low voltage, which makes 25.3% in the structure of the company.

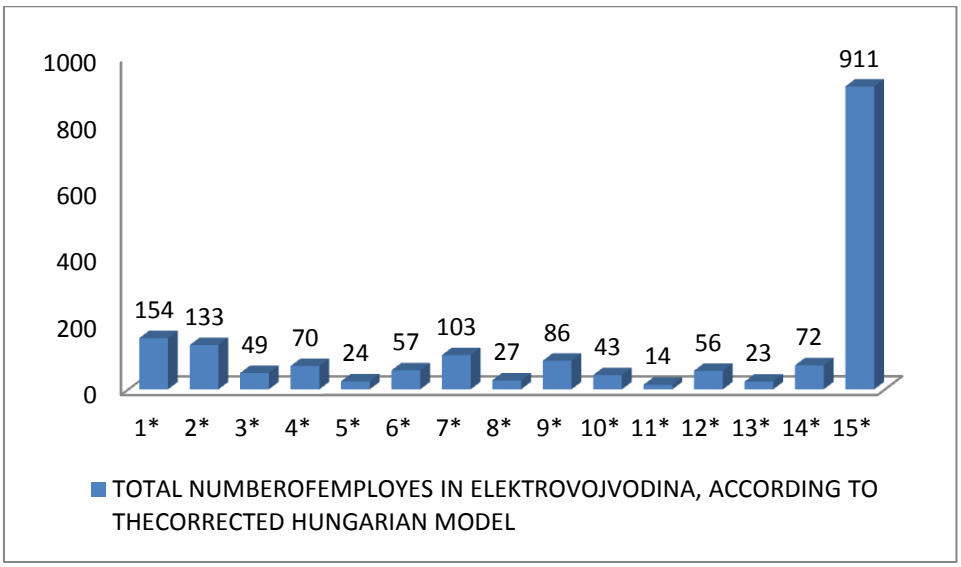
In this case, with such parameters, the following data of weights are obtained as well as the number of required employees and they are presented in Table 6.

Table 6: Physical parameters, weights, number of employees in Elektrovojvodina, with the maintenance of low and medium voltage, according to the Hungarian model (corrected situation)

Physical parameters	PP_1	PP_2	PP_3	PP_4	PP_5	PP_6	PP_7	PP_8	PP_9	PP_{10}	PP_{11}	PP_{12}	PP_{13}	PP_{14}
Values of PP	930,633 customers	8,534 GWh	1,457 MW	21,506 $км^2$	1,917/1.000 inh	80/20 %/%	61 TS110/x	75 TS35/x	9,588 TS20/x	1,477 TS10/x	1,359 DV35kV	9,212 DV20kV	952 DV10kV	14,433 DV04kV
Weights	K_1	K_2	K_3	K_4	K_5	K_6	K_7	K_8	K_9	K_{10}	K_{11}	K_{12}	K_{13}	K_{14}
Values of weights	0.00083	0.12	0.66	0.046	0.42	0.095/0.124	16.8	8.2	0.1	0.72	0.49	0.068	0.61	0.05
Factor – required employee	a_1	a_2	a_3	a_4	a_5	a_6	a_7	a_8	a_9	a_{10}	a_{11}	a_{12}	a_{13}	a_{14}
Share - percentage %	20	13	5	7	3	2	10	2	9	4	2	9	4	10
Number of required employees	154	133	49	70	24	57	103	27	86	43	14	56	**23**	72
Total number of employees	1*	2*	3*	4*	5*	6*	7*	8*	9*	10*	11*	12*	13*	14* 911 15*

Taken from: www.elektrovojvodina.rs/sl/.../energetski pokazatelji za 2013 4.March 2015. and the value of weights according to Table 3

Figure 5: Total number of employees in Elektrovojvodina with the maintenance of low and medium voltage, based on the corrected model of the Hungarian distribution system



Source: Authors listed below Table 6

Table 7 presents comparative weights and the number of employees of Elektrovojvodina - current situation (with the maintenance of medium and low voltage), and the future, projected design (without the maintenance of medium and low voltage) according to the Hungarian model as well as the future corrected situation (with the

maintenance of medium and low voltage) and the number of workers of the Hungarian power distribution company after privatization.

Table 7: Comparative weights and number of workers in Elektrovojvodina and the Hungarian electric power distribution system

Weights	**K_1**	**K_2**	**K_3**	**K_4**	**K_5**	**K_6**	**K_7**	**K_8**	**K_9**	**K_{10}**	**K_{11}**	**K_{12}**	**K_{13}**	**K_{14}**
Vojvodina (now)	0.0026	0.9	1.7	0.12	1.29	0.095/0,124	40.66	33	0.26	1.68	1.83	0.27	2.6	0.18
Hungary (now)	0.00064	0.09	0.51	0.035	0.32	0.095/0.124	12.9	14	0.08	0.55	0.38	0.052	0.47	0.034
Vojvodina (future design)	0.00064	0.09	0.51	0.035	0.32	0.095/0.124	12.9	14	0.08	0.55	0.38	0.052	0.47	0.034
Vojvodina (corrected)	0.00083	0.12	0.66	0.046	0.42	0.095/0.124	16.8	18.2	0.1	0.72	0.49	0.068	0.61	0.05
Number of employees, Vojvodina (now, without projection)	483	321	124	181	74	43	248	49	225	99	50	224	99	260 2,480
Number of employees, Hungary (now)	640	424	161	228	98	189	324	65	293	129	66	292	130	324 3,238
Number of employees, Vojvodina (projected future design)	120	100	38	53	19	43	79	21	69	33	11	43	18	50 700
Number of employees, Vojvodina (corrected)	154	133	49	70	24	57	103	27	86	43	14	56	23	72
Total number of employees, Hungary														3,238
Total number of employees, Vojvodina, corrected														911

Source: Authors listed below Tables 1, 3, 5 and 6

How could Elektrovojvodina benefit from optimization of the number of employees based on the Hungarian model that would result in 1569 redundancies? An average net salary in EPS (after 10% reduction) is over 70,000 dinars. Gross costs, per worker, taking into account: salaries, cost of office space, air conditioning, heating, the cost of official vehicles, mobile phones, transportation to work and the similar amount to a minimum of 1.000 € / worker per month or € 1,569,000 for 1,569 workers, which is annually € 18,828,000.

The current number of employees in EPS is still the highest among public utility companies, reaching 31,147, even after reorganization and the formation of EMS Serbia (transmission of electricity from production to distribution) with 1,502 employees at the end of last year and PEU Resavica (coal mine) with 4,381. The analyzed model of optimization of employees applies only to the electric-distribution activities of EPS. If the redundancies reached 40%, this would mean a saving of 31.147 x 0.4 x 1.000 € x 12 months – i.e. around 150 million euros annually.

7. Structure of human resources

When it comes to human resources, it is not enough to determine only the required number of workers employed by these parameters, but also the structure of employees since there may be more than necessary workers in the electricity distribution companies and, on the other hand, fewer than necessary of those who are directly involved in production work processes - fitters, engineers and others technical staff. This is unfortunately what often happens. In this model, the number of employees who are not directly in the production process and maintenance of the distribution system during the continuous supply of electricity to the consumption observed (non-production workers) ranges from 15-20% of total employees. If the number of non-production workers in Elektrovojvodina were 18% of the total number of employees, according to the corrected Hungarian model, that would involve 164 non-production employees, while the production part would contain 747 workers.

Conclusion

In case of Elektrovojvodina, by taking weights that are applied in the Hungarian electricity distribution company, with a correction higher by 30% for maintenance and overhaul of medium and low voltage, it can be concluded that the objectives should be making the organization with the total of 911 employees, of which 747 should be production workers and 164 - non-production workers.

Elektrovojvodina is the best organized part of the distribution activity in EPS and yet there is such a discrepancy in the number of employees and the associated consumption. In other parts of EPS there are also significant issues related to the number of employees. For Elektrovojvodina, the redundancy of 1,569 employees means monthly reduction in the costs of € 1,569,000 and € 18,828,000 annually.

Even if, owing to the difference in their activities, primarily, the maintenance (although the question is whether it should be insisted on keeping the maintenance and repair of medium and low voltage) the Hungarian model were increased by 50% (which accounts for 33.3% of assemblers in total employment), then the total number of employees in Elektrovojvodina would be about 1,050, which is still significantly fewer than the current situation.

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Originalni naučni članak UDK 005.52:330.133.3
657.422

Rad prihvaćen: 29. 12. 2016.

Instrumenti finansijske analize u oceni boniteta preduzeća na primeru „Metalac“ a.d. Gornji Milanovac

Irena Rašević[1]*, Ognjen Raketić[2]

[1] Fakultet tehničkih nauka Čačak,[1]

Apstrakt: Naučni rad nosi naslov instrumenti finansijske analize u oceni boniteta preduzeća. Pisan je sa ciljem da se ispita važnost instrumenata finansijske analize u ocenjivanju boniteta i likvidnosti preduzeća. Dvadeset i prvi vek uneo je velike promene u poslovanju i omogućio finansijskoj analizi da preuzme glavnu ulogu u ispitivanju boniteta i likvidnosti preduzeća. S obzirom na sve veću globalizaciju i na sve nestabilnije tržište, jedno od pitanja koje se postavilo: da li finansijska analiza i njeni instrumenti mogu da daju adekvatan odgovor rukovodstvu zarad poboljšanja finansijskih performansi preduzeća i kako? Metodologija istraživanja se zasnivala na studiranju i analiziranju literature i izvora koja je povezani sa finansijskom analizom, deskripciji, analizi i interpretaciji primarnih izvora koji su korišćeni u ovom radu, a konkretno se odnose na preduzeće „Metalac“ a.d. iz Gornjeg Milanovca. Istraživanjem je utvrđeno i zaključeno da finansijska analiza i njeni instrumenti imaju presudan uticaj na poslovne odluke, kako top menadžmenta „Metalac“ a.d., tako i na odluke investitora. Rezultati ovog istraživanja su primenjivi za top menadžere, finansijske analitičare, druge istraživače, studente i učenike. Rad je značajan za skretanje pažnje na sve veći značaj finansijske analize i njenih instrumenata, jer postoje indicije da nije zastupljena u dovoljnoj meri u privrednim društvima na teritoriji Srbije.

Ključne reči: Finansijska analiza, pokazatelji likvidnosti, pokazatelji aktivnosti, cash flow analiza, funds flow analiza

The Instruments of Financial Analysis and Their Role in the Company Credit Rating – Case Study “Metalac”, Gornji Milanovac

Abstract: The subject of this research are the instruments of financial analysis and their role in the company creditworthiness, i.e. the role of financial analysis in the estimation of a company’s liquidity and credit standing. Financial analysis and its instruments are not used enough in Serbia, due to the lack of qualified personnel. The quintessential problem that is discussed in the paper is the testing of importance of financial analysis and its instruments in business decision-making of top management and investors. The aim of the research is in raising awareness on the growing significance of financial analysis and its instruments, because there are signs indicating that it is not applied enough in companies in Serbia. The paper consists of liquidity indicators, activity indicators, cash flow analysis, and funds flow analysis. The research methodology is based on studying and analysing references and resources on financial analysis, describing, analysing and interpreting primary resources used to obtain data, which, in substance, refer to the “Metalac” Holding company. The first part of the paper deals with a short historical overview of “Metalac” Holding company.The second part of the paper analyses in detail and shows the results of the research. The results suggest that financial analysis and its instruments crucially influence business decisions of both the top managers of “Metalac” Holding company and investors. All this matters for top managers, financial analysts, other researchers, students and pupils.

Key words: Financial analysis, liquidity ratios, activity ratios, cash flow analysis, funds flow analysis.

[1] irenarasevic@yahoo.com

1. Basic information about the company

Metalac a.d. is a shareholding company with the head office in Gornji Milanovac. Metalac was founded on April 4, 1959 and since 1998 it has been acting as a shareholding company. Ever since January 2006 the Company has operated as a decentralized company, when Metalac a.d. transferred its primary activities to the newly founded enterprises: Metalac Posudje doo for production of cookware, Metalac Inko doo for production of stainless steel and composite kitchen sinks and Granmatrix composite plates, Metalac Bojler doo for production of water heaters and Metalac Print doo for production of carton packing material and transfers for cookware decoration and Metalac Market doo retailer managing a chain of 50 specialized shops throughout Serbia.

Today Metalac a.d. acts as a Group with 14 subsidiaries: four of them are productive, five trading companies in the local market and five compnies abroad. The property structure of Metalac shows 60 % held by natural persons, 5% share of legal persons and about 35% custody accounts. The share of foreign entities and investment funds in the total capital is 45%. Metalac a.d. shares are quoted on the B List of the Belgrade Exchange. Exchange analysts say that Metalac is one of the "healthiest" Serbian companies.

In 2012 according to the consolidate account Metalac made 59 million euro turnover and net profit of 5,2 million euro. Cookware production is the core-business and the company Metalac Posudje is one of the major cookware producers in Europe.

Metalac exports its products to 25 countries on all continents. Except traditional presence in the region, products of Metalac go to: Russia, France, Italy, Germany, Spain, Sweden, Finland, Denmark, Czech Republic, Ukraine, Georgia, Bulgaria, etc. and as far as the USA and Australia. Metalac Holding employs about 1700 people, half of them working in Metalac Cookware, every tenth with university degree. There is a trend of continuous education to improve and update knowledge in all fields.

1.1. Analysis of net working capital

In order to determine whether the company has sufficient funds for current operations the value of neto working capital should be calculated. The resulting value will greatly assist in the assessment of whether the company has sufficient funds financed from its own resources. If the calculated values are positive it will provide the conclusion that the company Metalac has enough of its own and long-term funds which is a prerequisite that the company may in the future operate normally and develop themselves according to their position in the market.

Table 1. Analysis of neto working fund of company Metalac for the period 2014 and 2015 year

	In 000 dinars	2014	2015
1.	Long-term sources of funding	3.069.072	3.078.787
1.а	Long-term liabilities	57.452	12.160
1.б	Capital	3.011.620	3.066.627
2.	Fixed assets	2.538.769	2.574.901
1 – 2	**Neto working capital**	**530.303**	**503.886**

Created by the authors based on APR and "Metalac" data

The positive neto working capital is a good signal for creditors of companies „Metalac". So that the entire fixed assets and part of current assets are financed by long-term sources, which means a favorable position and liquidity that has reached the long-term financial balance.

1.2.Analysis using the financial indicators

Table 2. Liquidity indicators of company Metalac for period 2014 and 2015 year

Liquidity indicators	2014.	2015.
Current ratio	3,25	3,02
Ratio of reduced value	3,24	2,99
Neto working capital	638.607	613.621

Created by the authors based on APR and "Metalac" data

- The ratio of overall liquidity in the interval from 3.25 in 2014 to a maximum of 3.02 in 2015. The value of this ratio is above normal but can be preliminarily concluded from the company liquidity. The interpretation of this ratio shows that in 2014 the company with 3.25 pounds of working capital covers 1 dinar short-term obligations and that with 3.02 dinars of working capital in 2015 1 dinar short-term obligations were provided.
- The normal or standard for rigorous liquidity ratio is 1. Metalac has 3.24 value of this ratio in 2014, 2.99 in 2015, which is significantly above the normal range and supports the earlier lend weight for the company liquidity. Based on the calculated value, which can be concluded we then exclude stocks of Metalac company and liquidity. The interpretation of this ratio shows that in 2014 the company with 3.24 pounds of working capital covers 1 dinar liquidity, that is, with 2.99 pounds of working capital in 2015 provided 1 dinar liquidity.
- The value of neto working capital in 2014 was 638,607 and it was reduced in 2015 which amounted to 613,621 dinars. This is a positive trend and shows that a significant portion of current assets is financed by long-term sources. Looking at the overall situation in Serbia as well as the global economic crisis can be concluded that the company Metalac is one of the few company in Serbia that has a positive value of neto working capital from year to year which poses subsumed under exceptional business results.

Table 3. Indicators activities of company Metalac for 2014 and 2015 year

Indicators activities	2014.	2015.
Coefficient velocity buyers The average collection period	1,35 267 days	1,29 279 days
Coefficient invertory turnover Average period binding of stock	2,51 144 days	1,69 213 days
Coefficient turnover ratio supplier Average time of settlements of liabilities	0,28 1286 days	0,27 1333 days
Coefficient turnover of fixed assets	0,0044	0,0046
Coefficient turnover ratio of total operating	0,0033	0,0034
Coefficient turnover of company funds	0,0037	0,0039

Created by the authors based on APR and "Metalac" data

- The average collection period of trade receivables in 2014 was 1.35 and in 2015 1.29 times during the year. It follows that since the sale of finished goods to customers on credit until the moment of collection of receivables on average 267 days passed in 2014, and in 2015 this amounted to 279 days.
- The value of the coefficient in 2014 amounted to 2.51 whereas in 2015 it was 1.69. The higher the turnover ratio of inventories to better position the company, the more necessary it is that during the year the lower amount of funds will be „trapped" into the stock. The interpretation of this ratio shows that from the moment we make the purchase of raw materials to the moment we make the sale of finished products 144 days pass on average as was the case in 2014, or 213 days in 2015.
- The value of the coefficient crafts suppliers in 2014 amounted to 1286 days, in 2015, 1,333 days. Accounts payable are paid 0.28 and 0.27 times on average during the year. It follows that from the time of purchase of materials and raw materials from suppliers to the time of payment, there are liabilities for average pass
- The value of the coefficient of fixed assets in 2014 amounted to 0.0044 and in 2015 to 0.0046. When the indicator of fixed assets is higher, it gets better, because it indicates a more efficient use of fixed assets in generating revenue. Based on the calculated value of the coefficient, it can be concluded that for each dinar investment in fixed assets it increases by 0.0044 or 0.0046 dinarss neto income of realization (sales). The value of this ratio is far below the competition, but the recommendations for management is to pay special attention to the efficient use of resources.
- Turnover ratio of total operating assets in the company Metalac amounts in 2014 and 2015 which was 0.0033 and 0.0034. The interpretation of the value of this ratio indicates that one dinar invested in the assets of companies in 2014 turned over the 0.0033 times for every 360 days, and in 2015 0.0034 times.
- Turnover ratio of own funds in the company Metalac amounts in 2014 to 0.0037 and in 2015 to 0.0039. It follows that for each dinar invested in their own funds or enterprises 0.0037 or 0.0039 pounds of net income are generated for the realization of sales.

Table 4. Indicators funding structure of Metalac company for 2014 and 2015 year

Indicators funding structure	2014.	2015.
A. Indicators cover		
Coverage ratio of expenditure on behalf of interest	9,63	11,41
B. Indicators funding structure		
The ratio of debt	12%	9%
The ratio of capital structure	34%	23%
The ratio of long-term debt to long-term resources	24%	18%

Created by the authors based on APR and "Metalac" data

- Value ratios for interest coverage show how operating profit companies are burdened by interest costs. On the basis of calculated value it can be concluded that increasing coverage of interest costs for business income, which is a positive trend for the company and opens up the possibility, it may further incur in the event of an investment. The interpretation of this indicator is that every penny of expenditure on behalf of the interest is covered with 9.63 dinars in 2014, or 11.41 dinars in 2015 of operating profit.
- The ratio of debt Metalac had in 2014 was 12% in 2015 it was 9%. It follows that 12% and 9% of the total transactions of funds are financed from foreign sources.
- The ratio of capital structure in the company Metalac was in 2014 34% and in 2015 23%. Consequently, the long-term resources participate in the financing of companies with 34% or 23% in relation to their own funds.
- The ratio of long-term debt to long-term resources for the company Metalac were in 2014 24% and in 2015 18%. It follows that the total of long-term sources of finance companies was 24% and 18% of the company which was purchased from long-term debt.

Table 5. Indicators of profitability in Metalac for 2014 and 2015 years

Indicators of profitability	2014.	2015.
A. Indicators rate gain		
Gross profit	56%	59%
Rate of business profit	9,5%	12,4%
Rate of neto income	57%	59%
B. Indicators yields rates		
Neto rate of return on commercial property	7,12%	7,32%
Rate of return on equity	7,98%	8,37%
Rate of return on commercial property	1,18%	1,54%

Created by the authors based on APR and "Metalac" data

- Gross profit in net sales revenue accounted for 56% and 59%.
- The rate of business profit shows that for every 100 pounds disclosed in operating income the company achieved operating profit of 9.5 dinars in 2014, and in 2015, 12.4 dinars. The value of this indicator of profitability is very important because it indicates that the company Metalac has sufficient margin and a sufficient amount of business income to cover total operating expenses. The value of this trend has stood at 9.5% in 2014, and in 2015 12.4%
- The rate of neto income in 2014 is 57% and in 2015 59%. The increase in the share of net income to operating income is a positive trend because it leads to increased profitability. In 2014, and in 2015, for every 100 Dinars disclosed in operating income, the company had a net profit of 57 dinars, or 59 dinars.
- The interpretation of the neto rate of return on commercial property shows that the company Metalac on every penny invested in total assets achieved 7.12% in 2014 and 7.32% in 2015 of the neto income.

- The interpretation of the rate of return on equity shows that the company Metalac on average used every dinar of its own capital so they achieved 7.98% in 2014, and 8.37% in 2015 of the neto income.
- The interpretation of the rate of return on commercial property shows that the company Metalac on average used every penny for business assets to achieve 1.18% in 2014 and 1.54% in 2015 on operating profit.

Table 6. Value relations market price for Metalac in 2014 and 2015 year

Value relations market price	2014.	2015.
Neto profit per share	0,1181	0,1247
The ratio of market prices per share and neto income per share	10.158	9.621
Divident payment ratio	0,05%	0,05%
Dividend rate	/	/
Book value per share	1,48	1,50

Created by the authors based on APR and "Metalac" data

- 0.1181 dinars in 2014, i.e. 0.1247 dinars in 2015 is the amount of the neto profit per share that may be paid in the form of dividends to shareholders or accumulated.
- Value relations market price per share and neto income per share for the company Rad in 2014 amounted to 5.08 in 2015 to 4.82 dinars. This means that the amount of 5.08 and 4.82 dinars potential shareholders have to pay for the purchase of shares in order to ensure future annual earnings per share is 1 dinar.
- 0.05% of neto income amounts to 2014 and 2015 and this amount is paid out to shareholders in the form of dividends, and the rest is accumulated.
- After fulfilling all its obligations, in the case of liquidation, each shareholder would be for each ordinary share, which has received the amount of 1,463, or 1.5032 dinars.

1.2.2. Cash flow analysis

Metalac in 2014 and 2015 had a positive cash flow from operating activities, which points to the fact that from the base of its activities, the company creates cashflow. Positive cash flow from operating activities shows that the company owns its earning ability and the ability to charge their goods or services on the market. The trend in the net cash flow from operating activities was positive and it says that every year more and more money Metalac created from the core business. Neto cash flow from investment activities was positive, while neto cash flow from financial activities is negative.

Table 7. Analysis of cash flow of the company Metalac 2014 and 2015 year

Cash flow statement	AOR	2014	2015
I. Cash flow from operating activities	301	874.516	964.898
II. Cash outflows from operating activities	305	826.414	897.975
III. Neto cash flow from operating activities	311	48.102	66.923
I. Cash flow from investing activities	313	438.988	592.005
II. Cash outflows from investing activities	319	371.365	472.516
III. Neto cash flow from investing activities	323	67.623	119.489
I. Cash flow from finacing activities	325	111.371	0
II. Cash outflows from financing activities	329	244.897	220.565
III. Neto cash outflows from financing activities	334	133.526	220.565
TOTAL CASH FLOW	336	1.424.872	1.556.903
TOTAL CASH OUTFLOWS	337	1.442.673	1.551.056
NETO CASH FLOW (336 - 337)	338	/	0
NETO CASH OUTFLOWS	339	17.801	34.153

Created by the authors based on APR and "Metalac" data

Table 8. Cash flow concept for the period 2014 and 2015 year

Sign	Position	2014	2015
	Annual neto profit	240.986	254.427
+	The increase in reserves	29.340	- 29.335
-	Depreciations	4.810	27.023
=	Cash flow I	265.516	198.069
+	Increase in long – term provisions	24.644	983
	(cover)		
=	Cash flow II	290.160	199.052
+	Other expenses	6.954	-5.424
-	Other profits	91.697	54.896
=	Cash flow III	205.417	138.732
-	Dividends paid	3.971	21.533
=	Cash flow IV	209.388	117.199

Created by the authors based on APR and "Metalac" data

The most important value of cash flow indicators is the value of cash flow III and IV. Cash flow III estimates a yield strength of the company. After the values of this indicator is calculated by years it can be seen that in the company Metalac there's growth, which has a positive trend and indicates that the company is strengthening its yield power. Cash flow IV is used to assess the financial strength of the company. During the observed period of

extension there is a cyclical movement of this indicator. The value of this indicator in 2014 compared to 2015 is increased by observations of 92,189 dinars, which indicates the decreased financial strength of the company.

1.2.3. Funds flow analysis

Funds flow analysis for the period 2014 to 2015 is shown in table number 9.

Table 9. Funds flow concept for the period 2014 and 2015:

	FUNDS flow concept	**2014.**	**2015.**
	Neto profit	236.006	254.935
+	Deprecitations	125.551	81.063
-	The increase in neto working capital	638.607	613.621
+	Equity	441.899	441.899
=	**Available financial flow**	**164.849**	**164.276**

Created by the authors based on APR and "Metalac" data

Funds flow analysis can follow any increases or reductions i.e. the net difference of balance sheet items or segments of two or more successive balance sheet. This analysis is used for the dynamic analysis of the balance i.e. analysis, development, and supplements the analysis of the viability of using the income statement and cash flow analysis.

Funds flow analysis of company Metalac can conclude that in 2014 and 2015, the available financial flow is less than the net profit. In 2014, depreciation costs amounted to 125,551 dinars, which means that the available cash flow increased by this amount. This year the company has reduced neto working capital of 638,607 dinars, which led to a reduction in available financial flow. In 2015 depreciation expense was 81,063 dinars. Neto current assets have decreased and amounted to 613,621 dinars. For this reason, in 2015 available cash flow is less than neto income.

2. Conclusion

Based on the due diligence Metalac can conclude the following:

- Operations of the company during the period took place under the influence of the financial crisis and deteriorating economic conditions.
- It is expected that the company will operate in more difficult and uncertain economic conditions in the future. The analysis so far of the measures implemented by the management believes that the continuity of business operations during the next period will not be compromised, even in extremely turbulent conditions because the company owns brand strength i.e. Metalac products are recognized not only in Serbia but in the region.
- Deteriorating economic situation in the country has affected the position of the company primarily through the danger that some clients (customers) will be able to meet their obligations as they fall due, which may impact the depreciation and provisions for potential losses of the company in 2016.
- Based on the analysis of all indicators, we can say that the company Metalac is one of the few in Serbia which has a long-term perspective and business strategy, as well as being in possession of the market beyond the borders of Serbia, which provides that in the future the company becomes a leader in the region and exports the power of Serbia.

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Originalni naučni rad UDK 519.226:004.4
Rad prihvaćen: 16. 12. 2016.

Optimalan izbor laptopa primenom DEA metode

Željko Grujčić[1]*, Vladimir Tomašević[2]

[1] Univerzitet „Union – Nikola Tesla“, Fakultet za inženjerski menadžment, Beograd,[1]
[2] Univerzitet „Union – Nikola Tesla“, Fakultet za inženjerski menadžment, Beograd

Apstract: Polaznu osnovu sistema za podršku odlučivanju predstavlja teorija odlučivanja. Ona nije zamena menadžmet disciplina već njihova podrška koja ima za cilj da unapredi funkcionisanje organizacije. U savremenim uslovima poslovanja sve je manje vremena za donošenje ispravnih odluka, njihovu analizu, praćenje efekata njihove implementacije, posebno na najvišim nivoima odlučivanja. Ideja rada je da se, relativno novom, metodom operacionih istraživanja napravi optimalan izbor laptopa. Alat korišćen u istraživanju je Analiza obavijanja podataka (DEA) i softver Criterium Decision Plus 3.04S. U prvoj fazi istraživanja je korišćena DEA metoda, a u drugoj fazi je softverom CDP sprovedeno rangiranje efikasnih alternativa. U istraživanju je tehnika rešavanja poslovnog problema, izbora optimalnog laptopa, u potpunosti opravdala upotrebu sistema za podršku odlučivanju.

Ključne reči: analiza obavijanja podataka, efikasnost, sistemi za podršku odlučivanju

Optimal Choice of Laptop Applying Dea Method

Abstract: The starting point of decision support systems is the decision theory. It is not a substitute for management disciplines but their support, which aims to improve the functioning of the organization. In modern business conditions, there is less time for proper decision-making, their analysis, monitoring of the effects of their implementation, especially at the highest levels of decision-making. The idea of this study is to make the optimal choice of the laptop, using a relatively new method of operational research. The tool used in the research is the Data Envelopment Analysis (DEA) and the software Criterium Decision Plus 3.04S. In the first phase of research DEA method was used, and in the second phase the software CDP was used for ranking effective alternatives. Within the study, a technique for solving the business problem, selecting the optimal laptop, fully justified the use of decision support systems.

Key words: data envelopment analysis, efficiency, decision support systems

1. Introduction

In the last few decades, economic activity at the micro (companies, industries) and the macro level (regional, national level) are influenced by global trends which converge to improve the performance within which special attention is paid to assessing and improving the efficiency of production systems. Thanks primarily to its abilities to improve performance, in production and service activities, national economies of individual countries have achieved economic supremacy over the last three decades. One of the most important principles in any business is the principle of efficiency which consists in achieving the highest possible economic effects (outputs) with as little economic sacrifice (inputs). Efficiency can shortly be defined as the ability to achieve desired goals with minimum use of available resources. Unlike the effectiveness, which is the ability to identify and achieve real goals, or to "do the right things”, efficiency consists of realizing these goals "the right way". Efficiency is a word of Latin origin (efficax), which means success. It shows the degree of effectiveness of production factors (resources involved) in the production of material goods and services. Efficiency is, in the simplest case, in organizations that use one input (costs, assets engaged, etc.) to produce a single output (gain, profit, revenue, etc.) defined as the ratio of output to input.

[1] željko.grujcic@gmail.com

For evaluating the success of organizations in practice, there are usually multiple inputs and outputs that are diverse in nature (financial, technical, technological, ecological, social, etc.) which have to be considered, and are expressed in different measuring units. It is therefore necessary to define a summary synthetic indicator of the efficiency, that consider all significant multiple results and all the resources that are used for their implementation. It is characterized by problems of aggregation of observed inputs/outputs in a virtual input/output. To determine the effectiveness of the organization, you should first solve the problem related to the expression of input and output data in the range of values that are comparable with each other, which is a problem of scaling. Another problem relates to the determination of the relative importance of individual input/output, and assigning weights or weighting. DEA method allows solving these problems.

2. DEA Method

Contemporary business trends in economy and management both in production and in service and non-profit sector, create tendency for more intensive use of quantitative methods in making decisions and analysis of the achieved results (Cvijanović, Dimitrijević, Grujčić, 2002). That is a way the role and importance of the methods of operation researches is huge. The most significant and the most common method of operation researches is linear programming. It is essentially the mathematical analysis of the problem of optimum (Zorič, 2006). One of the methods of linear programming is the *data envelopment analysis*, that is, *DEA* method.

Data envelopment analysis, or the DEA method is one of the new methods of operation researches and presents the method of linear programming for evaluating relative efficancy of organizational units which use multiple diverse inputs to create multiple diverse outputs. In the beginning the method was developed for evaluating the efficancy of non-profit organizations (schools, hospitals, cinemas, libraries) but in the later period the area of its usage has been greatly expanded. The development of the DEA method (Charnes, Cooper, Golany, Seiford, Stutz, 1985) was reflected in the development of family of basic DEA models and later in their numerous expansions, but also in the development of the specialized DEA software. Given that the procedure on how to apply DEA method and how to use more types of DEA model in practice by solving some problem has been developed, many authors for this method use the term „DEA methodology".

Data Envelopment Analysis – DEA is developed by Charnes et al., 1985. In order to measure the efficiency of organizational units, primarily non-profit ones, they suggested that the optimization task of linear fractional programming sholud be solved for each *Decision Making Unit – DMU*. In the mentioned paper, they formulated appropriate tasks of linear programming which are known in literature as *CCR primary* and *CCR dual models*. If we endeavor to minimize the inputs in production of the given output it is an *input-oriented DEA model*, but if we endeavor to maximize outputs in exisitng level of input it is *output-oriented DEA model*. *Constant returns to scale* are defined so that proportional increase of input results with proportional increase of output of some of the DMU. Banker, Morey,1986., gave the expansion of original CCR DEA models, by allowing the units to operate with *variable returns to scale*, which lead to creation of *BCC model*. In the meantime, DEA has been apllied in different areas of work such as, forest holdings, agricultural goods, power plants, fast food kiosks, scientific research projects, banking subsidiaries, military institutions, social and health facilities, schools, faculties, economic areas (regions), and recently also for evaluating the efficiency of e-commerce.

The development of DEA method and its models, presented in the Table 1, was motivated, with the need to evaluate efficiency of the work of related organizational units, where the presence of large number of inputs and outputs makes the comparability more difficult. The initial idea was the principle of efficiency which was introduced by Farell for the manufacturing organizations, and according to him, the goals should be achieved with minimal efforts, that is, with minimal usage of funds. As in the evaluation of the success of organizations, especially non-profit ones, various inputs or outputs usually should be considered, which by their nature are mostly diverse and are expressed in different units of measurement, it is necessary to solve the problem of aggregation of observed inputs/outputs into one *virtual* input/output. First of all, it is necessary to express input and output data in the range of values which are mutually comparable, that is, it is necessary to solve the problem of scaling so that the efficiency can be expressed with number between 0 and 1, and each organizational unit has the freedom to determine the value of the weighting coefficient in the manner which is the most convenient for it, that is, to maximize its efficiency, with limitation that the weights must be positive values and that the quotient of virtual output and virtual input of each unit can not have the value higher than 1. Then, it is necessary to solve the problem of weighting, that is, to determine relative importance of individual inputs and outputs (to assign weighting coefficients to inputs and outputs). In such circumstances, the creators of the DEA method, defined the *efficiency* of the observed unit as:

h=the sum of weighted output /the sum of weighted input (1)

The main characteristic of the DEA method is that the efficiency measure gives the *relative measure*. In other words, each of the units (entity) is evaluated, based on the inputs and/or outputs data, as relatively efficient or inefficient in regard to other units (entities) which are included in the analysis. Thus, DEA checks whether each of the entities is on the efficiency limit. It is important to emphasize that the *identification* of inefficient units are strong, while, the identification of efficient units is weak, because it can happen that certain units are efficient only because they included favorable weights into the measurement of its efficiency. The efficiency limit presents, in economic terms, empirically derived maximum of outputs which each unit can achieve with available inputs. On that occasion the efficiency limit behaves as an envelope for inefficient units. The envelope is the curve which in every point touches one of the curves which belong to the same family.

Table1. The review of the basic DEA models

INPUT ORIENTED MODELS	
The weight problem (PIp)	The envelopment problem (DIp)
(Max) $h=\mu^T y_0+u^*$ With limitations: $v^T x_0=1$, $u^* e^T+\mu^T y-v^T x\le 0$, $\mu^T\ge 0$, $v^T\ge 0$, where: $u^*\begin{cases}\ldots=0\ldots\ldots\ldots\ldots\ldots in\ldots PI_0\\ \ldots\le 0\ldots\ldots\ldots\ldots\ldots in\ldots PI_1\\ \ldots\ge 0\ldots\ldots\ldots\ldots\ldots in\ldots PI_2\\ \ldots\text{unlimited}\ldots\ldots\ldots in\ldots PI_3\end{cases}$	(Min) Z With limitations $y\cdot\lambda\ge y_0$, $Z\cdot x_0-x\cdot\lambda\ge 0$, Z unlimited, $\lambda\ge 0$. For DI0 : no additional limitation For DI1 : add $e^T\cdot\lambda\le 1$ For DI2 : add $e^T\cdot\lambda\ge 1$ For DI3 : add $e^T\cdot\lambda=1$
OUTPUT ORIENTED MODELS	
The weight problem (POp)	The envelopment problem (DOp)
(Min) $h=v^T y_0+v^*$ With limitations: $\mu^T y_0=1$, $v^* e^T-\mu^T y+v^T x\ge 0$, $\mu^T\ge 0$, $v^T\ge 0$, where: $v^*\begin{cases}\ldots=0\ldots\ldots\ldots\ldots\ldots in\ldots PO_0\\ \ldots\le 0\ldots\ldots\ldots\ldots\ldots in\ldots PO_1\\ \ldots\ge 0\ldots\ldots\ldots\ldots\ldots in\ldots PO_2\\ \ldots\text{unlimited}\ldots\ldots\ldots in\ldots PO_3\end{cases}$	(Max) ϕ With limitations $x\cdot\lambda\le x_0$, $\phi\cdot y_0-y\cdot\lambda\le 0$, ϕ unlimited, $\lambda\ge 0$. For DO0 : no additional limitation For DO1 : add $e^T\cdot\lambda\le 1$ For DO2 : add $e^T\cdot\lambda\ge 1$ For DO3 : add $e^T\cdot\lambda=1$

Source: (Grujčić, 2001)

In order for the inefficient units to be on the efficiency limit and become efficient, they have to eather reduce inputs or increase outputs. If the unit is possible to to envelop, then it is relatively inefficient, and if it is not, it is included in forming of the efficiency limit. Depending on which DEA method is used, the efficiency limit is in the shape of *convex cone* or *convex layer* (cape). The content and level of inefficiency, for each of the inputs and outputs, is determined for each inefficient entity, based on its distance from the efficiency limit. The level of inefficiency is defined with comparison with one reference unit or with convex combination of other reference units placed on the efficiency limit.

Based on the above, DEA can be described as an analysis which is oriented towards data because it derives evaluations of performances and other conclusions directly form observed data with minimal assumptions. DEA method (Charnes et al., 1985) involves several different approaches and models which are mutually connected and which are used together for evaluation of the efficiency limit and evaluation of the relative efficiency of

observed DMU. DEAmethod provides informations which are significant for managing further work of efficient or inefficient units.For inefficient units, DEA finds ways for achieving the efficiency of those units. For the units which are already efficient, DEA provides informations on how to become more efficient. In order for DEA to be succesfully used in the evaluation of performance, it is necessary for all the phases in the use of DEA to be entirely conducted.In conducting the study of efficiency by using DEA method, four phases can be singled out:

- Definition and choice of DMU, whose relative efficiency should be defined,
- Defining input and output factors which are relevant and convinient for evaluation of relative efficiency of the chosen DMU,
- Choosing the adequate DEA model and
- Solving DEA model, analysis and interpretation of the results.

3. Methodology and Results of Research

The intention of the research was primarily to identify the part of the product, a laptop, which should never be included when choosing the optimal solutions. It may seem strange, but when you make a division between what is good and what is not, the potentially great decision has already been made. This was the primary requirement, and the secondary was to find the solution among the acceptable/optimal ones, which is the best in given circumstances.

For this purpose was used the DEA method. Its specificity is that it quickly detects the sources/DMU inefficiencies, which means that the identification of inefficient units (laptops) is strong while the identification of efficient units is weak. Once the inefficient units/alternatives are rejected, it is needed to find the best/optimal remaining alternative. According to the DEA method, all the remaining units are efficient, thus for ranking within the DEA methodology is used the Anderson-Peterson's model, while in the study the ranking of alternatives was carried out using the software Criterium Decision Plus, version 3.04S, by Info Harvest Company.

The research referred to the selection of the optimal laptop, within the same price range. The study involved the combination of three inputs and three outputs. On the input side there were analyzed:

- processor,
- graphics card and
- RAM memory.

On the output side there were analyzed:

- monitor resolution,
- battery life and
- price.

In Table 2 the laptop models were given with the aforementioned input/output values.

Table 2. Overview of input/output in choosing the laptop

No	MODEL	CPU	RAM	GPU	RESOL	BATT	PRICE
1	Lenovo IdeaPad 510-15	Intel Core I3 6100U, 2.30GHZ	8GB	NVIDIA Ge Force	Full HD	Li 2 cell	65.999,00 RSD
2	Dell Inspirion 3157	Intel Celeron N3050, 2.13GHZ	4GB	Intel HD 5500	HD	Li 3 cell	65.999,00 RSD
3	Asus K555 DGXO103T	AMD A10 8700P, 3.20GHZ	12GB	AMD Radeon R5	HD	Li 2 cell	66.999,00 RSD
4	HP ProBox 450G2	Intel Core I5 5200U, 2.70GHZ	4GB	Intel HD 5500	HD	Li 4 cell	66.999,00 RSD
5	Lenovo IdeaPad B50-80	Intel Core I5 5200U, 2.70GHZ	8GB	AMD Radeon R5	Full HD	Li 4 cell	66.999,00 RSD
6	Asus K555 LBXO532D	Intel Core I5 5200U, 2.70GHZ	6GB	NVIDIA Ge Force	HD	Li-Poly 2 cell	68.999,00 RSD
7	Lenovo E50-80	Intel Core I5 5200U, 2.70GHZ	8GB	AMD Radeon R5	Full HD	Li 4 cell	68.999,00 RSD
8	Lenovo IdeaPad YOGA500	Intel Core I3 5005U, 2.00GB	4GB	Intel HD 5500	HD	Li 4 cell	69.299,00 RSD
9	Dell Inspirion 5559	Intel Core I5 6200U, 2.80GHZ	8GB	AMD Radeon R5	HD	Li 4 cell	69.999,00 RSD

10	HP 250G4	Intel Core I5 6200U, 2.80GHZ	8GB	AMD Radeon R5	HD	Li 3 cell	69.999,00 RSD
11	Lenovo V310-15ISK	Intel Core I5 6200U, 2.80GHZ	8GB	AMD Radeon R5	HD	Li 4 cell	69.999,00 RSD

Source: (ComTrade SHOP, 2016)

Using DEA Solver, which is an addition to Excel, performed according to the efficiency rating of given laptop computers. The analysis involved the evaluation of efficiency of observed units, by the implementation of:
- input-oriented model with a constant return to scale,
- input-oriented model with a variable return to scale,
- output-oriented model with a constant return to scale and
- output-oriented model with a variable return to scale.

In order for the comparison to make sense, DEA requires the previous implementation during two steps. The first involves scaling. This means that the value of the inputs/outputs presented in Table 2, is necessary to be expressed within the range of values that are comparable to each other, so the efficiency estimate could be presented as a number between 0 and 1. Then, in the second step, it is necessary to implement weighting, i.e. to determine the relative importance of individual inputs and outputs. For this purpose Table 3 was created.

Table 3. Overview of the input/output on which scaling and weighting was conducted

Typ	Input 1	Input 2	Input 3	Output 1	Output 2	Output 3
1	80	93	90	90	70	90
2	70	75	65	75	80	90
3	80	100	80	75	70	80
4	90	75	65	75	90	80
5	90	93	80	90	90	80
6	90	85	90	75	90	70
7	90	93	80	90	90	70
8	80	75	65	75	90	65
9	100	93	80	75	90	60
10	100	93	80	75	80	60
11	100	93	90	75	90	60

When you start DEA Solver and process the levels which were prepared in Table 3, you get the results that are given in Figure 1. On the left side of Figure 1 the results of the assessment of laptop efficiency using are present where the input-oriented model with a constant return to scale and on the right side of Figure 1 there are the results of the assessment of laptop efficiency using the input-oriented model with a variable return to scale.

Alternatives/laptop computers with shaded cells represent effective units, and efficiency rating is 1. The results show that almost half of the alternatives, in both models of efficiency assessment is unacceptable, given the set requirements. Namely, the requirements include good performance in terms of CPU, RAM, and GPU, but also that on the output side good/acceptable computer price remains, has a great battery life, and a good screen resolution. On the right side of Figure 1 there are the results of efficiency assessment, using the model that allows a variable return to scale. In column Returns-to-scale, you can see what kind of return to scale it was, in the efficiency assessment. The return to scale was constant, increasing or decreasing.

Figure 1. Results of efficiency assessment of laptop computer using the input-oriented model

INPUT ORIENTED MODELS								
CONSTANT RETURNS TO SCALE		VARIABLE RETURNS TO SCALE						
Efficiency scores		**Efficiency scores**			**Scale efficiencies**	**Returns-to-scale**	**CCR score**	**NIRS score**
1	1.0000	1	1.0000		1.0000	constant	1.0000	1.0000
2	1.0000	2	1.0000		1.0000	constant	1.0000	1.0000
3	0.8594	3	0.8750		0.9821	increasing	0.8594	0.8594
4	1.0000	4	1.0000		1.0000	constant	1.0000	1.0000
5	0.9750	5	1.0000		0.9750	decreasing	0.9750	1.0000
6	0.8946	6	0.9259		0.9662	decreasing	0.8946	0.9259
7	0.9750	7	1.0000		0.9750	decreasing	0.9750	1.0000
8	1.0000	8	1.0000		1.0000	constant	1.0000	1.0000
9	0.8125	9	0.8125		1.0000	constant	0.8125	0.8125
10	0.8125	10	0.8125		1.0000	constant	0.8125	0.8125
11	0.8065	11	0.8065		1.0000	constant	0.8065	0.8065

It is necessary, for good business decisions, to conduct an analysis of the efficiency assessment, using the output-oriented model with constant and variable returns to scale. Specifically, these models seek to achieve efficiency by maximizing output for given/current input state. The results of the efficiency assessment in this manner are presented in Figure 2.

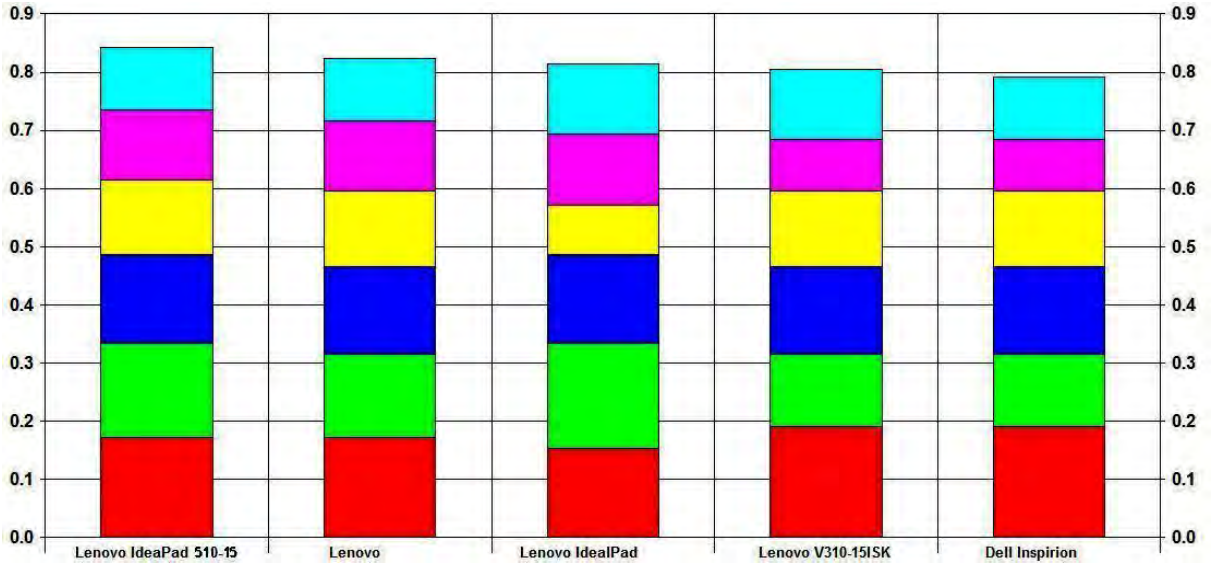
Figure 2. Results of efficiency assessment of laptop computer using the output-oriented model

OUTPUT ORIENTED MODELS								
CONSTANT RETURNS TO SCALE		VARIABLE RETURNS TO SCALE						
Efficiency scores		**Efficiency scores**			**Scale efficiencies**	**Returns-to-scale**	**CCR score**	**NIRS score**
1	1.0000	1	1.0000		1.0000	constant	1.0000	1.0000
2	1.0000	2	1.0000		1.0000	constant	1.0000	1.0000
3	0.8594	3	0.9032		0.9515	decreasing	0.8594	0.9032
4	1.0000	4	1.0000		1.0000	constant	1.0000	1.0000
5	0.9750	5	1.0000		0.9750	decreasing	0.9750	1.0000
6	0.8946	6	1.0000		0.8946	decreasing	0.8946	1.0000
7	0.9750	7	1.0000		0.9750	decreasing	0.9750	1.0000
8	1.0000	8	1.0000		1.0000	constant	1.0000	1.0000
9	0.8125	9	1.0000		0.8125	decreasing	0.8125	1.0000
10	0.8125	10	0.8889		0.9141	decreasing	0.8125	0.8889
11	0.8065	11	1.0000		0.8065	decreasing	0.8065	1.0000

Analysis of the results achieved by using output-oriented DEA model shows a similar situation as well as the application of the input-oriented DEA model. When it comes to output-oriented DEA model with a constant return to scale, the results are the same as in the previous case, as can be seen on the left side of Figure 2. The differences are only noted in the efficiency assessment by using the output-oriented DEA model that allows a variable return to scale, which can be seen on the right side of Figure 2. It can be noted that only two alternatives, laptop 3 and 10, are inefficient. This is explained by the fact that DMU, considering that this is the output-oriented model, is seeking to maximize the outputs and allows itself more freedom when it comes primarily to price. This analysis should be taken seriously and possibly will reject these results, especially when it comes to the procurement of a large number of laptop computers while having a limited budget.

Analysis of the efficiency assessment shows that the selection of the optimal laptop computer should be sought between models 1, 2, 4 and 8. The DEA method quickly detects the inefficient DMU. The remaining DMU were assessed as effective, but the DEA method should not be used for ranking the best alternative. For this purpose software Criterium Decision Plus was used with the version 3.04S, by Info Harvest Company.

Figure 3. Ranking of efficient DMU



Conducted ranking shows that the laptop computers made by Lenovo show better results, option 1, where the best alternative when choosing a laptop is Lenovo IdeaPad 510-15. The results can be explained by good CPU and RAM ration, as well as the affordable price. It is necessary to accentuate once again that this choice is gaining in importance only when purchasing larger quantities of computers, properly selecting it, if possible to achieve big savings.

4. Conclusion

The research has shown that DEA method can be a useful tool in business decision making. This method quickly and safely identifies inefficient alternatives, which is very important at the beginning of the analysis. By combining this method with some of the models for ranking, the analysis gets full meaning and gives representative results in the selection of optimal solutions.

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Originalni naučni rad UDK 005.41:330.322
005.22:005.591.1

Rad prihvaćen: 9. 12. 2016.

Izbor optimalne metode investicionog odlučivanja u funkciji upravljanja poslovnim procesom

Živko Ralić[1]

[1]Fakultet za inženjerski menadžment, Beograd,[1]

Apstrakt: Rad se bavi izborom optimalne metode investicionog odlučivanja u funkciji upravljanja poslovnim procesom. Nastao je kao rezultat analize neophodnih aktivnosti koje treba preduzeti u cilju povećanja energetske efikasnosti stambene zgrade. Mere preduzete na energetskoj sanaciji zgrade analizirane su sledećim metodama: neto sadašnja vrednost, interna stopa rentabilnosti i metoda povraćaja. Komparativna analiza urađena je na konkretnom projektu energetske sanacije četiri zgrade. Rezultati su pokazali da su primenjene metode kompatibilne, a razlikuju se u načinu prikazivanja rezultata. Metod neto sadašnje vrednosti iskazuje rezultat kao novčanu vrednost u sadašnjem trenutku, odnosno, pokazuje koliko novca će zaraditi ocenjivani projekat. Metod interne stope rentabilnosti pokazuje profitabilnost projekta izraženu procentima, a metod perioda povraćaja kao rezultat primene pokazuje vreme (broj godina) za koji će se uložena sredstva u projekat vratiti. Zbog specifičnosti problema predlaže se stavljanje modifikovane metode perioda povraćaja u prvi plan.

Ključne reči: poslovni proces, vremenska vrednost novca, interna stopa rentabilnosti, period povraćaja

Selection of Optimal Methods of Investment Decision-Making in Management of Business Processes

Abstract: This paper identifies the selection of optimal methods of investment decision-making in function of management with business processes. It was created as a result of the analysis of necessary actions to be taken in order to increase energy efficiency of residential buildings. Measures taken in the energy rehabilitation of buildings were analyzed by the following methods: net present value, internal rate of return and payback period method. A comparative analysis was performed on a real projects of energy rehabilitation for four buildings. The results showed that the applied methods are compatible and differ in the mode of displaying the results. The net present value expressed the result as a monetary value in the present moment, that shows how much money you will earn evaluated project. Methods of internal rate of return indicate the profitability of the project, expressed in percentages, a payback period method possesses time dimension, because it indicates how long it takes (number of years) to payback the investment outlays. Due to the specifics of the problem the placing payback period method is to the fore.

Keywords: business process, the time value of money, internal rate of return, payback period

1. Introduction

By coming of the Industrial Revolution on the world scene, human progress is linked with economic growth and material goods, so there come up drastic increases of production, consumption and wealth in general (Jacobus, 2006). The period stable growth in the world economy, which was performed after the Second World War, supported the belief in the unlimited possibilities of scientific and technical progress, but from the seventies of the 20th century, the oil crisis and other disorders, showed the depth of these misconceptions. The growing concern over the depletion of natural resources and increasingly present a discussion on possible limits to growth.

[1] zivko.ralic@fim.rs

Intensive growth of industrial production, growth of human population and its needs lead to a significant increase in energy consumption. The consequence of the increase in energy consumption is the intense emission of harmful substances into the atmosphere (Wilkinson S., 2006). The increased concentration of harmful substances, it is believed, causes the greenhouse effect, destruction of the ozone layer and other negative impacts on human health. The largest part of emissions (over 90%) comes from the combustion of fossil fuels (Ekologija sagorevanja).

The problem of preservation material resources is basically a problem of conservation of energy (Ralić, 2016). Matter can be used in a closed cycle, recycling many chemical compounds that were previously accounted as ballast (e.g. plastic.). Buildings are the largest single consumers of energy in Serbia, as they account for over 50% of final energy consumption. The efforts of the EU and other countries, are aimed at increasing energy efficiency in buildings in order to save energy. The common characteristic of much of the housing stock in Serbia is irrationally high consumption of all forms of energy so that the energy rehabilitation of buildings are imperative. The problem arises due to the fact that every step taken in this direction involves minor or major investment costs.

According to its basic characteristics of the investment decisions are strategic decisions, which means that they are difficult and associated with a significant risk regarding the final result. The situation is further complicated by the ownership structure of the housing stock. Similar to other countries in transition in Serbia are 98% of privately-owned flats (Republic Statistical Office Of Serbia, 2011). The adoption of any investment decision in buildings with multiple dwellings implies the consent of all owners. It must be very circumspect approach managing energy rehabilitation process taking into account the economic power of the population and the educational structure of decision-makers. The present selection criteria must be tangible and comprehensible to everyone.

Business processes are subject to permanent changes caused by various disorders of the Interior within the system up to influencing the external environment. They are structured by a number of activities initiated by a specific event (or more), and aimed at achieving a certain goal. Most of the problems in the company or in a company is a consequence of inadequate organization and management of processes. In order to achieve the desired objectives, the process should be managed in an effective and efficient manner. Decision-making in the energy rehabilitation is complicated due to the aforementioned reasons.

A number of methods are used to estimate engineering of investment projects. However, all methods are mutually compatible but what differentiates them is how they show the result (Milanovic D.Lj, 2012). So, for example, the net present value is expressed as a result of the monetary value at the present time, i.e. shows how much money you will earn during the evaluated project. The methods of internal rate of return show the earnings of the project, expressed in percentages, and the payback period methods as a result of the application has the dimension of time, because it shows the time (in years) for which the funds invested in the project give back.

This paper conserns with the engineering-economic analysis of the activities undertaken for the purpose of energy efficiency of residential buildings. We have analyzed four residential buildings which differ in their macro and micro location, shape, size, number of floors, shape factor, the structural characteristics, etc. Common to them is that they were built, as well as from 20.1% of the housing stock in Serbia in the period from 1961 to 1970 (Europe, 2006). The first regulations related to the thermal protection of buildings were adopted later.

2.0 Problem Formulation

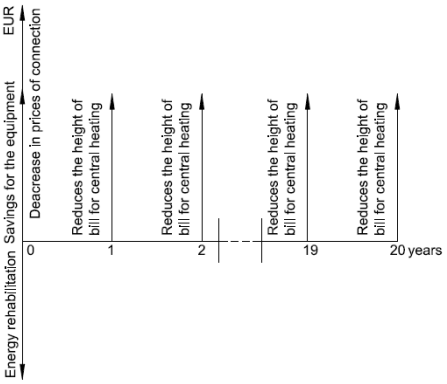
This paper on concrete examples that were the subject of the research is to determine whether there are significant differences in the results obtained using the above methods. Four buildings were analyzed where the comparison of the current situation with an alternative solution, included the appropriate technical procedures on energy rehabilitation in order to increase their energy efficiency. Buildings were insulated with thermal insulation thickness of 20 cm, and new windows were installed with multiple chamber PVC frame and low emission glass U = 1,1 W/(m^2K).

A comparative analysis was made on the basis of the following elements of cash flow:

1. The cost of energy rehabilitation of buildings
2. Savings in the amount of funds needed for equipment for heating buildings
3. Decrease in prices of connection to the public utility company „BEOGRADSKE ELEKTRANE“
4. Increasing the energy efficiency of buildings, thanks to energy rehabilitation, reduces the height of monthly bills for central heating.

The first three elements of the cash flow are present at the beginning of the lifetime of engineering investment project. The fourth element is present throughout the lifetime of the project. The discount rate, for investors, is the opportunity cost of committing the funds. For the purposes of this study used the rate of 12%. Lifecycle of the project is 20 years. Figure 1 graphically shows the cash flow in the observed period.

Figure 1. Graphical representation of cash flow



3.0 Net Present Value

The net present value is the most important dynamic method for estimation efficiency of investment projects. It is a classic discount method to perform the reduction of all income and expenses that arise during the lifetime of the project in the same time period (Newnan D, 1998). In this way, it becomes comparable with the amount of capital investment in the investment project, which is also expressed in the present value of money.

The function of the net present value depends on the influential parameters, and can be written as an equation that has the following form (Dubonjic R, 2005):

I – investment,

R_{pp} – annual income after tax**,**

C_{pp} – annual operating costs (and other expenses) after taxation

D_{ap} – amortization amounts after tax

L – liquidation value of investments

W – investment in working capital

WR – residual value of working capital

k – interest rate (discount rate),

n – number of years of the project.

$$S = -I - W + \left(R_{pp} - C_{pp} + D_{ap}\right) \cdot \frac{\left(1+k\right)^n - 1}{k\left(1+k\right)^n} + \left(L + WR\right) \cdot \frac{1}{\left(1+k\right)^n} \qquad (1)$$

where is: S – net present value of the project.

Table 1. Elements of cash flow at the beginning of the project

Building	**1**	**2**	**3**	**4**
The cost of energy rehabilitation	-109.107	-67.046	-35.902	-84.821
Savings for equipment	19.041	8.795	5.704	11.185
Savings for connection	41.329	18.656	11.113	24.430
In total	-48.736	-39.596	-19.085	-49.206

Source: (Ralic, 2012)

Table 2. The net present value for the buildings

Building	The lifespan of the project	Investment	Savings in exploitation	Amortization	Liquidation value	Discount rate	Net present value
	(n)	(I)	(R_{pp})	(D_{pp})	(L)	%	(S)
	years	EUR	EUR	EUR	EUR		EUR
1	20	-48.736	13.555	1.796	765	12	53.934
2	20	-39.596	7.953	912	563	12	20.548
3	20	-19.085	4.947	544	337	12	18.307
4	20	-49.206	11.506	1.119	642	12	37.642

Source: (Ralic, 2012)

All these methods have their advantages and disadvantages. In net present value method is necessary to determine the discount rate by which all values seen for the initial (zero) year, which is not always easy. Applying the criterion NPV all independent projects are acceptable whose net present value greater than zero. This method is an absolute indicator that clearly shows how much they will earn money from the contemplated project. In the case of four building can be seen that it is profitable to invest in the energy rehabilitation.

4.0 Method of Internal Rate of Return

The previous method has shown that investing in energy rehabilitation brings money. The method of internal rate of return gives the discount rate for which the net present value of the project is equal to zero (Chan, 2014). For the owner of the apartment is useful to know which is the minimum acceptable rate of interest to compared it with interest that would be obtained if the funds deposited at the bank.

The formula for calculating the internal rate of return has the following form (Dubonjic R, 2005):

I_0 – investments
NP_t – net cash flow of the project
k^* – internal rate of return (yield)
n – number of years of the project.

$$\sum_{t=1}^{n} \frac{NP_t}{\left(1+k^*\right)^t} = I_0 \qquad (2)$$

Internal rate of return is a condition, however, which cannot be directly calculated based on the formula. In calculating this investment criteria established by the systematic process of trial and error in order to find the discount rate which reduces the NPV cash flow to a value that is close to zero. Results of calculating the internal rate of return are shown in Table 3.

Table 3. Internal rate of return for the buildings

Building	The lifespan of the project	Investment	Savings in exploitation	Amortization	Liquidation value	Internal rate of return	Net present value
	n	I	R_{pp}	D_{pp}	L	%	S
	years	EUR	EUR	EUR	EUR		EUR
1	20	-48.736	13.555	1.796	765	27,98	4
2	20	-39.596	7.953	912	563	19,77	6
3	20	-19.085	4.947	544	337	25,95	0
4	20	-49.206	11.506	1.119	642	23,25	11

Source: (Ralic, 2012)

The value of internal rate of return for the buildings shows that investing in energy rehabilitation of building is a profitable investment because the calculated value is greater than the current interest rates on the capital market.

1.0 Payback Period Method with the Time Factor

The method of payback period was commonly used in investment decision-making by the late 1950s. This method indicates how long it takes (number of years) for the investment outlays to return. The advantage of this method is its simplicity. Checking the engineering investment projects focuses on the time in which there are expected returns on the initial investment. This method is also suitable for comparing several alternatives, at issue the more favorable project has a shorter period of return on investment than other.

Two major drawbacks of the payback method are:
1. The impossibility of measuring the profitability of the project. Simply getting time period of return on initial investment costs little to estimating cash inflow from the realization of this project.
2. The analysis of payback period does not respect the time value of money concept, i.e., it cannot identify the distinction between present and future value of money.

Between the moment of investment in engineering investment project and the moment of achieving income (effect) on the basis of the project there is always a time lag. In this regard, it is logical that money has a greater value at the time of issue of those values that has at the moment of payment (the concept of time value of money). Therefore, a modified payback period method of the return which includes a time factor are applied. Thus, the main disadvantage of the payback period method of return, disregard of the time value of money concept, is successfully eliminated.

Applying the payback period method with the time factor included, the number of years required for the return on investment outlays is obtained by cumulative calculations of net present value of money per year of project duration (from zero year and onwards), i.e., the number of years it takes for the return on investment outlays is obtained by summing up all years with a negative present value. The year of a present value transition from a negative into a positive value is the year of investment outlays payback. Payback period method of the return which includes a time factor is calculated using the following formula (Dubonjić R, 2005):

$$NSV_t(\mathrm{k}) = -\mathrm{I} + (\mathrm{R}_1 - C_1)\cdot(f_{SB})_k^1 + (\mathrm{R}_2 - C_2)\cdot(f_{SB})_k^2 + \ldots$$
$$\ldots + (\mathrm{R}_\mathrm{t} - C_t)\cdot(f_{SB})_k^t \geq 0 \qquad (3)$$

R – total income per annum,
C – total expenditure per annum,
I – total investment project outlays,
t – number of years required for the investment outlays to return
$(f_{SB})_k^t$ - present value factor for the year t.

The results of calculation of payback period, along with elements of the cash flow for each building are shown in Table 4.

Table 4. The results of calculation of payback period with the time factor for the buildings

Building	**1**	**2**	**3**	**4**
	EUR	EUR	EUR	EUR
The cost of energy rehabilitation	-109.107	-67.046	-35.902	-84.821
Savings for quipment	19.041	8.795	5.704	11.185
Savings for connection	41.329	18.656	11.113	24.430
In total Σ	-48.736	-39.596	-19.085	-49.206
Savings in exploitation	13.555	7.953	4.947	11.506
years	Net present value, NPV (12%)			
0	-48.736	-39.596	-19.085	-49.206
1	-36.633	-32.495	-14.668	-38.932
2	-25.827	-26.154	-10.724	-29.759
3	-16.178	-20.494	-7.203	-21.569
4	-7.564	-15.439	-4.059	-14.257
5	127	-10.927	-1.252	-7.728
6		-6.898	1.254	-1.899
7		-3.301		3.305
8		-89		
9		2.779		

The calculation results show how each building is specific. The period of return ranging from fifth to ninth year. The worst case is a building 2, in this case the payback period is shorter to by more than 50% of the life of the project (20 years).

6.0 Conclusion

The applied methods in this paper are compatible with each other and have shown that it is acceptable to invest in the energy rehabilitation of buildings to increase their energy efficiency and from an economic point of view. The results are differ in the way they are presented. Due to the specific ownership structure managing of the process of energy rehabilitation, and hence investment decisions must be based on indicators that are clear and understandable.

Method NPV is an absolute indicator that clearly shows how much they will earn money by investing in energy rehabilitation of each of the analyzed buildings, but it says nothing about the profitability of the proposed project. Method of internal rate of return eliminates this lack, and on the basis of its application leads to information that is more cost-effective to invest in the energy rehabilitation rather than deposit them in one of the commercial banks.

Applying the payback period method with the time factor gives more accurate results than classical methods, which ignored the time value of money. Size of error that occurs due to neglect of the time value of money depends on several factors, but primarily on the size of the discount rate and the difference between the money invested and earnings achieved by the project during its service life. The application of this method is precise information about the time when they will be returned invested funds. In most cases it can be a turning factor to invest in the energy rehabilitation.

Investment decisions are associated with the risk in terms of the final outcome, so they must be approached cautiously and judiciously. The ownership structure of the housing stock, underdevelopment of the market, lack of confidence in financial institutions further complicates decision-making. Similar to other countries in transition in Serbia is trying to find a model of rational management of housing stock. Making any investment decision in buildings with multiple dwellings should be approached cautiously, taking into account the economic

power of the population and the educational structure of decision-makers. The present selection criteria must be understandable to everyone, so it is recommended highlighting the results of payback period method with time factor to the fore. Other methods are compatible and should be used as a support for a comprehensive explanation of the economic justification of the proposed investment.

Increasing the energy efficiency of buildings, thermal insulation of buildings, the savings of all types of energy, renewable energy and environmental protection, have now become a basis for sustainable development. Sustainable development imposed itself as an essential prerequisite and as the ultimate goal of efficient organization of numerous human activities on Earth. Considered projects must be preferred with favorable prices, subsidies, education society and other measures that will allow their wide application.

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Originalni naučni rad UDK 004.655.3
Rad prihvaćen: 20. 1. 2017.

Preporuke za optimizaciju baza podataka

doc. dr Brankica Pažun [1]

[1] Fakultet za inženjerski menadžment, Univerzitet Union – Nikola Tesla,[2]

Apstrakt: Problem istraživanja rada jesu slabe performanse baze podataka i aplikacija, a koje nastaju usled neadekvatno napisanih SQL naredaba. U radu su predstavljene tehnike optimizacije sistema za upravljanje bazom podataka koje omogućavaju izvesna poboljšanja u odnosu na neoptimizovanu formu. U izabranom alatu se kao kriterijum poboljšanja koriste troškovi i vreme izvršavanja upita. Rezultati istraživanja su dati u vidu odgovarajućih preporuka optimizacije, čijom primenom se smanjuju troškovi i vreme izvršavanja upita, a što za posledicu ima slabije opterećenje diska, memorije i procesora, samim tim i efikasniji rad aplikativnog sistema.

Ključne reči: optimizacija, sistem za upravljanje bazom podataka, SQL

Some Recommendations in DBMS Optimization Process

Abstract: The problem of research is poor database and applications performance, which are caused by inadequate written SQL commands. This paper consists of DBMS optimization techniques that enable certain improvements compared to non-optimized version. The criterion used in research is cost and time of query execution. Research results are presented in the form of appropriate optimization recommendations, which implementation can reduce cost and time of query execution, therefore resulting in lower disk usage, as well as memory and processor usage, and thus the more efficient operation of an application system.

Key words: database management system, optimization, SQL

1. Uvod

Danas informacija predstavlja najznačajniji resurs kojim se raspolaže. Obim podataka se povećava svake godine, kao i količina podataka koja se skladišti po osobi. Pritom je neophodno obezbediti mehanizme kojima se na optimalan način ekstrahuju podaci od značaja. Primenom odgovarajućih tehnika optimizacije može se uticati na poboljšanje performansi naredaba koje se duže izvršavaju i nepotrebno zauzimaju resurse sistema, odnosno baze podataka. Operacije optimizatora podrazumevaju transformaciju SQL naredbe, procenu ukupnih troškova (pristupnih putanja i operacija spajanja), a koji zavise od procenjene potrošnje ulazno-izlaznih, procesorskih i memorijskih resursa, kao i generisanje plana izvršenja naredbe (Oracle, n.d.). Cilj rada je da se dođe do praktičnih preporuka u vezi sa optimizacijom, čiji efekti mogu na različite načine uticati na rad kompletnog sistema za upravljanje bazom podataka. Adekvatnim korišćenjem preporuka pri definisanju određenih naredaba optimizator kreira efikasniji plan izvršenja.

2. Tehnike optimizacije

Usled problema sa prostorom ili nedostatkom memorije bitan je segment upravljanja memorijom i mehanizam kompresije podataka, koji značajno mogu da optimizuju upotrebu hardvera. Ukoliko se neadekvatno rasporedi memorija, može doći do problema sa performansama, te u tom slučaju i tehnike optimizacije mogu naići na ograničenja pri pokušaju poboljšanja efikasnosti izvršenja naredaba. Sam potencijal hardvera može da iskoristi paralelizam koji se upotrebljava s ciljem ubrzanja izvršavanja naredaba podelom rada između više procesa.

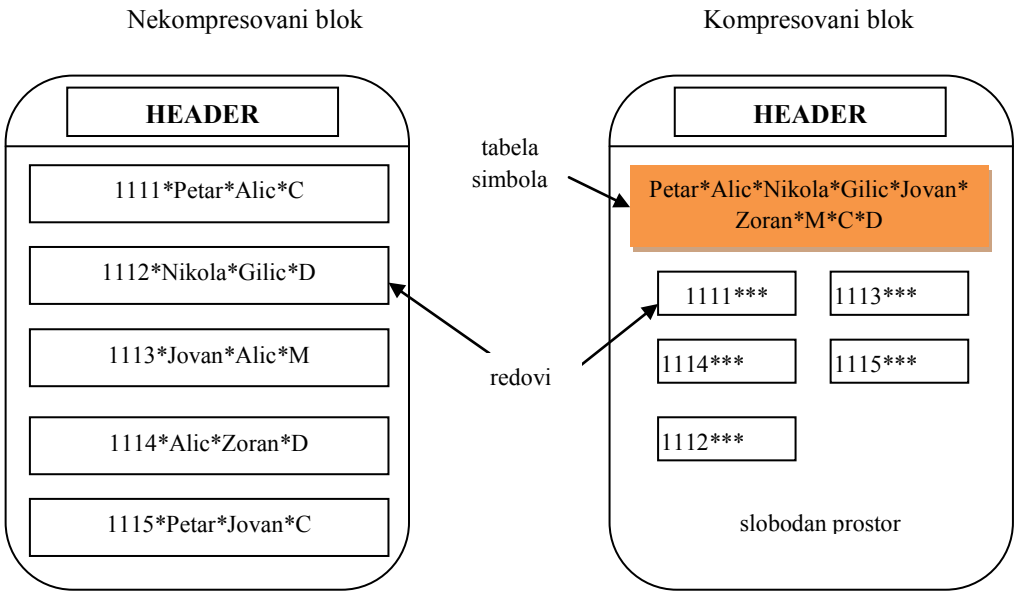
Kada se tabela sastoji iz velikog broja redova, neefikasna je i skupa operacija potpunog skeniranja radi nalaženja onih zapisa koji zadovoljavaju dati uslov. Tom prilikom se upotrebljava tehnika indeksiranja, koja, sa druge

[2] brankica.pazun@fim.rs

strane, može predstavljati najčešći uzrok loših performansi ukoliko nije efikasno iskorišćena prilikom definisanja upita. Da li je isplativije koristiti opciju "full table scan" ili indeks, zavisi od broja zapisa koji se vraćaju, kao i od samog hardvera i opterećenja servera. U opštem slučaju je isplativo koristiti bitmap indeks u slučaju da naredba vraća između 1% i 10% redova tabele. U tom slučaju se za svaku kolonu nad kojom je kreiran indeks, koristi bitmapa, odnosno niz bitova. Svaki bit u bitmapi odgovara jednoj vrednosti primarnog ključa. Funkcija konvertuje poziciju bita u odgovarajući identifikator zapisa, tako da bitmap indeksi omogućavaju istu funkcionalnost kao i b-stablo, samo što koriste drugačiji interni mehanizam. Bitmapa se sastoji od onoliko polja koliko ima različitih vrednosti u okviru indeksa. Najveće prednosti pri korišćenju indeksa se postižu kada nad jednom relacijom postoji više kreiranih bitmap indeksa, a istovremeno svi atributi imaju malu kardinalnost. Kreiranje više indeksa se primenjuje kod izvršavanja složenih naredbi. Ukoliko se u WHERE uslovu navedu sve kolone nad kojima je kreiran ovaj indeks, spajaju se pojedinačne bitmape i dobija se jedna koja predstavlja presek svih (Microsoft, n.d.).

Kompresija predstavlja tehniku upravljanja tabelama. Sam mehanizam koristi jedinstven algoritam čiji rad se zasniva na eliminaciji dvostrukih podataka iz blokova podataka. Nakon kompresije bloka, baza prvo računa broj ponavljanja vrednosti podataka u redovima. Kada prepozna podatke koji se ponavljaju, eliminiše ih iz zapisa i smesti blizu zaglavlja bloka. Za svaku ponavljajuću vrednost, u zaglavlju se zajedno sa podatkom upisuje i simbol kojim će biti predstavljen isti. Na slici 1. se može primetiti da su podaci iz zapisa izdvojeni i smešteni u poseban deo ispod sekcije "Header". Nakon što je blok kompresovan, dvostruke vrednosti se eleminišu dodavanjem jedne kopije u tabelu simbola. Svaki duplikat se potom menja odgovarajućim znakom iz tabele simbola. Kompresovani podaci se smeštaju u blokove podataka kao metapodaci, koji se ujedno koriste za prevođenje kompresovanih podataka u originalne podatke, a koji su se prvobitno nalazili u blokovima podataka. Pošto simboli zauzimaju manji prostor u odnosu na trenutne vrednosti simbola, sami zapisi zauzimaće manje memorije u poređenju sa prvobitnim redovima. Na slici 1. su prikazani nekompresovani i kompresovani blokovi kod Oracle baza, zajedno sa podacima u poljima.

Slika 1: Kompresija - Oracle SUBP



Izvor: prilagođeno prema Oracle (n.d.)

Prednosti tehnike kompresije kod Oracle sistema se ogledaju u sledećem:

- dovode do trostruko veće uštede prostora na disku;
- korišćenjem SSD diskova brzina pristupa može biti 300 puta veća u odnosu na pristup običnim diskovima;
- brze "full scan/ range scan" operacije - ukoliko optimizator odluči da koristi ove pristupne putanje pri kreiranju izvršnog plana, samo vreme izvršavanja je značajno kraće;
- smanjen mrežni saobraćaj - pošto su blokovi podataka kompresovani, eksterni paketi van mreže biće manji.

Star transformacija i particionisanje koje se u većini slučajeva poslednje primenjuje, predstavljaju česte tehnike u data warehouse sistemima, kao i upotreba bind varijabli koje kroz eliminisanje vremena potrebnog za parsiranje naredaba, poboljšavaju performanse. U Oracle sistemima postupak star transformacije, odnosno transformacije SQL naredbe, odvija se u dve faze: prvo se vraćaju redovi iz fact tabele korišćenjem bitmap indeksa kreiranih nad spoljnim ključevima iste, a potom se skup identifikatora zapisa spaja sa dimenzionom tabelom (Rittman, 2008). Sa druge strane, upotreba mehanizma hint omogućava uticaj na odluku optimizatora prilikom generisanja plana izvršenja tako što usmerava optimizator da izabere plan izvršenja sa određenim pristupnim putanjama, tj. operacijama.

3. Primena tehnika optimizacije

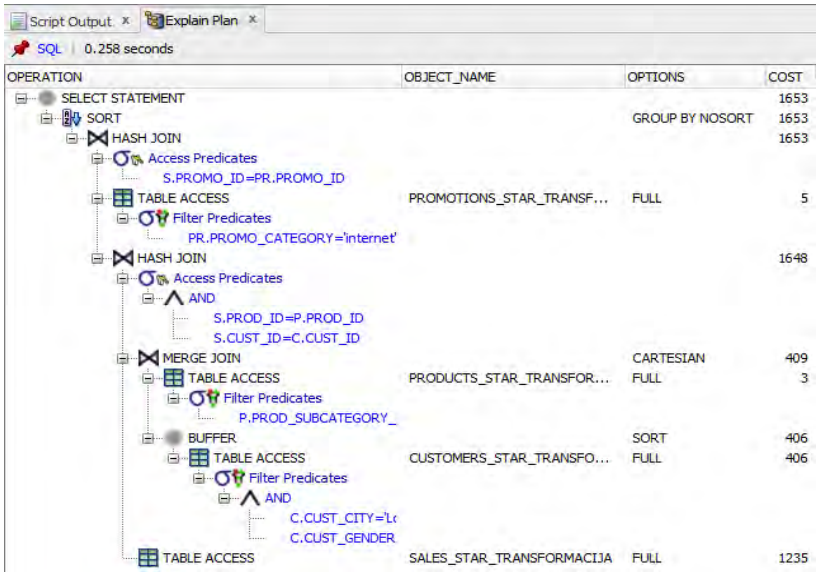
Upotrebom Oracle SQL developer alata primeniće se star transformacija koja se koristi nad naredbama koje se izvršavaju nad star šemom. Star šema se sastoji iz fact tabele i dve ili više dimenzionih tabela. Kreiraće se tabela sales_star_transformacija koja predstavlja fact tabelu i 3 dimenzione tabele, a što je uslov za postojanje star šeme. Fact tabela je preko spoljnih ključeva spojena sa dimenzionim tabelama.

```
create table sales_star_transformacija  as select * from sh.sales;
create table products_star_transformacija  as select * from sh.products;
create table customers_star_transformacija  as select * from sh.customers;
create table promotions_star_transformacija  as select * from sh.promotions;
alter table customers_star_transformacija add constraint customer_pk primary key (cust_id);
alter table products_star_transformacija add constraint prod_star_pk primary key (prod_id);
alter table promotions_star_transformacija add constraint promo_star_pk primary key (promo_id);
alter table sales_star_transformacija add constraint sales_prod_star_fk foreign key (prod_id)
      references products_star_transformacija;
alter table sales_star_transformacija add constraint sales_cust_star_fk foreign key (cust_id) references
      customers_star_transformacija;
alter table sales_star_transformacija add constraint sales_promo_star_fk foreign key (promo_id)
            references promotions_star_transformacija;
```

Pri izvršenju date naredbe trošak izvršavanja je 1653 (slika 2), usled čitanja kompletne tabele, tj. operacija FULL TABLE SCAN zbog nedostatka indeksa.

```
select sum (quantity_sold), pr.promo_category, c.cust_gender, c.cust_city,
p.prod_subcategory_desc
from sales_star_transformacija s, customers_star_transformacija c,
promotions_star_transformacija pr, products_star_transformacija p
where s.prod_id = p.prod_id
and s.cust_id = c.cust_id
and s.promo_id=pr.promo_id
and p.prod_subcategory_desc = 'Cameras'
and c.cust_city='Los Angeles'
and c.cust_gender='F'
and pr.promo_category='internet'
group by pr.promo_category, c.cust_gender, c.cust_city, p.prod_subcategory_desc;
```

Slika 2: Trošak izvršavanja naredbe 1653

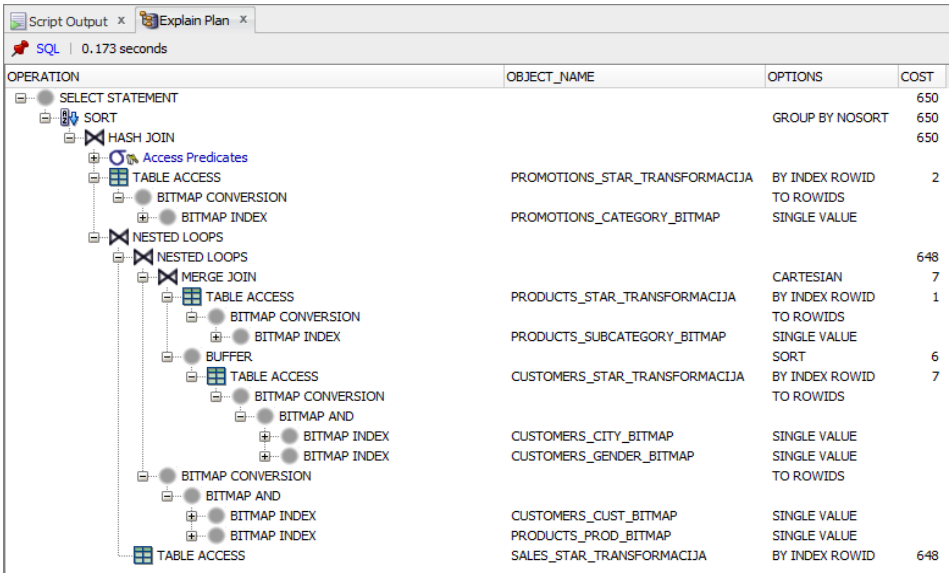


Izvor: autor

Posle kreiranja bitmap indeksa nad spoljnim ključevima fact tabele (sales_star_transformacija), trošak naredbe se smanjuje na 650 (slika 3). Zahvaljujući indeksima pri izvršenju naredbe vraćena je lista redova koji zadovoljavaju uslov (u vidu bitmape). Zatim je izvršen join fact tabele sa dimenzionim kako bi se vratile sve potrebne vrednosti iz dimenzionih tabela.

```
create bitmap index customers_cust_bitmap on sales_star_transformacija (cust_id);
create bitmap index promotions_promo_bitmap on sales_star_transformacija (promo_id);
create bitmap index products_prod_bitmap on sales_star_transformacija (prod_id);
create bitmap index customers_gender_bitmap on customers_star_transformacija (cust_gender);
create bitmap index customers_city_bitmap on customers_star_transformacija (cust_city);
create bitmap index products_subcategory_bitmap on products_star_transformacija
(prod_subcategory_desc);
create bitmap index promotions_category_bitmap on promotions_star_transformacija (promo_category);
```

Slika 3: Trošak izvršavanja naredbe 650

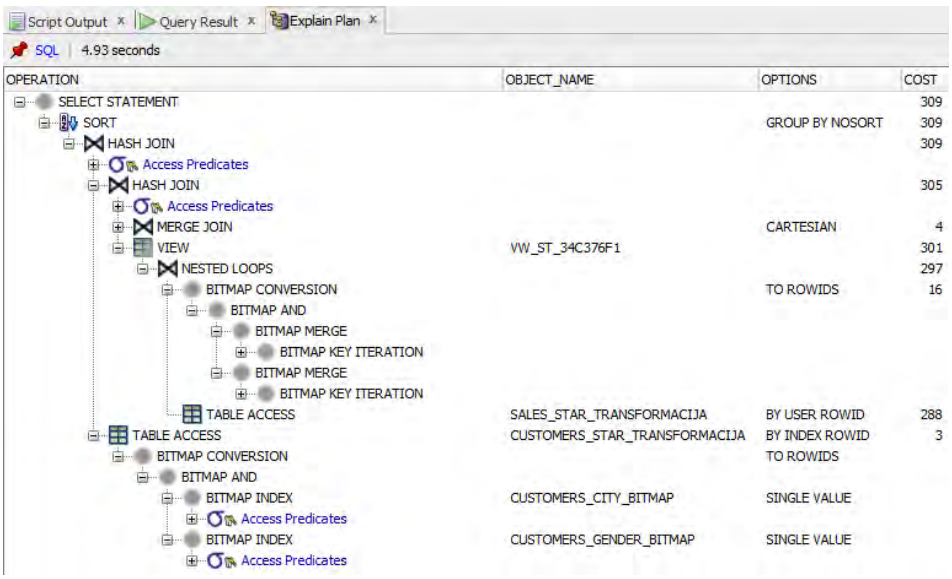


Izvor: autor

Posle omogućavanja star transformacije trošak se smanjuje na 309 (slika 4):

alter session set star_transformation_enabled='true';

Slika 4: Trošak izvršavanja naredbe 650

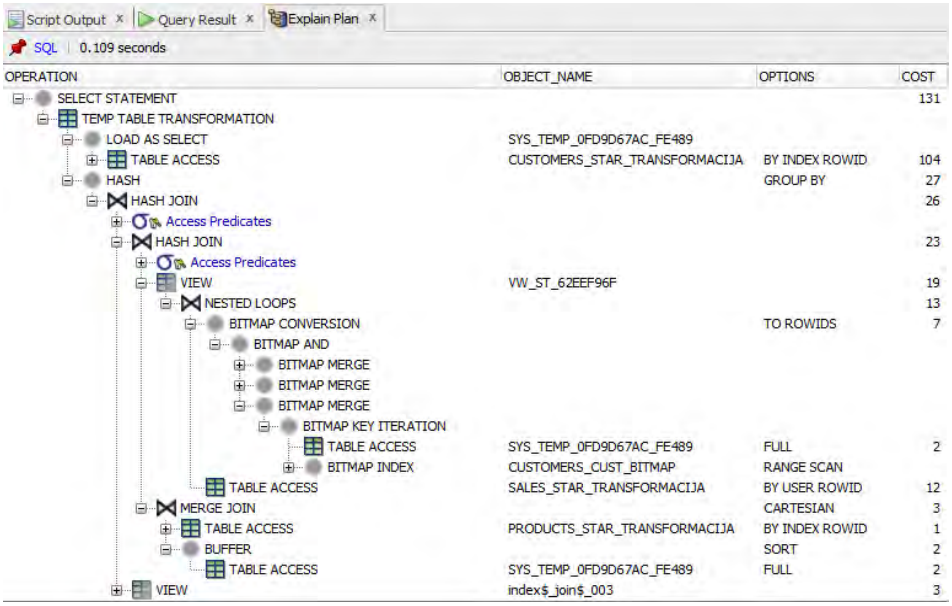


Izvor: autor

Još jednom dodatnom smanjenju na 131 doprinelo je sakupljanje statistike o datim kolonama, koje je pomoglo optimizatoru da generiše bolji plan izvršenja. Što su ažurnije statistike, vrednost je tačnija, odnosno, odluke optimizatora su bolje.

```
analyze table sales_star_transformacija compute statistics for table for all indexes for all indexed
        columns;
analyze table customers_star_transformacija compute statistics for table for all indexes for all
        indexed columns;
analyze table products_star_transformacija  compute statistics for table for all indexes for all
        indexed columns;
analyze table promotions_star_transformacija compute statistics for table for all indexes for all
        indexed columns;
```

Slika 5: Trošak izvršavanja naredbe 131



OPERATION	OBJECT_NAME	OPTIONS	COST
SELECT STATEMENT			131
TEMP TABLE TRANSFORMATION			
LOAD AS SELECT	SYS_TEMP_0FD9D67AC_FE489		
TABLE ACCESS	CUSTOMERS_STAR_TRANSFORMACIJA	BY INDEX ROWID	104
HASH		GROUP BY	27
HASH JOIN			26
Access Predicates			
HASH JOIN			23
Access Predicates			
VIEW	VW_ST_62EEF96F		19
NESTED LOOPS			13
BITMAP CONVERSION		TO ROWIDS	7
BITMAP AND			
BITMAP MERGE			
BITMAP MERGE			
BITMAP MERGE			
BITMAP KEY ITERATION			
TABLE ACCESS	SYS_TEMP_0FD9D67AC_FE489	FULL	2
BITMAP INDEX	CUSTOMERS_CUST_BITMAP	RANGE SCAN	
TABLE ACCESS	SALES_STAR_TRANSFORMACIJA	BY USER ROWID	12
MERGE JOIN		CARTESIAN	3
TABLE ACCESS	PRODUCTS_STAR_TRANSFORMACIJA	BY INDEX ROWID	1
BUFFER		SORT	2
TABLE ACCESS	SYS_TEMP_0FD9D67AC_FE489	FULL	2
VIEW	index$_join$_003		3

Izvor: autor

4. Preporuke za optimizaciju baze

Različite naredbe kreiraju drugačije planove izvršenja, a samim tim se razlikuju vreme i trošak izvršavanja, bez obzira na istovetan ishod. Potrebno je znati u kome trenutku i na koji način je neophodno optimizovati naredbu da bi se dobio dovoljno dobar, odnosno optimalan plan izvršenja. Sama primena tehnika optimizacija ne bi imala smisla bez adekvatnog upravljanja memorijom. Memorijske resurse bi itrebalo prebaciti na one komponente kojima je to neophodno.

U opštem slučaju najčešći uzrok loših performansi je neupotreba ili preterana upotreba indeksa. U slučaju obavljanja česte pretrage po određenim kolonama, poželjno je nad njima kreirati indekse. Ukoliko se u bazi definiše suviše mali broj indeksa, pronalaženje podataka će trajati duže nego što bi trebalo. Sa druge strane, ukoliko se definiše suviše veliki broj indeksa, naredbe nad podacima, kao što su unos i ažuriranje će trajati duže nego što bi trebalo.

Ukoliko postoji potreba za izvršavanjem mnogo komandi iste stukture, sa rezultirajućom promenom vrednosti samo jednog atributa (primera radi: Proizvod_id=5, Proizvod_id=7), najbolje je koristiti bind varijable. Drugi slučaj njihove primene jeste u radu sa rekurzivnim funkcijama koje u svojoj WHILE petlji uzimaju različite vrednosti iz tabele i pritom višestruko izvršavaju upit iste strukture. U ovakvim slučajevima je korišćenje bind varijabli više nego potrebno, jer se sa velikom verovatnoćom može desiti da vreme parsiranja svih sličnih upita bude duže od vremena izvršavanja upita (posebno ukoliko postoje paralelni zahtevi). U aplikacijama namenjenim masovnom skladištenju podataka (data warehouse) češće se upotrebljava keširanje naredbe kao i same tabele, umesto bind mehanizma.

Mehanizam paralelizma se predlaže u slučaju izvršavanja složenih naredaba, pri čemu je vreme izvršavanja duže (npr. duže od 10 sekundi). U suprotnom, trošak korišćenja paralelizma može biti dosta veći, a i sama primena tehnike uključuje kvalitetnije memorijske resurse i CPU.

Kompresija se preporučuje u slučaju nedostatka prostora za skladištenje podataka, čime se može ostvariti racio kompresije i do 3.5:1. Pristupa se većoj količini podataka na istom prostoru, više podataka može da se "pročita", samim tim se i izvršavanje naredaba ubrzava. Razlog tome se ogleda u manjem broju blokova/ strana koje je potrebno "pročitati". Pošto manji broj strana/blokova ostaje u keš memoriji, više prostora ostaje za druge blokove, što opet doprinosi poboljšanju performansi.

Kad je reč o tabelama sa ogromnim količinama podataka, od čega je većina podataka istorijska, predlaže se upotreba particionisanja. Istorijske podatke, odnosno, podatke koji se retko upotrebljavaju, treba skladištiti na veće particije i smestiti na sporije diskove. Noviji podaci se pohranjuju na brže diskove, manje particije, kako bi, zbog čestog pristupa tim podacima, samo izvršavanje naredbi bilo mnogo kraće.

Star transformacija je tehnika koja se preporučuje posebno u radu sa data warehouse sistemima, gde postoji potreba za izvršavanjem naredaba nad star šemom. Upotrebljava se kada se veliki broj dimenzionih tabela spaja sa fact tabelom, omogućavajući kraće vreme izvršavanja naredbi.

Na kraju, u slučaju neuspelog pokušaja primene neke od tehnika optimizacije, u smislu neadekvatnog načina upotrebe ili se smatra da dobijeni plan izvršenja nije optimalan, upotrebljava se mehanizam hint koji će uticati na generisanje drugačijeg izvršnog plana, jer utiče na optimizator da koristi drugu pristupnu putanju.

4. Zaključak

Krajnji korisnici danas posežu za trenutnim odgovorima. Iz razloga bržeg pristupa podacima, neophodno je razumeti upravljanje performansama. Od svih problema u vezi sa performansama sistema za upravljanje bazama podataka, 75% do 80% se mogu odnositi na neadekvatno i nekvalitetno napisane SQL naredbe. Komande koje se izvršavaju treba napisati na odgovarajući u cilju osiguranja optimalne performanse baze podataka i aplikacije. Svi sistemi za upravljanje bazama podataka sadrže optimizator koji pri izvršavanju upita generiše plan izvršenja sa ciljem obezbeđenja što boljih performansi. Međutim, optimizator često ne generiše ni približno dobar plan, zbog čega se naredbe duže izvršavaju, što je i predmet istraživanja ovog rada.

Opisani su neki od mehanizama optimizacije u Oracle sistemima. Zahvaljujući tehnikama došlo se do praktičnih preporuka čijom primenom optimizator kreira efikasnije planove izvršenja, a time i poboljšava performanse naredaba. Samo poboljšanje se ogleda u kraćem vremenu izvršenja naredbi, manjem opterećenju procesora, odnosno, kvalitetnijem upravljanju memorijskim resursima.

Kako pri izvršavanju naredaba ne bi dolazilo do ograničenja usled neoptimizovanog hardvera, predstavljeni su upravljanje memorijom i kompresija podataka. Opisani su indeksi koji se koriste s ciljem kraćeg vremena pristupa tabelama pri čestom pretraživanju podataka. Predstavljene su bind varijable, čijom upotrebom se poboljšavaju performanse korišćenjem istih planova izvršenja. Usled potrebe za jednostavnijim upravljanjem velikom količinom podataka, predstavljene su tehnike star transformacija i particionisanje tabela, koje se najviše koriste u data warehouse sistemima. U isto vreme je navedena i mogućnost upotrebe hinta koji može da usmeri optimizator na korišćenje određene tehnike.

U radu je predstavljen primer sa izvršnim planom i troškom izvršenja naredbe na početku, a zatim i stanje posle određenih izmena, tj. implementacije tehnika optimizacije. Prikazana je primena bitmap indeksa, sakupljanje statistike i upotreba star transformacije. Nakon svakog koraka predstavljen je plan izvršenja i praćen je trošak izvršenja naredbe, sa trendom opadanja.

Većina baza podataka podržava neke optimizacione tehnike radi bržeg pristupa podacima. Ideja o optimizaciji u svim sistemima za upravljanje bazama podataka je identična, sa razlikom u načinu implementacije.

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Kratko ili prethodno saopštenje UDK 338.124.4
Rad prihvaćen: 17. 1. 2017.

Криза у економској теорији и пракси

Радомир Стојковић[11]

[1] Факултет за инжењерски менаџмент, Београд,[2]

Апстракт: Аутор се у раду бави проблематиком економске кризе. Претходни, 20. век је обиловао кризним ситуацијама. Пракса се наставила и почетком 21. века и због тога философија кризе мора добити централно место у економској теорији. Раст и развој привредних организација и друштва није могуће планирати без анализе фактора који могу довести у питање спровођење истих. У раду се најпре појмовно одређује термин кризе. Након тога, аутор указује на симптоме као покретаче кризног стања, пре свега у предузећу. Због различитости привредих и друштвених система постоји читав низ фактора који доводе до избијања кризних ситуација. На основу тога урађена је и класификација економских криза која подразумева кризу предузећа, привредне гране и привреде у целини. Свако кризна ситуација не значи и појаву кризу. Криза, у економском контексту, највиши вид кризног стања коме углавном претходе стања стагнације, рецесије и депресије.

Кључне речи: криза, економска криза, привредне флукстуације и циксус

Crisis in Economic Theory and Practice

Abstract: In this paper, the author deals with the problems of economic crisis. In the previous, the 20th century it was all about crisis situations. The practice has continued in the early the 21st century and therefore the philosophy of the crisis have to get a central place in economic theory. The growth and development of economic organizations and society cannot be planned without an analysis of the factors that can endanger their implementation. The paper first defines the term conceptual crisis. Next, the author points to symptoms such as drivers of crisis situation, especially in the enterprise. Due to the diversity of the economy and social system there are a number of factors that lead to the outbreak of crisis situations. Based on this classification that has been done and economic crisis that involves a crisis of enterprises, industries and the economy as a whole. Every crisis situation does not mean the emergence of a crisis. The crisis in the economic context, the highest form of crisis situation that is primarily preceded situation of stagnation, recession and depression.

Keywords: *crisis, economic crisis, economic fluctuactions and cycle*

Увод – појмовно одређење кризе

Сам термин „криза“ данас је веома распострањен и користи се како у стручном контексту, тако и у свакодневном говору. Овај појам користи се да би се описало лично стање (појединца, организације и/или друштва у целини) које најчешће има негативну конотацију у садашњем, али и за будући период. Термин и појам „криза“ није јединствено одређен и дефинисан. То значи да постоји читав сет различитих интерпретација, објашњења и приступа дефинисању овог појма и философије.

Термин „криза“ потиче из старогрчког језика, где се овим појмом објашњавао тренутак који има пресудан значај за развој одређене ствари односно ситуације. Сматра се да је термин најпре употребљен у медицини да опише стање болесника, конкретније стање пацијента између оздрављења и смрти. После медицине и друге научне области почеле су да користе овај термин који у основи има исто значење. Политичка и теорија система биле су прве науке које су након медицине присвојиле овај термин и увеле

[2] radomir.stojkovic@fim.rs

га у свој вокабулар. Развој друштва и цивилизације генерално, утицао је на то да и друге науке прихвате овај термин и укључе га у своју теоријску и практичну дискусију.

Када је реч о етимолошком пореклу, не треба занерити ни кинеску етимологију. Транскрипт оригиналног термина са традиционалног кинеског је *weiđi*. Ова кинеска реч је сложеница од речи *wei* што се може превести као опасност и *đi* која се најједноставније може превести као тачка заокрета или преломни тренутак. Поменута сложеница се у том случају може превести као могућност да се догоди опасност односно нежељени моменат. Поред овог тумачења у кинеској традицији је да се ова реч преводи и на други начин. Наиме, други део речи може се превести и као прилика. Како је свака прилика моменат за напредовање, побољшање и позитиван тренд, у том смислу криза се на основу кинеске етимологије може дефинисати и као кључни момента за напредовање. Ово тумачење није званично, али и поред тога бројни стручњаци сматрају да је криза време када се највише размишља о напретку. Када је реч о оваквом тумачењу треба нагласити да га савремени теоретичари све чешће користе. Наиме, током трајања последње глобалне економске кризе (2007-2009) Јозеф Стиглиц је веома често понављао став да државе у транзицији, кризу могу искористити за унапређење макроекономских и пословних перформанси, јер су исте већ суочене са потенцијалном кризом мењања својих система.

Економска теорија под појмом „криза“ претежно описује стање које способност опстанка предузећа ставља и доводи у питање, другим речима стање које угрожава егзистенцију предузећа. Криза која захвата производна предузећа у пракси се често назива и предузетничка криза. Она је често и узрок комплетне економске кризе.

1. Симптоми економске и кризе предузећа

Да би привредне организације избегле кризу и на време спровеле мере за превизлажење исте морају препознати симптоме и суочити се са њима, а не са узроцима. Симптоми кризе представљају видљива дејства узрока кризе. Симптоме је веома тешко одвојити од узрока кризе, јер и сами могу изазвати кризно стање.

У основи кризе је да се креће експоненцијално. Дубина кризе зависи од броја симптома. Што је већи број симптома то је и криза дубља, самим тим и повратак у нормално стање функционисања је дуже. Зато су симптоми од круцијалне важности за пословање привредних организација.

Генерално, симптоми кризе у предузећу се могу поделити на финансијске и остале симптоме. Када је реч о финансијским симптомима најчешћи су: опадајућа продаја, опадајућа рентабилност, затим константно повећање задужености предузећа и опадање ликвидности. Остали симптоми могу бити људског (менаџерског) и техничко-технолошког карактера. Грешке и нестручност набавне службе може утицати на губитак поверења код добављача што у крајњем случају може проузроковати пад тржишног учешћа. С друге стране, техничко-технолошка застарелост производног процеса утиче на квалитет и цену крајњег производа и доводи до опадања конкурентности на одређеном тржишту.

Идентификација симптома кризе постиже се кроз директан контакт са: (Topfer, 1999.) **радницима** (они су носиоци производње и могу идентификовати аномалије техничког и људског карактера), затим са **руководством погона** (јер су менаџери средњег нивоа у директном контакту и са производњом и са топ менаџментом), са **потрошачима** (купци су ти који дају крајњи суд о квалитету, цени и перспективи производа), **дистрибутерима** (јер су они у контакту и са конкуренцијом па се могу открити подаци о нарученим количинама, рекламацијама), **ревизорима** (посебно екстерним, јер су независни од пословања предузећа у коме обављају проверу пословања) и **кредитним институцијама** (зато што оне прате пословање предузећа на макро плану).

Симптоми који изазивају кризе у пословању предузећа могу имати и екстерни карактер. Наиме, макро одлуке носиоца економске власти могу додатно финансијски да оптерете пословање предузећа. Промена политичко-економске констелације може негативно утицати на однос са иностраним партнерима и редукцију пословања у смислу смањења. Глобални фактори такође могу изазвати кризу пословања. Као глобални фактори који могу утицати на појаву кризе јављају се ванредне ситуације (ратови, револуције, тероризам), економске санкције, интервенционистичке мере појединих држава, поремећаји на глобалном финансијском тржишту и сл.

2. Узроци економске кризе

Узроци кризе су по правилу пресудни фактори који директно утичу на ескалацију кризе. Теорија и пракса су класификовале велики број узрока који могу имати пресудан утицај на избијање кризних ситуација, а самим тим и велики број критеријума за њихово класификовање. Тако су, реална пракса и теорија, по основу порекла промена све узроке клафисиковале на:

- ендогене и
- егзогене природе.

Свака промена која негативно утиче на пословање предузећа односно организације, а директно се тиче самог предузећа јесте ендогена промена. Ендогени узроци су уствари унутрашњи узроци (промене) који могу произвести кризну ситуацију. С друге стране, егзогени узроци су промене које се дешавају у спољном окружењу.

Ендогене узроке је лакше контролисати и кориговати. Узроци из спољног окружења чине трећину разлога за банкротство у предузећима која послују у тржишно орјентисаним економијама. Када су у питању привреде као што је српска онда је однос спољашних и унутрашњих узрока кризе 50:50. Српска, декларативно тржишна економија није у потпуности прихватила све принципе овог начина функционисања привреде и због тога егзогени узроци имају исти значај и потенцијал као и унутрашњи.

Свака промена која се деси у окружењу може бити потенцијални узрок за појаву кризе у предузећу односно привреди. Неке од најзначајнијих и најзаступљенијих промена које се негативно одражавају на функционисање предузећа (економије одређене државе) су:

- оскудица;
- високе цене на тржишту набавке;
- промене у појединим областима политике као што је социјална политика, политика заштите животне средине, али и пореске и политике конкуренције;
- природне катастрофе (земљотреси, поплаве, пожари) и друштвене (као што су штрајкови, ратови).

Улазак нових играча на тржиште, такође представља потенцијално кризну ситуацију. Ово је потенцијално кризна ситуација када на одређено тржиште улазе велике глобалне корпорације. Поред овога, удруживање предузећа односно конкуренције, такође може имати негативне утицаје и то не само по друге актере тржишта, већ и привреду у целини. Када се овим ситуацијама додају и промене из техничко-технолошке сфере на које се тржишни актери не прилагоде правовремено онда се стварају услови за потенцијалну кризу привреде.

Узроци економских криза, између осталог произилазе и из одређених противуречности облика својине, а као најчешћи наводе се:

- управљање новцем;
- друштвене противуречности;
- доминација политике;
- привредни парадокси;
- систем управљања;
- отуђивање дохотка;
- прерасподела дохотка и др. (Стојиљковић, 1999.)

Доминација политике је све чешћи узрок избијања економских криза коме се мора посвећивати велика пажња. Политика и економија су у узрочно-последичној вези. Свака политичка одлука или мера углавном се одражава и на економски систем државе. Као највиши облик организовања друштвеног живота политика има моћ да политизује све сфере друштва. То, веома често може да проузрокује и општедруштвену кризу што је карактеристично за друштва у транзицији.

3. Класификација економских криза

Кризе углавном настају због појаве више фактора. Фактори који доводе до избијања кризе могу бити чисто интерног односно екстерног карактера, али се најчешће дешава да кризну ситуацију изазива мултипликација два или више ендогених и егзогених фактора. Када се као критеријум користи место избијања кризе, исте се класификују на следећи начин:

- криза привреде;
- криза гране;
- криза куће. (Османагић, 2008.)

Привредна криза је стање у коме су сва предузећа, без обзира на величину, делатност и економску снагу трпе негативне последице по пословање. Ову врсту кризе могу изазвати најразличитији фактори, међу којима се издвајају политичке и правне одлуке које се тичу пословања предузећа унутар одређеног тржишта.

Привредна криза може бити изазвана и кризом гране. Криза гране углавном настаје због техничко-технолошке застарелости процеса производње. У том контексту може се закључити да најпре мора настати криза куће (предузећа) која ће се касније одразити на целу привредну грану којој организација припада. На основу овога јасно се уочава узрочно-последична веза свих врста кризе. У условима глобализације, жеље и потребе купаца се константно мењају. Уколико предузећа не модернизују своје технолошке капацитете, не развијају нове производе, не прате жеље и потребе потрошача исти ће се окренути другим продавцима. Предузеће због смањене продаје запада у кризу. Уколико се таква ситуација понови са више великих или средњих привредних система јавља се криза гране која, уколико нема системских решења утиче на целу привреду.

Пракса је показала да је криза куће највећи кривац за избијање економских криза. За преко 2/3 кризних ситуација у високоразвијеним државама Западне Европе главну одговорност сноси менаџмент компаније, неодговорно понашање и лоше пословање привредних организација.

Свака криза је специфична, јединствена и разликује се од претходних. Због тога постоји читав сет типова криза у развијеним друштвеним системима које се тичу кризе куће. Тако се разликују:

- **криза руковођења (менаџмента**) се у теорији сматра примарном кризом, јер је она извор сваке наредне кризе.
- **криза креативног управљања** је специфична врста кризе која, између осталог настаје и због техничко-технолошке застарелости и немогућности имплементације нових идеја у застареле производне токове.
- **организациона криза** настаје услед промена начина пословања и прилагођавања тржишним тенденцијама.
- **криза промоције и дистрибуције** настаје као резултат смањење комуникације између предузећа и потрошача.
- **криза пословног циклуса** настаје услед континуираног кретања пословног циклуса гране у којој предузеће послује.
- **финансијска криза** је последица смањене рентабилности производње.
- **социјална криза предузећа** настаје као резултат лоших међуљудских односа у предузећу.
- **институционално условљена криза** настаје због неразумевања носиоца економске и политичке власти новонасталих националних и глобалних тржишних околности и захтева.
- **општа економска или друштвена криза** најдубљи је облик кризе која може проузроковати нестајање читавих пословних система, друштвено-економског поретка, за чије решавање су потребне коренite друштвене промене и мере. (прилагођено према: Рујан, 2010.)

У основи сваке кризе лежи друштвено одговорно понашање појединаца и пословање предузећа. Уколико се принципи друштвено одговорног понашања поштују и примењују у пословању, број кризних ситуација може се смањити на минимум. У супротном, кризе ће се константно јављати, доћи ће до проширења концепта и појаве нових врста криза.

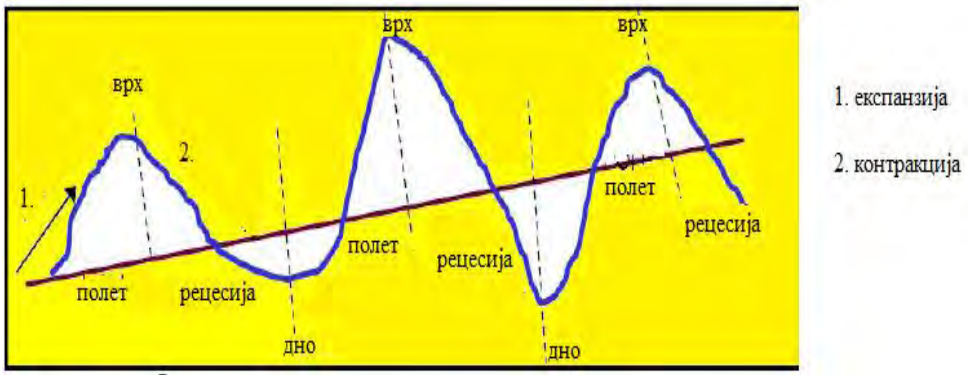
4. Фазе у развоју економске кризе

Економски циклус представља периодично понављање одређених тешкоћа, видљивих пре свега кроз наизменични пад и пораст економске активности, односно флуктуације дохотка. То је разлог због кога је циклично кретање у економији посматрано кроз смену повољних и мање повољних фаза за реализацију пословних активности, као пословних циклуса. (Ђукић, 2010.) Пословни циклус се може дефинисати као периодично понављање фаза пада дохотка и запослености у економској активности у различитом временском трајању.

Свака привреда је подложна пословним циклусима што значи да су подложне успонима и падовима својих привредних активности. Након периода полета и раста, привредне активности доживљавају свој врхунац. Криза је наредна фаза привредног циклуса којој претходи континуирано опадање стопе раста. Оног момента када економске активности достигну најнижу (негативну) тачну у развоју јавља се стање депресије, које уколико потраје прелази у кризу. Период изласка из депресије односно кризе и успостављање поновног раста је логичан след околности. Ово је сликовито приказано на слици број 1. На истој се јасно уочава да је рецесија време од момента достизања врха економске активности до достизања најниже тачке економског развоја. С друге стране, период од достизања најниже развојне тачке преко подизања раста активности, до достизања врха привредне активности назива се полет.

Најдужу историју криза у свету имају Сједињене Америчке Државе. Велики број кризних ситуација довео је тога да Сједињене Државе имају један од најбољих концепата за излаз из кризних ситуација. Константне анализе економских кретања врло лако доводе до предвиђања истих, па се због тога и кризне ситуације брже и ефикасније решавају у односу на остале државе. Стање рецесије почиње оног момента када улазна фаза пословног циклуса достигне врх, а завршава када силазна фаза достигне дно. На наредној слици то је објашњено кроз експанзију (стање криве означено бројем 1) и контракцију (позиција криве означена бројем 2).

Слика бр. 1 – *Циклично кретање привредне активности*



Извор: (прилагођено према: Дашић, Д., Пурић, С. & Тодоровић, Н., 2006)

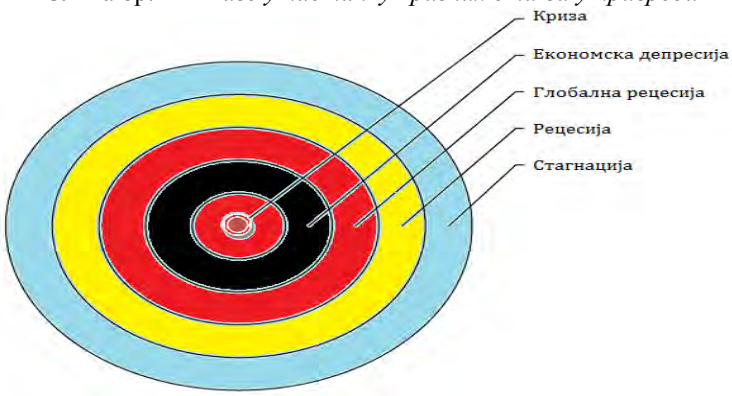
Када су у питању кризне ситуације које су погодиле привреду САД треба напоменути да су већина биле краткорочне. Анализирајући историјат америчких криза може се закључити да су се исте јављале у временским размацима од 3 до 5 година. Диверзификованост привреде Сједињених Држава омогућила је да се рецесије не претварају у депресију и кризу. Излаз из кризних ситуација у привредној пракси САД углавном траје мање од једне године. Изузетак су кризе из периода 1929-1933. године и последња глобална економска депресија која је трајала од 2007. до 2009. године. Остале кризне ситуације које су биле производ значајних промена на финансијским тржишта, али и тржишту нафте брзо су решаване и поред тога што су имале и глобалне последице.

Фазе у настанку кризних стања у привреди условљене су тржишним и институционалним капацитетом одређене државе. То значи да не постоји принцип аутоматизма да се из рецесије прелази у стање глобалне рецесије да би се доспело у депресију и стање кризе. Пракса је показала да се из стања рецесије, захваљујући одређеним мерама и акцијама, пре свега политичке природе брзо склизне у стање кризе привреде. Пример за то су друштва у транзицији.

На основу претходног уочавају се основне појединачне фазе у процесу избијања кризних стања:

- фаза стагнације;
- фаза рецесије;
- фаза глобалне рецесије;
- депресија и
- криза.

Слика бр. 2 – *Фазе у настанку кризних стања у привреди*



Извор: www.imf.org

Ситуација у којој привреда бележи позитивне резултате односно стопе раста, али које су ниже од планираних и стопа из претходног периода означава се као стагнација. Уколико се забележи истовремени пад привредних активности у више различитих привредних грана то значи да је привреда у стању рецесије. Пад стопе раста привредне активности на глобалном нивоу испод 3% означава фазу глобалне рецесије. Уколико се деси да стање рецесије потраје дуже од годину дана, уз истовремени пад вредности глобалног бруто производа од преко 10% то је знак да је наступила фаза економске депресије. Када у стању депресије тржишни актери нису у стању да сервисирају своје обавезе, а држава не поседује активни механизам за излазак из депресије наступа стање кризе. Све ово сликовито је приказано на наредној слици.

Двадесети век обележиле су бројне кризе, од економских преко безбедносних до опште друштвених. Кризне економске ситуације имале су за резултат креирање бројних инструмената за предвиђање истих како на глобалном тако и на националном плану. И поред тога што креирани различити начини предвиђања кризних ситуација и начини да се берзански и тржишни извештаји прате и предвиђају на дневном плану, веома је тешко са сигурношћу предвидети избијање кризе. Главни разлог за такво стање је нерационално понашање појединаца који имају велики утицај на финансијско тржиште и глобалну економију генерално.

Закључак

Основно обележје сваке кризе јесте да је она догађај који може проузроковати уништење система без обзира о којој врсти система је реч – економски, биолошки, технички, микро, макро или глобални. Фактори који доводе до појаве кризног стања одређеног система могу имати интерни и екстерни карактер. Најефикаснији начин спречавања кризне и кризних ситуација је деловање на симптоме који доводе до појаве кризе. У мору различитих класификација, једна од прихваћених подела у економској теорији и пракси је подела на кризу куће, гране и привреде. Ова подела на најједноставнији начин приказује значај како криза привредне организације може утицати на комплетну привреду и друштво. Међународни монетарни фонд класификовао је кризне ситуације и сврстао их у пет различитих фаза: стагнација, рецесија, глобална рецесија, депресија и криза. Не постоји аутоматизам у преласку из једну у другу фазу, већ се и из фазе рецесије може склизнути у дубоку кризу.

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Kratko ili prethodno saopštenje UDK 338.48-6:615.838(497.6)
Rad prihvaćen: 20. 1. 2017.

Stanje i perspektive balneo - klimatskog liječenja u Bosni i Hercegovini

Adis Puška[1]*, Admir I. Beganović[2], Sead Šadić[3]

[1] Visoka škola eMPIRICA u Brčkom distriktu BiH, Brčko, Bosna i Hercegovina,[2]
[2] Univerzitet za poslovne studije Banja Luka, Bosna i Hercegovina
[3] JZU Zdravstveni centar Brčko, Bosna i Hercegovina

Apstrakt: Bogatstvo i tradicija korištenja termo - mineralnih voda u Bosni i Hercegovini predstavlja jedan od glavnih potencijala razvoja zdravstva. Primarni značaj u banjskim centrima je pružanju zdravstvenih usluga i organizovanje turističke djelatnosti. Danas u Bosni i Hercegovini aktivno je, i registrovano, 15 banja u svojstvu „zdravstvenih centara". Historija korištenja termo - mineralnih izvora seže još iz vremena starih Grka i Rimljana, koji su njihova ljekovita i terapeutska svojstva koristili i davali im primaran značaj, gradeći prateće objekte, koji su se održali, u nekim krajevima, i danas. Tema ovoga rada je da se predstave perspektive razvoja zdravstva kroz promovisanje banjskog liječenja. Registrovanih 15 banja, kao zdravstvenih centara, koji raspolažu sa 3.455 ležaja, i ostvaruju oko 200.000 noćenja, na godišnjem nivou, što ukupno čini procenat od 23% ostvarenih, noćenja u Bosni i Hercegovini, i čine veliki privredni potencijal sa značajnim finasijskim prihodima. Zbog toga je veoma važno sagledati trenutnu banjsku ponudu u Bosni i Hercegovini, dati preporuke te kako unaprijediti i kako učiniti konkurentnojom ovu granu zdravstva.

Ključne reči: zdravstvo, banjski liječenje, banjski centri, potencijali, stanje

Situation and Prospects of Balneo-climatic Treatment in Bosnia and Herzegovina

Abstract: Wealth and tradition of using thermo - mineral waters in Bosnia and Herzegovina is the main potential for development of health tourism. The primary significance in spa centers is providing health services and the organization of tourist activities. Today in Bosnia and Herzegovina 15 spas as health institutions have been registered. History of use of thermo-mineral springs dates back to the ancient Greeks and Romans, who recognized the healing properties of geothermal resources. The topic of this paper is to present the perspective of the development of the tourism sector through the development of health tourism through spa treatment. There are registered 15 spas as health institutions which have 3,455 beds and generate around 200,000 overnight stays, which accounts for 23% of overall overnight stays in Bosnia and Herzegovina. It is therefore important to look at the current offer of spa treatments in Bosnia and Herzegovina and to make recommendations on how to improve this branch of health.

Keywords: health, spa health, spa centers, potential, state.

1. Uvod

Tradicija korištenja termo - mineralnih voda u ovim krajevima seže u daleku prošlost, još od antičkog vremena, Grka, Rimljana, zapažena je ljekovitost geotermalnih izvora. Bosna i Hercegovina ima veoma mnogo prirodnih, termalnih i termo - mineralnih izvora i peloida, među njima su i veoma rijetki mineralni izvori, koji su poznati u stručnim krugovima u cijelom svijetu. Bosna i Hercegovina je poznata i po izvorima, radioaktivne mineralne vode, koji su korišteni još u ranom historijskom periodu i bile eksploatisane u liječenju raznih vrsta oboljenja (Brkić, Unkić, 2009).

[2] adispuska@yahoo.com

Prevencija, liječenje i rehabilitacija u BH banjama primjenjuje različite vrste tarapija u smislu korištenja termo – mineralnih voda:

- pijenjem,
- kupanjem,
- banjanjem,
- inhalacijom,
- isparenjem i oblozima.

Upotrebljavaju se i savremene metode primene, kao što su:

- kinezoterapija,
- hidroterapija,
- masaža,
- akupunktura,
- terapija nisko i visokih frekventnih impulsa,
- talasoterapija i druge terapije.

Na taj način, u smislu široke medicinske primjene navedenih metoda liječenja raznih oboljenja i rahabilitacije, može se uočiti važnost banjskog liječenja u Bosni i Hercegovini. Banjskom liječenju je potrebno posvetiti veću pažnju i ukazati na značaj na njegov značaj u cilju razvoja i održanja banjskih kapaciteta.

2. Značaj primjene balneoterapije

Balneoterapija/hidroterapija kao dio fizikalne i rehabilitacijske medicine klinička je grana medicine koja se bavi prevencijom, dijagnostikom, liječenjem i rehabilitacijom nesposobnosti (Knež i sar., 2014). Počeci korištenja balneoterapije se javljaju još u starom vijeku. Rimljani su posebno cijenili kupke i korištenje termalnih izvora u svrhu liječenja (Jakovčić, 2013). Smisao banjskog liječenja je da se koriste prirodni izvori te postupci fizikalne terapije da bi se poboljšanje zdravstvenog stanja ljudi. Prije nego što se pređe na pregled značaja banjskog liječenja potrebno je definisati određene pojmove. Balneologija se bavi izučavanjem djelovanja i mogućnosti korištenja balneoloških faktora u medicinske svrhe. Kod korištenja banleoterapije moguće je upotrebljavati mineralne i termalne vode te primjenu air terapije, osim toga moguće je i primjenjivati blato u liječenju bolesti (Jajić i Jajić, 1998). Mineralna voda je ona koja ima više od 1 gram suhih ostataka na 1 litar vode, ili je njena terapija više od 20 stepeni ili ima u sebi malu količinu tvari koje pokazuju jako fiziološko djelovanje.

Korištenjem prirodnih izvora je osnova svake zdravstvene ponude u bankama. S obzirom na konstantno opadajući kvalitet savremenog života uzrokovan stresom i zagađenjem, zdravstveni turizam poprima sve značajniju ulogu u revitalizaciji psiho - fizičkih sposobnosti čovjeka. U banjama se nudi:

- uravnotežena prehrana,
- isključenost od buke,
- zagađenja zraka,
- tjelovježbe,
- društveni i duhovni programi.

3. Pregled radova o korištenju banjskog potencijala u regiji

Zdravstvena funkcija liječenja u banjama je jedna od najvažnijih i najstarijih funkcija koja se svodi na medikamentozni uticaj na zdravlje i kondiciju ljudi, a u novije vrijeme ovo prerasta i u turističku djelatnost. U pravilu liječenje u banjama djeluje kao preventiva, a kroz razvijeni stadij selektivne zdravstvene ponude i kao kurativa. Zdravstvena funkcija utiče najviše na ekonomsku funkciju ponude zdravstvenog liječenja i to u obliku poboljšanog zdravlja ljudi, koji će povećati produktivnost rada u različitim oblicima (Sergić, 2011). Brojni su stručni članci koji naglašavaju važnost zdravstvenog ponude banjskog liječenja ovdje ćemo napraviti samo pregled nekih od radova iz BiH, Srbije i Hrvatske. Radove sa ovog područja su odabrani jer oni pokazuju u kakvom se okruženju nalazi banjsko liječenje u BiH.

Segić (2011) je u svom radu naglašavao da je banjsko rekreativni zdravstvena djelatnost bila i ostala kao fenomen potreba ljudi, ali još nedovoljno obrađen u stručnoj literaturi zbog mnogih sukoba važnost pojedinih funkcija koje imaju banje kroz primjenu liječenja različitih bolesti. Isto tako naglašava da zdravstvena funkcija banjskog liječenja može biti osnovni pokretač turista. On je naglasio da ulaganje i razvoj u banjsko rekreativne zdravstvene centre može znatno pospješiti i ubrzati razvoj Republike Srpske.

Stanković i Pavlović (2005) naglašavaju da su banje i planine Srbije lokalne, regionalne i nacionalne zdravstvene vrijednosti. Također ističu da dosadašnji nivo turističke valorizacije banja i planina nije zadovoljavajući te se treba posvetiti velika pažnja razvoju ovoga vida turizma. Oni vide mogućnost razvoja ovoga vida turizma kroz komplementarnim razvojem banjskog i planinskog turizma. Radivojević (2008) je kroz svoj rad ukazala na to kako bi se moglo pridonijeti razvoju Republike Srbije kroz razvoj banjskog banjskog liječenja na primjeru Sokobanje. Iznijela je da je Sokobanja već duži niz godina predstavlja jednu od najznačajnih zdravstveno-turističkih destinacija u Srbiji. Preko svoga rada htjela je da ukaže na komparativne prednosti razvoja banjskog liječenja u cilju bolje turističke valorizacije prirodnog i stvorenog bogatstva.

Radiojević et.al. (2010) su predstavili Sokobanju kao jedno od najznačajnijih zdravstveno-turističkih mjesta u Srbiji koja raspolaže značajnim zdravstveno-turističkim potencijalom. Međutim, oni naglašavaju da pored toga na ovom prostoru zdravstvena djelatnost se nalazi u dobokoj krizi. Oni su analizirali prednosti i nedostake za razvoj zdravstvenog turizma u ovom banjskom prostoru i utvrdili da postoji dobra atrakcijska osnova, ali da su za dalji razvoj neophodna veća investiciona ulaganja, kao i veće angažovanje lokalnog stanovništva. Simić (2011) je u svom radu navela da je zdravstveni turizam koji treba da počiva na primjeni banjskog liječenja nezaobilazan dio savremenog društva, nosilac pozitivnih društvenih funkcija, ali također i negativnih posljedica koje se ispoljavaju u različitim oblicima na prirodu i društvo. Jedan od najznačajnijih resursa za razvoj održivog banjskog liječenja opštine Knjaževac su nesumnjivo termomineralne, mineralne i termalne vode. Ona je kroz ovaj rad htjela da ukaže na mogućnosti razvoja banjskog zdravstvenog turizma na načelima održivog razvoja u Rgoškoj banji, kao oblik turizma koji generiše ekonomske koristi za stanovništvo a istovremeno vodi računa o očuvanju prirodnih resursa.

Marković, Ostojić i Popović (2011) su u svom radu naglasili da u Srbiji postoje uslovi da se pitanja povezivanja zdravstva i turizma efikasnije rješavaju. Naglašavaju da je to širi društveni i ekonomski interes naše države. Specijalizovani zavodi i centri za prevenciju, zajedno sa hotelima i privatnim smeštajem u svojim mjestima i programima koje nudi lokalna turistička organizacija, obogaćuju ukupnu turističku ponudu. Bez kreativnih i komercijalnih kadrova za poslove dovođenja i prihvatanja turističkih grupa, zavodi će se i dalje baviti svojim statusom nesvjesno ignorišući potrebe naše države za deviznim sredstvima. Znači oni vide korištenje banjskog turizma kao načina za prikupljanje deviznih sredstava kroz dovođenje stranih turista.

Gligorijević i Petrović (2010) kažu da svi pokazatelji o dosadašnjem razvoju turizma u Srbiji ukazuju da zdravstveno liječenje u banjama predstavlja propuštenu šansu. Da su privredne i društvene okolnosti bile drugačije nesumljivo je da bi, sa stanovišta zdravstveno-turističke potražnje i prirodnog bogatstva, većina banja u Srbiji našla mesto među najatraktivnijim destinacijama Evrope. Oni naglašavaju da termomineralni izvori i gas radon su primarne prirodne vrijednosti Niške Banje, koje se koriste kao prirodni faktori banjskog liječenja i rehabilitacije. Međutim, promet odnosno posjete Niške Banje nije adekvatno srazmeran njenim prirodnim vrijednostima. Također su autori u ovom radu ukazali na karakteristike dosadašnjeg i mogućnosti njenog budućeg razvoja zdravstvenog turizma u Republici Srbiji.

Pavlović, Radivojević i Lazić (2009) u svom radu naglašavaju da svi relavantni pokazatelji o dosadašnjem razvoju zdravstvenog turizma kroz primjene banjskog liječenja ukazuju da ovo kao i u mnogim drugim zemljama tako i u Srbiji predstavlja propuštenu šansu. Oni kažu da su istorijske okolnosti bile drugačije nesumljivo je da bi, sa stanovišta zdravstveno-turističke potražnje i resursne osnove, Republika Srbija bi našla mjesto među najatraktivnijim zemljama Evrope. Oni smatraju da Srbija raspolaže značajnim prirodnim potencijalnom za razvoj zdravstvenog turizma, kao i da je primjena koncepta održivog razvoja važna za budući razvoj. Te ističu da su jedan od prirodnih potencijala Srbije termomineralni izvori koji ipak nisu na pravi način valorizovani i iskorišćeni.

Jakovčić (2003) je u svom radu istražila sadašnji ststepen razvoja turizma Krapinskih Toplica te mogućnosti budućeg razvoja s geografskog aspekta. Posebnu pažnju je poklonila razvoju zdravstvenog turizma te njegovog utjecaja na razvoj drugih oblika turizma. Također je pokušala da objasni razloge sporijega turističkog razvoja Krapinskih Toplica u poređenju s drugim toplicama u regiji. Na kraju je zaključila da bi se razvoj turizma odrazio bi se i na druge privredne grane, omogućujući plasman proizvoda i usluga. To bi pridonijelo razvoju preduzetništva te proizvodnju zdrave hrane. Razvoj zdravstvenog turizma pridonijelo bi i razvoju drugih oblika turizma, a posebno izletničkog i seoskog turizma za koji na području opštine Krapinske Toplice postoje dobre pretpostavke.

Koncul (2012) u svom radu naglašava da je zdravstveni turizam osjetio pritisak krize koja se javila kao posljedica globalne krize. Svjetska ekonomska situacija nakon 2007/2008. postavila je dodatni pritisak na psihofizičko stanje ljudi i njihovo zdravlje. On kaže da ljudi sve više traže nove načine opuštanja i regeneriranja. Neki oblici zdravstvenog turizma, na globalnoj razini, zbog ekonomske krize, su usporeni, no zdravstveno-

turistički sektor u cjelini iznimno dobro stoji tokom posljednje dvije-tri godina nudeći novi model turizma koji se općenito naziva Wellness. Ovaj autor kaže da unutar banjskog liječenja wellness je relativno novi trend koji registrira impresivan rast. Širom svijeta sve više i više ljudi koji putuju na odredišta koja pružaju wellness sadržaje. Znači autor u Wellness ponudi vidi šansu za razvoj zdravstvenog turizma u Republici Hrvatskoj.

Svi navedeni radovi i brojni drugi ukazuju na problem razvoja zdravstvenog turizma odnosno liječenja u banjama u ovoj regiji i ističu da je potrebno posvetiti veća pažnja ovom vidu zdravstvenog liječenja kroz razvoj posebne grane zdravstvenog turizma kako bi se ostvarili sinergetski efekti na razvoj ove regije. U narednom poglavlju će se predstaviti banjski potencijal u Bosni i Hercegovini, i dati preporuke i zaključci, kako podići ovu granu privredne na viši nivo.

4. Banjska ponuda u Bosni i Hercegovini

U BiH je trenutno 15 registrovanih banja u kojima se provode usluge zdravstvenog turizma. U ovom poglavlju će se predstaviti koje su to banje, te koje su njihovi potencijali u razvoju zdravstvenog turizma u BiH.

Banja Vrućica
Banja "Vrućica" je zdravstveno - turistički centar na području Republike Srpske, općina Teslić, koji je u 2012. godini ostvario najveći broj noćenja. Zbog specifičnih karakteristika termomineralne vode u toj banji, pogodna je za liječenje ne samo reumatskih nego i kardiovaskularnih oboljenja. Voda je ugljenokisela, s prirodnim gvožđem i ugljendioksidom, koji draže receptore kože, poboljšava cirkulaciju i na taj način olakšava rad srca i pogoduje kardiovaskulanim bolesnicima (novovrijeme.ba).

U kompleksu od 4 hotela, sa oko 1000 ležajeva, gostima su na raspolaganju brojni sadržaji i usluge što Banju Vrućicu pozicionira kao poznato prirodno lječilište, konferencijski, sportsko - rekreativni i turističko - manifestacioni centar. Voda Banje Vrućice uspješno liječi bolesti srca i krvotoka, reumatizam, stomačne bolesti, šećernu bolest, pospješuje i ubrzava procese rehabilitiacije, pomaže zdravim da održavaju i pospješuju kondiciju, neuroze i neuralgije. Umjereno kontinentalna klima, mnogo zelenila na širim prostorima Banje pružaju obilje i čistog i svježeg vazduha sa dovoljno ozona.

Termomineralna voda, kao najvažniji prirodni resurs, geografski položaj i klima, te uređeni kompleks i izgrađeni kapaciteti, kao i ljudski faktor, doprinijeli su da Banja Vrućica pruža veoma širok spektar zdravstvenih i turističkih usluga. Zdravstveni programi, kongresni kapaciteti, sportsko-rekreativni sadržaji, wellness… pružaju bezbroj mogućnosti za odmor, zdravlje, uživanje u predivnom prirodnom okuženju (www.banja-vrucica.com).

Banja Aquaterm
Banjsko rekreativni centar „Aquaterm" nalazi se u samom središtu grada Olova, pored mjesta gdje se sastaju dvije planinske rijeke Stupčanica i Bioštica i čine rijeku Krivaju. Raspolaže sa 60 soba sa 130 kreveta, te 12 novih dvokrevetnih soba sa 24 kreveta, restoranom sa ljetnom baštom kapaciteta 320 mjesta, tri kabineta, salom za seminare kapaciteta 80 mjesta, te salom za rekreaciju (aquaterm.olovo.ba).

Interesantno je da se po prvi put ljekovita mineralna voda sa područja Olova počela koristiti 1982. godine, mada se za nju znalo mnogo ranije. Čak je i nobelovac Ivo Andrić u svojoj pripovijetci "Čudo u Olovu" zabilježio značaj olovske vode. Osnov terapije u Aquatermu predstavlja poznata oligomineralna ljekovita voda (sehara.bosnjaci.agency). Olovska termomineralna voda u terapeutskim procedurama koristi se u tri vida i to: kupke, inhalacija i pijenje.

Vrste terapija koje se koriste u liječenju su:
- hidroterapija,
- elektroterapija,
- sonoterapija,
- magnetna terapija,
- termoterapija,
- masaže,
- kineziterapija

Banja Dvorovi
Banja Dvorovi se nalazi 6 kilometara od Bijeljine, i jedan je od najvažnijih turističkih resursa Semberije. Smještena je između rijeka Save i Drine i puteva koji preko Rače i Pavlović mosta iz Srbije vode u Bijeljinu, dalje do Banja Luke i Sarajeva.

Banja Dvorovi ima ljekovitu termomineralnu vodu natrijumsko – kalcijum -hidrokarbonatnog sastava, gdje se u savremeno opremljenom medicinskom bloku s uspjehom liječe svi oblici reumatskih oboljenja, hronične ginekološke bolesti, dijabetes, blage neuroze i rehabilitaciona postreumatska stanja, takođe i prevencija od karijesa ispiranjem usta. Pored navedenog, u banji se pružaju i sve vrste masaža, inhalacija i akupuntura. Rekreativcima i sportskim ekipama na raspolaganju su tereni za rukomet, odbojku na pijesku, košarku, trim kabinet, gimnastička sala, tenis i sauna (www.bijeljinaturizam.com).

Banja Gata
Smještena u blizini planina Grmeč i Plješivica, okružena živopisnim rijekama Unom i Koranom, na nadmorskoj visini od 120 metara, Banja Gata predstavlja krajišku oazu u kojoj se gost može odmarati ali i potpuno posvetiti sebi i svom zdravlju. Smještajni kapacitet je 99 ležaja, od toga 15 jednokrevetnih soba, 6 dvokrevetnih soba, 18 trokrevetnih soba i 6 apartmana. Svaka soba posjeduje WC i kupatilo.

Banja Guber
Ljekovitost srebreničke mineralne vode poznata je još iz doba starih Rimljana koji su njena izvorišta nazivali „Domavija“, a cijeli kraj u ovom lijepom kutku Istočne Bosne – „Argentarija“. I za vrijeme vladavine Turaka širila se „fama“ o ljekovitosti vode sa izvora planine Javor, a interesantno je da iz tih vremena datira i današnji naziv srebreničke banje.

Težak je položaj ove banje jer je kroz privatizaciju i davanje koncesije na korištenje prirodnih vodenih izvora uzrokovalo da smještajni kapaciteti ove banje polako odlaze bez obzira što postoji velika mogućnost za razvoj ovoga kraja putem ove banje.

Banja Ilidža, Gradačac
Centar za fizikalnu medicinu, rehabilitaciju i banjsko liječenje "Ilidža" u Gradačcu izgrađen je 1980. godine. Nalazi se na brežuljku sjevernog dijela grada, između dva vještačka akumulaciona jezera Hazna i Vidara, čije uređene plaže i trim staze omogućavaju pacijentima-posjetiocima, da pored medicinske rehabilitacije i banjskog liječenja aktivno se odmaraju i uživaju u ljepotama kraja (www.visitmycountry.net).

Smještajni kapaciteti Centra su 150 kreveta u dvokrevetnim i trokrevetnim sobama, te dva apartmana. Svaka soba posjeduje TV i balkon. Pored nadaleko poznate mineralne vode koja se koristi u liječenju i rehabilitaciji, u Centru se koriste i sve druge fizikalne terapije.

U ovoj banji se primjenjuju terapije za sljedeće bolesti:
- reumatske bolesti (upalne, degenerativne, vanzglobne),
- neurološke bolesti (moždani udar, išijas, lezije nerava),
- bolesti, povrede i postoperativna stanja lokomotornog aparata,
- bolesti metabolizma (dijabetes, giht),
- hronične ginekološke bolesti (www.banjagradacac.com).

Banja Ilidža, Sarajevo
U sarajevskoj kotlini, na osam kilometara od centra Sarajeva , nalazi se nadaleko poznata Banja Ilidža koja je ime dobila po turskoj riječi “iladža” što u prevodu znači, lijek. Smještena u podnožju Igmana i u blizini izvorišta rijeke Bosne.

Banja raspolaže sa 480 ležaja, u savremeno opremljenim jednokrevetnim, dvokrevetnim sobama, i apartmanima. U pogonu za fizikalnu medicinu i rehabilitaciju nalazi se hidroterapija sa 24 medicinske kade u kojima se pružaju usluge podvodne masaže, biserne kupke, četverostanične galvanske kupke, Habard kada, te mogućnost galvanizacija cijelog tijela ili dijelova tijela. Za rehabilitaciju se koriste i dva terapeutska bazena dimenzije 18 x 10 metara sa ugrađenim vodenim samomasažerima za pojedine segmente tijela. Trim kabinet posjeduje opremu od 29 mašina za rehabilitaciju svih segmenata tijela te mašinu za testiranje fizičkim mogućnosti organizma. Na osnovu testa planira se dozvoljeno opterećenje pacijenata u toku rehabilitacije.

U progonu za fizikalnu medicinu nalazi se elekto, sono, termo, magneto, laser terapija, solux i UV lampa, solux masaža, terapija laserom, limfna drenaža i manuelna masaža (www.visitmycountry.net).

Banja Kiseljak
Banja Kiseljak organizirano postoji od 1905. godine. 1972.god. Zdravstveno - klimatsko lječilište Banja Kiseljak je podijeljeno na Sarajevski Kiseljak (eksploatacija mineralne vode) i Banja Kiseljak (lječilište mineralnom

vodom sa smještajnim kapacitetima). Nakon rata je privatizirano i od tada kreću napori, od strane investitora, da se društvo pokrene, situacija kao i kod Banje Guber u Srebrnici.

Banja Laktaši
Termalna voda Banje Laktaši, poznata je po svojim ljekovitim svojstvima i blagotvornim efektima na ljudsko zdravlje još od antičkih (rimskih) vremena.
Banja Laktaši posjeduje: tradicionalnu banju, Hotel San, zatvoreni bazen punjen termo-mineralnom vodom, saunu, fitness, medicinsko - terapeutske sadržaje te kompleks vanjskih bazena. Banjska voda se koristi za liječenje bolesti lokomotornog sistema, kardiovaskularnih bolesti, bolesti očiju, nervnih poremećaja, za tretman gerijatrijskih bolesti, kao i za rekreaciju i turističke svrhe. Voda se koristi u balneoterapijske svrhe kao pomoćno ljekovito sredstvo i to kupanjem (u kadama i bazenu) i pijenjem. Osim toga, banja pruža usluge svih fizikalnih terapija koje su danas u upotrebi.

Banja Mlječanica
Institut za fizikalnu medicinu, rehabilitaciju i balmeoklimatologiju „Mlječanica" Kozarska Dubica je lječilište smješteno u prirodnom ambijentu na sjeverozapadnim obroncima planine Kozare. Koncipiran je kao savremena specijalizovana ustanova za fizijatriju i rehabilitaciju, koja obezbjeđuje sve uslove za uspješan oporavak i ugodan odmor njenih korisnika. Djelatnost Instituta „Mlječanica" je prevencija, liječenje i rehabilitacija za indikovana oboljenja i stanja nakon povreda.

Ova banja obavlja sljedeće djelatnosti:
- prevencija,
- dijagnostikovanje,
- bolničko liječenje,
- rehabilitacija neuroloških oboljenja,
- upalnog i degenerativnog reumatizma,
- posttraumatskih,
- ortopedskih,
- ginekoloških stanja, te
- prečišćavanje i distribucija mineralne vode (www.spamljecanica.com).

Banja Reumal
Lječilište "Reumal" Fojnica je specijalizirana ustanova za rehabilitaciju, rekreaciju, aktivni odmor i programirane sportske aktivnosti. Lječilište Reumal sa objektima Nove bolnice i Reumala, prostire se na površini od 60.000 m2, a korisni zatvoreni prostor iznosi 21.000 m2. Ukupni smještajni kapaciteti 520 kreveta (www.reumal.ba).

U okviru Centra obavljaju se:
- medicinska rehabilitacija lokomotornog aparata,
- kardiorehabilitacija,
- dječija habilitacija i rehabilitacija,
- rehabilitacija sportista i sportskih povreda.

Ova banja raspolaže i Welleness program zdravog življenja.

Banja Sanska Ilidža
Banja raspolaže sa velikim i uređenim izletničko rekreativnim prostorom, otvoreni bazen 25x12,5, za rekreaciju, dva zatvorena bazena za liječenje, jedan za muškarce, a drugi za žene, površine 24m2, medicinsko - terapeutskim prostorom, ugostiteljskim prostorom, trim stazama i velikim parking prostorom, a konstantno se radi na poboljšanju kvalitete usluga (www.banjailidza.ba). Ova banja je privatizovana i čeka se realizacija investicije koja će obogatiti ponudu.

Banja Slatina
Danas postoji izgrađena infrastruktura koja omogućava maksimalnu iskorištenost Slatinske vode. Banja Slatina raspolaže sa izvorom termomineralne vode i peloidima koji se, kao glavni balneo faktori koriste u prevenciji, liječenju i medicinskoj rehabilitaciji. Temperatura vode na vrelu iznosi 42 stepena i prirodnim padom voda se dovodi do 3 zatvorena bazena izgrađena u doba Austrougarske, pažljivo obnovljena da zadovolje savremene zahtjeve i omoguće očuvanje tradicije. U zgradi se nalazi hidroterapijski bazen sa ugrađenim podvodnim masažerima (www.visitmycountry.net).

Voda Banje Slatina blagotvorno djeluje na zapaljenski reumatizam u mirnoj fazi, degenerativni reumatizam, ekstraartikularni reumatizam, posljedice trauma. Poztivno djeluje i na izvjesne oblikei steriliteta – u prvom redu zapaljenskog i endokrinog porijekla. koristi se u pri terapiji hipertenzije kao i kod, funkcionalna i organska oboljenja perifernih arterijskih krvnih sudova.

Banja Vilina Vlas
Još iz rimskih vremena poznata su ljekovita svojstva geotermalnih voda iz područja današnje višegradske banje, Inače, ime Vilina Vlas ovo banjsko lječilište dobilo je jednom od rijetkih kontinentalnih nalazišta posebno nježne paprati – Viline vlasi (kose) (bosnjaci.agency).

Termomineralne vode višegradske banje imaju karakteristike radioaktivne, hidrokarbonantne homeoterme. Stepen radioaktivnosti je optimalan. Ljekovita svojstva vode potiču od termičkih, hemijskih i mehaničkih efekata, te minerala koje sadrži. Vrlo je značajan lako isparljivi plemeniti gas, radon, koji u organizam dospijeva putem kože i respiratornog sistema.

Dokazano je da radon usporava procese starenja, smanjuje bol, podiže opštu otpornost organizma i povoljno djeluje na neke kožne, endokrine, respiratorne i alergijske bolesti. Primjenjuje se za liječenje reumatskih, neuroloških, ortopedskih, ginekoloških, gerijatrijskih i oboljenja disajnih puteva, kao i za posttraumatska i postoperativna stanja.

Slana Banja
Smještena na obroncima Majevice, a okružena planinama Konjuh i Ozren nalazi se Slana Banja. Korištenje i ljekovitost vode koja izvire u njenoj neposrednoj blizini poznata je više od deset vijekova, a njena zvanična ispitivanja i upotreba otpočeli su 1908. godine. Intersantno je da je prvi pacijent ovog lječilišta bio car Austro - Ugarske monarhije, Franjo Josip.

U poliklinici sa banjskim lječilištem je moguće liječenje bolesti iz oblasti: reumatologije, neurologije, ginekologije, otorinolaringologije, bolesti, povrede i stanja nakon operacija lokomotornog aparata, respiratorne bolesti, hipertireoza i arterioskleroza (www.unibristol-tuzla.ba). U toku je izgradnja kompleksa koji će poslovanje ove banje unaprijediti.

5. Prilike i mogućnosti unapređenja banjskog liječenja

Zahvaljujući geografskom položaju, prirodnim ljepotama, kulturno - historijskom nasljeđu i pogodnim klimatskim uvjetima, BiH spada u najprimamljivije destinacije što se tiče mogućnosti primjene banjskog liječenja. Međutim, i pored ove činjenice banjsko liječenje u BiH je daleko od idealnog, još uvijek traži ulaganja, koja bi se državi itekako isplatitila u budućem periodu.

Prema podacima Zavoda za statistiku Republike Srpske, u 2014. godini ostvareno je u banjama 210.391 noćenja, što je 35,1 posto od ukupnog broja ostvarenih noćenja tokom ove godine. Na tabeli 1. je predstavljena noćenja u Reublici Srpskoj razvrsnoj po djelatnostima.

Tabela 1: Pregled noćenja turista u Republici Srpskoj 2011-2015. godine

Godine	Ukupno	Banjska mjesta	Planinska mjesta	Ostala turistička mjesta	Ostala mjesta
2011	614 637	259 095	94 145	217 635	43 762
2012	629 648	256 700	113 491	219 061	40 396
2013	629 663	225 694	121 412	239 989	42 568
2014	598 668	210 391	96 117	254 698	37 462
2015	686 944	230 440	142 902	286 570	27 032

Izvor: (Zavod za statistiku Republike Srpske, 2017)

Analizirajući broj noćenja koje su pokazani u tabeli 1. može se vidjeti da je broj noćenja u banjama bio najveći u 2011. godini te je do 2015. godine bio u opadanju. Upoređujući broj noćenja u banjskim mjestima sa ostalim turističkim može se uočiti da ne postoji povezanost te da je oscilacije kod ovih mjesta drugačina. Uzimajući na primjer ostala turistička mjesta može se vidjeti da je broj noćenja u stalom porastu. Dok je kod ostalih mjesta u 2015. godini u opadanju.

Tabela 2: Pregled noćenja turista u Fedaraciji BiH 2010-2015. godine

Godine	Banjska mjesta	Ukupno
2010	47 000	819 000
2011	51 000	870 000
2012	52 000	998 000
2013	51 000	1 135 000
2014	48 000	1 095 000
2015	51 000	1 439 000

Izvor: (Zavod za statistiku Federacije Bosne i Hercegovine, 2017)

Podaci predstavljeni na tabeli 2 pokazuju da postoji povećanje broja noćenja turista u Federaciji Bosni i Hercegovini. Međutim, taj rast noćenja nije popraćeno u banjama tako da je najveći broj noćenja bilo u 2012. godini pa potom slijede 2011, 2013. i 2015. godine sa 51000 noćenja. Ali ove podatke treba uzeti sa dozom obzira jer iz Banje Reumal Fojnica je izdato saopštenje da su imali u 2014. godine imali 156.600 noćenja. Razlog tome treba tražiti da i banje u svojim kapacitetima imaju hotele koje su predstavljeni u drugim kategorijama.

Na osnovu prethodnog pregleda banjske ponude u Bosni i Hercegovini i statističkih podataka vidi se da postoji velike mogućnosti i potencijali. Međutim, iz primjera banja Guber, Kiseljak i Sanska Ilidža, u ovim slučajevima osnovni problemi nastaju prilikom privatizacionog procesa u kojima se kod skoro svih navedenih primjera primjera pojavljuje isti problem neispunjavanja preduzetih obaveza prilikom privatizacije i gdje se ne mogu iskoristiti svi potencijali banjske ponude. Iako ove banje raspolažu sa odličnom termalno – mineralnim izvorima, ne ostvaruju značajne rezultate, odnosno ostvaruju zanemarive rezultate u svom poslovanju, međutim, osim ovih banja u BiH postoji i banje koje se razvijaju i ostvaruju značajne rezultate.

Pored navedenih negativnih pojava u banleo - klimaskog poslovanja prisutni su i pozitivni pomaci koji se ogledaju u većem interesovanju inozemnih turističkih agencija za banjsku ponudu gdje strani turisti dobijaju kvalitetan tretman po pristupačnim cijenama. Zbog toga je potrebno na adekvatan način pristupiti rješavanju svih problema sa kojima su navedene banje opterećene i uključiti sve interesantne grupe kako bi se podigli banjski potencijali u Bosni i Hercegovini i tako osnažili turističku ponudu.

Na osnovu analiziranog stanja zdravstveno banjskih kapaciteta i vrsta usluga koje pružaju, banjskim ustanovama potrebno je posvetiti značajniju pažnju razvoju banjskog zdravstvenog turizma. Navedeni primjeri poslovanja i stanja u stručnim radovima iz okruženja, upućuju na zaključak, da političko, institucionalno i pravno neuređeno područje poslovne aktivnosti djeluje destimulativno za investicije u tom pravcu, kao i strana ulaganja.

6. Zaključak

Posljednjih godina se sve više pridaje značaj banjskom liječenju. Bosna i Hercegovina je zemlja koja spada u bogatije zemlje po brojnim lječilištima, banjama i toplim izvorima, koji su registrovani kao medicinske ustanove i imaju dugu tradiciju. Međutim, razvoj ove grane zdravstva i analizirajući postojeću banjsku ponudu u BiH, može se reći, da postoji veliki potencijal za ovakav vid zdravstvenog liječenja koji su prepoznali još Rimljani, Austrougari, te su prve banje otvorene još u 19. vijeku.

Danas najviše banjskih posjetilca imamo iz redova domaćeg stanovništva, dok je mali broj iz inostranstva. Da bi se stanje promijenilo, potrebno je da se napravi strategija razvoja zdravstvenog liječenja sa posebnim naglaskom na banjsko liječenje, odnosno razvoj zdravstvenog turizma. Samo na taj način će se privući strani posjetioci i na taj način poboljšati devizni priliv u zemlji. Da bi se ovo sve postiglo potrebno je primjenjivati održivi razvoj koji se zasniva na očuvanju prirodnih resursa sa kojima BiH raspolaže i na taj način ponuditi atraktivan zdrastveno-turistički proizvod u svijetu.

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Kratko ili prethodno saopštenje UDK 330.342(496.5)"2002/2014"
Rad prihvaćen: 19. 1. 2017.

Da li je neformalna ekonomija prepreka za ekonomski razvoj Albanije?

Shkelqim Fortuzi[1]*, Arjeta Hallunovi[2], Elfrida Taraku [3], Ejona Duci[4]

[1] Faculty of Business, "Aleksander Moisiu" University, Durres, Albania[1]
[2] Faculty of Business, "Aleksander Moisiu" University, Durres, Albania
[3] Faculty of Business, "Aleksander Moisiu" University, Durres, Albania
[4] Faculty of Business, "Aleksander Moisiu" University, Durres, Albania

Apstrakt: Siva ekonomija predstavlja veliki problem, iako je u praksi to prirodna i spontana reakcija na nemogućnost formalne ekonomije da zadovolji potrebe nekih članova društva. Mora se priznati da u zemljama u razvoju i onih u tranziciji neformalna ekonomija daje značajan doprinos ekonomskom rastu, iako se povezuje sa brojnim problemima, koji zaslužuju da budu tretirani sa oprezom od strane političara i nosilaca ekonomske politike. Tačno je da je definisanje neformalne ekonomije veoma teško. Ne zbog teškoća saznavanja o načinima merenja i procene veličine i obima ovog sektora, već i zbog toga što su različiti autori videli problem iz više uglova i dali različite definicije, približne, ali sigurno drugačije. U ovom radu seukazuje na mere preduzete tokom studijskog perioda 2002-2014. i njihov uticaj koji su imali na smanjene sive ekonomije uz korišćenje modela potrošnje električne energije.

Ključne reči: Albanija, BDP, električne energije model, neformalna ekonomija.

Is the Informal Economy an Obstacle for the Economic Development in Albania?

Abstract: The problem of the informal economy is a major problem although in practice it is a natural and spontaneous reaction to the impossibility of the formal economy to meet the needs for some members of society. It must be recognized that in developing countries and countries in transition the informal economy provides a significant contribution to economic growth, although it is associated with a number of problems, which deserve to be treated with caution by the policymakers and the implementers of economic policy. It is true that to give a definition for the informal economy is something hard. This is not because of the difficulties of knowledge about ways of measurement and evaluation of the size and scope of this sector, but also because different authors have seen the problem from several angles and different definitions are approximate, but certainly different. To highlight the measures taken and the impact they have had during the study period 2002-2014 in the reduction of the informal economy the electricity consumption model is used.

Key words: Albania, GDP, Electricity Consumption Model, Informal Economy.

1. Introduction

The improvement of fiscal management is considered of special importance by the government, to overcome the challenges for the country's sustainable development and also European integration, as well as providing the financial resources needed for the implementation of the projects (Yoo and Hyun, 1998). The main objective of the reform of fiscal administration will be to increase budget revenues by expanding the taxable base and reducing the informal economy (Loayza, 1997). The negotiation process with the European Union and the achievement of obtaining candidate status is a clear reflection of the progress achieved so far by Albania in its transition, sometimes difficult. To advance these negotiations, required to fulfill certain strict standards for a

[1] shkelqimfortuzi@yahoo.com

European country before entry into the European Union, both politically and economically (Lippert and Walker, 1997). The recent problems in revenue collection, as evidenced by the ratio of income are consistently low against GDP with a repeated deficit, different from the initial budget forecasts. This has raised the concerns, if it is reasonable to expect that the implementation of the ambitious goals for the development of Albania (including the macroeconomic stability) can be realistically achieved within the time limits set by SKZHES (National Strategy of Economic Development of Strategic). Improving government performance to achieve social goals means the transition from an economy that avoided taxes (without infrastructure and misdirected safety nets), in a formal economy of tax payers (with efficient safety nets, although relatively small). However, many of these reforms are unlikely to be successful without reducing the corruption and the bureaucratic inefficiency (Petersen, 1982). By analyzing a large number of economies in transition in Central and Eastern Europe (excluding Albania), it is found that businesses react to a high degree of "politicization" of the activities of the private sector, with a retreat of the trend of the formal sector, implying that macroeconomic stabilization without accompanying reforms to strengthen the market institutions with not enough support for maintaining high rates of economic growth (Schneider, 1994).

First, a high informal sector leads to an increase in activities economically unproductive (particularly, in hiding, protection or detection of economic activities confidential, legal and illegal) and then in a significant loss of scarce resources (Schneider, 1998).

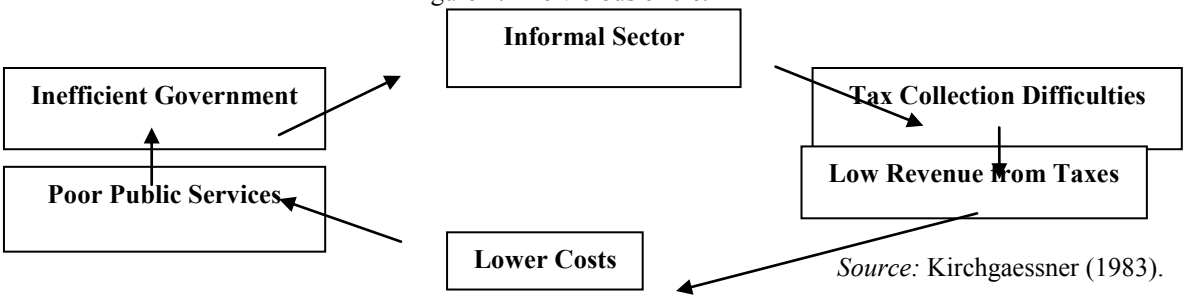
Secondly, it tends to cause a misallocation of production factors, mainly because informal enterprises - who are not able to use (fully) market supporting institutions, such as police, courts, or insufficient banks - use the technology of the production of intensive capital, which would make their goods and services uncompetitive eventually (Schneider and Enste, 2000).

Finally, an informal economy results with very substantial income from taxes, uncollected (Thomas, 1999), which, in particularly in countries like Albania - reduces economic prosperity because the investments (social) in infrastructure, which are required urgently, cannot be made, thus inhibiting private sector activities. In Albania, it has been done a small research work to examine the size and composition of the informal economy (and therefore the full extent of tax evasion). A notable exception is Schneider (2002), which adopted an approach that combined the physical input (electricity), demand for money, and the methods based on the model to estimate the informal economy in Albania.

2. "The vicious circle" of informality

An informal sector means that the economic activities "confidential" and "illegal", the revenues of which must be reported to the tax authorities, were hided from them - for the following reasons: First, a "confidential" economy includes activities that, except the violation of tax law, are mostly legitimate, as small businesses unlicensed. Thus, these types of activities are seen as a problem of tax evasion which represents a vital challenge for economic decision making. Second, the informal sector is defined to include also those activities that, by their nature, are "illegal". As a result, these activities are considered also crime organized activities (economic) - which mainly include arms, drugs and women trafficking. In addition, the "informal sector" shall be defined as the sum of all trading activities undeclared, de facto, that contribute to the national income (Johnson, Kaufmann and Shleifer, 1997). For the policymakers, the most difficult aspect of the tendency of increasing the relative size of the informal market is the juxtaposition of private benefits and public costs (Feige, 1979). As summarized in the figure 1, each market participant in the informal economy benefits directly and personally in several ways: (i) the individuals tend to receive higher net wages from taxes and are able to buy goods and services with lower prices; (ii) the firms can produce more competition without the expensive interactions which often are loss of time with government officials; and (iii) the corrupt officials and politicians take additional private income (bribes) in exchange for filling (wish) to those who participate and benefit from the informal economy (Frey and Hannelore, 1983). In contrast, the corresponding costs are all "public" by nature. They mainly include income tax reduced and, consequently, lower costs for public goods, such as hospitals, schools, universities, roads or the constant supply of energy and water. So, the economies that have a large informal sector tend to lag in a vicious cycle (Frey and Hannelore, 1984). With an inefficient public sector, the taxpayer discipline will remain low, leaving the economy mired in a fiscal trap.

Figure 1. The vicious circle.



Source: Kirchgaessner (1983).

Methodology and Results

To see the size and spread of the informal sector in Albania and its trends during the period 2002-2014 was used electricity consumption model. To apply this method are used data on economic growth and electricity consumption for the period under study. The purpose of this paper is to see the measures taken to reduce the informality and how effective they have resulted for the period under study. It is therefore set up the following hypothesis:

The hypothesis: The measures taken by the Albanian government during the period 2002-2014 have been effective and have contributed to reduce the informal economy.

Table 1. The performance of the informal economy.

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
GDP growth (%)		5.8	5.7	5.7	5.4	5.9	7,5	3.3	3.5	2	0.5	1.7	2.5
Power Supply (GWh)	5,430	5,900	5,945	5,933	6,121	5,750	6,300	6,592	6,924	7,342	7,616	7,957	7,793
Growth in electricity consumption (%)		8.66	0.76	-0.2	3.17	-6.06	9.57	4.63	5.03	6.03	3.73	4.48	-2.06
The informal economy as a % of GDP		2.86	-4.94	-5.9	-2.23	-11.96	1.87	1.33	1.53	4.03	3.23	2.78	-0.44
Informal Economy	30	32.86	27.92	22.02	19.76	7.82	9.69	3.2	2.86	5.56	7.26	6.01	2.34

Source: INSTAT, ERE and authors calculations.

2.1. The conclusions of the analysis

According to the model studied for the period 2002-2014 the results show that the level of the informal economy in the country has been in a gradual decline from year to year. In 2002 it was 30% and 2014 reached 2.34%. As it can be seen, the growth of the GDP and the increase of the level of power supply in the period under study were in an ever-increasing level, where such data are positive for the economy. This data clearly show the reduction of the informal sector in Albania, bringing further development to the country. Is it proven the hypotheses? The measures taken by our country for the reduction of this phenomenon have been different. This is noted in the results achieved and has been associated with the growth of GDP, which it has been gradual, and there have not been with large fluctuations. By seeing the results of the electricity consumption model (which clearly shows the level of the informality) and also taking into account its data, it is concluded that in our country the level of the informal economy has been decreasing. The decline of this phenomenon is the result of the actions taken by the country and the effectiveness that they have been in reducing the level of the informal economy. So, it is concluded that the hypothesis was confirmed.

3. Conclusions and recommendations

The countries with low taxes tend to have a low level of informal economy. But it should be noted that tax cuts only stabilize the informal economy and often do not reduce it, so that there is room for adjustments to the tax system by making it more simple in its content, logical for citizens and applicable in terms of the Albanian economy. The establishment of bridges between contributions and benefits from the fiscal system, it is seen as the main way that encourages citizens and businesses to be oriented towards the formal sector of the economy.

The complicated state rules for licensing, for the labor market and bureaucratic barriers increase the informal economy. Therefore, we think that there are many cases when it is necessary to facilitate the bureaucratic procedures and excessive documentation for licensing etc. There are a few studies in this field, but remains to be seen their implementation in the respective fiscal packages.

The informal economy is lower in countries where the state institutions are stronger and more efficient. The strengthening of these institutions continuously and the increase of public confidence towards them remain the safe streets for the formalization of the economy and the constant reduction of its informal sector.

We can also suggest that the modest achievements in the implementation of the strategy of poverty reduction and economic development, expressed in the inability to convert the recognized macroeconomic achievements in regional and sectoral developing, have due among the others, the weight still considerable of the informal sector of the economy and the lack of instruments, enabling its formalization without the injured, namely by revealing it in favor of sustainable development of our country.

The countries with more corruption have higher informal economy. The fight against corruption, it is understood as the strengthening and consolidation of the state institutions, as an increase of civic conscience and individual accountability, and the strengthening and modernization of public administration.

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12. Schneider, Friedrich and Dominik Enste (2000). Informal Economies: Size, Causes, and Consequences, The Journal of Economic Literature, 38/1, pp. 77-114.
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Guidelines for the Preparation of Papers for Publication in the Serbian Journal of Engineering Management

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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

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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

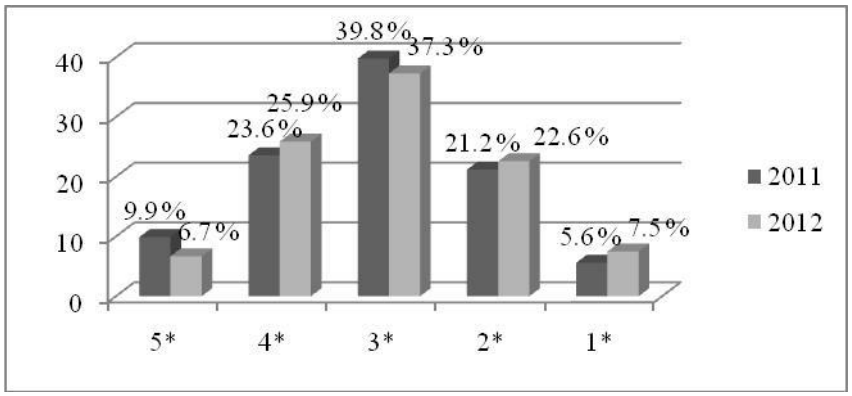
In the first line of the first page the title should be written in Serbian language (16 pt). Under the title of the paper the spaces for name(s) of the author and the names of the author's institutions should be indicated as specified and aforementioned in this Guideline. After the space for the institution 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)

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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)

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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).

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

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

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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).

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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:
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Industries Journal, 27 (7), 881 to 891. doi: 10.1080 / 02642060701570586

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Naslov rada na srpskom jeziku

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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.**

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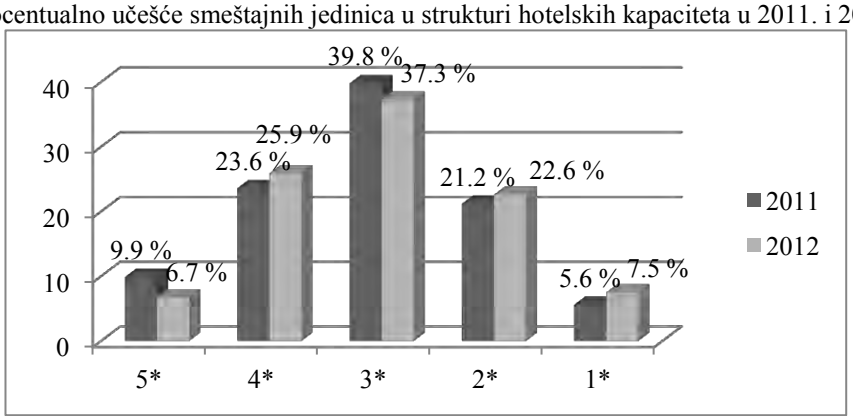
Numerisane podnaslove prvog nivoa treba formatirati korišćenjem fonta 12 pt boldovano, a podnaslove drugog nivoa 10 pt boldovano. Tekst, kao i spisak literature treba formatirati korišćenjem fonta 10 pt.

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.

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

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