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This edition of Ekonomika preduzeća is dedicated to the research papers on the project "Strategic and tactical measure to overcome real sector competitiveness crisis in Serbia".

The first paper written by *D. Malinić, V. Milićević*, and *M. Glišić* explores the correlation between firm size and its financial viability in Serbia's economy. The authors demonstrate that the volatility of ROE is the highest in the group of small companies, making them appear riskier than medium-sized and big companies, primarily when it comes to financial risks, arising from their highly leveraged capital structure. On the other hand, low participation of fixed costs in total operating expenses of small companies lowers their operating risks below the operating risks of medium-sized and big companies. The dominant participation of SMEs in terms of their number, as well as their extremely important contribution to employment growth and creation of value added, indicates that the development of such enterprises provides the great potential for overcoming the key economic problems. The authors confirm the experience of developed countries suggesting that a considerable influence of SMEs on the growth of economy and employment can be expected only in an organized and stimulating environment.

The second paper by *S. Janošević* and *V. Dženopoljac* analyzes the role of intelectual capital in ICT sector in Serbia. The paper analyzed financial performance of 594 enterprises that operate within the ICT industry in Serbia in the period of five years (2009-2013) and their dependence on IC efficiency. Three main hypotheses were tested in the paper regarding the relationship between human, structural, and physical capital, on one side, and financial performance (measured by net profit, operating profit, return on equity, return on assets, profitability, and return on invested capital), on the other. The results indicated that human capital and physical capital partially affect financial performance, which is consistent with empirical findings from other developing countries. When compared to other industries in Serbia, ICT industry demonstrated more significant impact of human capital.

In the third paper, *J. Kočovic, B. Paunović*, and *M. Jovović* present results of the assessment of performance of companies engaged in non-life insurance business in Serbia. Empirical research was conducted on the basis of financial statements of non-life and composite insurers during the period 2006-2013 by using CARMEL indicators and multiple regression analysis. The estimated model with individual fixed effects on panel data indicates a significant and negative influence of the combined ratio, financial leverage and retention rate on the profitability of non-life insurers, as measured by the return on assets (ROA), while the influence of the written premium growth rate, return on investment and company size is significant and positive. Conducted research enriches the information basis for the creation of business strategy and formulation of business policy of non-life insurers in Serbia.

V. Rajić, D. Azdejković, and *D. Lončar* in their paper present the basic topics related to the fixed point theory. Two theorems regarding fixed point existence are presented: Brouwer's theorem and Kakutani's theorem. Both of them are widely used in different economic fields, especially for equilibrium price determination and the game theory. Possibilities for utilization of these theorems are vast, but this paper focuses on several heretofore known applications in the field of economic research. The primary goal was to describe the foundations of fixed point theory and outline some of the possible applications. This was a starting point for future research regarding the determination of competitive relationship equilibrium in different markets.

The paper written by *M. Todorović* and *M. Vasilić* represents a study of the possible weak links in the agrarian budget management, primarily in terms of subsidizing beneficiaries in the light of improving competitiveness of the agriculture sector in the Republic of Serbia. The authors explored the possibilities for optimization of the scarce resources of Serbia's agrarian budget through enhancing the effects of its placement, suggesting possible innovations with regard to the criteria used for decision-making and selecting priority beneficiaries of support. Having in mind the need for export-led growth orientation of the economy and the urgent need to improve its overall competitiveness as well as the competitiveness of individual sectors, the authors suggested step-by-step guideline for choosing priorities in the agrarian budget allocation and pointed out some of the important issues related to the government support for the chosen ones.

In their paper, *A. Zečević* and *K. Radosavljević* explore the possibilities of web based business applicaions in agriculture. The authors point to the low usage of IT capacity in this sector in enhancing its competitiveness. Their paper contains three principal parts in which the positioning of Serbia relative to the application of information technologies has been analyzed, including also considerations of the problem of increased production and marketability on the selected example, as well as the usage of web-based information technologies with the aim of intensifying the activity level of agribusiness. The description of the management of an open-source web dynamic content system offers the possibility to raise the competitiveness of agricultural holdings. The authors also present how to manage the sections and create a web open-source dynamic content platform.

The last paper by *D. Kaličanin* and *V. Kuč* compares restructuring strategies in power sector in the EU and Serbia. The authors identified most important issues following restructuring strategy in Serbia, namely, the unbundling of enterprises, corporatization, management restructuring, outsourcing, downsizing, and others. The authors also discuss the privatization of the leading state-owned enterprise, its opportunities and perils.

Prof. Dragan Đuričin, Editor in Chief

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INTERDEPENDENCE OF ENTERPRISE SIZE AND VITALITY IN SERBIAN ECONOMY*

Uslovljenost veličine i vitalnosti preduzeća u srpskoj privredi

Abstract

The structure of economy is very heterogeneous. It consists of enterprises doing business in various branches and, accordingly, belonging to various sectors and various industries within them. In order to do their businesses with as much quality as possible, enterprises opt for various legal forms and thus operate as partnerships, limited partnerships, limited liability companies, joint stock companies and state-owned enterprises. Finally, enterprises belonging to a national economy can be dramatically different in terms of their size, measured by the number of their employees, level of total assets, level of generated revenues or their contribution to the creation of value added.

This paper puts stress on the overview of enterprise performance from their size's point of view. In the first few parts of the paper, special attention is paid to the research regarding the importance of enterprise size to economic performance and, accordingly, positioning big, medium-sized and small enterprises in Serbian economy. Central part of the paper pays attention to the overview of return potential of Serbian economy in terms of enterprise size. Finally, at the end of the paper we emphasize the problems of volatility regarding the performances of big, medium-sized, and small enterprises, as well as the influence of operating and financial leverage on their performance.

Key words: *competitiveness, enterprise size, employment, vitality, profitability, volatility, risk, leverage*

Sažetak

Struktura privrede je veoma heterogena. Nju čine preduzeća koja posluju u različitim delatnostima i koja u skladu s tim pripadaju različitim sektorima i unutar njih različitim privrednim granama. Da bi što kvalitetnije obavljala svoju delatnost, preduzeća biraju različite pravne forme, te otuda posluju kao ortačka preduzeća, komanditna društva, društva sa ograničenom odgovornošću, akcionarska društva i državna preduzeća. Konačno, preduzeća koja pripadaju jednoj nacionalnoj ekonomiji mogu da budu drastično različita sa stanovišta njihove veličine, mereno brojem zaposlenih, visinom angažovane imovine, visinom ostvarenih prihoda ili njihovim doprinosom stvaranju dodate vrednosti.

U ovom radu akcenat je stavljen na sagledavanje performansi preduzeća sa stanovišta njihove veličine. U prvim delovima rada posebna pažnja posvećena je istraživanju značaja veličine preduzeća za privredna ostvarenja i u tom kontekstu pozicioniranju velikih, srednjih i malih preduzeća u srpskoj privredi. U središnjem delu rada, pažnja je usmerena na sagledavanje prinosnih potencijala srpske privrede iz perspektive veličine preduzeća. Konačno, na kraju rada naglašeni su problemi volatilnosti performansi velikih, malih i srednjih preduzeća, kao i uticaj poslovnog i finansijskog leveridža na njihova ostvarenja.

Ključne reči: *konkurentnost, veličina preduzeća, zaposlenost, vitalnost, profitabilnost, volatilnost, rizik, leveridž*

* This paper is part of the research on the project financed by the Ministry of Education, Science and Technological Development entitled "Strategic and tactical measures to overcome real sector competitiveness crisis in Serbia" (No. 179050, period 2011-2014)

Introduction

Solving serious problems regarding the inefficiency of Serbian economy requires the overview of its performance from various aspects. The analysis of performance by sectors can point to directions (strategy) of developing sectors which have competitive advantages and can have the greatest contribution to the growth of GDP. The analysis of companies' performance in terms of legal form reveals not only the attractiveness of certain legal forms but the problems burdening them, such as the issue of gathering cheaper funding sources, level of owners' responsibility, efficiency in managing stare-owned enterprises and so on. Perceiving the success of economy from the point of view of enterprise size should reveal the need to create economic policies encouraging the development of those company groups that enable raising performance of the economy as a whole.

In order to raise the efficiency of national economies, increase growth, employment and created value added, many serious discussions are made these days regarding the possibilities of companies depending on their size. Thereby, the biggest opportunity for improving the performance of national economies, especially in terms of increasing employment and growth, is seen in the group of small and medium-sized enterprises (SMEs). Hence the efforts of many countries to create more favourable climate for the functioning of these companies. In this regard, the efforts are directed to creating pervious legislation, decreasing administrative barriers for founding and functioning of these companies, adopting national strategy for the development of SMEs, providing favourable financing sources, creating support for export etc.

Having all this in mind, it seems very important to study the performance of big, medium-sized and small enterprises in Serbian economy. There are at least two reasons to justify the efforts aiming to perceive the performance from the aspect of competitiveness, return potential, resistance to crises, and contribution to raise growth, employment and created value added. Firstly, in order to create high-quality information basis for developing economic policies and national strategies in this field and, secondly, to avoid creating wrong image of the importance of certain company groups, depending on their size, for the development of national economy.

Enterprise size as the determinant of economic activity level

Economic mosaic is miscellaneous, with the space left for big, medium-sized and small enterprises. Each of these enterprises tries to find its place on the market and provide required returns for owners. Each one of them has its clientele of investors and specific operating problems. Using business opportunities often requires tight connection among big, medium-sized and small enterprises.

Understanding the problems of big, medium-sized and small enterprises, as well as their positioning in national economy, require defining company's size. There are two related problems that burden the classification of enterprises. The first one is related to unequal power of different economies. Big enterprises in market-developed economies, such as Germany and France, are not the same as big enterprises in smaller economies where Serbia belongs. If we used the same criteria, the structure of economy from the perspective of real, mutual enterprise power would be significantly distorted. The other problem is related to the first one and it refers to the need to reach comparability of enterprises operating in different economies world wide. Contraposition of these criteria, as well as powerful arguments supporting them, result in the fact that the problem of classifying enterprises has not been uniquely solved yet.

Nevertheless, there is a high level of congruency in terms of criteria that should be used in the process of company classification. Certain criteria are imposed as usable, such as the number of employees, the level of employed capital and generated revenues. For the sake of comparability, in Table 1 we give the review of used criteria and ceilings set in order to classify companies into micro, small, medium-sized and big enterprises in the EU and Serbia. Since the ceilings for classification in Serbia were changed after the adoption of new Law on Accounting in 2013, in the following review we give comparable data, before and after the adoption of new Law.

Table 1: Criteria and thresholds for classifying companies by size in the EU and Serbia

Company category	EU			Serbia (before 2013)			Serbia (after 2013)		
	Employees	Revenues	Total assets	Employees	Revenues	Total assets	Employees	Revenues	Total assets
Micro	< 10	< 2	< 2	< 10	< 0.7	< 0.35	< 10	< 0,7	< 0.35
Small	10-50	2-10	2-10	10-50	0.7-8.8	0.35-4.4	10- 50	0.7-8.8	0.35-4.4
Medium	50-250	10-50	10-43	50-250	8.8-35	4.4-17.5	50-250	8.8-35	4.4-17.5
Big	> 250	> 50	> 43	> 250	> 35	> 17.5	> 250	> 35	> 17.5

Note: Revenues and assets are shown in millions of EUR
Source: [2, p. 36], [15], [16]

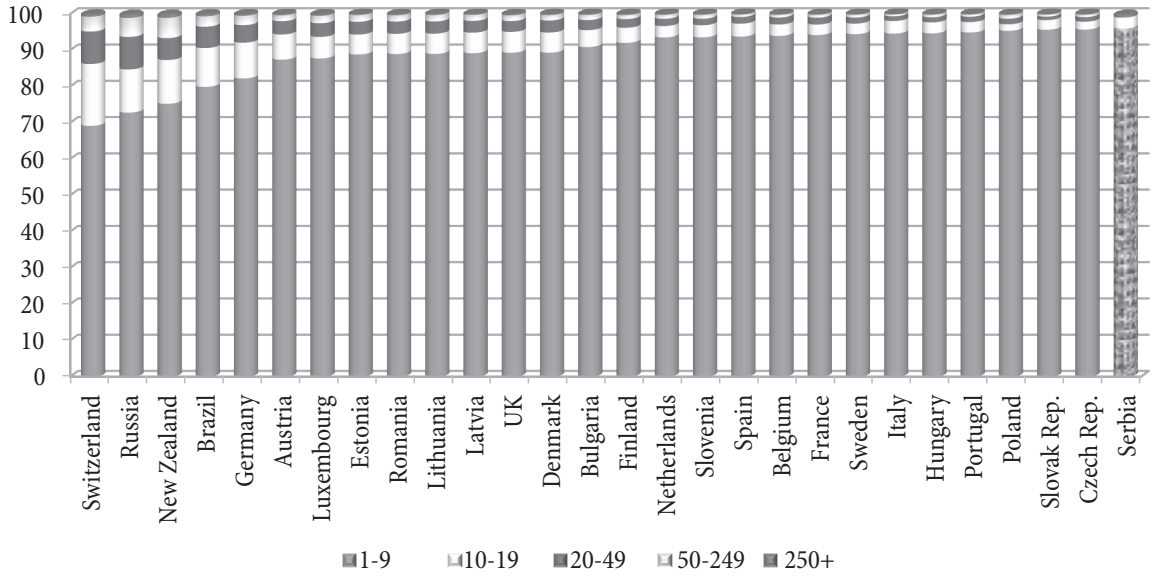
Major criterion for the classification of companies in Commissions Recommendations is the number of employees, while financial criteria are alternative and their application is aimed to provide as fair classification as possible. In Serbia, the condition for classification is to fulfil two out of three prescribed criteria.

The flaw of classifying companies in Serbia was reflected in lack of information on micro enterprises. This flaw limited comparability at the international level as well. However, raising the threshold for the classification of big, medium-sized and small enterprises has a few serious, negative implications: discontinuity was made in comparability within national frames, comparability at the international level has not been set since the criteria are below the recommended levels of EU and the circle of mandatory users of International Standards of Financial Reporting has been significantly narrowed.

The classification problem has not been universally solved even in the EU. European Commission brought The Recommendation on Classification which may or may not be adopted by national legislatures. Commissions Recommendations prescribed classification ceilings concerning the definition of micro and medium-sized enterprises, but, according to Article 2, these ceilings are considered to be maximum values. Each member state could set even lower ceilings. They could even choose to apply only the number of employees as a criterion (except in fields governed by various rules on State aid). There is no doubt that once set criteria should not be often changed. It changes the image of economic structure and contribution of certain company groups to performance of the economy, it ruins comparability and causes serious problems to analysts and other users of this information.

In general, nowadays the importance of small and medium-sized enterprises is widely discussed, primarily due to a fact that their development is seen as the opportunity to solve key problems that national economies face related to growth of economic activity, employment and GDP.

Figure 1: Enterprises by size classes



Source: [12], Serbia: own calculation
OECD publication excludes countries that have not updated their information, such as Canada, Israel, some EU members and countries with different methodology, such as Mexico, Japan, USA, Australia, Korea and Turkey.
For Serbia, all companies with up to 50 employees are displayed cumulatively.

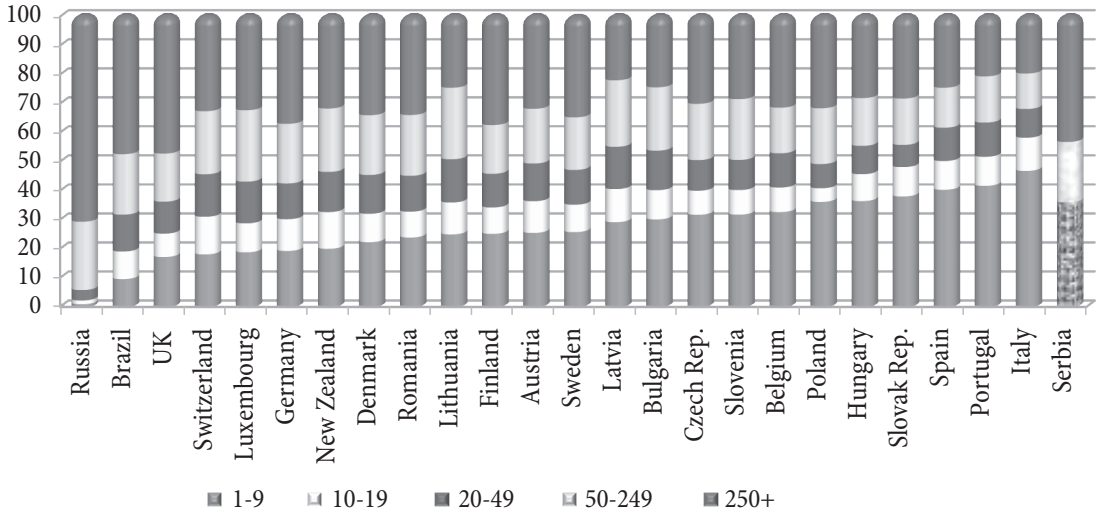
If the importance of SMEs is assessed from the perspective of their presence in economic structure of individual national economies, their dominance is undoubted. Again, within SMEs (micro, small and medium), micro enterprises are the most numerous. Coming from OECD data, the structure of national economies according to the number of enterprises classified by size (according to the number of employees) is shown in Figure 1 [12]. Following these data, we added information on small, medium-sized and big enterprises in Serbia, whereby entrepreneurs are not included in the analysis in this paper.

From Figure 1, it is more than obvious that big companies have the lowest participation in the structure of all presented national economies (e.g. EU members 0.23% on average, Russia 1.05%, New Zealand 1.04%, Brazil 0.62%), then follow medium-sized enterprises (in EU countries 0.22% on average, in Russia 5.23% , New Zealand 5.58%, Brazil 2.85%), while small enterprises take the dominant place (in EU countries 98.55% on average, in Russia 93.72%, New Zealand 93.38%, Brazil 96.53%), and within them micro enterprises with up to 10 employees are dominant. The situation is similar in Serbia. Small enterprises with up to 50 employees are dominant, with 96.01% participation in total number of companies, followed by medium-sized enterprises with 3.02% and big enterprises with 0.97%. The dominance of small enterprises is obviously a common practice in the world, since their participation in total number of companies is more than 90% in each country individually.

However, it still does not speak enough of their importance. In order to get the precise image of the importance of certain companies in terms of their size it is necessary to extend the analysis to the employment in small, medium-sized and big enterprises and their contribution to the creation of value added. In Figures 2 and 3 we displayed the participation of enterprises by their size and total number of employees (Figure 2) and total value added (Figure 3).

Employment analysis shows significantly different economic structure compared to the one determined by enterprise number. Averagely, at the level of whole set of analysed countries (except Serbia) almost a third of employees works in big enterprises. Within SMEs, 19.3% of total number of employees works in medium-sized enterprises, 20.6% in small enterprises and 26.9% in micro enterprises. Thereby, there are significant variations among countries. Employees are most numerous in big enterprises in Brazil (70.7%), Russia (47.4%), and UK (47.2%). On the other hand, employees are most numerous in SMEs in Italy (80.4%), Portugal (79.4%), Latvia 78.0%), Bulgaria (75.6%), Spain (75.5%), and Lithuania (75.5%). One of the interpretations of the presented variations could be that some countries managed to seize an opportunity to reach higher employment due to SMEs. That could mean

Figure 2: Employment by enterprise size class

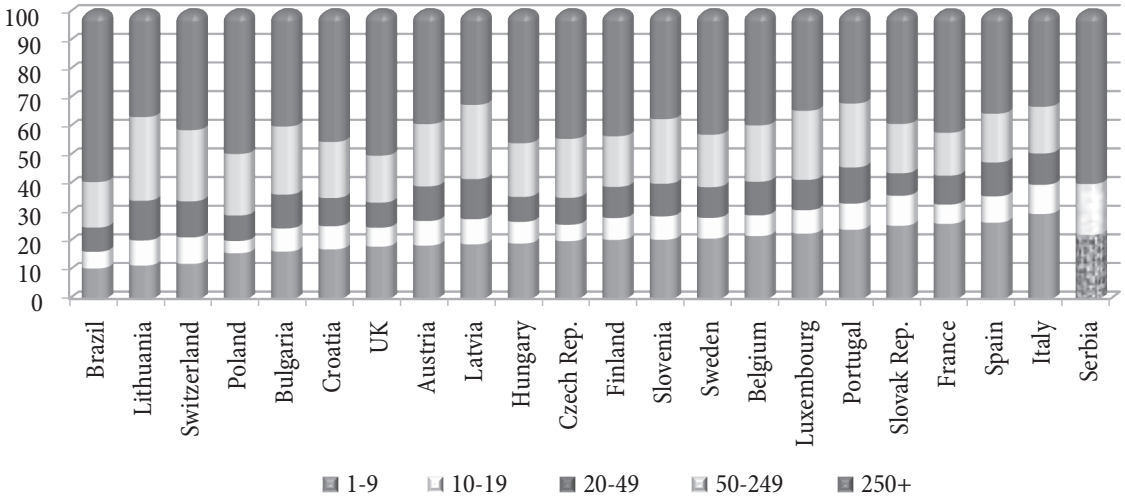


Source: [12], Serbia: own calculation

OECD publication excludes some EU members that have not updated their information and countries with different methodology, such as Israel, Mexico, Japan, USA, Australia and Turkey.

For Serbia, all companies with up to 50 employees are displayed cumulatively.

Figure 3: Value added by enterprise size class



Source: [12], Serbia: own calculation
OECD publication excludes Korea, USA, some EU members that have not updated their information and countries with different methodology, such as Mexico, Japan, Australia and Turkey.
For Serbia, all companies with up to 50 employees are displayed cumulatively

that the countries where the proportion of employees in SMEs is relatively small have better chances to raise total employment. Serbia could be included in such a group, since 43.2% of employees work in big enterprises, 20.8% in medium-sized enterprises and 36.0% in small enterprises.

Even larger deviations from earlier impressions of SME's importance based on the number of SMEs in total enterprise number are revealed in the field of their contribution to the creation of value added. Value added is one of the most important global performance indicators of companies, branches, sectors and national economies. It is defined as the difference between sales revenue and intermediary spending[1] valued at purchase prices. In terms of calculation, value added is obtained when labour costs, depreciation and amortization are added to operating income. In Figure 3, the analysis of presented countries shows that, averagely, big enterprises contribute to total value added with 41% (primarily Brazil – 59.2%, then UK – 50.0% and Poland – 49.4%), medium-sized enterprises with 24.4% (primarily Lithuania – 29.2%, Latvia – 25.9% and Switzerland – 24.9%), small enterprises with 18.7% (primarily Latvia – 22.8% Lithuania –22.6%, Switzerland – 21.8% and Portugal – 21.8%, while average participation of micro enterprises in total value added is 19.9% (primarily in Italy – 29.6%, Spain – 26.6%, France – 26.2% and Slovakia – 25.5%).

Greater participation of big enterprises in total value added is reasonable, having in mind that those companies often have huge capacities, great market share and high productivity level. Obviously, it is comparative analysis of key indicators that creates real image of the existing structure of each economy and reveals the directions of potential further growth of employment, value added and national economy.

Situation in Serbia is closer to those countries where the participation of big enterprises in the creation of value added is greater, such as Brazil and UK. Inherited economic structure and inefficient growth of small and medium enterprises could be main causes for that. At the same time, this also reveals potential opportunities for future growth of Serbian economy.

The attention paid to the importance of SMEs in the process of national economy functioning results from the fact that those enterprises are more flexible and relatively easy to adjust to surrounding changes. They also benefit from considerably expressed entrepreneurial initiative and successfully cover the attractive market niches beyond the reach of big enterprises. In this regard, SMEs were considered to be a serious rampart to devastation of national economies caused by global economic crisis. However, recovery of SMEs from crisis consequences has been slower

1 Intermediary spending implies spending on goods that are used in the production of certain product, coming from raw materials up to a final product.

than expected. Studies show that, from the perspective of employment and creation of value added in SMEs, only eight EU countries have recovered from the consequences of economic crisis, meaning that there was a growth of employment and value added in SMEs in 2013 compared to 2008. Fifteen countries still have a lower employment and lower value added in SMEs in 2013 compared to 2008. The remaining four countries (Slovak Republic was excluded due to discontinuity of data) have one parameter positive, while the other one is negative. The pace of recovery in SMEs has slowed down in the last three years and it nearly approximates the pace of recovery in big enterprises for the same period [3, pp. 6-7].

Despite the above mentioned, we cannot question the importance of SMEs for each national economy. In member states (EU28), 21.6 million SMEs in non-financial sector employ 88.8 million people and create EUR 3.666 trillion of value added. In other words, 99 out of 100 enterprises in this sector are SMEs, 2 out of 3 employees work in SMEs, while 58 cents of 1 euro of value added is created in these enterprises [3, p. 14]. In these circumstances, regardless of the disproportion between the number of these companies on one side and their contribution to employment and total value added on the other side, one must admit that they have very important role in growth of employment and GDP. Hence the considerable efforts, especially in the EU, to create a favourable climate for the development of these enterprises are understandable.

All previous statements should not cast a doubt on the importance of big enterprises. These are companies not existing completely independent of other, smaller companies by size. Many SMEs have tight business connections with big enterprises. Big companies often have a lot of small suppliers and they could not operate successfully without them. Also, there are many situations when big companies outsource the existing production of certain components to other business entities, thus enabling more successful cost management and risk reduction. Business connection among big, medium-sized and small enterprises can contribute considerably to the promotion of national economic growth.

Finally, we should have in mind that big enterprises, often organized as public (joint stock) companies, can attract big amounts of capital and do business ventures out of reach for SMEs. Their huge asset base in combination with great financial and market power enables them to perform big research projects, transfer capital to different business and geographical areas, differentiate risk and avoid sudden crisis situations. Owing to their power, they can implement new production and information technologies and be competitive on various markets. Although they are never dominant in number, they generate huge revenues, employ many staff and contribute considerably to the growth of GDP.

We should underline the importance of big enterprises in the development of capital markets. In general, financial resources are more accessible to big enterprises. When they are organized as public companies, they issue more easily shares and bonds. Their securities are often very liquid on developed markets, which makes them attractive to investors. In addition, securities of public companies represent important element of normal functioning of secondary capital market. In this regard, it seems logical to conclude that neither there are corporations without developed capital market, nor there is a developed capital market without developed corporations [5, pp. 78-82]. Therefore, it is necessary to take care of these companies' development (by creating the stimulating business environment), not for the sake of companies themselves, but for their importance for the functioning of capital market. It is hard to expect the fall in costs of expensive bank loans without the presence of alternative financing sources. We could even say that the importance of big public companies is crucial in the emerging economies, whose markets are by nature shallow and lack attractive and liquid securities. We should not forget that not only companies and individual investors, but the entire industries, such as pension and investment funds, depend on that.

Financial positioning of big, medium-sized and small enterprises in Serbia

Negative consequences of global economic crisis reflected more or less on all enterprises, regardless of their size. The accompanying problems are well known: the fall of business activity, competitiveness and unemployment, the

lack of favourable financing sources, chronic economic illiquidity, the fall of credit potential, growth of indebtedness, operating with losses etc. We have already implied that most EU countries have problems to reach the level of employment and value added from the period before the crisis. In 2007, employment in Serbia in small, medium-sized and big enterprises was higher by 1.12 times compared to 2013, while value added was considerably higher in 2013 by 1.64 times compared to 2007. These results seem very encouraging. However, slightly deeper analysis reveals interesting details. If we report value added in stable currency (EUR), we will see that value added is higher only for big companies, while it falls for medium-sized and small enterprises. Under such circumstances, value added is higher in 2013 only by 1.06 times compared to 2007 at the level of economy. If we divide value added reported in euros by the number of employees, the indicator is higher by 1.19 times, which is mostly the result of decreased employee number. Thereby, such growth appears firstly owing to big companies (28%) and then, owing to medium-sized enterprises (18%), while there is almost no growth of the indicator in the group of small enterprises for the period (0.01%).

In order to provide more detailed financial positioning of big, medium-sized and small enterprises, we chose several important items in financial statements, such as: operating assets, net owners' equity, accumulated losses, operating revenues, operating income, financial expenses, net income and net losses. Along with these data, Table 2 offers detailed information on fluctuations in enterprise number and number of employees by years. Furthermore, the last column of the given table shows changes in 2013 compared to 2007 for each financial indicator.

Table 2 provides a broad picture of the importance of big, medium-sized and small enterprises for the functioning of the entire Serbian economy. It brings several important conclusions.

Firstly, short inspection of financial indicators leads to a conclusion that big companies have the dominant position in the Serbian economy. Their participation is the highest in operating assets (averagely 59.5% for the whole analysed period), net equity (69.2%) and operating revenues (52.9%). They have slightly lower participation in operating income (49.0%) and net income (49.2%). Unfortunately, big companies also generate the predominant part of financial expenses (64.8%), accumulated losses (60.0%) and net losses (54.6%) of the economy.

Secondly, medium-sized enterprises significantly lag behind big companies by their financial strength. Calculations based on average values for the whole analysed period show that medium-sized enterprises have almost twice as less employees, 3 times lower total assets, 4 times lower net equity, about 2.7 times lower operating expenses and operating income and 2.5 times lower net income. However, they participate less in accumulated losses (3.3 times), financial expenses (3.33 times) and net losses (2.9 times). It is interesting to note that, according to almost all financial parameters, medium-sized enterprises lag behind small enterprises, except that they have higher participation in net equity (3.6 percentage points) and lower participation in accumulated losses (3.9 percentage points).

Thirdly, small enterprises are somewhere between big and medium-sized enterprises by their performance. We should particularly emphasize their considerable participation in operating revenues (averagely 27.8% for the whole period), operating income (averagely 32.9%, but with an alarming fall from 2009 to 2013) and net income (averagely 30.7%). Also, we should point out a very worrying growth of their participation in accumulated losses, which reached a third of total cumulated losses in the economy in 2013.

Fourthly, it is interesting to note the changes in the structure of financial performance of big, medium-sized and small enterprises. In order to get a better picture of not only financial strength, but the level of recovery from the crisis, in Figure 4 we show the changes in 2013 compared to 2008, for each indicator (number of companies – NC, number of employees – NE, total assets – TA, net equity – NEq, accumulated losses – AL, operating revenue – OP, operating income – OI, financial expenses – FE, net income – NI and net losses – NL) and for each enterprise group (big, medium-sized and small companies).

Very alarming trends are noticed with small enterprises as well, since their participation is substantially growing in accumulated losses (from 16.1% in 2007 to 33.3% in 2013), financial expenses (from 14.2 to 18.7%)

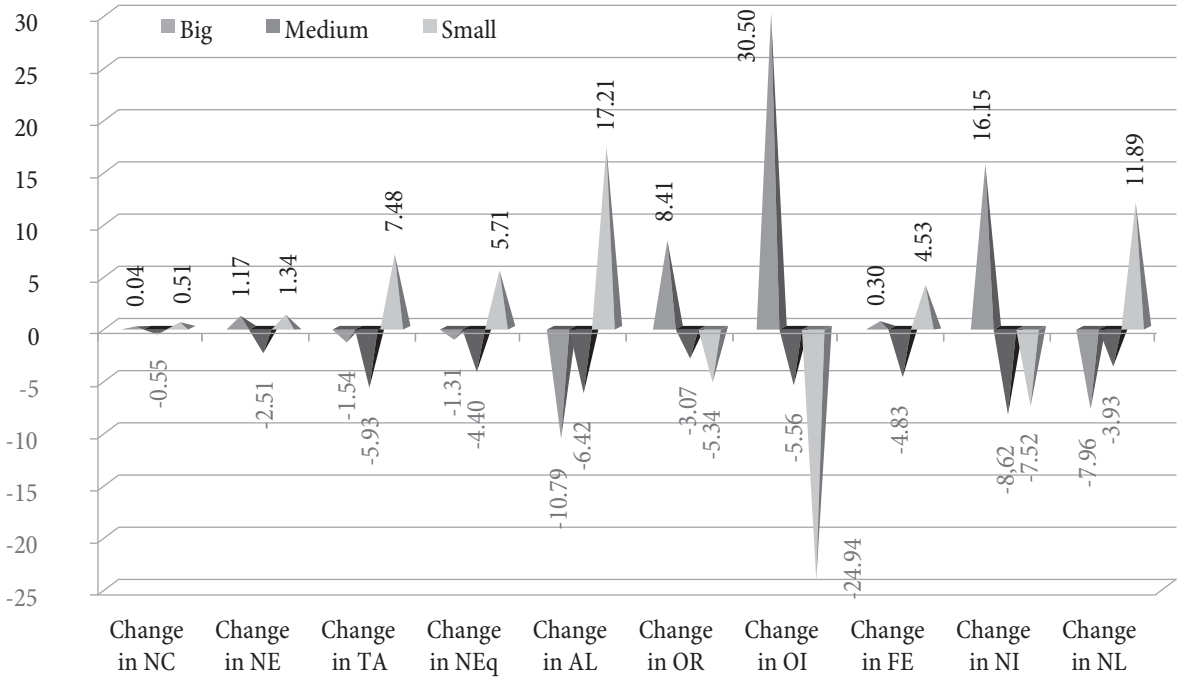
and net losses (from 15.7% to 27.6%) of the economy. At the same time, their participation is falling considerably in operating revenues (from 29.0% to 23.7%), operating income (from 42.3% to 17.4%) and net income (from 32.7% to 25.2%). This leads us to the problems related to financial structure and growth. Namely, it is well known that small enterprises have serious problems in terms of gathering necessary financing sources due to complicated approach

Table 2: Placement of big, medium-size and small companies by financial indicators

	2007	2008	2009	2010	2011	2012	2013	2013-2007
1. Participation in number of companies								
Big	0.93	1.00	1.02	0.91	0.92	1.01	0.97	0.04
Medium	3.57	3.82	3.79	3.15	2.99	3.09	3.02	(0.55)
Small	95.50	95.18	95.19	95.93	96.09	95.90	96.01	0.51
Economy	**87,550**	**92,577**	**94,573**	**90,985**	**91,901**	**93,369**	**94,362**	**6,812**
2. Participation in number of employees								
Big	42.06	42.02	41.98	41.93	42.05	43.09	43.23	1.17
Medium	23.28	23.27	22.93	21.90	21.12	20.71	20.78	(2.51)
Small	34.66	34.71	35.08	36.16	36.83	36.21	35.99	1.34
Economy	**1,113,659**	**1,124,036**	**1,072,605**	**1,001,913**	**1,011,531**	**1,010,000**	**991,030**	**(122,629)**
3. Participation in total assets								
Big	60.12	59.51	59.03	57.73	60.07	58.71	58.58	(1.54)
Medium	21.88	21.79	21.80	17.02	15.44	14.23	15.94	(5.93)
Small	18.01	18.70	19.17	25.25	24.49	27.06	25.48	7.48
Economy	**7,498.1**	**8,614.0**	**9,117.2**	**9,648.5**	**11,230.1**	**12,073.8**	**12,289.7**	**4,791.5**
4. Participation in net equity								
Big	70.29	68.96	68.63	65.89	71.94	68.02	68.98	(1.31)
Medium	18.73	19.27	18.99	16.22	13.63	13.00	14.33	(4.40)
Small	10.98	11.77	12.38	17.89	14.42	18.98	16.68	5.71
Economy	**3,531.0**	**3,562.9**	**3,501.9**	**3,385.6**	**4,452.4**	**4,486.1**	**4,485.0**	**954.0**
5. Participation in accumulated losses								
Big	63.92	62.01	59.86	57.01	55.31	52.37	53.13	(10.79)
Medium	20.00	20.06	22.23	15.08	14.72	14.84	13.58	(6.42)
Small	16.08	17.93	17.91	27.90	29.97	32.79	33.29	17.21
Economy	**1,100.9**	**1,374.3**	**1,649.9**	**1,947.9**	**2,233.1**	**2,507.1**	**2,856.7**	**1,755.8**
6. Participation in operating revenue								
Big	50.24	52.62	53.81	55.71	55.81	57.40	58.65	8.41
Medium	20.72	20.43	19.84	18.52	17.93	17.85	17.64	(3.07)
Small	29.04	26.94	26.35	25.77	26.26	24.75	23.71	(5.34)
Economy	**5,323.6**	**6,208.9**	**5,888.9**	**6,637.9**	**7,444.9**	**8,188.5**	**8,268.4**	**2,944.9**
7. Participation in operating income								
Big	36.54	40.46	59.82	62.41	59.14	62.41	67.04	30.50
Medium	21.16	22.15	17.13	16.89	18.19	18.06	15.60	(5.56)
Small	42.31	37.39	23.05	20.70	22.67	19.53	17.37	(24.94)
Economy	**162.9**	**193.5**	**187.7**	**282.5**	**296.5**	**361.1**	**354.3**	**191.5**
8. Participation in financial expenses								
Big	63.45	67.92	64.59	65.03	65.31	66.30	63.76	0.30
Medium	22.35	19.75	21.56	16.78	17.64	14.87	17.52	(4.83)
Small	14.19	12.32	13.86	18.20	17.05	18.83	18.72	4.53
Economy	**201.9**	**476.8**	**419.2**	**525.0**	**420.2**	**561.4**	**333.3**	**131,4**
9. Participation in net income								
Big	42.53	41.12	49.06	49.76	53.75	52.89	58.68	16.15
Medium	24.73	24.21	20.91	19.53	16.63	19.08	16.10	(8.62)
Small	32.74	34.67	30.03	30.70	29.62	28.03	25.22	(7.52)
Economy	**328.9**	**300.0**	**282.9**	**316.5**	**458.6**	**433.2**	**446.0**	**117.1**
10. Participation in net losses								
Big	66.57	57.63	55.46	48.97	45.98	53.05	58.61	(7.96)
Medium	17.76	22.24	23.44	17.65	17.79	14.51	13.84	(3.93)
Small	15.66	20.13	21.10	33.38	36.23	32.44	27.55	11.89
Economy	**279.0**	**343.5**	**385.1**	**406.2**	**373.7**	**520.2**	**469.2**	**190.1**

Note: All values are shown in billions of RSD

Figure 4: Change in participation structure



to financial markets, insufficient collateral, high mortality of these companies and consequent risks. If profitability is unsatisfactory as well, risks grow considerably, credit capacity falls, additional sources get more expensive, while sustainable growth is hard to reach.

Finally, it is important to emphasize that the recovery of Serbian economy from consequences of the crisis is rather delayed. Since small enterprises were considered to be more flexible and resistant to crisis situations than other companies in terms of their quick adjustment to changes, it was expected that they would push the economy forward and boost its recovery. Hence the surprise at the fact that their recovery in many ways lags behind the recovery of other, bigger enterprises. This clearly results in the need to seriously approach the problem of creating a favourable environment that would act as an incentive to financial performance and safety of such enterprises. Only in organized and stimulating environment could it be expected that these enterprises affect more seriously the employment growth.

Besides the above mentioned, we should not lose sight of the fact that Serbian companies created EUR 14,051 of value added by an employee in 2013, which is many times less than the same indicator in the EU. Thereby, the highest value added by an employee is in big enterprises (EUR 19,894), then in medium-sized enterprises (EUR 11,999) and, eventually, in small ones (EUR 8,710 by an employee). Obviously, a balanced approach is necessary in providing an environment for the functioning of all analysed company groups. It is true that big enterprises are burdened with great losses,[2] but this is also true for the small companies. Undoubtedly, there are huge opportunities to increase the employment and growth in SMEs sector. In this regard, our analysis can help in the identification of relevant problems and creation of directions for their resolving.

Methodological framework for the analysis

The discussion so far has shown that the analysed company groups are very heterogeneous in terms of their participation in total number of companies and employees and in terms of financial performance and changes in performance structure during the covered period. Our attention in this paper is directed towards more thorough analysis and evaluation of financial performance of small, medium-sized and big enterprises and their positioning in Serbian economy.

2 Special attention should be paid to big public companies. More on this in [6]

However, a thorough analysis of performance of big, medium-sized and small enterprises requires wider information basis that would enable more precise identification of problems all companies in Serbian economy face. Such analysis has to be based on official financial statements which, despite possible flaws, represent the best foundation for the global performance analysis. For this purpose, we used summary financial statements for Serbian economy that are grouped by enterprise size [13]. These summary financial statements for big, medium-sized and small enterprises are displayed in Table 3 and Table 4. Basic financial statements, balance sheet and income statement, are shown in the abridged form and somewhat differently structured compared to the official form. All latter statements, calculations, indicators and figures are derived by the authors.

Financial statement analysis provides a wide manoeuvring space for analysts to apply various techniques and draw important conclusions on financial risks, profitability, potential growth and other important phenomena. The need to estimate the level of profitability and indebtedness, volatility of return potential and level of exposure to business and financial risks cannot be successfully satisfied without financial statements.

Along with the above mentioned, we must bear in mind the limitations of the analysis based on summary financial statements. So, for example, net income (loss) is derived from offsetting net income with net losses. Income tax is obtained by cumulating all tax expenses of the period, so it exists even in those years when certain company group or economy as a whole operates with losses.

Cumulating all positions in balance sheets and income statements provides the insight into global position of the economy, sectors or otherwise defined company set. Furthermore, it means that, among big, medium-sized and small enterprises, there are companies operating with huge losses which distort the profitability of the analyzed group of companies. At the same time, there are also financially successful companies with the above-average performance which represent the healthy part of the economy. Burdening summary financial reports with huge losses is not as much the problem of accounting, as the problem of unacceptable maintaining the non-perspective and often already devastated companies in operations. Primarily, the problem is that insolvent and financially stumbled companies pull the healthy parts of an economy into illiquidity, insolvency and other financial problems. This fact alone warns enough those in charge to comply with relevant laws of market economies.

Problem of inefficiency and insufficient profit margins

Nowadays, the Serbian economy is burdened with numerous problems that do not result only from the economic crisis. Practically, long before the first hints of global crisis, our economy choked in the inherited, serious structural disorders, economic sanctions, insufficiently thoughtful economic policies, increasing lag in technical and technological development, slow and inefficient transition, lack of transparency in changing the ownership structure, undeveloped and very shallow capital market, lack of knowledge etc. Year by year, the consequences of these problems have been growing with more or less intensity. So, nowadays, we can say that Serbian economy is burdened with illiquidity, lack of working capital, high level of indebtedness, low efficiency, low employment rate, resulting high short-term and long-term operating and financial risks, and maybe the most serious problem – unacceptably low profit potential. If we would like to present the last problem in brief, we could say in advance that it was substantially initiated by inefficiency and insufficient profit margins on one hand and unsatisfactory return on equity on the other hand. Of course, the both aspects of decreased profit potential of Serbian economy are caused by numerous problems which we will try to identify hereinafter, discover their causes and measure the consequences.

A glance at the review of income statement reveals that Serbian economy operated mostly with losses in the analysed period. The exceptions to this observation are 2007 and 2011, when the economy was briefly on the territory of positive net income. However, as our analysis will show hereinafter, those short breaks from losses were much more the consequence of calming of the foreign exchange rate fluctuations than of any significant twist in

Table 3: Abridged Balance Sheet

in billions of RSD

	Big companies								Medium-sized companies								Small companies							
Positions	2006	2007	2008	2009	2010	2011	2012	2013	2006	2007	2008	2009	2010	2011	2012	2013	2006	2007	2008	2009	2010	2011	2012	2013
A Fixed Assets	**2,678.4**	**3,247.3**	**3,487.3**	**3,591.1**	**3,550.6**	**4,633.8**	**4,692.1**	**4,799.3**	**625.4**	**972.2**	**1,097.0**	**1,159.2**	**868.0**	**886.3**	**855.6**	**1,104.9**	**631.7**	**541.7**	**659.8**	**731.8**	**1,149.0**	**1,329.5**	**1,528.9**	**1,380.0**
I Subscribed capital unpaid	6.5	5.1	4.5	3.9	19.2	7.6	1.4	2.4	9.2	8.5	34.4	21.9	1.3	1.4	2.4	1.1	8.5	7.5	9.2	35.9	43.8	44.1	29.8	22.8
II Goodwill	1.4	3.6	5.9	5.1	5.3	10.3	10.7	31.4	0.3	0.3	0.5	2.5	0.8	0.5	0.8	1.1	0.3	0.3	0.2	0.6	3.1	1.1	1.6	1.9
III Intangible assets	72.2	88.4	128.4	123.5	132.6	135.2	147.4	147.1	12.7	48.9	25.3	30.7	16.1	22.7	18.0	20.1	13.6	10.8	32.1	28.1	46.7	41.3	45.9	45.0
III Property, plant and equipment	1,986.0	2,382.0	2,567.9	2,639.4	2,654.1	3,694.4	3,744.9	3,849.5	512.2	741.5	848.7	900.4	732.1	746.0	727.9	835.7	499.1	453.2	534.1	565.8	840.5	967.1	1,053.8	1,073.9
IV Long-term investments	612.3	768.1	780.6	819.1	739.4	786.3	787.7	768.9	91.0	173.1	188.2	203.7	117.6	115.7	106.5	246.9	110.2	69.8	84.1	101.4	214.9	276.0	397.8	236.4
B Current assets	**1,013.5**	**1,204.6**	**1,550.0**	**1,677.7**	**1,875.8**	**1,976.4**	**2,228.7**	**2,231.8**	**405.4**	**642.1**	**726.5**	**771.1**	**715.9**	**794.3**	**810.4**	**809.4**	**717.2**	**779.5**	**909.0**	**974.1**	**1,228.9**	**1,357.3**	**1,651.6**	**1,671.8**
I Inventories	336.2	420.3	519.0	526.5	578.7	612.8	743.5	663.2	150.6	250.2	270.4	267.1	252.8	267.6	263.3	262.6	275.4	298.3	357.4	367.2	434.5	506.9	528.8	538.2
II Account receivable	522.6	568.6	746.0	806.3	902.0	932.3	1,050.7	1,100.7	197.9	276.7	333.1	353.3	340.5	378.1	363.5	382.1	347.4	365.3	432.0	476.1	587.8	619.9	672.9	682.4
III Short-term investments	80.5	115.5	179.8	218.2	258.3	255.0	255.0	274.3	25.6	61.2	76.8	98.7	80.4	100.2	126.7	101.1	28.9	39.2	46.7	60.2	117.4	127.6	156.4	152.9
IV Cash and cash equivalents	74.2	100.2	105.1	126.6	136.8	176.3	179.5	193.5	31.3	54.0	46.3	52.1	42.3	48.3	57.0	63.5	65.5	76.8	72.9	70.6	89.2	102.9	293.5	298.3
C Value Added Tax and Accruals	**42.9**	**45.1**	**78.0**	**101.6**	**127.4**	**114.4**	**140.8**	**139.1**	**12.5**	**19.8**	**46.6**	**49.5**	**50.8**	**45.7**	**40.7**	**35.0**	**28.2**	**27.0**	**39.5**	**38.9**	**53.4**	**58.1**	**81.7**	**74.1**
D Deferred tax assets	**8.3**	**10.9**	**10.8**	**11.6**	**16.6**	**21.0**	**27.0**	**28.9**	**2.9**	**6.1**	**6.7**	**7.8**	**7.1**	**7.9**	**11.1**	**9.8**	**2.5**	**1.9**	**2.8**	**3.0**	**4.9**	**5.2**	**5.1**	**5.7**
E Total assets	**3,743.2**	**4,507.8**	**5,126.0**	**5,381.9**	**5,570.4**	**6,745.7**	**7,088.7**	**7,199.1**	**1,046.2**	**1,640.2**	**1,876.9**	**1,987.5**	**1,641.9**	**1,734.2**	**1,717.8**	**1,959.0**	**1,379.6**	**1,350.1**	**1,611.1**	**1,747.8**	**2,436.2**	**2,750.2**	**3,267.3**	**3,131.6**
F Loss over capital	**101.1**	**118.8**	**152.9**	**204.8**	**264.8**	**337.0**	**387.9**	**475.8**	**37.2**	**75.7**	**90.3**	**138.4**	**110.4**	**105.6**	**140.0**	**145.3**	**94.6**	**85.5**	**127.0**	**161.7**	**279.3**	**363.6**	**460.7**	**531.5**
G Total assets and loss over capital	**3,844.3**	**4,626.7**	**5,279.0**	**5,586.8**	**5,835.2**	**7,082.6**	**7,476.6**	**7,674.9**	**1,083.4**	**1,715.9**	**1,967.1**	**2,125.9**	**1,752.3**	**1,839.8**	**1,857.8**	**2,104.3**	**1,474.3**	**1,435.6**	**1,738.0**	**1,909.5**	**2,715.5**	**3,113.9**	**3,728.0**	**3,663.0**
Positions																								
A Equity	**2,194.5**	**2,606.0**	**2,614.5**	**2,612.2**	**2,514.7**	**3,547.7**	**3,440.6**	**3,572.2**	**543.5**	**745.5**	**811.3**	**825.4**	**661.0**	**714.0**	**725.6**	**789.1**	**526.9**	**480.6**	**555.4**	**630.9**	**928.7**	**1,049.9**	**1,342.2**	**1,302.6**
B Long-term provisions	**22.6**	**32.2**	**42.9**	**54.4**	**58.4**	**59.6**	**73.8**	**83.0**	**4.2**	**6.7**	**8.8**	**8.9**	**9.8**	**9.9**	**13.4**	**13.8**	**4.2**	**4.3**	**4.4**	**8.9**	**13.6**	**18.9**	**14.2**	**19.6**
C Long-term liabilities	**530.4**	**665.0**	**882.9**	**1,042.9**	**1,145.1**	**1,185.2**	**1,278.6**	**1,171.8**	**127.5**	**328.6**	**361.8**	**398.1**	**304.8**	**310.3**	**284.4**	**373.4**	**192.5**	**168.7**	**226.9**	**239.1**	**399.0**	**437.6**	**605.9**	**511.8**
D Short-term financial liabilities	**243.0**	**334.0**	**564.8**	**628.3**	**720.0**	**722.1**	**828.0**	**905.0**	**82.1**	**156.2**	**227.6**	**286.3**	**234.1**	**229.7**	**242.1**	**294.2**	**142.4**	**176.6**	**236.3**	**265.6**	**410.6**	**470.7**	**515.1**	**547.8**
E Current operating liabilities	**800.0**	**910.5**	**985.6**	**1,033.9**	**1,161.8**	**1,233.8**	**1,430.6**	**1,518.4**	**310.8**	**461.4**	**510.9**	**556.1**	**491.0**	**509.8**	**521.4**	**547.0**	**588.5**	**586.1**	**660.2**	**726.3**	**895.9**	**1,058.6**	**1,144.2**	**1,176.7**
F Accrual and deferred income	**31.3**	**35.9**	**141.1**	**170.7**	**191.0**	**225.2**	**285.4**	**277.1**	**13.5**	**14.5**	**41.6**	**46.0**	**46.5**	**60.5**	**63.5**	**77.4**	**18.9**	**18.2**	**53.4**	**36.9**	**64.8**	**74.6**	**100.0**	**97.4**
G Deferred tax liabilities	**22.5**	**43.0**	**47.3**	**44.3**	**44.1**	**108.9**	**139.6**	**147.4**	**1.8**	**3.1**	**5.0**	**5.1**	**5.2**	**5.5**	**7.3**	**9.3**	**0.8**	**1.0**	**1.4**	**1.7**	**2.9**	**3.5**	**6.5**	**7.0**
H Total capital and liabilities	**3,844.3**	**4,626.7**	**5,279.0**	**5,586.8**	**5,835.2**	**7,082.6**	**7,476.6**	**7,674.9**	**1,083.4**	**1,715.9**	**1,967.1**	**2,125.9**	**1,752.3**	**1,839.8**	**1,857.8**	**2,104.3**	**1,474.3**	**1,435.6**	**1,738.0**	**1,909.5**	**2,715.5**	**3,113.9**	**3,728.0**	**3,663.0**

Table 4: Abridged Income Statement

in billions of RSD

	Big companies								Medium-sized companies								Small companies							
Positions	2006	2007	2008	2009	2010	2011	2012	2013	2006	2007	2008	2009	2010	2011	2012	2013	2006	2007	2008	2009	2010	2011	2012	2013
A Operating revenues and expenses																								
I Operating revenues	2,156.9	2,674.6	3,267.3	3,169.0	3,697.7	4,154.8	4,700.0	4,849.4	791.3	1,102.8	1,268.7	1,168.3	1,229.4	1,334.7	1,461.7	1,458.9	1,461.3	1,546.2	1,672.9	1,551.5	1,710.8	1,955.4	2,026.8	1,960.1
II Operating expenses	2,117.1	2,615.1	3,189.0	3,056.7	3,521.4	3,979.5	4,474.6	4,611.9	776.7	1,068.3	1,225.9	1,136.2	1,181.7	1,280.7	1,396.5	1,403.6	1,404.4	1,477.3	1,600.6	1,508.2	1,652.3	1,888.2	1,956.3	1,898.6
III Operating income (loss)	**39.8**	**59.5**	**78.3**	**112.3**	**176.3**	**175.3**	**225.4**	**237.5**	**14.6**	**34.5**	**42.8**	**32.2**	**47.7**	**53.9**	**65.2**	**55.3**	**56.8**	**68.9**	**72.3**	**43.3**	**58.5**	**67.2**	**70.5**	**61.5**
B Financial revenues and expenses																								
I Financial revenues	141.9	107.1	176.3	144.2	170.7	197.8	216.4	152.3	22.8	31.5	40.5	32.1	37.0	42.0	42.6	33.2	32.2	19.2	27.6	22.5	30.9	39.1	46.3	30.4
II Financial expenses	111.4	128.1	323.8	270.7	341.4	274.4	372.2	212.5	33.0	45.1	94.2	90.4	88.1	74.1	83.5	58.4	33.4	28.7	58.8	58.1	95.5	71.6	105.7	62.4
III Net financial revenues (expenses)	**30.5**	**(21.0)**	**(147.5)**	**(126.5)**	**(170.7)**	**(76.6)**	**(155.8)**	**(60.2)**	**(10.2)**	**(13.6)**	**(53.7)**	**(58.3)**	**(51.1)**	**(32.1)**	**(40.8)**	**(25.2)**	**(1.2)**	**(9.5)**	**(31.2)**	**(35.6)**	**(64.7)**	**(32.5)**	**(59.4)**	**(32.1)**
C Net other gains and expenses	**(23.6)**	**(86.5)**	**9.4**	**(49.6)**	**(37.9)**	**(6.9)**	**(127.0)**	**(162.5)**	**9.8**	**14.6**	**12.0**	**(1.3)**	**(1.8)**	**(7.1)**	**(10.3)**	**(14.0)**	**1.4**	**12.7**	**1.1**	**2.2**	**(24.4)**	**(21.1)**	**(46.4)**	**(33.3)**
D Income (loss) before taxes	**46.7**	**(48.1)**	**(59.9)**	**(63.8)**	**(32.2)**	**91.8**	**(57.4)**	**14.8**	**14.2**	**35.5**	**1.2**	**(27.4)**	**(5.2)**	**14.8**	**14.1**	**16.0**	**57.0**	**72.1**	**42.3**	**9.9**	**(30.6)**	**13.6**	**(35.2)**	**(3.8)**
E Income taxes	**8.4**	**20.6**	**8.9**	**13.9**	**18.8**	**22.8**	**44.7**	**35.3**	**4.3**	**6.6**	**5.6**	**5.2**	**5.0**	**6.2**	**5.5**	**7.7**	**6.8**	**6.8**	**6.8**	**5.6**	**6.9**	**9.8**	**7.7**	**10.6**
F Paid to owners	**0.3**	**1.0**	**6.9**	**5.3**	**5.4**	**5.7**	**4.3**	**2.5**	**0.3**	**1.2**	**1.6**	**1.2**	**1.6**	**1.4**	**2.1**	**1.5**	**1.2**	**2.4**	**2.0**	**1.6**	**2.3**	**3.5**	**4.4**	**1.9**
G Net income (loss) after taxes	**41.1**	**(45.9)**	**(74.6)**	**(74.8)**	**(41.4)**	**74.6**	**(46.8)**	**(13.3)**	**12.9**	**31.8**	**(3.8)**	**(31.1)**	**(9.9)**	**9.8**	**7.1**	**6.9**	**51.3**	**64.0**	**34.9**	**3.7**	**(38.4)**	**0.4**	**(47.3)**	**(16.8)**
EBITDA	**261.9**	**234.9**	**418.9**	**370.3**	**459.6**	**547.3**	**499.8**	**431.3**	**71.3**	**113.5**	**126.8**	**95.6**	**114.5**	**122.9**	**133.7**	**112.1**	**117.6**	**128.5**	**128.8**	**102.7**	**98.5**	**128.8**	**108.2**	**102.2**
EBIT	**147.0**	**67.2**	**231.6**	**179.9**	**275.0**	**338.8**	**277.6**	**206.0**	**43.9**	**76.1**	**85.9**	**53.9**	**74.1**	**81.5**	**89.2**	**68.6**	**87.0**	**97.9**	**95.1**	**62.2**	**55.4**	**78.1**	**59.9**	**52.3**

the efficiency of the economy. The losses in all remaining years mostly come from a group of big companies which, even in 2007, reported loss higher than profit that this group achieved in 2006. Unlike them, medium-sized companies were obviously more successful, since they managed to earn profits in the last three years, which makes them the most successful part of the economy, at least according to this preliminary analysis. Small companies managed to defy the first strikes of crisis, obviously due to higher flexibility, and, until 2009, maintained the profitability of their operations. After that, these companies also ended up with losses.

We will gather more details for our story if we deal with the structure of reported earnings. The most important component of earnings, operating income, is not only positive at the economy level, but it also rises in all analysed years. Similar trend is present in certain company groups as well. Such achievements naturally impress, but only at first glance. We could easily realize that this is the truth if we ask ourselves whether positive achievements in the field of so-called core business are enough to provide final profitability of the economy and its companies. Based on our preliminary impressions, they are obviously not, and we are now interested why.

There is no doubt that perceiving absolute, rather than relative amount of reported operating income and all other kinds of earnings cannot help us answer this question. We will find the answer if we link certain components of earnings with generated sales revenues, which are crucial to cover total expenses. The resulting indicators are shown in Table 5.

If we consider only the operating income margin, we could easily identify the first and maybe the most important cause of the infertility of our economy. Our analysis reveals that operating income margins are very modest and that they do not reach the level of 5% in any year, whereby this observation is equally true for the economy as a whole and for certain enterprise groups. Such results are clearly insufficient to cover accumulated financial expenses, primarily interest costs and foreign exchange losses. Consequently, profit margins are mostly negative or marginally positive. To be precise, in terms of achieved profit margins, small companies have better position at the beginning, and medium-sized companies at the end of analysed period. However, as we will see later, these positive profit margins, along with a bit faster turnover of equity and assets compared to other company groups and economy as a whole, will provide profits to the

Table 5: Indicators of profit margin

	2007	2008	2009	2010	2011	2012	2013
Big companies							
Operating income margin	2.24	2.41	3.55	4.79	4.25	4.82	4.90
EBITDA margin	8.84	12.92	11.72	12.48	13.26	10.69	8.89
EBIT margin	2.53	7.14	5.69	7.47	8.21	5.94	4.25
Profit margin	(1.73)	(2.30)	(2.37)	(1.12)	1.81	(1.00)	(0.27)
Medium-sized companies							
Operating income margin	3.16	3.42	2.77	3.89	4.05	4.48	3.78
EBITDA margin	10.41	10.13	8.23	9.33	9.24	9.18	7.68
EBIT margin	6.98	6.86	4.64	6.03	6.12	6.13	4.70
Profit margin	2.91	(0.30)	(2.68)	(0.80)	0.74	0.49	0.47
Small companies							
Operating income margin	4.49	4.38	2.81	3.44	3.45	3.50	3.15
EBITDA margin	8.37	7.80	6.67	5.79	6.62	5.36	5.23
EBIT margin	6.38	5.76	4.04	3.26	4.01	2.97	2.68
Profit margin	4.17	2.11	0.24	(2.26)	0.02	(2.34)	(0.86)
Economy							
Operating income margin	3.08	3.15	3.20	4.27	4.00	4.43	4.29
EBITDA margin	9.03	10.97	9.70	10.17	10.79	9.10	7.81
EBIT margin	4.57	6.71	5.05	6.12	6.73	5.24	3.96
Profit margin	0.94	(0.71)	(1.74)	(1.36)	1.15	(1.07)	(0.28)

group of small enterprises but only in the first two years of the analysed period.

Unlike the positive profit margins that small and medium-sized enterprises managed to generate in the first three and last three years, positive profit margins at the level of economy and big enterprises appeared only sporadically. To be precise, such results were achieved in 2007 and 2011 at the economy level, and in 2011 in the case of big enterprises. Where do these deviations come from and is there any rational explanation for them? Firstly, mind that during the whole period the economy, big, medium-sized and small enterprises reported serious losses in the sub-section of income statement that summarizes financial revenues and expenses. Those losses annulled practically all efforts to generate profit by conducting operating activities, and they resulted from fluctuations in two basic components of financial expenses. Firstly, interest costs have been growing year by year due to increasing level of indebtedness. Secondly, foreign exchange losses also had a negative impact on net income of companies due to commonly inserted currency clause in loan contracts, especially in years when the dinar depreciated against the euro. Only in 2007 and 2011 foreign exchange rate was relatively stable in comparison to previous reporting year (see Table 8), and as a result, in those years the adverse influence of foreign exchange losses on the bottom line was reduced compared to years when the value of the dinar was falling. So, for these reasons the generated net income and profit margin of economy and big enterprises in stated years should be taken cautiously since they are obviously achieved neither as the result of higher efficiency, nor as the result of better cost management.

In these situations, analysts very often complement the analysis of margins by the concepts of Earnings Before Interest and Tax – EBIT and Earnings Before Interest, Tax, Depreciation and Amortization – EBITDA. When it comes to EBITDA, it is a valuable analytical instrument because at the same time it indicates the profitability and represents a rough approximation of cash flows from operating activities (CFO). Furthermore, since EBITDA is acquitted from depreciation, amortization, interest expenses and taxes, it represents a measure of earned profit, which is additionally acquitted from the chosen capital structure of a company. Presented EBITDA (previously in cumulative income statements) and its participation in sales revenues (Table 1) confirm the validity of profitability analysis from this perspective. Namely, in the whole analysed period, EBITDA is a few times (in some years even dozens of times) higher then net income/losses, whereby medium-sized enterprises are dominant in this sense, especially in the last three analysed years. As big and small companies on one hand, and the entire economy on the other hand accumulate serious losses, especially in the second part of the analysed period, we may draw a conclusion that their somewhat normal functioning persists owing to high EBITDA values.

Speaking of EBIT and its participation in revenues from sales, let us firstly point out that this earnings concept approximates total earnings which would be achieved if companies and economy could somehow afford themselves financing only from internal owners' sources. In spite of accumulated operating losses, positive values of this indicator (given in earlier income statements of entire economy and relevant company groups) are result of high interest expenses. That is why total earnings, in this case marked as EBIT, are not enough to cover interest costs in most analysed years, decreasing the equity of our economy and forcing it, year by year, to additionally borrow. Both factors weaken dramatically the return potential of the economy and many companies as well.

Besides the fact that only a small part of revenues from sales hardly ever finds its way to bottom line, additional problem of our economy comes in the form of insufficient efficiency in assets and capital management. This inefficiency results from unacceptably low level of activity, low employment and unsatisfactory level of utilization of capacities which are thereby very outdated and deprived of any possibility to be restored. Indicators given in Table 6 speak convincingly enough in favour of all these claims.

We can easily notice that total assets turnover and operating assets turnover didn't exceed 1in the covered period which abridged the effect of multiplication. This effect can be observed when gains in asset efficiency result in the multiple increase in profitability of companies and economy. To make things worse, the values of certain

Table 6: Key efficiency indicators

	2007	2008	2009	2010	2011	2012	2013
Big companies							
Assets turnover	0.64	0.67	0.60	0.67	0.67	0.68	0.68
Operating assets turnover	0.80	0.83	0.74	0.83	0.81	0.80	0.80
Equity turnover	1.16	1.31	1.30	1.59	1.52	1.50	1.58
Medium-size companies							
Assets turnover	0.82	0.72	0.61	0.68	0.79	0.84	0.80
Operating assets turnover	0.94	0.84	0.72	0.79	0.90	0.97	0.94
Equity turnover	1.88	1.86	1.72	2.02	2.30	2.45	2.38
Small companies							
Assets turnover	1.13	1.12	0.93	0.83	0.76	0.68	0.62
Operating assets turnover	1.25	1.22	1.02	0.94	0.89	0.81	0.72
Equity turnover	3.78	4.10	3.61	3.27	3.12	2.70	2.44
Economy							
Assets turnover	0.78	0.77	0.67	0.71	0.71	0.70	0.68
Operating assets turnover	0.92	0.91	0.79	0.85	0.84	0.83	0.80
Equity turnover	1.62	1.73	1.66	1.92	1.89	1.82	1.84

indicators from the shown table have decreased year by year. We may notice that this is not the case with equity turnover. However, the increase in the values of that indicator is unfortunately more the consequence of decreasing owners' equity caused by accumulated losses than the consequence of increasing revenue generating capabilities of the economy and its parts. In order to support this claim, let us note that, averagely, every year, losses swallow more than a third of owners' equity at the economy level [7]. Big companies precede here, which is not much of a surprise, but surprising are losses of small companies, which are soaring in second part of the analysed period.

Problem of unsatisfactory return on equity

Based on previous analysis, it is obvious that profit margins and the efficiency of economy are unacceptably low. Evidently, such performance cannot satisfy the interests of current investors or be appealing enough to attract new investors. We can support this conclusion by using widespread measures of profitability in the further analysis, which link reported earnings to capital and/or assets involved in creation of earnings. Of course, we speak of various measures of return on investment whose fluctuations in the covered 7-year period are shown in Table 7.

For the purpose of this research we chose Return on Operating Assets – ROOA, Return on Assets – ROA and Return on Equty – ROE. Opting for chosen return measures is totally reasonable. The first one of them, ROOA, measures the profitability of so-called core business. ROA should be used to estimate return acquitted from the influence of chosen capital structure, while ROE represents both the test for fulfilling owners' interests and indicator of investment attractiveness.

Generally speaking, the profitability of Serbian economy, measured by any of these indicators, is far from satisfactory. ROOA values should be high enough to provide satisfactory return to investors after covering the costs of borrowed capital, other expenses and tax costs. In this regard, it is enough to compare reported ROOA values (e.g. at the economy level the highest value was 3.66% in 2012) to calculated costs of borrowed capital displayed in Table 8 (at the economy level they rise from 8.82% up to 22.03%).[3] to make clear how modest operating earnings are and to what extent ROOA values are far from acceptable. Obviously, there is a problem on both sides, i.e. profitability of core business is unacceptably low, and the costs of borrowed capital are intolerably high for current profit potential of the economy and companies. At this point, it is evident that there is a strong correlation

3 Since we had only financial statements at our disposal, average costs of borrowed capital were calculated from the relation between total financial expenses and average liabilities understood as the sum of long-term loans and short-term financial liabilities. The obtained results can be considered an acceptable approximation for the purpose of perceiving profit potential of the economy and its parts.

Table 7: Key profitability indicators

	2007	2008	2009	2010	2011	2012	2013
Big companies							
ROOA	1.79	2.01	2.64	3.96	3.42	3.84	3.89
ROA	1.63	4.81	3.43	5.03	5.51	4.02	2.88
ROE	(2.01)	(3.02)	(3.08)	(1.79)	2.75	(1.50)	(0.43)
Effects of financial leverage	Negative	Negative	Negative	Negative	Negative	Negative	Negative
Medium-size companies							
ROOA	2.97	2.88	1.98	3.07	3.65	4.35	3.57
ROA	5.70	4.95	2.83	4.11	4.83	5.18	3.73
ROE	5.48	(0.56)	(4.60)	(1.63)	1.69	1.20	1.13
Effects of financial leverage	Negative	Negative	Negative	Negative	Negative	Negative	Negative
Small companies							
ROOA	5.59	5.35	2.86	3.24	3.08	2.83	2.28
ROA	7.22	6.46	3.75	2.70	3.06	2.02	1.65
ROE	15.77	8.65	0.87	(7.39)	0.07	(6.33)	(2.10)
Effects of financial leverage	Positive	Positive	Negative	Negative	Negative	Negative	Negative
Economy							
ROOA	2.85	2.87	2.54	3.62	3.37	3.66	3.42
ROA	3.54	5.14	3.36	4.34	4.80	3.68	2.69
ROE	1.53	(1.23)	(2.89)	(2.60)	2.16	(1.95)	(0.52)
Effects of financial leverage	Negative	Negative	Negative	Negative	Negative	Negative	Negative

between costs of debt and changes in the exchange rate between the dinar and the euro.[4]

Similar evaluation holds true for ROA values as well. Namely, if we see ROA as the indicator of capability to pay back debts, then its evident lag behind the costs of borrowed capital indicates the negative effect of financial leverage and unenviable position of the economy. Such a conclusion has another confirmation in fluctuations of ROE. Under normal circumstances, when the economy is profitable, it is logical that ROA is above the costs of debt and that the excess return goes to owners. This results in the fact that profitable business is characterized by ROE higher than ROA. As seen from the displayed results of our analysis, in the last 7 years, that has not been the case in our economy. In other words, in the analysed period, cost of debt was always higher than ROA, so, due to this fact, negative effects overflowed into ROE which fell below ROA. This is a typical example of negative effect of financial leverage. To make things even worse, in 5 out of 7 analysed years ROE values were negative. Let us point out once again that those values remained positive only in the years when exchange rate between the dinar and the euro was stable and did not derogate the generated operating earnings by great amounts of foreign exchange losses.

Of course, our previous marks are general in nature and concern the economy as a whole. We should not lose sight of the fact that there is a number of rather profitable companies in our economy. However, their profits are substantially lower than losses of unsuccessful companies, which decreases the profit potential of our economy.[5]

Table 8: Cost of debt and exchange rate between RSD and EUR

	Big companies	Medium-size companies	Small companies	Economy	Foreign exchange rate	Increase in exchange rate
2007	14.45%	13.00%	8.43%	12.83%	79.24	1.00
2008	26.47%	17.54%	14.53%	22.03%	88.60	1.12
2009	17.36%	14.19%	12.00%	15.64%	95.89	1.08
2010	19.31%	14.40%	14.54%	17.29%	105.50	1.10
2011	14.55%	13.74%	8.34%	12.79%	104.64	0.99
2012	18.55%	15.65%	10.42%	15.79%	113.72	1.09
2013	10.16%	9.78%	5.72%	8.82%	114.64	1.01

4 More details on this in [8]

5 For example, a sector whose profitability deviates from the profitability of the general economy is tellecomunications sector. More on this in [9]

Since in this paper we also dealt with the performance of companies grouped by their size, it is interesting to point out that only small companies deviated from previous conclusions, managing, as a group, to achieve positive effect of financial leverage in the first two years of the analysed period. However, positive effect of financial leverage was out of reach for the group of big companies during the whole analysed period, while medium-sized companies, despite profits in the last three years, didn't manage to bring closer the values of ROE and ROA.

After previous discussion, it is logical to ask ourselves where such low ROE values in our economy come from. We can complete the picture of unsatisfactory profitability if we disaggregate ROE even more and involve, besides ROA, solvency and interest burden. One of the ways to do that is to use four-component disaggregation of ROE, displayed in Table 9.

In order to understand better the conclusions hereinafter, firstly let us clarify the displayed components of ROE. Solvency represents the ratio of average assets to average equity. Assets turnover is calculated by dividing sales revenues by average assets. EBIT margin is the participation of this earnings concept in sales revenues, while interest burden represents the ratio of net income to EBIT. Also, it is obvious that the product of two medium components of the above formula represents ROA. Regarding ROA, mind that it is a return that depends on companies' operating abilities, since EBIT is an earnings concept acquitted from the influence of financing effects. So, the medium parts of ROE four-component formula are, among other things, determined by operating abilities, i.e. business risk. On the other hand, the first and the fourth component of ROE are directly related to borrowing. Theoretically speaking, if there were no borrowing, the first and fourth component of ROE would equal one, meaning that there would be neither financial risk nor the effect of financial leverage. Evidently, ROE and ROA would be equal in that case. However, since borrowing is more realistic option, in practice, the first component will be more than one (because the assets will be higher than equity), and the last component will be less than one (since interest costs will absorb a part of net income). Based on this, the conclusion is that indebtedness growth may result in the increase or decrease of profitability. The increase

Table 9: Four-component disaggregation of ROE

	2007	2008	2009	2010	2011	2012	2013
Big companies							
1. Solvency (leverage)	1.80	1.95	2.16	2.36	2.26	2.21	2.32
2. Assets turnover	0.64	0.67	0.60	0.67	0.67	0.68	0.68
3. EBIT margin	2.53	7.14	5.69	7.47	8.21	5.94	4.25
4. Interest burden	(0.68)	(0.32)	(0.42)	(0.15)	0.22	(0.17)	(0.06)
5. ROE (1x2x3x4)	(2.01)	(3.02)	(3.08)	(1.79)	2.75	(1.50)	(0.43)
Medium-size companies							
1. Solvency (leverage)	2.30	2.58	2.82	2.97	2.92	2.90	3.00
2. Assets turnover	0.82	0.72	0.61	0.68	0.79	0.84	0.80
3. EBIT margin	6.98	6.86	4.64	6.03	6.12	6.13	4.70
4. Interest burden	0.42	(0.04)	(0.58)	(0.13)	0.12	0.08	0.10
5. ROE (1x2x3x4)	5.48	(0.56)	(4.60)	(1.63)	1.69	1.20	1.13
Small companies							
1. Solvency (leverage)	3.34	3.65	3.89	3.95	4.09	3.98	3.97
2. Assets turnover	1.13	1.12	0.93	0.83	0.76	0.68	0.62
3. EBIT margin	6.38	5.76	4.04	3.26	4.01	2.97	2.68
4. Interest burden	0.65	0.37	0.06	(0.69)	0.01	(0.79)	(0.32)
5. ROE (1x2x3x4)	15.77	8.65	0.87	(7.39)	0.07	(6.33)	(2.10)
Economy							
1. Solvency (leverage)	2.08	2.26	2.49	2.71	2.65	2.60	2.71
2. Assets turnover	0.78	0.77	0.67	0.71	0.71	0.70	0.68
3. EBIT margin	4.57	6.71	5.05	6.12	6.73	5.24	3.96
4. Interest burden	0.21	(0.11)	(0.35)	(0.22)	0.17	(0.20)	(0.07)
5. ROE (1x2x3x4)	1.53	(1.23)	(2.89)	(2.60)	2.16	(1.95)	(0.52)

of profitability arises if the product of multiplication between the indicators of solvency and interest burden is more than one.[6] Then there will be a positive effect of financial leverage, manifested through the increase in owners' return, i.e. ROE above ROA. Of course, in the opposite case, borrowing inevitably leads towards the fall of profitability and negative effect of financial leverage. Thereby, borrowing limit is obtained by the equation of ROA with the costs of borrowed capital. Then ROA equals ROE, which, again, means that borrowing brings positive effects up to that limit, and negative effects upon exceeding that limit.

Following these notes, it is obvious that the first and fourth component of disaggregated version of ROE deserve our special attention. Speaking of solvency, firstly mind that it grows at all levels. At the economy level, debts amount to more than 60% of total capital in the whole analysed period. This puts a strong pressure on financial expenses (that effect is multiplied by the depreciation of dinar) and net income. Let us notice that solvency of medium-sized enterprises is higher then the solvency of big enterprises and the entire economy. A particularly alarming is the solvency of small enterprises, which isn't in line with rational, expectations only at first sight. When we consider all the difficulties that these companies have in gathering the capital, it should not be surprising that they are highly indebted and that they have to bear much higher interest expenses than big and medium-sized companies.

Nevertheless, we can get a more complete picture of the effects of borrowing only if we include the indicator of interest burden in the analysis. There are visible sharp fluctuations in this segment. Interest burden mostly records negative values at the level of economy and big companies, while, in some years, it reaches marginally positive values for medium-sized and small companies. In order to understand the real meaning of the given values of interest burden, mind that, e.g. at the economy level, out of 100 EBIT dinars generated in 2011, owners get only RSD 17, and creditors even RSD 83. Accordingly, in the years when interest burden recorded negative values, the generated EBIT was not high enough to cover interest expenses, so creditors had to settle themselves with the decrease in equity. In other words, in those years companies continued to "eat" their substance and hence another confirmation why the use of borrowed capital under these circumstances is very expensive for Serbian economy and why modest profit potential is its greatest problem. Since the economy, in our opinion, must continue to borrow, we can only hope that in the near future these loans will negotiated under different circumstances. We believe that there are enough arguments in this and similar research, in favour of systemic creation of safe and stable business environment on one hand, and raising the quality of corporate management (at much higher level than the current one) on the other hand.

The relation between risk and enterprise size

The analysis of profit potential of companies is usually followed by the assessment of their risks, since profits and risks are two related aspects of companies' performance. It is well-known that higher return on investment often requires higher exposure to risk. Therefore, the following pages of this paper will be dedicated to problems of measuring and evaluating risks of big, medium-sized and small companies.

In modern economic conditions, risks are widespread and result from operating and financing activities of companies. So, it is understandable that the relevant literature mostly divides risks into two categories: business and financial risk [1, p. 91]. The first category of risk manifests itself in the increased volatility of operating income and consists of two components: sales and operating risk. Sales risk includes numerous uncertainties arising from sales process, i.e. the process of sales revenue generation. Those uncertainties partly refer to sales prices, and partly to potential sales volume that could be achieved in the near or far future. Fluctuations in sales revenues definitely contribute to fluctuations in operating income. Operating risk, on the other hand, is a direct result of fixed operating costs (such as depreciation and amortization, lease expenses, administrative labour costs and so on), which cause high and intense oscillations of operating income, even in conditions of mild shifts in operating revenues.

6 For more details see [10, pp. 116-121]

Of course, a higher participation of fixed costs in total operating cost structure generates a higher volatility of companies' operating income. Similar to operating risk, financial risk arises from certain fixed costs. However, in this case relevant are fixed financing costs (i.e. expenses), whose level is directly determined by companies' capital structure. Due to interest expenses and other financial expenses that do not adjust to the sales volume, variations in sales volume, as well as in operating income, inevitably lead to significant variations in net earnings before and after taxes. It is logical that a considerable participation of debt in the capital structure causes high fixed interest expenses and high volatility of the above mentioned net earnings. Note that, unlike the operating cost structure, which is more or less determined by the nature of company's business activities, capital structure is primarily shaped by managerial decisions. Therefore, the exposure to financial risk represents a somewhat controllable variable.

Evidently, the volatility of sales and earnings represents the basis of our usual perception of enterprise risk. Having this in mind, we will firstly pay attention to the problems that arise in measuring that volatility. Of course, we will present the results of those measurements and discuss them in terms of enterprise size.

Volatility of sales and earnings of big, medium-sized and small enterprises

Measuring the volatility of companies' sales and earnings is hardly conceivable without using the standard apparatus of descriptive statistical analysis. Dispersion measures, such as variance, standard deviation, range and interquartile range, are very useful for this purpose. Each of them has its own advantages and disadvantages. However, they will not be discussed here. Almost every statistical analysis handbook lists the pros and cons of these measures [11, pp. 82-146]. Instead, we will focus on standard deviation and range, which are chosen in this paper to measure the volatility of sales and earnings. Why did we choose these two measures? Opting for standard deviation is somewhat expected. It is one of the most commonly used dispersion measures in practice, which reflects the very essence of variability, as the fluctuation around some mean. Furthermore, its advantage over variance is that it is represented in the same measurement units as a variable whose volatility is measured. Of course, we should also mention that in modern finance literature standard deviation is used for measuring total risk of stocks and other financial instruments [14, p. 140]. The reasons to choose range, as the difference between maximum and minimum value of some variable, are also understandable. Range could be used as a corrective measure of volatility that sometimes presents more convincingly the risks and possible amplitudes in fluctuations of company performance than standard deviation.

Which indicators of companies' performance should we use in the forthcoming volatility measurements? Should we concentrate on operating revenues and net earnings, as the absolute performance indicators, or on certain relative performance measures, such as assets turnover and return on equity? Bear in mind that assets turnover is the ratio of operating revenues to average assets, and that return on equity represents quotient of net earnings and average equity. The answer to these questions lies in the purpose of volatility measurements conducted in this paper. Note that this purpose is in estimating and evaluating the volatility of sales and earnings capabilities of big, medium-sized and small enterprises, with the aim to compare those companies by the level of their risk. It is reasonable expect that under normal circumstances big companies will generate higher sales revenues and net profits or losses than medium-sized and small companies. Therefore, we can confidently assume that standard deviation and range of those revenues and earnings will be higher for big companies than for medium-sized and small companies. However, this assertion does not necessarily imply higher risk of big companies. Simply, the difference in the amount of chosen dispersion measures could be entirely the consequence of the difference in the level of operating revenues and net earnings of the analysed companies, mostly determined by the very size of those companies. For this reason, the advantage in this paper was given to relative performance indicators, whose amounts are not primarily determined by the enterprise size. The measurement results shown in Table 10 vividly illustrate described problem. A completely different impression of risks of big, medium-sized and small enterprises stems

from the analysis of variability of relative performance indicators compared to the distorted picture created by absolute performance measures. Note that, besides dispersion measures, measures of central tendency are also given in the table in order to complete the descriptive statistical analysis of the chosen enterprise performance indicators.

We will deal only briefly with the explanation of results presented in Table 10. The focus will be exclusively on the values of dispersion measures of relative performance indicators, since they provide a reasonable comparison of enterprise risk. These measures suggest that the risk rises as we move from big companies towards the smaller ones. The small companies record the highest standard deviation and range of assets turnover and return on equity. On the other hand, the measures of dispersion are the lowest for the big companies, which evidently have the lowest exposure to risks. There is no doubt that these results are in line with the intuitive idea that most economists have regarding the relation between enterprise size and risk. Simply, the size brings certain stability and safety. Numerous studies imply higher rate of bankruptcy in the group of small companies compared to the group of big companies, a huge "mortality" of small companies short after their establishment, and their distinct vulnerability under the crisis circumstances.

The recorded volatility of ROE deserves a special attention because it reflects the true risks borne by the owners of big, medium-sized and small enterprises. In order to investigate the sources of that volatility, we used again the DuPont methodology of ROE disaggregation presented on the previous pages of this paper. Table 11 contains data regarding standard deviation and range of solvency, EBIT margin and interest burden. Note that the data on variability of assets turnover ratio are already given in Table 10.

It is evident that solvency and interest burden, which reflect the exposure of companies to financial risk, exhibit higher volatility in the group of small companies

Table 10: Descriptive statistics of companies' performance measures

Performance measure	Measure of central tendency or dispersion	Big companies	Medium-sized companies	Small companies
Operating revenues (in billions of RSD)*	Mean	3,583.7	1,227.0	1,735.6
	Median	3,482.5	1,249.1	1,691.8
	Standard deviation	**950.3**	**217.4**	**218.1**
	range	**2,692.5**	**670.4**	**565.5**
Net income after taxes (in billions of RSD)*	Mean	-22.6	3.0	6.5
	Median	-43.6	7.0	2.0
	Standard deviation	**54.1**	**18.4**	**40.7**
	range	**149.4**	**62.9**	**111.3**
Assets turnover**	Mean	0.66	0.75	0.87
	Median	0.67	0.79	0.83
	Standard deviation	**0.03**	**0.08**	**0.20**
	range	**0.08**	**0.23**	**0.51**
Return on equity (ROE)**	Mean	-1.30%	0.39%	1.36%
	Median	-1.79%	1.13%	0.07%
	Standard deviation	**2.00%**	**3.13%**	**8.27%**
	range	**5.83%**	**10.08%**	**23.16%**

* Covered period: 2006-2013.
** Covered period: 2007-2013. Averaging of assets and equity in calculations of relative performance measures results in one year data loss.

Table 11: Volatility of ROE components (2007-2013)

Component	Measure of dispersion	Big companies	Medium-sized companies	Small companies
Solvency (leverage)	Standard deviation	0.20	0.26	0.26
	range	0.56	0.70	0.75
EBIT margin	Standard deviation	1.98	0.93	1.41
	range	5.68	2.34	3.70
Interest burden	Standard deviation	0.29	0.31	0.53
	range	0.90	1.00	1.44

compared to the group of big companies. This leads us to a preliminary conclusion that small companies face higher financial risk than big companies. It seems that financial risk, along with evident sales risk reflected in higher volatility of assets turnover ratio, raises the level of total risk of small companies above the level of total risk of big companies. This conclusion also steams from the data on the variability of EBIT margin whose variations reflect the exposure of companies to operating risk. Standard deviation and range of EBIT margin are lower for small companies, implying lower level of operating risk of these companies compared to big companies. So, the sources of higher ROE volatility of small companies are assets turnover ratio, solvency and debt burden, but not the EBIT margin. Having this in mind, it is clear that the causes for high total risk of small companies can be found in the nature of their sales process, which generates extremely unstable revenues, and in their highly leveraged capital structure. Evidently, the structure of operating costs is not among those causes. These conclusions are also confirmed by the forthcoming analysis of operating and financial leverage.

The relation between leverage and enterprise size

In corporate finance literature, leverage is related to the use of fixed costs in operating and financing activities of companies in order to raise their potential profitability [1, p. 88]. As known, there are fixed operating and financing costs, so the literature differentiates between operating and financial leverage. Fixed operating costs produce operating leverage, whereas fixed financing costs produce financial leverage. The higher the fixed costs, i.e. the higher the operating or financial leverage, the higher is the potential net income of a company. However, the higher is the volatility of that net income as well. Namely, leverage can increase both earnings and losses of companies. Highly leveraged companies can record a considerable increase in profitability even in conditions of negligibly small rise of operating revenues, but at the same time, negligible deterioration of sales can produce enormous losses. This only shows that leverage raises significantly the volatility of profits and cash flows, i.e. the exposure of companies to operating and financial risk. Having this in mind, it is clear that the degree of leverage can serve as a useful instrument for measuring risks. In fact, the degree of operating leverage measures operating risk, indicating the sensitivity of operating earnings to the changes in operating revenues. On the other hand, the degree of financial leverage expresses the sensitivity of net earnings before taxes to the variations in operating earnings, so it represents a reliable measure of financial risk of a company.

For the purpose of leverage analysis, cumulative income statements of big and medium-sized companies are rearranged as the enclosed cumulative income statement of small companies, given in Table 12. We emphasize that the difference between reported operating revenues and expenses is defined as a sustainable operating income in this paper. It is the income produced by the regular operating activities of companies, such as the sales of goods, products or services and the consumption of various resources in the operating process, so it has permanent character and shows a certain tendency to be repeated from period to period. The difference between reported other revenues and expenses is defined as a transitory operating income. Other revenues and expenses are also generated in the operating process, only in a less usual or common way: by the sales of property, plant and equipment, sales of material inventories, write-offs of inventories or accounts receivable and so on. Operating income generated by these occasional operating activities has a transitory character and it does not depend so much on companies' sales, as it is the case with sustainable operating income. However, it affects considerably companies' net income before taxes. The sum of two previously mentioned types of operating income (i.e. sustainable and transitory operating income) forms total operating income which serves to cover net financial expenses. The difference between total operating income and net financial expenses represents the net income before taxes. Considering all the above, it is evident that one can get an idea of the degree of operating leverage by regressing the sustainable operating earnings on operating revenues. Also, the degree of financial leverage can be estimated by regressing the net income before taxes on total operating income of a company. We believe that previous discussion unequivocally answers the question why sustainable, and

not total, operating income is related to operating revenues when measuring the degree of operating leverage, as well as why net income before taxes is correlated with total, not sustainable, operating income in the estimation of the degree of financial leverage. The fact is that transitory operating earnings are rather independent of the sales volume. However, they have an important influence on the net income before taxes.

The results of regression analysis of operating and financial leverage of big, medium-sized and small companies are presented in Table 13. They will be discussed briefly hereinafter. We used the linear regression analysis based on the ordinary least squares method in the paper. Detailed explanation of this method can be found in the relevant econometrics literature [4, pp. 223-236].

For each of the three company groups (big, medium-sized and small companies) we ran three regressions: regression of sustainable operating income on operating revenues, regression of total operating income on sustainable operating income, and regression of net income before taxes on total operating income. As we have already explained, based on the first and third regression, one can get the idea of companies' degree of operating and financial leverage. In fact, the degree of leverage steams from the estimated slope coefficient (b) of the appropriate regression. Along with slope coefficients, Table 13 provides information on coefficients of determination (R^2), which suggest the explanatory power of conducted regressions.

We will consider firstly slope coefficients indicating the sensitivity of sustainable operating earnings to the changes in operating revenues, i.e. the degree of operating leverage of big, medium-sized and small companies. Big companies recorded the highest slope coefficient among these coefficients. On the other hand, small companies obtained the lowest coefficient, which brings us to a conclusion that the degree of operating leverage rises along with the enterprise size. The value of the above mentioned coefficient for big (small) companies of 0.0775 (0.0196) suggests that cumulative sustainable operating income of these companies increases averagely by 77.5

Table 12: Abridged Income Statement, tailored to leverage analysis

Position	2006	2007	2008	2009	2010	2011	2012	2013
Operating revenues	**1,461.3**	**1,546.2**	**1,672.9**	**1,551.5**	**1,710.8**	**1,955.4**	**2,026.8**	**1,960.1**
Operating expenses	1,404.4	1,477.3	1,600.6	1,508.2	1,652.3	1,888.2	1,956.3	1,898.6
Sustainable operating income (loss)	**56.8**	**68.9**	**72.3**	**43.3**	**58.5**	**67.2**	**70.5**	**61.5**
Transitory operating income (loss)	1.4	12.7	1.1	2.2	(24.4)	(21.1)	(46.4)	(33.3)
Total operating income (loss)	**58.2**	**81.6**	**73.4**	**45.5**	**34.1**	**46.1**	**24.2**	**28.2**
Financial revenues	32.2	19.2	27.6	22.5	30.9	39.1	46.3	30.4
Financial expenses	33.4	28.7	58.8	58.1	95.5	71.6	105.7	62.4
Net financial revenues (expenses)	(1.2)	(9.5)	(31.2)	(35.6)	(64.7)	(32.5)	(59.4)	(32.1)
Net income (loss) before taxes	**57.0**	**72.1**	**42.3**	**9.9**	**(30.6)**	**13.6**	**(35.2)**	**(3.8)**

Note: All values are shown in billions of RSD

Table 13: Regression analysis of companies' leverage (2006-2013)

Coefficient	Big companies	Medium-sized companies	Small companies
	Operating leverage:		
	Sustainable operating income$_t$ = b × Operating revenues$_t$ + e$_t$, t = 2006, 2007,..., 2013		
b	0.0775	0.0705	0.0196
R^2	0.9402	0.9215	0.1988
	Total operating income$_t$ = b × Sustainable operating income$_t$ + e$_t$, t = 2006, 2007,..., 2013		
b	0.5270	0.5079	0.5124
R^2	0.4093	0.5477	0.0556
	Financial leverage:		
	Net income before taxes$_t$ = b × Total operating income$_t$ + e$_t$, t = 2006, 2007,..., 2013		
b	0.2788	0.5352	1.7312
R^2	0.0901	0.0994	0.8466

(19.6) thousand dinars with each 1 million dinars of their additional cumulative operating revenues.[7] So, the sustainable operating earnings are far more sensitive to the changes in operating revenues in the group of big companies than in the group of small companies. Of course, this conclusion raises an important question. What are the reasons for such a high degree of operating leverage of big companies? The obtained result comes as no surprise. The possible reasons are the large capacities and high fixed operating costs caused by them. Also, the use of these capacities is rather poor and highly volatile, which altogether exposes big companies to considerable operating risk.

The slope coefficients reflecting the companies' financial leverage also deserve a special attention. These coefficients indicate the sensitivity of net income before taxes to variations in total operating income of big, medium-sized and small companies. Table 13 shows that small companies had definitely the greatest slope coefficient among these coefficients in the analysed period, while big companies recorded the lowest coefficient. The coefficient's value of 1.7312 for small companies suggests that cumulative net income before taxes of these companies grows by 1.7312 million dinars with each 1 million dinars of their additional cumulative total operating income.[8] The fact that this value is 6 times higher than the value of the same coefficient for big companies leads us to very important conclusion that the degree of financial leverage falls as the enterprise size rises. So, the net income before taxes is far more sensitive to the changes in total operating income in the group of small companies than in the group of big companies. There are at least two reasons for this kind of relationship between enterprise size and degree of financial leverage. One reason definitely arises from the previous analysis of companies' return potential and it refers to their solvency. It has been already shown in this paper that the equity of small companies bears much more debt burden than the equity of other companies. Such highly leveraged capital structure of small companies inevitably imposes high financing costs, which expose these companies to considerable financial risk. The other reason is closely related to the first reason, just described here. It is refers to the variations in exchange rate which, by means of indebtedness and foreign exchange gains or losses generated by currency clause effects, produce the increased volatility of net financial revenues (expense) and net income before taxes. The results summarized in Table 14 imply the presence of negative correlation between exchange rate and net financial revenues (expenses) of big, medium-sized and small companies, leading to a conclusion that the rise in exchange rate decreases (increases) net financial revenues (expenses) of these companies. Thereby, the strongest correlation of all companies, according to the Pearson's coefficient, is recorded by small companies. This indicates that the instability of exchange rate strikes exactly these companies most of all. The relationship between exchange rate and net financial revenues (expenses) of small companies is presented in Figure 5, which shows that the variations in exchange rate explain 61.09% of variations in net financial revenues (expenses) of these companies.

Table 14: Correlation between exchange rate and net financial revenues (expenses) of companies (2006-2013)

Coefficient	Big companies	Medium-sized companies	Small companies
Pearson correlation coefficients	-0.5624	-0.3702	-0.7816

The key results of the regression analysis of leverage are presented graphically as well. Figure 6 illustrates the operating leverage of big companies, which have the greatest exposure to operating risk of all companies according to results given in Table 13. Figure 7 sketches the financial leverage of small companies. It has been already

7 The coefficient of determination in the regression of sustainable operating income on operating revenues of big companies is extremely high and amounts to 0.9402, showing that 94.02% of variations in sustainable operating income of these companies is explained by the variations in their operating revenues. The coefficient of determination in a similar regression for small companies is considerably lower (0.1988). This leads us to a conclusion that some other factors as well have an important influence on sustainable operating income of these companies, apart from the above mentioned operating revenues.

8 The coefficient of determination in the regression of net income before taxes on total operating income of small companies in the amount of 0.8466 shows that 84.66% of variations in net income before taxes of these companies is explained by the variations in their total operating income. The coefficients of determination in similar regressions for big and medium-sized companies are considerably lower and equal 0.0901 and 0.0994, respectively.

Figure 5: Relationship between exchange rate and net financial revenues (expenses) of small companies (2006-2013)

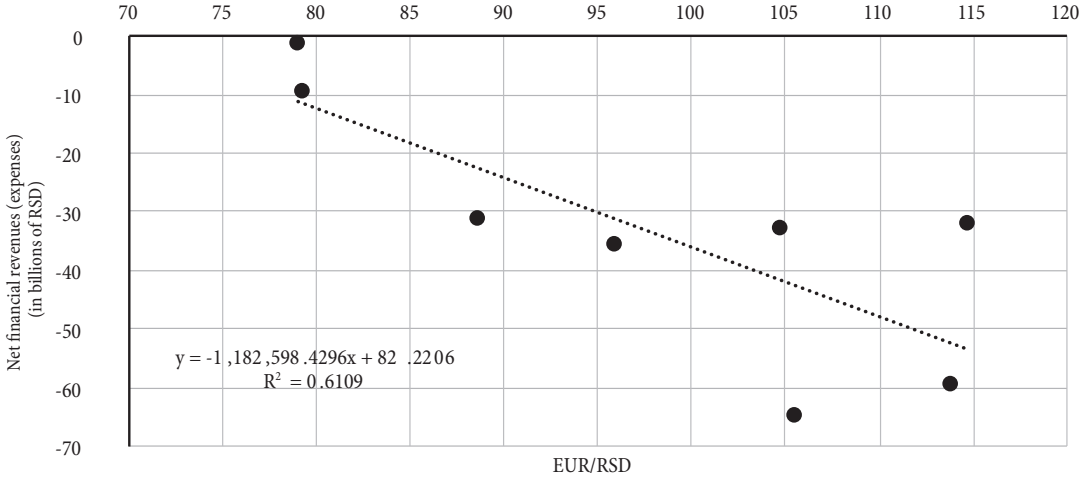


Figure 6: Operating leverage of big companies (2006-2013)

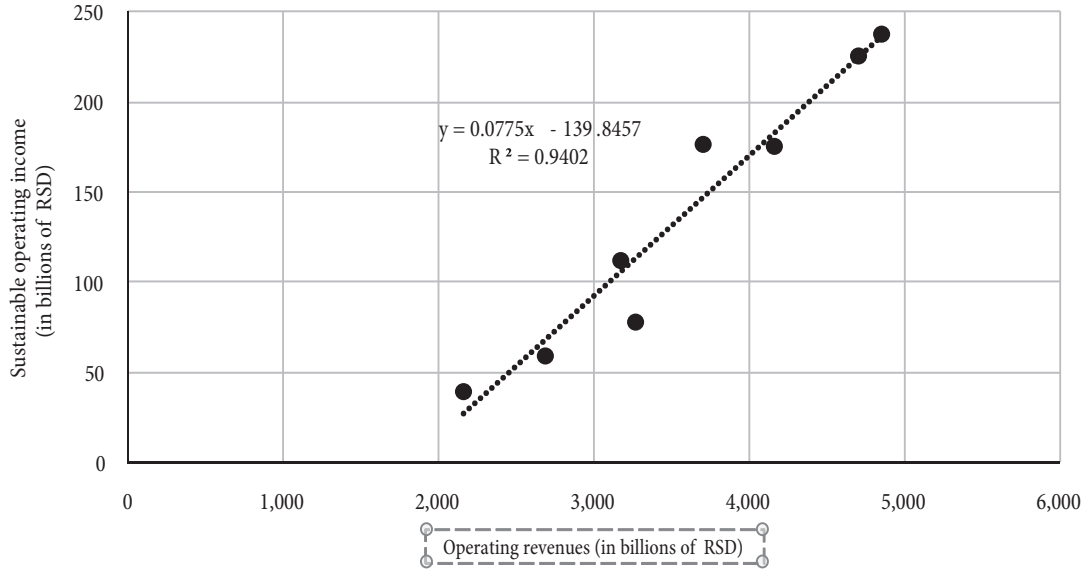
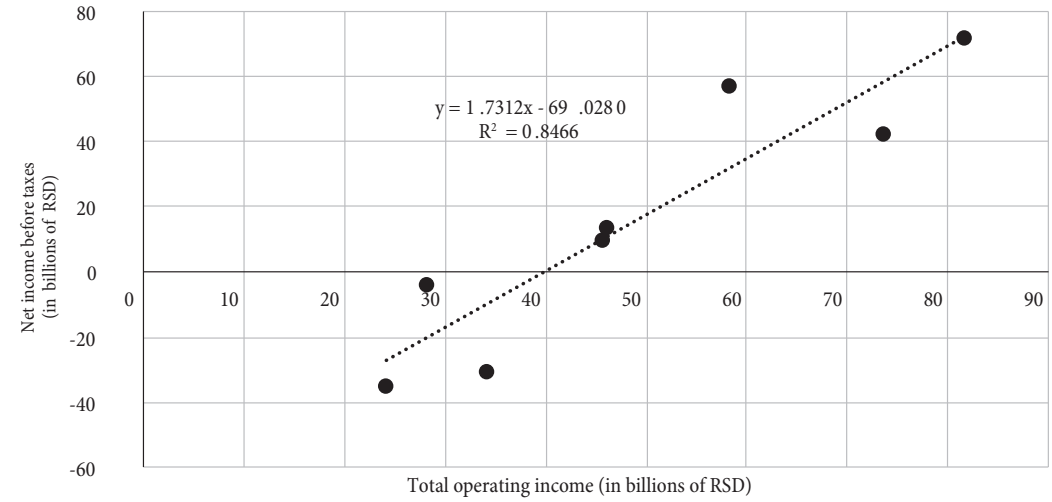


Figure 7: Financial leverage of small companies (2006-2013)



explained that financial risk of these companies is higher than financial risk of medium-sized or big companies.

Finally, we would like to underline a very important observation. Reported findings of leverage analysis are in accordance with the previously presented findings of volatility analysis of ROE. This additionally enhances our conclusions regarding the level and nature of risks of big, medium-sized and small enterprises.

Conclusion

Unsatisfactory profitability represents the greatest limitation which ramshackles Serbian economy in its attempts to grow and prosper. Low profitability is characterized by decreased efficiency, insufficient profit margins, high borrowing costs, low return on equity and negative effect of financial leverage, recorded for almost all company groups. Such economic circumstances are unattractive for new investments and they cannot provide desirable economic growth. At the same time, economic situation seems destimulating for present investors as well, since under such circumstances, companies cannot generate sufficient operating income to cover high borrowing costs. All this creates an unfavourable image of the overall economic environment in Serbia.

Profitability and the related risks in Serbian economy vary from one company to another, among other things, depending on their size. The analysis has shown that the volatility of ROE is the highest in the group of small companies, making them appear riskier than medium-sized and big companies. The increased volatility of solvency and interest burden suggests that small companies are exposed primarily to financial risks, arising from their highly leveraged capital structure. On the other hand, low participation of fixed costs in total operating expenses of small companies lowers their operating risks below the operating risks of medium-sized and big companies. The comparison of EBIT margin volatility of small, medium-sized and big companies supports this conclusion. Consequently, the highest degree of financial leverage is recorded by small companies, while the highest degree of operating leverage is recorded by big companies.

The dominant participation of SMEs in terms of their number, as well as their extremely important contribution to employment growth and creation of value added, show that the development of such enterprises provides the great potential for overcoming the key economic problems. The experience of developed countries suggests that a considerable influence of SMEs on the growth of economy and employment can be expected only in an organized and stimulating environment. Nevertheless, we must emphasize that SME performance in the period of crisis shows that their recovery in the EU and Serbia was unexpectedly slow. One of the reasons for this slow recovery of SMEs is that their business is closely linked to business of big companies. Nowadays, the business of big companies is hardly conceivable without the chain of small suppliers, who are more and more involved in the production process and left to produce certain components. The main benefits of mentioned outsourcing are higher competitiveness, significant cost savings and risk dispersion.

Economic policy regulators must pay equal attention to the creation of favourable business environment for both SMEs and big enterprises. We must not forget that, although big companies have very low participation in total company number, their participation in total assets, total number of employees and creation of value added is very high. The possibility of attracting high amounts of capital enables them to undertake the activities which cannot be conducted by small companies, due to their insufficient financial strength. We should particularly stress the importance of big joint-stock companies for the development of primary and secondary capital markets. If there are no alternative financing sources, as is the case for Serbia, external (banking) financing sources become too expensive. Thereby, it is well known that expensive financing sources jeopardize the economic recovery.

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THE RELEVANCE OF INTELLECTUAL CAPITAL IN SERBIAN ICT INDUSTRY*

Značaj intelektualnog kapitala u IKT industriji u Srbiji

Abstract

Knowledge economy is mainly based on intellectual capital (IC), which plays a key role in contemporary enterprise's value creation. The basic components of IC are human, structural, and relational capital. The substance of IC is made of intangible resources of an enterprise. There is empirical evidence of increased investments in IC that reveals the true nature of relationship between IC and financial performance. Knowledge-intensive industries are given special treatment in this field of research. This is why the objective of this study is to find out whether Serbian enterprises in the information and communication technology (ICT) industry rely more on tangible or intangible resources in their quest for improving financial performance. The paper analyzed financial performance of 594 enterprises that operate within the ICT industry in Serbia in the period of five years (2009-2013) and their dependence on IC efficiency. Three main hypotheses were tested in the paper regarding the relationship between human, structural, and physical capital, on one side, and financial performance (measured by net profit, operating profit, return on equity, return on assets, profitability, and return on invested capital), on the other. The results indicated that human capital and physical capital partially affect financial performance, which is consistent with empirical findings from other developing countries. When compared to other industries in Serbia, ICT industry demonstrated more significant impact of human capital.

Key words: *intellectual capital, financial performance, ICT industry, Value Added Intellectual Coefficient*

Sažetak

Osnovu ekonomije zasnovane na znanju čini prevashodno intelektualni kapital (IK) koji ima ključnu ulogu u procesu stvaranja vrednosti savremenog preduzeća. Glavne komponente IK-a su ljudski, strukturni i relacioni kapital. Supstancu IK čine nematerijalni resursi preduzeća. Brojni su empirijski dokazi koji potvrđuju značajan rast investicija u IK i koji ukazuju na prirodu odnosa između IK i finansijskih performansi. Privredne grane koje se posmatraju kao grane intenzivne znanjem zauzimaju posebno mesto u ovoj oblasti istraživanja. Ovo je i razlog zbog čega je osnovni cilj istraživanja utvrđivanje međuzavisnosti između komponenti IK i finansijskih performansi preduzeća iz industrije informaciono-komunikacionih tehnologija (IKT). Predmet istraživanja su 594 preduzeća iz IKT industrije Srbije u vremenskom periodu od pet godina (2009-2013). U radu su testirane tri osnovne hipoteze u vezi sa uticajem ljudskog, strukturnog i fizičkog kapitala na finansijske performanse (izražene neto dobitkom, poslovnim dobitkom, prinosom na sopstveni kapital, prinosom na ukupnu aktivu, profitabilnošću i prinosom na investirani kapital). Rezultati ukazuju na to da ljudski i fizički kapital delimično opredeljuju finansijske performanse, što je u saglasnosti sa rezultatima empirijskih istraživanja u drugim zemljama u razvoju. Kada se IKT industrija uporedi sa drugim industrijama u Srbiji, ona pokazuje veće oslanjanje na ljudski kapital u procesu stvaranja vrednosti.

Ključne reči: *intelektualni kapital, finansijske performanse, IKT industrija, koeficijent dodate vrednosti intelektualnog kapitala*

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Introduction

The global economic horizon has experienced paradigm shift in the last couple of decades. The main determinants of these changes are decreased cost of information flow, increases in the number of markets, liberalization of product and labor markets in many parts of the world, and the deregulation of international financial flows. These factors introduced new fundamental core of wealth creation in contemporary enterprises. That new source of wealth creation constitutes of development, deployment, and utilization of enterprises' intangible assets (IA) or intellectual capital (IC). The corner stones of IC that drive enterprise performance are knowledge, competence, intellectual property, brands, reputation, customer relationships, and the like. While there are many ways in which enterprises may increase revenues, there is only a diminishing set of strategies increasing profit margins. Therefore, in the world of heightened competition, the focus should be on developing and owning intangibles that are difficult to imitate, as well as on orchestrating these assets appropriately. The capability of using intangibles adequately is often labeled as dynamic competence of an enterprise [49, p. 3]. In the era of information and knowledge, IC has been the main driving force of corporate performance, value creation, and sustainable competitive advantage. In 1836, *Senior* was the first who emphasized the concept of IC. The essence of IC in that time was made solely of human capital. American scholar *Galbraith* considered that IC was not the static form of capital, like pure knowledge, but also a dynamic process of effective use of that knowledge with the objective of improving enterprise performance [14].

The most significant growth in value of IC, as well as the growth of its impact on corporate performance became evident during the eighties of the XX century, when a number of knowledge-intensive industries emerged. These industries included software, biotechnology, and internet-based industries. The growth and importance of intangibles has been increasing ever since [36]. Investments in intangibles have become the main indicator of enterprises' vitality and a key indicator of future returns. Research studies show that IC has significant positive impact on productivity growth. In USA, in the period from 1973 to 1995, IC contributed in average 0.4% to annual human labor productivity increase. This contribution grew even more from 1995 to 2003 and IC's contribution to productivity rose to 0.8%. In France, from 1995 to 2003, IC's contribution to productivity growth was 0.9%; In Germany, IC contributed by 0.6%, in Italy 0.4%, and in Spain the contribution was 0.2% [9]. In Great Britain, from 1979 to 1995, IC positively affected productivity growth by 0.4% on average, annually, while between 1995 and 2003 this impact increased to 0.6% [32]. In Finland, the growth in IC's contribution to productivity was 0.6% on average in the period from 1995 to 2000, while in the 2000-2005 period this contribution steadily grew to 0.9% on average [22].

The undisputed importance of IC for an enterprise and for an economy was the main driving force for undertaking the research in order to understand the essence of competitive advantage in the information age. Therefore, the main *objective* of this paper is to reveal whether Serbian enterprises in the ICT manufacturing industry rely on tangible or intangible resources in their quest for better financial performance. The defined research objective will be carried out through in-depth analysis of financial performance of 594 enterprises that operate within the ICT industry in Serbia. According to this, the paper is divided into an introduction and the following five parts. *The first part* presents a theoretical and methodological framework for understanding the concept of IC and its importance for creating value in the enterprises of information era. In addition, this segment of the paper deals with the main elements and dimensions of IC. Finally, the first part ends with brief insight into the main categories of IC measurement approaches. *The second part* relates to the importance and role of IC in the value-creation process of enterprises in ICT industry. In *the third part* of the paper, the focus shifts towards explaining the research methodology, which includes sample definition, development of research hypotheses, and identification of variables used in the empirical study. *The fourth and crucial part* of the work deals with the analysis of the results of applied research study in Serbia, which is intended to demonstrate the impact of IC on financial performance of

enterprises in the ICT manufacturing industry in Serbia. *The final part* contains concluding remarks and directions for future research.

Definitions, dimensions, and measurement of IC

There is no generally accepted definition of IC, as well as there is no universal term that entails all of the IC's dimensions and characteristics. In practice the terms like intellectual capital, knowledge capital, intellectual assets, or intangible assets are often used interchangeably as they all represent the property of an enterprise that has no physical form but possesses the significant potential for future value creation. In addition, these intangible assets cannot deliver tangible outcomes without being related to tangible assets. The economists note them as knowledge capital, management experts refer to them as IC, and accountants explain them as intangible assets or intellectual assets. Intangible assets represent generic term used to describe the invisible capital of an enterprise that is likely to generate future value. Intangible assets commonly refer to IC or knowledge capital or intellectual assets. If IC is considered as an input then, intellectual assets is referred to as output, in an intangible form. When intellectual assets are legally protected, they become intellectual property [28]. However, the terms most commonly used by researchers and practitioners are intellectual capital, intangible resources, immaterial capital, immaterial resources, intellectual property, invisible assets, immaterial values, intellectual knowledge.

In terms of various definitions, notions, and elements of IC, Table 1 depicts terms, definitions, and corresponding categorization that generally made the most significant impact on the literature in this scientific field.

The dimensions of IC are its main components. As described in Table 1, different forms of IC are most commonly categorized as human, structural, and relational capital. *Human capital* entails employee knowledge, skills, expertise, and innovative capabilities. In addition, human capital consists of their talents, motivation, creativity, demonstrated enthusiasm, ability to learn, and teamwork. *Structural capital* is made of management systems, corporate culture, information-communications technology (ICT), internal databases, and different forms of intellectual property through which intangible assets are being exploited. *Relational capital* includes numerous relationships with different stakeholders, such as customers, suppliers, creditors, investors, and partners. In addition, relational capital takes into account stakeholders' perception of the enterprise. Examples of relational capital are brand, reputation, customer and supplier relations, various agreements, licenses, supply chains, negotiation capacity, and external networking.

Measurement of IC and its contribution to value creation presents an extremely important task since it is an input for strategy formulation and implementation, decision-making process regarding diversification and growth in general, applying appropriate compensation schemes, and communication with external stakeholders [31]. During the last three decades, a number of IC measurement methods have been developed with the aim of quantifying its absolute value, as well as for measuring IC's relative contribution to value creation in an enterprise. The four broad categories of measurement methods exist and they entail direct intellectual capital methods (DICM), market capitalization methods (MCM), return-on-assets methods (ROA methods), and scorecard methods [42]. The mentioned categories and their methods are presented in Table 2.

The first three groups of measurement methods produce financial value of IC, while the scorecard methods point to nonfinancial value of IC and propose certain nonfinancial measures of IC. The methods that belong to DICM aim at delivering the money value of separate elements of IC in an enterprise. In case of MCM, the starting premise is the fact that successful companies tend to have their market value significantly above their book value of assets, and that this positive difference can be appended to the effect of IC. ROA methods use financial statements of enterprises as the starting point for estimating absolute value or relative contribution of IC to corporate performance. The last category of measurement methods seeks data regarding certain components of IC in an enterprise and forms the indicators as the scorecard. The objective is to create graphical presentation of IC and to monitor investment in this type of assets. These methods are similar to the

Table 1: The terms and definitions of IC

Author(s)	Term/concept	Definition	Categorization
Brooking [5]	Intellectual capital	Intellectual capital constitutes of market capital, assets related to human capital, intellectual property, and infrastructure.	- Market assets - Human capital related assets - Intellectual property - Infrastructure assets
Sveiby [49]	Intangibles	Intellectual capital possesses three dimensions: employee competence, internal structure, and external structure.	- Employee competence - Internal structure - External structure
Stewart [46]	Intellectual capital	Intellectual capital represents intellectual material – knowledge, information, intellectual property, experience – that can be used for wealth creation. In other words, it represents the collective brainpower.	- Human capital - Customer capital - Structural capital
Bontis et al. [2]	Intangible resources, intellectual capital as a subcategory	Intellectual capital is simply the sum of intangible resources and their flows; intangible resources are any factor that contributes to the enterprises' value creation process.	- Human capital - Structural capital
Petty & Guthrie [39]	Intellectual capital	Intellectual capital is an indicator of economic value of two IC's components in an enterprise: organization and human capital.	- Organizational capital - Human capital
Sullivan [47]	Intellectual capital	Intellectual capital represents knowledge that can be converted into profit.	Human capital is the essence of intellectual property, which includes intellectual assets
Lev [30]	Immaterial assets	Immaterial assets represent the claim for future benefits, which has no physical or financial form.	- Discovery - Organizational practices - Human resources
FASB (Financial Accounting Standards Board) [15]	Intangible assets	Intangible assets represent non-financial expectations from future benefits, which have no physical or financial form.	- Technology - Customers - Market - Employees - Contracts - Statutory assets
MERITUM [33]	Intangibles, intellectual capital, intangible resources, intangible activities	Intangibles (intangible assets) refer to intangible resources that represent sources of future benefits for an enterprise, which could (but not necessarily) appear in the financial statements.	- Human capital - Structural capital - Relation capital
Pablos [38]		The broader definition of intellectual capital states that it is the difference between market and book value of an enterprise. It includes the knowledge-based resources that contribute to realization of competitive advantage.	- Human capital - Structural capital - Relation capital
Mouritsen et al. [35]	Intellectual capital	Intellectual capital mobilizes employees, clients, information technology, managerial work, and knowledge. Intellectual capital cannot operate independently since it represents a mechanism that enables connections between different resources in an enterprise's production process.	- Human capital - Organizational capital - Customer capital
IASB (International Accounting Standards Board) [20]	Intangible assets	Intangible assets that can be identified as non-monetary asset without physical substance that is used for production process and purchase of goods and services, for rent or for administrative purposes.	- Marketing - Distribution - Human resources trainings - Start-up - Research and development - Brands - Copy rights - Cooperation agreements - Franchise - Licenses - Operating rights - Patents - Original recordings - Secret processes - Trade marks

Table 2: Categorization of IC measurement methods

Category	Output	Level of analysis	Methods	Author
Direct Intellectual Capital Methods	Financial value	Enterprise	Technology Broker	*Brooking, A.*
		Business units	Citation-Weighted Patents	*Petrash, G., Dow Chemical*
		Functional units	Value Explorer	*KPMG, Knowledge Advisory Services*
			Intellectual Asset Valuation	*Sullivan, P. H.*
			Total Value Creation	*Anderson, R., & McLean R., Canadian Institute of Chartered Accountants*
Market Capitalization Methods	Financial value	Enterprise	Tobin's q	*Stewart, T.*
			Investor Assigned Market Value	*Standfield, K.*
			Market-to-Book Value	*Stewart, T.*
ROA Methods	Financial value	Industry	Economic Value Added	*Stern Stewart & Co.*
		Enterprise	Human Resource Accounting	*Flamholtz, E. G.*
			Calculated Intangible Value	*Stewart, T.*
			Knowledge Capital Earnings	*Lev, B.*
			Value Added Intellectual Coefficient	*Pulic, A.*
Scorecard Methods	Nonfinancial value	Enterprise	Skandia Navigator	*Edvisson, L.*
		Business units	Value Chain Scoreboard	*Lev, B.*
		Functional units	Intangible Assets Monitor	*Sveiby, K. E.*
			Balanced Scorecard	*Kaplan, R., & Norton, D.*

Source: Adapted according to [11]

methods from DICM group since both groups aim at gathering information about individual components of IC. However, the difference is that scorecard methods do not estimate money value of intangibles but at best can produce certain composite index of IC.

Literature review

There is a lot of empirical evidence regarding the research about impact of IC on financial performance [29], [34], [50], [54], [55]. In a research covering different industries, which was conducted in *Finland*, it was found that relative value of IC is fairly high in the electronics industry, whereas the results of both efficiency measures are near average. By contrast, in the electricity, gas and water supply the relative value of IC is quite low and, in addition, the total efficiency and efficiency of IC are among the highest. Moreover, in business services the relative value of IC as well the total efficiency of IC are fairly high, but the efficiency of IC is low [29]. When investigating the relationship between IC and corporate performance, *Moeller* [34] applied structural equation modelling to test a large-scale empirical study of more than 100 *German* business networks. Quantitative data were collected from the heads of the management accounting departments by means of a written questionnaire. The results revealed an interrelation between intangible and tangible/financial performance that is mainly influenced by strategic relevance and participation. In contrast to other studies, trust is not found to have significant effects on tangible or intangible performance. In a study by *Tan et al.* [50] which used the data from 150 publicly listed companies on the *Singapore* Stock Exchange, the findings showed that IC and company performance were positively related, that IC was correlated to future company performance, that the rate of growth of a company's IC was positively related to the company's performance, and that the contribution of IC to company performance differs by industry. Research undertaken in *Taiwan*, aimed to provide insights into the relationship between IC and market value and the financial performance of listed companies [6]. Another interesting study [18] presented the level of IC in domestic and foreign banks in *Malaysian* territory. *Goh*'s research found that domestic banks were generally less efficient at IC exploitation. Another study from *Malaysia* involved entire financial sector [53], with the aim of determining

the impact of IC on financial performance in this sector from 1999 to 2007. *Ting* and *Lean* chose to analyze the financial sector after assuming its heavy dependency on IC performance [22, p. 248].

It has been already argued that positive difference between enterprise's market value and its book value of assets can be attributed to the adequate use of IC. According to [4; 28] it is estimated that the market-to-book ratio of the Standard & Poor's 500 companies reaches 6.0, compared to just over 1.0 in the early eighties. While some of this difference is attributable to the current value of physical and financial assets exceeding their historical cost, a large proportion is still the result of adequate IC management. Intangibles have, therefore, become the major value driver for many companies. These assets are generated through innovation, organizational practices, human resources or a combination of these sources and may be embedded in physical assets and employees. These conclusions especially apply for knowledge-intensive industries, like software industry, telecommunications, biotechnology, or professional consulting.

In recent literature, numerous empirical studies were implemented in order to analyze the effect of IC on corporate performance within industries that heavily rely on intangibles. One such industry is ICT manufacturing industry, which is the object of the analysis in this paper. *Firer* and *Williams* [16] examined the IC's impact on corporate performance of 75 *South Africa* IC-intensive enterprises that operated within banking, electrical, information technology, and services industries. The empirical findings suggested that physical capital remained the most significant underlying resource of corporate performance in South Africa at the time of the research, despite the efforts to increase the nation's IC base. In a research conducted by *Shiu* [44], Value Added Intellectual Coefficient (VAIC) was applied in order to measure the contribution of IC to corporate performance of 80 listed technological firms in *Taiwan* in 2003. The research concluded that VAIC had significant positive correlation with profitability and market value, while there was negative correlation with productivity. The study also revealed that Taiwanese technological firms possess the ability of transforming intangible resources into tangible outcomes, but with certain time lag. A similar study was conducted on Egyptian software companies to analyze how human capital, as a part of IC, affected the organizational performance of selected companies [43]. *Gan* and *Saleh* [17] investigated the relationship between IC (measured by VAIC) and corporate performance of technology-intensive companies in *Malaysia* and found that in the time of the study, these Malaysian companies were primarily dependent on physical capital. The results also indicated that physical capital efficiency is the most significant variable related to profitability while human capital efficiency is of great importance in enhancing the productivity of the company. This study concluded that VAIC can explain profitability and productivity but failed to explain market valuation of these companies. *Erickson* and *Rothberg* [12] carried out a longitudinal assessment of three *USA* hi-tech industries in the period of eight years, in two separate data sets (1993-1996 and 2003-2006). One of the conclusions of the research was that these industries seriously lack effective knowledge sharing because of high risk of competitive intelligence. However, the IC and effective knowledge management (KM) can contribute to market performance of these industries, measured by Tobin's q. Another research was conducted within *Irish* ICT sector [7] and aimed at discovering the relationship between management accounting and structural capital of enterprises. The research did not confirm the premise that management accounting systems positively influence firms' structural capital, whereas the results did indicate a positive relationship between management accounting information and structural capital. However, the findings strongly supported positive impact of human, structural, and relational dimensions on IC and business performance.

Kavida and *Sivakoumar* [28] evaluated the role of IC in the performance of the *Indian* IT industry, with an objective to enlighten the relevance of IC in the Indian IT industry. The results showed that IC was relevant to the corporate performance of the Indian IT industry. In a study carried out among telecommunication enterprises in *Nigeria* [48], which belong to the broader definition of ICT sector, results revealed that Nigerian telecommunications companies had mostly emphasized the use of customer capital, exemplified by market research and customer relationship management to boost their business performance. On the

other hand, putting too much focus on customer capital to the detriment of other intellectual capital components is found to be undermining the productivity of Nigerian telecommunications companies. *Fan et al.* [13] investigated the relationship between IC and company performance in *China's* IC-intensive manufacturing industry, information technology industry, and banking and insurance industry. The study covered the period between 2007 and 2009, using Value Added Intellectual Coefficient (VAIC) as the indicator of IC performance. The paper identified three empirical research models based on economic performance, financial performance, and stock market performance. The results showed that there existed significant difference between the efficiency of IC among different industries. The efficiency of IC in finance and insurance industry was the highest, while the efficiency of IC in information and technology industry was not quite clear because this industry was still at an early stage of development in China, at the time of the study. Another conclusion was drawn and this was that the driving force of value creation lied in human capital and structural capital, while the effect of physical capital was relatively low. The latest research on IC's impact on corporate performance was performed by *Osman* [36] and the research investigated the issue on a sample of ICT small and medium enterprises (SMEs) in *Malaysia*. The study revealed that IC had significant and positive direct impact on both innovation capability and firm performance in Malaysian ICT SMEs. As intellectual capital significantly affects firm performance, a complementary mediation or partial mediation effect of innovation capability was also established for the relationship between IC and performance.

While ICT sector was extensively investigated by the researchers in various national economies, the performance of ICT sector in Serbia in relation to IC has not been analyzed so far. In terms of relationship between IC and corporate performance among Serbian companies, several research studies were implemented. The most important of these research studies were conducted in the real sector of Serbia in 2010 [22], among enterprises that constituted BELEX15 index [23], within the 300 of top Serbian exporting enterprises [24], among 100 top performing enterprises in terms of net profit in 2011 [26], and in the Serbian banking sector [3]. The research studies carried out in mentioned industries in Serbia, so far revealed that enterprises in Serbia in majority cases rely on physical capital, except in the cases of employee productivity, which is often significantly affected by human capital of an enterprise.

Research methodology

In terms of information and communications technology sector (ICT sector), the basic classification used in this paper relies on International Standard Industrial Classification of All Economic Activities (Revision 4) from 2008, issued by The Department of Economic and Social Affairs of the United Nations Secretariat, Statistics Division [51]. There were several revisions of this industry classification so far. By following the logic of Revision 4, the research was primarily oriented on broader scope of ICT sector that incorporates three major segments: ICT manufacturing industries, ICT trade industries, and ICT services industries. In Serbia, the European Classification of Economic Activities (EU – NACE Rev. 2) was accepted without any changes on January 1, 2008 [13].

In the process of identifying the ICT economic activities (industries), the following general principle is used: "The production (goods and services) of a candidate industry must primarily be intended to fulfill or enable the function of information processing and communication by electronic means, including transmission and display" [52, p. 278]. According to this, the *ICT manufacturing* industries entail manufacturing of electronic components and boards, manufacturing of computers and peripheral equipment, manufacturing of communication equipment, manufacturing of consumer electronics, and manufacturing of magnetic and optical media. The industries that belong to the *ICT trade* industries are wholesale of computers, computer peripheral equipment and software, and wholesale of electronic and telecommunications equipment and parts. Lastly, the *ICT services* industry consists of businesses in the field of software publishing (publishing of computer games and other software); telecommunications (wired telecommunications activities, wireless telecommunications activities, satellite telecommunications activities, and other

telecommunications activities); computer programming, consultancy and related activities (computer programming activities, computer consultancy and computer facilities management activities, and other information technology and computer service activities); information service activities (data processing, hosting and related activities; web portals); and repair of computers and communication equipment (repair of computers and peripheral equipment and repair of communication equipment).

The total number of enterprises operating in the ICT sector of Serbia is 13,989 according to the official data published by the Serbian Agency for Business Registers. The 12,207 enterprises operate within the ICT services sector (87%), 1,583 belong to ICT manufacturing industry, and 199 enterprises are in the ICT trade segment. Figure 1 illustrates the structure of whole ICT sector in Serbia.

Sample description

Serbia is in the state of structural, rather than cyclical, crisis, which can be illustrated by the data that in 2012 Serbian economy experienced immense difficulties due to irreversible trends in both real and financial sectors. After GDP growth of 2% in 2011, a drop of 1.5% recorded in 2012 must be observed as a serious warning sign. Industrial production fell by 3.5%, while agricultural production declined by 8% [10]. If we analyze key macroeconomic indicators of national economy in 2013 and 2014, it can be seen that the situation has not improved; the industry growth is insufficient, with realistic risks of industry activity decrease in 2015. This data shows the reality in Serbian real sector and necessity for focusing on manufacturing industries with higher added value. This is one of the main reasons why we conducted a research on a sector that is both IC-intensive and production-oriented.

The sample consists of 1,583 enterprises that operate within ICT manufacturing sector in Serbia. The data was gathered from the official financial statements of these enterprises for the period of five years (2009-2013). The structure of the ICT manufacturing industry is given in Figure 2.

However, after a thorough analysis of available data, we found that 594 enterprises (37.52%) have complete data

Figure 1: The structure of ICT sector in Serbia

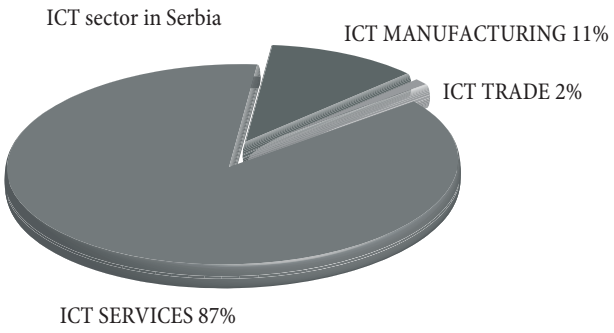


Figure 2: The structure of ICT manufacturing industry in Serbia

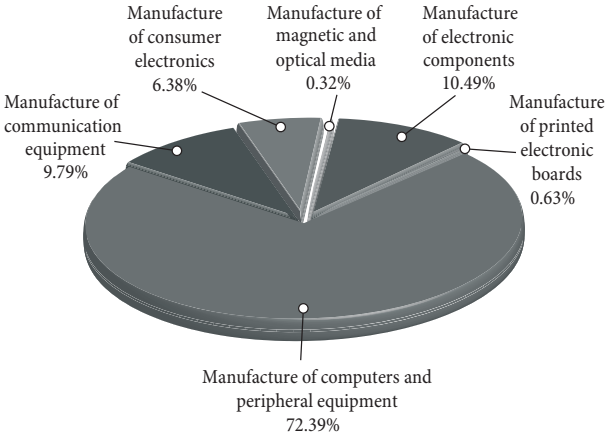
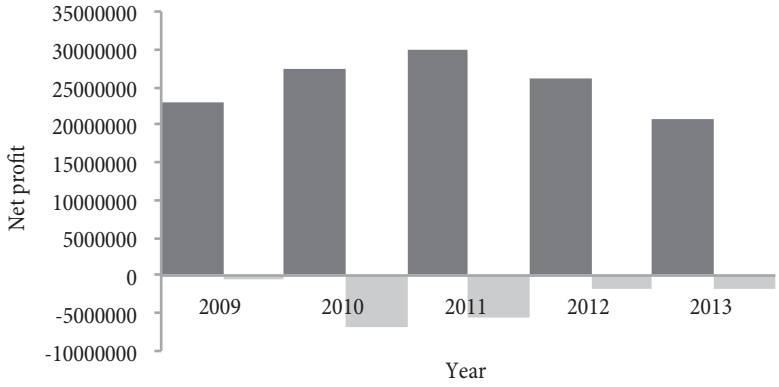


Figure 3: Aggregate net profit in ICT manufacturing industry



for the observed five-year period. In order to have sample that is homogenous and comparable among subjects the analysis included these 594 enterprises for the period from 2009 to 2013. The 552 enterprises are limited liability firms (92.93%), 28 are entrepreneurial entities (4.71%), 7 of them are corporations (1.18%), there are 3 partnerships (0.51%), 2 limited liability partnerships (0.34%), one state-owned enterprise (0.17%), and one cooperative (0.17%). During the observed period, the net effect in terms of profit was positive since in average 524 enterprises realized net profit. This net effect of the ICT industry is presented in Figure 3.

The share of realized loss in total net profit of the ICT manufacturing sector in Serbia varied over five-year period. In 2009, only 2.17% of realized net profits were realized losses by enterprises in this industry. However, this percentage drastically grew in 2010 to 25.35%. In 2011 and 2012, the share of losses in total net profits decreased to 18.21% and 6.77% respectively. In 2013 this percentage slightly rose to 8.92%. These indicators reveal the overall profit generation by the enterprises in the ICT manufacturing sector. In order to investigate the driving forces behind this performance, this paper will examine thoroughly the main value drivers in ICT manufacturing industry in Serbia. The study used data drawn from the publicly available financial statements of each of these enterprises. Software SPSS 21.0 was used to analyze the data statistically.

Development of hypotheses

The main advantages of VAIC model for measuring IC performance in enterprises are its simplicity and ability to determine relative contribution of tangible and intangible resources to the creation of value added. In order to determine this contribution VAIC is divided into two separate elements. The first element is intellectual capital efficiency (ICE), which is calculated by simply adding together values of human capital efficiency (HCE) and structural capital efficiency (SCE). The second part represents capital employed efficiency (CEE), which is a proxy for efficient use of physical and financial capital of an enterprise. In accordance to the identified objective of this research, which is examining whether Serbian enterprises in the ICT manufacturing industry rely more on tangible or intangible resources in their quest for better financial performance, and bearing in mind this duality of VAIC measure, the following research hypotheses are proposed:

H1. *Human capital efficiency (HCE) has direct positive impact on financial performance of enterprises in ICT manufacturing industry*

a. Enterprises with higher values for HCE tend to have higher net profit
b. Enterprises with higher values for HCE tend to have higher operating profit
c. Enterprises with higher values for HCE tend to have higher ROE
d. Enterprises with higher values for HCE tend to have higher ROA
e. Enterprises with higher values for HCE tend to have higher profitability
f. Enterprises with higher values for HCE tend to have higher ROIC

H2. *Structural capital efficiency (SCE) has direct positive impact on financial performance of enterprises in ICT manufacturing industry*

a. Enterprises with higher values for SCE tend to have higher net profit
b. Enterprises with higher values for SCE tend to have higher operating profit
c. Enterprises with higher values for SCE tend to have higher ROE
d. Enterprises with higher values for SCE tend to have higher ROA
e. Enterprises with higher values for SCE tend to have higher profitability
f. Enterprises with higher values for SCE tend to have higher ROIC

H3. *Capital employed efficiency (CEE) has no significant impact on financial performance of enterprises in ICT manufacturing industry*

a. CEE has no significant impact on net profit
b. CEE has no significant impact on operating profit
c. CEE has no significant impact on ROE
d. CEE has no significant impact on ROA
e. CEE has no significant impact on profitability
f. CEE has no significant impact on ROIC

The defined research objective and identified research hypotheses will be tested through correlation and multiple linear regression analysis regarding the relationship between intellectual capital and physical capital efficiency and financial performance of 594 enterprises that operate within the ICT industry in Serbia.

Variables used in the research

The starting point in terms of variables identification is presenting the rationale behind model of measuring IC's contribution to value creation, which was introduced by *Pulic* [40], [41]. The model relies on achieved value added (VA) from business as an indicator of efficient exploitation of IC. The basic premise of the model is to measure the contribution of a company's total resources (human, structural, physical, and financial) to the creation of VA, which can be calculated as:

$$VA = OUT - IN$$

Here, outputs (OUT) are the company's total sales or sales income. Inputs (IN) comprise all management costs, excluding those related to human resources, which in this model are treated as investment. IC is made up of human capital (HC) and structural capital (SC). Thus, IC efficiency consists of human capital efficiency (HCE) and structural capital efficiency (SCE). The calculation starts from salaries and wages, which, as mentioned previously, are not regarded here as inputs. The formula for HCE calculation is therefore constructed as the contribution of human resources to VA creation:

$$HCE = VA/HC$$

Human capital consists of total employee salaries and wages in one fiscal year. The next IC component, structural capital, represents everything that remains in the company when employees go home at the end of the working day. SC includes hardware, software, organizational structure, patents, and trademarks [1]. SCE can now be calculated as:

$$SCE = SC/VA$$

This rationale for SCE calculation can be explained by the fact that SC is the second component of IC and is obtained by subtracting HC from VA. Therefore, SCE is a measure inversely proportionate to HCE (VA = HCE + SCE = VA/HC + SC/VA). Finally, the value for capital employed efficiency (CEE) is obtained through dividing VA by the net book value of assets. In the following equation capital employed (CE) represents the capital invested in the company:

$$CEE = VA/CE$$

Despite its critics, VAIC methodology is gaining increasing acceptance among researchers as a good indicator of a company's efficient use of IC. The main critics lie in the fact that VAIC is calculated using the financial statements of companies, which imply that, the coefficient is a measure of value created in the past and not that of value-creation potential. In addition, the model does not incorporate synergy realized through interactions between different components of IC. The VAIC methodology clearly depicts the contribution of each component of IC to value creation. However, in practice, elements of IC interact, and therefore it is not possible to calculate accurately the contribution of each component to the creation of VA. In addition, the model fails to offer adequate analysis of VA creation for those companies that have negative equity in terms of operating profit [26].

The proposed research model employs several variables. The first group of variables relate to the calculation of VAIC, defined above. These are HCE, SCE, and CEE. The second group of variables represents chosen measures of financial performance of enterprises in Serbian ICT manufacturing industry. The measures selected for the purpose of the present paper are net profit (NP), operating profit (OP), return on equity (ROE), return on assets (ROA), profitability (P), and return on invested capital (ROIC).

Most of the previous empirical studies that interlinked IC and business performance used firm size, leverage, firm age, growth ability, industry as control variables [16], [44], [14]. However, because the enterprises in our present study belong to the same industry (ICT manufacturing industry), since the period is limited to five years, our research model includes two controlling variables: firm size (using total assets, TA, as a proxy) and financial leverage (*Lev*) of enterprises in the ICT manufacturing sector.

Research results

Descriptive statistics

Table 3 presents the results of descriptive statistics analysis. The data presented consists of minimum and

Table 3: Descriptive statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
NP	2970	-3703939.9	5062446.56	37305.1024	264324.72197	8.654	.045	175.841	.090
OP	2970	-1758911.5	5535421.46	34130.847	311168.14364	10.786	.045	154.546	.090
ROE	2367	-26.5652	67.0000	.259382	2.2560274	22.049	.050	663.855	.101
ROA	2957	-26.5652	17.0000	.032310	.6944697	-11.914	.045	890.885	.090
P	2755	-1098.9350	507.9730	-1.322422	36.7212713	-18.456	.047	584.627	.093
ROIC	2291	.0001	2047.4000	14.099570	76.9493612	18.894	.051	411.816	.102
Valid N	2291								

maximum values, means, standard deviation, skewness, and kurtosis statistics.

The data for skewness suggests that majority of research variables (except for ROA and profitability) tend to be placed left of the average values, which means that these values are relatively smaller ones. On the other hand, the values for kurtosis suggest that all of the variable's values are concentrated close to the average values in the research sample.

Correlation analysis

In order to test the existence of relation between dependent and independent variables, a correlation analysis was used in the case of enterprises within Serbia's ICT manufacturing sector. Table 4 illustrates the results of conducted correlation analysis. The *Spearman*'s correlation coefficient was used because it is suitable for nonparametric tests.

Interpretation of correlation analysis results will be performed according to the scale proposed by *Cohen* [8]. *Cohen*'s scale considers correlation from -0.29 to -0.10, or from 0.10 to 0.29 to be low; from -0.49 to -0.30, or from 0.30 to 0.49 to be mediate; from -1 to -0.5 and from 0.5 to 1 to be high correlation. As illustrated in Table 4, the results of correlation analysis are as follows:

High, positive, and significant correlation

- HCE with net profit, operating profit, ROA, and profitability
- CEE with ROIC

Medium, positive, and significant correlation

- HCE with ROE
- SCE with profitability

Low, positive, and significant correlation

- SCE with net profit, operating profit, ROE, and ROA
- CEE with net profit, operating profit, and ROA

Low, negative, and significant correlation

- SCE with ROIC

In case of human capital efficiency, the highest positive correlation exists with profitability, operating profit, ROA, net profit, and ROE, respectively. When we observe structural capital component, the highest correlation is with profitability, operating profit, ROE, ROA, and net profit. As far as ROIC is concerned, the correlation is negative and low. Finally, physical capital possesses strongest correlation with ROIC, ROE, ROA, operating profit, and net profit respectively.

Table 4: Correlation analysis

		NP	OP	ROE	ROA	P	ROIC
HCE	Correlation Coefficient	.565**	.730**	.448**	.566**	.878**	-.009
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.671
	N	2635	2635	2181	2635	2554	2156
SCE	Correlation Coefficient	.113**	.218**	.218**	.131**	.391**	-.088**
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000
	N	2909	2909	2350	2900	2745	2286
CEE	Correlation Coefficient	.068**	.260**	.442**	.280**	.314**	.646**
	Sig. (2-tailed)	.001	.000	.000	.000	.000	.000
	N	2367	2367	2367	2367	2291	2291

Regression analysis

After completing correlation analysis, we proceed to examine the nature and direction of relationships between elements of VAIC and chosen indicators of financial performance. Therefore, we used multiple linear regression analysis to assess these relationships and to determine the value drivers in ICT manufacturing enterprises in Serbia. Since there are six dependent variables in the research, we identified six regression models, which can explain whether financial performance is more dependent on the tangible or intangible resources. Formally, the model for multiple linear regression, given n observations, is

$$Y_i=\beta_0+\beta_1 x_{i1}+\beta_2 x_{i2}+ \dots +\beta_p x_{ip}+\varepsilon_i$$

for i=1, 2, 3...n

In the presented model of multiple regression, Y_i is dependent variable, β_0, β_1, β_2 … β_p are regression coefficients, x_{i1}, x_{i2}... x_{ip} are independent variables, and ε_i represents the notation for the model deviations. In order to determine the characteristics of the relationships between IC, physical capital, on one side, and basic indicators of financial performance, on the other, the regression models were developed accordingly.

Table 5 depicts the results of the first regression model where net profit acted as dependent variable. The results of ANOVA analysis confirm that the regression model is valid (Sig. = 0.000). This regression model leads to the conclusion that, after controlling for firm size and financial leverage, there is only significant positive impact of human capital efficiency on the size of realized net profit in the observed period. Also, the quality of the regression model is satisfactory because the changes in VAIC components can explain 35.2% of the alterations in

Table 5: Regression model 1(Net profit)

Model Summary[c]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.592[a]	.350	.350	229226.75647	
2	.593[b]	.352	.351	229051.79895	2.147

a. Predictors: (Constant), Lev, TA
b. Predictors: (Constant), Lev, TA, SCE, HCE, CEE
c. Dependent Variable: NP

ANOVA[a]

	Model	Sum of Squares	df	Mean Square	F	Sig.
1	Regression	61296867688467.910	2	30648433844233.953	583.281	.000[b]
	Residual	113707176323290.500	2164	52544905879.524		
	Total	175004044011758.400	2166			
2	Regression	61627769827108.766	5	12325553965421.754	234.930	.000[c]
	Residual	113376274184649.640	2161	52464726600.948		
	Total	175004044011758.400	2166			

a. Dependent Variable: NP
b. Predictors: (Constant), Lev, TA
c. Predictors: (Constant), Lev, TA, SCE, HCE, CEE

Coefficients[a]

	Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	17862.054	5107,590		3.497	.000		
	TA	.046	.001	.591	34.136	.000	1.000	1.000
	Lev	-134.203	120.419	-.019	-1.114	.265	1.000	1.000
2	(Constant)	16401.434	5139.975		3.191	.001		
	TA	.046	.001	.591	34.128	.000	1.000	1.000
	Lev	-143.310	131.148	-.021	-1.093	.275	.842	1.188
	HCE	763.016	319.246	.041	2.390	.017	.999	1.001
	SCE	646.252	897.213	.012	.720	.471	1.000	1.000
	CEE	28.423	141.000	.004	.202	.840	.841	1.189

a. Dependent Variable: NP

net profit. According to the results of the first regression model, the equation has the following elements:

*Net profit = 17,862.05 + 763.02*HCE + 0.046*TA*

In Table 6, we present the results for the second regression model where operating profit stands as dependent variable. The model fit is also satisfactory because this regression model can describe 33.9% of operating profit variations. ANOVA table defines the second regression model as adequate, too (Sig. = 0.000).

When analyzing coefficients within Table 6, we can confirm that human capital efficiency has significant positive impact on operating profit. Other components of VAIC have no impact on operating profit in the case of ICT manufacturing enterprises in Serbia. As a consequence, we construct the second regression model as follows:

*Operating profit = 5,719.42 + 872.72*HCE + 0.056*TA*

When observing third regression model (Table 7), we can see that it is a valid regression model (according to the ANOVA table), but it can explain only 12.7% of all changes in ROE values.

After the analysis of third model's regression coefficients, the conclusion is that only physical capital (capital employed efficiency) has significant, positive, and low impact on this measure of financial performance of enterprises. Therefore, after controlling for firm size and leverage, the regression formula in case of ROE is:

*ROE = 0.235 + 0.021*CEE –0.008*Lev*

The fourth regression model (see Table 8), where ROA is dependent variable, suffers from borderline validity (Sig. close to 0.05) and very poor explaining power, with the ability to describe the ROA variations only in 0.6% of cases.

Table 6: Regression model 2 (Operating profit)

Model Summary[c]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.581[a]	.337	.336	288767.56365	
2	.582[b]	.339	.337	288623.49886	2.093

a. Predictors: (Constant), Lev, TA
b. Predictors: (Constant), Lev, TA, SCE, HCE, CEE
c. Dependent Variable: OP

ANOVA[a]

	Model	Sum of Squares	df	Mean Square	F	Sig.
1	Regression	91740951704374.440	2	45870475852187.220	550.093	.000[b]
	Residual	180448831389362.300	2164	83386705817.635		
	Total	272189783093736.750	2166			
2	Regression	92170867529375.720	5	18434173505875.145	221.289	.000[c]
	Residual	180018915564361.030	2161	83303524092.717		
	Total	272189783093736.750	2166			

a. Dependent Variable: NP
b. Predictors: (Constant), Lev, TA
c. Predictors: (Constant), Lev, TA, SCE, HCE, CEE

Coefficients[a]

	Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	5719.419	6434.268		.889	.374		
	TA	.056	.002	.580	33.161	.000	1.000	1.000
	Lev	-106.700	151.697	-.012	-.703	.482	1.000	1.000
2	(Constant)	4050.161	6476.778		.625	.532		
	TA	.056	.002	.580	33.147	.000	1.000	1.000
	Lev	-121.028	165.257	-.014	-.732	.464	.842	1.188
	HCE	872.724	402.275	.038	2.169	.030	.999	1.001
	SCE	679.134	1130.559	.011	.601	.548	1.000	1.000
	CEE	42.955	177.671	.005	.242	.809	.841	1.189

a. Dependent Variable: OP

Table 7: Regression model 3 (ROE)

Model Summary[c]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.149[a]	.022	.021	2.2029903	
2	.356[b]	.127	.125	2.0833630	1.997

a. Predictors: (Constant), Lev, TA

b. Predictors: (Constant), Lev, TA, SCE, HCE, CEE

c. Dependent Variable: ROE

ANOVA[a]

	Model	Sum of Squares	df	Mean Square	F	Sig.
1	Regression	239.150	2	119.575	24.639	.000[b]
	Residual	10502.251	2164	4.853		
	Total	10741.402	2166			
2	Regression	1361.795	5	272.359	62.750	.000[c]
	Residual	9379.607	2161	4.340		
	Total	10741.402	2166			

a. Dependent Variable: ROE

b. Predictors: (Constant), Leverage, Total assets

c. Predictors: (Constant), Leverage, Total assets, SCE, HCE, CEE

Coefficients[a]

	Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	.235	.049		4.789	.000		
	TA	-6.34E-009	.000	-.010	-.494	.621	1.000	1.000
	Lev	.008	.001	.149	7.002	.000	1.000	1.000
2	(Constant)	.204	.047		4.374	.000		
	TA	-2.94E-009	.000	-.005	-.242	.809	1.000	1.000
	Lev	.000	.001	.009	.402	.688	.842	1.188
	HCE	-.001	.003	-.007	-.356	.722	.999	1.001
	SCE	.003	.008	.008	.412	.680	1.000	1.000
	CEE	.021	.001	.352	16.076	.000	.841	1.189

a. Dependent Variable: ROE

Table 8: Regression model 4 (ROA)

Model Summary[c]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.055[a]	.003	.002	.2020420	
2	.076[b]	.006	.003	.2019014	2.035

a. Predictors: (Constant), Lev, TA

b. Predictors: (Constant), Lev, TA, SCE, HCE, CEE

c. Dependent Variable: ROA

ANOVA[a]

	Model	Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.263	2	.132	3.225	.040[b]
	Residual	88.337	2164	.041		
	Total	88.600	2166			
2	Regression	.508	5	.102	2.495	.029[c]
	Residual	88.091	2161	.041		
	Total	88.600	2166			

a. Dependent Variable: ROE

b. Predictors: (Constant), Leverage, Total assets

c. Predictors: (Constant), Leverage, Total assets, SCE, HCE, CEE

In addition, there are no independent variables in this model that has significant impact on return on assets. This is why the regression model cannot be constructed. Just in the case of structural capital efficiency, we can find borderline impact, but due to the model quality this is disregarded.

Table 9 gives detailed description on fifth regression model that uses profitability as a dependent variable. Like

Table 8 (continued): Regression model 4 (ROA)

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	.076	.005		16.990	.000		
	TA	-8.546E-01	.000	-.016	-.726	.468	1.000	1.000
	Lev	.000	.000	-.052	-2.434	.015	1.000	1.000
2	(Constant)	.076	.005		16.877	.000		
	TA	-8.100E-01	.000	-.015	-.688	.491	1.000	1.000
	Lev	.000	.000	-.063	-2.688	.007	.842	1.188
	HCE	.000	.000	-.028	-1.304	.192	.999	1.001
	SCE	.001	.001	.037	1.747	.081	1.000	1.000
	CEE	.000	.000	.027	1.155	.248	.841	1.189

a. Dependent Variable: ROA

Table 9: Regression model 5 (Profitability)

Model Summary[c]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.003[a]	.000	-.001	7.6257387	
2	.125[b]	.016	.013	7.5716336	1.985

a. Predictors: (Constant), Lev, TA

b. Predictors: (Constant), Lev, TA, HCE, SCE, CEE

c. Dependent Variable: Profitability

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.203	2	.602	.010	.990[b]
	Residual	124386.895	2139	58.152		
	Total	124388.098	2141			
2	Regression	1931.996	5	386.399	6.740	.000[c]
	Residual	122456.102	2136	57.330		
	Total	124388.098	2141			

a. Dependent Variable: Profitability

b. Predictors: (Constant), Lev, TA

c. Predictors: (Constant), Lev, TA, HCE, SCE, CEE

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	.088	.171		.513	.608		
	TA	-5.84E-009	.000	-.003	-.131	.895	1.000	1.000
	Lev	.000	.005	-.001	-.059	.953	1.000	1.000
2	(Constant)	-.013	.171		-.075	.941		
	TA	-7.85E-009	.000	-.004	-.178	.859	.999	1.001
	Lev	-.007	.007	-.030	-.945	.345	.462	2.164
	HCE	.059	.011	.121	5.610	.000	.999	1.001
	SCE	.014	.035	.009	.397	.692	1.000	1.000
	CEE	.012	.010	.039	1.237	.216	.462	2.166

a. Dependent Variable: Profitability

in the previous case, the model has very low explanatory power ($R^2 = 0.016$).

Yet, if we observe regression coefficients, there is only significant impact of human capital efficiency on profitability. This does not mean a lot because only 1.6% of variations in profitability values is attributable to the changes in VAIC components, or in this case, the human capital element. Still, there is theoretical possibility to construct regression equation:

*Profitability = 0.088 + 0.059*HCE*

The next regression model analyzes the relationship between intellectual and physical capital on one side, and return on invested capital on the other. The model is presented in Table 10.

The results of sixth regression model point to the several conclusions. Firstly, this model has the highest explanatory power so far. Secondly, it is obvious that only capital employed efficiency has significant impact on ROIC values, after controlling for firm size and leverage. Finally, the adequate regression equation that explains this relationship can be constructed as follows:

*ROIC = 3.872 + 1.243*CEE + 1.99*Lev*

The results of the multiple linear regression analysis lead us to the conclusions about hypotheses confirmation or rejection. According to this analysis, we can conclude that human capital efficiency and capital employed efficiency partially affect financial performance of enterprises in ICT manufacturing industry in Serbia. Therefore, the first and the third hypothesis are partially confirmed. Structural capital efficiency does not determine the financial performance when analyzing all of the financial performance indicators, which rejects the second research hypothesis.

Table 10: Regression model 6 (ROIC)

Model Summary[c]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.861[a]	.742	.742	40.1534155	
2	.902[b]	.814	.814	34.0949929	1.954

a. Predictors: (Constant), Lev, TA
b. Predictors: (Constant), Lev, TA, HCE, SCE, CEE
c. Dependent Variable: ROIC

ANOVA[a]

	Model	Sum of Squares	df	Mean Square	F	Sig.
1	Regression	9914122.010	2	4957061.005	3074.534	.000[b]
	Residual	3448702.798	2139	1612.297		
	Total	13362824.808	2141			
2	Regression	10879792.010	5	2175958.402	1871.843	.000[c]
	Residual	2483032.798	2136	1162.469		
	Total	13362824.808	2141			

a. Dependent Variable: ROIC
b. Predictors: (Constant), Lev, TA
c. Predictors: (Constant), Lev, TA, HCE, SCE, CEE

Coefficients[a]

	Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	3.872	.902		4.294	.000		
	TA	-2.09E-007	.000	-.010	-.892	.372	1.000	1.000
	Lev	1.999	.025	.861	78.405	.000	1.000	1.000
2	(Constant)	3.873	.772		5.020	.000		
	TA	-8.51E-008	.000	-.004	-.428	.669	.999	1.001
	Lev	1.326	.032	.571	41.635	.000	.462	2.164
	HCE	-.058	.048	-.011	-1.222	.222	.999	1.001
	SCE	-.028	.157	-.002	-.176	.860	1.000	1.000
	CEE	1.243	.043	.396	28.821	.000	.462	2.166

a. Dependent Variable: ROIC

Conclusion and directions for future research

In the last couple of decades, significant number of research studies has been implemented with the objective of determining the relationship between intellectual capital and corporate performance. In addition, these studies examined various industries and reached various conclusions. The majority of empirical studies confirmed positive impact of intellectual capital on corporate performance. However, these conclusions were often made for the developed economies, which already rely significantly on intangible resources as the major driver of value creation. On the other hand, conclusions from developing economies vary. For example, as stated by *Firer* and *Williams* [16], physical capital remained the most significant underlying resource of corporate performance in South Africa among enterprises in the knowledge-intensive sectors (banking, electrical, information technology, and services industries). Similarly, *Gan* and *Saleh* [17] when investigated the relationship between components of intellectual capital and corporate performance of technology-intensive companies in Malaysia found that in the time of the study, these Malaysian companies were primarily dependent on physical capital. The results also indicated that physical capital efficiency is the most significant variable related to profitability while human capital efficiency is of great importance in enhancing the productivity of the company.

The research conducted in Serbian ICT manufacturing industry, where relationship between intellectual capital and financial performance of 594 enterprises were analyzed for the period of five consecutive years (2009-2013), produced results that were expected to a certain extent. The starting premise was that intellectual capital components (human and structural capital efficiencies) were primary drivers of financial performance, while physical capital had no significant influence on value creation. The research hypotheses were identified accordingly. The results of multiple regression analysis showed that only human capital efficiency affects financial performance (in cases of net profit, operating profit, and profitability), while capital employed efficiency had significant impact on ROE and ROIC. Structural capital had no impact on any indicator of financial performance. Overall, we can say that ICT manufacturing industry might be moving into the right direction when discussing employing IC in achieving positive financial results. When compared to other industries in Serbia, ICT manufacturing industry demonstrated increasing significant impact of human capital, thus confirming that this industry is knowledge-intensive even in developing country like Serbia. On the other hand, the research that analyzed IC and financial performance of another presumably knowledge-intensive sector in Serbia (banking sector) pointed out that human capital component was undervalued and not exploited effectively. In addition, physical capital still played a significant role in achieving exceptional levels of profitability and ROE in banking sector [3]. In a study conducted on 100 enterprises with the highest net profits in 2011 [27] there was no statistically significant impact of either of IC components on financial performance. In particular, the results of regression analysis showed that ROE was mainly influenced by physical capital and to a small extent by structural capital. ROA was affected solely by physical capital, while employee productivity was not influenced by any component of IC. Profitability was determined by physical and structural capital, and not by human capital.

The results of our empirical study undertaken in Serbia in ICT manufacturing sector serves as a good basis for further research to improve understanding of the impact of IC on financial performance in knowledge-intensive industries. One direction can be towards including more variables in the study, such as different nonfinancial measures of performance. By doing this, the scope and validity of the research could be increased. Another route would be to conduct the research on a larger sample and include the whole ICT sector, and not only manufacturing segment. This broader study would increase the validity of the results and could help in understanding the IC flows in knowledge-intensive industries in developing economies.

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DETERMINANTS OF BUSINESS PERFORMANCE OF NON-LIFE INSURANCE COMPANIES IN SERBIA*

Determinante poslovnih performansi kompanija za neživotno osiguranje u Srbiji

Abstract

The possibilities for growth of the insurance sector and its contribution to the development of the national economy are conditioned by business performance of insurance companies. This paper presents results of the assessment of performance of companies engaged in non-life insurance business in Serbia. Empirical research was conducted on the basis of financial statements of non-life and composite insurers during the period 2006-2013 by using CARMEL indicators and multiple regression analysis. The estimated model with individual fixed effects on panel data indicates a significant and negative influence of the combined ratio, financial leverage and retention rate on the profitability of non-life insurers, as measured by the return on assets (ROA), while the influence of the written premium growth rate, return on investment and company size is significant and positive. Conducted research enriches the information basis for the creation of business strategy and formulation of business policy of non-life insurers in Serbia.

Key words: *non-life insurance, business performance, profitability, solvency, liquidity, CARMEL*

Sažetak

Mogućnosti rasta sektora osiguranja i njegovog doprinosa razvoju nacionalne ekonomije opredeljene su performansama poslovanja osiguravajućih kompanija. U radu su prezentovani rezultati ocene performansi kompanija koje se bave poslovima neživotnih osiguranja u Srbiji. Empirijsko istraživanje je sprovedeno na osnovu finansijskih izveštaja neživotnih i kompozitnih osiguravača tokom vremenskog perioda 2006-2013. godine, primenom CARMEL pokazatelja i višestruke regresione analize. Ocenjeni model individualnih fiksnih efekata na podacima panela ukazuje na značajan negativan uticaj kombinovanog racija, finansijskog levridža i stope samopridržaja na profitabilnost neživotnih osiguravača, merene stopom prinosa na aktivu (ROA), dok je uticaj stope rasta fakturisane premije, stope investicionog prinosa i veličine kompanije značajan i pozitivan. Sprovedenim istraživanjem se obogaćuje informaciona osnova za kreiranje poslovne strategije i formulisanje politike poslovanja neživotnih osiguravača u Srbiji.

Ključne reči: *neživotno osiguranje, performanse poslovanja, profitabilnost, solventnost, likvidnost, CARMEL*

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Introduction

The performance of insurance companies is in the focus of interest of various stakeholders, including management, current and potential policyholders, shareholders and future investors, creditors and supervisory authority for the insurance market. Subject of the analysis is a comprehensive evaluation of the performance of non-life insurance companies in Serbia. In general, business performance of the insurance companies is conditioned by the influence of a number of factors which can be internal or external by their nature. Internal factors relate to the specific characteristics of individual companies, such as the structure of the insurance and investment portfolios, financial structure, size, and age of the company. On the other hand, external factors include characteristics of the macroeconomic environment that are beyond the impact of insurers, such as the level of development of the national economy and financial market as well as the relevant legal regulations. Due to their systematic or systemic character, external factors affect the performance of the overall insurance sector (or its segments) to a greater or lesser extent. However, the differences in performance between individual companies operating within the same insurance sector can be explained by the influence of internal factors that are specific for each of them.

The aim of the study is to identify the key factors of business performance of non-life insurance companies in Serbia and to measure their effects. The principles of safety, liquidity and profitability represent postulates of functioning of each insurance company as well as of entities in other business areas. Since the primary function of insurance is reflected in providing economic and social protection from risks, it is logical that the security principle appears as a crucial guideline for decision-making in all aspects of insurer's operations. A timely fulfilment of obligations towards policyholders imposes preservation of solvency, i.e. long-term financial security as an imperative for the business policy of insurers. Long-term earning capacity of a business entity is a safe indicator of its long-term financial security. Therefore, profitability is a key indicator of insurance company's business performance and the primary objective of its management. In the long-term perspective, profit is not only a prerequisite of insurer's solvency, but also has an important role to "persuade" policyholders and shareholders to entrust their available funds to an insurance company. Insurers' profit margins become narrower with intense market competition and unfavourable macroeconomic environment. Under such conditions, knowledge of the direction and intensity of impact of various internal factors on the profitability of insurers becomes an important pillar of the process of making business and strategic decisions.

The first section of the paper reviews results of the previous empirical studies of determinats of insurance companies' performance. After an elaboration of data and methodology used in this study, insurers' performance will be assessed through calculation of relevant quantitative indicators, with a special emphasis on the dispersion of their values between companies, as well as demonstrated trends of their movements over time on the level of the non-life insurance sector. A concrete empirical model which describes the impact of key internal factors on the profitability of non-life insurers in Serbia will be defined and estimated in the rest of the paper.

Literature review

The concept of performance of financial institutions has an important place in financial theory in recent decades. The financial sectors in developing countries are becoming opened for foreign capital entry in the current conditions of financial internationalization, integration, and liberalization. Due to intensified market competition, there is a need to examine the factors that determine the performance of participants in the sector of financial services. Contemporary literature abounds with examples of studies of determinants of banks' performance [24], [12], [3], while research papers on performance of insurance companies are relatively scarce and more recent.

Lee [19] conducted a study of relationship between performance of insurance companies and the relevant internal and external factors on a sample of 15 non-life insurers in Taiwan using the panel data over the period 1999-2009. The return on assets and operating ratio were used as performance indicators of insurers. Both indicators

are subject to the negative impact of loss ratio, expense ratio and retention rate, as well as the positive impact of investment return and market share of insurers. Although the use of financial leverage reduces the need for capital, its overly high value is reflected in the lower market value of the company, thus reducing its profitability (measured by the return on assets) and leading to insolvency problems in the future. Rate of economic growth has a significant impact on the operating ratio, but not on the return on assets of insurers, while the impact of the inflation rate is insignificant in both cases.

Bawa & *Chattha* [4] investigated interdependence of profitability of insurance companies and relevant indicators of their size, liquidity, solvency and financial leverage. The research was based on the case of 18 life insurance companies in India during the period 2007-2011. The estimated regression model revealed positive impact of liquidity and size of surveyed companies on their profitability. *Browne et al.* [6] also empirically demonstrated that insurer's size is directly linked to its profitability, on the example of life insurance companies in the United States. However, the size of the company was not found to be an important determinant of business performance of companies on the Bermuda insurance market according to *Adams* & *Buckle* [1].

Similarly, *Shiu* [29] found a statistically significant relationship between liquidity and performance of non-life insurance companies in the UK, measured by their investment yield, percentage change in shareholders' funds and return on shareholders' funds. However, using investment yield as a performance measure, *Ismail* [15] proved the opposite – increase in the share of liquid instruments in the structure of insurer's assets leads to a reduction in profitability due to the relatively lower risk and, consequently, lower yield compared with long-term investments.

Burca & *Batrînca* [7] observed the return on assets of insurers, as a proxy of their financial performance, as a function of 13 explanatory variables, including the specific characteristics of insurers but also of their macroeconomic environment, within the panel model with fixed effects. Their investigation was performed on the data for 21 insurance companies operating in Romania during the period 2008-2012. According to the gained results, the company's size, solvency margin and the degree of risk retained in own coverage positively influence its financial performance. On the other hand, the effect of combined ratio, financial leverage and rate of written premium growth on insurers' return on assets is negative. *Bilal et al.* [5] also proved that financial leverage is negatively correlated with the profitability of insurers.

On the example of eight companies that dealt with life insurance business in Tunisia during the period 2005-2012, *Derbali* [11] found that the most important determinants of insurers` performance, measured by the return on assets, are the size, age and growth rate of insurance premium. Estimation of regression model on panel data indicates that smaller life insurers are relatively more efficient than large companies. Maturity at the same time has a positive effect on insurer's profitability, on the basis of more experience, reputation and recognized brand. The written premium growth also contributes to the profitability of insurance business, through intensified underwriting activities and market expansion. On the other hand, *Mehari* & *Aemiro* [23] found that the size of the insurance company positively affects its performance while *Malik* [21] claims that there is no empirical evidence of the significant impact of age on the performance of insurers.

Empirical findings regarding the relationship between performance of insurers and the degree of diversification of their portfolios are also contradictory. *Fiegenbaum* & *Thomas* [13] show that insurers who follow a product diversification strategy have combined ratio that is lower than market average. However, using a Herfindahl Index-derived measure of product diversification, *Tombs* & *Hoyt* [31] reported that diversified insurers generate relatively lower risk-adjusted returns. Based on sample of 321 life insurers in the United States over the period 1990 to 1995, *Meador et al.* [22] proved that companies who are diversified across multiple product lines are more efficient than those that are focused on one or a small number of lines of business. On the other hand, using a 10-year sample (1995 to 2004) of 914 insurance companies, *Liebenberg* & *Sommer* [20] found that undiversified companies outperform those that are diversified. *Lee* [19] empirically proved that the

influence of insurance portfolio concentration on company's performance, although negative, is not significant.

Data and methodology of analysis

Recording premium income of approximately RSD 49.9 billion in 2013, non-life insurance sector achieves a dominant share (of 78.0%) in the overall insurance portfolio on the Serbian insurance market. Non-life insurance activities are dealt with a total of 17 insurance companies in 2013, of which 11 companies are engaged solely in non-life, and the remaining 6 companies in both life and non-life insurance [27, p. 7]. However, units of observation in the analysis of non-life insurance sector performance in Serbia were only companies that operated continuously during the period covered by analysis, in order to increase generalization capabilities of its conclusions. These are 12 insurance companies that were involved in non-life insurance over the previous eight year period (2006-2013), which formed the sample of 96 observations for each of the variables. According to data from 2013, cumulative absolute market share of these companies in the non-life insurance sector amounts to 90.1% [25], due to which given sample can be considered representative.

Performance analysis of non-life insurers is carried out using a set of ratio indicators that are developed by the International Monetary Fund, in the function of measuring weights and vulnerabilities of the insurance sector, as one of the parts of the entire financial system. These indicators are classified into six categories: Capital Adequacy, Asset quality, Reinsurance and actuarial issues, Management soundness, Earnings and profitability and Liquidity, which is why the generally accepted acronym CARMEL is used for their labelling. Proceeding from the financial statements of insurance companies, CARMEL framework allows assessment of their financial position and earning capability, as well identification, analysis and monitoring of a wide range of risks that jeopardize their operating. Respecting limitations in terms of the data availability, 22 CARMEL indicators were used as basic research variables. The analysis is conducted on the basis of the descriptive statistics (measures of central tendency and dispersion) of calculated indicators per unit of observation in the previous year and also through the monitoring of the movements of their average values for the overall non-life insurance sector during the covered period.

Determinants of performance in non-life insurers are identified and the impact of each of them estimated in the study through multiple regression analysis. The returns on assets, as a summary measure of insurer`s profitability, is used in the function of dependent variable, while the choice of explanatory variables is based on an examination of relevant literature and previous empirical studies in the given area. Functional relationship of variables is described by linear panel model in the following general form:

$$ROA_{it} = \beta_{1it} + \beta_2 AGE_{it} + \beta_3 COMBINED_{it} + \\ + \beta_4 GROWTH_{it} + \beta_5 HHI_{it} + \beta_6 INVESTMENT_{it} + \\ + \beta_7 LEVERAGE_{it} + \beta_8 LIQUIDITY_{it} + \\ + \beta_9 REINSURANCE_{it} + \beta_{10} SIZE_{it} + u_{it}$$

where:

ROA_{it} – rate of return on assets of company *i* in year *t*,

$\beta_{1it}, \beta_2, ..., \beta_{10}$ – intercept and slope coefficients,

AGE_{it} – number of years since the company *i* operates in the Serbian insurance market observed in year *t*,

$COMBINED_{it}$ – combined ratio of the company *i* in year *t*, as a percentage share of net claims incurred and operating expenses in net earned premium,

$GROWTH_{it}$ – percentage growth rate of written premium of company *i* in year *t* compared to a year (*t*-1),

HHI_{it} – Herfindahl - Hirschman index as a measure of concentration degree of insurance portfolio of company *i* in year *t*, in the form of the sum of squares of shares of individual business lines in the total written premium,

$INVESTMENT_{it}$ – investment ratio of company *i* in year *t*, as a percentage share of investment return in net earned premium,

$LEVERAGE_{it}$ – leverage of company *i* in year *t*, as a percentage ratio of technical reserves and capital,

$LIQUIDITY_{it}$ – liquidity ratio of company *i* in year *t*, as a percentage ratio of current assets less inventories and current liabilities (including unearned premiums and claim provisions),

$REINSURANCE_{it}$ – retention rate of company *i* in year t, as a percentage ratio of net earned premium and gross earned premium of the company,

$SIZE_{it}$ – size of the company i in year t as natural logarithm of a written premium of the company,
u_{it} – disturbance term, i = 1,...,12, t = 1,...,8.

Calculation of all indicators is founded on the balance sheets, income statements and notes to the financial statements of insurance companies, published on the websites of the National Bank of Serbia and the Serbian Business Registers Agency [25], [28]. The National Bank of Serbia databases and publicly available annual reports on insurance sector supervision were used as additional data sources. The data were previously adapted to the needs of the given analysis. Namely, there are five composite insurance companies encompassed among the units of observation, for which only the total values of operating expenses, as well as claim settlement expenses and reimbursement revenues are known. A part of operating expenses of these companies that refers only to non-life insurance is approximated on the bases of the assumption of proportional share of life and non-life insurance operations in their premium revenues and operating expenses. In a similar manner claim settlement expenses and reimbursement revenues are distributed in proportion to the known ratio of claim payments in life and non-life insurance operations of these composite companies [16, p. 341].

Performance assessment of non-life insurers in Serbia

In order for the insurance company to be continuously able to settle its obligations to policyholders in accordance with the agreed dynamics, it is necessary to consider all the risks that threaten its operating and to manage them in an adequate way. In addition to typical financial risks that other types of financial institutions are endangered with (market and investment risks, credit risk, liquidity risk, etc.), insurance companies face risks that are specific to the insurance industry, such as the risk of insufficient premiums and technical reserves (or claim provisions), reinsurance risk, the risk of catastrophic events, etc. Finally, as well as all business entities, regardless of their specific activity, insurers are exposed to the broad range of risks included in the operational risk category.

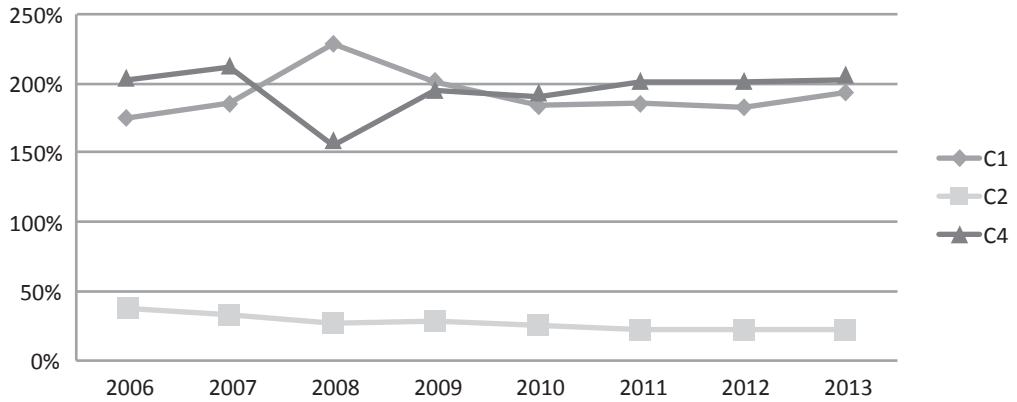
Resilience of financial institution to "shocks" that affect its balance sheet is ultimately determined by the adequacy of its capital [30, p. 15]. For the insurance company, the capital is the absorber in the last instance of adverse consequences of realizations of the all threatening risks. Appropriate categories presenting exposure to insurance risks are net insurance premiums (in the case of non-life) and technical reserves (in the case of life

Table 1: Capital adequacy indicators of non-life insurers in Serbia in 2013

Indicator	Average value	Median	Min. value	Max. value	Relative st. dev.
Net premium / Capital (C1)	194.0%	213.2%	13.9%	1684.0%	75.9%
Capital / Total assets (C2)	21.7%	21.2%	4.5%	73.9%	119.8%
Guarantee reserve / Required solvency margin (C4)	203.0%	142.3%	17.5%	310.8%	180.7%

Source: Authors' calculation on the basis of [25], [28]

Figure 1: Trend of capital adequacy indicators of non-life insurers in Serbia (2006-2013)



Source: Authors' calculation on the basis of [25], [28]

insurance). Their exceptionally high values relative to the capital base of the company imply a possible inability of timely settlement of assumed obligations to policyholders. The exposure to financial risks, on the other hand, can be roughly approximated by the value of total assets of insurers. Finally, a key measure of capital adequacy from the aspect of the supervisory body is ratio between the actually available capital (i.e. guarantee reserve) and the calculated minimum required amount of capital to cover the risks that endanger the insurance company (i.e. required solvency margin).

Available data for 2013 show that non-life insurers' retained premium exceeds their capital 1.9 times on average (see Table 1). Movements of average values of this indicator during time indicate an increase in the capital adequacy of considered companies with regard to the insurance risks assumed since the occurrence of the economic crisis in 2008/09 (see Figure 1). However, such a tendency is the result of premium income stagnation (given the unfavourable macroeconomic environment) and cautious policy of retaining taken risks in insurers` own coverage. During the same period, insurers' capital recorded a relatively slow growth and then a reduction in 2013 under the influence of the net result deterioration. The average value of the ratio of capital to total assets in 2013 amounted to 21.7%, wherein variations between companies in terms of the given indicator are relatively high, given that its value, individually viewed, ranges from only 4.5% to as much as 73.9%. The gradual decline in the average value of C2 CARMEL indicator over time indicates a decline in adequacy of capital of non-life insurers to cover the financial risks as a result of relatively rapid growth of their balance sum. Guarantee reserve of insurers was, on average, twice as large as their required solvency margin in 2013, although the legal requirement for the value of C4 ratio to be larger than 100% [14, article 123] was not satisfied in the case of two insurance companies.

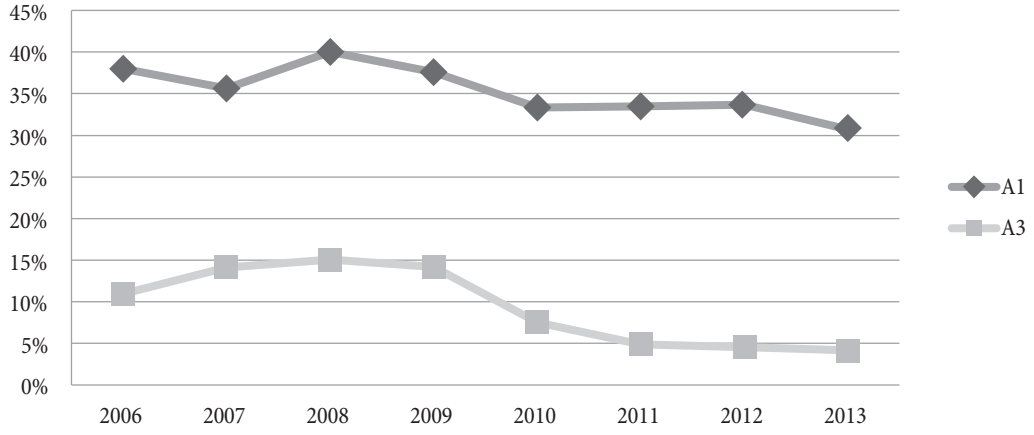
A more comprehensive insight into the level of exposure to investment, market and credit risks provide asset quality indicators that take into account the share in the total insurer assets of those instruments which are characterized by difficult marketability and/or possible overestimation in the financial statements. In the first place, that is the case with intangible assets, real estate, receivables, and placements in securities that are not traded on a regulated market. The average aggregate share of these instruments in the total assets of non-life insurers in Serbia was equal to 30.7% in 2013 (see Table 2). The dominant

Table 2: Selected asset quality indicators of non-life insurers in Serbia in 2013

Indicator	Average value	Median	Min. value	Max. value	Relative st. dev.
(Intangible assets + real estate + unquoted equities + receivables) / Total assets (A1)	30.7%	31.2%	0.8%	59.1%	171.8%
Equities / Total assets (A3)	4.2%	1.0%	0.1%	26.6%	54.8%

Source: Authors' calculation on the basis of [25], [28]

Figure 2: Trend of selected asset quality indicators of non-life insurers in Serbia (2006-2013)



Source: Authors' calculation on the basis of [25], [28]

position among the specified investment directions of insurers have real estate investments (58.6%), contrary to the usual structure of assets of financial institutions, but in line with a low development level of the domestic financial market, which is confirmed by the low share of equities in total assets of the insurers (of 4.2% in the 2013).

There is an obvious improvement of the values of A1 and A3 CARMEL indicators in 2013 compared to 2008, when they reached maximum average values of even 40.0% and 15.1%, respectively (see Figure 2). Although the individual share of the above forms of risky investments in total assets of insurers decreased during the observed period, it should be emphasized that the share of receivables remained at approximately same level (of about 7.9% on average). Since receivables for insurance premiums dominate among total receivables of insurance companies, such a finding witnesses on persistent insurers' propensity to credit their policyholders, in terms of illiquidity of the economy and low payment capabilities of population.

Although it represents the most important instrument of risk management for insurance companies, reinsurance by itself generates certain risks in terms of the inadequately estimated self-retention limit and arranged reinsurance coverage, but also credit risk, i.e. inability and/or unwillingness of reinsurer to meet its obligations to the insurer. Therefore, monitoring of relevant actuarial positions (reflected through the amount of net technical reserves in relation to net claims paid or net premium), as well as the reinsurance policy (in the form of share of retained in the gross earned premium) occur as an inevitable element of the insurer financial stability evaluation.

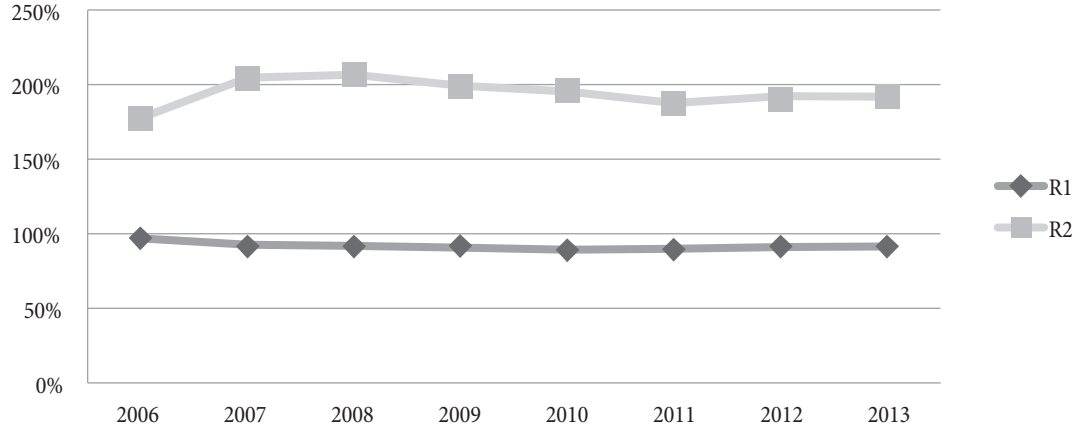
According to available data for 2013 non-life insurers in Serbia retain approximately 91.6% of the insured risks in their own coverage (see Table 3). Such a value of the retention rate is relatively high, having in mind that the average value of the same indicator at the level of the OECD countries in non-life insurance sector amounts to 80.5% [10, p. 32]. The behaviour of R1 indicator in time suggests no significant changes in the reinsurance policy of observed non-life insurers during the period 2006-2013 (see Figure 3). The relatively high average value of the ratio of net technical reserves and the average of net claims paid (of 192.0% in 2013), indicates sound quantification and estimation of insurance liabilities and, therefore, the absence of pressures on the insurers' capital, thus leaving manoeuvring space to cover possible unexpected and catastrophic losses. However, given indicator provides only a rough measure of the actuarial calculation accuracy. More reliable conclusions on the sufficiency of technical reserves can be obtained on the basis of their run-off

Table 3: Indicators of reinsurance and actuarial issues of non-life insurers in Serbia in 2013

Indicator	Average value	Median	Min. value	Max. value	Relative st. dev.
Net earned premium / Gross earned premium (R1)	91.6%	91.9%	73.3%	98.7%	8.4%
Net technical reserves / Average of net claims paid in last three years (R2)	192.0%	246.0%	150.3%	1305.0%	103.1%

Source: Authors' calculation on the basis of [25], [28]

Figure 3: Trend of indicators of reinsurance and actuarial issues of non-life insurers in Serbia (2006-2013)



Source: Authors' calculation on the basis of [25], [28]

analysis, which cannot be performed solely on the basis of the financial statements of insurance companies.

Operational risk occupies an important place among the factors that influence on the financial soundness of insurers. Inadequate internal processes, personnel and systems rarely directly cause the insolvency of insurers, but critically contribute to it. Potential weaknesses and failures of management that are relatively the most difficult to identify and quantify are of particular relevance within the broad category of operational risks from the aspect of the solvency of insurers. Despite its indisputable importance, the lack of data is a fundamental problem in measuring operational risk in insurance. Although modelling of operational risk is primarily of qualitative nature, relationship between appropriate indicators of business volume (such as total premium or assets) and number of employees or the salaries expenses can provide initial guidelines in terms of operational efficiency and, indirectly, the quality of the management structure of insurance companies. The average values of the total contracted premium and total assets per employee in the amount of RSD 5,455 thousand and RSD 12,083 thousand, respectively, are calculated for observed non-life insurers on the basis of the available data from 2013 (see Table 4). At the same time, average share of salaries expenses in net premium reached the amount of 7.8%.

More relevant conclusions can be obtained from the analysis of the manifested trend of given indicators' values over time (see Figure 4). Increasing average value of the M2 indicator, on one hand, and the decreasing average value of the M3 indicator, on the other hand, witness of a gradual improvement of the quality of non-life insurers management structure in Serbia. However, it is worth noting that not only the increase in business volume contributed to this outcome, but also reduction in the number employees on the entire sector level since 2008, which may be related to the better organization of companies and the more rational use of resources, but also with a lower quality of services to customers and greater exposure to operational risk. Therefore, the conclusions of the given analysis must be complemented by a more detailed and complete examination of the efficiency and quality of the business model of insurers and their management.

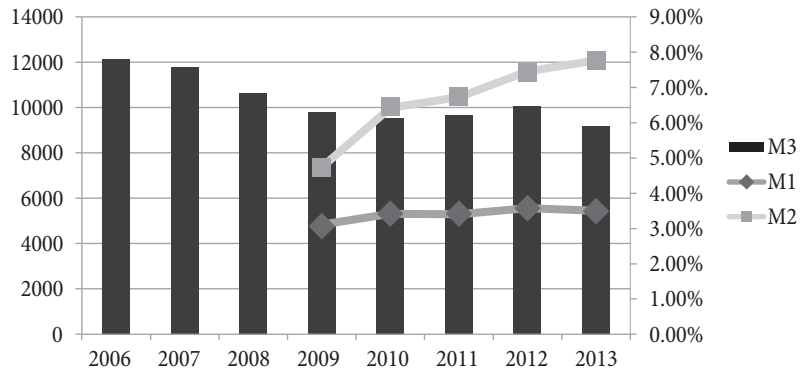
Accounting data on net result, revenues and expenses represent the starting point for the measurement of earnings and profitability of insurance companies. Insurers make profit from taking risks as well as from investing of funds stemming from premiums collected on financial market [18, p. 196]. In the field of non-life insurance, underwriting business performance is measured by the loss ratio (as a percentage share of claims incurred in the earned premium)

Table 4: Management soundness indicators of non-life insurers in Serbia in 2013

Indicator	Average value	Median	Min. value	Max. value	Relative st. dev.
Total contracted premium in RSD thousands / Number of employees (M1)	5,455.2	5,357.1	3,437.0	15,951.3	178.6%
Total assets in RSD thousands / Number of employees (M2)	12,083.3	10,184.8	6,150.8	96,259.6	74.0%
Salaries expenses / Net written premium (M3)	7.8%	6.2%	0.8%	22.4%	128.3%

Source: Authors' calculation on the basis of [25], [28]

Figure 4: Trend of management soundness indicators of non-life insurers in Serbia (2006-2013)



Source: Authors' calculation on the basis of [25], [28]

and the expense ratio (a percentage share of operating expenses in the earned premium), or by the combined ratio, as their sum. When the value of combined ratio is less than 100%, the insurer makes a profit in the insurance business, and vice versa. However, even if its value is greater than 100%, the total insurer's operating can be profitable if loss from insurance activities may be offset by realized investment income. The difference between combined ratio and investment ratio (as a percentage share of investment return in the earned premium), represents an operating ratio, as a measure of the profitability of the overall insurer's business. In addition to these indicators that are specific to insurance activities, by analogy with entities in other business areas, return on assets (ROA) and return on equity (ROE) appear as relevant indicators of profitability of insurance companies. Earning potential of insurance companies is also seen through the comparison of their net results and total revenues or number of employees.

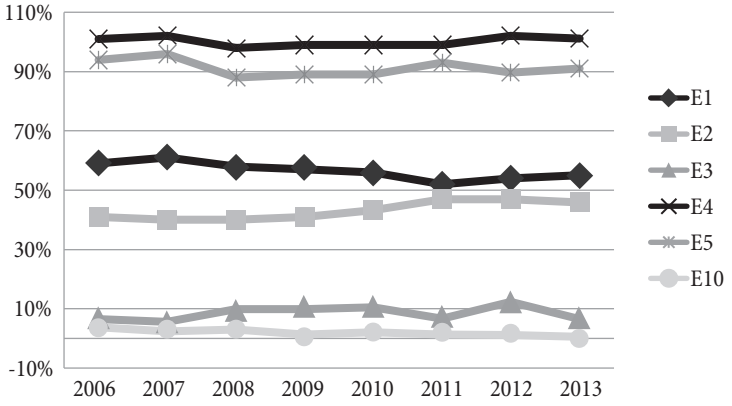
The calculated value of the combined ratio of 101.1% in 2013 demonstrates that non-life insurance activities in Serbia are not profitable, on average, which is primarily to due high amounts of the operating expenses (see Table 5). Nevertheless, realized investment return at the sector level exceeds the loss from insurance operations, causing the whole business to be profitable, as indicated by the value of the operating ratio of 91.1% and positive, although low, rates of return on assets and on equity in the same year (in the amounts of 0.5% and 2.5%, respectively). Although the average values of the selected profitability indicators are relatively stable over time (see Figure 5), there is a slight deterioration in the domain of the insurance activities results, primarily due to faster growth in the operating expenses in relation to the growth of net earned premium. Although variations in the average values of these ratios between the years are not significant, variations between companies exist, which is why it is necessary to further

Table 5: Indicators of earnings and profitability of non-life insurers in Serbia in 2013

Indicator	Average value	Median	Min. value	Max. value	Relative st. dev.
Net incurred claims /Net earned premium (Loss ratio - E1)	55.1%	54.8%	29.5%	79.9%	440.3%
Operating expenses / Net earned premium (Expense ratio - E2)	45.9%	47.4%	21.3%	66.4%	380.4%
Investment return / Net earned premium (Investment ratio - E3)	6.5%	7.6%	0.8%%	32.8%	119.0%
Combined ratio (E4=E1+E2)	101.1%	100.3%	77.6%	141.5%	493.2%
Operating ratio (E5=E1+E2-E3)	91.1%	94.6%	44.7%	137.2%	332.5%
Claim examination, estimation and liquidation expenses / Net claims paid (E6)	8.9%	8.0%	1.3%	16.3%	203.4%
Net result / Average capital (ROE - E8)	2.5%	1.4%	-232.9%	33.0%	34.8%
Net result in RSD thousands / Number of employees (E9)	255.2	32.6	-2,720.9	5,561.8	12.20%
Net result / Total assets (ROA - E10)	0.5%	0.4%	-25.3%	5.8%	35.5%
Net result / Total revenues (E11)	1.0%	0.6%	-35.0%	34.9%	15.9%

Source: Authors' calculation on the basis of [25], [28]

Figure 5: Trend of indicators of earnings and profitability of non-life insurers in Serbia (2006-2013)



Source: Authors' calculation on the basis of [25], [28]

investigate the influence of internal factors on their profitability.

The liquidity of insurer is evaluated based on the ratio of liquid assets, defined according to different concepts, from cash and cash equivalents, up to securities that are traded on organized market, securities issued by the government, central bank, international financial institutions (or guaranteed by any of these entities), as well as the part of long-term investments maturing within one year and other short-term investments [26, p. 15] and their current liabilities (including unearned premiums and provisions for claims). Tracking the values of liquidity indicators is particularly important for companies dealing with non-life insurance, whose predominantly short-term nature of funding sources and liabilities requires a relatively higher share of more liquid, short-term financial instruments in their investment portfolios, compared with companies that are engaged in life insurance business.

Data from 2013 show that on average 16.0% of non-life insurers` current liabilities are covered by cash and cash equivalents (see Table 6). Defined according to a broader concept, as current assets reduced by inventories, liquid assets of observed companies, on average, covers 98.0% of their short-term liabilities, which undermines the rule of thumb according to which the given value should be greater than 100% [9, p. 77]. The fall in the average value of L2 indicator since 2011 reflects the change in the investment strategy of insurers from short-term to long-term financial investments due to government borrowing through the issue of long-term bonds whose significant buyers are insurance companies (see Figure 6). On this basis, the investment results of insurers have improved during the period. Nevertheless it would not be good if this tendency of fall continues in the future, because it potentially opens the problem of illiquidity of non-life insurers. In a situation of insufficient liquid assets to settle current liabilities, the insurer is exposed to possible loss because he is forced to borrow or sell assets under unfavourable conditions, which undermines his profitability.

Empirical model specification

Table 7 presents descriptive statistics for each of the predefined research variables, that are calculated on the basis of 96 available observations. It is notable that the return on assets (ROA), as the dependent variable, ranges between -25.3% and 25.4%, with an average value of 1.9%.

In order to test if there is the potential for the multicollinearity of explanatory variables, the matrix of Pearson's correlation coefficients was calculated before the panel model design. Since none of the computed correlation coefficients in Table 8 is greater than 0.7 it can be concluded that a high correlation between selected explanatory variables does not exist.

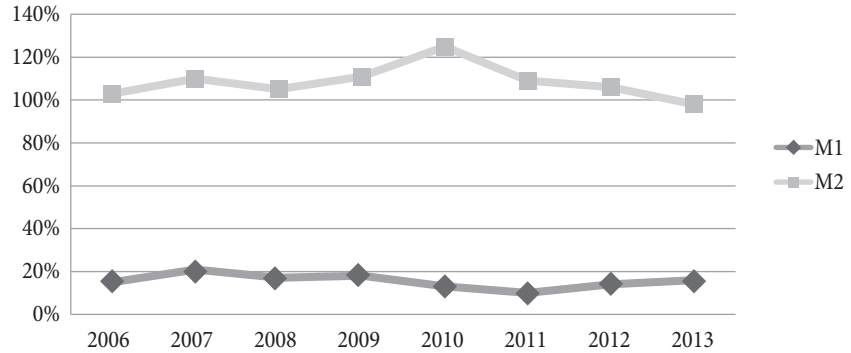
The choice of the concrete panel model specification is determined with appropriate statistical tests, having as a starting point a model with random effects (RE model),

Table 6: Liquidity indicators of non-life insurers in Serbia in 2013

Indicator	Average value	Median	Min. value	Max. value	Relative st. dev.
Cash and cash equivalents / Current liabilities (L1)	16.0%	16.7%	0.3%	93.1%	87.2%
(Current assets-inventories) / Current liabilities (L2)	98.0%	115.6%	45.1%	774.5%	86.6%

Source: Authors' calculation on the basis of [25], [28]

Figure 6: Trend of liquidity indicators of non-life insurers in Serbia (2006-2013)



Source: Authors' calculation on the basis of [25], [28]

Table 7: Descriptive statistics of variables

	ROA	AGE	COMBINED	GROWTH	HHI	INVESTMENT	LEVERAGE	LIQUIDITY	REINSURANCE	SIZE
Mean	1.9%	18.6	90.2%	154.3%	0.4691	12.0%	293.8%	155.2%	91.8%	9.08
Median	1.6%	16.0	94.9%	8.9%	0.4462	8.3%	226.2%	120.7%	94.6%	9.18
Maximum	25.4%	51.0	140.2%	11442%	0.9322	67.7%	1840.1%	774.7%	100.0%	10.22
Minimum	-25.3%	4.0	37.4%	-43.1%	0.1504	-6.0%	9.6%	45.1%	60.5%	5.90
Std. Dev.	6.4%	10.6	21.7%	1175.8%	0.2375	13.8%	277.3%	116.2%	8.7%	0.79
Observations	96	96	96	96	96	96	96	96	96	96

Source: Authors' calculation

Table 8: The matrix of Pearson`s correlation coefficients

	AGE	COMBINED	GROWTH	HHI	INVESTMENT	LEVERAGE	LIQUIDITY	REINSURANCE	ROA	SIZE
AGE	1.000	0.283	-0.110	-0.371	-0.090	-0.168	-0.152	0.016	-0.090	0.456
COMBINED	0.283	1.000	0.062	-0.024	-0.456	0.163	-0.598	0.240	-0.558	0.443
GROWTH	-0.110	0.062	1.000	0.150	-0.150	-0.075	-0.035	0.117	0.022	-0.436
HHI	-0.371	-0.024	0.150	1.000	0.012	-0.038	0.186	0.473	-0.073	-0.592
INVESTMENT	-0.090	-0.456	-0.150	0.012	1.000	0.021	0.614	-0.350	0.323	-0.340
LEVERAGE	-0.1681	0.163	-0.075	-0.038	0.021	1.000	-0.079	-0.243	-0.580	0.169
LIQUIDITY	-0.152	-0.598	-0.035	0.186	0.614	-0.079	1.000	-0.112	0.284	-0.538
REINSURANCE	0.016	0.240	0.117	0.473	-0.350	-0.243	-0.112	1.000	-0.207	-0.184
ROA	-0.090	-0.558	0.022	-0.073	0.323	-0.580	0.284	-0.207	1.000	-0.191
SIZE	0.456	0.443	-0.436	-0.592	-0.340	0.169	-0.538	-0.184	-0.191	1.000

Source: Authors' calculation

which is estimated on the basis of available observations. According to the Hausman test results, which are shown in Table 9, the null hypothesis under which the difference between the estimates of the regression coefficients obtained on the basis of fixed-effects and stochastic-effects specification is not statistically significant is rejected at a significance level of 1%, indicating a selection of model with fixed effects (FE model).

Table 9: The Hausman test results

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	33.061068	9	0.0001

Source: Authors' calculation

The presence of individual and/or time fixed effects in the FE model can be tested using the F test. According to its results presented in Table 10, the null hypothesis under which individual fixed effects are not significant is rejected at a significance level of 1%, which is why the model with individual fixed effects is superior to the pooled regression model.[1]

Table 10: The Redundant Fixed Individual Effects Test

Test Summary	F Statistic	F d.f.	Prob.
Cross-section fixed	3.0339	(11.75)	0.0021

Source: Authors' calculation

1 The same test indicates that the time effects, or individual and time effects simultaneously, are not statistically significant.

Table 11 shows the estimated FE model by using covariance method. The calculated value of the coefficient of determination indicates that 60.2% of the total variations of the return on assets as dependent variable is explained by the variations of all explanatory variables in the model. Given regression is statistically significant because F statistic has a value of 12.6 at a significance level of 1%. The impact of each of the explanatory variables, except LIQUIDITY and SIZE, on the movement of the dependent variable ROA is statistically significant at a significance level of 5%.

However, admissibility of obtained coefficient estimations requires prior verification of fulfilment of FE model assumptions. According to the Breusch-Godfrey/ Wooldridge test for serial correlation in panel models, whose results are shown in Table 12, it can be concluded that the null hypothesis of absence of serial correlation in the model cannot be rejected at a significance level of 5%.

Table 12: Breusch-Godfrey/Wooldridge test for serial correlation in panel models

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section fixed	1.8867	2	0.3893

Source: Authors' calculation

On the other hand, the Breusch-Pagan test indicates the presence of heteroscedasticity in the considered FE model.

Table 11: Fixed effect model

Variable	Coefficient	Std. Error	t-value	Prob.
AGE	-0.007463	0.002148	-3.4743	0.0008**
COMBINED	-0.135056	0.039481	-3.4208	0.0010**
GROWTH	0.001543	0.000679	2.2710	0.0260*
HHI	-0.240591	0.085619	-2.8100	0.0063**
INVESTMENT	0.104551	0.042383	2.4668	0.0159*
LEVERAGE	-0.012482	0.002254	-5.5363	0.0000**
LIQUIDITY	-0.003335	0.005018	-0.6647	0.5082
REINSURANCE	-0.240073	0.089708	-2.6761	0.0091**
SIZE	0.070533	0.041635	1.6940	0.0944

Significance codes: 0.01 '**', 0.05 '*'

R-squared=0.60187, Adj. R-squared=0.47021

F-statistic=12.5979, Prob(F-statistic)=0.0000

Source: Authors' calculation

Based on the results of this test that are shown in Table 13, the null hypothesis of random error homoscedasticity is rejected at a significance level of 5%.

Table 13: Breusch-Pagan test

Test Summary	BP	BP d.f.	Prob.
Cross-section fixed	119.6202	9	0.0000

Source: Authors' calculation

Heteroskedasticity can be controlled through robust covariance matrix estimation, i.e. sandwich estimation [17, pp. 1387-1396]. For the panel model with fixed effects, robust estimators of the covariance matrix of coefficients can be provided in accordance with *Arrelano* [2] allowing for both heteroskedasticity and serial correlation [8, p. 31]. Table 14 displays the results of t-test for heteroskedasticity consistent coefficients. Explanatory variables COMBINED, GROWTH, INVESTMENT, LEVERAGE, REINSURANCE and SIZE have a significant impact on the dependent variable ROA at a significance level of 5%.

Discussion of results

Estimated values of coefficients in suggested fixed-effects model show that the combined ratio, leverage and retention rate negatively affect the profitability of non-life insurers in Serbia, while the influence of the written premium rate of growth, investment ratio and company size is positive. Taking into account the absolute t-values of coefficients, the leverage and combined ratio have relatively greatest impact on the return on assets. On the other hand, the influence of companies' age, liquidity and product diversification on their profitability was not found to be statistically significant.

Combined ratio is a measure of efficiency of insurance operations. The more the value of this ratio, a key segment of activities of the insurance company, and thus of its entire business, may be regarded the less successful. The results show that an increase in the combined ratio by one percentage point on average leads to a reduction in the rate of return on assets of non-life insurer by 0.13 percentage points, with other conditions unchanged. However, losses in the insurance activities may be offset by realized investment yield. For every additional percentage point in the investment ratio, we can expect the return on assets to increase by an average of 0.10 percentage points, *ceteris paribus*. These results coincide with the findings of *Lee* [19].

On the other hand, increase in the annual written premium rate of growth by one percentage point leads to an increase in the return on assets for 0.001 percentage point on average, *ceteris paribus*. Obtained result is in line with certain previously conducted studies that suggest a negative impact of premium growth on non-life insurer profitability (i.e. *Burca* & *Batrînca* [7]). In the case of non-life insurance Serbian market, such a result can be explained by the fact that premium has stagnated after the onset of the economic crisis in 2009, because of which there is an objective need for its faster growth in the coming period. One should bear in mind that the increase in insurer's business volume is followed by the increase in liabilities towards policyholders and it is necessary to set aside relatively larger technical reserves. If premium growth is too aggressive, insurance company is exposed to actuarial risks to the extent that exceeds its available

technical and financial capacity, which can be one of the key causes of its insolvency.

Financial leverage reflects the potential impact of technical reserve deficit on insurer`s equity in the case of larger-than-expected losses due to insured risks realization. The increase in financial leverage by one percentage point corresponds to a decline on the return on assets by 0.01 percentage point on average, with other circumstances unchanged. The negative correlation between financial leverage and ROE supports the findings of *Bilal et al.* [5] and *Lee* [19].

In general, the effect of reinsurance on the profitability of insurer is not uniquely determined. By itself, reinsurance implies corresponding costs for insurers, as well as the risk of reinsurance protection insufficiency due to reinsurer default, inadequately estimated self-retention limit and arranged reinsurance coverage. On the other hand, greater retention rate means lower dependence on reinsurance. On that basis, the insurer achieves adequate savings, but at the same time he is exposed to the actuarial risks in a relatively greater extent. The estimated negative impact of retention rate on business results of non-life insurers in Serbia can be explained by the fact that they, on average, retain a relatively large volume of risks in their own coverage, as evidenced in the context of the analysis of their performance. The available data for domestic non-life insurance market show that an increase of retention rate of non-life insurer by one percentage point leads to a reduction in the return on assets by as much as 0.24 percentage point on average, *ceteris paribus*, which is in accordance with *Shiu* [29].

Finally the results of conducted research indicate that the increase by one percentage point in the size of the insurer as measured by the volume of written premiums, causes an increase in the return on assets by 0.07 percentage points on average, with other conditions unchanged. This finding is consistent with the studies of *Browne et al.* [6], *Bawa* & *Chattha* [4], and *Mehari* & *Aemiro* [23]. Larger companies realize the effects the economies of scale and better cost efficiency based on the control of distribution channels, as well as the application of modern information technology to automate business operations. Thanks to available capacities, they are more able to cope with the adverse market conditions in comparison with smaller insurers [29, p. 1082], but also to achieve the effects of risk diversification [23, p. 252], which justifies the result obtained.

Conclusion

Modern insurance market on the global scale is characterized by processes of internationalization, liberalization and financial integration, spurred primarily by opening of the developing countries for foreign capital, in an attempt to encourage the development of their own insurance markets. Faced with intense market competition, insurers strive to maintain and improve their profitability, as the main source of capital growth and value creation for shareholders. Identification of the profitability determinants of insurance companies and measurement of their impact is even more important in the adverse macroeconomic conditions under which insurance companies in Serbia operate. Improvement of insurers' performance is a necessary precondition for the growth of the insurance sector and its contribution to the development of the national economy.

A comprehensive assessment of business performance of non-life insurance companies operating in Serbia is presented in this paper. Macroeconomic factors that determine the performance of the overall non-life insurance sector were identified on the basis of the achieved average values of selected CARMEL indicators of financial strength of insurers as well as their manifested trend over time. The direction and intensity of the impact of key internal factors on the profitability of individual companies is described through concrete empirical model. Estimated values of the regression model coefficients show that the combined ratio, leverage and rate of retention negatively affect the profitability of non-life insurers in Serbia, while the influence of the written premium growth, investment return, and the company size is positive.

Important implications for the management of insurance companies operating in Serbia arise from the presented empirical results. In general, room for profitability improvement of non-life insurers should be sought in the transfer of risks to reinsurance to a greater degree. Thus not only the retention rate, but indirectly financial

leverage and the combined ratio can be decreased, due to which it is possible to expect multiple contribution to increase in the return on assets of insurers. Hereby it is important to properly assess the financial strength reinsurer and to provide a dispersion of ceded risks among a large number of reinsurers simultaneously. Operating expenses represent a critical area for the profitability of non-life insurers in Serbia. Their rationalization requires tightening of management discipline, proper management of distribution channels and automation of business operation implementation using modern information technology. Profitability of non-life insurers can be increased through investment activities, with respect to the relevant regulatory restrictions, and taking into account the compliance of the maturity structure between assets and liabilities, in order to safeguard liquidity of insurers.

The main limitation of the conducted research stems from its grounding on the financial statements of insurers. The applied indicators are reliable to the extent to which the values in those statements are realistically estimated and reported. Even though assuming their absolute credibility, we should not forget the fact that they only reflect events from the past. Because of their static nature, the values of these indicators are not sufficient to predict the future, even if they are calculated for longer time intervals. Appropriate prospective approach implies relevant stress tests as a supplement to trend projections as one of possible further research directions, so that future challenges and potential threats to the financial health of insurers could be considered.

Long-term earning capability is certainly an indicator of long-term financial security of a business entity. However, we should not neglect the fact that, in the short run, excessive requirements for profitability may threaten the safety of operations and jeopardize the survival of that entity. Therefore it is very important to establish a delicate balance between these two business principles. Such a requirement is particularly evident in the insurance companies, whose primary role is not an increase of capital, but provision of adequate security and protection against risks.

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FIXED POINT THEORY AND POSSIBILITIES FOR APPLICATION IN DIFFERENT FIELDS OF AN ECONOMY*

Teorija fiksne tačke i mogućnosti primene u različitim granama ekonomije

Abstract

This paper is the review article which presents the basic topics related to the fixed point theory. Two theorems regarding fixed point existence are presented: Brouwer's theorem and Kakutani's theorem. Both of them are widely used in different economic fields, especially for equilibrium price determination and the game theory. Possibilities for utilization of these theorems are vast, but this paper focuses on several heretofore known applications in the field of economic research. The primary goal of this paper is to describe the foundations of fixed point theory and outline some of the possible applications. More precisely, this is a starting point for future research regarding the determination of competitive relationship equilibrium in different markets.

Key words: *fixed point theory, equilibrium, Brouwer's theorem, Kakutani's theorem*

Sažetak

Ovo je pregledni članak u kome su navedeni osnovni pojmovi teorije fiksne tačke. Prezentovane su dve teoreme o postojanju fiksne tačke: Brauerova i Kakutanijeva. Ove teoreme su našle široku primenu u različitim granama ekonomije, pre svega u određivanju ravnotežne cene, kao i u teoriji igara. Naravno, mogućnosti primena su velike, tako da se u radu navodi jedan kratki segment dosadašnjih primena u ekonomiji. Cilj rada je da se prikažu osnovni pojmovi vezani za teoriju fiksne tačke i da se navedu neke moguće primene. Ovaj rad praktično predstavlja osnovu za buduće istraživanje koje bi se odnosilo na određivanje ravnotežnog konkurentskog odnosa na različitim tržištima.

Ključne reči: *teorija fiksne tačke, ravnotežna tačka, Brauerova teorema, Kakutanijeva teorema*

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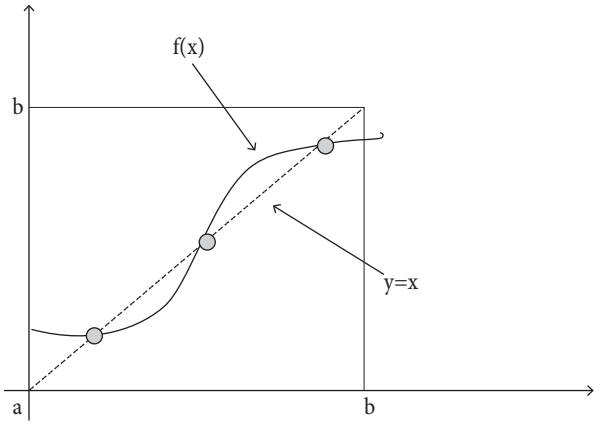
Introduction

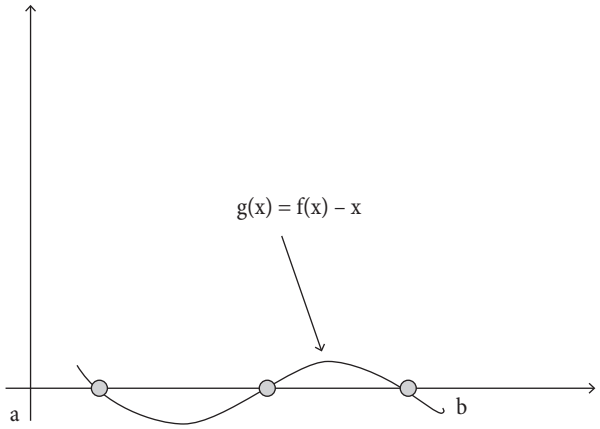
Fixed point theory examines the existence of the point x belonging to the domain of function f for which stands that $f(x) = x$, i.e. function values are equivalent to identical function mapping. In Figure 1 three intersections of function $f(x)$ and function $y = x$ represent the fixed points. A more subtle analysis would lead to the conclusion that a marginal change in the $f(x)$ function causes additional fixed points to emerge.

Figure 1: Three fixed points of the function f



If a certain function g is presented as $g(x) = f(x) - x$, than the solution to the equation $g(x) = 0$ is the fixed point of the function f (see Figure 2).

Figure 2: Solution to the equation g(x) = 0 is the fixed point of function f



Fixed point theory is applied in different scientific fields. In mathematics, it is used for solving different equations, creating approximations and simulations, in game theory, etc. In the field of economics, it is often used in the process of determining the coincidence point of supply and demand functions. Actually, fixed points (i.e. equilibriums) are at the core of many generic economic models. This theory enhanced the understanding of many other problems inherent to economic models such as comparative statics, robustness to marginal changes and equilibrium stability as well as equilibrium calculation.

One of the pioneer theorems regarding the fixed point is the *Brouwer's theorem* (refer to [2] for more details). The proof of the Brouwer's fixed point theorem is one of the most important results in the history of topology because it initiated a substantial number of generalizations and broadened its effects to different fields of mathematics and other scientific disciplines. *John von Neumann* [12] used it first to prove the existence of a "minimax" solution to two-agent games. He used a generalization of Brouwer's theorem again (in 1937) to prove existence of a balanced growth equilibrium for his expanding economy (refer to [13] for more details). This generalization had been simplified by *Kakutani* (1941). Fixed point theorems (*Kakutani's theorem* especially) made it possible to prove the crucial theorems in *Nash* [8], [9] for the case of non-cooperative games as well as *Arrow* and *Debreu* [1] on general equilibrium theory. Brouwer's theorem was used in the papers [5], [10], [11] and many others.

In this paper, the basic results of fixed point theory valuable to the economic researches are reviewed. The primary goal of this paper is to present Brouwer's and Kakutani's theorems in order to analyze potential applications in the field of economic research.

Brouwer's and Kakutani's theorems

Brouwer's and Kakutani's theorems are presented in this section[1].

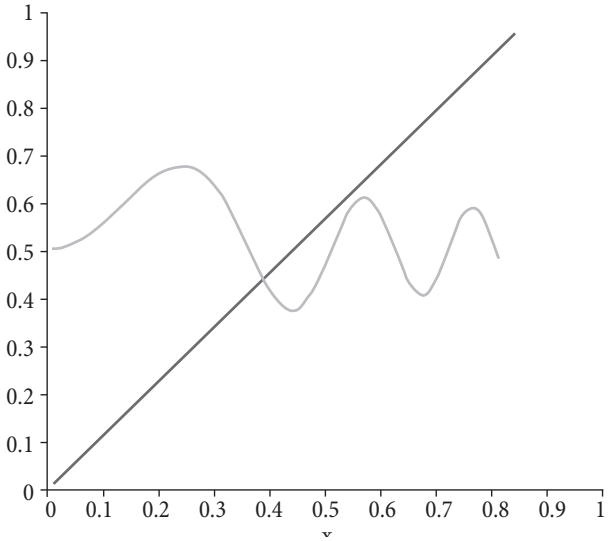
1 The following labels should be introduced in order to make mentioned theorems more understandable. Let X be a set, and let T be a family of subsets to the set X for which the following stands:
- The empty set and X belong to T;
- Any union of elements from T is an element of T;
- The intersection of any finite number of sets from T belong to T.

T is regarded as topology on X and that (X, T) is a topological space. A set from T is called an open set. A set which is a complement to the set from T is called a closed set. A set is convex if for every two points x, y from that set a point $tx+(1-t)y$ also belongs to this set (whereas t is within interval [0,1]). A set is compact if for each sequence from this set there is a subsequence that converges to some point from the set. Besides that, a set is compact if it is closed and bounded.

Brouwer's theorem [2]. Let $X \subseteq \mathbf{R}^n$ be nonempty, compact, and convex, and let $f: X \to X$ be continuous. Then f has a fixed point.

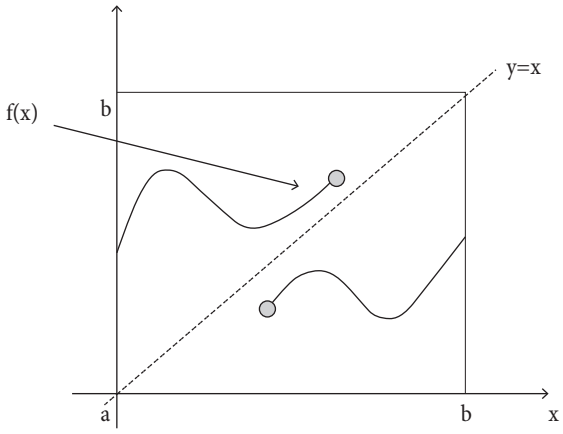
Application of this theorem makes it possible to conclude, for example, that continuous function that maps the interval [0,1] to [0,1] has a fixed point (see Figure 3).

Figure 3: Fixed point of the continuous function within interval [0,1]



In Figure 4 is shown a function which is not continuous so within interval $[a,b]$ it does not have a fixed point.

Figure 4: Fixed point does not exist for a function which is not continuous on [a,b]



It is common for economic models, particularly those in the field of game theory to account for settings in which agents have more than one rational choice at their disposal. The first generalization of Brouwer's theory emphasizes on this. Let us introduce the following labels (see [6]):

- If X and Y are sets, a correspondence $F: X \to Y$ is a function from X to the nonempty subsets of Y.
- If Y is a topological space, F is compact valued if, for all $x \in X$, $F(x)$ is compact.
- If Y is a subset of a vector space, then F is convex valued if each $F(x)$ is convex.

In order to apply Brouwer's theorem to correspondences it is necessary to define the continuity of correspondences (see [6]):

- If X and Y are topological spaces, a correspondence $F: X \to Y$ is upper semicontinuous if it is compact valued and, for each $x_0 \in X$, and each neighborhood $V \subset Y$ of $F(x_0)$, there is a neighborhood $U \subset X$ of x_0 such that $F(x) \subset V$ for all is $x \in U$.
- Fixed point of a correspondence $F: X \in X$ is a point x^* for which holds $x^* \in F(x^*)$.

The version of fixed point theorem most frequently used in economic analysis had been proven by *Kakutani* [3].

Kakutani's theorem [3]: If $X \subset \mathbf{R}^n$ is nonempty, compact, and convex, and $F: X \to X$ is an upper semicontinuous convex valued correspondence, then F has a fixed point.

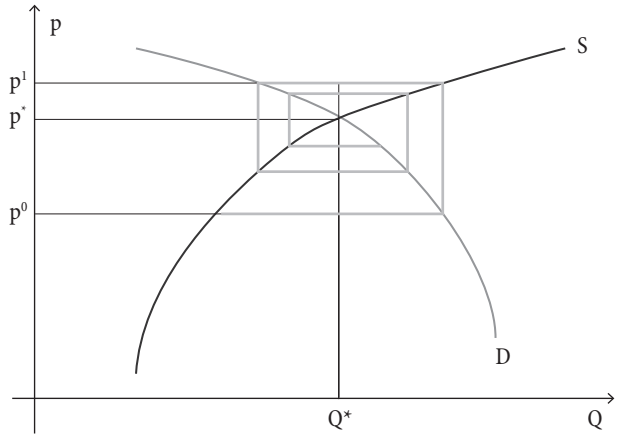
The economic application of Brouwer's and Kakutani's theorems

Fixed point theorems are most frequently used for proving that at least one equilibrium exists in an economic or game theory model. Equilibrium is the vector of endogenous model variables when all agents are presumed to act rationally, through utility maximization, and when an individual agent regards all other endogenous variables *ceteris paribus*.

Application 1. Let P be the price and Q the quantity. Let $P=D(Q)$ be the demand function and $P=S(Q)$ supply function. If supply is equal to demand then there exists market equilibrium, presented with equilibrium $[Q^*, P^*]$ (Q^* being the equilibrium quantity and P^* being the equilibrium price, see Figure 5).

Market price differs from equilibrium price due to effects of competition. That is why a market is regarded as stable when price converges to equilibrium price.

Figure 5: The equilibrium



Let $P_{\min}$ be the lowest price for a commodity in the given market. Let $P_{\max}$ be the highest price at which a commodity can be sold in the given market. Observe the following function:

$$f:[P_{\min}, P_{\max}] \rightarrow [P_{\min}, P_{\max}]$$

defined with:

$$f(P) = D(S^{-1}(P_0)),$$

Function f is adequately defined for a given price domain because the monotony of demand and supply function allows for the existence of adequate inverse functions. It is straightforward to prove that function is continuous. Since domain $[P_{\min}, P_{\max}]$ is compact and convex, it can be concluded that fixed point (price) exists on the basis of Brouwer's theorem.

Let us describe the algorithm used in order to determine equilibrium price. Let P_0 be the market price which is lower than equilibrium price, i.e. $P_0 < P^*$. Let $Q^0{}_D$ and $Q^0{}_S$ be the demand quantity and supply quantity, respectively for price P_0. The following is true then:

$$Q^0{}_D = D^{-1}(P_0) \text{ and } Q^0{}_S = S^{-1}(P_0).$$

Given that D is monotonic decreasing function and D is monotonic increasing function then inverse functions D^{-1} and S^{-1} exist. If producers increase the price to P_1 (for a demanded quantity) then the following is true:

$$P_1 = D(Q^0{}_S) = D(S^{-1}(P_0)),$$

and $P_1 > P^*$. The following stands for corresponding demand and supply quantities $Q^1{}_D$ and Q^1:

$$Q^1{}_D > Q^1{}_S,$$

which leads to deviation of $|Q^1{}_S - Q^1{}_D|$. If producers decrease the price to P_2 so that:

$$P_2 = D(Q^1{}_S) = D(S^{-1}(P_1)).$$

If we repeat this algorithm, we get the sequence of the prices $P_0, P_1, P_2, \ldots, P_k, \ldots$ for which:

$$P_k = D(S^{-1}(P_{k-1})), k = 1,2,...$$

According to that the sequence of the prices (P_k) converges to the equilibrium price P^*. This is presented in Figure 5. *Meznik* [7] has also considered this application.

Application 2 (Nash equilibrium). Let N be a fixed finite set, which is called "set of players (participants)". Each player is labeled with index i.

Normal-form game is an ordered triple, in which for every $i \in N$, S_i is non-empty sets, and u_i is functions $u_i : \prod_{i \in N} S_i \rightarrow \mathbf{R}$. We will regard S_i as a set of strategies, and i as a user's gain (utility) function ($i \in N$). If we denote $S_N = \prod_{i \in N} S_i$, then every $s \in S_N$ is the *outcome* (strategic profile) in the game Γ. Player i chooses strategy $s_i \in S_i$. When all players choose their strategies, then the outcome of game s and gain for every player $i - u_i(s)$.

From the aforementioned the single *normal-form game* is defined when the following three elements are defined:

1) set of game participants,
2) set of strategies for each player,
3) gain function for each player.

Firstly, several useful notations will be introduced. Let $s = (s_1, s_2, ..., s_n)$ be a strategic profile. Then:

1) $s_{-i} = (s_1, s_2, ..., s_{i-1}, s_{i+1}, ..., s_n)$
2) $(s_{-i}, s^*_i) = (s_1, s_2, ..., s_{i-1}, s^*_i, s_{i+1}, ..., s_n)$

Nash equilibrium is the strategic profile $s^* \in S$ in which for every $i \in N$ stands that $u_i(s^*_{-i}, s^*_i) \geq u_i(s^*_{-i}, s_i)$ for $s_i \in S_i$.

Nash theorem [8], [9]**.** If strategic sets of each player are non-empty, convex and compact and their utility functions are continuous and quasiconcave for s_{-i} then Nash equilibrium exists for a normal-form game.

The proof of this theorem is implied by Kakutani's theorem since the best answer function is defined with $b_i(s_{-i}) = \arg\max \{u_i(s_i, s_{-i}) | s_i \in S_i\}$ and $b(s) = \prod_{i=1}^{n} b_i(s_{-i})$. Function b is well defined on the basis of *Weierstrass theorem*. It should be noticed that if $s^* \in b(s^*)$ then $s^*_i \in b(s^*_{-i})$ for every $i \in N$, which leads to the conclusion that s^* is Nash equilibrium.

Application 3 (*Cournot oligopoly,* see [4]). *Cournot oligopoly model* is the model for which holds the next assumptions:

- there are n firms;

- a firm i produces commodity i for $i\in\{1,2,\ldots,n\}$($q_i \geq 0$ is the quantity of commodity and p_i is the price);
- all goods (commodities) are perfectly divisible;
- the goal of each firm is to choose an amount of product that maximizes its own profit given the production levels chosen by other firms.

Let $q_{-i} = (q_1,\ldots, q_{i-1}, q_{i+1},\ldots,q_n)$ be a vector of quantities produced by the other firms. We can assume that:

$$p_i = P_i(q_i, q_{i-1}) = a_i - b_i q_i + \sum_{j\neq i} d_{ij} q_j,\ i = 1,\ldots, n$$

i.e. price p_i is decreasing in its own quantity q_i and, due to complementarities between the commodities, is assumed to be increasing in the quantities $q_j, j \neq i$, of the other firms (parameters a_i, b_i, d_{ij} are positive).

Each firm $i\in\{1,2,\ldots,n\}$ has a linear cost function:

$$C_i(q_i) = c_i q_i$$

with $a_i > c_i > 0$. The profit π_i of firm $i\in\{1,2,\ldots,n\}$ is:

$$\pi_i(q_i, q_{-i}) = q_i P_i(q_i, q_{-i}) - c_i q_i.$$

A tuple $(q^*_1,\ldots, q^*_n)\in\mathbf{R}^n_+$ is a *Cournot-Nash equilibrium* if for every firm $i\in\{1,2,\ldots,n\}$ holds:

$$\pi_i(q^*_i, q^*_{-i}) \geq \pi_i(q_i, q^*_{-i})$$

for all $q_i\in\mathbf{R}_+$. This equilibrium exists if $2b_i > \sum_{j\neq i} d_{ij}$ for every firm $i\in\{1,2,\ldots,n\}$.

Discrete Cournot-Nash equilibrium is analyzed when the assumption that all commodities are perfectly divisible is not satisfied. Some commodities, like cars, machines, etc. are produced and sold in integer quantities. Also many divisible goods are sold in discrete quantities, like barrels of oil or grain.

A tuple $(q^*_1,\ldots, q^*_n)\in\mathbf{Z}^n_+$ is a discrete Cournot-Nash equilibrium if for every firm $i\in\{1,2,\ldots,n\}$ holds:

$$\pi_i(q^*_i, q^*_{-i}) \geq \pi_i(q_i, q^*_{-i})$$

for all $q_i\in\mathbf{Z}_+$. That is, given the integer quantities chosen by other firms, each firm chooses an integer quantity that yields a profit which is at least as high as any other integer quantity could give.

A firm $i\in\{1,2,\ldots,n\}$ can maximize its profit $\pi_i(q_i, q_{-i})$ if its optimal integer quantity is given by the reaction function:

$$r_i(q_{-i}) = \left[\frac{a_i - c_i}{2b_i} + \sum_{j\neq i} \frac{d_{ij}}{2b_i} q_j\right]$$

The symbol $[x]$ denotes the greatest nearest integer to x and for $i\in\{1,2,\ldots,n\}$ holds $r_i(q_{-i}) \geq 0$ for every $q\in\mathbf{Z}^n_+$ (because $a_i > c_i > 0$).

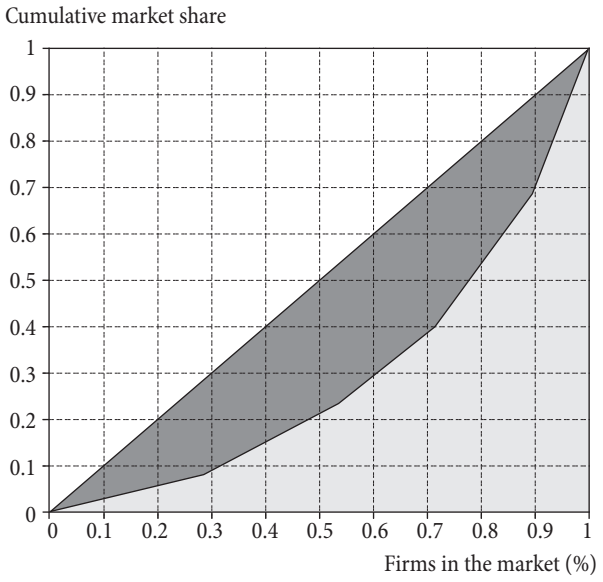
Define the function $f: \mathbf{Z}^n_+ \to \mathbf{Z}^n$ by

$$f_i(q_i, q_{-i}) = r_i(q_{-i}) - q_i,\ i = 1,\ldots, n.$$

A discrete zero point of f is a discrete Cournot-Nash equilibrium. Brouwer's fixed point theorem can show that function f will have a discrete zero point if $2b_i > \sum_{j\neq i} d_{ij}$, $i = 1,\ldots, n$. This means that Cournot oligopoly model with complementary commodities will have a discrete Cournot-Nash equilibrium when $2b_i > \sum_{j\neq i} d_{ij}$, $i = 1,\ldots, n$.

Application 4 (Measuring market concentration). Concentration curve is a popular tool for visualizing market concentration and perceiving the market strength inequality. The steps in order to draw concentration curve are the determination of competitor ranking in terms of market share (smallest to largest), cumulative competitor market share and joining the dots points created in the process. Newly drawn concentration curve is then compared to the curve representing equal market shares (45° line) in the hypothetical perfect competition setting (Figure 6).

Figure 6: Concentration curve



Actually, concentration curve is a graph of continuous function f which maps interval [0,1] to [0,1]. Since assumptions of Brouwer's theorem are satisfied, a fixed point for this mapping exists. More precisely, this fixed point is not unique since from Figure 6 can be observed that both points 0 and 1 are the fixed points. In case of the perfectly equally distributed market strength, Gini coefficient would be equal to zero since competition curve would be identical to the curve representing equal market

shares. Since for the whole domain $f(x) = x$ would be true, and an indefinite number of fixed points for this function would exist. It should be, however, taken into account that such an extreme situation is empirically rare.

Similarly to concentration curve Lorenz curve depicts the level of household income inequality. When income discrepancy is large then the curve is substantially remote from the 45° line. The less the inequality the more will curve converge to 45° line. In the case of perfect equality, as with concentration curve, perfect equality leads to the Lorenz curve with indefinite number of fixed point. It should be, however, outlined that such a case is empirically rare.

*Application 5 (Competitive dynamics within industry)***.** Primary goal of this segment is to define the framework for further research in prospective papers. Let us first assume that there is a market structure with characteristics of duopoly in ice cream wholesale industry in Serbia (Frikom and Nestle Ice Cream). Frikom dominates the market with a market share of 82% while the main follower is Nestle with market share of 12%. After market share distribution and dynamics leading to competitive balance are assessed it is observed that these factors remained stable during the last 4 years, which leads to the conclusion that certain form of competitive equilibrium is established, i.e. that a fixed point exists.

Analyzing the history of competitive dynamics for these two market participants provides interesting conclusion since the industry went from one competitive equilibrium to another. Nestle Ice Cream was dominant market participant with almost 60% market in 2000. At the same time, Frikom had a market share of 29% and was on the brink of bankruptcy mainly because of serious liquidity issues. The turning point was the acquisition of Frikom by Croatian company Agrokor. Agrokor invested aggressively in all elements of business (R&D, marketing, employee education, transportation, equipment, refrigerating systems, etc.). Distribution model was also changed from distributor oriented to capillary model. Aggressive investment, fresh know-how and brave managerial decisions led to a steep market share increase that peaked in 2009 at 82%. Despite intensive competitive efforts by Nestle in the previous 4 years (including organizational redesign, changes in the management team, improvements of distribution model, aggressive rebate-based discount strategy, among others) market share equilibrium remained nearly completely intact. The intention of future research efforts and papers would be to explain outlined transition of competitive equilibrium by using theorems explained in the previous sections of this paper. Final result of research would be the generalization of findings to other industries.

Conclusion

This paper is the starting point for further research on the fixed point theory application in economics. In order to clarify the potential scope of utilization for economic research purposes elementary topics of fixed point theory are hereby introduced. Brouwer's and Kakutani's theorems reviewed in this paper are the basis for further analysis and assessment of equilibrium. Although its application is a great challenge, this theory draws attention of mathematicians all around the world. Authors of this paper intend to apply this theory to the research of topics such as market concentration and competition as well as the determination of equilibrium states.

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SUBSIDIZING WISELY: SOME LESSONS FOR MANAGING SUBSIDIES FOR AGRICULTURE*

Subvencioniraj mudrije – neke pouke za upravljanje subvencijama u poljoprivredi

Abstract

The subject of this paper is the study of the possible weak links in the agrarian budget management, primarily in terms of subsidizing beneficiaries in the light of improving competitiveness of the agriculture sector in the Republic of Serbia. The paper aims to investigate the possibilities for optimization of the scarce resources of Serbia's agrarian budget through enhancing the effects of its placement, and to suggest possible innovations with regard to the criteria used for decision-making and selecting priority beneficiaries of support. Having in mind the need for export-led growth orientation of the economy and the urgent need to improve its overall competitiveness as well as the competitiveness of individual sectors, we have suggested step-by-step guideline for choosing priorities in the agrarian budget allocation and pointed out some of the important issues related to the government support for the chosen ones.

Key words: *competitiveness, agriculture support, subsidies, budget allocation, direct payments*

Sažetak

Predmet ovog rada je analiza mogućih slabosti u upravljanju agrarnim budžetom, prvenstveno u svetlu sredstava subvencija, a imajući u vidu unapređenje konkurentnosti agrarnog sektora u Republici Srbiji. Rad ima za cilj da ispita mogućnosti optimizacije ograničenih sredstava agrarnog budžeta Srbije kroz poboljšanje efekata njegovog plasmana, kao i da predloži moguće inovacije kriterijuma korišćenih prilikom donošenja odluka o odabiru prioritetnih korisnika za podršku. Imajući u vidu orijentaciju ekonomije na rast kroz izvoz, kao i neodložnu potrebu za unapređenjem konkurentnosti, kako ekonomije u celini tako i pojedinih sektora, predložili smo korak-po-korak smernice za odabir prioriteta pri alokaciji agrarnog budžeta i istakli neka od značajnih pitanja državne podrške odabranih prioriteta.

Ključne reči: *konkurentnost, podrška agraru, subvencije, alokacija budžeta, direktna plaćanja*

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Introduction

Serbia's economy is out of balance and performing below its potential, with important reforms significantly lagging [14, p. 1]. Critical areas and burning issues abound, and the need for improvement is becoming of paramount importance. According to the World Bank experts [14], after the years of consumption-led growth, the time has come to change the growth model and focus on exports. The potential is there, it *just* needs to be realized. Although it is noted that Serbia's exports are very low by regional standards, primarily due to the lack of competitiveness, one particular sector is recognized as a possible leader, i.e. a sector with comparative advantage – namely, the sector of agriculture and food production. In the period 2007-2012 the stated sector had evident revealed comparative advantage and growth of productivity among the highest in the region [14].

However, the agriculture sector itself is not blooming. Unfortunately, the situation is quite the opposite. The variety of problems, their persistence and expansiveness make the agriculture one of the sore points of Serbia's economy. Also, having in mind its importance and the fact that it employs around half a million people and accounts for around 10 percent of GDP [14, p. 35], as well as the fact that it actually possesses significant potential for improvement, it is probably a sore point that hurts the most.

Consequently, if agriculture is to be one of the sectors to improve Serbia's overall competitiveness and contribute to the rebalancing of the economy as a whole, it is clear that its own sore points will have to start healing. Marked by a powerful social dimension, Serbia's agriculture has traditionally been a sector heavily supported by the government in order to address specific obstacles arising along the way. Possibly, resolving social issues as they emerged, the government had simultaneously created obstacles to the development of agriculture as a fully dynamic and competitive sector of the economy. Therefore, the reform and improvement of government support mechanisms, i.e. investments and incentive policies, are recognized as one of the top reform priorities for strengthening the agriculture and food processing sector [15]. Moreover, given the long-term integration-related goals of the Republic of Serbia, it is recommended that these reforms be CAP-oriented, i.e. generally aligned with the agricultural policy of the EU.

The paper will first present a short overview of budgetary support for the agriculture in Serbia during the previous period, with an overview of future strategy. Then we will discuss the possible criteria to be used when deciding on which agriculture priorities to support in the light of improving overall agriculture competitiveness. Finally, we will stress some of the issues important for the selection of appropriate instruments of support as well as for the frugal use of available funds. Other important aspects of the agrarian budget management, such as possibilities for its increase, issues of filling the budget, customs barriers, price guarantees etc. remain outside the scope of our analysis.

Budgetary subsidies for agriculture in the previous period and a strategy for the future

The most important aspect of the government support to the sector of agriculture is executed through the agrarian budget – a part of the total budget of the Republic of Serbia which aims to provide stable financing resources for the stimulation of the development of agriculture, as emphasized by the Strategy on Agriculture and Rural Development [13, p. 45]. However, the elements influencing the amount of the total budget allocated to the agriculture oftentimes have been designed to resolve burning issues actually not related to the performance of the agriculture sector itself. Consequently, the agrarian budget varied, both in absolute and relative terms, as show in Figure 1.

The increase of the total budget funds allocated for agriculture was mainly influenced by ongoing inflation and depreciation of the dinar. In relative terms, after witnessing remarkable growth in the period 2002-2004, there was a decreasing trend starting from 2004, with positive changes recorded in 2012 and 2013.

There is a general consensus that the budgetary support to the agriculture in Serbia is insufficient and significantly lagging behind other countries [13]. Nonetheless, the actual amount of the agrarian budget is not the only problem. Another pickle is its allocation. While there is

no doubt that "bigger is better" when it comes to available funds, the matter of their allocation becomes an issue of contention. *How to allocate the agrarian budget* can practically be translated to *how to design the agrarian incentives policy* issue. Although farmers crave for direct support, researchers wonder whether that support will provide actual results in the long run. In fact, some of them claim that public expenditure in R&D, extension, and infrastructures may have a larger impact on farm productivity than commodity programs or direct subsidies [8]. Consequently, the matter of designing agricultural incentives becomes the cornerstone of the sector's future development.

Preparing for the anticipated accession to the EU, Serbia has adopted the 10-year Strategy on Agriculture and Rural Development [13], adapted to the principles of the Common Agricultural Policy, whose incentives policy could be generally summarized in the following [10]: 1) single farm payments, independent of production; 2) cross-compliance favoring environmentally friendly behavior, food safety, animal and plant health and welfare; 3) strengthened rural development policy; 4) reduction in direct payments for larger farms in favor of rural development.

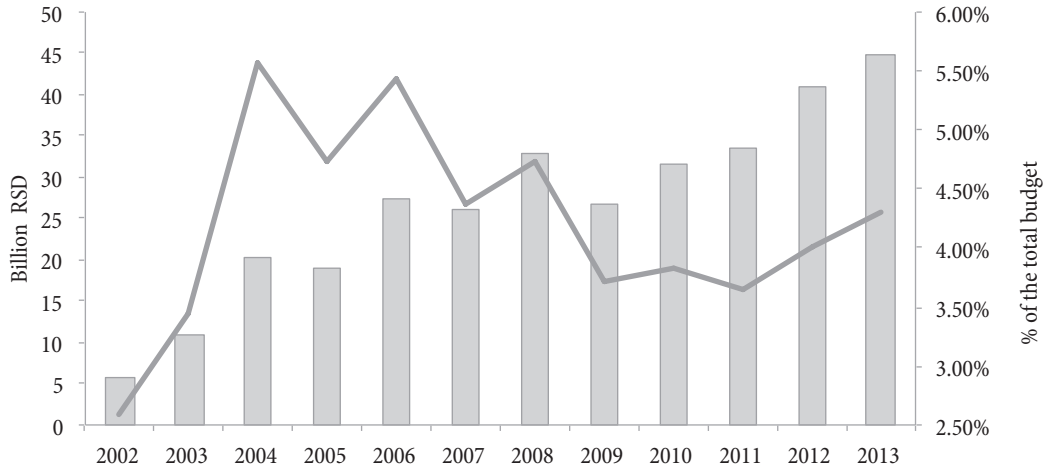
However, the transition to "single farm payment" agricultural policy is not expected to happen quickly. Basically, fine-tuning the amounts of the agrarian budget to different pillars of support in the coming years is expected to result in the graduate decreasing of direct support incentives in favor of the strengthening of rural development. On the other hand, choosing the "winners", i.e. adequate beneficiaries of support, is not a virtue usually attributable to the government. Therefore, when it comes to agriculture incentives, there is a serious danger that wrong government interventions might result in a misallocation of resources and eventually deteriorate competitiveness of agriculture.

Some guidelines for choosing priorities for direct support

Management incompetence immanent to governments, together with societal-related burning issues that require ongoing attention, is commonly recognized as an obstacle to the development of agriculture. On the other hand, the necessity of Serbia's economy to finally start moving towards competitiveness requires reforms not just in the realm of policies and regulations, but also in the way of thinking – towards contributing, producing, and value-creating approach. That said, when deciding on the priorities which will be honored with agricultural incentives, the government needs to introduce some economics-related criteria.

Bearing in mind the necessity of shifting to export-led growth model of development and preparing for the accession to the EU, there is no doubt that competitiveness is a characteristic to be nurtured and strengthened, which especially applies to the agricultural sector that has already

Figure 1: Agrarian budget, 2002-2013



Source: The authors' compilation according to [12]

been recognized as a potential. Consequently, it seems rational to incorporate the competitiveness-related criteria in the agrarian budget allocation decision-making.

Revealed competitive advantages

But, what is competitiveness? And more importantly, can we measure it? Competitiveness as a concept is based on the idea of comparative advantage. Namely, comparative advantage exists if the economy can produce a commodity at a lesser opportunity cost than others do. The same can be applied to specific sectors, value chains, individual producers, and specific products. Consequently, the operationalization of this concept resulted in the development of the variety of tools and measures, which essentially aim to portray the relative efficiency of the domestic production of a commodity in relation to the rest of the world. However, it should not be forgotten that the comparative advantage of a specific product (sector or the economy) does not imply that it can, by default, be produced and sold at profit, i.e. be actually competitive. Many other elements need to be considered as well, market conditions primarily [9, p. 29].

One of the commonly used tools for assessing comparative advantages in the field of agriculture (both as a sector and on the product level) is the Revealed Competitive Advantage Index (RCA index, also known as the Balassa index). Originally defined by *Bela Balassa* in 1965 [2], the index underwent different types of modifications by various authors, resulting in the variety of RCA measures, out of which *Thomas Vollrath*'s index [17] is one of the most commonly used. What these different RCAs have in common is that they calculate the ratio of a country's export share of a specific commodity in the international market to the country's export share of all other commodities. We calculated the RCA index using the following formula:

$$RCA = \ln\left[\frac{X_i}{M_i}\right] \text{ x } \left(\frac{\sum_{i=1}^{n} X_i}{\sum_{i=1}^{n} M_i}\right)$$

where:

X_i – value of export of the product *i*

M_i – value of import of the product *i*

$\Sigma^n_{i=1} X_i$ – value of the total export of all products

$\Sigma^n_{i=1} M_i$ – value of the total import of all products

Comparative advantage exists for those commodities with RCA greater than 1.0 [11, p. 8]. RCA bellow 1.0 stands for the absence of comparative advantage.

Reviewing the existing literature we have found a variety of studies dealing with competitiveness from the aspect of comparative advantages, based on the RCA analysis (supplemented with other indicators) at the level of different sectors in the economy, and especially, at the level of agriculture and agricultural products. Some of them aim to investigate the competitiveness of agriculture as a whole, or certain groups of products of non-EU economies in the light of the future EU integration. Certain research studies have been carried out at the level of Serbian agriculture. *Buturac et al.* [3] in their research from 2010 confirm the existence of comparative advantages in export of Serbian food industry. Analyzing the performance of Western Balkan countries in 2008, they have found that Serbia had the highest indicator of competitiveness for the *Food and live animals* section. However, a common characteristic for all analyzed countries is the presence of comparative advantages in low value added sectors and the absence of correlation between the values of the RCA indicator and the share of individual products in the total export structure.

Having in mind the relative simplicity of the RCA calculations, availability of necessary data and the applicability to different levels of the analysis, i.e. economy sectors, value chains, groups of products, down to the level of individual products, RCA index can serve as a solid initial criterion when deciding on the priority beneficiaries of the budgetary support. Considering that the products (groups of products or value chains) with existing revealed comparative advantage are worth supporting in order to increase the overall competitiveness of agriculture, the initial selection naturally leans toward candidates with higher RCA. Therefore, RCA analysis can be used in the first step of decision-making process, as a tool for compiling the initial list of products (groups of products or value chains) whose competitiveness could be improved and thus trigger the economic growth, and which are as such possible candidates for budgetary support.

In order to illustrate the possible use of RCA analysis as a criterion for the selection of candidates who could be supported using the agricultural budget funds, we examined the levels of RCA index of comparative advantage of Serbian agricultural products in five-year period. The necessary data were obtained from the Statistical Office of the Republic of Serbia (SORS), focusing on the sector of food and live animals (as defined by the Standard International Trade Classification – SITC [16]), in relation to the entire international market. Results of the analysis have been summarized into categories corresponding to groups of products within the analyzed sector, according to SITC categorization and are shown in Table 1.

According to the results of the analysis, out of 36 analyzed product groups, only 7 of them had revealed comparative advantages during the whole period (RCA index was higher than 1.0 in each year of the analyzed period). Consequently, these groups can be initially highlighted as possible priorities for budgetary support, i.e. selected for the initial list of priority beneficiaries.

Table 1: RCA index by commodity groups of the Serbian food and live animals sector, 2009-2013

Food and live animals - product groups by SITC, Revision 4	2009	2010	2011	2012	2013
Live animals other than animals of division 03	0.72	1.22	0.90	0.45	0.23
Meat of bovine animals, fresh, chilled or frozen	2.86	2.24	1.74	1.68	1.71
Other meat and edible meat offal, fresh, chilled or frozen	-0.32	-0.41	-0.41	-0.59	-0.89
Meat and edible meat offal, salted, in brine, dried or smoked	-0.71	-0.85	-1.04	-1.13	-1.24
Meat and edible meat offal, prepared or preserved, n.e.s.*	0.21	0.16	0.19	0.17	0.18
Milk and cream and milk products, other than butter or cheese	0.70	0.24	0.34	0.20	0.14
Butter and other fats and oils derived from milk; dairy spreads	0.79	0.10	-0.30	-0.24	-0.01
Cheese and curd	0.51	0.29	0.40	0.47	0.66
Eggs, birds' and egg yolks, fresh, dried or otherwise preserved; egg albumin	-0.73	-0.39	-0.52	-0.38	-0.60
Fish, fresh (live or dead), chilled or frozen	-2.43	-2.53	-2.57	-2.50	-2.40
Fish, dried, salted, in brine; smoked fish; flours, meals and pellets of fish, for human consumption	-2.14	-	-0.43	0.35	0.34
Crustaceans, mollusks and aquatic invertebrates, fresh, chilled, dried, salt or in brine	-1.86	-2.27	-2.11	-2.66	-3.58
Fish, crustaceans, mollusks and other aquatic invertebrates, prepared or preserved, n.e.s.	-0.99	-1.32	-1.44	-1.56	-1.79
Wheat (including spelt) and meslin, unmilled	2.72	3.36	2.92	2.52	4.27
Rice	-1.57	-1.82	-1.88	-1.62	-1.79
Barley, unmilled	1.13	0.53	-0.77	-0.16	0.10
Maize (not including sweet corn), unmilled	1.89	2.22	2.19	2.09	1.58
Cereals, unmilled (other than wheat, rice, barley and maize)	0.00	0.38	-0.41	-0.67	-0.60
Meal and flour of wheat and flour of meslin	1.55	1.78	1.82	1.85	2.24
Other cereal meals and flours	2.05	2.72	2.17	1.58	2.20
Cereal preparations and preparations of flour or starch of fruits or vegetables	0.58	0.55	0.51	0.46	0.49
Vegetables, fresh, chilled, frozen or simply preserved; roots, tubers	0.05	0.16	0.18	-0.08	-0.06
Vegetables, roots and tubers, prepared or preserved, n.e.s.	0.20	0.35	0.29	0.38	0.28
Fruit and nuts (not including oil nuts), fresh or dried	-0.33	-0.17	-0.05	-0.19	0.01
Fruit, preserved, and fruit preparations (excluding fruit juices)	1.34	1.44	1.46	1.25	1.62
Fruit juices (including grape must) and vegetable juices, unfermented and without added spirit	0.17	0.49	0.60	0.44	0.73
Sugars, molasses and honey	1.03	1.59	1.13	1.07	1.19
Sugar confectionery	-0.18	-0.18	-0.07	-0.46	-0.48
Coffee and coffee substitutes	-1.89	-2.20	-2.11	-1.64	-1.88
Cocoa	-2.32	-2.12	-2.04	-1.56	-1.48
Chocolate and other food preparations containing cocoa, n.e.s.	0.53	0.34	0.32	0.21	0.05
Tea and mate	-0.21	-0.09	-0.21	-0.37	-0.50
Spices	0.86	0.80	0.76	0.31	0.39
Feeding stuff for animals (not including unmilled cereals)	0.25	0.23	0.39	0.46	0.20
Margarine and shortening	0.07	-0.13	-0.10	-0.06	-0.31
Edible products and preparations, n.e.s.	0.03	-0.13	-0.18	-0.16	-0.02

**n.e.s. - not elsewhere specified*

Source: The authors' calculations (according to SORS data)

Comparing the RCAs of the seven groups with revealed comparative advantage for the period, as displayed in Figure 2, we can see that *Wheat and meslin* group stands out notably. We must also note that the results of our analysis generally coincide with the results of previously conducted studies on the subject matter.

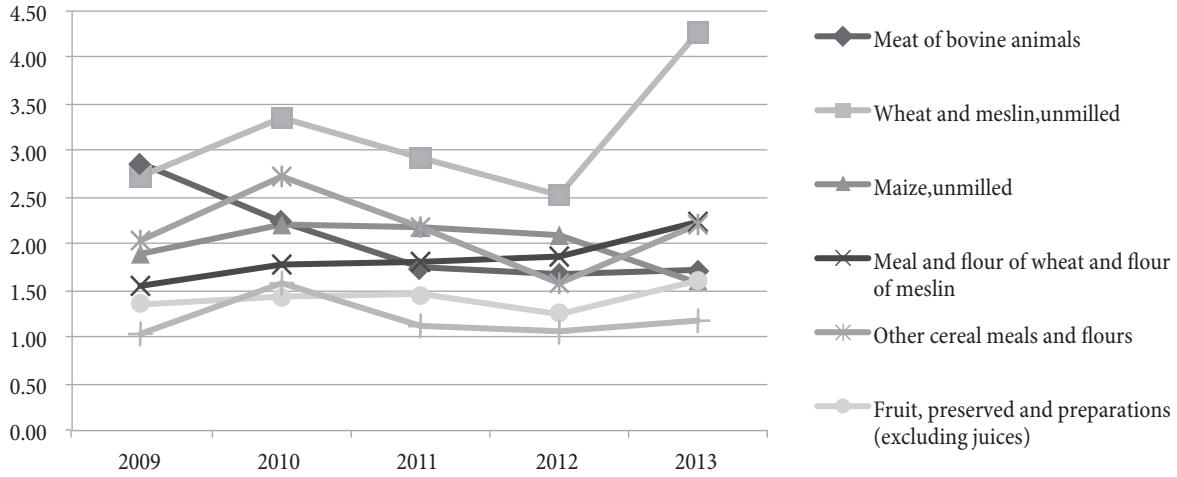
Going deeper into the analysis, RCA index can be calculated all the way down to the level of certain agricultural products or, combining individual data, the level of specific agricultural value chains. Additionally, comparative advantages can be examined not just in relation to the entire international market, but also focusing on desired countries or regions of interest.

To illustrate the possibility of a more detailed analysis, we have examined the RCAs of individual products within the two previously analyzed groups – *Fruit, preserved, and fruit preparations (excluding fruit juices),* which proved to be *competitive* during the whole analyzed period, and *Fruit and nuts (not including oil nuts), fresh or dried* which had negative RCAs (except in 2013 when it leveled up to somewhat above zero). As shown in Table 1, there was a substantial difference in the RCAs of these, at first glance similar, groups. However, analyzing the RCA at the product level, we have found that even in the "non-competitive" group, certain products stand out with high RCAs, exceeding the competitiveness of the products from the "competitive" group. That said, extending the RCA analysis to product level becomes crucial for the competitiveness analysis. Table 2 summarizes the RCA indexes of competitive products within these two groups.

However, when prioritizing sectors for budgetary allocations on the basis of their revealed competitive advantage a certain caution is necessary, due to the existing shortcomings of the RCA indicator. Namely, RCA is not capable of seizing the clear effects of purely economic factors affecting the comparative advantage [9, p. 30]; it also comprises the effects that previously applied government policies and incentives have on the comparative advantage. Bearing in mind that government support is commonly accused as a trigger of market distortions, one should be careful when judging on the relative competitive advantage of already subsidized sectors, value chains or products. In the light of our analysis, and taking into account the structure of agriculture budget in the analyzed period [12] it is clear that a serious doubt should be expressed on the actual competitiveness of the selected groups, i.e. their ability to compete without the safety net of the agricultural budget. Surprisingly or not, the *milk* group of products, traditionally marked in Serbia as heavily subsidized, turned out to be a group without comparative advantages in relation to the international market.

Additional shortcoming of RCA lies in the fact that it is a past performance indicator. Namely, the design of the RCA index prevents it from grasping any dynamics – it portrays achieved results and comparative advantages, not being able to incorporate the effects of current trends and market dynamics when assessing comparative advantage. Given the imperfections of the RCA analysis, necessary caution must be present when interpreting the attractiveness of different candidates for budgetary support. Assuming

Figure 2: Products with revealed comparative advantage



Source: The authors' compilation

that the analyst recognizes these limitations, RCA index can prove to be a quite helpful tool.

Introducing market-based criteria into the analysis

Once the revealed competitive advantages have been analyzed and the initial list of potential candidates narrowed down to selected "competitive" ones, the following step requires the introduction of market-based criteria into decision-making process. Namely, bearing in mind the shortcomings of the RCA index as a past performance indicator, it is necessary to obtain additional aspects of competitiveness which could cast some light on the current situation, i.e. indicate if the revealed comparative advantages are still present and whether there are some elements which could jeopardize them. Therefore, it can be useful to study the results of the RCA analysis in the light of the existing and expected trends and market conditions. Practically, these anticipated market surroundings can be observed as moving targets, to identify the outcomes, which need to be achieved, for each individual item from the initial list of priorities. Sensitivity analysis is preferable, to portray the anticipated outcomes in the case of different scenarios i.e. market circumstances. Factors to be considered include the nature of demand, its size and tendencies, segments and potential niches, price tendencies, customer preferences, current competitors, market access, and other requirements [9, p. 30].

Referring to the results of our analysis, the second step in prioritizing budgetary beneficiaries would require the decision-makers to investigate existing and expected market trends and conditions for the initially selected groups of products. Assuming that we focus on the seven groups of products with revealed comparative advantages in the period 2009-2013 (as shown in Figure 2), it would be useful to examine which international markets are of most significance for their exports, and to direct the further analysis towards those markets, at the same time keeping the other market options open (the possibility of entering new markets in the future). Therefore, we analyzed the structure of export of these product groups, investigating the participation of different countries in the total sum of the value of Serbian export for each product group, for the period 2009-2013. The results were summarized by grouping export markets into three categories – Former Yugoslav Countries (including the ones within the EU), EU member states (except the ones which have been a member of Yugoslavia) and other countries, as shown in Figure 3.

Evidently, some of the product groups are predominately oriented towards regional markets – *Meal and flour or wheat and flour of meslin* and *Other cereal meals and flours* group, while others like *Fruit, preserved, and fruit preparations, Maize* and *Wheat* focus on the EU market. Consequently, market factors that will be taken into consideration differ accordingly. The EU-oriented products will be heavily tested in terms of the expected trends on

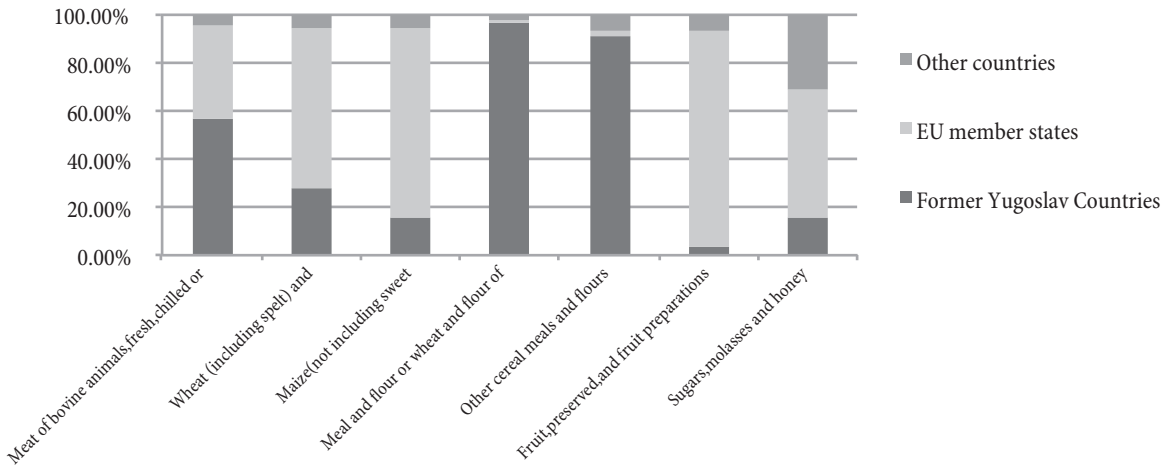
Table 2: RCA index by individual fruit products, 2009-2013

Type of product	2009	2010	2011	2012	2013
Fruit and nuts (not including oil nuts), fresh or dried	**-0.33**	**-0.17**	**-0.05**	**-0.19**	**0.01**
Blackberries, mulberries and loganberries, fresh	2.21	2.72	3.44	3.96	4.61
Cherries and sour cherries, fresh	2.32	2.49	2.86	1.98	3.21
Plums and sloes, fresh	2.06	2.92	2.40	2.63	3.67
Raspberries, fresh	1.87	1.76	2.68	3.16	3.90
Fruit, preserved, and fruit preparations (excluding fruit juices)	**1.34**	**1.44**	**1.46**	**1.25**	**1.62**
Blackberries and mulberries, frozen, without sugar	2.10	2.20	2.23	1.71	2.20
Cherries and sour cherries, preserved	1.58	1.33	1.69	1.44	2.07
Raspberries, frozen, without sugar	2.07	2.15	2.46	1.74	2.07
Sour cherries, uncooked or cooked in water, frozen, not cont. added sugar	1.60	2.15	2.27	1.85	2.33
…					
Peaches, including nectarines, preserved	-1.35	-1.33	-1.31	-1.11	-1.23
Mixtures of fruits or other edible parts of plants, prepared or preserved, n.e.s.	-1.07	-0.79	-0.34	-0.29	-0.39
Strawberries, prepared or preserved, n.e.s.	-3.00	-2.38	-2.01	-2.01	-2.82
Currants, frozen, without sugar	-1.21	-0.97	-1.12	-1.44	-1.54

**n.e.s. - not elsewhere specified*

Source: The authors' calculations (according to SORS data)

Figure 3: The structure of total export in the period 2009-2013



Source: The authors' calculations according to SORS data

the EU market – the anticipated size of demand, possible changes in the customer expectations and preferences, possible tightening of demands regarding food safety and quality of commodities etc. Namely, scenario analysis will aim to portray the probability that these groups of products will keep their comparative advantages in the case of possible changes in any of these elements. On the other hand, regionally-oriented products will probably be tested not just in the light of the regional markets, but also in the light of investigating the possibility to increase their exports and bring them to the EU market. Going deeper into the analysis, RCA index can be calculated for specific targeted markets, as a more reliable basis for making conclusions on their competitiveness. Having in mind Serbia's EU orientation, we have examined the RCAs of the two "regionally focused" product groups in relation to the EU member states solely, to determine if their competitiveness exists on this market as well, in case of a possible market expansion. Therefore, we calculated the RCAs for the *Meal and flour or wheat and flour of meslin* and *Other cereal meals and flours* group, narrowing the analysis to the EU market. The results are summarized within Table 3.

Naturally, *Other cereal meals and flours* group appeared as a highly competitive group in relation to the EU market. Consequently, the further analysis should examine potential barriers to expanding on the EU market in this particular field, as well as the possibilities for their overcoming. By contrast, *Meal and flour or wheat and flour of meslin* group should primarily be analyzed in the light of potential competitiveness improvement, before expanding to the EU market.

Market-based analysis can be used as a reversed criterion for selection, as well. Namely, if there are evident or expected market advantages for certain types of products (groups of products or value chains), they can be included in the initial list of priorities, even if they failed to achieve significant (or any) comparative advantages in the past. Therefore, the assessment of barter arrangements, if any, and free trade arrangements (FTA) is needed so that they also might become the criteria for selection. The analysis of the market threats and opportunities for the selected products or groups of importance should finally result in the further tuning of the list of priorities. Providing that the appropriate metrics have been established, the selection would favor those candidates with the highest potential for value creating.

Last but not least, the list of priorities may be tested by introducing additional requirements, not necessarily competitiveness-driven. Namely, having in mind the

Table 3: RCA index of regionally-oriented product groups, 2009-2013

Product groups	2009	2010	2011	2012	2013
Meal and flour of wheat and flour of meslin	-2.59	-2.59	-4.17	-4.52	-1.75
Other cereal meals and flours	7.06	8.11	7.22	4.98	5.24

Source: The authors' calculations (according to SORS data)

nature of agriculture and the structure of population whose fundamental activities, directly or indirectly, depend on it, the allocation of the agricultural budget is unlikely to be entirely economical, especially in the short term. Consequently, it is expected that societal aspects such as the reduction of poverty and the stability of farmer's income will be very much considered as a selection criterion. The art of managing the agricultural budget lies in choosing those beneficiaries, i.e. the means of societal support, whose rewarding will not significantly deteriorate the overall competitiveness. However, we should also note that social and rural development criteria could, and oftentimes will, be highlighted by the government as "top priorities" for budgetary support. That subject matter remains outside the framework of the analysis elaborated in this paper.

Choosing the instruments for support

Once the list of priorities has been set, i.e. once the products (or value chains) that will benefit from the allocation of the agricultural budget have been selected, the important questions and difficulties facing the decision-making process start to increase. Namely, all of them can generally be summarized in the following question – *how to help*? That is, once the long-term directives for budget allocations have been set, the important question is how to operationalize the budget payments. Basically, setting the right instruments of the agricultural policy, in terms of agricultural budget use, becomes the matter of utmost significance. Selecting the means of support for the identified priorities which would imply the "best possible" use of the available budget, i.e. would result in the increase of competitiveness and boost the performance of the chosen ones, arises as a challenging reaching target.

Reviewing the existing literature on the subject, the overall conclusion is that when it comes to the design of agricultural budget and allocation mechanisms, a common view is that there is no common view. When it comes to the EU, CAP is in the final stage of the transition process to the Single Payment Scheme, predominantly based on direct payments (DPs) and particularly payments not related to the production level – Decoupled Direct Payments (DDPs) [5]. DDP as an incentive does not impose an obligation to farmers in terms of production – they are free to respond to market signals and to decide on the type and volume of production accordingly. However, a significant part of the EU budget was allocated in the past through production-related incentives, i.e. Coupled Direct Payments (CDPs).

Generally, direct payments can be considered as incentives aimed at providing additional revenues or reducing costs for farmers, leading to the increase (and stabilization) of farmers' income. However, in spite of their evident advantages relative to previously popular measures such as price support, direct payments are not flawless. Although some of their shortcomings are mainly theoretical, noticeable practical issues in their application make them a measure that must be used with caution.

From the theoretical point of view, DPs are potentially troublesome because they are believed to cause distortions in the farmers' production and investment decisions (i.e. farmers' decisions would probably be different and possibly better in the absence of DPs) and to change their risk aversion. CDPs create even greater distortions because they stimulate farmers to increase production and invest more in those businesses which are supported by government. Consequently, farmers fail to invest in other types of production and to make profit on other products they would normally do if there were no CDPs. Additionally, CDPs may create an excess supply of certain products that cannot be spent or profitably exported. Since DDPs are not related to production level, the risk of distortions is much lower, but on the other hand there is a danger that the effects of the increased production will be missed out, i.e. farmers would fail to use the granted funds of the taxpayers to increase the production level. When it comes to the changes in the farmers' risk aversion, as a certain income DPs would have positive impact on the stabilization of the total farmers' income. On the other hand, the stabilization of farmers' income together with income increase may decrease the farmers' risk aversion, boost the production and investment distortions, and increase the cost of capital (WACC).

Additional problems of direct payments come from the fact that they are allocated both to family farms and agriculture companies, i.e. non-family farms, which significantly differ in terms of size and the effects these

payments aim to produce. When it comes to non-family farms, i.e. companies, DPs will increase their revenues or partially cover the costs incurred, which will increase the income (EBIT, EBITDA), i.e. accounting rate of return (ROI, ROA). However, maximizing EBITDA or ROA does not necessarily lead to value creation. In addition to the increase of EBITDA, the focus on value creation requires at least to take into account investments in Net Working Capital and Capital Expenditure (CAPEX), and also WACC. DPs are not capable of influencing these two important components of value. Moreover, due to the investment distortions and the reduction of risk aversion (WACC increase) in some cases DPs can actually implicitly destroy value. Generally, the main shortcoming of the DPs can be summarized in the fact that they do not favor the "winners".

In connection with the previous observation, at macro level DPs can result in keeping the farmers in agriculture business even when they are evidently uncompetitive without the budgetary support. Additionally, DPs may cause undesirable distribution effects, i.e. produce bigger income disparities than the ones which would exist without them [1]. This is particularly troublesome due to the fact that the reduction of income disparities is often proclaimed as a goal of DPs. For example, a study ordered by the European Commission [5] showed the high concentration in the distribution of DPs. In 2006, farmers of the EU-25 received in average EUR 12,200 of subsidies per farm and 72% of these subsidies were EU DPs. Interestingly, 20% of the FADN farms received 76% of the DPs recorded in FADN, and around 15% of FADN farms did not benefit from any EU DPs. Furthermore, direct payments could possibly trigger the increase of land prices, cancelling out the part of their benefits. Finally, there is an issue of the actual receiver of the direct payment – should it be the landowner or the land leaseholder who actually initiates production, together with the taxpayer's never-ending dilemma who actually receives their money and where it is spent.

When it comes to the Republic of Serbia, as previously elaborated, the agrarian budget varied, in absolute and relative terms, during the past decade. Simultaneously, its structure varied, as well. The structure of the agricultural and rural development subsidies for the period 2010-2013 is shown in Table 4.

As show in Table 4, during the period 2010-2013, direct support to producers was the most significant budget incentive in terms of allocated funds. As the incentive with the longest tradition and direct effect on the production and income of agricultural holdings, direct support is recognized as the most attractive type of support from the farmers' point of view [13, p. 48]. Direct support incentives have usually comprised direct payments based on outputs, input subsidies as well as payments per hectare or per livestock. The structure of funds allocated in the form of direct payments in 2013 is shown in Figure 4.

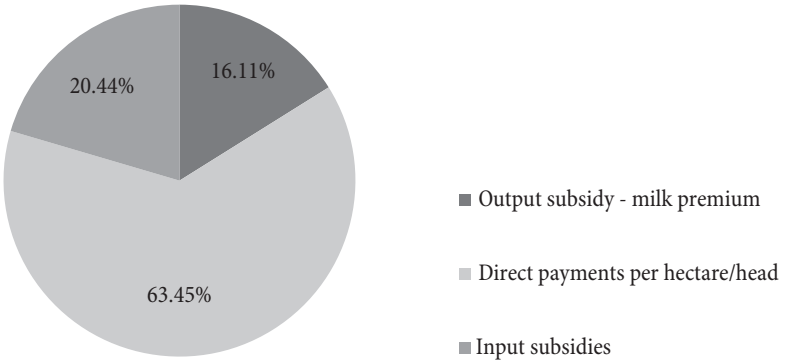
As shown in Figure 4, 20.44% of the direct payments in 2013 were allocated for the milk premium. Bearing in mind the results of the RCA analysis elaborated in the

Table 4: Agricultural and rural development subsidies per subsidy type (RSD mil.), 2010-2013

Type of subsidy	2010		2011		2012		2013	
	RSD mil	%	RSD mil	%	RSD mil	%	RSD mil	%
MARKET SUPPORT MEASURES AND DIRECT SUPPORT TO THE PRODUCERS	20,627	81.88	14.120	80.62	23,848	89.36	25,933	91.86
Market support measures	1,317	5.23	31	0.18	0	0.00	0	0,00
Direct support to producers	19,310	76.65	14,089	80.44	23,848	89.36	25,933	91.86
STRUCTURAL AND RURAL DEVELOPMENT SUBSIDIES	3,205	12.72	2,039	11.64	2,410	9.03	1,855	6.57
Improving agricultural competitiveness	3,071	12.19	1,886	10.77	1,674	6.27	1,696	6.01
Improving the environmental and rural landscape	21	0.08	20	0.11	45	0.17	15	0.05
Support for rural economy and population	113	0.45	133	0.76	690	2.59	144	0.51
GENERAL SUPPORT MEASURES	526	2.09	214	1.22	385	1.44	442	1.57
R&D, advisory and extensions	474	1.88	163	0.93	385	1.44	442	1.57
Food quality and food safety control	52	0.21	51	0.29	0	0.00	0	0.00
UNALLOCATED	835	3.31	1,142	6.52	45	0.17	0	0.00
TOTAL	25,193		17,515		26,687		28,230	

Source: [12]

Figure 4: The structure of direct payments in 2013



Source: The authors' calculations according to [12]

previous section and the fact that all the *milk* product groups proved to be uncompetitive relative to the entire international market, such budgetary allocation should be carefully reconsidered for future periods, if increasing overall agriculture competitiveness is to become a priority goal.

At the same time, as shown in Table 4, when it comes to subsidies for improving competitiveness and rural development subsidies, the situation is getting worse in the last four years, both in absolute and relative terms. That said, the agrarian budget in Serbia practically rests on the direct support to the agricultural producers, through both production-related and non-related instruments, while competitiveness and rural development (together with the general support measures) remain on the fringe. Although the structure of the budget is generally aligned with the CAP pillars of support, given the actual use of the budget, the situation is far from an essential alignment. Namely, rural development measures, intended to help farmers modernize their farms and become more competitive, account for some 20% of the CAP's budget, while 70% of the budget is reserved for the direct payments [7]. However, these direct payments are predominately decoupled (DDPs) and are paid to farmers provided that they fulfill strict standards regarding food safety, environmental protection, and animal health and welfare.

The previous discussion on the advantages and shortcomings of various types of agriculture incentives emphasizes the delicacy of allocation of the limited agrarian budget on different instruments of support. In the absence of an *optimal* allocation policy, when selecting the budgetary allocation means, policy makers must bear in mind the pros and cons of the available alternatives i.e. what is gained, and how much is sacrificed. Taking into account that the position of Serbia and its agriculture sector significantly differs from the position of the EU, it is obvious that the agrarian budget allocation mechanisms cannot blindly follow CAP solutions, particularly not in terms of sharp turn to DDPs exclusively. Therefore, given the potentials and significance of agriculture in Serbia, as well as the long and not entirely certain EU accession process with which EU policies become mandatory, CDPs jointly with other instruments focused on competitive products should be prioritized over non-selective DDPs. We believe that, compared to the present situation when only 6.57% of the budget is allocated to competitiveness improvement and rural development, a significantly larger part of the budget should be allocated to those very areas and selectively – to support the identified priorities, as we discussed in the previous section. Besides farmers who produce products with competitive advantages, positive discrimination in favor of low-income family farms and farmers from rural areas (also as selected priorities) should be applied.

When it comes to the actual form of distribution to selected priorities, the increase of the incentives through subsidized loans should be considered. An evident advantage of such subsidy is the effect of multiplication, which cannot be achieved with the other forms of direct payments. Namely, no matter how high the subsidies that farmers receive from the government are, they are almost always insufficient for financing significant investments. On the other hand, if these funds are received in the form of loan interest subsidy, farmers could apply with a bank

for a loan that could be even ten times higher than the amount of the actual government subsidy, and necessary funds for significant investment will be obtained. Except for cheap (or interest-free) loan for farmers this form of allocation carries other not so insignificant benefits as well. It stimulates the credit activity of banks, which is currently extremely low in Serbia, and at the same time the bank takes care on the collateral of the loan and monitors its use and payback. The benefits from monitoring are not to be neglected, since the government monitoring is often quite inefficient.

Finally, once the set of measures and instruments of the agrarian budget allocation have been determined by policy makers, the matters of their execution arise. Namely, adequate budget management requires the allocation to be performed strictly according to plan, with precise amounts for distribution specified by beneficiaries, budgetary instruments, and appropriate allocation dynamics. Specific issues of the budget execution process remain outside the scope of this paper.

Sparing the budget: Monitoring, review and evaluation

Due to the limited scope of this paper, these subject matters will not be elaborated in detail in the following section.

Monitoring the use of agricultural subsidies

Management of the agricultural budget is practically impossible without an adequate monitoring of the amounts spent. Namely, when available funds are scarce and the requirements of the beneficiaries on the verge of life or death importance, any misuse of the agricultural budget is simply not affordable. Therefore, designing the precise and reliable management and control systems to prevent, detect, and finally recover any irregular payments to the beneficiaries becomes one of the matters of utmost importance.

As for Serbia, activities aiming to ensure the reliable control of the spent agricultural budget funds have been initiated, primarily by setting the legal framework. The Directorate for Agrarian Payments was incorporated, modeled according to the EU's paying agency, as the authority with an exclusive right to manage and control all agricultural budget payments to beneficiaries. But the overall impression is that the Directorate lacks the capacities needed to fully realize its tasks and goals. Therefore, further development and strengthening of the Directorate in terms of capacities, knowledge and employees must be set as one of the priorities aimed at improving the efficiency of the allocated agrarian budget.

The incorporation and design of the monitoring mechanisms must be tailored to ensure the correct and accurate spending of the agrarian budget funds. Consequently, the most important assignments when it comes to monitoring can be summarized in the following [4]: 1) ensuring that the admissibility of budgetary claims and compliance with the national regulations is determined prior to payment; 2) ensuring that payments are adequately recorded in the accounts; 3) ensuring that the admission documents are correctly kept and presented in time; 4) ensuring that adequate checks and controls prescribed by the national regulations are made; 5) developing a computerized database according to the EU Integrated Administration and Control System to enable the cross-checks of information in the applications for budget payments.

Tracking and measuring the effects of allocated incentives

Any serious debate on the adequacy of the set agriculture budget instruments is pointless without the possibility to track and measure the effects of the introduced measures and instruments used. When it comes to instrument selection, the wisdom, like always, lies in setting the right measure, i.e. managing the budget allocation process steadily and safely. However, designing "the right" policies is practically impossible without the feedback on the effects of the imposed measures. Namely, measures must also be "measured". However, policy makers must also bear in mind that "what you measure is what you get" and adjust the measurement system accordingly.

The analysis of the effects of the imposed measures and instruments for agricultural budget allocation is one

of the weakest links of Serbian agriculture. The lack of the data necessary for the analysis makes any debate on the agricultural budget design strictly theoretical. Financial data on the allocated budget funds in the previous years are aggregate and inconsistent, due to the frequent changes in national regulations and instruments. Publicly available data on the amounts of budget support at the level of certain agriculture sectors, groups of products or individual commodities are not available. The same goes for the users of agricultural budget – there is a serious lack of the financial and other data that can be used to analyze their overall performance and assess their competitiveness. Therefore, to raise the efficiency of the allocated budget and create an impulse for increasing competitiveness, one of the priorities is to create solid and reliable data basis. Initial steps have been taken, through the incorporation of the Registry of agricultural holdings and introduction of the Farm Accountancy Data Network (FADN) system, but these are still in the early phase and the overall impression is that they need to be intensified.

The FADN is an instrument for evaluating the income of agricultural holdings and the impacts of the agricultural policy. It is considered by the European Commission to be the main information system to support the development of the Common Agricultural Policy [7]. The aim of the network is to gather accountancy data from selected farms for the determination of incomes and business analysis of agricultural holdings. Hence, the FADN database becomes a precious source of information for the farms' performance analysis, but also for the analysis of effects of changes in agriculture policies. Consequently, a set of various indicators and variables was developed under FADN, for the purpose of monitoring and review, and the goal for Serbia lies in their timely development and adoption. Once the initial data basis is created, decision makers can implement a variety of profit or value-based studies to examine the relation between certain types of budgetary instruments and performance of related beneficiaries. Additionally, the introduction of FADN can serve as an opportunity to educate the farmers and direct them towards the approach of value creation thinking, to plant the ideas of value-based management in the very core of the allocated funds management.

Review and evaluation

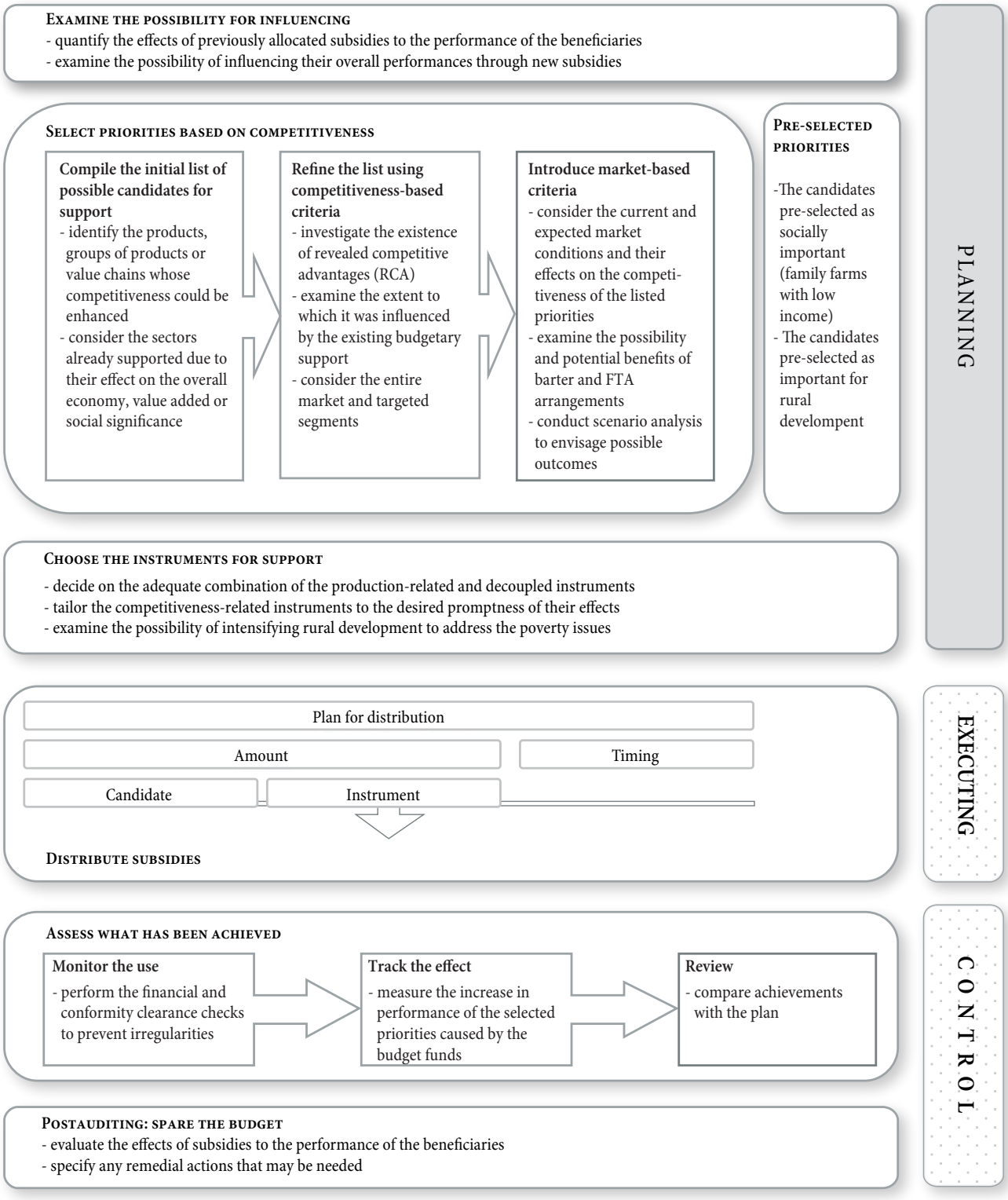
Finally, in terms of evaluating the effects of agricultural instruments and measures imposed, Serbia's agriculture is in need of a significant improvement once again. Fortunately, the experience of the EU agriculture practice can serve as the solid guideline in this field as well. For example, one of the studies financed by the European Commission [6] examined the effects of the direct support schemes, prescribed by the CAP provisions, on the income of farmers of the 27 EU member states. The results of the study showed the positive relation between the direct payments and the income of farmers i.e. their positive and significant contribution to enhancing the income, and the stability of income as well. Also, the efficiency of direct payments in targeting appropriate recipients proved to be high, meaning that direct payments actually supported the farmers with under-average income and contributed to the reduction of income disparities among farmers.

However, the evaluation itself is not limited to academic studies alone. FADN database enables a more operational approach. That said, one of the methods used compares only the farms that receive subsidies – "before and after" analysis, while another compares the differences in performance between the farms that receive the particular measure, i.e. budgetary support, and the ones that do not – counterfactual analysis. Second approach of the so-called *counterfactual paradigm* portrays the effect of the budgetary allocation instrument used as a difference between the value after the government intervention and the value which would exist without the intervention, for the same period and the same subjects. However, problems of practical application of both methods are not insignificant. Namely, the main difficulties lie in the possibility of tracking the "pure" agricultural policy effects, i.e. isolating other factors of impact, as well as in the inability to apply this analysis on those subjects which cannot be both beneficiaries and non-beneficiaries of a policy.

Having in mind the never-ending debates on the appropriateness and actual effects of the direct payments in Serbian agriculture, the possibility to perform such studies seems crucial. Namely, upon the identification of the groups of products with revealed comparative

advantage the following step of the analysis could include the evaluation of the effects which previous budget allocations (if existed) had on the competitiveness of those very groups. Consequently, insights of such analysis could help the decision-makers to evaluate the soundness of the achieved revealed competitive advantages that is the extent to which it was actually generated by the budgetary use in the previous years. Additionally, conclusions could be

Figure 5: The agricultural budget allocation – important steps



Source: The authors' compilation

made on the actual possibility of the budgetary support to influence the competitiveness of these groups i.e. the reasonableness of selecting such groups as priorities.

Important issues and steps to follow in the process of the agricultural budget allocation elaborated in this paper have been summarized in Figure 5.

Conclusion

Agriculture sector in Serbia is craving for support. Limited available funds, the sector's existing underperformance and evident perspective, together with the urgency of its improvement in the light of the future EU integrations, call for serious and immediate actions. In numerous instruments and areas of intervention, revision of the existing government support mechanisms and introduction of economical criteria for agriculture subsidies allocation appear to be among priorities. The complexity of goals bestowed upon policy makers and their rivalry, the absence of the organized tracking system for the allocated funds and the limited possibility to envisage the effects of taken measures and instruments make this revision a challenging task.

Designing the "right" combination of measures and means for agriculture subsidies allocation, policy makers should strive towards competitiveness improvement, keeping the inevitable social development (and rural development) related goals. Thus, economic criteria must be introduced in the selection of priorities to enable the government support to be directed towards "the winners" with revealed competitive advantages and evident market opportunities, believing that their improvement will trigger the improvement in performance of the sector as a whole. Although selecting the winners is traditionally marked as problematic when it comes to the government, designing the instruments for their support has proven to be an even trickier issue. Accordingly, revising the existing agriculture support mechanisms inevitably requires the improvement of the ancillary systems – introducing reliable and detail databases on agriculture support to beneficiaries, establishing policy evaluation systems, and monitoring the use of the allocated funds. The shining example of the EU Common Agricultural Policy could serve as a solid guideline, provided that it does not blind the policy makers in tailoring the incentives system to the agriculture of Serbia.

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WEB-BASED BUSINESS APPLICATIONS AS THE SUPPORT FOR INCREASED COMPETITIVENESS IN AGRIBUSINESS*

Web poslovne aplikacije kao podrška agrobiznisu u cilju podizanja konkurentnosti

Abstract

During the last several decades, on a global level, the development of information technologies, particularly those with applicability in all spheres of human activity, has shown distinctive excellence. Experts in the field of prediction expect expanded and more reasonable usage of information technologies, particularly in the areas where a full ICT support is needed. Agriculture is the sector which has rather insufficiently relied on information technologies in almost all its activities.

It can be noticed that in the Republic of Serbia information technology, according to its capacities, has provided high-quality assistance to particular areas. However, this does not apply to the sector of agriculture. Due to the above-mentioned reasons, the subject of this paper is devoted to the issues related to information technology support in agribusiness, which is further aimed at strengthening competitiveness.

In addition to introductory notes and conclusions, the paper contains three principal parts in which the positioning of Serbia relative to the application of information technologies has been analyzed, including also considerations of the problem of increased production and marketability on the selected example, as well as the usage of web-based information technologies with the aim of intensifying the activity level of agribusiness.

Key words: *agribusiness, marketability, competitiveness, information technologies, electronic business (e-business), web-based business applications*

Sažetak

U poslednjih par decenija, na globalnom nivou, razvoj informacionih tehnologija, a posebno u primeni u svim sferama ljudske delatnosti, predstavlja određenu izuzetnost. Eksperti iz oblasti predviđanja očekuju dalju, sve racionalniju primenu informacionih tehnologija, naročito u oblastima koje očekuju potpunu podršku. Poljoprivreda je sektor koji je veoma skromno koristilo podršku informacionih tehnologija u svojim aktivnostima.

U Republici Srbiji, prema mogućnostima, može se reći da je informaciona tehnologija podrška određenim oblastima na dosta kvalitetan način, što se ne može reći za oblast poljoprivrede. Iz ovih razloga, tematika rada posvećena je problematici podrške informacione tehnologije u agrobiznisu u cilju jačanja konkurentnosti.

Pored uvodnih napomena i zaključka, rad sadrži tri osnovna dela u kojima se razmatra pozicioniranje Srbije u pogledu primene informacionih tehnologija, razmatranje problema povećanja proizvodnje i tržišnosti na izabranom primeru, kao i korišćenje *web* informacionih tehnologija u cilju podizanja nivoa aktivnosti agrobiznisa.

Ključne reči: *agrobiznis, tržišnost, konkurentnost, informacione tehnologije, elektronsko poslovanje, web poslovne aplikacije*

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Introduction

Today science and information technologies are penetrating into all aspects of economic activities, including agribusiness as well. Methods and manners of planting and growing already existing types, introducing new agricultural sorts and their placement on the market are being constantly improved in versatile ways.

Thanks to the usage of information and communication technologies (ICT), consumers are given the possibility of gaining much more information about producers, distributors, competitors, structure of goods supply and market services, structure of prices, time and place of supply, etc. Therefore, producers themselves more and more frequently show the interest in cooperating with the consumers in all phases of product development. Traditional research of marketing channels has been directed only to selling of products; however, it is nowadays changed, due to numerous reasons, thus giving the way to all-encompassing analysis. Among the main reasons that emphasise the necessity of integral investigation of marketing channels, the following ones can be enumerated: usage of ICT, shortened "life span" of the products, complex, corporative joint business undertakings and constantly increasing demands for versatile services. Such an integral approach in the process of investigating marketing channels implies simultaneous observation of strength proportion among all participants in marketing channels, starting with the producers of raw materials and repro materials, processors of transportation and storage organizations, wholesalers and retailers, up to final consumers. Developing the concentration and cooperation in marketing channels results in corresponding actualization increase [4, p. 173].

Inappropriate application of information technologies that relates to production and turnover of agrarian products, as well as inadequate adjustment to constant changes in the environment present huge blunder and weakness of the Republic of Serbia. World economy continuously works on modifications and improvements, particularly in the part related to the introduction of informatics support into all processes of production and selling, as a manner of increasing competitiveness.

Nowadays, by accepting the Internet technologies, both individuals and organizations constantly improve productivity, simultaneously developing communication on a global level. Using of e-business operations has become the most significant factor in global economy. Moreover, e-business application enables organizations to equally experience advantages and challenges and, in that way, to contribute to better-quality business operations.

The Internet has forced organizations to redefine their information systems. Companies use the Internet in order to enhance their business processes, materials purchase, selling of products, automation of users' services, creation of new income sources, etc.

While the Internet cannot eliminate or replace the classical functions performed within a marketing channel, the Internet can restructure them. In itself, the Internet has become a distribution channel for products and services, with the components of speed, interaction, and flexibility. As a distribution channel, the Internet provides a portal for communication between the buyer, the seller, and the entire distribution phase of the physical item. The Internet offers the marketing channel potential of eliminating some of the marketing costs and combines in the shrinking of the channel and making distribution much more efficient [1, p. 33].

The spread of the Internet as a successful medium of communication and exchange has broadened the scope of doing business to the global market place. The Internet is a global phenomenon in which fortune will favour truly global players. Substantial market shares within one set of territorial or market boundaries have started to become meaningless in a global context. On the other hand, niches unsustainable within purely domestic markets become viable in an electronic networked environment [3, p. 31].

From the point of view of today's ICT development, usage of dynamic web pages has absolutely become widespread subject matter regarding all business interactions. Static web sites are losing the battle since they have simply lost their functionality which can be provided by dynamic web sites. Content Management System – CMS has been used for some time and, generally speaking, it simplifies web pages, generating dynamic web pages. Additionally, CMS scripts of the open code have been used. Among the others, with the

appearance of Joomla[1] system, as the very powerful CMS of the open source code, obtained were the advantages of this system, implying very simple administration of the web contents and using of versatile patterns. Flexibility of this system presents one of the key characteristics; therefore, it appears now to be the most significant feature for the web contents that is being created. Web dynamic business applications nowadays absolutely demand flexibility, also including various different possibilities offered by Joomla system. Moreover, Joomla system can be managed without any previous programming knowledge or experience related to database systems operations. Therefore, it is seen as the greatest advantage of this system. The basic assumption is that without particular capital investment in software and without possessing any special skills and knowledge in the field of information technologies, it is possible to become competitive on the Internet, particularly in the domain of agribusiness, as it will be presented further in this paper.

Positioning of Serbia in the domain of information-communication technologies

With the aim of reaching the conclusion regarding the level of agricultural development concept implementation in the Republic of Serbia and scrutinizing the manner in which it is possible to encourage such a concept by applying information technologies, it is necessary to call attention to the current situation of the Republic of Serbia referring to the domain of information technologies. The surveys that were carried out and that are relevant, encompass the surveys and conclusions of the World Economic Forum [14], specifying the position of the Republic of Serbia in the world, as well as the surveys of the Statistical Office of the Republic of Serbia [11] regarding the usage of ICT in the Republic of Serbia.

World Economic Forum has published the 13th issue of the Report on Information Technologies, accentuating that the report has been published in the period when the world economy is supposed to strengthen the recovery after the period of the worst economic and financial crisis during the last 80 years. In the context of the world's economy recovery, ICT has the key role in presenting versatile innovations and enabling new working positions.

The mentioned report has been monitoring world development of ICT for over a decade, pointing out the significance of the data and long-term competitiveness. The report from 2014 offers a global overview of the current situation in the area of ICT. The data have been observed through the prism of the so-called Networked Readiness Index which is decomposed into four segments. Additionally, it is to be emphasized that the survey has been conducted in 148 counties and it has the greatest coverage ever, regarding the number of world economies involved.

Four segments (subindexes) that are defined in scope of Networked Readiness Index and further decomposed into ten additional parts involve [13, p. 6]:

1. Environment subindex
- Political and regulatory environment
- Business and innovation environment

2. Readiness subindex
- Infrastructure and digital content
- Affordability
- Skills

3. Usage subindex
- Individual usage
- Business usage
- Government usage

4. Impact subindex
- Economic impacts
- Social impacts

The final NRI score is a simple average of the four composing subindex scores, while each subindex's score is a simple average of those of the composing pillars. In doing this, we assume that all NRI subindexes make a similar contribution to networked readiness.

The environment subindex gauges the friendliness of a country's market and regulatory framework in supporting high levels of ICT uptake and the emergence of entrepreneurship and innovation-prone conditions. A supportive environment is necessary to maximize the potential impacts of ICTs in boosting competitiveness and well-being.

The readiness subindex, with a total of 12 variables, measures the degree to which a society is prepared to

1 The name comes from Swahili language, meaning "all together".

make good use of an affordable ICT infrastructure and digital content.

The usage subindex assesses the individual efforts of the main social agents – that is, individuals, business, and government – to increase their capacity to use ICTs as well as their actual use in their day-to-day activities with other agents. It includes 16 variables.

The impact subindex gauges the broad economic and social impacts accruing from ICTs to boost competitiveness and well-being and that reflect the transformation toward an ICT- and technology-savvy economy and society. It includes a total of eight variables.

Overall survey is divided into 54 indicators (variables), whereof 27 (50%) present quantitative data, and the rest 27 indicators relate to qualitative data; more precisely said, internationally comparable data simply were not attainable for a large enough number of countries, but were, however, crucial for the analysis and therefore were classified as qualitative variables.

Total estimation of NRI index is measured on the scale from 1 to 7. Values on the scale define measures from the best to the worst ranked participating economies:

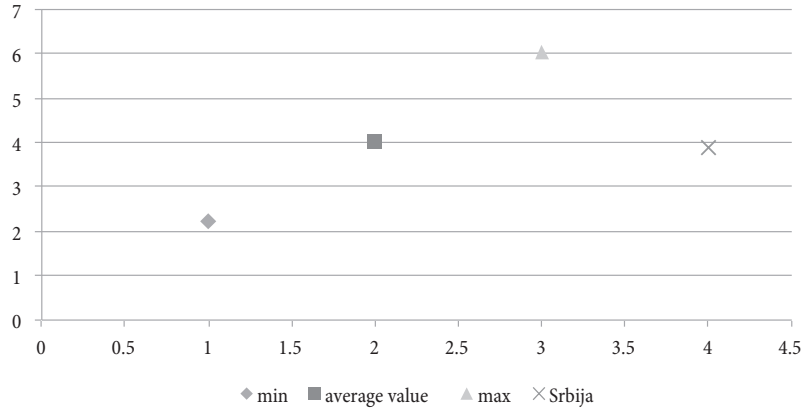
- 7.0 – 5.4 (the best ranked)
- 5.4 – 5.0
- 5.0 – 4.0
- 4.0 – 3.3
- 3.3 – 1.0 (the worst ranked)

The first survey of overall NRI score shows that Serbia is in 80th position, on the list of 148 countries, with the score 3.88; it is better in comparison with the previous year, when Serbia was in the 87th position. Figure 1 shows the minimal value, maximal value, average value and value of Serbia's score among all 148 countries:

The survey Environment subindex shows that Serbia is in the position 106, with the score 3.58. Figure 2 presents minimal, average score, as well as the score of Serbia in the category of this survey:

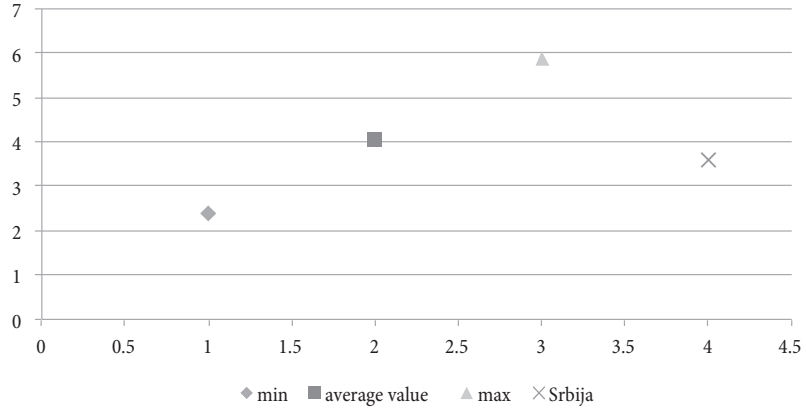
The survey Readiness subindex, indicating the general readiness of usage and improvement in ICT, shows that

Figure 1: Total values of Networked Readiness Index – average values, extreme values and score for Serbia



Source: Data processed by the author, according to [13]

Figure 2: Environment subindex – average values, extreme values and score of Serbia



Source: Data processed by the author, according to World Economic Forum, 2014 [13]

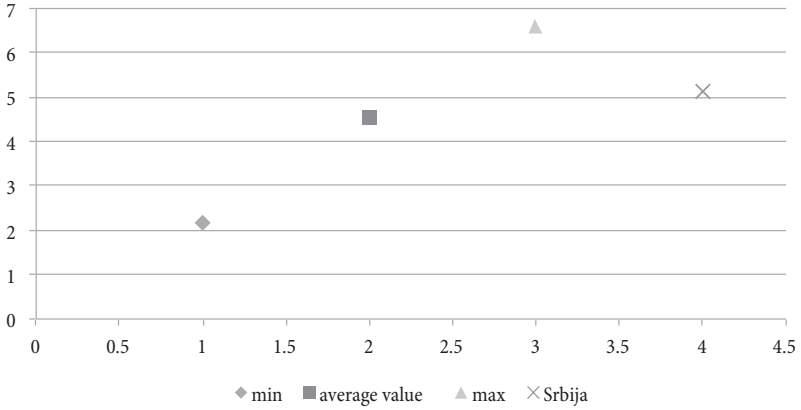
Serbia in the area of Infrastructure and digital content takes the 49th position, regarding the area of Affordability, the 67th position, and referring to the area of Skills, Serbia is in the 63rd position (see Figure 3). The scores of the above-mentioned sub-categories obviously indicate the overall 53rd position, with the general score of 5.11.

The survey Usage subindex presents the scores for the sub-categories: Individual usage, Business usage and Government usage. Total score of 3.66 places Serbia on the 72nd position of this survey (see Figure 4).

Finally, the survey Impact subindex shows the scores for Economic impacts and Social impacts. Total score of these two sub-categories equals 3.19, positioning Serbia in the 93rd place (see Figure 5).

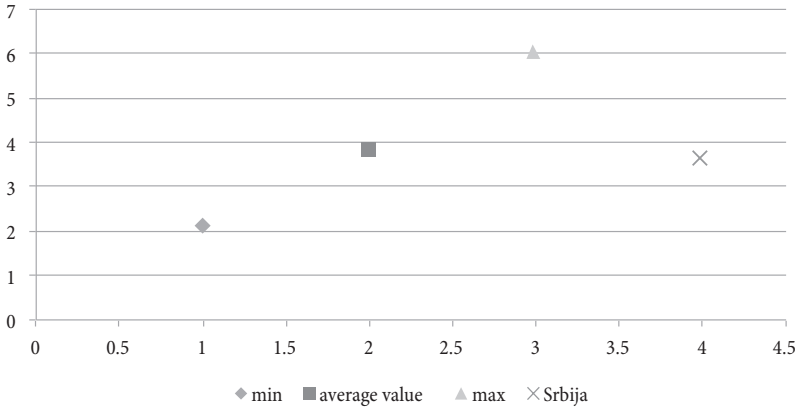
According to the presented data from the surveys, it can be concluded that the position of Serbia in the area of

Figure 3: Readiness subindex – average values, extreme values and score of Serbia



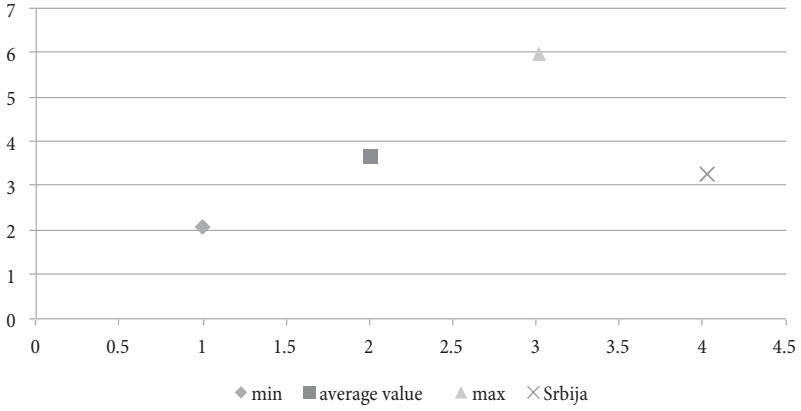
Source: Data processed by the author, according to [13]

Figure 4: Usage subindex – average values, extreme values and score and score of Serbia



Source: Data processed by the author, according to [13]

Figure 5: Impact subindex – average values, extreme values and score of Serbia



Source: Data processed by the author, according to [13]

ICT, expressed by several economic and sociological criteria is not at a desirable level. There are several relatively good conditions for further improvement and introduction of ICT innovations, but much more efforts are required, particularly with the support of the government strategy.

The data that could depict the rough picture of the situation regarding ICT usage in the Republic of Serbia encompass the official data of the Statistical Office of the Republic of Serbia. Such data are obtained as two-phase stratified sample and as such, they do not present completely obvious picture of the current situation; however, they certainly reflect in a very good manner the actual situation of ICT usage. Selection of two-phase stratified sample is performed in two phases: the first phase presents the selection of certain number of strata, while the second phase relates to the selection of elements that contain particular characteristic which is relevant for the survey.

Considering that in this paper the focus is placed on economic potential of agribusiness which can increase, among other ways, by applying information technologies, particular attention should to be paid to technologies which might encourage agricultural development.

E-business presents the domain of ICT which, among other issues, also offers application of e-commerce. This is the area which can, for the most part, contribute to growth of agribusiness' potentials and as such, the data correlated with this area become relevant for the purpose of enabling creation of the image of actual ICT usage.

The survey was carried out by the Statistical Office of the Republic of Serbia, encompassing both individuals and enterprises. In order to reach certain relevant data that could be important in the domain of e-commerce in scope of agribusiness, attention has been paid only to data which involve usage of computers, the Internet and e-commerce on the Internet. Particular data referring to agricultural products' trade on the Internet, in any form, cannot be obtained since they were not considered in the survey.

The survey represents that using of suitability of e-business appears to be very disputable. First of all, the fact is that in 2014, regarding the section of individuals, 59.5% have never performed the trade over the Internet. Even though the number has decreased in comparison with the previous years, the situation still remains dissatisfying. Table 1 presents the review of the users of e-commerce on the Internet:

Concisely, 1,160,000 persons purchased or ordered goods or services on the Internet in 2014, presenting the increased number of persons for somewhat over 260,000 respective to 2013.

Regarding enterprises, 74% of enterprises possess website and 83% of them consider their website suitable for visitors, i.e. it offers all possibilities to its visitors. Percentage of enterprises which ordered products/services over the Internet amounts to 40.4%, while 21.2% of enterprises received orders (excluding e-mail orders) for delivery of the own products/services, thus presenting only a half of the enterprises of the previous group. The reason for half the number of enterprises that received orders for their products/services can be, among other things, found in the fact that their web sites are not web dynamic defined to the extent so as to be able to offer an adequate interaction with the buyers.

In scope of the section related to share of total turnover realized on the basis of orders received via the Internet, the enterprises provided the following answers:

- with less than 24% of turnover (63.5% of enterprises);
- more than 24% and less than 50% of turnover (17.2% of enterprises);
- more than 50% and less than 75% of turnover (13.4% of enterprises);
- 75% and over turnover (5.9% of enterprises).

Table 1: Users of e-commerce (in %), in the period 2006-2014

	2006	2007	2008	2009	2010	2011	2012	2013	2014
Never performed e-commerce	88.4	89.7	86.3	87.4	87.0	81.9	73.3	64.5	59.5
Performed e-commerce in the last 3 months	5.6	3.7	6.3	6.5	6.1	9.3	16.6	19.3	21.6
Performed e-commerce more than 3 months ago and less than a year ago	4.6	3.2	4.9	4.0	4.5	5.1	5.4	9.2	10.2
Performed e-commerce more than a year ago	1.4	3.4	2.5	2.1	2.4	3.7	4.7	7.0	8.8

Source: [9]

The provided data indicate that almost all preconditions for electronic trade of goods and services exist, but they are not used in the appropriate and best possible manner.

The data that strongly support this topic in the area of agriculture, obtained on the basis of 2012 Census of Agriculture [8], involve the data that present number of holdings in the Republic of Serbia, by municipalities, which used computers for bookkeeping records about agricultural business activities. Furthermore, they present the only official data showing whether and to which extent the holdings are ready to use innovations in scope of information technologies, with the aim of improving their positions on the market.

Total number of holdings that answered to be using computers for bookkeeping records about the agricultural business operations amounts to 10,355, presenting 1.6% of total number of agricultural holdings in Serbia, according to 2012 Census of Agriculture. In order to depict more meaningful result of the total number of 165 municipalities, the holdings were divided into strata:

- Up to 10 holdings;
- From 11 to 30 holdings;
- From 31 to 60 holdings;
- From 61 to 100 holdings;
- From 101 to 200 holdings;
- Over 200 holdings.

The data represented in Figure 6 do not illustrate overall survey, but only the parts which are of significance for the issues that this paper deals with.

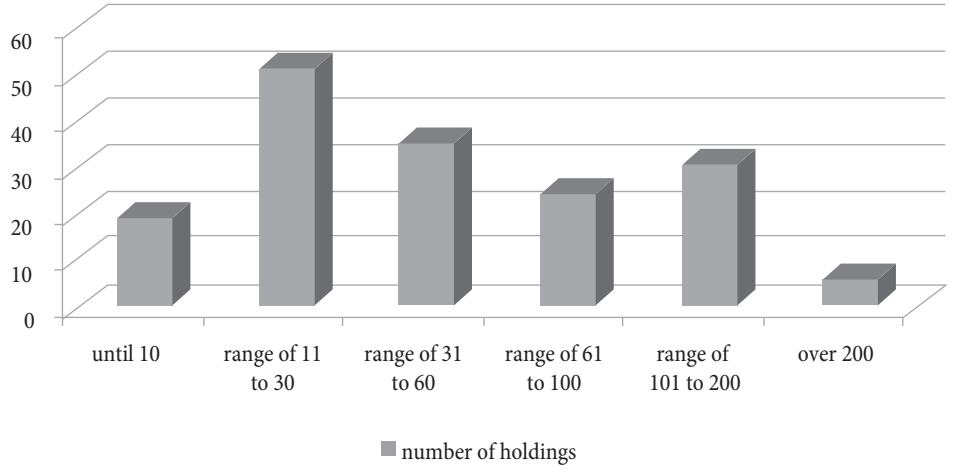
Production potential and marketability in the section of vegetables growing on the selected example

The Republic of Serbia has not been using its huge potential in the section of agriculture to the highest possible extent. Agriculture participates in gross domestic product with 8.5% [7], while regarding exports ofagricultural products it participates with 22.8% [7]. The structure of holdings is highly inappropriate, with the average size of 3.6 hectares, while only 2.37 hectares present arable land, and only 5.5% of agricultural producers of total number of 778,891 cultivate over 10 hectares.

Agrarian budget is a part of total budget of the Republic of Serbia that is intended for development of agricultural production, improvement of products' quality and their promotion. Moreover, it predicts expenditures for crop production and livestock breeding in the sense of subventions and premiums. During the last several years, remarkable is the increase of budget expenditures intended for organic farming and rural development.

The Republic of Serbia is, in regional terms, the greatest producer of vegetables, and the position it takes in total production, consumption and exports indicates attractiveness and profitability of this branch for business activities. Climatic conditions are the most favourable for planting mid-early and mid-late vegetables, and it has resulted in development of various types of production, such as gardening, field and intensive industrial production

Figure 6: Number of holdings which used computers for bookkeeping records, by strata



Source: Data processed by the author according to [8]

or production under protective covers (glasshouses, polly-tunnels, etc.). Out of total sown areas, 9% is under vegetable crops, while 11.3% of overall agricultural production is realized exactly in this section [5].

Decreased purchasing power of agricultural producers and insufficient usage of information technologies diminish their demand for agrarian inputs, thus influencing the extensiveness of agricultural production, instability of yields and volume of production, relatively low level of using the capacities of the corresponding branches of manufacturing and even greater decrease of competitiveness of agriculture of the Republic of Serbia on the market.

The degree in which agricultural products appear in trade of goods, that is, a percentage of agricultural production which is purchased on the market is called marketability of agricultural production. In the most developed countries, the degree of marketability amounts to 70-80%.

Agricultural producers of modest size, of fairly small productive and financial resources are most frequently determined to productive orientation and satisfying the own needs of their households. Potential market surplus and turnover of their own products are conceded to the others, middlemen, purchasers, or to direct sale on the market. Information about market trends and flows is realized through mediators to which they sell their products. Huge agricultural producers with expressive merchantability of production most frequently establish their own selling policies (product, prices, promotion, etc.), thus tending to direct selling and immediate realization of market demands. In majority of cases, this is the way of direct and generally short channels of turnover. The above-presented facts lead to the conclusion that direction of further consideration should relate to higher level of informatics support, since the Internet is getting more and more important factor of wider vertical and horizontal cooperation among the producers and trade organizations.

Through the example-based analysis of the selected product – potato, which in the observed referent period 2003-2012 recorded the greatest produced quantities within the section of vegetables growing, due to low marketability, it can be concluded that there exists particular problem in well-organized channels of marketing, as a result of shortage of information about inputs and sales. Placement of goods mostly ends via direct channel of marketing or in natural consumption.

Furthermore, apart from its share in exports, potatoes also present specific goods grouping of vegetables which have recorded the greatest share in consumption as compared with other vegetables (see Table 3), the greatest share in produced quantities of vegetables (see Table 2), and also the enormous commercial, technological and nutritional significance.

Table 2: Comparative review of production of vegetables with the largest share in Serbia (in tonnes)

	Potatoes	Cabbage and kale	Tomatoes
2003	679,309	301,850	163,606
2004	975,090	304,085	184,688
2005	969,562	272,760	169,076
2006	930,305	324,657	189,222
2007	743,282	280,191	152,005
2008	843,545	300,519	176,501
2009	898,282	326,162	189,353
2010	887,363	336,600	189,412
2011	891,513	315,490	198,677
2012	577,966	281,557	155,663
Total	**8,396,217**	**3,043,871**	**1,768,203**

Source: Data processed by the author on the basis of SORS data, Statistical Yearbooks of RS (2003-2012)

Table 3: Annual consumption of vegetables per a household member, in kilograms, 2009

Potato	Cabbage	Tomato	Beans	Tuber vegetables	Onion	Other vegetables	Total
36.2	18.8	15.1	5.6	9.8	13.0	22.7	121.2

Source: Household Budget Survey, the Statistical Office of the Republic of Serbia

The production and consumption of potatoes in Serbia have their established tradition because potatoes are one of the main vegetable crops. The current efficiency of potatoes farming in Serbia is by far under its potential. Rational use of the capacities of potatoes producers in Serbia is limited by factors such as availability of varieties, availability of quality seeds, disregard of crop rotation, inadequate soil fertility, inadequate control of plant pathogens and pests, insufficient use of irrigation system, lack of adequate storage, and insufficient usage of information technologies restricting access to information.

Organised sale and especially purchase influence considerably market-oriented vegetable growing. Technological progress in vegetable production and production under protective cover provide unlimited conditions for vegetable growing all the year round and facilitate the making of offers of various structure and assortment. Traditional supply with fresh vegetables on farmers' markets and its relatively large share in the turnover will gradually diminish the turnover share in favour of organised wholesale and retail trade provided that the producers have necessary information on the needs of larger market.

Associations or cooperatives of producers are almost inexistent. Only a few potatoes producers are organised in associations (Association of Market-oriented Potato Producers "Zablace", Association of Potato Producers "Kondor", Leskovac) or are clearly defined as a group within various other associations of agricultural producers (e.g. "Plodovi Srbije" – group for potatoes, the association "100P plus" from Vojvodina). The members of the mentioned associations are mainly producers with 1-5 and 5-20 hectares, although there are several of those with more than 20 hectares [6].

Potatoes producers are getting organised in view of simpler and more favourable purchase of seeds, fertilizers and chemicals, as well as joint market positioning. The way producers are organised at their own initiative, the attainment of more advantageous purchase of seeds and the objectives to making exclusive producers' profit need particular attention, since being at initial stage. Farmers should attend training related to all possible options and advantages of computer support in the process of organising production and marketing channels.

The training should deal with producers' action, their possibilities and advantages of organization, method of financing the associations and surveys pertinent to the work of the associations. More stable and stronger producers' association should be created for decision-making in all aspects of production, which will influence the decisions of government administration.

As far as production and consumption are concerned, potatoes are the most important vegetables. The average production of potatoes in the mentioned period amounts to 840,000 tonnes, with a downward trend of on average 4.52% annually (see Table 4).

Delivery of potatoes on the market can be divided into two marketing channels. The first one is the delivery through organized marketing channels, i.e. through specialized purchase and trade organizations. Farmers' markets as direct marketing channels are the second form of potatoes placement on the market. The delivery through organized channels on average amounts to 23,000 tonnes. When observed in relation to marketing channels organization, delivery movements went in different directions. Namely, the sale in the scope of enterprises and cooperatives has recorded an annual growth rate of

Table 4: Offer of potatoes by entities of marketing channels on the market of the RS (2003-2012)

Characteristics	Total	
	Average	Rate %
Production -000 tonnes	**840**	**-4.52**
Family holding	809	-4.65
Enterprises and cooperatives	31	-1.32
Delivery, intermediary marketing channels -000 tonnes	**23**	**0.3**
Family holding	6	-7.95
Enterprises and cooperatives	17	2.75
Turnover on farmers' market, 000 tonnes	29	-4.48

Source: Authors' processing of SORS data, Statistical Yearbooks of the RS (2003-2012)

Table 5: Marketability of potatoes by entities of marketing channels on the market of the RS (2003-2012)

Characteristics	Total	
	Average %	Rate %
Marketability (total marketability shown with farmers' market)	**6.43**	**1.88**
Total marketability of family holdings	4.5	-0.24
Marketability of enterprises and cooperatives	55	4.13
Marketability of family holdings, direct marketing channel	3.7	0.17
Marketability of family holdings, indirect marketing channel	0.78	-3.47

Source: Authors' processing of SORS data, Statistical Yearbooks of the RS (2003-2012)

+2.75%, with considerable 44.58% variation. At the same time, the purchase from family holdings saw a significant annual growth rate of –7.95%, with a 47.59% variation. One of the reasons is badly organized and dysfunctional sale channel. The mentioned conclusion confirms that efficient marketing channels, accompanied by adequate usage of information technologies, are a key assumption of competitiveness of agricultural business in modern circumstances.

The sale through farmers' markets is predominant in the structure of the total delivery, participating with 56% in total deliveries. Family holdings choose direct marketing channels because it is cost-efficient and because they cannot store potatoes in adequate technological conditions in order to prolong the shelf life.

The total marketability of production is the ratio of delivery through organized marketing channels and farmers' markets. The average marketability of the total production of potatoes without farmers' market amounts to approximately 2.8%. Thus, for example, the largest marketability amounted to 3.88% in 2008, and the smallest was recorded in 2004, being 1.44%. Low marketability is due to the fact that production is oriented towards households' own consumption of potatoes, while the remaining quantities are mainly sold on farmers' markets. There are only a few real, large potatoes producers in our country because of, among all other things, a lack of adequate information on market needs. The conclusion is that a new system emerges in the production of food by integration process. The competitiveness is becoming more obvious rather among integrated systems than among independent entities of the agricultural business; this is a prerequisite for good information.

Family holdings (see Table 5) record a very small percentage of marketability through indirect and direct marketing channels, being 4.5%. The maximum marketability of the mentioned form of business amounted to 5.6% in 2007. Decreasing trend is noted with family holdings, being 0.24%, while enterprises and cooperatives show an increase of 4.13%.

Marketability through farmers' markets amounts on average to 3.7% and is relatively stable. Marketability through farmers' markets, family holdings is significantly larger than the marketability through organized marketing channels. The total marketability, farmers' markets included, amounted on average to 6.4% on annual basis, with a variation coefficient of 48%, which is expressive of considerable variations in trends. The maximum marketability was noted in the last observed year when it was 8.2% and the minimum was 4.87% in 2004.

The largest part of potatoes, 96%, produced by family holdings is consumed in agricultural enterprises and farms through natural consumption or is used as seeds. Of the total production of potatoes 0.71% is sold by agricultural holdings through indirect marketing to trade enterprises, with a downward trend of 7.95% and extreme one of 48%. 3.6% of the production of family holdings is sold on farmers' markets, with a negative trend of 4.48% and negative variations of 7.2%. Enterprises and cooperatives deliver 55% of their total production to trade enterprises through retail trade establishments and manufacturing industry for the production of chips, French fries, etc.

Low income of family holdings does not allow savings and modernization. Marketing channels of vegetables are not organized well; the intermediaries deal in grey economy. The link such as cooling of vegetables on the level of farmers, wholesale and retail trade is necessary.

The inexistence of cooling facilities renders lower quality of vegetables and considerable waste due to inadequate business conditions. Vegetables are mainly exported through food manufacturers or exporters. Feedback about the needs of final consumers does not reach the producers. Producers cannot diversify their production without feedback. In addition to external link between the producers and exporters, there is no link between producers and manufacturers. Consulting services for production advancement are under-developed; hence producers' business is based on classical principles. The assumption is that these links would be reinforced by using available information technologies.

Usage of web information technologies in view of raising agricultural competitiveness

The paper defines the assumption that the usage of information technologies, especially web information technologies can improve market entry and the general output and sale, especially of agricultural produces. Web information technologies are technologies based on Internet usage. The system of web dynamic contents is particularly convenient because open code systems are widely utilized. The usage of these systems is cheap and very user-friendly. No specific knowledge of programming languages or skills of databases administration are required for managing these systems. The above-mentioned Joomla is one of the most frequently used open-source content management system, and its application will be briefly explained below.

In every content management system Administrator Backend is the most important part, as being the place from which complete dynamic web presentation is managed. The first page of the Administrator Backend is the control panel containing all options for web content management. It is consisted of the following:

1. *Add new article* (this option allows the access to the page for adding new article);
2. *Article manager* (presents the list of all articles created in this system, which can also be updated in this option);
3. *Front page manager* (displays all the articles that the users of the web presentation need to view);
4. *Section manager* (option for section updating);
5. *Category manager* (option of category updating);
6. *Media manager* (option where different files can be uploaded within this system);
7. *Menu manager* (option for defining new menu options or new menus);
8. *Language manager* (option for changing the default language for pages viewed by the users);
9. *User manager* (option of users' account management);
10. *Global configuration* (option for a large number of various settings).

Section management in the system

Section management in Joomla is indicated as "Section manager" in the scope of which articles can be viewed. The number of sections will depend on the number of pages necessary in the whole web presentation. A bigger number of sections allow larger flexibility in dealing with articles. However, in addition to these sections, several categories need to be created if a number of different articles are at disposal – i.e. for each type of articles a new category is to be opened. It is necessary first to create a section and then the content inside.

The creation of sections comes before the creation of categories or articles. Let assume that a web application for the sale of agricultural produces of an agricultural holding is to be created. It is necessary first to divide the sections for each type of produces (vegetables, fruit, cereals, etc.) and then to define the categories within the respective sections (e.g. maize, cabbage, tomato, etc.). "Section manager" opens, and in the scope of this page a tools panel opens in which are to be entered the name of the section, level of access, possible section description in the box for text entry, as well as the picture of the produce.

Content creation

The content of the web presentation is the most important and it shows how the whole presentation will look like. Without content it is only possible to create a non organised, insufficiently clear and hard to use presentation. Consequently the presentation is not useful. It is completely obvious that the content management system such as Joomla cannot function properly at all without a well-designed content of

the presentation. However, the content certainly needs to be organised when a web presentation is created, whether Joomla is used or not.

Content creation in Joomla relies generally on the creation of articles, being in a way the material parts of the content. The tool used in the system for article creation is *Article manager*. Content management and entry of different parameters and texts is done in the so-called *backend*, and the display of this content and result of different entries and modifications on the webpage is the so-called *frontend*.

Within the creation of articles the following parameters are set up in *Article manager*: article title (e.g. sale of agricultural produces), selection of the section to which the article belongs (the sections may be for example vegetables, fruit, etc.), publication (No/Yes) and space for text entry relevant to the article.

After safeguarding these changes, it is possible to view the article by clicking on the option "Preview", which opens in this case in form of a picture with the name and description of a particular agricultural produce.

In addition to the content, the user part of the presentation can contain links grouped as a menu, which would allow going to certain pages of the presentation. It is necessary to select a new menu in *Menu manager,* then to define new parameters, such as individual name, name and description of the menu. The name of the new menu appears on the menu list, rendering the access to the new menu very simple. The links within the menu are also easily accessed. By accessing the new menu *Menu item manager* opens within which it is possible to add new items.

Joomla system is in constant communication with the database management system MySql through PHP scripts, which already exist in the system and do not need to be created separately. This way all changes made in the web presentation via Joomla are recorded in the database. There is no Dynamic Content Platform used on the Internet without being supported by databases. The use of databases is of great importance. However, Joomla does not require having skills for databases systems, although these are constantly used for data storage and handling.

Software extensions existing in Joomla are a special convenience that allows the use and modification of components, modules, plug-in additions, patterns and languages. *Extension manager* is designed to install wanted extensions in the system.

Components are an application performed within the system and located in the main part of the page. Components already incorporated in Joomla are as follows:

- Banners (Banner manager) – installation of banners on a web presentation. Banners are sometimes used as a link to other parts of a presentation, and sometimes as a method for generating income by selling advertising space;
- Contacts (Contact manager) – creation of personal page with contact information;
- News feeds (News feed manager) – collection of news and other information. Review of RSS (Really Simple Syndication) content, where News feeds allow the users to read different messages and review web presentations;
- Polls (Poll manager) – creation of different polls, where next to questions answers are proposed, of which one is to be ticked;
- Search (Search statistics) – allow simple searching of information;
- Web links (Web link manager) – display URL addresses in form of list of categories.

Joomla system is completely open for handling dynamic web content. Skills in programming languages are a convenience to reach higher level of system management. In addition, the system is free. All this makes it a very powerful and flexible system which will further progress along with other web content in the field of e-commerce. This is at the same time an excellent example of application and the subject of this paper.

The usage of information technologies is really necessary; hence one needs to design a system which will facilitate the access on the Internet to offers and sales of agricultural produces. Also, it is possible to network several smaller systems (family holdings) through one system and make the market more accessible.

Conclusion

The fact is that agriculture, as an economic activity, contains special characteristics influencing production, storage, sale, etc, which is mentioned a number of times in the paper. This being:

- Diversified products;
- Holding geographical location;
- Geological soil composition;
- Number of agricultural holdings;
- Holding size;
- Production technique;
- Climate;
- Dispersion on large surfaces;
- Tradition.

Each of these characteristics has its own modalities, which influence considerably the production – quantity, quality, transport, and sale; thus it is only natural that this paper presents the nature of the problem and suggests the usage of web information technologies as a solution to it.

Raising competitiveness in the agricultural business requires information on a number of characteristics, producers and consumers, which would, provided the usage of certain information technologies, contribute to better business. According to what is said above, one should be concerned about the situation in the Republic of Serbia; thus this paper aims at finding an answer to the following question: how to improve the usage of information technologies so that agriculture can take on expected good characteristics? The analysis of data provides answers on the position of Serbia in the World. Numerous research studies (of world research institutes, both economical and statistical, dedicated agricultural forum in Serbia, etc.) and data processing by the authors oriented to the relationships of Serbia with the World convey a clearer picture of the situation in Serbia, as far as information technologies are concerned.

The problem of production potential and marketability, on the example of vegetable growing, points to certain issues and possibilities of considerable improvement of products placement with the help of modern information technologies. The paper also stressed out products losses that occur because large quantities, which have not reached the market or consumer, have to be destroyed.

Agricultural competitiveness requires, among all other things, the usage of web information technologies that contributes to better offer and sale of agricultural produce. The description of the management of an open-source web dynamic content system offers the possibility to raise the competitiveness of agricultural holdings. The paper also presents how to manage the sections and create a web open-source dynamic content platform. One should not forget to mention that some time ago only big companies were able to be present on the web, but today, owing to the open code software with various GPL (General Public Licence) and economic solutions, small companies and systems can also come out with a quality dynamic web location and establish a certain level of competitiveness to large enterprises.

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COMPARING RESTRUCTURING STRATEGIES OF ELECTRIC POWER COMPANIES IN THE EU AND SERBIA*

Poređenje strategija restrukturiranja elektroenergetskih kompanija u Evropskoj uniji i Srbiji

Abstract

The electric power sector is the most important and the most complex segment of the entire energy system. It consists of four interrelated operations: electricity generation, electricity transmission, distribution of electricity, and supply to final customers. Guided by the positive experience of other countries worldwide, and believing in the superiority of market competition versus monopoly, the EU started the restructuring process of this sector twenty years ago with the aim to create a single competitive electricity market. Bearing in mind the complexity of the activity itself and great differences between the electric power systems of the Member States leads us to conclude that the creation of a single electricity market of the EU is a very complex and time-consuming process. For this reason, the liberalization of the electric power market has been one of the most radical changes and major challenges for the EU since its foundation. Restructuring process usually includes following activities: corporatization and privatization, change of top management and introducing of performance contracts, unbundling of enterprises, outsourcing, etc.

In 2004 with the adoption of the Energy Law and Energy Sector Development Strategy according to requirements of the EU Electricity Directives, the implementation of reforms of Serbian electric power sector started. The process is just partially completed. The electricity market in Serbia has been opened since 1 January 2013. All electricity customers who are connected to the transmission system have lost their right to public supply, or supply at regulated prices. Final customers of electricity have the right to freely choose their supplier on the market. The exceptions are households that will exercise their right as of 1 January 2015. Taking into account the fact that reforms in Serbia concerning the electric power sector are overdue, it has the possibility to learn from the experience and mistakes of the EU electric power companies and to implement reforms successfully.

Key words: *electric power companies, electricity market, restructuring strategies, corporatization, Electric Power Industry of Serbia*

Sažetak

Elektroenergetski sektor je najvažniji i najkompleksniji deo celokupnog energetskog sistema. Sastoji se od četiri međusobno povezane delatnosti: proizvodnje, prenosa, distribucije električne energije i snabdevanja krajnjih potrošača. Vođena pozitivnim iskustvima drugih zemalja širom sveta i verujući u superiornost tržišne utakmice naspram monopola, EU je započela proces restrukturiranja ovog sektora još pre dvadeset godina sa ciljem da stvori jedinstveno konkurentno tržište električne energije. Reč je o veoma kompleksnom i dugotrajnom procesu imajući u vidu tehnološku kompleksnost same delatnosti, kao i velike razlike između elektroenergetskih sistema zemalja članica. Stoga, liberalizacija tržišta električne energije predstavlja jednu od najradikalnijih promena i najvećih izazova EU od njenog osnivanja do danas. Proces restrukturiranja obično uključuje sledeće aktivnosti: korporatizaciju i privatizaciju, promenu top menadžmenta i ugovore o performansama, razdvajanje preduzeća, seljenje aktivnosti itd.

Proces reformi elektroenergetskog sektora Srbije je krenuo dosta kasnije, 2004. godine, donošenjem Zakona o energetici i Strategije razvoja energetike u skladu sa zahtevima direktiva EU. Ovaj proces je samo delimično završen. Tržište električne energije Srbije je otvoreno od 1. januara 2013. Svi kupci električne energije koji su povezani na prenosni sistem izgubili su pravo na javno snabdevanje, odnosno na snabdevanje po regulisanim cenama. Krajnji kupci električne energije imaju pravo da slobodno biraju svog snabdevača na tržištu. Izuzetak čine domaćinstva

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koja će to pravo ostvariti od 1. januara 2015. godine. Imajući u vidu činjenicu da kasni u procesu reformi, Srbija ima mogućnost da uči na iskustvu i greškama elektroenergetskih kompanije iz zemalja EU i da dalji put reformi sprovede na najbolji mogući način.

Ključne reči: *elektroenergetske kompanije, tržište električne energije, strategije restrukturiranja, korporatizacija, Elektroprivreda Srbije*

Introduction

Electricity is the existential source and driver of modern civilization. It represents the most flexible and most commercial form of energy. Automation, computerization, the development of telecommunications, as well as the continuous pursuit of comfortable and easier work, result in growing electricity needs [18]. Because of its socioeconomic importance, electricity is often viewed as a public good, and the electric power industry is organized as a monopoly activity. The cost of electricity is an inevitable component of the generation cost of each product and service, but also of the cost of living in general. The price of electricity is an instrument that protects the standard of living, encourages the development of certain industries and increases the competitive position of the entire economy. Therefore, the availability of electricity and its price are in the focus of macroeconomic policy creators.

The electric power sector is the most complex segment of the overall power system. It consists of four interrelated activities: electricity generation, electricity transmission, distribution of electricity, and supply to final customers. The complexity of the electric power system results from the technological complexity of the process but also from the fact that its generation, transmission, and distribution take place simultaneously. Unlike oil, gas and other energy generating products, electricity cannot be stored and spent later, when the need arises. There must be a continuous balance between the supply and demand for electricity which is why its generation is effected in accordance with the foreseen needs.

Electricity generation includes its generation in hydro power plants, thermal power plants, thermal power plants – district heating plants, and other power plants that use renewable energy sources. Electricity is generated by transforming various forms of energy (thermal, nuclear, wind, tide, sun, etc.) or energy generating products into electricity. Electricity transmission is transmission of electricity from its producers to the distributors and/or final customers through a high-voltage grid. The distribution of electricity is the transmission of electricity via low-voltage and mid-voltage grids to the final customers. The supply to the final customers includes all the activities related to the sale of electricity and provision of services to final customers.

Characteristics of the electric power sector in Serbia

The electric power sector is a capital-intensive activity that carries a number of risks: a long period of capacity building (2-7 years on average), fluctuations in fuel prices, electricity price changes, rigorous regulatory requirements, costs of externalities, freedom to choose suppliers, etc. The absence of competition and low price elasticity of the demand for electricity provide room for monopoly electric power companies to transfer the costs increased due to their inefficiency to the consumers, taxpayers [16].

Main characteristics of Serbian electric power system are: electricity market liberalized for all customers except households and small companies, low electricity price on regulated market, slow growth of electricity demand[1], modest efforts for faster growth of renewable electricity generation, opened for foreign investments in electricity generation, good electricity generation mix, obsolete generation capacities, good power interconnections with neighbouring countries [1, p. 5].

Serbia is one of the few countries in the region whose electricity export exceeds its import. During the spring and summer, Serbian electric power system produces greater amounts of electricity than necessary, which allows for significant export (about 15% of total generation), while it is imported during the winter months. The total generation capacity of the electric power system of Serbia constitute sources of power amounting to 7,120 MW, of which lignite thermal power plants comprise 55% of the capacity, hydro power plants 40%, while the remaining 5% are thermal power plants that use crude oil and/or natural gas. The

1 Except in recent years with a small decrease in demand caused by financial crisis

electric power distribution system of Serbia consists of a 141,482 km long network, transformers whose power is 25,413 MVA and meters infrastructure for approximately 3.5 million customers. The electricity transmission system is an 8,932 km long grid.

Total number of electricity customers in Serbia is about 3.5 million, 3.1 million of which are households. At the same time, the share of households in total electricity consumption in Serbia has been over 50% (in 2013, it amounted to 53%) in recent years, almost the highest in the region[2]. In the EU countries, the share of households in total consumption of electricity usually does not exceed 30%. The electricity balance of Serbia for the last three years is shown in Table 1.

Serbia has the lowest electricity prices in Europe. The unrealistically low price of electricity has led to multiple consequences. First, the price of electricity covers current operating costs and partly the costs of the depreciation of fixed assets. Such a pricing policy does not provide the necessary funds for the construction of new facilities and the purchase of new technology, which are preconditions for development. This is demonstrated by the fact that the age of the hydro power plants ranges between 38 and 47 years, and the thermal power plants between 24 and 47 years. Second, substantial resources are invested in the service and maintenance of the existing technology which further increases the costs of the whole process. The negative impact on the environment requires additional investment in order to meet environmental standards and obtain environmental permits. Third, the price level is counterproductive in attracting investors. Finally, low electricity prices encourage wasteful consumption, which is reflected in (bad) energy efficiency indicators in Serbia.

A key player and holder of the Serbian electric power system is a public enterprise Electric Power Industry of Serbia (hereinafter referred to as EPS). EPS is a vertically organized company that is 100% owned by the Republic of Serbia. It has founding rights in 13 companies and three public enterprises in Kosovo and Metohija[3]. The main activity of EPS is the supply of electricity, while electricity generation, electricity distribution and the distribution system management, generation, processing and transportation of coal, steam and hot water in combined processes is performed in affiliated companies

Table 1: Energy Balance of the Republic of Serbia for the period 2011-2013

Description	2011 GWh	2012 GWh	2013 GWh
Import	6,701	5,781	4,077
Export	6,979	5,392	6,614
Gross inland consumption	**-278**	**389**	**-2,537**
Transformation input			
Transformation output	**29,357**	**26,885**	**29,024**
Thermal power plants	28,672	26,275	28,620
(TE-TO) / CHP	455	439	202
Autoproducers	230	171	202
Exchange and transfers (hydro energy)	**9,243**	**9,914**	**10,853**
Consumption in the energy sector	**4,487**	**4,412**	**4,936**
Losses	**5,844**	**5,609**	**5,501**
Energy available for final consumption	**27,991**	**27,167**	**26,903**
Final non-energy consumption			
Final energy consumption	**27,991**	**27,167**	**26,903**
Industry	7,147	6,614	6,769
Construction	326	317	310
Transport	529	492	478
Households	14,665	14,517	14,146
Agriculture	321	309	301
Other users	5,003	4,918	4,899

Source: [27], [28], [29]

2 Record household consumption was recorded in 1990, when it reached 60% of total electricity consumption

3 Since1999 EPS has no longer been managing the capacities in Kosovo and Metohija

established by EPS. The development of EPS will be the subject of analysis later.

The regulatory framework for the electric power sector in the EU and Serbia

Earlier regulation of the energy sector was based on the predominant belief that the sources of primary energy (such as coal, oil, gas) were natural resources that needed to be controlled by the state. Given the fact that the primary forms of energy actually provide input for generating electricity, the electric power activity was treated in the same manner. Many economic theorists who focus on the theory of monopoly have pointed out that it is wrong to equate the electric power industry with a natural monopoly. Practice has shown that monopoly as a model in the organization of the electricity market is not effective either in terms of the efficiency of the process or in determining the real price of electricity. Systemic deficiencies of monopoly and technological advances in the generation and transmission of electricity have led to the abandonment of the existing legal provisions or replacement of economic regulations with competition in the segments where it is possible to do so [16], [18].

A pioneer in the liberalisation of electrical power market is Chile, which implemented changes in the mid-1980s. Subsequently, this practice has been applied by many Latin American countries, followed by individual states within the USA. At the time of formation of the EU, the liberalization wave had largely spread and come to Europe. Guided by the positive experiences of other countries (notably the UK), and believing in the superiority of market competition versus monopoly, the EU opted for a single market for electricity. The creation of a single electricity market of the EU is very complex and time-consuming process, bearing in mind the complexity of the activity itself but also the great differences between the electric power systems of the Member States. For this reason, the liberalization of the electric power market has been one of the most radical changes and major challenges for the EU since its foundation.

After several years of preparations, in 1996, the EU adopted the First Electricity Directive (Directive 96/92/EC) which marked the official beginning of the creation of the internal European energy market. This Directive laid the foundations and initiated the process of liberalization and reform of national legislations of Member States. The guidelines were defined in such a manner that allowed for the Member States to choose between different options. For example, the Directive provides for the right to choose between three different solutions for access to operating systems: regulated, negotiated or single buyer. Soon, it became obvious that such an approach did not lead to synchronization and equalization of national regulations of the EU Member States [4].

The Second Directive (Directive 2003/54/EC), which was adopted in 2003, had more binding elements and reduced the discretionary powers of the national legislations. It set a deadline of July 2007 when all consumers can freely choose their supplier of electric power. Compared to the first directive, it comprised a number of additional requirements: mandatory legal separation and unbundling[4] of grid operating activities from generation and supply (management unbundling and separate accounting are not enough); using regulated access to the network (no choice); establishing an independent regulatory body responsible for implementing regulations; promotion of competition in the segment of generation and so on [5], [16, p. 108]. An overview of key demands from the first and second directives and regulations before the start of reforms is given in Table 2.

In order to introduce competition in the electric power market, it was first necessary to separate market-oriented activities such as the generation and sale of electricity from its transmission and distribution as natural monopolies. Each new requirement defined by the directives had to pass the test phase so that it could be applicable for all in the next iteration. This evolutionary path is quite understandable if we take into account the number of Member States and their differences. The best examples of this are the leading European countries: Germany, France and the United Kingdom. Germany did not have nationalized monopoly electricity market

4 The deadline for the completion of legal unbundling of the transmission network operator was 1 July 2004, and for the operator of the distribution network, it was 1 July 2007

Table 2: EU Electricity Directives

	Most common form pre-1996	1996 Directive	2003 Directive
Generation	Monopoly	Authorisation Tendering	Authorisation
Transmission (T) Distribution (D)	Monopoly	Regulated TPA Negotiated TPA Single buyer	Regulated TPA
Supply	Monopoly	Accounting separation	Legal separation from T and D
Customers	No choice	Choice for eligible customers (=1/3)	All non-household (2004) All (2007)
Unbundling T/D	None	Accounts	Legal
Cross-border trade	Monopoly	Negotiated	Regulated
Regulation	Government department	Not specified	Regulatory authority

Source: [19]

but mixed public-private energy market. Even before the start of the reform, it had privately-owned companies with public or mixed companies being the predominant ones. France, like our country, had a nationalized market (since 1947) dominated by one state-owned enterprise, Electricite de France (EdF). A complete opposite of which was the United Kingdom, which liberalized its market and privatised the electricity supply industry already in the 1980s [3].

Implementation of the Second Directive left a number of unresolved issues such as the high degree of market concentration, lack of cooperation and trade across national borders, favouring of national players, lack of transparency, etc. In order to rectify the deficiencies identified, the European Parliament adopted a new set of measures in 2009, the so-called Third Energy Package, which comprises two directives and three regulatory decisions. The documents relevant for the activity of the electric power sector are: Directive 2009/72/EC - concerning common rules for the internal electricity market, Regulation No 714/2009 on conditions for access to the network for cross-border electricity exchanges, and Regulation No 713/2009 on establishing an Agency for the Cooperation of Energy Regulators. The main objectives of the Third Package are [16, p. 122]:

- effective unbundling of the transmission network in terms of ownership unbundling the Independent System Operators (ISO) and the Independent Transmission Operator (ITO),
- establishing a European regulatory agency (ACER) whose function is to coordinate national regulators and also to serve as an advisory body to the Commission for Energy,
- cooperation between transmission system operators (ENTSO),
- ensuring greater powers for national regulators in order to maximize their independence from governments and allow better control of the operation of the electricity market.

When it comes to Serbia, the energy sector reform started much later, in 2004, with the adoption of the Energy Law and Energy Sector Development Strategy. Through this law, the national legislation incorporated the requirements of the first two EU directives and began the process of liberalization of Serbian electricity market. Serbia became a full member of the regional energy community a year later. The Energy Community Treaty was signed in Athens obligating all state members to open completely the electricity and gas market until 2015. Having in mind rapidly changing European energy policy, domestic regulations have been changed too. In 2011, the government adopted the new Energy Law in accordance with the main requirements from the Third Energy Package [15].

Electricity market includes: bilateral market[5], balancing market[6] and the organized[7] electricity market.

5 Bilateral market is a market where market participants buy and sell electricity based on agreements on electricity sales and purchase

6 In the balancing market, the transmission system operator buys and sells electricity from market participants to balance the entire system

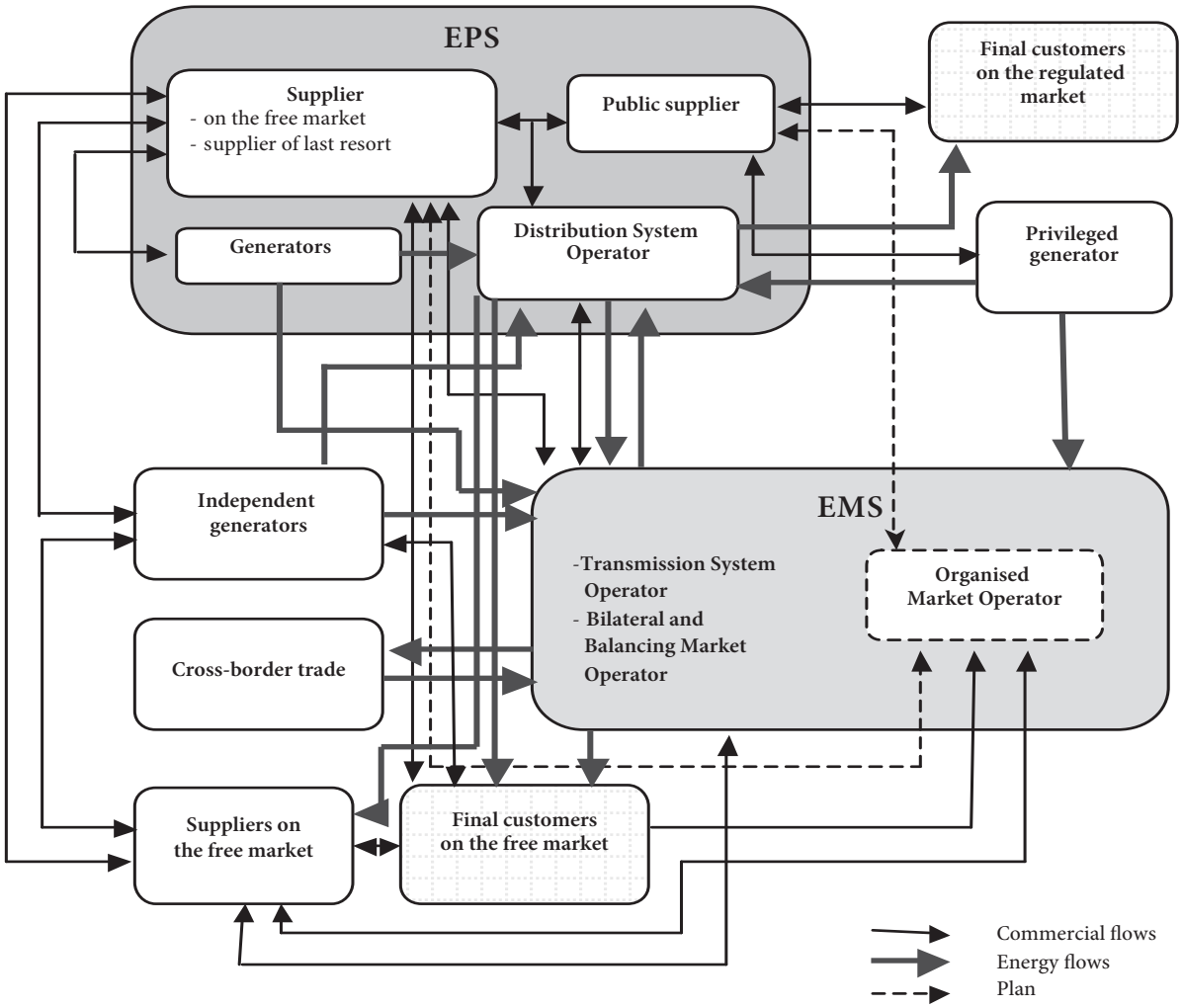
7 The market operator organizes and administers organised electricity market and its liaisons with organized electricity markets of other countries, in accordance with international commitments

It can comprise the following participants: the generator, the supplier, public supplier, the final customer, the transmission system operator, the distribution system operator and market operator [11]. The structure graph of the electricity market in Serbia is given in Figure 1.

Unlike the oil market which has been liberalized since 1 January 2011 [20], the electricity market in Serbia has been opened since 1 January 2013. All electricity customers who are connected to the transmission system have lost their right to public supply, or the supply at regulated prices. Final customers of electricity have the right to freely choose their supplier in the market. The exceptions are the households that will realize this right as of 1 January 2015. Customers who are not eligible for public supply of electricity purchase their electricity from the suppliers on the free market.

Progress in the liberalization of the electricity market is certainly there, but it is far smaller than expected. At the very beginning of this process, it was expected that the effects of liberalization of electricity would be similar to the effects of liberalization of telecommunications, another network-based infrastructure activity. Telecommunications have experienced expansion and competition has led to an increase in quality and a decrease in prices of services. However, the introduction of competition in the electricity market has not led to such effects. In order to achieve positive effects of the introduction of competition in the electricity sector, it is necessary to meet three conditions [18, p. 260]: 1) there must be an excess of generation capacity, i.e. the amount exceeding the level of demand that would further encourage competition and the competitive cost reductions; 2) a sufficient number of competitors that

Figure 1: Electricity market in Serbia



Source: [25]

prevents an oligopoly agreement; 3) the amount and level of generation costs should be similar, and the transmission cost should not be an obstacle to competition between geographically distant generators. It is obvious that these conditions have not been met.

Difficulties in implementing reforms in the electricity market, both in the EU and in our country, are the consequences partly due to the state's industrial policies that encourage particular, strategically important industries. It is a new concept of economic policy that is focused on strengthening the competitiveness of domestic industry through supporting its growth and development. According to the Reindustrialization Strategy of Serbia, the energy sector is at the top of the list of priority sectors with comparative advantages [6].

We must note that nowadays no one is denying that there are numerous weaknesses of regulation. However, this certainly does not mean that deregulation is always better than regulation, and the experience in the case of the electricity market is the best example for this. The issue of (de)regulation is actually an issue of its degree. Consequently, the prevailing attitude is that crisis 2008- cannot be overcome by undertaking the measures that were its direct causes (such as deregulation, deindustrialization, securitization and outsourcing) [7, p. 11].

Elements of restructuring strategies of electric power companies in the EU

Experience shows that public enterprises (as well as state-owned enterprises) that obtain a monopoly position often operate at a loss and are not focused on consumers, neither do they work to improve the quality of their products. In addition, the state often uses these companies for making populist decisions, develops non-core activities, and restricts the impact of commercial market and labour market. Also, they have easier access to financial markets (because the state is the guarantor of their repayment), and there is no big risk of bankruptcy and liquidation of those companies. For these reasons, and in order to improve the efficiency of the sector in the achievement of general interest, public enterprises go through restructuring processes.

From the perspective of our research, it is important to note that the Law on Public Enterprises of the Republic of Serbia stipulates that public enterprises are established by the state in order to perform activities of general interest which include, among other things, the production, transmission and distribution of electrical energy [23]. In this context, this paper further discusses the need and possible elements of the restructuring strategy of PE Electric Power Industry of Serbia (EPS) as the pillar of the power system of the Republic of Serbia. The experience of countries in the European Union is a solid starting point for the formulation and implementation of such a strategy.

Implementation of restructuring process includes several major activities:

- Corporatization and privatization;
- Change of top management and introducing of performance contracts;
- Unbundling of enterprises;
- Outsourcing;
- Downsizing.

Prior to the beginning of the restructuring, it is necessary that there is a willingness and vision of key stakeholders, which in this case is the state (government). The consensus on the need of restructuring more easily is achieved if the company has entered a phase of strategic, rather than operational or tactical crisis. "Hopelessness of the desperate situation" makes drastic changes in the business portfolio, marketing, organization, management, finance, or technology more obvious.

More or less organisations which are part of the electric power industry in all countries across the globe, as well as in the European Union, had the characteristic of a vertically integrated natural monopoly, which was owned by the state. A great number of electric power industries were organized within a single economic entity – a company. Solid control of the state was the main feature of managing this sector. That was until the 1980s, when the belief that the electric power industry should be viewed as a natural monopoly, became forsaken. This led to the unbundling of production and supply of electricity and their transformation into competitive businesses, while the transmission continued to remain regulated by the state [16, p. 25]. This was followed by privatization and

corporatization as the initial elements of the strategy of restructuring electric power companies.

Company Electricite de France (EdF) was founded in France in 1946 by nationalization of 1,450 companies in the field of generation, transmission, and distribution of electricity and gas [31]. Consolidation of capacity within a single state-owned enterprise enabled further large investments, especially in the field of electric power transmission. These investments were followed by the growth in demand for electricity, which almost doubled every 10 years. After the global oil crisis in 1974, France in the name of gaining energy independence started the construction of nuclear power plants which became the dominant source of energy in this country. In 1991 EdF transformed into a joint stock company, and in 2004 this company was transformed into a limited company. Today, the French government owns 84.49% of the company. Viewed by the market value, EdF is the world's largest electric utility, and it is worth over USD 75.5 billion [26]. Revenues from sales in 2013 amounted to EUR 75.6 billion, and the number of employees was over 158 thousand. The second world's largest electricity utility comes from France, too. It is GDF Suez with a market value of USD 64.6 billion and an annual turnover of over EUR 81 billion. In this company the French government holds 33.6% of ownership.

Italian ENEL, according to the market value is the third world's largest electricity utility with a value of USD 53.2 billion. Revenues of the company in 2013 amounted to over EUR 109 billion. The company was created by nationalization and unification of more than 1,270 companies in the field of electricity. In 1992 ENEL was transformed into a joint stock company. It has been listed on the Milan Stock Exchange since 1999. After the partial privatization, the Italian government has remained the largest shareholder, but not the majority. It owns 31.2% of the company [9].

The German electricity market is dominated by the companies E.ON and RWE. E.ON was founded in June 2000 by the merger of VEBA and VIAG (founded in the 1920s). Those enterprises were privatized in the 1960s and 1980s. Nowadays they are investor-owned companies. RWE is a company that was for many years owned by the local government. It is founded in 1898, and its shares have been quoted on the Berlin Stock Exchange since 1922. In terms of revenues from the electricity sales, it is in the third place in Europe, and the first in Germany. In 1914, about half of the shares of the company were in the hands of local government, and the other half in the hands of private companies [24, p. 135]. Today, the largest number of institutional investors comes from Germany (about 32%) and the largest shareholder is RWEB GmbH, in which municipal shares are pooled together, culminating at 15%.

Great Britain also underwent a similar scenario regarding electrical power companies. They have their electric utility made up of three sectors which were found in private ownership: transmission network, regional distribution network, and production (excluding nuclear power stations) [16, p. 42].

In the Czech Republic, electric power industry was organized as a vertically integrated company until 1990, when the restructuring program was launched. First of all, they unbundled regional distribution companies, which were gradually privatized. Production and transmission were an integral part of CEZ for more than nine years before separation. Nowadays, CEZ is a company with majority state ownership (69.78%), although there were attempts to privatize it. Its development strategy significantly relies on mergers and acquisitions, and at the moment they are expressing interest in expanding into the countries of Central Europe [2]. Here, we can mention even the Spanish company Iberdrola, which is owned by several institutional investors, the largest of which is Qatar Investment Holding. Other significant shareholders are ACS, Kutxabank and Bankia [17]. Also, there is a Swedish company Vattenfall as one of the largest producers of electricity and heat. The company is 100% owned by the state [34].

Considering ownership structure of presented electric power companies, it can be seen that in one group of these companies the state is getting out of the ownership, while in other companies it retains 100% of ownership. Also, globalization and international mergers and acquisitions activities have not bypassed this sector, and we can talk about the fact that on the global electricity market there are already strong multinational companies emerging.

They base their growth not only on organic growth, but also on M&A and strategic alliances.

However, the state's concern is the protection of its citizens' interests, which relate to the quality of the delivered product, correctly formed prices, business sustainability (avoiding bankruptcy, etc.). This leads to the conclusion that citizens as owners can influence public companies only indirectly (through voting in elections and through the formation of a new government). Again, citizens lack the mechanisms of control over the ministers who are members of the government [32].

Corporatization is seen as one of the initial steps in the restructuring process. This is a translation of state-owned enterprises into the form of joint stock company or the form of a limited liability company, i.e. the formation of a separate legal entity independent of the state. Corporatization usually precedes the privatization process, but it can also be implemented independently. In any case, it facilitates the transformation of business operations on a commercial basis and reorganization processes that are common for the company as a business organization, not a social category.

Corporatization of public enterprises aims to solve several substantive issues. These include the appointment of an agent who will represent the state in consultations with the management as well as the improvement of corporate governance. State agent can come from [33, pp. 9-11]:

- the relevant sector ministries (in our case the Ministry of Energy) – decentralized or sector model,
- two ministries; one that controls all public companies (usually the Finance Ministry or the Ministry of Economy and Finance) and the sector ministries – the dual model, or
- one ministry or agency that is responsible for these companies (the Finance Ministry and the Ministry of Industry) – a centralized model.

Establishing clear ownership relations and corporate governance bodies that will enable owners to exert a strong pressure on managers to meet their goals is a prerequisite for further steps in the restructuring process.

The change of top management is considered as one of the most important steps in the process of restructuring. Such a scenario is almost inevitable in the situation where the existing management led the company to a crisis. When the crisis is caused by external reasons, it is not uncommon that the existing top management runs the recovery process [8, p. 450]. These companies should be headed by experienced and motivated managers with expertise in running similar businesses. They have to create the vision and form a team that will lead changes. The new management should have a strong support from key stakeholders. In the case of electric power companies with dominant state ownership, it means the support of the government or the ministry.

In addition to the support, the new management should receive an appropriate reward for their commitment and achievement of goals. It is common that in these situations managers sign performance contracts with the government. Under these contracts, the government sets strategic goals, without identifying the detailed plans that lead to the achievement of the goals. Operational plans remain at the discretion of the managers themselves. In this way, the state withdraws from the direct management of the company. However, the biggest benefit of these contracts is reflected in the fact that they establish a language of communication between the government and managers in terms of the goals, sales revenue, profit, international activities, investments, and quality policy. An excellent example of the introduction of performance contracts in an electric utility is French EdF in 1970. The state, in its supervision, limited the determination of energy policy and completely excluded the possibility of subsidizing. Managers with clear agreements about their performance led EdF to the position of leading electric utility not only in Europe but also in the world [25, p. 23], [25, p. 116].

The performance system included in a contract should encompass not only accounting but also economic performance measures, such as Economic Value Added (EVA), Market Value Added (MVA), Cash Flow Return on Investment (CFROI), Total Shareholder Value (TSV). All these measures are closely associated with the real value creation that belongs to the owner and at the same time take into account the risk to which the business of an electric utility is exposed.

In addition to economic performance measures, i.e. financial measures, it is necessary to define non-financial

(operating) performance measures. These measures are taken from the perspective of consumers, business processes and development of intangible assets, which today largely affect the value creation. The conclusion is that it is logical to define performance contract using the Balanced Scorecard. A prerequisite for the use of this technique is that the strategy is described by the strategy map that has been previously developed [21], [22].

The separation of new companies from an electric power company represents a kind of disintegration of vertically integrated company. The aim is to achieve that electricity producers supply the electricity transmission company; which allows the transmission company to deliver electricity to companies for its distribution; distribution companies still deliver electricity to the enterprises that have signed electricity supply contract with customers. Unbundling of utilities allows the inclusion of several companies in the electric power system, thus achieving greater competition.

The companies from the power utilities that are vertically integrated in the process of restructuring implemented various forms of separation [16, p. 109]:

- legal unbundling of the transmission system and distribution of other activities,
- functional unbundling of distribution,
- accounting unbundling in terms of separate accounts between the operators of transmission and distribution.

Unbundling of the company may precede privatization. The good side of the sequence of activities in the restructuring process is that in this way monopoly is neutralized. A successful example of such a sequence of activities is found in Bulgaria, where seven of the distribution operators (new separated companies) were privatized in a way that they sold 67% stake in the companies to CEZ, E.ON and EVN, whereby the country achieved total revenue of EUR 693 million. Otherwise, the privatization would lead to the transmission of monopoly from the hands of the state to the hands of investors.

Restructuring, among other things, includes downsizing. Downsizing refers to the reduction in the number of employees in accordance with the new technological needs. In terms of job losses, the EU-15 cut 246,000 jobs in the period 1995-2000. New Member States experienced a loss of 44,000 jobs in the period 2000-2004. There have been reductions in jobs with lower qualifications, then middle-level managers, while at the same time a growth in the number of higher-level managers, professionals, lawyers and technical experts has been recorded [30, p. 5].

However, restructuring (including downsizing) should not be inhumane, but socially responsible (SRR). Numerous examples of SRR best practice can be observed in the cases of the above-mentioned energy companies from developed countries, but also of the companies originating from developing countries. SRR considers several areas: social dialogue, anticipation and transparency, training, retraining and redeployment, health and psychological issues, the role of public authorities and cross border learning [30, p. 8].

Social dialogue implies an active partnership between management and employees. Employees certainly want to express their opinion on issues that affect them. An effective social dialogue is one that is timely, active, and achieved through trade unions. In addition, communication is vital to the efficient SRR. In the case of EdF, the restructuring strategy was first presented to trade unions, and then to all employees. Also, comprehensive communication means sharing information about required skills in the new company, as well as the assistance in finding new employment for the employee or his/her spouse. In Poland, Electrownia Łaziska formed Restructuring Unit which dealt with the process. The representatives of the government, primarily from the Ministry of Economy, were involved in this process. They presented predictions about the possible changes important for the company over the next 5-15 years. In CEZ, social dialogue with trade unions takes place on a monthly basis. For instance, in the case of Ireland's company Electricity Supply Board (ESB) ten years prior to market opening, i.e. in 1994, the representatives from the Department of Transport, Energy and Communications and the relevant trade unions negotiated a tripartite agreement to manage job losses and cost reductions. As for RWE, a minimum set of standards for dialogue over restructuring was defined in the Restructuring Agreement. In the early 1990s, after the transition to commercial operations, Vattenfall made a projection that about 1,200 jobs would be terminated.

Because there had not been any experience of dealing with the reduction in the number of employees, the company created the so-called "expert group" that developed a strategy for cooperation with trade unions regarding the issues of reducing the workforce and diminishing resistance to change [30, pp. 24-29].

Redeployment and relocation of employees have a special place in the SRR. It is a way of moving them to the areas of the organization that are stable or growing. It implies re-skilling and retraining employees. It would be interesting to mention the case of the retention of older employees in Vattenfall AB in Sweden. In that company, for example, the employees aged over 58 years have the opportunity of working 80% of working time for 90% of their personal earnings. Moreover, their experience is used as a basis for the mentoring program for younger workers [30, p. 36]. On the other hand, ENEL established its own training company Sfera, which organizes the learning of foreign languages, IT, management and soft skills, as well as technical and professional training.

SRR can also imply the involvement of public authorities. Every restructuring has its implications for the local economy. Local municipality can take important role in solving problems caused by restructuring. For example, Electrable Polaniec in Poland got support from local municipality in identifying training and employment opportunities, information about tax, supplying staff to provide advice to affected employees, etc. Finally, SRR provides a possible insight into other people's experiences in restructuring. For example, Eesti Energia in Estonia organised for their representatives (management and unions) the visits to ESB and CEZ that had undergone restructuring, thus providing them with the opportunity to learn from the experience of others.

Downsizing is often a consequence of outsourcing. Outsourcing means that certain activities are moving outside the company, so they are now performed by suppliers. Ideally these activities are now executed not only in cheaper way, but also in a more efficient way. Outsourcing was initially applied to the services such as cleaning, catering, and security, and later to network maintenance, meter reading, information technology, call centres, billing, accounting, and transport.

Restructuring process of the PE Electric Power Industry of Serbia

The restructuring of a domestic electric power entity should follow the logic of the restructuring of public enterprises (state-owned enterprises) as well as the specifics of the electric power sector. In our conditions, the rationale for the restructuring lies on two grounds: the current untenable situation in these companies and the need for the adoption of standards and adjustment of regulations governing this area in the EU accession process. The implementation of institutional and structural changes that are based on the directives of the European Union began in July 2006, when the Republic of Serbia ratified the Treaty on establishing the Energy Community of South East Europe.

Electric Power Industry of Serbia was established as a public enterprise in 1991. It was created as a vertically integrated company, which included three electro-economic activities: generation, transmission, and distribution of electricity. Electric Power Industry of Serbia has founder's rights in 13 subsidiaries and three public enterprises in Kosovo and Metohija. As of June 1999, EPS has not been managing its capacities in Kosovo and Metohija.

The process of restructuring of the electric power system started in 2003 with the separation of non-core activities from EPS. They first separated underground coal mines and established a separate public company, the Underground Coal Mining Company (PE PEU), while other non-core companies were established later. Following the adoption of the new Energy Law, in accordance with the EU directives, the government of the Republic of Serbia adopted a decision on the formation of two independent companies: Electric Power Industry of Serbia (EPS – Elektroprivreda Srbije) for the generation, distribution and trade in electricity and Serbian Transmission System Operator (EMS – Elektromreza Srbije)[8] for the purposes of transmission and managing of the transmission system. Since mid-2005, these two companies have operated

8 PE EMS is engaged in the transmission and managing the transmission system, including the activities of the operator and organiser of the electricity market. Furthermore, it is responsible for the allocation of rights to use the available cross-border transmission capacities on interconnection lines of the electric power system of Serbia

independently. The process of restructuring led to a decrease in the total number of employees from 60,000 in 2001 to about 35,000 at the end of 2009 [1, p. 173]. In 2013, the number of employees was 36,038 (including Kosovo and Metohija).

In 2012 the Government of the Republic of Serbia adopted the Framework for the Reorganization of PE EPS, while the Energy Law formed the basis for its reorganization. It provided the appropriate conditions for further liberalization of the electricity market. In accordance with this plan in 2013 the company EPS Snabdevanje was founded. It is a public supplier of electricity customers at regulated prices. The establishment of EPS Snabdevanje split the business of supply and distribution of electricity. The unbundling was necessary for enabling the second phase of the market opening and the entry of other suppliers that can, as of 1 January 2014, supply all customers except households and small customers (available since 1 January 2015). All suppliers use the service of distribution operators. There are five companies for electricity distribution: Elektrovojvodina, EDB, Elektrosrbija, Centar, and Jugoistok.

For EPS a real battle on the market starts as of 1 January 2015. In fact, that date marks the beginning of the third phase of liberalization of the market, where small customers (households) can choose their electricity supplier (after two waves of market liberalization that allowed all companies in the high and medium voltage segments to enter into a contract with any supplier of electricity, EPS has retained 97% of the market share). Market liberalization in other countries has led to lower prices for households. However, in Serbia the current electricity price is below the market price and represents a kind of instrument of social policy that leads to irrational consumption of electricity. Existing electricity price ensures only the coverage of current expenditures and minimum investment in maintenance. For this reason, we can anticipate the growth of electricity prices, which will have positive consequences for the further implementation of the restructuring strategy, particularly in terms of growth and investments. Growth and investments can be implemented independently or with the support of a strategic (or financial) partner. However, it is impossible to attract any partner if real prices do not allow for the generation of profits.

On the other hand, it is not impossible that the opening of the market will attract competitors who will be ready (thanks to their financial strength) to enter into a price war (as it happens in the liberalized electricity market in Croatia). Such a scenario would probably lead to the disposal of investments. Attracting a strong strategic partner – large multinational corporations, could strengthen EPS and increase its chances to defend its leading position. However, this issue will remain open, and the decision on attracting strategic partners and recapitalization with total (or partial) privatization will be made by the Government of the Republic of Serbia. This issue will be considered after corporatization. Corporatization is a prelude to privatization, even though privatization is not required.

When it comes to corporate governance, bodies of the company are: Supervisory Board, Executive Board and Director. Executive management has already been for two years at the helm of EPS, and new Supervisory Board was appointed in November 2014. All of them will be faced with some very important decisions in the process of restructuring. The most important one is definitely corporatization. It is a form of translation of a company from a public company into a joint stock company. Transformation from PE to the joint stock company will imply the establishment of the Shareholders Assembly. Essentially corporatization will lead to a kind of consolidation and an establishment of logical relationships between the parent company (EPS) and its subsidiaries. Today one of the least logical relationships is that EPS has no authority to manage operations within their subsidiaries. It is expected that the optimization of the management process, reduction in the number of sectors and managers, as well as procurement centralizing, will enable savings in the amount of 100,000 EUR per day, which would accumulate to about 36 million EUR annually [12].

The final result of the restructuring of EPS is the fulfilment of his mission, and that is: to "*secure electricity supply to all customers, under the most favourable market conditions, with continuous upgrading of the services, improvement of environmental protection and welfare of the community*" [13]. The mission is realized through

strategy, and a strategy is being implemented through concrete investments.

It is expected that EPS will be ready after corporatization to enter into a new investment cycle independently, with a strategic partner at the level of corporation, or with strategic partners for specific projects. It is about the investment in building new capacities [14]:

- Completion of the construction of TPP Kolubara B;
- Construction of new unit at TPP Nikola Tesla B3 and TPP Kostolac B3;
- Reconstruction of the existing CHP using natural gas with implementation of gas turbines i.e. reconstruction of CHP Novi Sad;
- Developing project of opening OCM Radljevo;
- Construction of minimum 5 HPP on Velika Morava, 10 cascade HPP on the river Ibar, 4 HPP on the upper Drina, 3 HPP on the middle Drina, PS HPP Djerdap 3 and PS HPP Bistrica;
- Construction of small hydro power plants and generation of electricity from other renewable energy sources.

In accordance with the strategic documents on the energy sector development of the Republic of Serbia, as well as with their development interests, EPS aims to increase the share of renewable energy in the production of electricity. EPS is ready for the application of the latest technologies in the field of renewable energy, increasing energy efficiency, cost-efficiency as well as sustainable energy development, primarily on the basis of water resources. In this sense, the priorities for EPS are the revitalization and modernization of existing large and small hydropower plants, construction of new small hydropower plants, but also the development of wind farms and solar power plants, and combustion of municipal waste and the use of biomass.

Conclusion

The electricity sector is perhaps the most complex and the most dynamic segment of the energy sector today. Tightly regulated for decades, this sector has become the hallmark of a strong state intervention in the economic flows. However, in order to improve its efficiency, the energy development strategy creators have initiated its restructuring. The most prominent issues are those related to: the unbundling of enterprises, corporatization, management restructuring, outsourcing, downsizing, and others. The choice of solutions is quite varied; nevertheless, our research may lead to several conclusions:

- the key player in the restructuring of the electric power companies is the state, i.e. the government (energy is too serious a matter to be left to the market),
- the vast majority of these enterprises have been established as a joint stock companies, some of them have also been established as limited liability companies,
- unbundling of the companies follows a technological process pattern, thus, vertically integrated monopolies are being broken into generators, transmitters, distributors, and suppliers to end-users,
- the transmission grid, as a form of natural monopoly, have remained in the hands of the state, while other energy entities may be subject to privatization in any form, as well as to various methods of privatization,
- in energy sectors across all countries, liberalization of the energy market has led to intensified competition usually to the benefit of the consumers (by reducing the price of electricity),
- corporate restructuring has involved the exclusion of non-core businesses from the business portfolio, and then outsourcing of many activities that do not add value,
- the restructuring process has usually been accompanied by downsizing,
- motivation for managers in enterprises where the state has a stake usually involves performance contracts which clearly outline performance indicators from the perspective of the key stakeholder,
- upon disintegration, leading European electric power companies based their growth both on organic growth and on national and international mergers and acquisitions and joint ventures.

The Republic of Serbia has also embarked upon a restructuring of its electric power sector. It is a process that has been imposed externally, i.e. it is a result of meeting the prerequisites for accession to the European Union. In

terms of its inclusion in the single energy market, Serbia has also made an interim step, i.e. it has joined the Energy Community of South Eastern Europe.

Guided by the European energy directives, Serbia has an opportunity to reduce its uncertainty regarding the outcome of the restructuring of its electric power sector. The process of unbundling of the company is completed. EPS and EMS are separate entities. EMS as a natural monopoly will remain in the hands of the state, but it is surely competing in the open market. The generators, distributors and supplier have been and will be getting their own competitors.

EPS with its 13 subsidiaries has initiated the process of corporatization. A joint stock company will be formed (with the Shareholders Assembly, which is currently lacking among governance bodies), and logical relationships will be finally established between the parent company and its subsidiaries with a clear and unambiguous authority of the parent company.

And what about privatization? Yes or no? And privatization of which enterprises: the generators or the distributors, or both of them? For now, the directors of EPS and the leading people from the key stakeholder – the government, have stated that EPS will not be sold, that there is a possibility of recapitalization, a possibility of cooperation with strategic partners in individual projects and the like. It is obvious that no consensus has been reached on this issue as yet. Certainly, the decision should be made with the aim of improving the overall competitiveness of the economy, because EPS is one of the drivers of the development of the national economy. However, it is obvious that energy industry is, and will increasingly be so, a global industry. It is hard to get into a competitive battle alone. It is clear that we need allies. We need to think about them in a timely manner. They are not to be sought after in times of hardship (the ever-present hard to overcome budget deficit, for example). Some kinds of loss cannot be avoided if we choose allies when troubles arise.

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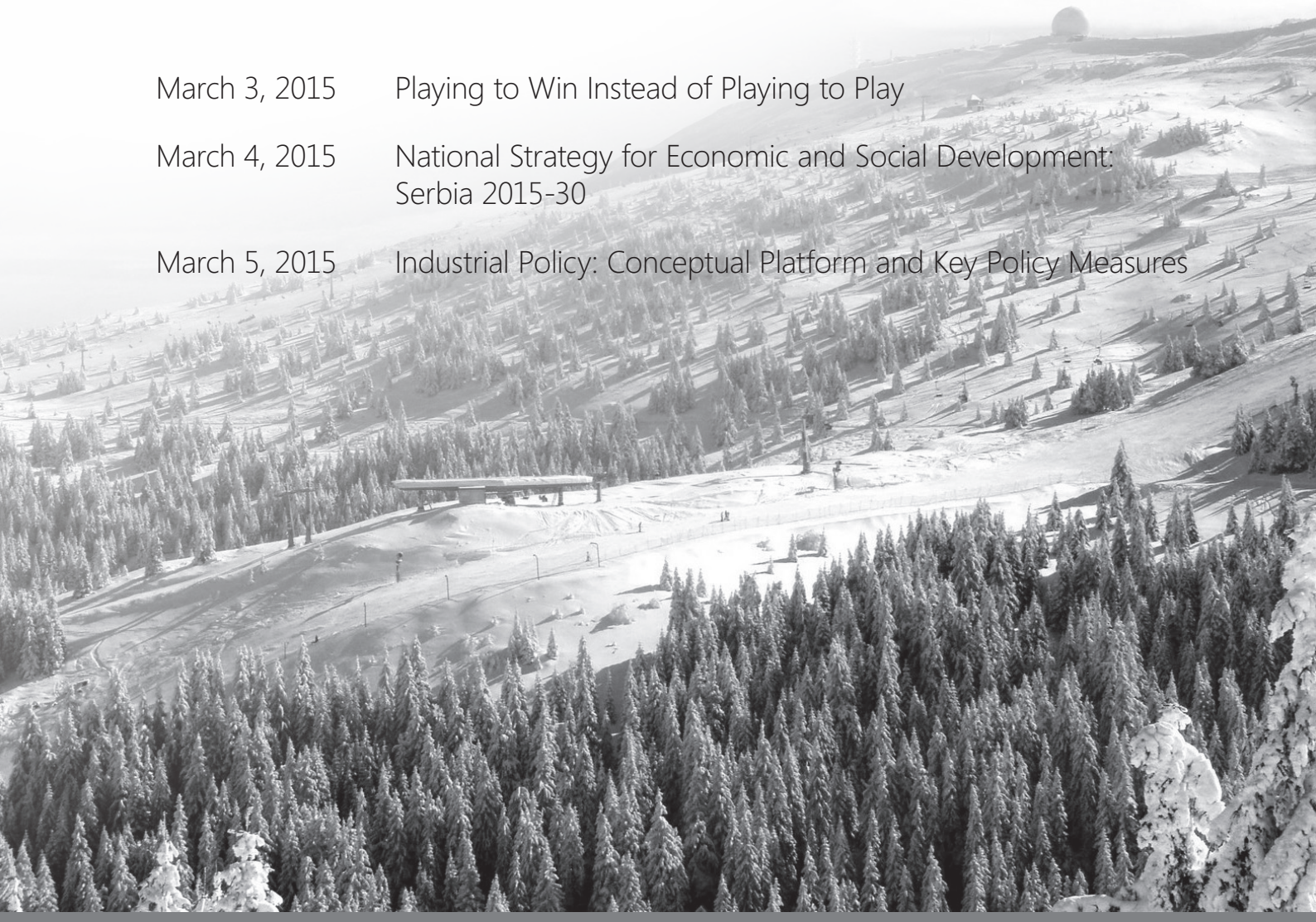

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