Determination of the Ecological-Economic Degree of Development in Countries of SE Europe – Weight Coefficients Technique

Oszacowanie ekologiczno-ekonomicznego poziomu rozwoju w krajach południowo-wschodniej Europy

Mirjana Golušin*, Olja Munitlak Ivanović**, Larisa Jovanović***, Siniša Domazet*

*Educons University, Vojvode Putnika bb, Sremska Kamenica, 21208, Serbia,
E-mail: mirjanagolusin@sbb.rs, sdomazetns@gmail.com; **Faculty of Business in Services,
Vojvode Putnika st. bb, 21000 Sremska Kamenica, 21208, Serbia,
E-mail:oljaivanovic@eunet.rs; ***Vojvode Putnika bb, Sremska Kamenica, 21208, Serbia,
E-mail: ecologica@open.telekom.rs.

Abstract

The practice has indicated that there is a particularly sensitive relationship that exists between ecological and economic subsystem of sustainable development. Therefore this research suggests to compare the states of these two subsystems as a new conceptual frame which is essential for strategic conceptualization of development of countries, by the use of weight (importance) coefficients method. The research pointed out at a rather visible gap between the achieved degree of economic and ecological development in the countries of South Eastern Europe in respect to Germany and France – which were taken into consideration as two of the most developed countries in the European Union and in the entire world. The usage of statistic method of weight (importance) coefficients requires assigning a certain degree (of individual value) to each and every indicator. In order to have a better overview and to get more precise results the weight coefficients in range from 0 to 100 were used. The results obtained by using the scale with lower values showed less qualitative final outcome. Used statistical technique for indicated research has shown excellent results and requires additional improvements.

Key words: ecological indicators, economic indicators, weight coefficients, SE Europe

Streszczenie

Praktyka wskazuje na istnienie szczególnego powiązania pomiędzy ekologicznym i ekonomicznym subsytemem rozwoju zrównoważonego. Dlatego w prezentowanych badaniach dokonaliśmy porównania stanów tych dwóch subsystemów używając metody współczynników ważności – to nowa perspektywa niezbędna dla strategicznej konceptualizacji rozwoju poszczególnych krajów. Badania wskazały na istnienie poważnych rozbieżności pomiędzy osiągniętym poziomem ekonomicznego i ekologicznego rozwoju krajów Europy Południowo-Wschodniej a najbardziej rozwiniętymi krajami, tak w Unii Europejskiej, jak i z perspektywy ogólnoświatowej, którymi są Niemcy i Francja. Użycie metod statystycznych wymaga przypisania określonego stopnia (wartości indywidualnej) dla każdego wskaźnika. Aby uzyskać bardziej trafne wyniki użyto współczynników ważności z zakresu 1 – 100.

Słowa kluczowe: wskaźniki ekologiczne, wskaźniki ekonomiczne, współczynniki ważności, Europa płd.-wsch.

1. Introduction

There are different indicators of development of a country and the measuring itself represents the aims of development and control over achievement of those aims (Paschalis-Jakubowicz, 2011). The chosen aims of economic development are set as a standard of control of success of economic

development and as a criteria of efficacy of economic policy of development (EEA, 2007). The choice of these aims depends on developmental orientation of a country, degree of economic growth (Michałowski, 2011), international position of a country and similar (Udo, Pawlowski, 2011). Without taking into consideration problems of international (non) comparability of valid indicators (Borys, 2011) many shortcomings were noted when it comes to evaluation of well-being of a certain country based only on economic indicators (UNDP, 2007; Zacher, 2011).

This research presents a short overview of existent conceptual frames for determining the degree of development of a country, by indicating their basic advantages and flaws. Given the ever growing need to preserve the quality of environment it is necessary to work on new conceptual frames (Dodić et al., 2009), which in great amount overcome the flaws of traditional indicators of development (Kronenberg, Iida, 2011).

In order to develop practical methods acceptable for a more transparent portraying of the degree of sustainable development, the authors conducted a research of a current degree of sustainable development in countries of SE Europe based on the state of indicators of sustainable development, therefore the authors suggest a new conceptual frame which would have, in its focus of observation, comparison of relationship of economic and ecological degree of development (Golušin, Munitlak-Ivanović, 2009, Golušin et al., 2010). The basic aims of the research can be seen in the following:

- defining the existent conceptual frames for determining the degree of development;
- suggesting a new conceptual frame based on comparison of economic and ecological indicators of sustainable development;
- determining the current state of ecological and economic development in countries of SE Europe and in chosen countries of the European Union;
- comparison of the determined state of sustainable development in aforementioned countries;
- final grade of mutual relationship between economic development and preservation of nature;
- pointing out the need for further monitoring and reaching the unique scientific agreement when it comes to conceptualizing the relationship between ecology and economics.

By surveying the available data sources it was determined that the similar or the same types of research have not been conducted so far.

2. Methodology of research

Monitorning of the state of sustainable development indicators covered 11 countries of former Yugoslavia and region of Southeastern Europe (Greece, Albania, Former Yugoslavian Republic of Macedonia, Montenegro, Serbia, Bosnia and Herzegovina, Croatia, Hungary, Slovenia, Bulgaria, Romania), and in order to visualize the real state there was given the review of the state of indicators in Germany, France, and Greece, as well as in the countries of the European Union that attained high standards in the given area. Up until now, around 400 sustainable development indicators have been defined. However, in accordance to the needs of the research, other sustainable development indicators were considered, and they were those taken to be the most acceptable ones. They are presented in Table 1.

Table 1. Review of the used indicators of sustainable development. Source: Authors' own work.

Indicator No. i_n	Indicator	Measure
1.	GDP/pc	$
2.	Debt	% GDP
3.	Road infrastructure	1.000 km
4.	Inflation	%
5.	Gini coeficient	Index
6.	Growth of GDP	% GDP
7.	Investments as part of GDP	% GDP
8.	Industrial growth	%
9.	External debt	Bln of $
10.	Export	Bln of $
11.	Life span	Years
12.	Poverty	% under the poverty limit
13.	Population number	1.000.000
14.	Literacy	%
15.	Urban population	%
16.	Unemployment	%
17.	Birth rate	% per 1.000
18.	Mortality rate	Number per 1.000
19.	Phone network	Users per 1.000
20.	Internet network	Users per 1.000

The research covered previously defined indicators of sustainable development, however, some attention was given to the need for a more precise definition of their relative value in comparison to the others. Namely, each of the observed indicators describes the state in that special, very narrow area of observation and therefore they are expressed in specific measures. On the other hand, sustainable development by its definition represents the unity of development of all four basic subsystems (economic, ecological, social and institutional), so that it is necessary to narrow down all the values of indicators to a simple way of expressiveness in

order to get the final picture of the state of sustainable development in the countries of South Eastern Europe.

In order to respect variances of the observed indicators and their unequal importance in the area of observance, to each of the indicators certain relative value was given in comparison to the others (Golušin et al., 2010). Relative value of the monitored indicators as well as their set values are given in the chart.

Considering the fact that the most sensible relationship was noted between indicators of ecological and economic development, the authors of this research took indicators of these two subsystems of sustainable development as the basis of their research.

Statistical method of Importance (Weight) coefficient techniques has been used.

The usage of this method requires assigning a certain degree of individual value to each and every indicator. In order to have a better overview and to get more precise results the weight coefficients in range from 0 to 100 were used. The results obtained by using the scale with lower values showed less qualitative final outcome.

By calculating the indicators of ecological subsystem it was necessary to conduct some adjustments, in order to get clear and comparable results. Namely, the units in which ecological indicators are expressed are such that even in the final outcome they have figures with very low values in comparison to results attained in other groups of indicators. So as to solve this methodological problem and to make values of ecological indicators comparable with others and as such useful for achieving the final grade of state of sustainable development, the obtained values of ecological indicators for every monitored country were augmented for 100,000.

The final values of indicators of sustainable development were obtained by using the special mathematic formulae for every separate subsystem. Because of the specifications of used indicators (some of them affect the final outcome positively and some of them negatively) it was not possible to use a unique formulae for calculating. Therefore, the part of the research which deals with the results, shows the mathematic formulae used in that case with an explanation of the symbols used:

$i_n \rightarrow$ indicator

$S_n \rightarrow$ subsystem

$\qquad S_1 \rightarrow$ economic subsystem

$\qquad S_2 \rightarrow$ ecological subsystem

$W \rightarrow$ weight coefficient (0-100)

$C \rightarrow$ overall indicator

3. Results

After having defined separate countries in the area of former Yugoslavia (Munitlak-Ivanović et al., 2009), it is possible to start with a more precise defining, monitoring and comparison of the indicators of sustainable development, as well as in the countries of former Yugoslavia, as in the countries of the South Eastern Europe. Mentioned activities can be considered particularly significant from the point of view of the need for a collective action on the improvement of the entire state in the region, given the geographical, historical and economic relations that exist among them. In accordance to the results of comparison, a suggestion of the strategy of sustainable development can be stated, as for every country separately so as for the region as a whole. The results of comparison of sustainable development indicators in the countries of South Eastern Europe, and their comparison to the results and the state of indicators in Germany and France lead to conclusions.

Based on the defined key markers of the state in all four subsystems of sustainable development in the research sample, basic conclusions can be drawn on the state of sustainable development in economic and ecological, as well as the final comparative view of the state when degree of sustainable development as a wholeness is in question.

All the mentioned indicators of economic subsystem can be shown graphically by using the following formula which takes into consideration the importance (weight) coefficient of every single indicator:

$$(C'25)-(D'5)+(E'5)-(F'10)+(G'10)+(H'5)+(I'5)+(J'5)-(K'10)+(L'20)$$

After calculating the mutual value in the previously mentioned way, it was determined the current state of economic subsystem in some countries, which is presented by the histogram 1.

Figure 1. Value of index of economic indicators of sustainable development in SE European countries. Source: Authors' own work.
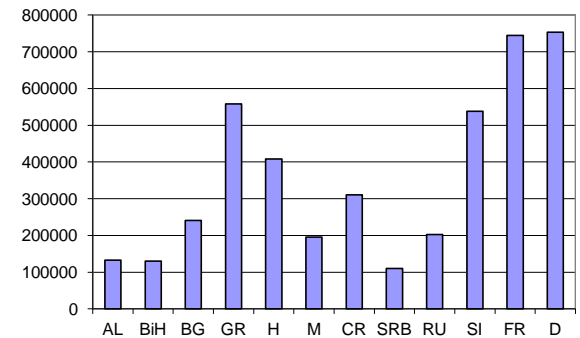
Economic indicators of sustainable development in the countries that made research sample, above all show a clear unevenness in all observed countries. Generally speaking, the highest values of indicators in a monitored subsystem were recorded in France and Germany, as it was expected. Quite positive results were achieved in Greece and Slovenia when it comes to economic markers.

The other group consists of the countries at a medium level of economic development, Hungary and Croatia, followed by the new EU members, Bul-

Table 2. Economic indicators of sustainable development in countries of South Eastern Europe. Source: Authors' own work.

Indicator	Sign	GDP	Debt	Road infrast.	Inf-la-tion	Gini coef.	Growth of GDP	Invest. in GDP	Indu-strial growth	External debt	Export
Measure		$/pc	% GDP	1000 km	%	in-dex	% GDP	% GDP	%	bln $	bln $
Coeff. (W)		25	5	5	10,0	10	5	5	5	10	20
Albania	AL	5300	66,2	18,00	2,4	28,2	5,5	22,4	3,1	1,55	0,65
Bosnia and Herzegovina	BiH	5200	29	21,85	4,4	26,2	5,0	22,4	5,5	3,12	2,70
Bulgaria	BG	9600	31,9	102,00	5,0	31,9	5,5	23,8	7,3	15,32	11,67
Greece	GR	22300	106,8	116,47	3,5	35,1	3,7	24,6	-0,3	75,18	18,54
Hungary	H	16300	58,9	159,57	3,6	24,4	4,1	23,1	7,3	66,22	61,75
Macedonia	M	7800	33,7	8,68	0,0	28,2	4,0	18,3	6,8	2,19	2,05
Croatia	CR	12400	49,7	28,34	3,3	29,0	4,3	28,6	5,1	30,62	10,30
Serbia	SRB	4400	53,1	37,89	15,5	35,0	5,9	14,2	1,4	15,43	1,55
Romania	RU	8100	20,3	11,38	9,0	28,8	4,1	24,3	1,9	35,68	27,72
Slovenia	SI	21500	28,5	38,40	3,4	28,4	4,0	24,8	3,2	19,87	18,53
France	FR	29600	66,2	891,29	1,7	32,7	1,2	19,6	0,2	2826	443,40
Germany	D	30100	67,3	231,581	2,0	28,3	0,9	17,1	2,9	3626	1016,00

Table 3. State of environmental indicators of sustainable development. Source: Authors' own work.

Indicator	Sign	Fertile-ground	Plough ground	Irriga-tion	Usage of fertilizers	Org. agric.	Usa-ge of pesti-cides	Emission of CH$_4$	Emission of CO$_2$	Fore-statio	Usage of ene-rgy
Measure		%	%	km^2	kg/ha	%	kg/ha	1000 met.t.	metric tonnes	km^2	eq. tonnes
Coeff. W		5	10	5	5	5	5	20	25	10	10
Albania	AL	20,1	4,21	0,12	0,4	0,07	61	0,018	0,00011	0,028	595
B i H	BiH	19,61	1,89	0,59	0,5	0,01	33	0,022	0,00027	0,1	988
Bulgaria	BG	29,94	1,9	0,005	0,9	0,23	49	0,009	0,00041	0,028	2696
Greece	GR	20,45	8,59	0,11	2,8	2,72	149	0,12	0,00066	0,086	2793
Hungary	H	49,58	2,06	0,025	2,4	2,19	109	0,12	0,0006	0,018	2639
Macedonia	M	20,01	1,79	0,022	0,8	0,02	39	0,05	0,00034	0,014	132
Croatia	CR	25,82	2,19	0,19	2,2	0,23	118	0,067	0,00033	0,024	1950
Serbia	SRB	22,1	60	0,12	0,8	0,37	91	0,1	0,00053	0,013	1723
Romania	RU	39,49	1,92	0,13	2,1	0,51	35	0,055	0,00039	0,059	1749
Slovenia	SI	8,53	1,43	1,48	6,8	4,55	416	0,12	0,00075	0,041	3487
France	FR	33,45	2,03	4,75	4,5	1,8	215	0,11	0,00068	0,063	4453
Germany	D	33,11	0,6	13,58	2,3	4,52	220	0,18	0,0024	0,07	4211

garia and Romania (EEA, 2007). The last group includes countries that face serious economic problems, which can mostly be seen in the high rate of unemployment which is a logical consequence of a long term unstable political state and wars. It is quite unrealistic to expect a quick and simple recovery of this group of countries.

Ecological indicators of sustainable development in countries of South-Eastern Europe

When talking about the ecological indicators in the most developed countries a higher degree of evenness and a completely reversed picture are noticed. That is to say, the lowest values of ecological indicators of sustainable development have been recorded in France and Germany, which, of course, can be explained by an extremely high degree of

economic development which was recorded in the previously observed indicators. With respect to the high level of economic development (two or three times bigger in comparison to other studied countries) it was possible to suppose that values of ecological indicators were going to be two or three times lower.

Nonetheless, the research also shows the fact that Germany and France do not have such a bad situation in ecological subsystem after all (Dodić et al., (2010). This could be explained by the efforts of the aforementioned countries to follow their economic development with adequate measures in the field of planned management of natural resources and with implementation of all-embracing measures when it comes to control of pollution.

All the mentioned indicators of environmental subsystem can be shown graphically by using the following formula which takes into consideration the importance (weight) coefficient of every single indicator:

$$(C\cdot 5)-(D\cdot 10)+(E\cdot 5)-(F\cdot 5)+(G\cdot 5)+(H\cdot 5)+(I\cdot 20)+(J\cdot 25)-(K\cdot 10)+(L\cdot 10)$$

After calculating the mutual value in the previously mentioned way, it was determined the current state of environmental subsystem in some countries which can be presented by the Figure 2.

Figure 2. Value of index of ecological indicators of sustainable development in SE European countries. Source: Authors' own work.
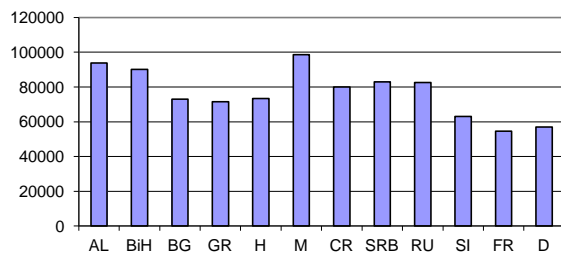
Relatively positive situation is recorded in the remaining watched countries, which can be interpreted by the lower degree of economic development, thanks to which the further exhaustion of natural resources did not happen (Ranković et al., 2009). With a more careful inspection it can be noticed that the biggest ecological problem in studied countries refers to an irrationally high usage of energy, which also means high emission of gases that leads to the global warming (Munitlak-Ivanović, Golušin, 2011).

4. Discussion

Authors considered that the comparison of indicators of sustainable development which concern ecological and economic subsystem are of primary importance. The choice of subsystem and type of indicator does not have as its goal minimization of values of other indicators (like indicators of social

and institutional subsystem of sustainable development, but countries of SE Europe have reached the degree of development that imposes the need for a higher valuation of indicators of the two previously mentioned subsystems). Based on previously determined exact values of indicators of economic and ecological subsystem and using the statistic comparison together with methods of importance (weight) coefficients, the following cross-section of the state and the inferred value of the degree of achieved sustainable development in the field of economic and ecological development have been determined. It can be shown in the following way:

$$C = S_1 + S_2$$

Table 4. Overall economic and ecological indicators of sustainable development. Source: Authors' own work.

|	Economic	Ecological	Overall
Coeff. (W)	50	50	100
AL	132671.3	93882.17	226553.5
BiH	130351.8	90070.8	220422.6
BG	240813.5	72956.06	313769.6
GR	557968.7	71509.94	629478.7
H	408441.2	73326.54	481767.8
M	195311.8	98590.59	293902.4
CR	310317.9	80042.09	390360
SRB	110213.3	83017.77	193231.1
RU	202813.8	82541.03	285354.8
SI	538045	63100.49	601145.5
FR	744221.9	54584.41	798806.3
D	753495.5	57033.19	810528.7

In the chart the total of results can be seen in two observed subsystems of sustainable development, together with their final value for every country which was covered by this research. Given that this position was accepted, i.e. that all four subsystems of sustainable development have an equal influence on all-inclusive state of sustainable development the authors used uniform weight (importance) coefficients for every subsystem itself. The obtained results are shown graphically on Figure 3.

After a careful observation of the results it can be noted, first of all, a relatively unified degree of achieved sustainable development in countries that made part of ex-Yugoslavia, which can be interpreted by a similar historic and macroeconomic conditions that are characteristic for these areas. On the other hand, in all the mentioned countries a lower degree of economic development with high degree of preservation of natural resources was noticed. The only exception when it comes to countries of ex Yugoslavia is Slovenia which is the only country of all the aforementioned ones that became a European Union member (Maruotti, Martino-Yauryoso, 2010).

A group of countries that have been EU members for a longer period of time shows also a mutual degree of unified values of observed indicators. By comparison of these two groups of countries some certain regularities can be noticed and some

conclusions can be drawn. For instance, Hungary and Former Yugoslavian Republic of Macedonia (FYROM) can serve as examples where the most important indicators of observed problems were noted. FYROM shows a twice lower degree of economic development in respect to Hungary, but at the same time it has around 30% higher value of indicators of ecological development that clearly points at preservation of natural resources in FYROM. A similar relationship of economic development and preservation of environment can be seen in all cases of comparison among countries outside of the EU and those which are the EU members.

Figure 3. Overall economic and ecological indicators of sustainable development. Source: Authors' own work.
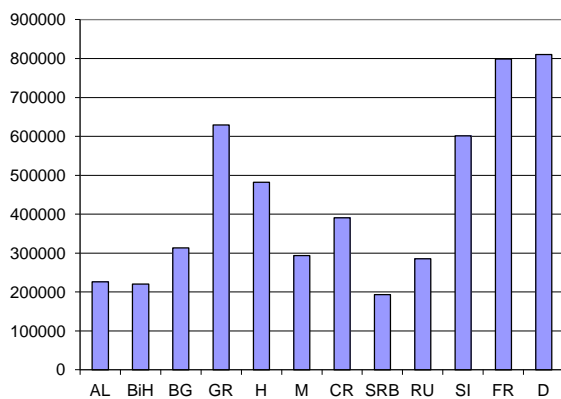
The biggest irregularity, as expected, was recorded while observing the degree of development in Germany and France, which belong to the group of most developed countries in the world. The two countries compared, all the indicators of values of chosen indicators are almost identical, which points to efficacy of policy of sustainable development which is essential for all EU member countries. The degree of economic development in these countries is three or four times higher in comparison with countries outside of the EU, and it could have as a consequence three or four times lower degree of development of ecological subsystem, in case of unsustainable exploitation of natural resources (Maler et al., 2011). Thanks to efficient ecological policy, in all these mentioned countries the degree of ecological development is just for one third lower in comparison to countries outside of the EU.

These results undoubtedly point out the most important conclusion of the research of mutual relationship of development of ecological and economic subsystem. Namely, the traditional understanding of economic development of a country implies the need for as high degree of exploitation of natural resources and higher pollution of the environment (Kristindottir, 2011). The new concept of development that accepts the introduction of adequate policy of sustainable development also underlines the fact that a certain

degree of economic development can be achieved by a much lower degree of exploitation of resources and by less pollution of nature than expected (Speth, 2011). The given results should serve, above all, as a guideline for planning the strategy for development of countries that are not members of the EU and which are at the moment at a low degree of sustainable development but they have at their disposition quite precious and preserved natural resources.

5. Conclusion

The results of the research point at several basic indicators of the current state, as well as to the directions of further observation. The principal result of the research can be seen in that the indicators of economic and ecological subsystem are theoretically the most important ones when talking about the entire sustainable development of countries. Alternatively, economics and ecology are two mutually directly opposite systems. The research clearly shows the direct connection between the level of economic development and ecological endangering of the environment. This research also points at the necessity of recognition of degree of importance of some indicators of sustainable development, especially in the countries that are at the very beginning of the planning of strategy of development, which is based on the principle of sustainability.

High positive values of indicators of ecological subsystem point at potentially economically weakly developed countries of South Eastern Europe. The mentioned countries should certainly take great and extensive efforts, when it comes to economic development, but without endangering their own ecological potentials, which now and in the future definitely represent their biggest value.

The region of South Eastern Europe represents a geographical and historic wholeness, with the trend of gradual acceptance of certain countries to the European Union. In that respect, it is necessary to define and observe the state of sustainable development in all four subsystems in all studied countries. Based on the results of this and similar research it will be possible to visualize the current state, to define quality and quantity of connections that exist between certain indicators, to stimulate all the positive directions of development, that is, to take up all the activities which are necessary in order to aim the efforts to the direction that indicates the biggest current and potential weaknesses. Because of this, all of these countries will be challenged with the strategic planning and conceptualizing the relationship between economics and ecology which is a necessary precondition for sustainable development.

Acknowledgments

References

1. BORYS T., 2011,Sustainable Development – How to Recognize Integrated Order, in: *Problemy Ekorozwoju/Problems of Sustainable Development,* vol. 6, no 2, p. 75-81.
2. European Environment Agency, *The European Environment, State and Outlook 2005,* Prepared for 'Environment for Europe' Conference, Belgrade 2007.
3. UNDP, *Evnironmental Policy in South-Eastern Europe,* Prepared for 'Environment for Europe' Conference, Belgrade 2007.
4. DODIĆ S., POPOV, S., DODIC J., RANKOVIC J., ZAVARGO Z., GOLUSIN M., 2010, An overview of biomass energy utilization in Vojvodina, in: *Renewable and Sustainable Energy Review*, vol. 14, issue 1, p. 550-553.
5. Dodić S, Popov S, Dodić J, Ranković J, Zavargo Z., 2009, Potential Contribution of Bioethanol Fuel to the Transport Sector of Vojvodina, in: *Renewable and Sustainable Energy Reviews*, doi: 10.1016/j.rser.2009.01.005.
6. GOLUSIN M., MUNITLAK-IVANOVIC O., 2009, Definition, characteristics and state of indicators of sustainable development in countries of SE Europe, in: *Agriculture, Ecosystems and Environment*, vol. 130, issue 1-2, p. 67-74.
7. GOLUSIN M., MUNITLAK-IVANOVIC O., BAGARIC I., VRANJES S., 2010, Exploitation of geothermal energy as a priority of sustainable energetic development in Serbia, in: *Renewable and Sustainable Energy Review*, vol. 14, issue 2, p. 868-871.
8. GOLUSIN M., TESIC Z., OSTOJIC A., 2010, The Analysis of the Renewable Energy Production Sector in Serbia, in: *Renewable and Sustainable Energy Review*, vol. 14, issue 5, p. 1477-1483.
9. GOLUSIN M., MUNITLAK-IVANOVIC O., TEODOROVIC N., 2010, The review of achieved degree of sustainable development in South Eastern Europe – The use of linear regression method, in: *Renewable and Sustainable Energy Review*, vol. 15, issue 1, p. 776-772.
10. GOLUSIN M., MIHIC S., MIHIC M., 2010, Policy and Promotion of Sustainable Inland Waterway Transport in Europe – Danube River, in: *Renewable and Sustainable Energy Review*, vol. 15, issue 4, p. 1801-1809.
11. KRISTINDOTTIR M. S., The Issis agreement – How sustainability can improve organizational performance and transform the world, in: *Ecological Economics*, in printing.
12. KRONENBERG J., IIDA N., 2011, Simple Living and Sustainable Consumption, in: Problemy Ekorozwoju/Problems of Sustainable Development, vol. 6, no 2, p. 67-74.
13. MALER K., NORBRERG J., CREPIN A., *Coupled economic-ecological systems with slow and fast dynamics – modelling analysis method, Ecological Economics*, in printing.
14. MARUOTTI A., MARTINEZ-ZARZOSO I., 2010, The impact of urbanization on CO_2 emissions, in: *Ecological Economics*, vol. 70, issue 7, p. 1344-1353.
15. MICHAŁOWSKI A., 2011, Spatial Environmental Services in the Approach of the Assumptions of Economics for SD, in: *Problemy Ekorozwoju/ Problems of Sustainable Development*, vol. 6, no 2, p. 117-126.
16. MUNITLAK-IVANOVIĆ O., GOLUSIN M., DODIĆ S., DODIĆ J., 2009, *Perspectives of sustainable development in countries of Southeastern Europe*, in: *Renewable and sustainable energy review*, vol. 13, issue 8, p. 2179-2200.
17. MUNITLAK-IVANOVIĆ O., GOLUSIN, M., Kyoto protocol implementation in Serbia as precognition of sustainable energetic and economic development, in: *Energy Policy*, in printing.
18. PASCHALIS-JAKUBOWICZ P., 2011, Theoretical Basis and Implementation of the Idea of Sustainable Development in Forestry, in: *Problemy Ekorozwoju/Problems of Sustainable Development*, vol. 6, no 2, p. 101-106.
19. RANKOVIĆ J., DODIĆ J., DODIĆ S,, POPOV S., 2009, Bioethanol production from intermediate products of sugar beet processing with different types of *Saccharomyces cerevisiae,* in: *Chemical Industry & Chemical Engineering Quarterly*, 15:1, p. 13-16.
20. SPETH J. G., American passage: Towards a new economy and new politics, in printing.
21. UDO V., PAWŁOWSKI A., 2011, Human Progress Towards Equitable Sustainable Development – part II: Empirical Exploration, in: *Problemy Ekorozwoju/Problems of Sustainable Development,* vol. 6, no 2, p. 33-62.
22. ZACHER L.W., 2011, Dimensions of Ecological Discourse, in: *Problemy Ekorozwoju/ Problems of Sustainable Development,* vol. 6, no 2, p. 83-92.