



Faculty of Economics, University of Niš, 18 October 2013

**International Scientific Conference
THE GLOBAL ECONOMIC CRISIS AND
THE FUTURE OF EUROPEAN INTEGRATION**

**EXPLORATION OF RELATIONSHIP BETWEEN
COMPONENTS OF SUSTAINABLE DEVELOPMENT
IN SOUTH-EASTERN EUROPE COUNTRIES**

Vera Đorđević*

Snežana Đekić*

Vesna Janković Milić*

Sonja Jovanović*

***Abstract:** Achieving sustainable development is a challenge for each country in the contemporary circumstances of development. The object of this research is the issue of sustainable development indicators and their correlation and dependency in South-eastern Europe countries. The aim of the study is to determine the direction and level of agreement between the indicators of sustainable development concept in the sample of South-eastern Europe countries. In this context, the focus is on the economic, environmental and social components of sustainable development, so this paper analyses indicators that reflect each dimension of sustainable development. Thus, for the purposes of research, in this paper will be used following indicators: GDP (Gross Domestic Product – indicator which reflects economic dimension of sustainability), EPI (Environmental Performance Indicator – indicator which reflect conditions in ecological field), and SSI (Sustainable Society Index – indicator which shows the achieved level in social sustainability). Based on selected indicators of sustainable development, the paper performs interdependence analysis of sustainable development components for the South-eastern Europe countries in the period of 2006-2012, using the methods of statistical inference and correlation analysis.*

***Keywords:** sustainable development, correlation analysis, South-eastern Europe countries.*

* University of Niš, Faculty of Economics, vera.djordjevic@eknfak.ni.ac.rs,
snezana.djekic@eknfak.ni.ac.rs, vesna.jankovic@eknfak.ni.ac.rs,
sonja.jovanovic@eknfak.ni.ac.rs

This paper is realized within projects No. 179066 and 031020 financed by Ministry of Education and Science, Republic of Serbia.

1. Introduction

Achieving sustainable development is a challenge for each country in the contemporary circumstances of development. *The object of this research* is the issue of sustainable development indicators and their correlation and dependency in South-eastern Europe countries.

Management of the concept of sustainable development means, in addition to establishing the institutional framework, the development of indicators for monitoring progress towards sustainable development. Bearing in mind that the management of economic development implies the necessity of direction the environmental and social policies, based on sustainability concept, three dimensions of sustainable development (economic, environmental and social) are clarified in the modern theory and practice.

To monitor the achieved level of sustainable development, and to facilitate creation of development policy and strategy, it is necessary to define a set of indicators of sustainable development. This goal is more prominent in the Rio Conference on sustainable development in 1992. Some of the most important indicators for monitoring the achieved level of sustainable development are: the growth rate of GDP per capita, employment rate, the expected life of the people, the emission of harmful gases, etc. In addition to these indicators, there are composite indices that include several indicators of economic, environmental and social dimensions of sustainability. Some of these indices are: the Environmental Performance Index - EPI, Sustainable Society Index – SSI, Index of Sustainable Economic Welfare, European Benchmark Indicators and others.

The aim of the study is to implement the correlation analysis in order to determine the direction and level of agreement between the indicators that reflect economic, environmental and social components of sustainable development concept in the sample of South-eastern Europe countries.

2. Research Context

The first important analyses of issues related to degradation of environmental resources have emerged in the early 1970's. The results of these analyses (Meadows et al. 1972) pointed to the limited capacity of natural resources to support the growing number of population and economic activity on a global level. This raised the challenge of dealing with the limited capacity of the environment and the growing needs of the population. In response to this challenge, the concept of sustainable development is appeared, offering a solution through balancing economic growth with environmental protection facilities. The concept of sustainable development was defined firstly in the Report of the World Commission on Environment and Development in 1987, entitled *Our Common Future* (Our Common Future, 1987). "Sustainable development offers a new theoretical paradigm that differs from the standard economic approach. Review of the new paradigm is justified because the global reality changed radically over the past years when the economic policy could be formulated without regard for the impact on the environment" (Harris 2009, 32).

The classical concept of sustainable development defined its three main dimensions - economic, environmental, and social. Nowadays, the concept of sustainable development is embedded in all contemporary development models and strategies. This

Exploration of Relationship Between Components of Sustainable Development in South-Eastern Europe Countries

concept has been recognized as an important element of macroeconomic policy in a growing number of countries.

The concept of sustainable development occupies the attention worldwide, and to the large and important conferences on development. One of the most important conference on the global level was the United Nations Conference on Sustainable Development “Rio +20” held in June 2012 in Rio de Janeiro. Some of the recommendations in the documents from this conference are: a) all countries should adjust their own policies, strategies and programs in accordance with the “green economy”, b) the creation of an institutional framework for the implementation of the concept of sustainable development should establish better coordination and cooperation of all available resources (Objective and Themes of the United Nations Conference on Sustainable Development 2012). In order to improve the capacity to manage environmental or ecological performance, it is certainly important measure and analyze a large number of elements of dimensions of sustainable development. In addition, it is important to analyze the indicators or indices that reflect the social and economic component of this concept. However, the institutional component of sustainable development, as an important condition for the realization of this concept, is becoming more prominent (Spangenberg 2002).

Creation of indicators that show the status and trends in the field of environmental protection, and more broadly, sustainable development, is an essential prerequisite for the policy of economic, social and environmental development. In addition, the formulation and analysis of indicators is important for monitoring the achieved level of sustainable development, as well as for benchmarking analysis between countries or regions in the achieved level of sustainability.

“This objective is even more emphasized in Agenda 21, a document that presents an action plan for implementation of sustainable development adopted at the Rio Conference on sustainable development in the 1992” (UN Department of Economic and Social Affairs, Janković-Milić, Jovanović, 2012, p.200). In this document it was stressed that “countries at the national level and international governmental and non-governmental organizations at the international level should develop the concept of indicators of sustainable development in order to identify such indicators” (UN Department of Economic and Social Affairs).

Some of the most important indicators of the achieved level of sustainable development, used in this paper, are: *GDP* per capita (Gross Domestic Product – indicator which reflects economic dimension of sustainability), *EPI* (Environmental Performance Indicator – indicator which reflect conditions in ecological field), and *SSI* (Sustainable Society Index – indicator which shows the achieved level in social sustainability).

The economic dimension of sustainable development is focused on economic growth, with the limitation imposed by natural conditions. Namely, the economic dimension of sustainable development involves the efficient use of natural resources to ensure economic growth. In addition to indicators such as the level of consumption, production, trade, an important indicator of the economic dimension of sustainability is GDP per capita.

“The GDP is the sum of the market value of all final goods and services produced in a country in a given period” (Beyond GDP, 2012). Also, GDP measures „goods and services are both sold to consumers, government, investors and exported” (Beyond GDP, 2012). In Table 1 is presented data about GDP per capita in South-eastern Europe countries for the period 2006-2012.

Table 1. GDP per capita in South-eastern Europe countries (2006-2012) in USD

Country	Year			
	2006	2008	2010	2012
Albania	4900	5500	6200	7800
Bosnia	6800	6600	6300	8200
Bulgaria	9000	11800	12600	13500
Croatia	11600	15500	17600	18300
Macedonia	7600	8400	9000	10400
Romania	8400	11100	11500	12300
Serbia	2700	7700	10400	10700
Moldova	2100	2200	2400	3400
Montenegro	2700	3800	9800	11200
Turkey	7900	9400	11200	14600
Greece	22800	30500	32100	27600

Source: http://www.photius.com/rankings/economy/gdp_per_capita

The identification of the key problems in the field of natural resources and the environment is very important for policymakers, so they should focus their actions on their removal and mitigation. In addition, the identification of environmental indicators is important for comparison with other countries and determination the achieved level of environmental performance. One of the index which "shows how countries are well on track to achieve the goals of environmental policy" (2010 Environmental Performance Index) is an EPI.

EPI methodology is developed by World Economic Forum, Yale Center for Environmental Law and Policy – YCELP, and Columbia University - Center for International Earth Science Information Network - CIESIN. Table 2 shows the values of EPI for each South-eastern Europe country in the period 2006-2012.

Table 2 Values of EPI for South-eastern Europe countries in the period 2006-2012

Country	Year			
	2006	2008	2010	2012
Albania	68,90	84,00	71,40	65,86
Bosnia	-	79,70	62,50	36,76
Bulgaria	72,00	78,50	55,90	56,28
Croatia	-	84,60	68,70	64,16
Macedonia	-	75,10	60,60	46,96
Romania	56,90	71,90	67,00	48,34
Serbia	-	-	69,40	46,14
Moldova	62,90	70,70	58,80	45,21
Montenegro	-	-	69,40	46,14
Turkey	72,80	75,90	60,40	44,80
Greece	80,20	80,20	60,90	60,04

Source: 2012 Environmental Performance Index and Pilot Trend Environmental Performance Index, Yale University (Yale Center for Environmental Law and Policy - YCELP), Columbia University (Center for International Earth Science Information Network – CIESIN) in collaboration with World Economic Forum, 2012. Available at: <http://www.epi.yale.edu/downloads>

Exploration of Relationship Between Components of Sustainable Development in South-Eastern Europe Countries

For the analysis of the social dimension of sustainable development in this paper, index SSI is chosen. This index was developed by Sustainable Society Foundation, based in The Netherlands, in 2006 and this index monitor the level of sustainability for 151 countries. The main goal of this index is "stimulating and assisting societies in their development towards sustainability" (Sustainable Society Foundation). SSI is calculated with help of 21 indicators grouped into 3 categories of wellbeing (environmental, human, and economic wellbeing).

"The three core values Human, Environment and Economic Wellbeing are interrelated. They are not independent. On the contrary, they are very much interdependent. There are large trade-offs between all three values." (Sustainable Society Foundation). The values of SSI for the observed period are presented in Table 3.

Table 3 Values of SSI for South-eastern Europe countries in the period 2006-2012

	Year			
	2006	2008	2010	2012
Albania	6,38	6,26	6,50	5,76
Bosnia	5,91	5,96	5,83	3,92
Bulgaria	5,68	5,84	6,30	5,13
Croatia	5,96	5,97	6,53	5,55
Macedonia	5,96	5,76	6,07	4,94
Romania	5,92	6,09	6,70	5,48
Serbia	5,59	5,53	6,39	4,50
Moldova	5,87	6,21	6,50	4,87
Montenegro	5,66	5,58	6,47	5,60
Turkey	6,07	6,00	6,07	4,77
Greece	5,71	5,75	6,13	4,32

Source: Sustainable Society Foundation, Available at: <http://www.ssindex.com/results-2012/ranking-all-countries/>

3. Research Methodology

Having in mind appointed object and aim of this research, the following hypotheses will be tested:

H1 - analyzed annually, economic and environmental component of sustainable development are in the highest degree of agreement;

H2 - analyzed by countries, economic and environmental indicators of sustainable development are negatively correlated (have the opposite direction of agreement); and

H3 - economic and social indicators of sustainable development, taken by countries, are positively correlated.

In this paper several methods of statistical analysis were used. Special attention is on correlation analysis and methods of statistical inference. Using this methods it is possible to determine nature and significance of interdependence between analyzed indicators of sustainable development.

The examination of this research is performed through the following steps: a) the relationship between the indicators of sustainable development for all countries in observed period, and b) relationship between the indicators of sustainable development for the observed period for each country.

4. Research Results and Discussions

a) The examination of relationship between the indicators of sustainable development for all South-eastern Europe countries in observed period

Statistical method by which it is possible to monitor the level and direction of the dependencies between variables (indicators of sustainable development in this case) is the correlation analysis. In the case of interdependence analysis of two variables, simple correlation method will be applied (bivariate analysis). If the analysis includes more than two variables, applied method is multiple correlation analysis (multivariate analysis) (Đorđević, 2009, Đorđević, Janković-Milić, 2011).

In order to examine the agreement of all three selected indicators it is calculated the coefficient of multiple linear correlations. In 2006 this coefficient amounts 0.775. This ratio indicates a highly significant degree of agreement of all three selected indicators. As this ratio shows only the degree of agreement (intensity), and not the direction of agreement, it is necessary to perform a partial correlation. Table 4 shows the coefficients of partial correlation that show the highest degree of correlation between GDP and EPI, while the SSI is negatively correlated with GDP and with EPI.

Table 4 Coefficients of partial correlation values in 2006

		GDP 2006	EPI 2006	SSI 2006
GDP 2006	Pearson Correlation	1		
	Sig. (2-tailed)	0		
EPI 2006	Pearson Correlation	0,686	1	
	Sig. (2-tailed)	0,133	0	
SSI 2006	Pearson Correlation	-0,099	-0,212	1
	Sig. (2-tailed)	0,773	0,687	0

Multiple linear correlation coefficient for 2008 amounts 0.690, indicating a significant degree of agreement. Table 5 shows the partial correlation coefficients which indicate that it is still the highest degree of correlation between GDP and EPI, while the SSI is negatively correlated with GDP and with EPI, as well as in 2006.

Table 5 Coefficients of partial correlation values in 2008

		GDP 2008	EPI 2008	SSI 2008
GDP 2008	Pearson Correlation	1		
	Sig. (2-tailed)	0		
EPI 2008	Pearson Correlation	0,336	1	
	Sig. (2-tailed)	0,377	0	
SSI 2008	Pearson Correlation	-0,210	-0,105	1
	Sig. (2-tailed)	0,536	0,788	0

**Exploration of Relationship Between Components of Sustainable Development
in South-Eastern Europe Countries**

In 2010, the multiple linear correlation coefficient is 0.118, indicating a negligible degree of agreement of selected indicators of sustainable development. Table 6 shows the partial correlation coefficients, which indicate that the highest degree of correlation is between EPI and SSI, while GDP is negatively correlated with the other two indicators of sustainability. Negative correlation between economic and environmental dimensions of sustainable development is observed for the first time (in comparison with 2006 and 2008) in this year.

Table 6 Coefficients of partial correlation values in 2010

		GDP2010	EPI2010	SSI2010
GDP2010	Pearson Correlation	1		
	Sig. (2-tailed)	0		
EPI2010	Pearson Correlation	-0,083	1	
	Sig. (2-tailed)	0,808	0	
SSI2010	Pearson Correlation	-0,114	0,509	1
	Sig. (2-tailed)	0,739	0,110	0

Calculated coefficient of multiple correlation amounts 0.657 for 2012. This coefficient indicates a significant correlation between the observed indicators of sustainable development. Partial correlation coefficients for observed countries in 2012 are shown in Table 7.

Table 7 Coefficients of partial correlation values in 2010

		GDP2012	EPI2012	SSI2012
GDP2012	Pearson Correlation	1		
	Sig. (2-tailed)	0,000		
EPI2012	Pearson Correlation	0,469	1	
	Sig. (2-tailed)	0,146	0,000	
SSI2012	Pearson Correlation	-0,135	0,539	1
	Sig. (2-tailed)	0,691	0,087	0,000

Based on the data in Table 7, it can be seen that the highest level of agreement exists between the environmental and social components of sustainable development, while economic and social components are negatively correlated.

According to previous analysis one can see that the relationship between GDP and EPI weakening since 2006 by 2010 (in 2010 was negative), and in 2012 is stronger again. Correlation between GDP and SSI is negatively correlated in all observed years. The relationship between EPI and SSI is negative in the first two years (2006 and 2008) while the results obtained in 2010 and 2012 suggest that there is positive and gradually strengthening correlation.

The results presented above indicate that the hypothesis H1 (*economic and ecological component of the concept of sustainable development, analyzed annually, are in the highest degree of agreement*) was confirmed in 2006 and 2008, while in 2010 and 2012 the economic and environmental dimensions of sustainable development are not in the highest degree of correlation. In this way, the hypothesis H1 is not fully confirmed.

b) The examination of relationship between the indicators of sustainable development for the observed period for each South-eastern Europe country

In the calculation of the coefficient of multiple correlations for each country, there was not enough data for Bosnia and Herzegovina, Croatia, Macedonia, Serbia and Montenegro. That is, the time series was not long enough to calculate a representative value of the correlation coefficient. The calculated values are given in Table 8, from which it can be seen that in Turkey there is the greatest level of agreement between indicators of sustainable development.

Table 8 Coefficients of multiple correlation for the period 2006-2012

Country	R
Albania	0,822
Bulgaria	0,634
Romania	0,033
Moldova	0,938
Turkey	0,960
Greece	0,651

It should be noted that in 2012 there was a change in the methodology of calculating the index SSI. Due to the better understanding and objectivity of the results, data for SSI index in 2012 are excluded from the calculation of partial correlation coefficients.

Table 9 Coefficients of partial correlations by countries

Country	GDP-EPI	GDP-SSI	EPI-SSI
Albania	0,110	0,538	-0,778
p-value	0,930	0,638	0,432
Bulgaria	-0,438	0,835	-0,861
p-value	0,711	0,371	0,340
Romania	0,903	0,752	0,395
p-value	0,283	0,458	0,741
Moldova	-0,511	0,972	-0,296
p-value	0,659	0,150	0,809
Turkey	-0,789	0,052	-0,655
p-value	0,421	0,967	0,546
Greece	-0,633	0,697	-0,996
p-value	0,564	0,509	0,055

According to the analysis in this paper, the hypothesis H2 (*indicators of economic and environmental development, analyzed by countries, are negatively correlated*) is not

Exploration of Relationship Between Components of Sustainable Development in South-Eastern Europe Countries

fully confirmed. Specifically, Albania and Romania are the countries where the GDP and EPI indicators are positively correlated.

Results presented in Table 9 clearly show a positive correlation between GDP and SSI in all observed countries. The highest correlation of these two indicators was noted in Moldova, followed Bulgaria and Romania. The lowest correlation level has noted in Turkey. This indicates that Hypothesis H3 (*economic and social indicators of sustainable development, analyzed by countries, are positively correlated*) is fully confirmed.

5. Conclusion

Sustainable development is a contemporary development concept based on three key dimensions (economic, environmental and social). All three dimensions are very important but in different circumstances one of them has a smaller or greater importance. In spite of that, final objective is their balanced development. One of the most important preconditions for implementation of this concept and for monitoring achieved level of development is defining appropriate indicators.

Results of this research indicate that in South-eastern Europe countries in the period 2006-2012: a) balanced development of economic, environment and social dimensions was at lowest level in 2010; b) economic and social dimensions are negatively correlated during the whole observed period, analysed by years for all countries together, but this relationship is positive in analyses by countries separately; c) relationship between social and economic dimensions become stronger after 2010; d) the highest level of agreement between all three dimensions of sustainable development has noted in Turkey.

The observed group of countries is quite heterogeneous according to values of the indicators (GDP, EPI and SSI) in the analysis. This heterogeneity is exactly the reason for the opposite findings in terms of the analysis of all countries together and in terms of the analysis of individual countries. In this analysis of the indicators that reflect dimensions of sustainable development for all observed countries together, it can be concluded that there is high level of balanced and harmonized correlation between them.

References

1. *2012 Environmental Performance Index and Pilot Trend Environmental Performance Index*, Yale University (Yale Center for Environmental Law and Policy - YCELP), Columbia University (Center for International Earth Science Information Network – CIESIN) in collaboration with World Economic Forum, 2012. Available at: <http://www.epi.yale.edu/downloads> (Accessed in February 2012)
2. *Beyond GDP*, Available at: <http://www.beyond-gdp.eu/index.html> (Accessed in February 2012).
3. Đekić, S., Jovanović, S., Krstić, B. (2011). Komparativna analiza strategija održivog ruralnog razvoja zemalja u okruženju - osnova za kreiranje efektivne strategije održivog ruralnog razvoja u Srbiji, *Ekonomске teme*, N^o2, Univerzitet u Nišu, Ekonomski fakultet Niš.
4. Đorđević, V. (2009). Statistika u ekonomiji, Univerzitet u Nišu, Ekonomski fakultet Niš.

5. Đorđević, V., Lepojević, V., Janković-Milić, V. (2011). Primena statističkih metoda u istraživanju tržišta, Univerzitet u Nišu, Ekonomski fakultet Niš.
6. Harris, J.M. (2009). Ekonomija životne sredine i prirodnih resursa, Datastatus, Beograd.
7. *IMF*, Available at:
<http://www.imf.org/external/pubs/ft/weo/2011/01/weodata/index.aspx> (Accessed in February 2012)
8. Objective and themes of the United Nations Conference on Sustainable Development, Report of the Secretary General, Available at: <http://www.uncsd2012.org/rio20/> (Accessed in February 2012)
9. Our Common Future, (1987). World Commission on Environment and Development, Oxford University Press, Oxford.
10. Spangenberg, J.H. (2002). Environmental space and the prism of sustainability: frameworks for indicators measuring sustainable development, *Ecological Indicators*, N°2, Available at: <http://www.china-sds.org/kcxfzbg/> (Accessed in February 2012)
11. *Sustainable Society Foundation*, Available at: <http://www.ssfindex.com/results-2012/ranking-all-countries/> (Accessed in February 2012)
12. UN Department of Economic and Social Affairs, Division for Sustainable Development, Agenda 21, Section IV. *Means of Implementation*, Chapter 40 - Information for Decision-Making, Paragraph 40.6, Available at: http://www.un.org/esa/dsd/agenda21/res_agenda21_40.shtml (Accessed in February 2012)
13. Meadows D.H. et al. (1972). *The Limits to Growth: A Report for the Club of Rome's project on the Predicament of Mankind*, Earth Island, Universe Books, New York.

ISPITIVANJE MEĐUZAVISNOSTI KOMPONENTI ODRŽIVOG RAZVOJA ZEMALJA JUGOISTOČNE EVROPE

Rezime: Implementacija koncepta održivog razvoja predstavlja izazov za svaku zemlju u savremenim uslovima razvoja. Predmet ovog rada jeste problematika indikatora održivog razvoja i ispitivanje njihove povezanosti u zemljama Jugoistočne Evrope. Cilj rada je određivanje smera i stepena slaganja između indikatora održivog razvoja na primeru zemalja Jugoistočne Evrope. U tom kontekstu, fokus je na ekonomskoj, ekološkoj i socijalnoj komponenti održivog razvoja, odnosno u ovom radu se analiziraju indikatori koji odražavaju svaku od navedenih dimenzija održivog razvoja. Za potrebe istraživanja u ovom radu korišćeni su sledeći indikatori: DBP (društveni bruto proizvod – indikator koji odražava ekonomsku demenziju održivosti), EPI (Indikator ekoloških performansi – indikator koji odražava stanje u oblasti životne sredine) i SSI (Indeks održivog društva – indikator koji pokazuje dostignuti nivo u oblasti socijalne održivosti). Na osnovu odabranih indikatora održivog razvoja, u radu će biti analizirana međuzavisnost između komponenti održivog razvoja zemalja Jugoistočne Evrope u periodu 2006-2012. godine, uz pomoć metoda statističkog zaključivanja i korelacione analize.

Ključne reči: održivi razvoj, korelaciona analiza, zemlje Jugoistočne Evrope.