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ENVIRONMENTAL PROTECTION IN THE CONTEXT OF SUSTAINABLE DEVELOPMENT. COMPARATIVE ANALYSIS ACROSS EU COUNTRIES

Alexandru STRATAN
National Institute for Econonomic Research Chișinău, Republic of Moldova
alex_stratan@yahoo.com

Cristina CĂUTIȘANU
SDEAA, Alexandru Ioan Cuza University of Iași, Romania
cautisanucristina@yahoo.com

Mariana HATMANU
Alexandru Ioan Cuza University of Iași, Romania
mariana.hatmanu@uaic.ro

Costică MIHAI
Alexandru Ioan Cuza University of Iași, Romania
ticu@uaic.ro

Abstract:
The protection of the environment is an important topic in these days and is given a special attention at national and international level. The quality of the environment has effects that propagate at both economic and social levels, putting its mark on the state of health and lifestyle of present and future generations. The aim of the paper is to verify whether the implementation of environmental protection measures led to the improvement of the economic and social climate. The variables used are composite indicators developed for the three components of sustainable development, such as the Environmental Wellbeing, the Economic Wellbeing, and the Human Wellbeing. In order to capture more analytically the relationship between the environmental component and the other two components of sustainable development, in the paper are analysed also the indicators that compose the aggregate indices. The applied methods are cluster analysis and regression analysis. The analysis is performed at the level of the 28 EU countries, in 2008 compared to 2016. The result of the comparative analysis show that the quality of the environment is negative correlated with the economic and social climate, in 2008 and 2016. The aggregated indicators for economic and social components registered significant increases in 2016 compared to 2008 and the corresponding indicator for the economic component decreased. The econometric models identified have highlighted the importance of good governance and economic growth policies in implementing environmental policies.

Key words: sustainable development, environmental protection, EU countries, cluster analysis, regression analysis

JEL classification: C21, C38, Q01

1. INTRODUCTION

Analysis of the development represents a challenge of a great complexity for both practitioners and researchers. The complex structural transformation phenomena which accompany development are, in fact, profound combinations of the various factors that generate different results under different conditions. The challenges of the end of the 20th century and the beginning of the 21st century start from the concrete objectives of economic development, but also emphasize the balance of evolution regarding different aspects of society, environment and economy. These challenges lead to one of the most important and controversial concepts in the current period: sustainable development. There are authors who consider that this goal is not only achievable but also imperative to ensure the evolution in the current period. Others, on the contrary, appreciate that sustainable development would be an utopia, that pure and free pursuit of the economic development objectives represents the solution to the current problems.

The European Union countries, due to legislation adopted at the community level, are champions in the adoption of sustainable development measures. The first event that brought into attention the problem of the environmental deterioration as a result of human activities was the UN Environment Conference (ECO I), which took place in Stockholm in 1972. Subsequently, the United Nations established the World Commission on Environment and Development (1983), which, through the elaboration and publication of the Brundtland Report (1987), provided the basis of Agenda 21 containing the principles of the Rio Declaration (1992).

The European Union Sustainable Development Strategy was adopted in Güteborg in 2001, although concerns in this area existed before that date. The strategy was revised and further developed by adding an external dimension in 2002, in Barcelona, or by adopting the revised EU Sustainable Development Strategy in 2006, in Brussels. The new global framework for sustainable development is UN Agenda 2030, adopted by world leaders in 2015. The proposed objectives are to balance the three dimensions of sustainable development - economic, social and environmental - and to increase convergence in EU countries.

Environmental issues such as water and air pollution or waste management have been included in the European Union policy since the mid-1970s, when the European Commission signaled the need for an environmental agenda. A series of 7 such programs have been created. In these programs were defined some priority objectives that must be achieved in a number of years. The 7th Union Environment Action Program stated that, by 2020, we will have "A good life within our planet" and was adopted in January 2014, covering the period up to 2020 (European Comission, 2014).

In this paper we aim to analyze, both statically and dynamically, the state of the EU countries, highlighting the mutations that take place in the structure of the countries concerning the dimensions of the sustainable development: economic, social and environmental. The analysis is carried out for the years 2008 and 2016, a period characterized by profound conjunctural changes generated by the stages of the global financial crisis.

Starting from the premises that the countries accept the standards imposed by the objectives of sustainable development and the fact that each of them face its own conditions and objectives, our analysis attempts to develop a study in which, first, we conduct an interstate analysis at the level of the two years of reference. In order to capture the convergence of the countries from the perspective of the specific indicators of sustainable development components, we create a grouping of the countries based on the correlations between these indices using the following methods: PCA and cluster analysis. The state of sustainable development reached at European level will be described by the transformations appeared in its three components in all EU countries. In the end, taking into consideration the correlations between indices, we conduct several econometric model in order to analyse the influence of the economic and social components of the sustainable development on the third component, the environment.

2. LITERATURE REVIEW

A special importance is given to the sustainable development not only in national and EU policies, but also in specialised literature that tries to find a better understanding and explaining of the phenomenon, measure it, identifying its determinants, etc. Given the complexity of the sustainable development and its components, a significant part of the specialized literature is dedicated studying the theoretical framework of the phenomenon.

Sustainable development is a complex and integrated development process that ensures "a basic quality of life for all people and at the same time protects ecosystems and community systems that make life possible and worthwhile." (Van der Merwe & Van der Merwe , 1999). In this context, each of the economic, social and environmental dimensions must be analyzed and evaluated through specific indicators taking into consideration these objectives.

At the whole EU level the goal of ”sustainable development” is a fundamental, being grounded in Article 3 of the Treaty on European Union. The indicators regarding the EU

sustainable development are constantly published by Eurostat from 2005 expressing the interest the Europe in monitoring the common Strategy for Sustainable Development. (Council of the European Union (2006), Review of the EU Sustainable Development Strategy (EU SDS) — Renewed Strategy , 10917/06).

Beyond the common or national strategy regarding the sustainable development, countries may experience different evolutions concerning the components of sustainable development depending on other factors that influence the economy. For example, in the context of the global financial crisis, "the idea of sustainable development is an exceptional opportunity that could lead to significant economic achievements" (Tampakoudis et al., 2014, p.16).

In order to observe the progress of the different countries on the sustainable development direction, there were developed some evaluation methodologies based on various indicators. Extension and typology of these indicators can be very high: Tasaki et al (2010) used in their analysis 1790 indicators grouped into four broad categories for characterization. This study emphasize the fact that these indicators must be adapted over time and correlated with the evolution of economic, social and environmental aspects. In the Indicators of Sustainable Development Methodologies Guidelines and Methodologies of United Nations (2007), the aggregate indicator is based on 96 indicators. This methodology also makes reference to the ways in which the indicators should be develop in order to have a better capture of the dimensions of sustainable development.

We mention composite indicators such as: Environmental Performance Index (Esty et al., 2008), Composite Index of Environmental Performance (García-Sánchez et al., 2015), Economic Performance Index (IMF, 2013), Social Progress Index (Stiglitz et al., 2010), SSI (SSI index website. 2006).

Empirical studies which measured sustainable development are much less compared to those proposing theoretical analysis methodologies (Tampakaodis et al., 2014, p. 19). Considering that, in addition, there are few studies that have analyzed the evolution of the main components of the sustainable development and the relationships between them, we appreciate that the present study may have an important impact in the specialised literature. In a paper published by the Overseas Development Institute (Machingura, F., Development S., 2017), there are analysed the situations in which a country should decide whether to opt for environmental sustainability or ending hunger, for economic growth or sustainable environments, is discussing the paradox of social and economic development goals. The problem is that concrete situations or different levels of development lead to different approaches among decision-makers in different countries. Observing the changes between the indicators which characterize the dimensions of sustainable development can be an important starting point in studying the status and trend of this process.

In one recent studies (Neumann et al 2018, p. 17) the authors appreciate that the „modeling will provide useful insights, allow for the discovery of potential synergies and trade-offs or ambivalences, and create ownership for stakeholders of the transition towards sustainability”. By using statistical analyzes, correlations and evolutions of the indicators there can be highlighted important aspects related to the status and direction of action of different countries in promoting values of sustainable development.

3. DATA AND METHODOLOGY

The statistic analysis was structured into several steps. The first step of the analysis was to identify the main indicators that can be used in order to measure the sustainable development. In order to fulfill this step, we studied the literature review and we identified the folowing composite indices: the Economic Wellbeing Index (EcW), the Environmental Wellbeing Index (EnW) and the Human Wellbeing Index (HW). The second step of the analysis consisted in finding the correlations between the three composite indices using the Principal Component Analysis. In the third step, we grouped the EU countries taking into consideration the similarities between them regarding the scores of the composite indices. In the last step, taking into consideration the results obtained in the previous analysis, we conducted several regression models in order to analyse the existing

influences between variables.

Economic Wellbeing Index, Environmental Wellbeing Index and Human Wellbeing Index represent the dimensions of the Sustainable Society Index (SSI). The construction of SSI is based on the definition of sustainable development which was elaborated in the Brundtland Report (1987): „A sustainable society is a society that meets the needs of the present generation and that does not compromise the ability of future generations to meet their own needs" (S. Imperatives, 2000). Beyond this definition, in purpose of the SSI was added another objective reffering to the fact that both Human Wellbeing and Environmental Wellbeing are needed to create a sustainable society. The aditional objective emphasize that „each human being has the opportunity to develop itself in freedom, within a well-balanced society and in harmony with its surroundings" (SSI index website. 2006). Reffering to the relationship between the three dimensions of the SSI, the authors of the SSI consider that Economic Wellbeing does not represent a goal in itself for a sustainable development, it is integrate as an essential condition to achieve Human Wellbeing and Environmental Wellbeing.

Figure no. 1 presents the structure established by the authors of the SSI. It comprises there levels: 21 indicators, 7 categories and 3 wellbeing dimensions.

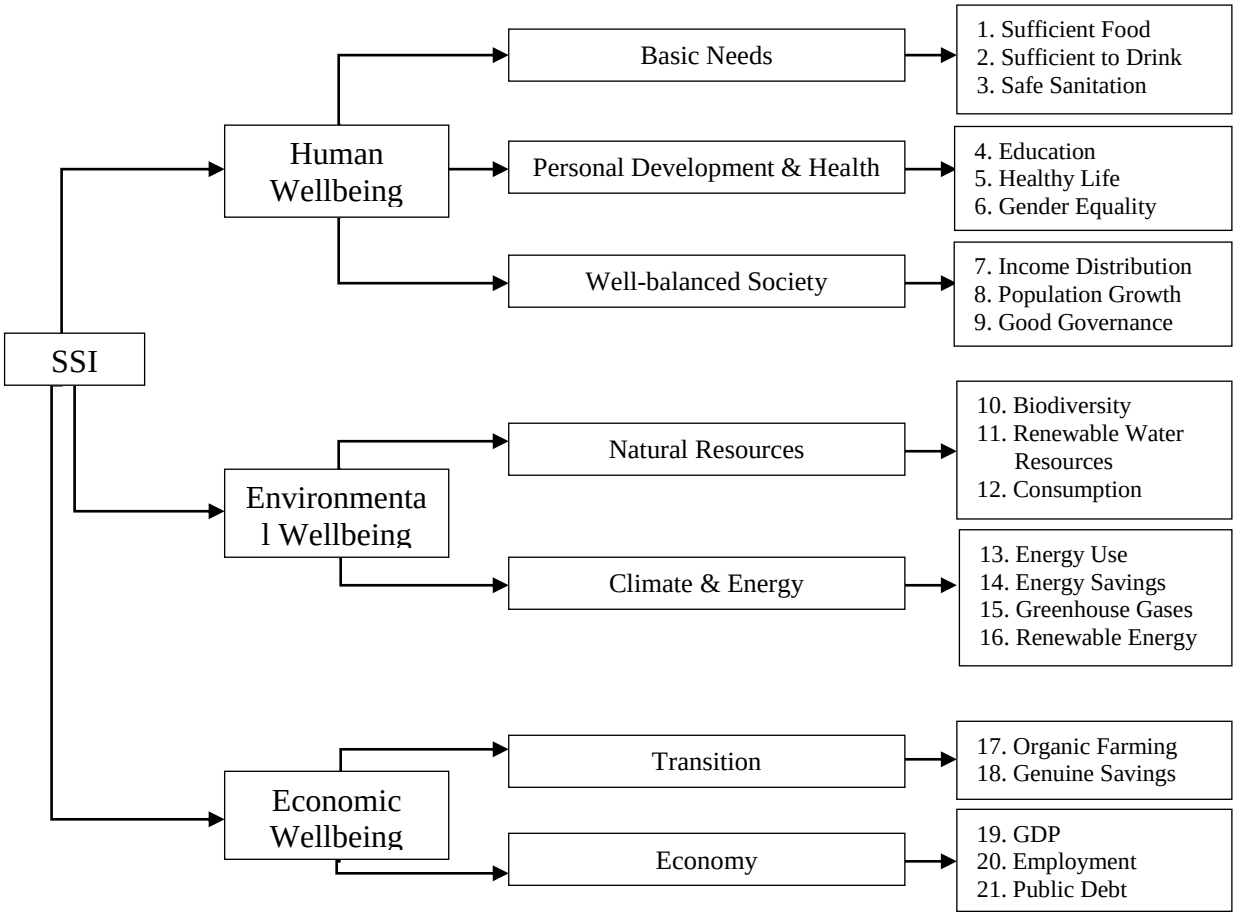

Figure no. 1. Components of the Sustainable Society Index

Source: authors' processing based on SSI classification from http://www.ssfindex.com/ssi/framework/

Following the recommendations of the European Commission concerning the construction of the SSI, the authors of the index have not aggregated the dimension levels into one single Figure no. for the overall index because of the negative correlation between Environmental Wellbeing and Human Wellbeing.

Each of the three dimensions of the SSI are aggregated into scores based on the scores of their component indicators. Every indicator had received the same weight for the aggregation into dimensions. For the aggregations was used the geometric average in order to avoid the possibility of compensation between the levels of the component indicators. The scores for the dimensions can

have values in the range [1, 10].

The SSI has been published for the first time in 2006 and is updated every two years. In this paper, we take into consideration the scores for Economic Wellbeing Index, Environmental Wellbeing Index and Human Wellbeing Index corresponding to the years 2008 and 2016. The data that we use in the paper is downloaded from the oficial site of SSI (SSI index website. 2006).

Various statistical methods adequate for the data analysed were applied using the softwares SPSS and Tableau. In order to describe the indicators under consideration Descriptive Statistics were used. The correlation matrix shows the correlations between sets of variables. Principal Components Analysis (PCA), which is an exploratory data analysis method, was used to discover the relationships among variables. In PCA a set of correlated variables is transformed to a smaller set of uncorrelated hypothetical constructs called principal components (Timm, 2002).

Cluster analysis examines the similarities and differences between units in order to group them in the form of distinct clusters and homogeneous within them. One of the cluster methods used in the specialised literature is the Two-Step Cluster. Unlike other cluster methods, the Two-Step Cluster has the advantage of providing information on the importance of each variable in the structure of individual clusters. The method is conducted in a 2-step approach: pre-clustering units in multiple subclusions and classifying them into a desired number of groups (Mooi, 2011), The decision to choose the appropriate number of clusters can be guided by the values of the Akaike (AIC) and Bayes (BIC) information criteria. In order to validate the cluster solution, the resulted clusters must have high levels of intra-group homogeneity and high intergroup heterogeneity.

We also have developed a regression analysis to examine whether any of the explanatory variables have a significant effect on the explained variable. The relationship between the explained variable, denoted with Y, and the explained variables, denoted with X, is $Y = f(X)$. The regression models were validated by testing certain hypotheses at both the level of the deterministic component and the level of the stochastic component. In the case of the latter, the following hypotheses were tested: the influence of the error component is null, the homoscedasticity hypothesis, the independence hypothesis, the normality hypothesis.

4. RESULTS

A summary of the characteristics of the analyzed indicators is provided by the descriptive statistics indicators presented in Table no. 1. The indicators were abbreviated as follows: EnW (Environmental Wellbeing), HW (Human Wellbeing) and EcW (Economic Wellbeing).

Table no. 1. Descriptive statistics of HW, EnW and EcW for years 2008 and 2016

	2008			2016		
	EnW	**HW**	**EcW**	**EnW**	**HW**	**EcW**
Mean	3.3429	8.1107	6.3357	4.2536	8.3000	5.6250
Std. Deviation	.66301	.53496	1.27663	.93114	.39814	1.54479
Skewness	.033	-1.064	-.074	-.493	-.307	-.116
Kurtosis	-.813	1.480	-1.417	-.356	-.672	-.939
Minimum	2.20	6.60	4.40	2.20	7.50	2.50
Maximum	4.60	8.90	8.30	5.90	9.00	8.10

Source: authors' processing

It can be noticed that at the level of all EU countries the average level of EnW and HW indicators increased in 2016 compared to 2008 but, the EcW indicator decreased. The degree of homogeneity of the EU countries' assembly relative to the indicators considered is appreciated by the coefficient of variation, calculated as the ratio between the standard deviation and the mean. The distributions of the three indices are homogeneous, the highest degree of homogeneity being characteristic to the distributions corresponding to HW indicator, which has the coefficient of variation of 6.59%, for 2008, respectively 4.79% for the year 2016. The distributions corresponding to the EcW indicator have large values for the coefficient of variation, equal to 20.15% for 2008

and 27.45% for 2016, indicating a moderately representative mean.

Regarding the forms of the distributions, it can be noticed a weak left skewness for the distributions corresponding to the three indices at the level of the two analyzed years. This skewness can be explained by the fact that some countries have obtained values of indicators which have negative deviations from the average level compared to the average deviations of other countries.

The weak left skewness, indicated by the value of the coefficient of skewness and the weak flattening, indicated by the coefficient of kurtosis, do not affect the normal distribution rule of the indicators for the years 2008 and 2016, a statement confirmed by the results of Kolmogorov-Smirnov and Jarque – Bera tests.

In order to verify that there were significant differences in the average score of the three indicators, the Student Pair Test is applied. According to the results obtained (Table no. 2), for a 5% risk, all indicators obtained a significant increase in the case of the EnW and HW indicators, but, a significant decrease in the case of the EcW indicator.

Tabel no. 2 Student Pair Test for checking the differences between the average indicator level for the years 2016 and 2008

Indicator	$t_{computed}$	Significance
EnW	2.299	0.030
HW	8.827	0.000
EcW	-2.795	0.009

Source: authors' processing

The comparative analysis of the aggregate indices in 2008 and 2016 highlights their different evolutions at the level of the European Union countries. The graphical analysis of EnW's evolution (Figure no. 2) shows that its level increased in 2016 compared to the 2008 level for each of the EU Member States, except for Estonia, which had a decrease of 0.20 units. The minimum values for this indicator were registered by Belgium in 2008 and Estonia in 2016. Croatia had maximum values for the EnW indicator, equal to 4.6 units in 2008 and 5.9 in 2016. The highest increases in 2016 compared with 2008, were obtained by Denmark, with an increase of 1.8 units, Italy with an increase of 1.7 units, Spain and Greece, with increases of 1.6 units.

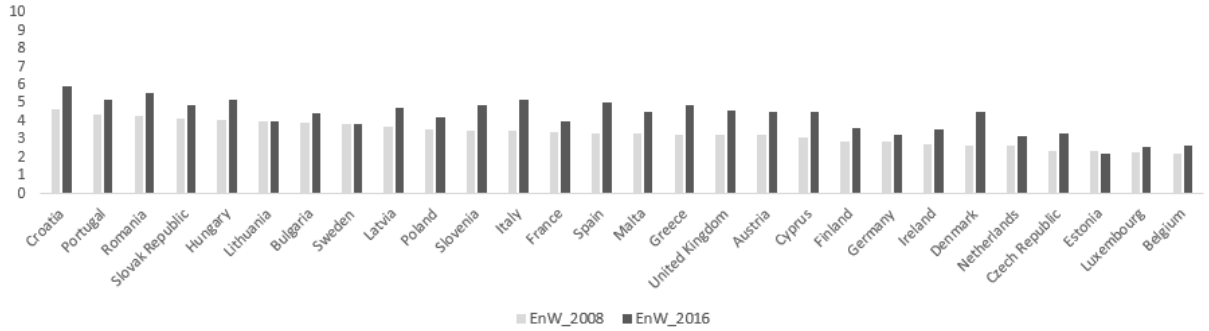

Figure no. 2. Comparative analysis of EnW's evolution in the European Union countries for the years 2008 and 2016

Source: authors' processing

The analysis of these data shows that, in particular, developed countries have experienced major developments regarding environment, existing a trend towards convergence of specific indicators. The large disparities in the EnW level in 2008 for some developed countries such as Denmark, Spain or Greece represented real challenges for these countries. Through subsequent environmental programs, these countries began to have evident increases. In contrast with these countries were countries such as Lithuania, Sweden, Estonia, where this indicator has stagnated or even decreased. The case of Sweden is interesting because this country is known as having very

high values for the environmental indicators but the evolution from 2008 to 2014 is as non-existent in terms of the environmental indicator. Referring to this country, Simon Upton, OECD Environment Director said that "Sweden is a frontrunner in using market-based instruments ... But the better one is, the harder it is to improve. Sweden will need more cost-effective policies and a fair sharing of compliance costs to meet future goals." (OECD - Environmental Performance Reviews. Sweden. Highlights 2014, p. 2.)

The HW indicator shows roughly equal values in 2008 and 2016 for most countries, with the exception of Ireland, Romania and Malta, for which there were observed significant increases in 2016 compared to 2008 (Figure no. 3). The highest values of this indicator for both years have been reported by the Nordic countries (Finland, Sweden, Denmark). The minimum values of the HW indicator were obtained in Malta in 2008 and in Luxembourg in 2016.

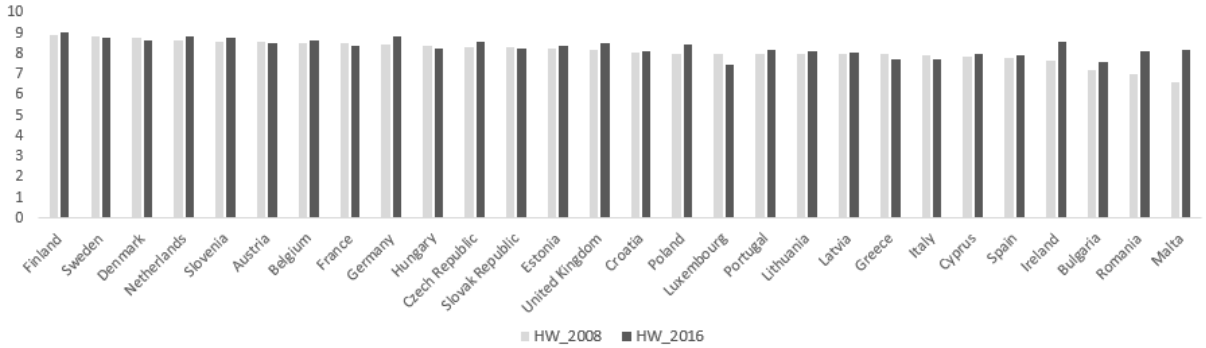

Figure no. 3. Comparative analysis of HW's evolution in the European Union countries for the years 2008 and 2016

Source: authors' processing

High levels of poverty in countries such as Bulgaria and Romania, the lack of basic facilities and the existence of social policies with poor effects on poverty eradication can explain the low level of the HW in 2008. In addition, Malta, Romania and Bulgaria have been integrated into the EU in 2004 and 2007 respectively, the European social policies did not have the expected results at the level of 2008. The visible increase of this indicator in 2016 is explicable precisely by the reporting of the positive effects of cohesion policy in these states.

From the graphical analysis of the evolution of EcW (Figure no. 4) there can be observed different directions of the evolution of the aggregate index in 2016 compared to its values in 2008. Thus, on the one hand, the northern European Union countries (Denmark, Estonia, Sweden and Latvia) had a level almost constant between the two years considered. The minimum level of the indicator was reported in Greece in both years considered in analysis, and the maximum level was reached in Denmark in 2008 and in Estonia in 2016. Countries such as Poland, Romania and Bulgaria obtained significant increases in their values EcW over 1.2 units. The other EU Member States reported significant decreases in aggregate index values between the two years compared, with the largest differences being reported in Spain and Cyprus. In the delicate context of the economic situation in which were these countries after the global economic and financial crisis explains to a large extent the decline in the EcW indicator: budget imbalances, economic regressions, high unemployment, high external debt.

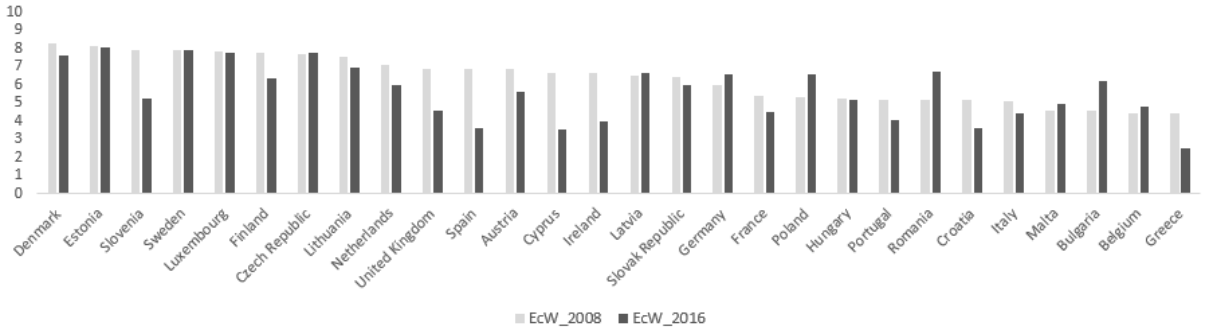

Figure no. 4. Comparative analysis of EcW's evolution in the European Union countries for the years 2008 and 2016

Source: authors' processing

The correlation between the Economic Wellbeing, Environment Wellbeing and Social Wellbeing was analyzed at the EU level for 2008 and 2016. The results are presented in the Table no. 3.

Table no. 3. Correlation matrix

Correlation	2008			2016		
	EnW	**HW**	**EcW**	**EnW**	**HW**	**EcW**
EnW	1	-0.282* (0.146)**	-0.401 (0.035)	1	-0.371 (0.052)	0.272 (0.162)
HW	-0.282 (0.146)	1	0.523 (0.004)	-0.371 (0.052)	1	-0.509 (0.006)
EcW	-0.401 (0.035)	0.523 (0.004)	1	0.272 (0.162)	-0.509 (0.006)	1

* Pearson correlation coefficient

** Significance for the Student t test

Source: authors' processing

According to the correlation analysis, there are significant correlations in 2008 between EcW and EnW, as well as between EcW and HW, considering a 5% risk. In 2016, the EcW indicator is only correlated with the HW indicators, and there is a significant correlation between the EnW and HW indicators.

These results may indicate that the evolution of the phenomena corresponding to the three components of sustainable development - economic, social and environmental - had different dynamics.

In order to obtain more analytical information on the relationships between EnW and the indicators for the economic and social components at EU level for the years 2008 and 2016, all indicators of the aggregate Human Welllbeing and Economic Welllbeing are analyzed individually, as shown in figure no. 1, point 3 of the paper, Data and Methodology. After the database was verified and cleaned and EnW's correlation analysis was performed, the following indicators were kept in the analysis: healthy life (HL), population growth (PG), good governance (GG), genuine savings (GS), GDP and employment (Empl).

A synthetic image of the relationships between the selected variables and of the defining of countries' groups created based on the correlations between variables which have revealed similarities are obtained with PCA and cluster analysis.

The PCA results, for 2008 and 2016, with KMO > 0.7 and the cumulative variation explained by the first two factorial axes above 75% indicate that the relationships identified by the PCA are validated. In figure no. 5 and figure no. 6 are presented the correlations between the variables considered.

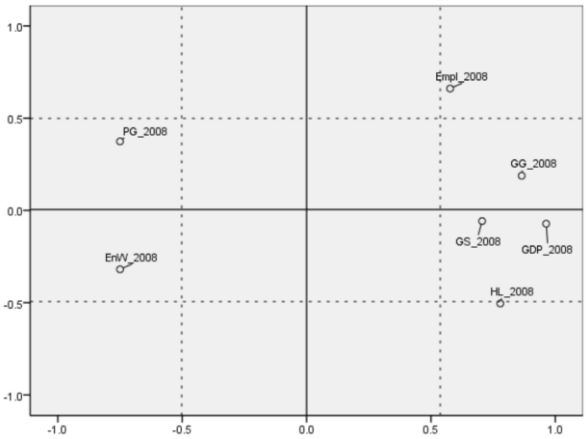

Figure no. 5. Correlations between EnW and the indicators considered in 2008

Source: authors' processing

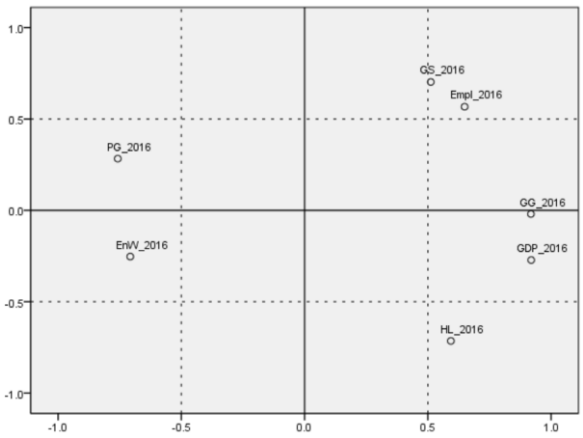

Figure no. 6. Correlations between EnW and the indicators considered in 2016

Source: authors' processing

In 2008, on the first factorial axis, the variable EnW is negatively correlated with Good Governance, Healthy Life, Genuine Savings and GDP, and positively correlated with Population Growth. The second factorial axis is defined by the Employment, located in the positive dial. Regarding the correlations between the indicators analyzed in 2016, it can be noticed that, on the first factorial axis, EnW is negatively correlated with Good Governance and GDP, and positively correlated with Population Growth. The second factorial axis is defined by Genuine Savings and Employment, located in the positive dial, and Healthy Life, located in the negative dial.

Graphical representations showed that, unlike in 2008, when HL explained a part of the variance of the first factorial axis, being negatively correlated with EnW, in 2016 the HL index explains a part of the variance of the second factorial axis and it is not significantly correlated with EnW. The other indicators are in the same dials in 2008 and 2016.

For the years considered in the analysis, there are analysed the similarities between the scores for EnW and the other indicators considered and, then, the European Union member countries are grouped in 4 clusters. Figure no. 7 shows the composition of clusters in 2008, and figure no. 8 shows the composition of clusters corresponding to year 2016.

In 2008, the first cluster consists of the countries of Cyprus, Ireland, Luxembourg and Spain, the group of these countries having the highest average level for HL, GDP, GS and Empl, but also the lowest average for EnW and PG. This group of countries is composed of countries where economic development prevails at the disadvantage of environmental or social indicators. When some countries experience economic disparities compared to others (in the second cluster), the focus in particular on economic development policies can omit the other dimensions of sustainable development.

Cluster 2 consists of 15 countries (Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Italy, Malta, Netherlands, Slovenia and United Kingdom), characterized by the highest average level of the GG indicator, but also high values for HL, PG, GS, GDP and employment. This cluster is the representative group of European countries that develops sustainably, have good governance (GG) and have high values for both GDP and HL.

Cluster 3 comprises 8 countries (Bulgaria, Croatia, Greece, Hungary, Lithuania, Poland, Slovak Republic), with the lowest average level for GG and GDP, and modest average values for the other indicators. This is a representative cluster of countries with medium level of resources which do not have the possibility to improve very much their status of environmental and social aspects.

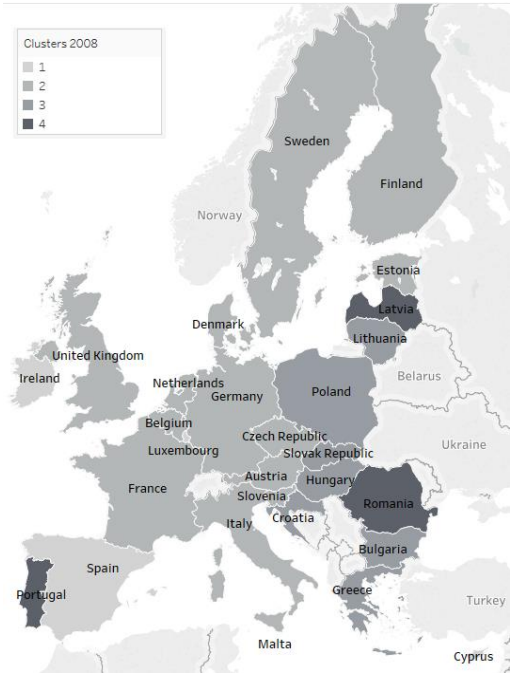

Figure no. 7. Grouping of EU countries in clusters in 2008
Source: authors' processing

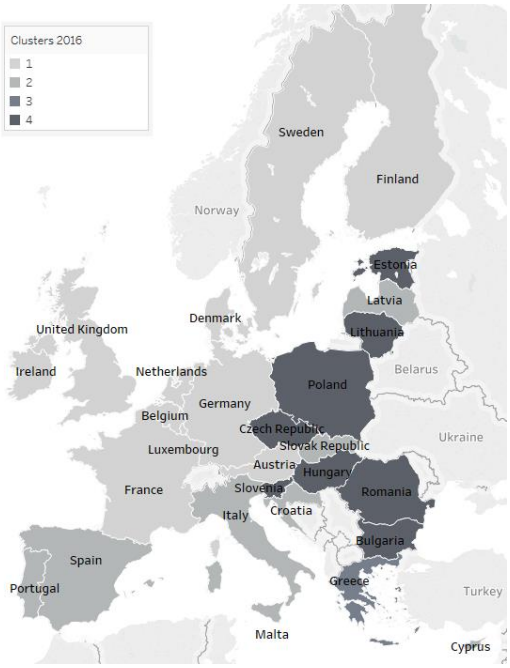

Figure no. 8. Grouping of EU countries in clusters in 2016
Source: authors' processing

Cluster 4 consists of 3 countries (Latvia, Portugal, Romania) with the highest level for EnW and PG, but the minimum level for GS and low average values for GG and GDP. In these countries, low levels of economic performance and governance do not condition the level of the environment, especially due to the high availability of natural resources. On the other hand, a low level of GDP could determine a negative impact of activities such as industry or services on the environment.

Concerning the cluster solution in 2016 compared to 2008, cluster structure changes significantly and more homogeneous clusters are emerging. Cluster 1 consists of 13 countries (Ireland, Luxembourg, Austria, Belgium, Denmark, Finland, France, Germany, Malta, Netherlands, Sweden and United Kingdom) with high average values for HL, GG, GDP and Empl but minimum values for EnW and PG. The orientation of many countries from the second cluster in the 2008 analysis to this first cluster in 2016 highlights a possible adaptation of post-crisis policies to stability and economic growth, with a decrease regarding the focus on the social or environmental policies.

Cluster 2 includes 8 countries (Cyprus, Spain, Italy, Croatia, Slovakia, Latvia, Portugal), characterized by very high values for EnW and very low values for Employment. This cluster is composed by a group of countries in which the values of indicators characterizing the environment is maintained (eg. Portugal or Latvia) followed by other countries that have developed sustainably but whose economies did not have the positive trend after the period of economic crisis.

Cluster 3 is consists of a single country, Greece, which has small, extreme values for Employment, GDP, GG and GS. The profound crisis which has crossed over and still crosses Greece places it distinctly in this cluster, with low values of economic and social indicators.

Cluster 4 includes 7 countries, including Romania (Czech Republic, Estonia, Slovenia, Bulgaria, Hungary, Lithuania, Poland, Romania), presents high values for GS but low and very low values for HL, GDP, EnW and GG. At the level of 2016, it can be noticed a group of Eastern European countries which have low levels regarding the economic, environmental and social indicators. The place of these countries in this cluster is explained by the difficulties that they are confruntiong with in finding a way for development in the context of new global conditions and challenges.

Based on the results of the correlation analysis, a simple linear regression model of the EnW depending on the Healthy life (positive relationship) and GDP (negative relationship) in 2008 is identified. For the year 2016, a simple linear regression model of the EnW is identified depending on the Good governance (negative relationship). If in the year 2008 the relationship between environmental quality, quality of life and GDP is fully explicable, in the year 2016 the negative relationship identified is difficult to explain from the theoretic point of view. However, good governance being especially a part of the social actions category and social policies being in a continuous relationship of compensation with environmental policies, and given the post-crisis period in which a large part of the economic and social mechanisms were the result public intervention, it can be concluded that the negative relationship between EnW and GG can be explained and fully justified.

We try to identify a regression model that explains the formation of the EnW in relation to the factors of influence identified above, based on correlation analysis, such as: HL, PG, GG, GDP and Empl.

To avoid homoscedasticity problems, the GDP variable is converted by logarithm. Selecting the independent variables in order to explain most accurately the formation of the EnW was made by using the Backward method. A simple linear regression model of the EnW depends on the GDP and, respectively, GG is identified. The results obtained are shown in Table no. 4 for the models for 2008 and table no. 5 for the models corresponding to 2016.

Table no. 4. Regression models of EnW in relation to influence factors for 2008

Model	Predictors	b_j	Std. error	$t_{computed}$	Sig	R-square	F	Sig F	DW
M1_2008	c	11.612	1.911	6.077	0.000	0.419	18.778	0.000	1.866
	ln_GDP	-0.3.850	0.888	-4.333	0.000				
M2_2008	c	6.259	0.724	8.650	0.000	0.389	16.558	0.000	2.208
	GG	-0.408	0.100	-4.069	0.000				

Source: authors' processing

Table no. 5. Regression models of EnW in relation to influence factors for 2016

Model	Predictors	b_j	Std. error	$t_{computed}$	Sig	R-square	F	Sig F	DW
M1_2016	c	17.976	4.196	4.284	0.000	0.292 (0.000)	10.709	0.003	2.091
	ln_GDP	-6.269	1.916	-3.273	0.003				
M2_2016	c	8.386	0.982	8.538	0.000	0.410 (0.000)	18.056	0.000	2.434
	GG	-0.581	0.137	-4.249	0.000				

Source: authors' processing

All models have coefficients significantly different from zero, according to the Student test, and the models are significant overall, according to the Fisher test. Signs of regression coefficients indicate the negative relationship between EnW and GDP and GG respectively in both 2008 and 2016.

The GDP variation explains 41.9% of the EnW variation in 2008 and 29.2% in 2016. Good governance explains 38.9% of EnW training in 2008 and 41% in 2016.

Assumptions regarding regression errors are validated, according to the results of Spearman and Glejer statistical tests for the hypothesis of homoscedasticity, Durbin-Watson for the hypothesis of lack of autocorrelation of errors and, respectively, Kolmogorov-Smirnov for the hypothesis of normality.

5. CONCLUSIONS

Comparing the results obtained from the cluster analysis for the 2 years, we found out that, in time, the interests regarding the protection of the environment and the social progress became

bigger. But, the pace and modality of modifying these dimensions of sustainable development differ from one country to another. In our analysis, we highlighted the fact that overall, at EU level, these indicators have improved (with the exception of the economic downturn especially because of a major disturbing factor - the global crisis – which affected the entire European economy).

However, integrated analysis is not enough to explain the complex dynamics generated by private factors which affect each country. Using the descriptive statistics and the PCA model to highlight the status of each indicator, each country of the European Union and each of the years considered (2008 and 2016), we obtained a series of important information regarding the state of sustainable development of each country:

- Each country has a certain pattern of evolution so that the situation in a certain period does not guarantees the same levels of indicators in the next period. Factors such as the economic crisis, its own natural resources (the case of Romania), the adopted policies (the case of Denmark or Spain) and even its own achievements (Sweden) determine the place in one cluster or another, more or less favorable for sustainable development;
- Each country has some levels for social or environmental indicators and can choose to preserve or change them depending on its own options and its ability to manage the situations it confronts with;
- The quality of the environment is important for all European countries, the trend being to improve it;
- The global economic crisis has led to profound and diverse changes in the situation of the sustainable development of each country; analyzing the situation of the two periods we can see that countries which were originally in the same situation evolved, under different decision-making conditions, at different states of the development level.

The analysis of the relationship between the quality of the environment and the various indicators which form the economic and social dimensions of development highlights correlations which explain how the environment is promoted in each country: in 2008 a positive relationship between the EnW and the Healthy Life and a negative one between EnW and GDP; in 2016, a negative relationship, between the EnW and the Good governance.

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