



# The application of relative taxonomy to the study of disproportions in the area of sustainable development of the European Union



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## ABSTRACT

The aim of this paper is a comparative analysis of the disparities between EU Member States regarding the uniformity of the observed changes in the field of sustainable development. In order to fulfil the purpose the relatively dynamic taxonomy has been applied. In the work the key indicators of the Sustainable Development analysis have been used. Application of relative measures enabled to assess the situation of a given country in relation to all other countries. According to the research relatively high levels of dis-proportionality between the EU Member States in the field of sustainable development can be observed. Surprisingly the greatest deterioration was observed between Southern European countries and not as could be expected between Western and Northern ones. The leaders throughout the period of analysis were the Netherlands and France, which clearly stood out in favor of the other countries. The least favorable positions were taken by Malta and Bulgaria, which were at the end of the all rankings. The results obtained can be utilized in subsequent years to examine the directions of change observed both from the point of view of individual EU Member States and geographical regions of Europe in the area of sustainable development.

## 1. Introduction

The concept of sustainable development was first formulated explicitly during the Third UNEP Program in 1975. Sustainable development was then defined as “ (...) such a course of inevitable and desirable economic development that would not materially and irreversibly affect the human environment and would not lead to the degradation of the biosphere and would not undermine the laws of nature, economics and culture” (UN, 1975). Importantly, the inclusion of economic issues in this definition has become the basis for formulating a broader concept of sustainable development. In the Brundtland Briefing Report of the World Commission on Environment and Development UN in 1987, sustainable development was defined as “sustainable development to meet current needs without the risk that future generations will not be able to meet their needs” (WCED, 1987).

Such an understanding of sustainable development, often

considered to be classic and invariably up to date, indicates the need for a consensus between the three dimensions of social, environmental, and economic functioning. It is recognized that the appearance of the Brundtland report has brought about a significant change in the perception of the concept of sustainable development, namely the transition from the concept of “physical development” to a socio-economic model of sustainable development (Pezzey, 1992; Adams, 2009).

Evolving the concept of sustainable development and establishing it as a global trend has been achieved through the United Nations Conference on Environment and Development held in Rio de Janeiro in 1992 (the so-called Earth Summit), during which government representatives from 170 countries declared support for the idea of environmentally sound and natural economic development. The key role in the evolution of sustainable development is attributed to two more conferences: the Johannesburg Conference (2002) and the Rio Conference (2012), (Moomaw et al., 2017; 2).

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The realization of important international commitments on sustainable development in different regions of the world and countries varies in intensity (Meadowcroft, 2000). The European Union, which is an economic and political partnership of 28 European countries, is one of the leaders in implementing this concept, both at the level of state policy and in practice.

The EU's long-term Sustainable Development Strategy is the main tool for setting the EU's specific goals and actions. EU priorities and objectives are also included in many other EU strategic documents (i.e. EU, 2001, 2004, 2017; Eurostat, 2015; UN, 2015). Apart from the EU Sustainable Development Strategy, this topic was one of the leading areas of The Lisbon Strategy (EU, 2007a; Berger and Zwirner, 2008) and the Europe 2020 Strategy (EU, 2007b). The latter document is a program of economic and social development of the European Union (EU) for the years 2010–2020, to meet the challenges of globalization, the aging of societies and the growing need for the rational use of resources.

Sustainable development is the subject of many different papers published on various disciplines for many years. A list of publications related to this subject available in the Web of Science was presented by Zhu and Hua in 2017, who identified nearly 60,000 records (analyzed 1987–2015) on various areas of sustainable development. As many as 149 different research areas have been identified by researchers from nearly 50 countries around the world. Most publications in this area were published by authors from the People's Republic of China (11,718), the United States (8839), the United Kingdom (4905), Australia (2976) and Germany (2958). The greatest level of interest in the area of sustainable development has been noted over the past 10 years. Between 2012–2015 more than six thousand publications on various areas of sustainable development appeared. Such great interest in this subject proves the growing importance of sustainable development in different areas of human life. In spite of the existence of discussions on the interpretation of sustainability (Shearman, 1990; Harris, 2000; Connelly and Graham, 2003; Dryzek, 2005; Zidanšek, 2007; Glavic and Lukman, 2007; Waas et al., 2011), the concept of sustainable development has acquired a global cultural and social dimension. In mainstream thinking about sustainable development, the dominant belief is that it is a reformist concept and is essentially coherent in formulating its proposals (Ioppolo et al., 2016). Attempts to adapt to the existing economic order and political actions do not alter its principles or practices. Its essence consists in combining two concepts: “sustainability” and “development”, in order to jointly and simultaneously solve the conflict between a sustainable growth economy and the maintenance of a high quality planetary environment (Redclift, 1997).

Many attempts at setting semantic boundaries for the notion of sustainable development have taken the form of indexing, that is, the establishment of definitions, in numerous cases with a default character (Brown et al., 1987; Goodland, 1995; Hopwood et al., 2005; Moomaw et al., 2017; Liu et al., 2017). Establishing sustainable development indicators is justified and necessary (Arbolino et al., 2017). The basic premise is that it allows diagnosis of the present state and evaluation of changes over time. Indicators at the global level have been developed for many years by: the United Nations Sustainable Development Commission, the OECD Environmental Policy Committee and the European Commission (Duran et al., 2015; Youn et al., 2017; Klopp and Petretta, 2017).

One of the key areas for research into sustainable development is the measurement which includes, among others, the identification of indicators, e.g. for different spatial units (countries, regions, cities, etc.) (Haberl et al., 2004; Gillis et al., 2015; Belletti et al., 2015; Ioppolo et al., 2016; Kharrazi et al., 2016; Manzhynski et al., 2016) or different thematic areas (transport, socio-economic development, climate change), (Böhringer and Jochem, 2007; Moran et al., 2008; Monni and Spaventa, 2013) and analyses conducted in different spatial (Lombardi and Brandon, 2005) or temporal (Parris and Kates, 2003; Palme and Tillman, 2008) systems. Analyses of changes in indicators describing

sustainability are mainly focused on assessing their conformity with the objectives indicated in strategic documents such as those of the European Union. However, most of those analyses mainly focus on assessing the conformity with the objectives indicated in strategic documents such as those of the European Union. It is hardly to find analyses which aim to evaluate the uniformity of the observed changes, for example with respect to different spatial systems, and the homogeneity of changes in selected time periods (Liu et al., 2017).

Therefore, the aim of this paper is a comparative analysis of the disparities between EU Member States in the field of sustainable development. Relatively dynamic taxonomy has been used to study the spatial diversity of the EU's sustainable development. In the literature, the most commonly for this purpose is used the linear approach. The basic shortcoming of linear approaches, however, is the difficulty in interpreting the distance between objects, whose positions in the ranking are determined on the basis of well-defined synthetic measures. Greater opportunities in this field gives the relative approach used at this paper, according to which, for example, to determine the position of the country to other not only information about its level of development, but also about all the other countries to which it is compared is required. In the proposed approach it is also possible to analyze the scale of disproportions between the analyzed features in a dynamic perspective. This allows to trace e.g. the process of leveling them down over time.

The information base of the study was the lead indicators used by the European Union to monitor the achievement of the objectives of the major Sustainable Development Strategies. The results of the study are presented both to individual EU Member States and geographical regions of Europe (Western, Eastern, Northern and Southern Europe). Data spanning the period 2009–2015 was analyzed.

The paper is organized as follows: the second part describes the statistical materials, including indicators description, which were utilize in the analysis. The following part presents the stages of the applied method. The next part of the paper presents study results which were divided into two topics: results of EU Member States' ranking in the field of sustainable development and uniformity of the balanced development of the European Union. The final part of the article put forward conclusions and discussions. In this part the study results introduced in this paper with other analysis in the field of sustainable development have been compared.

## 2. Statistical materials

The analyses presented in the paper utilize information on the indicators used to monitor the implementation of the objectives of the EU Sustainable Development Strategy (Eurostat, 2015) published by Eurostat. These Sustainable Development Indicators (SDIs) have a hierarchical structure that reflects the three levels. At the top there are 11 so-called headline indicators. Level two (lower) represent 31 operational indicators, while the third (lowest) level includes 84 indicators describing actions that detail the indicators. There is also information about the so-called contextual indicators that are not used directly for measuring sustainability, but can be used as background for the research.

In the work to study the relative disparities in development between the EU Member States in the field of sustainable development, the main (leading) indicators, which monitor the general objectives of the key challenges of the Sustainable Development Strategy, have been used. The analysis covered 12 indicators describing 8 thematic areas of sustainable development collected for 28 EU Member States. The analysis does not take into account Area 10 – Good governance, which has no lead indicator, and the indicator of natural resources (common bird species) that are available only in some EU Member States in the Eurostat database. It was decided that due to the collapse of many of the observed trends in the 2007–2008 crisis, the first period to be included in the study will be 2009. In addition, due to the gaps in country-

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