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Multiple criteria analysis of environmental sustainability and quality of life in post-Soviet states

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ABSTRACT

This article deliberates the achievements and trends relevant to environmental sustainability—Ecological Footprint (EF) and the Environmental Performance Index (EPI)—and Quality of Life Index (QLI) in 15 republics of the former USSR over the past 25 years, which have been in constant flux globally. This comparative research additionally includes nine nearby European and four Asian countries. Studies have shown that the environmental sustainability and quality of life of these countries depend on various macroeconomic, values-based, human development and well-being factors. The aggregations of analyzed data from the framework of variables were from World Bank, Country Economy and other databases, which this article details. The method applied is the Degree of Project Utility and Investment Value Assessments (INVAR). The INVAR method provided new opportunities for performing the multicriteria analysis on environmental sustainability and the quality of life. Over the course of the research, there were strong correlations established between the EPI, EF and QLI indicators on one side and the macroeconomic, values-based, human development and well-being factors from the other side.

1. Introduction

Twenty-five years ago, on December 8, 1991, the top officials of Russia, Ukraine and Belarus signed the so-called Belavezha Accords dissolving the Soviet Union. How did the environmental sustainability and quality of life performance of the post-Soviet states and their neighbors change over the past 25 years? Many diverse forces drive the environmental sustainability and quality of life dynamics of the post-Soviet states making every feature unique and multifaceted.

The purpose of this research was to analyze the trends in 15 post-Soviet states (Russia, Ukraine, Belarus, Uzbekistan, Kazakhstan, Georgia, Azerbaijan, Lithuania, Moldova, Latvia, Kyrgyzstan, Tajikistan, Turkmenistan, Armenia and Estonia) and their neighbors between 1991 and 2016 and to assess their diverse development routes in environmental sustainability and quality of life. This research not only includes an analysis of 15 post-Soviet republics but also the nearby nine European countries surrounding them (Germany, France, UK, Italy, Spain, Denmark, Norway, Sweden and Finland) and four Asian countries (China, Iran, Iraq and India). The supplementary countries were incorporated into this comparative research to be able to ascertain whether the post-Soviet republics are advancing in the area of environmental sustainability and quality of life in comparison to other countries in the region. In other words, this research explores whether the advancements by the post-Soviet states in environmental sustainability and quality of life are greater or lesser in comparison with the worldwide and regional country averages.

The basis for the explanation of the main trends of environmental sustainability and quality of life (Ecological Footprint (EF), Environmental Performance Index (EPI) and Quality of Life Index (QLI)) consists of a system of integrated, most frequently used sustainability indicators.

Integrated efforts to secure economic growth, human development and well-being, values-based, environmental sustainability and quality of life have become the focus for many researchers and practitioners around the world (Frugoli et al., 2015; García-Sánchez et al., 2015; Iddrisu and Bhattacharyya, 2015; Luzzati and Gucciardi, 2015; das Neves Almeida and García-Sánchez, 2016; Liu et al., 2016; Cook et al., 2017; Dias, 2017; Environmental Performance Index, 2017; Numbeo,

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2017; Redefining Progress, 2017; Simas et al., 2017). Developments of certain key sustainable indicators have been adopted worldwide involving a country performance assessment with special emphasis on national environmental sustainability and quality of life. These indicators are the macroeconomic ranking (Roaf et al., 2014), the Human development index (HDX, 2015; United Nations Development, 2015), the Quality of life index (Numbeo, 2017), the Environmental performance index (EPI, 2017), the Worldwide governance indicators (Kaufmann et al., 2007), the Social progress index (Stern et al., 2016), the Genuine progress indicator (Redefining Progress, 2017) and the Good country index (Good Country, 2017), etc. These assessment systems and frameworks for country environmental sustainability and quality of life along with a respective country's quality of life typically contain an integrated system of quantitative and qualitative criteria with their units, values and significances. The indicators presented in the Table 1 constitute the traditionally used sustainability indicators for country performance, environmental sustainability and a country's quality of life assessment. Table 1 shows that numerous scholars presented as the research resources deliberated environmental sustainability and quality of life comprehensively by various macroeconomic, values-based, human development and well-being, environmental and quality of life aspects.

The most advanced, existing research on the environmental sustainability and quality of life of countries (see Table 1) were compared with the three innovative elements that distinguish this current study. The first innovation relates to the INVAR method. It can be applied as the foundation for developing rational micro-, meso- and macro-environments for the countries under investigation. These environments realistically affect the transformations of these countries toward an environmentally sustainable and healthy outlook. Secondly, this research adopts the INVAR method and its abilities to supplement the QLI with new functions: provision of digital recommendations for countries under analysis by the indicators under deliberation; optimization of indicators with consideration of indicators achieved in the quality of life area and establishment of the values of the indicators under deliberation permitting the country under analysis to raise its rating to a desired level. The third innovation manifests by the opportunities to improve the EF, EPI and QLI indicators with various supplemental values-based, human development and well-being indicators. The studies presented in Table 1 indicate that environmental sustainability and quality of life indices improve upon ensuring gender equality, reducing corruption and improving happiness, education and social progress.

2. Complex systems and fragmentation of countries sustainability research

Different approaches, e.g., a Multi-Scale Integrated Analysis of Societal and Ecosystem Metabolism (Giampietro and Mayumi, 1977) and different researchers (Andreoni, 2017; Ciesielska and Kołtuniak, 2017) assert that societies and countries are complex systems functioning by diverse levels. As complex systems, countries are highly diverse. For example, Bradshaw and Swain (2014) emphasized that "the former Soviet Union's centrally planned economy was a complex system, very different from the market economies of the West". Societies and countries, the same as ecosystems, climates, businesses and towns are adaptive and complex systems of self-organization, which transform and learn from their own experiences. Numerous researchers (Cilliers, 1998; Boulanger and Bréchet, 2005; Steffen et al., 2011; Phillis and Kouikoglou, 2012; Kalawsky et al., 2013) highlight the various complex systems that are quite difficult to model and to analyze. For example, in the opinion of Kalawsky et al. (2013), an attempt to learn about a huge, complex system can be very problematic. Numerous natural systems (biodiversity, air, land and water) and manmade systems (policies, economy, education and health) affect the well-being and sustainability of a state, and such systems are hard to model (Phillis and Kouikoglou, 2012). According to Steffen et al. (2011), complex systems (i.e., ecosystems or social systems) are difficult to predict. Further, Steffen et al. (2011) continue the thought, noting that high uncertainty frequently characterizes the interactions between a socio-economic system and the environment. In line with Deffner and Hoerning (2011), the tendency is to analyze social structures as gradually fragmented by breaking up the previous social, cultural, economic and political segments of a society.

Similarly, scientists such as Cilliers (1998), Miller and Scott (2007), Mitleton-Kelly (2012) also argue that complex systems are quite difficult to model and analyze. Conforming to Miller and Scott (2007), a complex adaptive system is a system in which an ideal perception of its separate components does not mechanically require an excellent knowledge of the entire system's performance. In agreement with Mitleton-Kelly (2012), complex systems are dynamic grids of interactions, and their interrelationships are not collections of separate static components; i.e., the performance of the ensemble is not forecasted by the performance of the entities". According to Cilliers (1998), several of the most significant features of complex systems are that the components interact dynamically and that such interactions are numerous. Other features include that the interactions are non-linear and that the general performance of the system of components is not predicted by the performance of the separate components. Cilliers continues that such systems may be open, and it may be impossible to describe system boundaries. These complex systems have a past and they change; their history is co-responsible for their current performance, and components in the system may be ignorant of the performance of the system in its entirety.

Research further emphasizes that the understandings of scholars about complex systems are imperfect and fragmented. There are discussions on the fragmentation of the scientific society (by Konijnendijk et al., 2007; Gond et al., 2012; Matthews and Smith, 2015; Oberlack et al., 2016; Lueg and Radlach, 2016; Schäfer and Kröger, 2016; Kania-Richmond et al., 2017; Patterson et al., 2017), industries and the built environment (Matthews and Smith, 2015), which increase research disagreements. Meanwhile Kirkby et al. (1995), Glavič and Lukman (2007), Ahi and Searcy (2013) and Missimer et al. (2017) accent the fragmentation of global research. As reported by Gond et al. (2012), studies on sustainability are fragmented relevant to definitions, perspectives and performance. While various views suggest beneficial insights, they fail to offer a clear picture of sustainable development (Gond et al., 2012). Various researches are instances of scientific fragmentation, where outcomes are not comparable due to disparities in time, geography, industry and comparative concepts (Lueg and Radlach, 2016). Schäfer and Kröger (2016) accent knowledge fragmentation, which is a common attribute of up-to-date societies. Patterson et al. (2017) bring together varied viewpoints that have, thus far, continued as mostly fragmented in order to strengthen the forthcoming studies on transformations to sustainability. Patterson et al. (2017) analyze multiple and various perspectives found in the research on transition and transformation within worldwide sustainability. Patterson et al. (2017) aspire to contribute to the multiple, at times overlapping, viewpoints in research by analyzing various views on how societal progress functions.

There is no generally accepted sustainability definition; though, various sustainability terms can be found. As reported by Ahi and Searcy (2013), the definition of "sustainability" has been understood in various ways, changing from an inter-generational philosophical opinion to a multi-dimensional definition for business management. Glavič and Lukman (2007) analyzed fifty-one chosen sustainability definitions. Conforming to Missimer et al. (2017), the massive and growing assortment of concepts, techniques and tools in the sustainability field propose a need for a structuring and harmonizing framework that would include a uniting and rational term of sustainability. In agreement with Kirkby et al. (1995), numerous researchers and practitioners indicate sustainable development by using at least 70 various terms that had been collected by 1992.