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An Updated Assessment of the OECD's Quality of Life Index

Zaktualizowana ocena Indeksu Jakości Życia OECD

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Abstract

Indexing for measuring the quality of life have been developed by various countries or organizations. Probably the most comprehensive among these indexes is the *Better Life Index*, which is developed by OECD. The sampling of the study consists of 34 countries that are the members of OECD, and two countries that are not members of OECD. The data are obtained from the 2017 criteria of OECD life index. In this way, the welfare levels of the countries were compared through the 11 life index criteria defined by OECD. In the study, correlation and regression analyses were performed to reveal the relationships between the OECD life criteria and to measure the degree of these relationships. Thus, it was attempted to demonstrate to what extent the index criteria, particularly the safety criterion, affect a society's quality of life. When we evaluate these analyses in general sense, it was observed that there is a significant and positive relationship between the safety criterion and other parameters. However, a negative relationship between the safety and the satisfaction criteria was found according to another result of the analyses. This is because of the fact that, after a certain threshold level, an individual won't have a positive attitude towards the interventions to the living space.

Key words: quality of life, OECD, Better Life Index, security, social welfare, sustainability, socio-cultural factors

Streszczenie

Metody indeksowania danych w celu zmierzenia poziomu jakości życia są rozwijane przez wiele krajów i organizacji. Prawdopodobnie najbardziej obszernym z tych indeksów jest *Better Life Index*, opracowany przez OECD. W przypadku tego artykułu dane odnoszą się do 36 krajów, z których 34 należy do OECD, a pochodzą one z OECD Life Index z 2017 r. Poziomy dobrostanu w poszczególnych krajach zestawiono z 11 kryteriami określonymi przez OECD. Przeprowadzono analizy korelacji i regresji, aby wykazać powiązania pomiędzy kryteriami OECD Life i aby określić ich zakres. Umożliwiło to wykazanie w jakim zakresie kryteria indeksowania, w szczególności kryterium bezpieczeństwa, wpływają na jakość życia społecznego. Z ogólnej perspektywy można dostrzec istnienie znaczącego i pozytywnego związku pomiędzy kryterium bezpieczeństwa a innymi parametrami. Jednocześnie zauważono występowanie zależności negatywnej pomiędzy bezpieczeństwem a kryterium zadowolenia. Uwarunkowane jest to istnieniem pewnego poziomu progowego, powyżej którego jednostka nie będzie miała pozytywnego nastawienia do ingerowania w przestrzeń życiową.

Słowa kluczowe: jakość życia, OECD, Indeks Lepszego Życia, bezpieczeństwo, społeczny dobrostan, zrównoważoność, czynniki społeczno-kulturowe

1. Introduction

Quality of life is a concept, which is difficult to identify and assess. It may have numerous personal and

social dimensions, because the human's desire for a better life is not only related to his/her current status. As the human being is a social being due to

his/her nature, this situation prompts him/her to try to be better among the other members of the society (Headey et al., 1991). So much so that, the motivations of achieving a quality life and being in the forefront will bring about a kind of competition among the people. For this reason, in order to be able to talk about a quality life, a data variation in which all the physical, social and cultural characteristics of a person can be measured, is required (Evans et al., 1991; Forette, 2000; Greenwood, 2004).

In this sense, the basic concepts that determine the quality of life, are influenced by a number of factors, such as the threshold of the social rights, access to the information, number of days on leave, quality of the environment, working conditions, safety, justice, and the threshold of the freedoms, in addition to the economy. The quality of life, with this side, emerges as a concept based on individual, social, public and social welfare in addition to its economical side (Gregory et al., 2009; Jackson, 1996; Wish, 1986). Within the scope of this understanding, indexes have been developed with the aim of measuring the quality of life by various countries and international organizations taking all the above-mentioned factors into account. Perhaps, the most comprehensive one among these indexes is the *Better Life Index*, which was developed by OECD. This index tries to measure the quality of life in the most accurate way by including numerous different variables in the calculation, together with the variable of national income. The index consists of 11 different criteria. Perhaps, the most important among these criteria is safety, which is essential for an individual. The safety criterion is an inalienable element in measuring the quality of life both individually and socially.

This study attempts to demonstrate to what extent the quality of life criteria, particularly the safety criterion, which were developed by OECD, affect a society's quality of life. After the literature review in the second chapter, the third chapter presents information about the method of the study. In the fourth chapter, an analysis is performed according to the OECD data. The fifth, which is the final chapter, is the conclusion part in which the findings are interpreted and discussed.

2. Literature Review: Conceptual and Theoretical Framework

Life or existence is defined as the living organisms' ability to sustain their vital forms, to physically and chemically interact with each other, to adopt to the environment by reproducing, and to be active and produce throughout their lives (Headey et al, 1991; Ryle, 1949; WHO, 1998). The term quality refers to the qualifications and the values of services, products, or *things* when compared to their similar (Hinton, 1994). The term quality of life, which is the combination of these words, is defined as physical,

mental and social well-being or not having any disease. According to other definitions, the quality of life is explained as welfare, individuals' proving themselves, low unemployment, psychological and biological well-being (Phelan, 2012), having high Gross National Product (GNP), living in a democratic environment (country), understanding the meaning of existence, having comfort (Felce and Perry, 1995), technology acquisition, increasing the productivity (Jackson, 1996) and living in good conditions (Cummins, 1997). Hence, it can be seen that it is difficult to reach to a generally acceptable definition of quality of life. However, in general, the quality of life is explained as the point or the level of an individual's satisfaction in his/her living space, during his/her life cycle (Chochinov, 2002; Gasper, 2010).

On the other hand, the role of public spending in the quality of life is an indisputable reality. It is because of the fact that, many services (health, education, safety, and etc.) related to living spaces of the people are provided by the public sector (Bealey and Johnson, 1999; Kagawa et al, 2010). For example, the government of the time in the US established *social security institutions* to support the elderly, the poor, and those in need of assistance, in order to eliminate the adverse effects of the economic crisis of 1929, within the context of the *New Deal Plan* (1930). In addition, starting from the 1960s, new regulations have been put in place to increase the quality of life in US society. For instance, transforming the markets to the form that is suitable for the use of disabled customers, providing safe products for consumers, improving working conditions, low-term housing loans, and incentive policies for specific economic areas are some of these regulations (Bishop, 2004; McConnell, et al., 2011; Stevens, 2011). Therefore, as Milton Friedman stated 45 years ago, *the rules of the game are now developed and become established with the increased economic prosperity. This situation has caused people to expect much more from the state* in today's societies. As the result, in addition to the economic (monetary) factors, the social, environmental and political activities also play important role in determining the quality of life (Leisinger, 2009; OECD, 2017).

Campbell and Shin and Johnson, who are known for their studies in this field, examined the well-being elements that determine the quality of life under the topics of: family life, friendship, work, neighborhood relations, housing, living in a city or town, health, personality, education and national concerns (Campbell, 1981; Shin and Johnson, 1978). Lehman added the elements such as mental health, safety, religious concerns, living conditions, leisure activities, and the concerns regarding business and finance to these concepts. Additionally, Keith listed the seven impact factors in the current literature as material well-being, emotional well-being, productivity, inti-

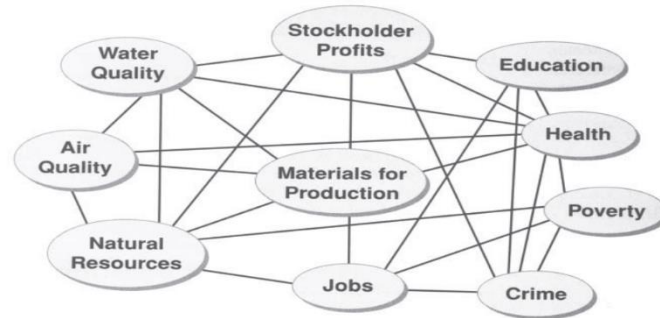


Figure 1. Community as a web of relations among spheres (Hart, 1999)

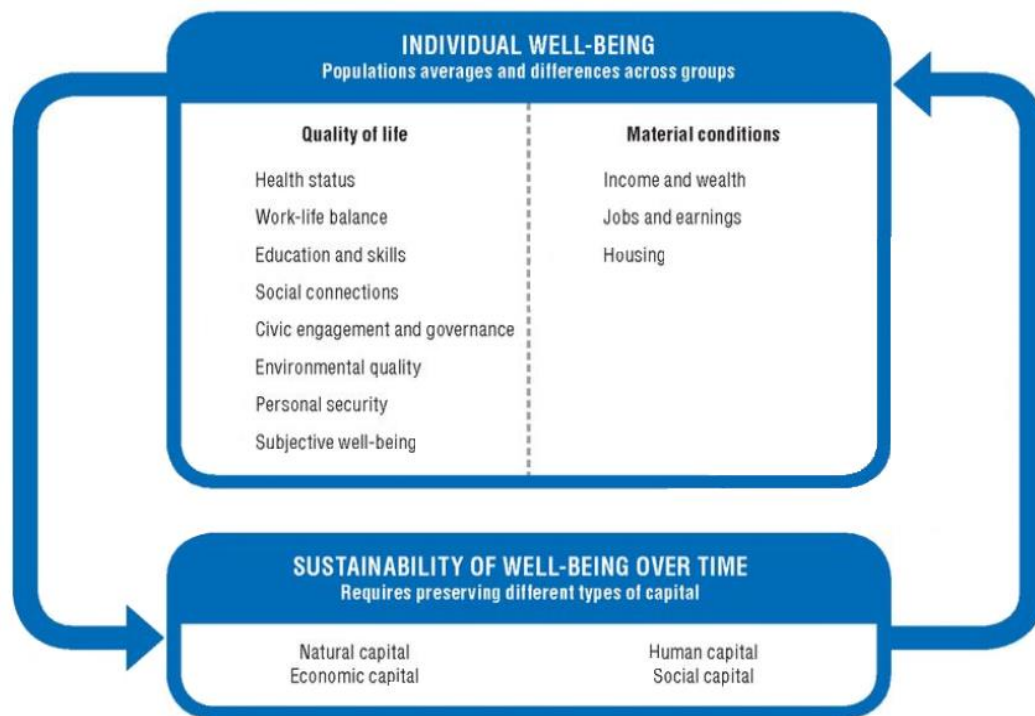


Figure 2. The OECD well-being conceptual framework (OECD, 2013)

macy, safety, community and health (Keith, 1990; Lehman, 1988; Strada, 2011).

Hart examined the main factors that create well-being under three topics as economic, social and environmental factors (Fig.1) (Hart, 1999). The **environmental factors** that create well-being in the traditional presentation of Hart consists of natural resource management, and the quality of air and water. The **economic factors** represents the production and national wealth; additionally, it explains the quality of life by the level of the income per capita. Whereas the **social elements** are discussed under the topics of education, health, poverty and crime rates. Today, factors such as pollution, use of toxic materials, percentage of recycled products, ratio of renewable to nonrenewable energy are added to the **environmental structures**; factors such as growth in employment areas, working conditions, effective use of renewable resources are added to the **economic structures**; and factors such as cultural level, percentage of registered voters, infant mortality rate, percentage of in-

surance coverage, human rights are added to the **social structures**, in this classification (EC, 2014; Keith, 1990; NRC, 2002; Rapley, 2003).

Yet, the economists and social scientists has long been using the GNP (*Gross National Product*) method, which is one of the traditional approaches in measuring the prosperity level (Sen, 1993; United Nations, 1995), because it is simpler to measure the changes in wealth and well-being using the GNP data. In contrast, some researchers pointed out that it was wrong to use money and well-being as if they are the same. The researchers found that the GNP method have made the calculations easier; however, they criticized the method for being insufficient and being a roughly measuring style (Bishop, 2004; Soubbotina, 2004). Therefore, problems arising from the existence of methods such as GNP that measure well-being on monetary indicators still remain as a matter of criticism. In the recent years, this has led to the emergence of new definitions of the well-being concept. The well-being concept was ex-

panded to include concepts of happiness and satisfaction. Thus, the benefits provided through various elements, including the contributions of the forms of sacrificing such as family, religion, human capital, donations, were added to the *benefit* function. In this way, it was possible to determine the well-being and the quality of life more accurately (Graham, 2008; Hagerty, 1999; NRC, 2002; Rapley, 2003).

Similarly, it has been observed that, various index types such as the *United Nations' Human Development Index* and the *Estes's Index of Social Progress* used in the United States of America are included in this context in addition to GNP. The existing methods have been measuring and describing the quality of life through economic growth, in other words, through the increase in the national income (GNP). According to this, while the increase in the national income accelerates the quality of life, the decrease in the national income causes an opposite effect. The existence of these kind of problems made it essential to develop new and rational measurement techniques that are in accordance with the conditions of the day and that involve economic, social and environmental factors. In the direction of this necessity, a new method of measuring the status of well-being under the name of *Better Life Index* was developed by the OECD (Andrews and Withey, 1976; Gregory et al., 2009; Kagawa et al., 2010; Rabkin et al., 2000).

With this measurement method, the OECD suggests that development-based definitions of quality of life are required rather than the growth-oriented definitions. Because, while, the economic growth includes measurable quantities in the form of the increase in national income, the economic development takes socio-cultural factors into account as well as the increase in the national income (Gregory et al., 2009; Jacobs, 1991). In other words, while the **economic factors** of development are focused on industry, technology, capital accumulation and employment linkage, **socio-cultural factors** include other aspects of human well-being such as education, health, culture, environment and civic engagement. In this way, in order to reach a broad-based quality of life concept, the attention was drawn to the necessity of social sustainability definitions in addition to the financial elements (Kagawa et al., 2010; OECD, 2013; Wood-Dauphinee, 1999).

The report of The Commission on the Measurement of Economic Performance and Social Progress, which is also known as the Stiglitz-Sen-Fitoussi Commission, has great importance in establishing the Index. The Commission, under the leadership of Joseph Stiglitz, Amartya Sen and Jean-Paul, listed the criteria that have effects on well-being under eight topics according to different types of needs. These include: Material living standards (income, consumption and wealth) (ii) Health (iii) Education (iv) Personal activities including work (v) Political voice and governance (vi) Social connections and relationships (vii) Environment (present and future

conditions) (viii) Insecurity, of an economic as well as a physical nature (Anderson, 2015; Stiglitz et al., 2009).

The welfare levels of 34 OECD countries and the changes occurring in these levels are measured and assessed in terms of *index score* by the abovementioned method of OECD for measuring the well-being. The index consists of 11 basic criteria. These are: income and wealth, proper business, housing, health, education, work life balance, civic engagement and good governance, social connections, environment, safety, subjective well-being (OECD, 2013; OECD, 2017). Thus, the inclusion of elements such as education, environment, health, housing, working hours into the calculation of well-being (Anderson, 2015) makes it possible to evaluate the quality of life more thoroughly. Also Russia and Brazil which are not OECD member countries, was included in the table in order to do comparison, within the scope of the index (OECD, 2017; WHO, 1997).

In this context, current and future welfare are separated from each other (Figure 2). Current welfare consists of (i) material living conditions and (ii) quality of life. Future well-being consists of natural capital, economic capital, human capital and social capital, as can be seen at the bottom of the figure. The sustainability of quality of life varies depending on the continuity of the capital accumulation. Income, jobs and housing are on the right side of the column within the context of the material conditions. **Income**, which is one of the most basic indicators, is overall of the economic assets that help to finance the needs and demands of the individuals. Because income and wealth are the most basic means for counteraction against the risks that individuals may face in life. Having good **jobs and earnings** increase the well-being levels of individuals. Having a **housing** in healthy conditions does not only make it possible for a person to have a good life, but also helps him/her to feel better (OECD, 2008a, 2017).

In the quality of life part, which is on the left side of the column, the **health factor** emerges as one of the most basic conditions determining the quality of life. The level of health generally explains the individual's being physically, mentally and socially well (Bowling, 2004; Welford, 1983). **Work-life balance**, refers to the ability to establish a balance between work life and private life as well as being able to have an income-generating occupation (Walsh, 2013). **Education and skills** explain they are the basic opportunities and needs for all individuals and this situation has an impact on the quality of life (Edgerton et al, 2012). The impact of the communication of the members of a society among each other on the well-being is explored through **social connections** (Kahneman et al, 1999). **Civic engagement** means people's having a say in political decisions, which shape the well-being status of the community **and governance** examines the effects of implement-

ing the practices aiming to serve the citizens on the quality of life (Boarini, 2015). *Environmental quality*, is extremely important in terms of the continuity of a range of activities, such as human health in particular, raising children and social life (Burger, 2003). *Personal security*, expresses that living in a safe environment is regarded as the guarantee of the existence of the people, together with a higher quality of life level. The crime rate in the areas, where the people live, has a determining effect on the quality of life. Finally, regarding the terms of *subjective well-being or life satisfaction*; besides objective aspects of living conditions and quality of life, it is crucial to consider how people feel about their life and experience. In other words, it is about to what extent the individuals enjoy from their lives (Lucas, 2008; OECD, 2013).

All of the 11 criteria by OECD, which are described above, are composed of the titles that can universally be accepted by all societies. However, there are critics regarding the fact that there are significant differences in terms of earnings and wealth between rich and poor countries. Moreover, there are also numerous differences due to the conditions and institutional characteristics of the countries. For example, concepts such as health, education, transportation facilities, welfare state implementations, and also governance may considerably vary from country to country (Graham, 2008). OECD officials, who respond to these criticisms, admit that there are relative differences among countries, while claiming that the index is composed of 11 very comprehensive criteria. Thus, societies can see their deficiencies or low-order areas more clearly, and can increase their quality of life by investing more in these low-order areas (OECD, 2011; OECD, 2013).

3. Material and Method

The sample of the study consists of 34 countries that are the members of OECD and two countries that are not members of OECD. The data are taken from the OECD's 2017 life index criteria (Table 1). Each one of the countries to be evaluated with the 11 criteria are scored out of 10. In this way, well-being comparisons between the countries were made on 11 life index criteria defined by OECD. Additionally, the countries with a higher quality of life level are determined based on the criteria of OECD. In particular, the relationship between the safety criterion and other variables was investigated, due to the fact that safety is the basic element that shows individual's quality of life (UN, 2013). SPSS 2.0 (Statistical Package for Social Sciences) software package was used for data analysis. In the study, correlation and regression analysis were applied to reveal the relationships of the OECD criteria between each other and measure the degree of these relationships. Thus, it was tried to put forward to what extent the index

criteria, especially the safety criterion, affect a society's quality of life.

4. Findings

Accordingly, the highest coefficient in the housing criterion belongs to the USA and Canada. While, the country with the highest score is the USA in income ranking according to the OECD data, whereas the countries with the lowest index scores are Turkey and Mexico. While, Iceland, Switzerland and Norway have the highest index scores in terms of jobs, Greece and Spain are the countries with the lowest index scores. Ireland is in the first place in terms of social and personal relationships or the perceptions of communication. In education, the country with the highest score is Finland, and the country with the lowest score is Mexico. Sweden is the most sensitive country to the environment. On the contrary, Mexico and Turkey are the last countries in terms of environmental sensitivity. While civic engagement is extremely important in Australia, inadequate civic engagement remains as a problem for the societies in Chile, Estonia and Israel (Diener, 1984). It is very important for a person to get a quality health care service physically, psychologically and socially, in order to be able to continue a good life (Nar, 2014). While the countries with the highest health scores are Canada and New Zealand, the countries with the lowest health scores are Hungary and Estonia. Countries with the highest scores for life satisfaction are Denmark, Iceland, Switzerland and Norway. This development in Scandinavian countries can be explained by (a) high level of equity, (b) low patronage and corruption levels, and (c) providing country resources to each individual without any discrimination, within the context of well-being programs. On the contrary, life satisfaction level is extremely low in countries such as Greece, Hungary and Portugal. While Japan is the safest OECD country, Mexico is OECD country which has the lowest safety level (OECD, 2017).

Brazil, which is not an OECD member, has the lowest safety level and is a very risky country in terms of being available for traveling (Romer, 2011). Work-Life Balance is measured by comparing one's working life (working hours, working conditions) and the free time that he/she reserve for his/her wife/husband and children (Adams et al., 1996). It is aimed to establish a healthy and consistent balance of work and life with this method. While the countries with the highest work-life balance are Denmark and Spain, the countries with the lowest scores are Turkey and Mexico, respectively. Therefore, the *Better Life Index*, in which many index parameters from education to environment, from communication to civic engagement are evaluated together, has a significant advantage in welfare measurement methods with this aspect. Thus, at this type of index,

Table 1. Better Life Index Criteria of OECD According to the Countries (OECD, 2017)

| COUNTRIES | Housing | Income | Jobs | Communi-ty | Education | Environ-ment | Civic En-gagement | Health | Life Sa-tisfaction | Safety | Work Life Balance |
|--------------------|---------|--------|------|------------|-----------|--------------|-------------------|--------|--------------------|--------|-------------------|
| Australia | 7.6 | 4.9 | 8.3 | 8.2 | 8.1 | 8.6 | 9.5 | 9.2 | 9.2 | 9.6 | 5.2 |
| Austria | 5.8 | 5.0 | 8.2 | 7.1 | 6.7 | 7.2 | 5.6 | 7.4 | 8.0 | 9.1 | 6.0 |
| Belgium | 7.3 | 5.9 | 7.0 | 9.2 | 7.4 | 7.1 | 5.9 | 7.7 | 7.6 | 7.5 | 8.8 |
| Canada | 7.8 | 5.7 | 7.9 | 8.0 | 7.7 | 8.5 | 5.8 | 9.3 | 9.3 | 9.8 | 6.1 |
| Chile | 3.7 | 1.2 | 5.8 | 5.6 | 3.4 | 2.0 | 0.0 | 5.8 | 7.2 | 6.8 | 5.0 |
| Czech Republic | 4.6 | 1.8 | 6.0 | 5.1 | 7.8 | 7.6 | 3.7 | 5.6 | 6.3 | 9.2 | 7.1 |
| Denmark | 6.2 | 4.0 | 8.0 | 9.5 | 7.8 | 8.8 | 7.0 | 7.3 | 10 | 8.9 | 9.8 |
| Estonia | 4.4 | 0.9 | 5.7 | 7.1 | 7.9 | 7.8 | 2.3 | 4.4 | 2.9 | 7.3 | 7.4 |
| Finland | 6.3 | 3.5 | 7.0 | 9.4 | 9.1 | 8.8 | 5.9 | 6.9 | 9.6 | 9.3 | 7.4 |
| France | 6.4 | 5.0 | 6.4 | 6.2 | 5.7 | 7.8 | 4.3 | 7.7 | 6.2 | 8.4 | 7.6 |
| Germany | 6.3 | 5.3 | 8.1 | 8.9 | 7.9 | 8.8 | 3.9 | 7.1 | 8.1 | 9.0 | 8.0 |
| Greece | 3.8 | 1.9 | 1.5 | 4.5 | 6.0 | 4.2 | 4.0 | 7.7 | 0.0 | 8.7 | 7.1 |
| Hungary | 3.8 | 1.3 | 4.8 | 6.2 | 6.6 | 6.7 | 4.5 | 4.2 | 0.6 | 8.8 | 7.7 |
| Iceland | 5.9 | 3.6 | 9.5 | 9.8 | 7.3 | 8.9 | 5.3 | 8.8 | 10 | 9.4 | 5.8 |
| Ireland | 7.3 | 3.3 | 6.2 | 10.0 | 6.9 | 7.4 | 6.1 | 8.5 | 8.2 | 9.3 | 7.9 |
| Israel | 4.2 | 3.8 | 6.6 | 6.1 | 5.4 | 4.9 | 2.4 | 8.7 | 9.6 | 7.4 | 5.1 |
| Italy | 5.1 | 4.4 | 5.2 | 7.2 | 4.9 | 5.2 | 4.5 | 7.7 | 4.6 | 8.4 | 7.5 |
| Japan | 4.9 | 5.6 | 7.7 | 6.8 | 7.7 | 6.5 | 3.2 | 5.0 | 4.2 | 10 | 5.1 |
| Korea | 5.9 | 2.3 | 7.3 | 0.0 | 7.9 | 4.8 | 7.4 | 4.7 | 3.8 | 9.5 | 5.0 |
| Luxembourg | 6.2 | 6.5 | 8.2 | 6.3 | 5.0 | 8.2 | 6.9 | 7.9 | 7.8 | 8.7 | 7.8 |
| Mexico | 3.7 | 0.4 | 5.5 | 1.8 | 0.5 | 3.5 | 5.3 | 4.7 | 7.0 | 0.4 | 2.4 |
| Netherlands | 6.9 | 5.3 | 8.2 | 7.6 | 7.6 | 6.5 | 5.1 | 8.0 | 9.3 | 8.3 | 8.8 |
| New Zealand | 6.6 | 2.1 | 7.5 | 9.1 | 7.0 | 8.8 | 7.5 | 9.3 | 9.3 | 9.4 | 6.1 |
| Norway | 7.7 | 4.0 | 9.0 | 8.9 | 7.1 | 8.7 | 6.5 | 8.2 | 9.8 | 9.1 | 8.7 |
| Poland | 3.5 | 1.3 | 4.9 | 7.9 | 8.3 | 4.5 | 5.3 | 5.0 | 3.6 | 9.8 | 5.6 |
| Portugal | 6.6 | 2.5 | 4.1 | 5.6 | 4.3 | 7.5 | 3.4 | 5.3 | 1.3 | 7.9 | 6.7 |
| Slovak Republic | 4.1 | 1.5 | 4.3 | 7.5 | 6.1 | 7.6 | 3.6 | 5.3 | 5.0 | 9.1 | 7.1 |
| Slovenia | 5.8 | 2.2 | 5.9 | 7.2 | 7.6 | 6.7 | 4.6 | 6.8 | 3.4 | 8.8 | 6.6 |
| Spain | 6.8 | 2.9 | 2.4 | 9.3 | 5.2 | 4.9 | 5.0 | 8.2 | 6.2 | 8.7 | 9.3 |
| Sweden | 6.3 | 5.0 | 7.6 | 8.3 | 7.9 | 9.6 | 8.8 | 8.7 | 9.0 | 8.3 | 8.1 |
| Switzerland | 6.3 | 7.3 | 9.4 | 9.8 | 7.5 | 8.4 | 3.4 | 9.1 | 9.9 | 8.7 | 7.2 |
| Turkey | 2.2 | 0.6 | 3.8 | 5.7 | 2.7 | 2.2 | 6.2 | 4.9 | 3.0 | 8.2 | 0.0 |
| United Kingdom | 6.0 | 4.9 | 7.4 | 7.8 | 6.0 | 8.4 | 6.9 | 7.8 | 7.3 | 9.7 | 6.1 |
| United States | 7.8 | 10.0 | 8.1 | 7.4 | 7.0 | 7.3 | 5.4 | 8.1 | 8.7 | 8.9 | 5.3 |
| NON-OECD COUNTRIES | | | | | | | | | | | |
| Brazil | 4.2 | 0.1 | 5.8 | 7.2 | 1.8 | 5.8 | 4.4 | 4.6 | 8.1 | 2.2 | 6.7 |
| Russian Federation | 3.3 | 1.2 | 6.3 | 7.4 | 6.2 | 4.3 | 2.1 | 0.6 | 4.7 | 6.5 | 7.9 |

where the quality of life is exhibited with all directions, it is also possible to make the current analyzes in a more clear and correct way (Barcaccia et al., 2013; Fine, 2010; Herzberg et al, 1993; OECD, 2017).

For example, in Mexico, *income* and *safety* scores are extremely low and it has 0.4 points out of 10 when the data are analyzed. Visiting the streets of Mexico is a problem when the data about the safety of this country is taken into consideration. However, this country has a very high level of life satisfaction score such as 7 out of 10. This indicates that Mexico has adopted a lifestyle with low opportunities and violence. In countries where civic engagement is sufficiently achieved, the problem of regime crisis based on political instability, vicious cycles and cri-

ses can be prevented. Moreover, the political authority's deviation from the public interest becomes harder and the welfare increases while the corruption decreases. Thus, it becomes possible to regulate the basic macroeconomic priorities such as efficient use of resources, allocating the investments to the productive areas, and growth in a way that provide economic development (Toboso, 2011; Soubotina, 2004).

On the other hand, the ability of lifelong learning became an important necessity in today's business market (Hodgson, 2000). The development of the information economy is an important factor in the elimination of inadequacies in education and in increasing the quality of life. Especially the modernization and sustainability of a country is possible by improving

the human capital. This is also important in terms of achieving economic growth and high living standards. Education is also a need for a healthy, safe and financially satisfying life (Fallowfield, 1990; Soubotina, 2004). For this reason, literacy data is regarded as one of the most important indicators of the quality of life in a country. The health indicators of a country, such as the length of the individual's life span and the mortality rate below 5 years of age are also determinants for the life quality of the country (Achat et al., 1998; OECD, 2008b). In this context, public health comes to the forefront. Improving the public health has a positive impact on the quality of life. Similarly, worries stemming from safety policies, income, nutrition, access to safe water resources appear to be the main indicators of quality of life (Ekblom, 2000; WHO, 2001).

4.1. The Effects of Safety Policies on the Quality of Life

It is extremely important to establish safety policies in terms of the continuing the human existence, because it is impossible to talk about other elements about the quality of life for an area, where there is no safety. Yet, according to certain philosophers, the emergence of states is a consequence of safety concerns of societies. Aristotle who had dealt with the question of where the states originated from, explained the state as a necessity of human nature. Rousseau, Hobbes and Locke indicated that it is formed by means of social contracts. According to another theory, the principalities' coming together in order to construct large-scale irrigation systems constituted the states. The most important theory is that the enlargement and increasing in the volume of the populations led to the formation of the states. The political anthropologist Diamond explains the fundamental element that formed state with the need for a centralized organization in order to ensure internal and external safety. Similarly, according to Elias, the need for safety, aimed at resolving internal and external disputes by collecting the power in one place, is the main reason for the emergence of the states (Carment et al., 2011; Diamond, 1999; Lutz and Lux, 1988; Nar, 2013).

As a matter of fact, safety worries are the most fundamental reasons for paving the way for the formation of the states. Besides protecting their citizens' rights of living, safety is also very important in terms of the execution of economic policies such as securing the property rights, and the regulation of power and wealth relations. Therefore, safety, which is one of the main determinants of quality of life, is always on the forefront among the central goals of the states (Ekblom, 2000; Toboso, 2011). In this sense, this situation becomes more apparent when the data of the OECD countries are analyzed.

4.2. Research Findings

Table 2 shows data on the variables of safety, accommodation, income, employment, community, education, environment, engagement, health, satisfaction, and quality of life, belonging to OECD member countries. The scores of each variable of each criterion were graded from 1 to 10 using a Likert scale. The number of samples evaluated is 36. In the sample group, while the criterion with the lowest mean score is income (Mean = 3.53), the criterion with the highest mean score is safety (Mean = 8.3). Besides, mean score for housing is 5.59, for jobs 6.54, for community 7.21, for education 6.38, for engagement 5.04, for health 6.83, for satisfaction 6.63 and for quality of life 6.66. It can be seen that all mean scores of 11 variables included in the survey exceeded the score of 5 except for one of the variables (income).

4.3. Correlation Analysis

Table 3 shows the matrix of the correlation among the variables of safety, housing, income, jobs, community, education, environment, engagement, health, satisfaction, and quality of life belonging to OECD member countries. According to the results on the correlation matrix, there is no significant relationship between the safety variable and the variables of jobs, engagement, satisfaction and quality of life. On the other hand, there appears to be a statistically significant, moderate and positive relationship between the safety variable and the housing variable ($r=.393$; $p<0.05$). In other words, safety scores increase as the housing scores of the countries increase. Similarly, there is a significant, moderate and positive relationship between the income variable and the safety variable ($r=.418$; $p<0.05$). This status reveals the result that the income scores belonging to the OECD countries increase together with the increase in their safety scores.

Again, there appears to be a moderate and positive relationship between countries' *safety* and *community* scores ($r=.365$; $p<0.05$). This result shows that the safety scores increase in OECD countries as the *community*-related scores increase. The results of the analysis show that the meaningful relationships of the other variables with the safety variable are generally moderate. The only exception to this is the strong relationship between safety and education variables. Correlation matrix data revealed that there was a meaningful, positive and strong relationship between the safety and the education variable ($r=.763$; $p<0.01$). This result implies that as education scores of OECD countries increase, safety scores also increase, and there is a very strong relationship between these two variables.

Correlation matrix results also revealed a significant relationship between safety and the environment ($r=.431$; $p<0.01$). The analysis shows that the relationship between these two variables is moderate and positive. This result shows that the safety scores of

Table 2. Descriptive Data belonging to OECD Countries

| variable | min | max | std | mean | median | Mode |
|-------------------|-----|-----|------|------|--------|------|
| safety | 0.4 | 10 | 1.92 | 8.3 | 8.8 | 8.7 |
| housing | 2.2 | 7.8 | 1.48 | 5.59 | 5.95 | 6.3 |
| income | 0.1 | 10 | 2.21 | 3.53 | 3.55 | 5 |
| jobs | 1.5 | 9.5 | 1.85 | 6.54 | 6.8 | 8.2 |
| community | 0 | 10 | 2.12 | 7.21 | 7.4 | 7.2 |
| education | 0.5 | 9.1 | 1.91 | 6.38 | 7 | 7.9 |
| environment | 2 | 9.6 | 1.98 | 6.79 | 7.35 | 8.8 |
| civic engagegent | 0 | 9.5 | 1.91 | 5.04 | 5.2 | 5.3 |
| health | 0.6 | 9.3 | 1.94 | 6.83 | 7.55 | 7.7 |
| life satisfaction | 0 | 10 | 2.88 | 6.63 | 7.45 | 9.3 |
| wlbn9 | 0 | 9.8 | 1.87 | 6.66 | 7.1 | 6.1 |

Table 3. Correlation matrix (N = 36)

| Correlations | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|--------------|-------------------|-----------|-------|---------|-------|-------|-------|-------|--------|--------|-------|------|----|
| 1 | Safety | Pearson r | 1 | | | | | | | | | | |
| 2 | Housing | Pearson r | .393* | 1 | | | | | | | | | |
| 3 | Income | Pearson r | .418* | .709*** | 1 | | | | | | | | |
| 4 | Jobs | Pearson r | .216 | .552** | .622* | 1 | | | | | | | |
| 5 | Community | Pearson r | .365* | .456** | .367* | .340* | 1 | | | | | | |
| 6 | Education | Pearson r | .763* | .468** | .408* | .437* | .430* | 1 | | | | | |
| 7 | Environment | Pearson r | .431* | .696** | .515* | .608* | .567* | .607* | 1 | | | | |
| 8 | Civic Engage-ment | Pearson r | .256 | .504** | .275 | .328 | .153 | .258 | .441** | 1 | | | |
| 9 | Health | Pearson r | .396* | .704** | .625* | .395* | .467* | .287 | .508** | .456** | 1 | | |
| 10 | Life Satisfaction | Pearson r | .007 | .562** | .504* | .750* | .511* | .184 | .481** | .340* | .610* | 1 | |
| 11 | WLB | Pearson r | .240 | .460** | .249 | .123 | .505* | .453* | .512** | .007 | .209 | .180 | 1 |

*. Correlation is significant at the 0.05 level (2-tailed); **. Correlation is significant at the 0.01 level (2-tailed).

OECD countries increase as the environmental variable scores increase. The analysis also indicates that there is a significant relationship between the health status of the OECD countries and the safety status. According to the data, it was determined that there is a positive and moderate relationship between the health and the safety variables. Therefore, the increase in health scores leads to an increase in safety scores.

4.4. OLS Regression Analysis

The relationship between each variable was analyzed by the correlation analysis described above. There

are six variables that are significantly related to the independent variable of safety as a result of the correlation analysis. At this stage of the research, a multivariate (OLS regression) analysis was conducted by creating a model from all variables in order to determine their effects on the safety scores of the countries. The analysis results are given in Table 4. According to the analysis results, there were three variables that have statistically significant relationship with the safety scores of the countries. These are the variables of *education*, *health* and *satisfaction*. According to the regression analysis results, the rate of these nine variables' giving the variance of the safety variable is 74.9% (Model $R^2 = .749$).

Table 4. OLS Regression Analysis of the SAFETY of the OECD countries (N=36)

| | Model | |
|-------------------------------------|---------------------|-----------|
| | B ^a (SE) | β^b |
| Independent Variables | | |
| Housing | -.031 | -.024 |
| Income | .112 | .128 |
| Jobs | .040 | .039 |
| Community | .183 | .202 |
| Education | .717 | .713*** |
| Environment | -.078 | -.080 |
| Civic Engagement | .036 | .036 |
| Health | .363 | .367* |
| Life Satisfaction | -.318 | -.477** |
| WLB | -.165 | -.161 |
| Model F | 7.453 *** | |
| Model R ² | .749 | |
| Model R ² _{ADJ} | .648 | |

* p<0.10, ** p<0.05, *** p<0.01 (One tailed test),

a Unstandardized regression coefficient

b Standardized regression

There is a statistically significant, strong and positive relationship between education and safety variables ($\beta = .713$; $p < 0.01$) when all other variables are kept constant. In the case that other variables are kept constant, when the education level of the countries increases, the safety variable also shows a positive increase. From that, the result that the countries with high education level has a high safety level as well. In other words, it can be suggested that countries with high safety levels also have higher levels of education. Since causality cannot be determined in this analysis, both of the inferences are true according to the reality. It can be said that, when education increases, safety also increases, and as safety increases, people are more focused on education.

Furthermore, regression analysis reveals that there is a statistically significant and positive relationship between the health and the safety variables when all other variables are kept constant ($\beta = .367$; $p < 0.10$). Hence, when other variables are kept constant, every one unit increase in the health scores leads to a positive increase of 0.367 units in the safety variable. This indicates that the development of health criteria in the OECD countries will provide a certain amount of increase in the safety criteria.

OSL analysis results show that there is a statistically significant relationship in the negative direction between the satisfaction and safety variables for the OECD countries ($\beta = -.477$; $p < 0.05$). In the case that other variables are kept constant, when the satisfaction scores of the countries increase, the safety score decreases at the rate of 0.477. This result shows that there is an inversely proportional relationship between safety and satisfaction statuses of the OECD countries. In other words, an increase in the safety status of the country leads to a decrease in the satis-

faction statuses of the citizens at a certain rate. In other words, if the safety policies that are applied have the characteristics of restricting the freedoms of the citizens, this may reduce the degree of satisfaction.

5. Conclusion

While quality of life is a concept initially used in specific fields such as medicine, today it is defined as a broad concept that encompasses many areas such as economics (GNP) in particular, psychology, regulations, working life, culture. This situation caused the variation of the measurement criteria that are used in calculating the quality of life. Additionally, many problems and different parameters originated from individual values and research methods (theoretical structure) make it difficult to measure the quality of life. In particular, although measuring the concepts such as quality of life or well-being is something desired, it requires extensive calculations and how to do it is still a matter of discussion. In addition, how healthy or reliable the indicators or data used in measuring the quality of life is also another point of discussion (Mottner and Ford, 2008). In this regard, Susan Holmes (2005) pointed out the difficulty of making assessment in the field with her statement mentioning that *Are we really trying to measure the things which cannot be measured?*

In this sense, it is clear that quality calculations made on one or two variables will not yield healthy results. Therefore, in order to be able to calculate the quality of life and to understand how an individual continues his/her life, we need to evaluate the environment, which is perceived by the individual, as a whole. In this sense, in order to accurately calculate the quality of life, it is necessary to consider many criteria such as safety, health and culture that affect the human nature. Otherwise, our analysis will not be able to go beyond a limited calculation. For example, in primitive and traditional societies, in which the use of money is extremely limited, and there is a subsistence economy largely depending on commodity exchange, it will be extremely meaningless to try to calculate the quality of life through the GNP criterion alone. Likewise, the fact that a community has a higher GNP than other communities does not mean that the life quality of that community is high. Or, as in evaluation of a modern community, assessing the life quality of people living in a society where there is a lot of safety problems, or where the social statute is acquired only on the basis of the number of animals possessed, may be misleading.

Hence, there is a need for a concept of quality of life and measurement index that is widely accepted. The quality of life measurement index, which was developed by OECD in 2011 as a result of these searches, has the characteristic of responding to these searches in a way. In this sense, the index criteria developed by the OECD include numerous different variables.

With this index, more realistic results can be achieved in comparison with other measurement tools. However, there is no universal criterion that may apply to all of the societies. For example, since literacy rates in developed countries are already high, the determination of life quality through this criterion may be insufficient in international comparisons. Therefore, the stretched calculations to be carried out over the educational criteria in the developed countries will give more accurate results. Again, within the context of the life index, countries with low criterion scores will also be able to increase their quality of life by investing more in these areas. Finally, for the index scores to produce more consistent results, the main criterion should be evaluated in sub-topics at the same time, thus, safer results will be achieved. For example, examining the health criteria under the sub-topics of nutritional health and hygiene standard.

On the other hand, a good or quality life necessitates living in a safe environment. Because; only individuals living in a safe environment will be able to meet other needs, especially the biological and psychological needs. When we evaluate the analysis in general, it is seen that there is a meaningful and positive relation between the safety criterion and other parameters. However, according to another result of the analysis, we can mention a negative relationship between safety and satisfaction criterion, because, after a certain threshold level, the individual does not regard the interventions to his/her life with safety reasons in a positive way. This was confronted in our study in a striking way. Indeed, such a result shows the individual's reaction within the context of the protection of private life. The most striking example of this can be seen in the US government's desire to increase the CIA and NSA budgets on the grounds of terrorism in recent years. This was perceived by US public as a threat to their freedom and private life, and they reacted against those regulations. Therefore, in the safety-freedom balance, it is observed that even though the income levels in the societies increase, freedom is preferred at a certain threshold. Another striking consequence of the analysis is that, even though the crime rates are high in countries such as Mexico, there is no decline in people's satisfaction levels. We can explain this situation in a way that the crime is accepted as a normal mode of behavior in the community (in the form of stereotyped behavior). Moreover, we can say that a criminal culture has been formed in these societies.

As the result, a quality or a good life is desired by all societies. For this purpose, a number of criteria have been developed for measuring the level of the quality of life. However, it is clear that the criteria that has been developed are insufficient. In our era; it is extremely difficult to come to the conclusion that the quality of life of the societies is low or high through an assessment only based on the universal criteria.

Of course all the developed criteria and the calculations may give us, the researchers, general information about a community's level of quality of life. However, how much can this information satisfy us? In addition to universal criteria, societies can have different perspectives and cultural values that are originated from cultural diversities. Therefore, we can achieve healthier results when we evaluate the quality of life of societies with an approach that is far from biased and ethnocentric viewpoints.

References

1. ACHAT H., KAWACHI I., LEVINE S., BE-RKEY C., COAKLEY E., COLDITZ G., 1998, Social Networks, Stress and Health-Related Quality of Life, in: *Quality of Life Research*, 7(8), p. 735-750.
2. ADAMS G.A., KING L.A., KING D.W., 1996, Relationships of Job and Family Involvement, Family Social Support, and Work-Family Conflict With Job and Life Satisfaction, in: *Journal of Applied Psychology*, 81(4), p. 411-420.
3. ANDERSON R. E., 2015, Implications of World Suffering for Human Progress, in: *World Suffering and Quality of Life*, ed. Anderson R.E., Springer, p. 3-30.
4. ANDREWS F.M., WITHEY S.B., 1976, *Social Indicators of Well-Being: Americans' Perceptions of Life Quality*, Plenum, New York.
5. BARCACCIA B., ESPOSITO G., MATA-RESEC M., BERTOLASO M., ELVIRA M., MARINIS M.G., 2013, Defining Quality of Life: A wild-Goose Chase?, in: *Europe's Journal of Psychology*, 9(1), p. 181-203.
6. BEALEY F., JOHNSON A.G., 1999, *The Dictionary of Political Science: A User's Guide to Its Terms*, Blackwell, Massachusetts.
7. BISHOP M., 2004, *Essential Economics*, New York, Bloomberg Press.
8. BOARINI R., 2015, Wellbeing Quality of Life Reporting at the OECD, in: *Global Handbook of Quality of Life: Exploration of Well-Being of Nations and Continents*, eds. Glatzer W., Camfield L., Moller V., Rojas M., Springer Science, New York, p. 747-762.
9. BOWLING A., 2004, *A Review of Quality of Life Measurement Scales*, Open University Press.
10. BURGER J., 2003, Perceptions About Environmental Use and Future Restoration of an Urban Estuary, in: *Journal of Environmental Planning and Management*, 46(3), p. 399-416.
11. CAMPBELL A., 1981, *The Sense of Well-Being in America: Recent Patterns and Trends*, McGraw-Hill, New York.
12. CARMENT D., PREST S., SAMY Y., 2011, *Security, Development and the Fragile State*, Routledge Group, New York.
13. CHOCHINOV H.M., 2002, Dignity, Conserving Care, A New Model for Palliative Care: Helping the Patient Feel Valued, in: *JAMA*, 287(17), p. 2253-2260.
14. CUMMINS R.A., 1997, Assessing Quality Of Life, in: *Quality of Life for People with Disabilities: Models, Research and Practice*, ed. Brown R.I., Stanley Thornes Publishers Ltd., United Kingdom, p. 116-150.

15. DIAMOND J., 1999, *Guns Germs and Steel: The Fates of Human Societies*, W.W. Norton, New York.
16. DIENER E., 1984, Subjective Well-Being, in: *Psychological Bulletin*, 95(3), p. 542-575.
17. EC (EUROPEAN COMMISSION), 2014, *Life Programme: LIFE Sub-Programmes*, Publications Office of the European Union.
18. EDGERTON J.D., ROBERTS L.W., BELOW S., 2012, Education and Quality of Life, in: *Handbook of Social Indicators and Quality of Life Research*, eds. Land K.C., Michalos A.C., Sirgy M.J., Springer Science, New York, p. 265-296.
19. EKBLOM P., 2000, The Conjunction of Criminal Opportunity, in: *Secure Foundations: Key Issues in Crime Prevention, Crime Reduction and Community Safety*, eds. Ballintyne S., Pease K., McLaren V., The Institute for Public Policy Research, United Kingdom, p. 30-66.
20. EVANS R.W., VAN DER CAMMEN T.J.M., VERSCHOOR C.J., HARWOOD R., SHAH I., 1991, Quality of Life, in: *The Lancet*, 338 (8767), p. 636-637.
21. FALLOWFIELD L., 1990, *The Quality of Life: The Missing Measurement in Health Care*, Souvenir Press, London.
22. FELCE D., PERRY J., 1995, Quality Of Life: Its Definition and Measurement, in: *Research in Developmental Disabilities*, 16(1), p. 51-74.
23. FINE B., 2010, *Theories of Social Capital*, Pluto Press, New York.
24. FORETTE F., 2000, Quality of Life and Disorders of Longevity, in: *Longevity and Quality of Life: Opportunities and Challenges*, eds. Butler R.N., Jasmin C., International Longevity Center, Springer, New York, p. 69-76.
25. GASPER D., 2010, Understanding the Diversity of Conceptions of Well-Being and Quality of Life, in: *The Journal of Socio-Economics*, 39(3), p. 351-360.
26. GRAHAM C., 2008, Measuring Quality of Life in Latin America, in: *Barometers of Quality of Life Around the Globe*, eds. Moller V., Huschka D., Michalos A.C., Springer, Netherlands, p. 71-106.
27. GREENWOOD D., 2004, Measuring Quality Of Life With Local Indicators, in: *What Has Happened to the Quality of Life in the Advanced Industrialized Nations?*, ed. Wolff E.N., Northampton, Levy Economics Institute, Edward Elgar Press, New York, p. 334-74.
28. GREGORY D., JOHNSTON R., PRATT G., WATTS M., WHATMORE S., 2009, *Dictionary of Human Geography*, John Wiley & Sons, USA.
29. HAGERTY M.R., 1999, Unifying Livability and Comparison Theory: Cross National Times Series Analysis of Life Satisfaction, in: *Social Indicators Research*, 47(3), p. 343-356.
30. HART P.M., 1999, Predicting Employee Life Satisfaction: A Coherent Model of Personality, Work and Nonwork Experiences, and Domain Satisfaction, in: *Journal of Applied Psychology*, 84(4), p. 564-584.
31. HEADEY B., VEENHOVEN R., WEARING A., 1991, Top-Down Versus Bottom-Up Theories Of Subjective Well-Being, in: *Social Indicators Research*, 24 (1), p. 81-100.
32. HERZBERG F., MAUSNER B., SNYDERMAN B.B., 1993, *The Motivation to Work*, Transaction Publisher, USA.
33. HINTON J., 1994, Can Home Care Maintain an Acceptable Quality of Life for Patients with Terminal Cancer and Their Relatives?, in: *Palliative Medicine*, 8(3), p. 183-196.
34. HODGSON A., 2000, *Policies, Politics and the Future of Lifelong Learning*, Routledge, London.
35. HOLMES S., 2005, Assessing the Quality of Life: Reality or Impossible Dream? A Discussion Paper, in: *International Journal of Nursing Studies*, 42(4), p. 493-501.
36. JACKSON T., 1996, *Material Concerns: Pollution, Profit and Quality of Life*, Stockholm Environment Institute, Routledge.
37. JACOBS M., 1991, *The Green Economy: Environment, Sustainable Development and the Politics of the Future*, London, Pluto Press.
38. KAGAWA SINGER M., PADILLA G.V., ASHING GIWA K., 2010, Health-Related Quality of Life and Culture, in: *Seminars in Oncology Nursing*, 26(1), p. 59-67.
39. KAHNEMAN D., DIENER E., SCHWARZ N., 1999, *Well-Being: Foundations of Hedonic Psychology: Close Relationships and Quality of Life*, New York, Russell Sage Foundation.
40. KEITH, K.D., 1990, Quality of Life: Issues in Community Integration, in: *Quality of Life: Perspectives and Issues*, ed. Schalock R.L., Washington, American Association on Mental Retardation, p. 93-100.
41. LEHMAN A. F., 1988, A Quality of Life Interview for the Chronically Mentally ill, in: *Evaluation and Program Planning*, 11(1), p. 51-62.
42. LEISINGER K.M., 2009, The Role of Corporations in Shaping Globalization with a Human Face, in: *The Role of Law and Ethics in the Globalized Economy*, ed. Straus J., Verlag, Berlin, Heidelberg, p. 27-46.
43. LUCAS R.E., 2008, Personality and Subjective Well-Being, in: *The Science of Subjective Well-Being*, eds. Eid M., Larsen R.J., The Guilford Press, New York, p. 171-194.
44. LUTZ M., LUX K., 1988, *Humanistic Economics: The New Challenge*, Bootstrap, New York.
45. MCCONNELL C.R., BRUE S.L., FLYNN S.M., 2011, *Microeconomics*, McGraw-Hill, USA.
46. MOTTLNER S., FORD J.B., 2008, Internal Competition in A Nonprofit Museum Context: Development of a Scale, in: *International Journal of Nonprofit and Voluntary Sector Marketing*, 13(2), p. 177-190.
47. NAR M., 2013, *Kamu Ekonomisi, Ekonomik Etkinlik ve Vergileme*, Seçkin Yayıncılık, Ankara.
48. NAR M., 2014, Global Public Goods and Sustainable Development, in: *Journal of Sustainable Development Studies*, 6(2), p. 205-230.
49. NRC (NATIONAL RESEARCH COUNCIL), 2002, *Community and Quality of Life: Data Needs for Informed Decision Making*, National Academy Press, Washington D.C.
50. OECD (Organization for Economic Cooperation and Development), 2008a, *Glossary of Statistical Terms*, OECD Press.
51. OECD, 2008b, *Are We Growing Unequal? New Evidence on Changes in Poverty and Incomes Over the Past 20 Years*, OECD Press.
52. OECD, 2011, *How's Life? 2011: Measuring Well-Being*, OECD Press.
53. OECD, 2013, *How's Life? 2013: Measuring Well-Being*, OECD Press.

54. OECD, 2017, *Better Life Index*, OECD Press.
55. PHELAN J., 2012, *What Is Life? A Guide to Biology with Physiology & Prep*, W.H. Freeman Company, USA.
56. RABKIN J., WAGNER G., GRIFFIN K.W., 2000, Quality of Life Measures, in: *Handbook of Psychiatric Measures*, ed. Rush A.J., American Psychiatric Association, Washington, p. 135-50.
57. RAPLEY M., 2003, *Quality of Life Research: A Critical Introduction*, First Edition, SAGE Publications.
58. ROMER C., 2011, *Work-Life Balance and the Economics of Workplace Flexibility*, Executive Office of The President, Council of Economic Advisers, DIANE publishing.
59. RYLE G., 1949, *The Concept of Mind*, Chicago, The University of Chicago Press.
60. SEN A., 1993, Capability and Well-being, in: *The Quality of Life*, eds. Nussbaum M., Sen A., Oxford-Clarendon Press, United Kingdom, p. 30-53.
61. SHIN D.C., JOHNSON D.M., 1978, Avowed Happiness as an Overall Assessment of the Quality of Life, in: *Social Indicators Research*, 5(1-4), p. 475-492.
62. SOUBBOTINA T.P., 2004, *Beyond Economic Growth: An Introduction to Sustainable Development*, The International Bank for Reconstruction and Development, Washington, D.C.
63. STEVENS A., 2011, Drugs, Crime and Public Health: The Political Economy of Drug Policy, in: *The British Journal of Criminology*, 51(5), p. 876-878.
64. STIGLITZ J.E., SEN A., FITOUSSI J.P., 2009, *Report by the Commission on the Measurement of Economic Performance and Social Progress*, by OFCE, France.
65. STRADA E.A., 2011, The Cultural Context of Spirituality and Meaning, in: *End-of-Life Issues, Grief, and Bereavement: What Clinicians Need to Know*, eds. Qualls S.H., Godley J.E., John Wiley & Sons, New Jersey, USA p. 43-63.
66. TOBOSO F., 2011, Institutional Arrangements Matter for Both Efficiency and Distribution: Contributions and Challenges of the New Institutional Economics, in: *Political Economy of Institutions, Democracy and Voting*, eds. Schofield N., Caballero G., Springer, New York, p. 137-156.
67. UN (United Nations), 2013, *State of the World's Cities 2012/2013: Prosperity of Cities*, London, Routledge.
68. UN, 1995, *Human Development Report*, United Nations Development Programme, Oxford University Press.
69. WALSH J., 2013, Work-life Balance: The End of the Overwork Culture?, in: *Managing Human Resources: Human Resource Management in Transition*, eds. Bach S., Edwards M., John Wiley & Sons, United Kingdom, p. 150-177.
70. WELFORD A.T., 1983, Social Skills and Aging: Principles and Problems, in: *International Journal of Aging and Human Development*, 17(1), p. 1-5.
71. WHO (WORLD HEALTH ORGANIZATION), 1997, *Measuring Quality of Life: The World Health Organization Quality of Life Instrument*, WHO.
72. WHO, 1998, The World Health Organization Quality Of Life Assessment (WHOQOL): Development and General Psychometric Properties, in: *Social Science and Medicine*, 46 (12), p. 1569-1585.
73. WHO, 2001, *The World Health Report 2001: Mental Health, New Understanding, New Hope*, WHO Press, Geneva.
74. WISH N.B., 1986, Are We Really Measuring the Quality Of Life? Well-Being Has Subjective Dimensions, as Well as Objective Ones, in: *The American Journal of Economics and Sociology*, 45(1), p. 93-99.
75. WOOD-DAUPHINEE S., 1999, Assessing Quality of Life in Clinical Research: From Where Have We Come and Where are We Going?, in: *Journal of Clinical Epidemiology*, 52(4), p. 355-63.

Environmental Welfare: Quality of Policy vs. Society's Values

Środowiskowy dobrostan: jakość polityki a wartości społeczne

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Abstract

In the 21st century, in addition to the generally well-known indicators of material well-being, in the modern paradigm of the welfare state, the quality of the ecological environment is gaining an ever-increasing role. In the context of interdisciplinary research, the formation of the ecological consciousness as a way of being is important for today, in which citizens feel a direct connection with the natural environment, trying to preserve it for prosperity people. Studies of the connection between economic and environmental development are often confined to financial-economic interactions, leaving out the attention of the educational and scientific components of the problem. The article is devoted to the study of the ecological component of the social welfare, as well as the analysis of the impact of quantitative and qualitative indicators (governance quality, development of democracy, GDP per capita, value orientations) on the Environmental Performance Index as a comprehensive indicator of environmental welfare assessment. The hypothesis is that along with effectiveness indicators of the state policy (quality of governance, democracy index), the demand for the public good for the *environmental quality* is determined by the ability to invest in the environment (GDP per person) and the dominance of the self-realization values over the survival values. Using economic and mathematical modeling it is proved that the indicators of governance quality and the level of development of democracy play a key role in shaping the ecological component of well-being, while the level of GDP per person and values is influenced with less intensity. It is substantiated that public policy should be aimed directly at improving governance efficiency and the development of democracy and civil society.

Key words: environment, welfare, ecological policy, values, institutes

Streszczenie

W XXI wieku, oprócz powszechnie znanych wskaźników materialnego dobrobytu, w nowoczesnym modelu państwa socjalnego, coraz większą rolę odgrywa jakość środowiska naturalnego. W kontekście badań interdyscyplinarnych na dzień dzisiejszy ważne jest kształtowanie świadomości ekologicznej, jako sposobu bycia, w którym obywatele odczuwają bezpośredni związek ze środowiskiem, starając się zachować je dla dobrobytu ludzi. Badania związków między ekonomicznym i ekologicznym rozwojem często są zawężone do ekonomicznych interakcji, z pominięciem kwestii edukacyjnych i naukowych. Artykuł jest poświęcony ekologicznemu komponentowi zabezpieczenia społecznego, a także analizie wpływu ilościowych i jakościowych wskaźników (jakość zarządzania, rozwój demokracji, PKB na mieszkańca, wartości orientacji) na Indeks Wydajności Środowiskowej (Environmental Performance Index), jako kompleksowego wskaźnika oceny jakości środowiska. Założona hipoteza zakłada, że wraz ze wskaźnikami skuteczności polityki publicznej (jakość zarządzania, indeks demokracji) o popycie na dobro publiczne *jakość środowiska* decyduje zdolność do inwestowania w środowisko (PKB na osobę) i przewaga wartości samorealizacji nad wartościami przetrwania. Wykorzystując ekonomiczno-matematyczne modelowanie udowodniono, że wskaźniki jakości zarządzania i poziomu rozwoju demokracji odgrywają kluczową rolę w kształ-

towaniu środowiskowego elementu dobrobytu, podczas gdy poziom PKB na mieszkańca oraz wartości wpływają w mniejszym stopniu. Ponadto udowodniono, że polityka publiczna powinna być skierowana bezpośrednio na zwiększenie efektywności zarządzania i rozwój demokratycznego społeczeństwa obywatelskiego.

Słowa kluczowe: środowisko, dobrobyt, polityka ochrony środowiska, wartości, instytucje

Introduction

The beginning of the 21st century was marked by an increase in the interest of scholars, policymakers, public activists and ordinary citizens to solve the ecological problems of humanity, both at the micro and macro levels. From a microeconomic point of view, stakeholders are becoming more and more concerned about the negative environmental externalities of firms, which are an important investing considerations in minimizing their impact and contributing to reducing environmental damage. From a macroeconomic point of view, the development of countries is increasingly determined by the ability of national economies to produce environmental public goods (Duit, 2005), which are understood as *good or service in which the benefits to any party does not reduce the availability of these benefits to other parties, and access to the benefit cannot be limited* (UK NEA, 2014). Typical examples of environmental public goods are: air, groundwater reserves, forests, and so on. However, if in developed democracies access to them is guaranteed to each citizen by the laws of one or another state, then in oligarchic economies and countries with a lack of democratic values, the benefits of consuming economic social goods are most often assigned to groups of special interests, blocking access to them by ordinary citizens. And despite the fact that every country should be accountable to its citizens for the environmental policy pursued to ensure welfare, the realities of countries with hybrid regimes and the authoritarian style of public administration proves the existence of such phenomena as *punishment for poverty, environmental racism* (Dluhopolskyi, 2018), which prove the lack of existence of political and economic freedoms, social movements, developed civil society.

Literature Review

A number of studies conducted on the basis of empirical per capita income comparisons and the values of a certain set of representative environmental indicators confirm the conclusion on the positive impact of the economic growth factor on the environment (Arrow et al., 1996). This emphasizes the *U-like effect of interaction* (the growth of incomes is attributed to the degradation of the environment to a certain point, after which the quality of the latter improves). That is, at the initial stages of increasing pollution is considered as an acceptable side effect of economic growth. However, in the case of a country with a higher level of well-being, individuals begin to formulate requests for environmental me-

asures that lead to the emergence of environmental legislation, new environmental protection institutes, etc. Environmental degradation necessitates institutional reforms that would force private users of environmental resources to bear the full burden of social costs caused by their activities (Dasgupta, Mäler, 1990).

Another vector of research focuses on the concept of *environmental resource base*, which is reflected in a wide range of environmental systems, but is characterized by limitation. As a result, careless use of it will irreversibly be marked by a decline in economic potential. That is why there is a need to develop an ecological policy that would consist in preserving the sustainability of ecosystems, provided that the nature and extent of economic activity are uncertain (Kozlovskyi, et al., 2017). Scientists came to the conclusion that economic liberalization, as well as any other policy that contributes to the growth of the gross national product, do not substitute for environmental policy. Of particular significance in this context are reforms that are based on *signals* from resource users. Environmental damage, including the loss of environmental sustainability, is usually characterized by inevitable negative manifestations. Ignoring such *signals* is due not only to the ignorance of the dynamic effects of ecosystem changes (for example, their boundaries, marginal productivity, loss of sustainability), but also the existence of institutional barriers, such as the lack of clearly defined property rights. The development of the relevant institutions depends, among other things, on understanding the dynamics of ecosystems, based on the analysis of relevant indicators. Economic growth is not a panacea in the case of achieving an appropriate level of environmental quality, its nature – the composition of inputs (input characteristics, including environmental resources) and outputs (the end result, taking into account negative harms in the form of harmful effects) is considerably more important in this sense. In addition, the nature of growth is also determined by the activities of institutions that are designed to provide adequate incentives to protect environmental sustainability. Balancing measures in the framework of environmental policy will not only contribute to an increase in the efficiency of environmental resource allocation, but will also ensure sustainable levels of economic activity within the ecological systems. Protecting their potential, driven by the need to maintain well-being, is important for both poor and rich countries (Arrow, et al., 1996). Influence analysis of numerous indicators on the ecological state in the country is devoted to the work of many scientists (Clarkson, Li, et al., 2008; Al-Tu-

waijri, et al., 2004; Duit, 2005; van den Bergh, Janssen, 2004; Klare, 2009; Wiesmeth, 2012; Dluhopolskyi, et al., 2018). However, various scholars investigated the impact of macroeconomic indicators on a fairly diverse environmental performance. So, in the work (Esty, Levy, et al., 2008) the emphasis is on The Environmental Sustainability Index, in works (Prescott-Allen, 2001a; Prescott-Allen, 2001b) – on the Ecosystem Wellbeing Index, in a study (Goedkoop, Spriensma, 2001) – on the Eco-Indicator 99, in the works (Roodman, 2004a; Roodman, 2004b) – on the Environmental Performance Index for Rich Nations, in the works (Adriaanse, 1993; Adriaanse, 2007) – on the Environmental Policy Performance Index, in the study (Puolamaa, Kaplas, et al., 1996) – on the Index of Environmental Friendliness. Despite the fact that the relationship between environmental indicators and some indicators of the development of socio-economic systems is partly described in the scientific literature, in this study we focused on how the environmental dimension is associated with a matrix of structural and institutional characteristics of social and economic systems, to which we include: 1) the volume of GDP per person; 2) the values and beliefs of the population; 3) the level of development of democracy; 4) the quality of governance.

Research Hypothesis

The article proposes hypothesis that, along with effectiveness indicators of the state policy (quality of governance, democracy index), the demand for the public good for the *environmental quality* is determined by the ability to invest in the environment (GDP per person) and the dominance of the self-realization values over the survival values.

Methodology

Researchers often use the index method to assess the state of the environment. In statistics, the index is relative value, which characterizes the ratio of a certain indicator values in time, space, as well as comparison of actual data with the plan or other norm (Halafyan, 2008). There are a number of international indexes that are successfully used to assess the state of the environment (The Environmental Sustainability Index, Ecosystem Wellbeing Index, Eco-Indicator 99, Environmental Performance Index for Rich Nations, Environmental Policy Performance Index, Index of Environmental Friendliness). However, based on the criterion of structural content, for this research, The Environmental Performance Index (EPI), developed by the Yale Center for Environmental Law and Policy (YCELP), was selected as a dependent variable, together with the Center for International Earth Science Information Network (CIESIN) of the Columbia University in collabora-

tion with Samuel Family Foundation and the World Economic Forum.

For the formation of the initial analytical matrix, available country ratings and databases, developed by renowned educational, scientific and financial institutions, were used. Thus, the ratings of 180 countries by the Environmental Performance Index (EPI) and its component criteria are taken from the report of the EPI (The Environmental Performance Index, EPI). The EPI indicator examines the state of the environment through the prism of two main areas: 1) protecting human health from adverse environmental conditions and 2) protecting the ecosystem. The first direction, which can be defined as *Ecology and human health*, is assessed from the standpoint of protecting the health of individuals in the context of continuously increasing pollution of the environment. The direction *Ecosystem Protection* is assessed in terms of environmental protection and the rational management of ecosystem resources. The methodology for the formation of the EPI index in the context of these two directions allows to group the performance indicators of the countries into nine main groups and twenty key indicators. These indicators demonstrate the degree of compliance (inconsistency) of the state environmental policy of the individual country with the global goals and objectives of environmental protection (Sustainable Development Goals).

The uniqueness of the EPI index is that it not only includes an assessment of the state of the environment but also takes into account factors influencing the modern civilization on human health. That is, it shows how favorable the state of the environment in the region (country) is, how much resources are spent and maintained on ecological safety at the required level, as all this in a complex influences human health, thus avoiding the incorrect assessment of the environment. For example, in economically underdeveloped countries of Africa, even in the absence of such a powerful factor as industrial pollution and the presence of virgin nature, the index of environmental efficiency will be low due to the lack of favorable living conditions for the population (unsanitary, uncontrolled consumption of natural resources, access restriction of the population to the benefits of civilization, etc.).

As a dependent variables, we selected several key indicators that we will consider more detailed:

1. Wealth or economic growth. According to a number of studies (Church, 1992; van den Bergh, Janssen, 2004; Wiesmeth, 2012), the effectiveness of environmental policy and the environment generally depend on economic indicators of the country development. Simply by some scientists (Arrow, Bolin, et al., 1996) it is argued that the most competitive countries in the world demonstrate unequivocally better results of the achievement of environmental development targets. Thus, in the work (Scruggs, 1999),

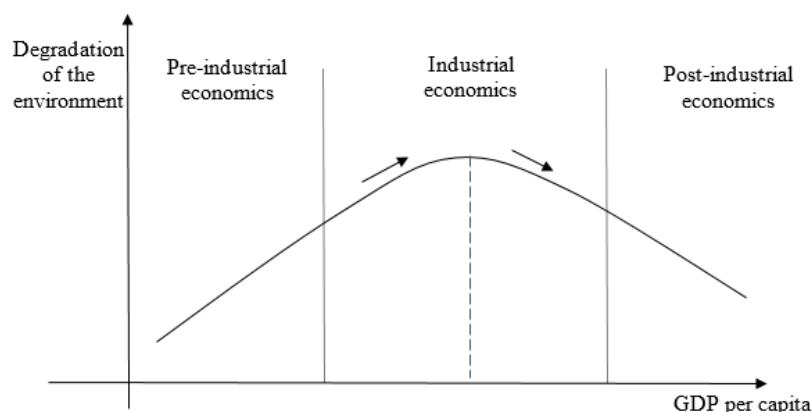


Figure 1. Kuznets Ecological Curve, made by authors based on (Panayotou, 2003)

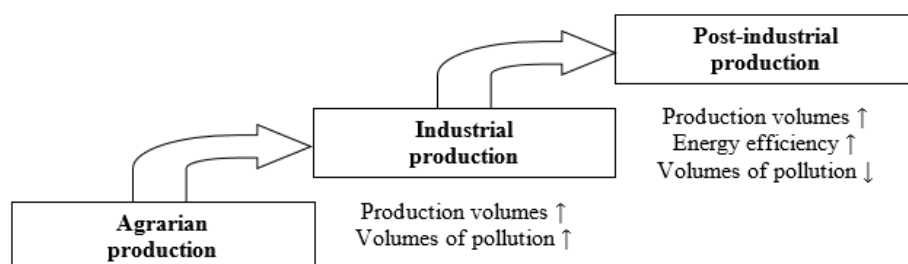


Figure 2. Logic of Kuznets Curve, made by authors based on (Dluhopolskyi, 2017)

Table 1. Correlation matrix of the Environmental Performance Index (EPI) and indicators characterizing the welfare, the system of values and beliefs of the population, the level of governance and democracy in the country, made by authors based on (Environmental Performance Index, 2018; The World Bank, 2018; World Economic and Financial Surveys, 2017; Democracy Index, 2017; The Worldwide Governance Indicators project, 2017; The World Values Survey, 2015)

| Indicators | Indicators | | | | |
|------------|------------|----------|----------|----------|----------|
| | EPI | GDPpc | WVS | GEI | DemI |
| EPI | 1,000 | 0,711*** | 0,525*** | 0,810*** | 0,701*** |
| GDPpc | 0,711*** | 1,000 | 0,523*** | 0,752*** | 0,505*** |
| WVS | 0,525*** | 0,523*** | 1,000 | 0,646*** | 0,674*** |
| GEI | 0,810*** | 0,752*** | 0,646*** | 1,000 | 0,789*** |
| DemI | 0,701*** | 0,505*** | 0,674*** | 0,789*** | 1,000 |

Coefficient of correlation * – $p < 0,05$, ** – $p < 0,01$, *** – $p < 0,001$.

based on a sample of seventeen industrial democracies, it has been shown that higher per capita income is positively correlated with the ecological indicators of the countries of the world. However, other scholars (Kuznets, 1955; Porter, van der Linde, 1995) emphasize the existence of a certain threshold of economic growth, to which the degradation of the environment occurs, while beyond this limit, further economic growth is contributing to the improvement of the environment. This logic is laid down in the Kuznets model, which has the form of an inverted U-shaped curve (fig. 1-2). At a certain stage of societal development, consumers not only begin to invest more in environmental funds, but also exert political pressure on regulators in order to increase their responsibility for violating environmental legislation and to give it more rigor.

In order to represent economic wealth, the gross domestic product (GDP) per person (GDPpc), which

depends on several components, such as private consumption, investment, government expenditure, total exports and imports, has been selected (Blanchard, 2017). According to researches (Cracolici, Cuffaro, 2010; Cracolici, et al., 2018), GDP can be considered adequate in terms of its ability to provide good living conditions for citizens from an economic, social and environmental point of view. Increasing GDP per person is a prerequisite for improving living standards and providing better social services, as well as better access to education, working conditions and more sustainable environmental development. In our study, we will try to demonstrate that the higher the GDP per capita in the country, the better the environment for the lives of ordinary citizens.

2. Values and beliefs of the population. On the map of cultural values (Inglehart, Welzel, 2015) we have selected the meanings of survival and self-expression values that demonstrate the propensity of a par-

ticular population for economic and physical security, intolerance of dissent, xenophobia, low evaluation of freedom and respect for human rights, readiness to accept authoritarianism (survival values) or to the dominant role of the individual, the observance of key human rights and freedoms, the desire for success, gender equality (self-expression values). Negative meanings of values orientations show a propensity to survival values (the greater the negative value, the more population of the country professes such values), and positive values, respectively, - to the self-expression values (indicator WVS 6). It should be noted that there is a direct link between the commitment of population to the self-expression values and welfare state in country (see annex). However, the study will try to test the hypothesis about the negative impact of survival values on the state of the environment.

3. Development of democracy index. The Democracy Index (DemI), introduced by the Economist Intelligence Unit, ranked the countries according to the level of development of democratic procedures in them, separating countries into several groups: full democracy, incomplete democracy, hybrid regime, authoritarian regime. To calculate the DemI, 60 indicators are grouped into five different categories that measure the electoral process and pluralism, the government functioning, civil liberties, citizens' participation in political life and political culture (Democracy Index, 2017).

4. Governance effectiveness. The effectiveness of state administration and government can be an effective prerequisite for improving environmental performance. Such efficiency covers indicators of bureaucratic quality, the competence of civil servants, independence from political pressure, and trust in the government-elected policy (Kaufmann, Kraay, et al., 2009). The results of research on EPI creators show that there is a slight positive correlation between the effectiveness of the authorities and the good *fine ecology* (Esty, Levy et al., 2008), but given the relative preservation of the data received by other scientists and the systematic improvement of indicators methodology (accuracy) made us to check the nature of their correlation using the Government Effectiveness Index (GEI) as a measure that reflects the effectiveness of governance.

Results

An analysis of the level of stochastic dependence between the above variables (tab. 1) indicates that all the pair correlation coefficients between the variables are statistically significant (appendix). Strong direct correlation dependence (according to Chadock's table) was found between the environmental performance index and the government effectiveness index ($r = 0.810$), GDP per capita ($r = 0.711$), democracy index ($r = 0.701$). There is also a significant direct correlation between the dependent variable of

the EPI and the regressor, which characterizes the values and beliefs of the population, but its level is slightly lower ($r = 0.525$).

The visual analysis of scatter plot matrix between the regressant and the regressors was illustrated (fig. 3), which shows a linear dependence among all variables for the aggregate sample of countries. Well-detected paired dependencies between variables are illustrated by the corresponding scattering diagrams.

As a result of the multivariate regression analysis, an adequate linear regression model (tab. 2) is constructed, according to which 70.3% of the variation in the dependent variable is explained by the variation in the independent variables (predictors). The regression model has the following form:

$$EPI = 43,941 + 0,169GDPpc - 1,221WVS + 6,190GEI + 1,745DemI. \quad (1)$$

The significance of the obtained model indicates the calculated F-criterion value (47,921), which is considerably larger than the table value for the significance level of 1% (3,56). Significant in the model is a free member and three of the four regression coefficients (see tab. 2). Regarding the values, the initial assumption that the dominance of survival values over self-realization values negatively affects the state of the environment was not empirically confirmed, since the model parameter at the prediction index *World Values Survey* was insignificant. In addition, the p-value for the WVS indicator is significantly higher than for others (its statistical significance is low, since in over 28% of the cases the result is unreliable). This can be explained by the fact that not only values, but the quality of environmental protection policy are crucial for maintaining the good «fine ecology» on quality level. This result does not deny the fact that values are positively correlated with the quality of policy, but in combination with other variables, the WVS indicator has not demonstrated a significant and sustained impact on the value of EPI. This has important institutional implications, since it indicates the absence of socio-cultural determinism for such a factor of well-being as ecology.

Thus, the resulting model makes it possible to predict that with an increase in the value of GDP per person by \$1000 is expected growth of the EPI index by 0.169. By improving governance efficiency, which is reflected by the growth of GEI per unit, we can count on an increase in the environmental performance index by 6,190 points. An improvement in the level of democracy (an increase in DemI per unit) is likely to be accompanied by an increase in EPI by 1,745 points. The change in the value-based survival benchmark for self-expression is likely to affect the value of the EPI index on the logic of the Kuznets curve, in conjunction with the growth of welfare and the transition to a higher level of environmental consciousness (as example Scandinavian countries, Germany, etc.).

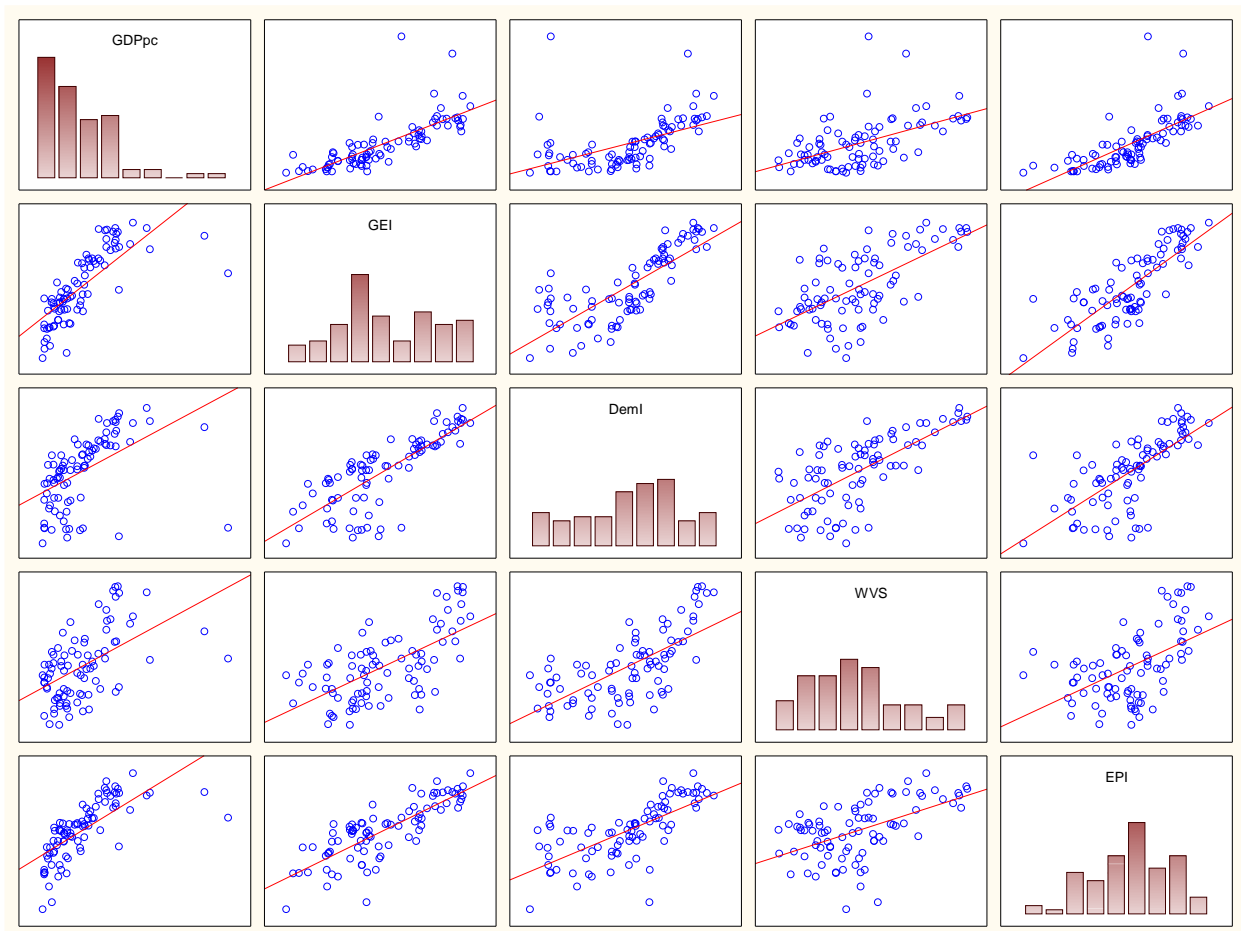


Figure 3. The scatter plot matrix between regressors and regressant, made by authors based on (Environmental Performance Index, 2018; The World Bank, 2018; World Economic and Financial Surveys, 2017; Democracy Index, 2017; The Worldwide Governance Indicators project, 2017; The World Values Survey, 2015)

Table 2. Statistical criteria of a multidimensional linear regression model, made by authors based on (Environmental Performance Index, 2018; The World Bank, 2018; World Economic and Financial Surveys, 2017; Democracy Index, 2017; The Worldwide Governance Indicators project, 2017; The World Values Survey, 2015)

| Regression Summary: R= 0,838, R ² = 0,703, Adjusted R ² = 0,688, F(4,81) = 47,921, p < 0,0000, Std. Error of estimate: 7,0919 | | | | | | |
|--|--------|-------------------|--------|------------------|-------|---------|
| | b* | Std. Err. - of b* | b | Std. Err. - of b | t(81) | p-value |
| Intercept | | | 43,941 | 4,554 | 9,65 | 0,000 |
| GDPpc | 0,297 | 0,096 | 0,169 | 0,054 | 3,11 | 0,003 |
| WVS | -0,092 | 0,086 | -1,221 | 1,139 | -1,07 | 0,287 |
| GEI | 0,431 | 0,133 | 6,190 | 1,909 | 3,24 | 0,002 |
| DemI | 0,272 | 0,109 | 1,745 | 0,701 | 2,49 | 0,015 |

A comparative analysis of standardized regression coefficients b^* shows that the greatest contribution to prediction of a regressant is the efficiency factor of governance (0.431). A slightly lesser role is assigned to the GDPpc and DemI regressors.

For the quality confirmation of the regression model an analysis of its residues is carried out. As we see from the configuration of the residue distribution graph (fig. 4) and histograms of the residues (fig. 5),

the residues of the model are distributed by law, close to normal. The value of the calculated Durbin-Watson (1,879) statistics and the serial correlation coefficient between the residues of neighboring observations (0.052) indicate a lack of autocorrelation of the residues in the model. Thus, the actual value of the Durbin-Watson criterion is less than the critical table values DW1 (1.39) and DW2 (1.60) for 1% of the significance level.

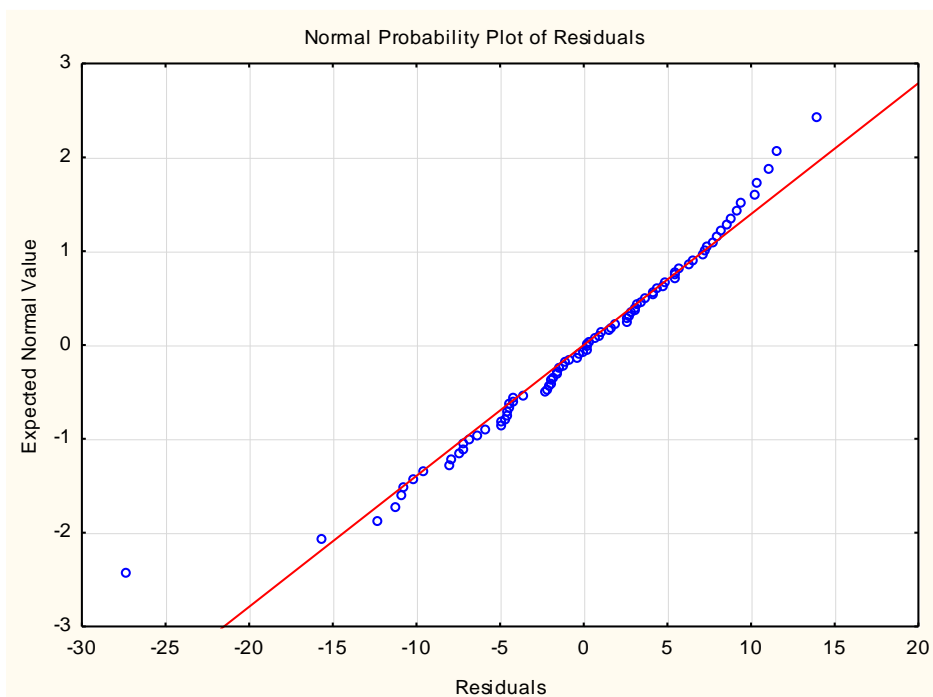


Figure 4. Distribution of residues of a regression model to a normal law, made by authors based on (Environmental Performance Index, 2018; The World Bank, 2018; World Economic and Financial Surveys, 2017; Democracy Index, 2017; The Worldwide Governance Indicators project, 2017; The World Values Survey, 2015)

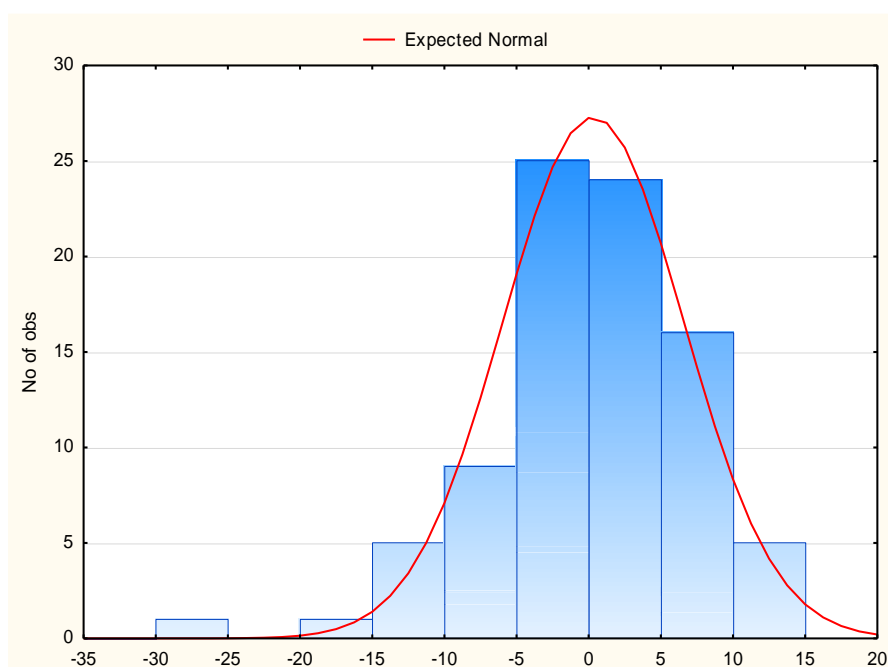


Figure 5. Distribution histogram of regression model residues, made by authors based on (Environmental Performance Index, 2018; The World Bank, 2018; World Economic and Financial Surveys, 2017; Democracy Index, 2017; The Worldwide Governance Indicators project, 2017; The World Values Survey, 2015)

Thus, as a result of the canonical analysis, a reliable link was found between the processes of implementation of the state ecological policy and a set of indicators that characterize the level of well-being, governance, democracy and value orientations. Moreo-

ver, the quality of governance and the level of development of democracy play a key role, while the level of well-being and values affect the EPI with less force.

Conclusions

To sum it up, we note that the research results allow to assess in different ways the influence of the complex of indicators on the environmental performance index. It is empirically confirmed that the quality of governance does not only affect the EPI value, but is more closely related to it ($b = 6,190$) than the level of democracy ($b = 1,745$). The results of the analysis confirmed the hypothesis about the direct influence of the institutional quality and state policy on the environmental conditions in the country. Regarding the level of well-being and values, they are more likely to have a complex impact on the environmental performance index, reflecting a rather insignificant value of the EPI compared to the previous figures. From this it can be concluded that investments in the quality of management, transparency, accountability and development of democratic institutions have a more significant impact on the state of the environmental situation than income growth and the change of values, the change of which can be affected in the long run, and therefore public policy should be aimed at increasing the governance efficiency and the progress of democracy.

Taken together, empirical evidence suggests that environmental friendliness in countries is determined primarily by the government effectiveness, rather than by the formal attribute of the welfare state as the scale of GDP redistribution through the budget. This situation can be characterized as the absence of a fatal character in the direct relationship between the level of income and the quality of environmental goods. In a wider sense, this confirms our hypothesis that environmental goods can be offered not so much by the quantitative parameters of such a state, but rather by qualitative as an attribute of the modern understanding of welfare state. Detected dependencies confirm that environmental friendliness as a manifestation of a modern, inclusive state-driven state is not the property of extremely wealthy countries. In other words, the more the society will generate pressure on the quality of institutions, the more likely it will be to improve governance, which will improve the environmental situation, and to a greater extent it will be coherently with a modern understanding of what social and individual well-being are.

In general, two important conclusions are drawn from the research: firstly, the level of country environmental performance index can be regarded as an important complementary criterion for the welfare state; secondly, the country environmental state is much more determined by the government efficiency, the quality of state institutions and their activities, rather than by an extensive increase in the funding of such institutions and environmental measures.

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References

1. ADRIAANSE C.C.M., 1993, Environmental Policy Performance Indicators: A Study of the Development of Indicators for Environmental Policy in The Netherlands, in: *Import*, 175 p.
2. ADRIAANSE C.C.M., 2007, Measuring residential satisfaction: a residential environmental satisfaction scale (RESS), in: *Journal of Housing and the Built Environment* 22.
3. AL-TUWAIJRI S., CHRISTENSEN T., HUGHES K.E., 2004, The Relations Among Environmental Disclosure, Environmental Performance, and Economic Performance: A Simultaneous Equations Approach, in: *Accounting, Organizations & Society* 29, p. 447-471.
4. ARROW K., BOLIN B., COSTANZA R., DASGUPTA P., FOLKE C., HOLLING C.S., JANSSON B., LEVIN S., MÄLER K., PERRINGS C., PIMENTEL D., 1996, Economic Growth, Carrying Capacity, and the Environment, in: *Environment and Development Economics* 1, p. 104-110.
5. BLANCHARD O., 2017, *Macroeconomics*, The MIT Press.
6. CHURCH D., 1992, *The Economy Vs. The Environment: Is There A Conflict?* http://www.ecoiq.com/dc-products/prod_conflict.html (1.05.2018).
7. CLARKSON M.P., LI Y., RICHARDS G.D., VASVARI F.P., 2008, Revising the Relation between Environmental Performance and Environmental Disclosure: An Empirical Analysis, in: *Accounting, Organizations & Society* 33, p. 303-327.
8. CRACOLICI M.F., CUFFARO M., 2010, The Measurement of Economic, Social and Environmental Performance of Countries: A Novel Approach, in: *Social Indicators Research* 95(2), p. 339-356.
9. CRACOLICI M.F., CUFFARO M., LACAGNINA V., 2018, Assessment of Sustainable Well-being in the Italian Regions: An Activity Analysis Model, in: *Ecological Economics* 143, p. 105-110.
10. DASGUPTA P., MÄLER K.-G., 1990, The Environment and Emerging Development Issues, in: *Proceedings of the Annual Bank Conference on Development Economics*.
11. DLUHOPOLSKYI O.V., 2017, Ecological component of sustainable development: from theories to implementations, in: *World of Finance* 4, p. 7-23.
12. DLUHOPOLSKYI O.V., 2018, Ecological racism and the movement for environmental justice, in: *Management of socio-economic development of the state and regions*, Collection of materials of the XII International Scientific and Practical Conference (26-27.04.2018), Zaporizhya, ZNU Publishing House, p. 91-93.
13. DLUHOPOLSKYI O.V., DLUHOPOLSKA T.I., ALI BAZMI, 2018, Sustainable development, values and ecological policy, in: *Strategies and policy of territories development: international, national, regional, and local challenges*, Materials of International Scientific and Practical Conference (10-12.05.2018), Chernivtsi, p. 91-92.
14. *Democracy Index*, 2017, <https://www.eiu.com/topic/democracy-index> (1.05.2018).
15. DUIT A., 2005, Understanding Environmental Performance of States: An Institution Centered Approach and Some Difficulties, *Working Paper Series* 7, Göteborg, Göteborg University, Sweden.

16. *Environmental Performance Index*, 2018, Palisades, NY, NASA Socioeconomic Data and Applications Center (SEDAC).
17. ESTY D., LEVY M.A., KIM C.H., de SHERBININ A., SREBOTNJAK T., MARA V., 2008, *Environmental Performance Index*, Yale Center for Environmental Law and Policy, New Haven, CT, USA.
18. GOEDKOOP M., SPRIENSMA R., 2001, *The Eco-Indicator '99: A Damage Oriented Method for Life Cycle Impact Assessment: Methodology Report*, <http://www.pre.nl>. (1.08.2018)
19. HALAFYAN A.A., 2008, *STATISTICA 6*, Statistical data analysis, M., 512 p.
20. INGLEHART R., WELZEL CH., 2015, *Inglehart–Welzel Cultural Map*, <http://www.worldvaluessurvey.org/WVSContents.jsp> (1.08.2018).
21. KAUFMANN D., KRAAY A., MASTRUZZI M., 2009, *Governance Matters VI: Governance Indicators*, World Bank Policy Research Working Paper 94280.
22. KOZLOVSKYI S., KHADZHYNOV I., VLASENKO I., MARYNCHAK L., 2017, Managing the sustainability of economic system as the basis of investment development in Ukraine, in: *Investment Management and Financial Innovations* 14(4), p. 50-59.
23. KLARE M.T., 2009, *Rising Powers, Shrinking Planet: New Geopolitics of Energy*, Henry Holt and Company, New York, 340 p.
24. KUZNETS S., 1955, Economic growth and income inequality, in: *American Economic Rev.* 49, p. 1-28.
25. PANAYOTOU T., 2003, *Economic Growth and the Environment*, Spring Seminar of the UN Economic Commission for Europe (March 3).
26. PORTER M.E., van der LINDE C., 1995, Toward a New Conception of the Environment-Competitiveness Relationship, in: *Journal of Economic Perspectives* 9(4), p. 97-118.
27. PRESCOTT-ALLEN R., 2001, *Measuring the Well-being of Nations*, <http://pratlif.com/economy/well-being.htm> (1.08.2018).
28. PRESCOTT-ALLEN R., 2001, *The Wellbeing of Nations: a Country-by-Country Index of Quality of Life and the Environment*, Washington DC, 342 p.
29. PUOLAMAA M., KAPLAS M., REINIKAINEN T., 1996, *Index of Environmental Friendliness: a Methodological Study*, Eurostat/Statistics, Finland.
30. ROODMAN D., 2004, Another Take on Free Market Environmentalism: A Friendly Critique, in: *PERC Reports* 22(1).
31. ROODMAN D., 2004, *Environmental Performance Index for Rich Nations*, Center for Global Development, 61 p.
32. SCRUGGS L., 1999, Institutions and Environmental Performance in Seventeen Western Democracies, in: *British Journal of Political Science* 29, p. 1-13.
33. The World Bank, 2018, *Indicators*, <https://data.worldbank.org/indicator> (1.08.2018).
34. *The Worldwide Governance Indicators project*, 2017, <http://info.worldbank.org/governance>.
35. *The World Values Survey*, 2015, <http://www.worldvaluessurvey.org> (1.08.2018).
36. *UK National Ecosystem Assessment*, 2014, <http://uknea.unep-wcmc.org>, (1.08.2018).
37. UN, Sustainable Development Goal, 2017.
38. van den BERGH J.M., JANSSEN M.A., 2004, *Economics of Industrial Ecology: Materials, Structural Change and Spatial Scales*, The MIT Press, 388 p.
39. WIESMETH H., 2012, *Environmental Economics. Theory and Policy Equilibrium with Contributions*, Springer-Verlag, Berlin, Heidelberg.
40. World Economic and Financial Surveys, 2017, *World Economic Outlook Database*, <https://www.imf.org/external/pubs/ft/weo/2017> (1.08.2018).

Appendix: Indicators of EPI, GDP per capita, WVS 6, GEI and DemI by country, made by authors based on (Environmental Performance Index, 2018; The World Bank, 2018; World Economic and Financial Surveys, 2017; Democracy Index, 2017; The Worldwide Governance Indicators project, 2017; The World Values Survey, 2015)

| Country | EPI (2018) | GDP per capita (2017) | WVS 6 (2015) | GEI (2016) | DemI (2017) |
|------------------------|---------------|--------------------------|-----------------|---------------|----------------|
| Albania | 65,46 | 12,472 | -1,020 | 0,00 | 5,98 |
| Algeria | 57,18 | 15,150 | -0,630 | -0,54 | 3,56 |
| Argentina | 59,30 | 20,677 | 0,420 | 0,18 | 6,96 |
| Armenia | 62,07 | 9,098 | -0,940 | -0,15 | 4,11 |
| Australia | 74,12 | 49,882 | 1,915 | 1,58 | 9,09 |
| Austria | 78,97 | 49,247 | 0,665 | 1,51 | 8,42 |
| Azerbaijan | 62,33 | 17,433 | -1,170 | -0,16 | 2,65 |
| Bahrain | 55,15 | 51,846 | -0,580 | 0,32 | 2,71 |
| Belarus | 64,98 | 18,616 | -1,415 | -0,51 | 3,13 |
| Belgium | 77,38 | 46,301 | 1,290 | 1,33 | 7,78 |
| Bosnia and Herzegovina | 41,84 | 11,404 | -0,875 | -0,43 | 4,87 |
| Brazil | 60,70 | 15,500 | 0,290 | -0,18 | 6,86 |
| Burkina Faso | 42,83 | 1,884 | -1,375 | -0,55 | 4,75 |
| Burundi | 27,43 | 0,808 | -0,250 | -1,40 | 2,33 |
| Canada | 72,18 | 48,141 | 2,080 | 1,80 | 9,15 |
| Chile | 57,49 | 24,588 | 0,310 | 1,02 | 7,84 |
| China | 50,74 | 16,624 | -1,100 | 0,36 | 3,10 |
| Colombia | 65,22 | 14,455 | 0,920 | 0,02 | 6,67 |
| Croatia | 65,45 | 24,095 | -0,190 | 0,49 | 6,63 |
| Cyprus | 72,60 | 36,557 | -0,415 | 0,98 | 7,59 |
| Czech Republic | 67,68 | 35,223 | 0,000 | 1,06 | 7,62 |
| Denmark | 81,60 | 49,613 | 2,185 | 1,89 | 9,22 |
| Ecuador | 57,42 | 11,234 | 0,500 | -0,43 | 6,02 |

| | | | | | |
|--------------------------|-------|---------|--------|-------|------|
| Estonia | 64,31 | 31,473 | -0,790 | 1,12 | 7,79 |
| Ethiopia | 44,78 | 2,113 | -0,315 | -0,64 | 3,42 |
| Finland | 78,64 | 44,050 | 1,250 | 1,85 | 9,03 |
| France | 83,95 | 43,550 | 1,000 | 1,41 | 7,80 |
| Georgia | 55,69 | 10,644 | -0,875 | 0,51 | 5,93 |
| Germany | 78,37 | 50,206 | 0,685 | 1,74 | 8,61 |
| Ghana | 49,66 | 4,605 | -0,335 | -0,20 | 6,69 |
| Greece | 73,60 | 27,776 | 0,040 | 0,21 | 7,29 |
| Guatemala | 52,33 | 8,173 | 0,080 | -0,60 | 5,86 |
| Hungary | 65,01 | 28,910 | 0,650 | 0,45 | 6,64 |
| Iceland | 78,57 | 52,150 | 2,020 | 1,41 | 9,58 |
| India | 30,57 | 7,174 | 0,390 | 0,10 | 7,23 |
| Indonesia | 46,92 | 12,378 | -0,750 | 0,01 | 6,39 |
| Iraq | 43,20 | 17,004 | -1,030 | -1,26 | 4,09 |
| Ireland | 78,77 | 72,632 | 0,170 | 1,35 | 9,15 |
| Japan | 74,69 | 42,659 | 0,205 | 1,83 | 7,88 |
| Jordan | 62,20 | 12,487 | -1,100 | 0,14 | 3,87 |
| Kazakhstan | 54,56 | 26,071 | -0,770 | -0,06 | 3,06 |
| Kyrgyzstan | 54,86 | 3,652 | -0,580 | -0,90 | 5,11 |
| Latvia | 66,12 | 27,291 | -0,800 | 1,00 | 7,25 |
| Lebanon | 61,08 | 19,486 | -0,750 | -0,53 | 4,72 |
| Lithuania | 69,33 | 31,935 | -1,200 | 1,09 | 7,41 |
| Luxembourg | 79,12 | 109,192 | 0,960 | 1,69 | 8,81 |
| Macedonia | 61,06 | 15,203 | -0,125 | 0,09 | 5,57 |
| Malaysia | 59,22 | 28,871 | -0,330 | 0,88 | 6,54 |
| Mali | 43,71 | 2,169 | 0,040 | -0,99 | 5,64 |
| Malta | 80,90 | 42,532 | 0,420 | 0,95 | 8,15 |
| Mexico | 59,69 | 19,480 | 1,210 | 0,14 | 6,41 |
| Moldova | 51,97 | 5,657 | -1,610 | -0,62 | 5,94 |
| Montenegro | 61,33 | 17,439 | -0,690 | 0,10 | 5,69 |
| Morocco | 63,47 | 8,612 | -1,190 | -0,10 | 4,87 |
| New Zealand | 75,96 | 38,502 | 1,710 | 1,86 | 9,26 |
| Nigeria | 54,76 | 5,927 | -0,210 | -1,09 | 4,44 |
| Norway | 77,49 | 70,590 | 2,040 | 1,88 | 9,87 |
| Pakistan | 37,50 | 5,354 | 0,040 | -0,64 | 4,26 |
| Peru | 61,92 | 13,342 | 0,000 | -0,17 | 6,49 |
| Philippines | 57,65 | 8,229 | 0,310 | -0,01 | 6,71 |
| Poland | 64,11 | 29,251 | 0,750 | 0,69 | 6,67 |
| Portugal | 71,91 | 30,258 | -0,080 | 1,22 | 7,84 |
| Qatar | 67,80 | 124,927 | 0,205 | 0,75 | 3,19 |
| Romania | 64,78 | 23,991 | -1,000 | -0,17 | 6,44 |
| Russia | 63,79 | 27,89 | -1,250 | -0,22 | 3,17 |
| Rwanda | 43,68 | 2,081 | -0,460 | 0,11 | 3,19 |
| Serbia | 57,49 | 15,164 | -0,835 | 0,09 | 6,41 |
| Slovakia | 70,60 | 32,895 | -0,065 | 0,89 | 7,16 |
| Slovenia | 67,57 | 34,063 | 0,125 | 1,12 | 7,50 |
| South Africa | 44,73 | 13,403 | 0,125 | 0,27 | 7,24 |
| South Korea | 62,30 | 39,387 | -0,630 | 1,07 | 8,00 |
| Spain | 78,39 | 38,171 | 0,335 | 1,12 | 8,08 |
| Sweden | 80,51 | 51,264 | 2,205 | 1,79 | 9,39 |
| Switzerland | 87,42 | 61,360 | 1,375 | 2,03 | 9,03 |
| Taiwan | 72,84 | 49,827 | -0,710 | 1,37 | 7,73 |
| Thailand | 49,88 | 17,786 | 0,010 | 0,34 | 4,63 |
| Trinidad and Tobago | 67,36 | 31,154 | 0,290 | 0,22 | 7,04 |
| Tunisia | 62,35 | 11,987 | -1,625 | -0,21 | 6,32 |
| Turkey | 52,96 | 26,453 | -0,250 | 0,05 | 4,88 |
| Ukraine | 52,87 | 8,656 | -1,315 | -0,58 | 5,69 |
| United Kingdom | 79,89 | 43,620 | 1,550 | 1,61 | 8,53 |
| United States of America | 71,19 | 59,495 | 1,165 | 1,48 | 7,98 |
| Uruguay | 64,65 | 22,445 | 0,705 | 0,55 | 8,12 |
| Zambia | 50,97 | 3,997 | -0,625 | -0,66 | 5,68 |
| Zimbabwe | 43,41 | 2,277 | -0,460 | -1,16 | 3,16 |
| Viet Nam | 46,96 | 6,876 | -0,065 | 0,01 | 3,08 |

Sustainable Development in Asian countries – Indicator-based Approach

Zrównoważony rozwój krajów azjatyckich – podejście wskaźnikowe

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Abstract

The study discusses problems related to the concept of sustainable development in Asian countries in the period 2002-2015. The introduction presents the occurring transformations, involving the majority of Asian countries, taking into account their diversity and contrasts. In addition, the goals allowing the implementation of sustainable development concept in Asia-Pacific region are specified. In the next part of the article the indicators of sustainable development, selected for the analysis and covering all key areas, i.e. social, economic, environmental, spatial, institutional-political are characterised. A synthetic development measure (SDM) was applied as the research method, and the data for calculations were collected from the World Bank sources. The research results, illustrating the position of individual countries against the level of sustainable development concept implementation in the analysed years, remain the crucial part of the study. Within the framework of conclusions it can be stated that the situation of Asian countries, in terms of sustainable development, requires improvement. In turn, a noticeable and gradual progress refers to the majority of analysed countries. The best results were recorded in the following countries: Singapore, Japan, South Korea, Qatar, United Arab Emirates and Malaysia. The least favourable situation was observed in Yemen, Iraq, Burma, Uzbekistan, Cambodia, Oman and Iran.

Key words: Asia, sustainable development, linear ordering, economy, society, environment

Streszczenie

W opracowaniu poruszona została problematyka odnosząca się do koncepcji zrównoważonego rozwoju w krajach azjatyckich w latach 2002-2015. W ramach wprowadzenia nawiązano do zachodzących przemian, które są udziałem większości krajów Azji, uwzględniających ich zróżnicowanie i kontrasty. Ponadto wyszczególniono cele, które umożliwiają implementację koncepcji zrównoważonego rozwoju w regionie Azji i Pacyfiku. W kolejnej części artykułu scharakteryzowano wskaźniki zrównoważonego rozwoju wybrane do analizy, obejmujące wszystkie kluczowe obszary, tj. społeczny, ekonomiczny, środowiskowy, przestrzenny, instytucjonalno-polityczny. Zastosowaną metodą badawczą był syntetyczny miernik rozwoju (SMR), dane do obliczeń pozyskane zostały ze źródeł Banku Światowego. Najważniejszą część opracowania stanowią wyniki badań, pokazujące pozycję poszczególnych krajów względem poziomu implementacji koncepcji zrównoważonego rozwoju w badanych latach. W ramach wniosków można stwierdzić, że sytuacja krajów azjatyckich względem rozwoju zrównoważonego wymaga poprawy. Zauważalny jest natomiast sukcesywny progres, będąca udziałem większości krajów. W grupie krajów, które wypadły najkorzystniej znalazły się: Singapur, Japonia, Korea Południowa, Katar, Zjednoczone Emiraty Arabskie, Malezja. Najmniej korzystnie sytuacja przedstawia się w Jemenie, Iraku, Birmie, Uzbekistanie, Kambodży, Omanie, Iranie.

Słowa kluczowe: Azja, zrównoważony rozwój, porządkowanie liniowe, gospodarka, społeczeństwo, środowisko

1. Introduction

In recent years the region of Asia has experienced dynamic transformations, which have predominantly covered the economy sector, but also referred to demographics, institutional, environmental or cultural spheres. An assumption can be adopted that in the context of the aforementioned changes it is Asia, which apart from South America, is going to play an increasingly important role in the global scale due to its significant growth potential. In other words, Asia has returned to the centre of the world's attention, just as it used to be for centuries, before the dominance of the Western world (Batabyal and Nijkamp, 2016). This huge continent, the largest in the world, is also the arena of extensive contrasts, development disparities, areas of great wealth and extreme poverty. Diversification remains both its strength and weakness, depending on the adopted assessment criteria (*Environmental Governance ...*, 2002).

As a result of the occurring structural changes, covering the majority of Asian countries, a gradual shift from a rural society, with its dominant agricultural function, to an urban one with its prevailing industrial function is observed (Zhou, 2001). Based on the available forecasts, one can assume that this phenomenon will be intensified in the decades to come. It has been adopted that sustainable development is the correct direction for socio-economic development of continental agglomerations. Moreover, along the path heading towards economic growth the requirement of avoiding environmental damage, destroying natural resources, underestimating the importance of social fabric and culture sector may never be neglected (Prasad, 2017; Raszkowski, 2014; *Urban Environmental Governance ...*, 2005; Starr, 2013). In Asian countries competitive advantages are developed increasingly frequently, as they derive from supporting socio-economic activity by modern development factors, high quality human capital, revitalization of public space adjusted to contemporary requirements, also covering environmental aspects (Raszkowski and Głuszczyk, 2015, 2017; Sutton, 2010; Mitchell, 2001; Wang *et al.*, 2013).

The awareness of the importance of sustainable development principles' implementation and environmental responsibility depend on the level of an individual country development and the carried out public policies, education level taking into account environmental concerns and the heritage of future generations (Judson, 2010, 2017; Archer, 2017; Ramathan *et al.*, 2017; Mori, 2013). Among numerous goals, to be achieved as a result of implementing the sustainable development concept in Asia-Pacific region, the following can also be included: counteracting poverty and combating hunger, improving health, higher education quality, gender equality, access to clean water and sanitation, ecological energy sources, acceptable working conditions and the level

of economic growth. Moreover, the listed factors are extended by: the pursuit towards innovative industry and infrastructure, the reduction of social inequalities (Kohl, 2002), urban and social development based on the fundamental principles of sustainable development, responsible consumption and production, the improvement of natural climate, aquatic environment, life on land, the pursuit of peace and justice as well as cooperation to accomplish all of the aforementioned objectives (*Asia-Pacific Sustainable Development ...*, 2017; *Achieving the Sustainable Development ...*, 2017; Choi, 2018; Servaes, 2017). The study aims at presenting and analysing the position of individual Asian countries regarding the level of sustainable development concept implementation in the years 2002-2015, thus the study covers a relatively long period of time. The selection of indicators used in the conducted analyses and the period under consideration were determined by the availability of reliable public statistics. The chosen indicators remain in line with the European approach towards measuring the level of sustainable development. They also cover all areas responsible for the achievement of sustainable development goals in Asian countries (*Asia-Pacific Sustainable Development ...*, 2017). A synthetic development measure (SDM) was used as the research method to assess the implementation of sustainable development standards in Asian countries, and the data for calculations were collected from the World Bank sources. The applied research method should be approached as one of the proposals for measuring sustainable development, as its advantage is both measurability and comparability.

2. Research methodology, sustainable development indicators of Asian countries

Indicators can be perceived as a useful accessory for evaluation, communication and decision making. In other terms, they represent quantitative tools synthesizing and simplifying data relevant in assessing specific phenomena. The indicators of sustainable development can be defined as a statistical measure that gives an indication on the sustainability of social, environmental and economic development. In the opinion of some researchers, indicators represent the basic instrument for monitoring sustainable development, as they show this concept of development in a rational and measurable manner (*Handbook of National Accounting ...*, 2003; Borys, 2005, 2010; Palmer, 1998; Geniaux *et al.*, 2009).

The indicators selected for the presented analysis allow analysing progress in the discussed development concept implementation with reference to territorial units, in this case at the national level of Asian countries, in accordance with the approach adopted by the European Union (*Sustainable development in the European Union ...*, 2015; 2017) in measuring the level of sustainable development.

Table 1. The indicators of sustainable development selected for the analysis with regard to Asian countries, characteristics, source: World Development Indicators; *Indicators of Sustainable Development...*, *Defining a Sustainable Transport...*

| SDI theme | Indicator | The importance of an indicator for sustainable development |
|--|--|--|
| Socio-economic development | GDP per capita (current US\$) | GDP per capita is gross domestic product divided by midyear population. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in current U.S. dollars. |
| | Foreign direct investment, net inflows (BoP, current US\$) | Foreign direct investment refers to direct investment equity flows in the reporting economy. It is the sum of equity capital, reinvestment of earnings, and other capital. Direct investment is a category of cross-border investment associated with a resident in one economy having control or a significant degree of influence on the management of an enterprise that is resident in another economy. Ownership of 10 percent or more of the ordinary shares of voting stock is the criterion for determining the existence of a direct investment relationship. Data are in current U.S. dollars. |
| | Unemployment, total (% of total labour force) | Unemployment refers to the share of the labour force that is without work but available for and seeking employment. |
| Sustainable production and consumption | CO ₂ emissions from solid fuel consumption (kt) | Carbon dioxide emissions from solid fuel consumption refer mainly to emissions from use of coal as an energy source. |
| | Access to electricity (% of population) | Access to electricity is the percentage of population with access to electricity. Electrification data are collected from industry, national surveys and international sources. |
| | Fertilizer consumption (kilograms per hectare of arable land) | Fertilizer consumption measures the quantity of plant nutrients used per unit of arable land. Fertilizer products cover nitrogenous, potash, and phosphate fertilizers (including ground rock phosphate). Traditional nutrients--animal and plant manures--are not included. For the purpose of data dissemination, FAO has adopted the concept of a calendar year (January to December). Some countries compile fertilizer data on a calendar year basis, while others are on a split-year basis. Arable land includes land defined by the FAO as land under temporary crops (double-cropped areas are counted once), temporary meadows for mowing or for pasture, land under market or kitchen gardens, and land temporarily fallow. Land abandoned as a result of shifting cultivation is excluded. |
| Social inclusion | Depth of the food deficit (kilocalories per person per day) | The depth of the food deficit indicates how many calories would be needed to lift the undernourished from their status, everything else being constant. The average intensity of food deprivation of the undernourished, estimated as the difference between the average dietary energy requirement and the average dietary energy consumption of the undernourished population (food-deprived), is multiplied by the number of undernourished to provide an estimate of the total food deficit in the country, which is then normalized by the total population. |
| | Individuals using the Internet (% of population) | Internet users are individuals who have used the Internet (from any location) in the last 3 months. The Internet can be used via a computer, mobile phone, personal digital assistant, games machine, digital TV etc. |
| | Unemployment, youth total (% of total labour force ages 15-24) (modelled ILO estimate) | Youth unemployment refers to the share of the labour force ages 15-24 without work but available for and seeking employment. |
| Demographic changes | Birth rate, crude (per 1,000 people) | Crude birth rate indicates the number of live births occurring during the year, per 1,000 population estimated at midyear. Subtracting the crude death rate from the crude birth rate provides the rate of natural increase, which is equal to the rate of population change in the absence of migration. |
| | Population ages 65 and above (% of total) | Population ages 65 and above as a percentage of the total population. Population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship. |
| | Age dependency ratio (% of working-age population) | Age dependency ratio is the ratio of dependents--people younger than 15 or older than 64--to the working-age population--those ages 15-64. Data are shown as the proportion of dependents per 100 working-age population. |
| Public health | Life expectancy at birth, total | Life expectancy at birth indicates the number of years a newborn infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life. |
| | Mortality rate, infant (per 1,000 live births) | Infant mortality rate is the number of infants dying before reaching one year of age, per 1,000 live births in a given year. |
| | Health expenditure, total (% of GDP) | Total health expenditure is the sum of public and private health expenditure. It covers the provision of health services (preventive and curative), family planning activities, nutrition activities, and emergency aid designated for health but does not include provision of water and sanitation. |
| Climate change and Energy | CO ₂ emissions (kg per 2010 US\$ of GDP) | Carbon dioxide emissions are those stemming from the burning of fossil fuels and the manufacture of cement. They include carbon dioxide produced during consumption of solid, liquid, and gas fuels and gas flaring. |
| | Renewable energy consumption (% of total final energy consumption) | Renewable energy consumption (% of total final energy consumption) |
| | Total greenhouse gas emissions (kt of CO ₂ equivalent) | Total greenhouse gas emissions in kt of CO ₂ equivalent are composed of CO ₂ totals excluding short-cycle biomass burning (such as agricultural waste burning and Savannah burning) but including other biomass burning (such as forest fires, post-burn decay, peat fires and decay of drained peatlands), all anthropogenic CH ₄ sources, N ₂ O sources and F-gases (HFCs, PFCs and SF ₆). |

| SDI theme | Indicator | The importance of an indicator for sustainable development |
|-----------------------|---|--|
| Sustainable transport | CO ₂ emissions from transport (% of total fuel combustion) | CO ₂ emissions from transport contain emissions from the combustion of fuel for all transport activity, regardless of the sector, except for international marine bunkers and international aviation. This includes domestic aviation, domestic navigation, road, rail and pipeline transport, and corresponds to IPCC Source/Sink Category 1 A 3. In addition, the IEA data are not collected in a way that allows the autoproducer consumption to be split by specific end-use and therefore, autoproducers are shown as a separate item (Unallocated Autoproducers). |
| | Fossil fuel energy consumption (% of total) | Fossil fuel comprises coal, oil, petroleum, and natural gas products. |
| | Air transport, passengers carried | Air freight is the volume of freight, express, and diplomatic bags carried on each flight stage (operation of an aircraft from take-off to its next landing), measured in metric tons times kilometres travelled. |
| | Air transport, freight (million ton-km) | Air freight is the volume of freight, express, and diplomatic bags carried on each flight stage (operation of an aircraft from take-off to its next landing), measured in metric tons times kilometres travelled. |
| Natural resources | Forest area (% of land area) | Forest area is land under natural or planted stands of trees of at least 5 meters in situ, whether productive or not, and excludes tree stands in agricultural production systems (for example, in fruit plantations and agroforestry systems) and trees in urban parks and gardens. |
| | Forest rents (% of GDP) | Forest rents are roundwood harvest times the product of average prices and a region-specific rental rate. |
| | People using basic drinking water services (% of population) | The percentage of people using at least basic water services. This indicator encompasses both people using basic water services as well as those using safely managed water services. Basic drinking water services are defined as drinking water from an improved source, provided collection time is not more than 30 minutes for a round trip. Improved water sources include piped water, boreholes or tubewells, protected dug wells, protected springs, and packaged or delivered water. |
| | Total natural resources rents (% of GDP) | Total natural resources rents are the sum of oil rents, natural gas rents, coal rents (hard and soft), mineral rents, and forest rents. |
| Global partnership | Import value index (2000 = 100) | Import value indexes are the current value of imports (c.i.f.) converted to U.S. dollars and expressed as a percentage of the average for the base period (2000). UNCTAD's import value indexes are reported for most economies. For selected economies for which UNCTAD does not publish data, the import value indexes are derived from import volume indexes (line 73) and corresponding unit value indexes of imports (line 75) in the IMF's International Financial Statistics. |
| | Imports of goods and services (% of GDP) | Imports of goods and services represent the value of all goods and other market services received from the rest of the world. They include the value of merchandise, freight, insurance, transport, travel, royalties, license fees, and other services, such as communication, construction, financial, information, business, personal, and government services. They exclude compensation of employees and investment income (formerly called factor services) and transfer payments. |
| | Improved water source (% of population with access) | Access to an improved water source refers to the percentage of the population using an improved drinking water source. The improved drinking water source includes piped water on premises (piped household water connection located inside the user's dwelling, plot or yard), and other improved drinking water sources (public taps or standpipes, tube wells or boreholes, protected dug wells, protected springs, and rainwater collection). |
| Good governance | Voice and Accountability | This indicator reflects the extent to which a given country population is capable of participating in the election of their authorities. Additionally, freedom of speech and expression level, the functioning of free media or the freedom of association are taken into account. The particular elements of good governance are extremely important in an overall perception of sustainable development concept implementation. |
| | Rule of Law | Rule of law captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence. |
| | Control of Corruption | Control of corruption capturing perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as capture of the state by elites and private interests. |

In this case, the reference to the European perspective on the perception of sustainable development is intentional. Such solution provides the basis for putting forward conclusions and potential comparisons of Asian countries against the European ones. In addition, despite many differences between the two continents, the concept of sustainable development is characterised by universalism, hence its basic values are unchanged in the global dimension. Moreover, the basic goals of sustainable development remain identical. The selected indicators are characterised in Tab. 1.

The discussed approach towards analysing the concept of sustainable development implementation is

based on a general assessment of individual elements, the fulfilment of which results in full implementation of the concept. At this point it should be emphasized that the choice of variables for the study was driven by the concern to include each of the spheres that co-create sustainable development, i.e. social, economic, environmental, spatial, and institutional-political one. In the process of assessing the level of sustainable development standards implementation, it is crucial to specify the list of indicators representing the selected, significant aspects related to each of the aforementioned spheres of sustainable development. Moreover, the indicators should be characterised and described in terms of their im-

Table 2. The set of indicators included in Asian countries ordering from the perspective of implementing sustainable development concept, source: authors' compilation based on the World Development Indicators

| SDI theme | Indicator | Indicator type | Reference value |
|--|--|----------------|-----------------|
| Socio-economic development | GDP per capita (current thousand US\$) | stimulant | 88,56 |
| | Foreign direct investment, net inflows (BoP, current billion US\$) | stimulant | 2900928,43 |
| | Unemployment, total (% of total labour force) | destimulant | 0,1 |
| Sustainable production and consumption | CO ₂ emissions from solid fuel consumption (kt) | destimulant | 0 |
| | Access to electricity (% of population) | stimulant | 100 |
| | Fertilizer consumption (kilograms per hectare of arable land) | destimulant | 0 |
| Social inclusion | Depth of the food deficit (kilocalories per person per day) | destimulant | 0 |
| | Individuals using the Internet (% of population) | stimulant | 93,48 |
| | Unemployment, youth total (% of total labour force ages 15-24) (modelled ILO estimate) | destimulant | 0,17 |
| Demographic changes | Birth rate, crude (per 1,000 people) | stimulant | 38,04 |
| | Population ages 65 and above (% of total) | destimulant | 0,75 |
| | Age dependency ratio (% of working-age population) | destimulant | 16,45 |
| Public health | Life expectancy at birth, total (years) | stimulant | 83,84 |
| | Mortality rate, infant (per 1,000 live births) | destimulant | 2,0 |
| | Health expenditure, total (% of GDP) | stimulant | 87,60 |
| Climate change and Energy | CO ₂ emissions (kg per 2010 US\$ of GDP) | destimulant | 0,10 |
| | Renewable energy consumption (% of total final energy consumption) | stimulant | 91,31 |
| | Total greenhouse gas emissions (kt of CO ₂ equivalent) | destimulant | 6460,24 |
| Sustainable transport | CO ₂ emissions from transport (% of total fuel combustion) | destimulant | 4,78 |
| | Fossil fuel energy consumption (% of total) | destimulant | 8,62 |
| | Air transport, passengers carried (persons) | stimulant | 436183969 |
| | Air transport, freight (million ton-km) | stimulant | 232960,3 |
| Natural resources | Forest area (% of land area) | stimulant | 68,48 |
| | Forest rents (% of GDP) | destimulant | 0 |
| | People using basic drinking water services (% of population) | stimulant | 100 |
| | Total natural resources rents (% of GDP) | destimulant | 0,00 |
| Global partnership | Import value index (2000 = 100) | stimulant | 1211,35 |
| | Imports of goods and services (% of GDP) | stimulant | 210,41 |
| | Improved water source (% of population with access) | stimulant | 100 |
| Good governance | Voice and Accountability | stimulant | 1,11 |
| | Rule of Law | stimulant | 1,82 |
| | Control of Corruption | stimulant | 2,32 |

portance for sustainable development (Borys, 2011; Pawłowski, 2008).

It is also important to define the quantitative objectives to be achieved, in order to indicate the extent of sustainable development concept implementation. Defining such objectives depends, however, on the nature of each variable. The following variables can be distinguished: stimulants, destimulants and non-instants.

The method of synthetic development measure (SDM) was used to assess the implementation of sustainable development standards in Asian countries. It provided the basis to develop the ranking and to establish the position of individual countries. SDM is applied in linear ordering of objects characterised by many diagnostic variables, later replaced by one diagnostic value (Jajuga *et al.*, 2003).

The SDM development procedure is carried out in several stages and has been presented in detail in the study discussing the level of sustainable development concept implementation in the Russian Federation (see: Bartniczak and Raszkowski, 2017).

3. Sustainable development of Asian countries in the years 2002-2015

The values of the synthetic development measure (SDM), in the years 2002-2015, were estimated based on the set of indicators listed in Tab. 2. The Table also presents the nature (interpretation) of indicators and the coordinates (values) of the reference unit common for the years 2002-2015.

The analysis covered the situation in terms of implementing sustainable development standards in Asian

Table 3. SDM value, positions of particular countries, changes in positions in the years 2002-2015, source: authors' estimations based on the World Development Indicators

| Country | | 2002 | | 2003 | | 2004 | | 2005 | | 2006 | | 2007 | | 2008 | | 2009 | | 2010 | | 2011 | | 2012 | | 2013 | | 2014 | | 2015 | | | | | | | | | | | | | |
|--------------|----|------|-----------|------|-----------|------|-----------|------|-----------|------|-----------|------|-----------|------|-----------|------|-----------|------|-----------|------|-----------|------|-----------|------|-----------|------|-----------|------|-----------|----|----|----|----|----|----|----|----|----|----|----|----|
| | | SD M | posi tion | SD M | posi tion | SD M | posi tion | SD M | posi tion | SD M | posi tion | SD M | posi tion | SD M | posi tion | SD M | posi tion | SD M | posi tion | SD M | posi tion | SD M | posi tion | SD M | posi tion | SD M | posi tion | SD M | posi tion | | | | | | | | | | | | |
| Saudi Arabia | 84 | 19 | 0.3 | 86 | 20 | 1 | 85 | 21 | 2 | 90 | 22 | 1 | 07 | 17 | -5 | 12 | 17 | 0 | 21 | 16 | -1 | 22 | 9 | 3 | 18 | 3 | 29 | 16 | -2 | 33 | 15 | -1 | 38 | 17 | 2 | 46 | 12 | -5 | | | |
| Armenia | 77 | 23 | 0.3 | 73 | 23 | 1 | 75 | 23 | 0 | 76 | 24 | 1 | 80 | 24 | 0 | 86 | 24 | 0 | 84 | 26 | 2 | 91 | 26 | 0 | 96 | 26 | 0 | 02 | 24 | -2 | 07 | 24 | 0 | 07 | 26 | 2 | 01 | 29 | 3 | | |
| Azerbaijan | 32 | 31 | 0.3 | 31 | 46 | 55 | 26 | -3 | 58 | 28 | 2 | 57 | 31 | 3 | 65 | 31 | 0 | 69 | 29 | -2 | 78 | 27 | -2 | 85 | 27 | 0 | 93 | 27 | 0 | 98 | 27 | 0 | 05 | 25 | -2 | 05 | 28 | 3 | 08 | 27 | -1 |
| Bahrain | 09 | 11 | 0.4 | 09 | 17 | 10 | -1 | 21 | 9 | -1 | 21 | 9 | -1 | 21 | 9 | -1 | 36 | 10 | -4 | 29 | 14 | 4 | 30 | 14 | 0 | 36 | 13 | -1 | 38 | 14 | 1 | 41 | 14 | 0 | 39 | 16 | 2 | 32 | 18 | 2 | |
| Bangladesh | 65 | 24 | 0.3 | 65 | 45 | 66 | 25 | 1 | 74 | 24 | -1 | 77 | 23 | -1 | 85 | 23 | 0 | 92 | 23 | 0 | 91 | 23 | 0 | 95 | 24 | 1 | 01 | 24 | 0 | 01 | 26 | 2 | 05 | 26 | 0 | 11 | 25 | -1 | 11 | 26 | 1 |
| Burma | 91 | 34 | 0.2 | 91 | 34 | 0 | 98 | 34 | 0 | 17 | 34 | 0 | 21 | 34 | 0 | 33 | 34 | 0 | 42 | 34 | 0 | 50 | 34 | 0 | 65 | 33 | -1 | 82 | 30 | -3 | 95 | 29 | -1 | 99 | 29 | 0 | 15 | 23 | -6 | | |
| China | 03 | 15 | 0.4 | 03 | 15 | 0 | 08 | 15 | 0 | 14 | 14 | -1 | 17 | 14 | 0 | 28 | 13 | -1 | 36 | 9 | -3 | 52 | 9 | 0 | 57 | 8 | -1 | 59 | 7 | -1 | 62 | 7 | 0 | 64 | 8 | 1 | 53 | 10 | 2 | | |
| Philippines | 97 | 14 | 0.3 | 97 | 90 | 88 | 18 | 1 | 03 | 16 | -2 | 96 | 18 | 2 | 99 | 20 | 2 | 97 | 22 | 2 | 96 | 22 | 0 | 08 | 21 | -1 | 17 | 19 | -2 | 24 | 18 | -1 | 32 | 16 | -2 | 39 | 15 | -1 | 42 | 15 | 0 |
| Georgia | 03 | 16 | 0.4 | 03 | 16 | 0 | 18 | 12 | -2 | 27 | 9 | -3 | 31 | 10 | 1 | 33 | 13 | 3 | 29 | 13 | 0 | 44 | 11 | -2 | 47 | 9 | -2 | 53 | 9 | 0 | 04 | 9 | 0 | 65 | 7 | -2 | 62 | 8 | 1 | | |
| India | 02 | 13 | 0.4 | 02 | 13 | 0 | 18 | 11 | -2 | 21 | 11 | 0 | 30 | 11 | 0 | 37 | 9 | -2 | 34 | 11 | 2 | 36 | 12 | 1 | 45 | 10 | -2 | 48 | 11 | 1 | 52 | 11 | 0 | 04 | 10 | -1 | 65 | 6 | -4 | | |
| Indonesia | 68 | 22 | 0.3 | 68 | 73 | 61 | 21 | -2 | 86 | 20 | -1 | 91 | 20 | 0 | 03 | 19 | -1 | 12 | 16 | -3 | 07 | 18 | 2 | 21 | 17 | -1 | 31 | 15 | -2 | 40 | 13 | -2 | 42 | 13 | 0 | 48 | 11 | -2 | 48 | 11 | 0 |
| Iraq | 02 | 35 | 0.2 | 35 | 66 | 66 | 36 | 1 | 02 | 35 | 0 | 02 | 35 | 0 | 94 | 35 | 0 | 03 | 35 | 0 | 19 | 35 | 0 | 22 | 35 | 0 | 21 | 35 | 0 | 28 | 35 | 0 | 37 | 35 | 0 | 40 | 35 | 0 | 43 | 35 | 0 |
| Iran | 58 | 25 | 0.3 | 58 | 63 | 63 | 25 | 0 | 67 | 24 | -1 | 62 | 27 | 2 | 66 | 30 | 3 | 67 | 31 | 1 | 70 | 31 | 0 | 70 | 32 | 1 | 74 | 31 | -1 | 80 | 32 | 1 | 80 | 33 | 1 | 81 | 33 | 0 | 83 | 32 | -1 |
| Israel | 04 | 26 | 0.4 | 26 | 5 | 0 | 29 | 6 | 1 | 33 | 6 | 0 | 47 | 5 | -1 | 55 | 5 | 0 | 48 | 7 | 2 | 52 | 7 | 0 | 58 | 7 | 0 | 58 | 8 | 1 | 59 | 8 | 0 | 58 | 9 | 1 | 59 | 9 | 0 | | |
| Japan | 66 | 1 | 0.4 | 66 | 1 | 0 | 75 | 1 | 0 | 82 | 1 | 0 | 79 | 2 | 1 | 86 | 2 | 1 | 86 | 2 | 1 | 86 | 2 | 0 | 87 | 3 | 1 | 84 | 3 | 0 | 84 | 3 | 0 | 84 | 3 | 0 | 85 | 4 | 1 | | |
| Jordan | 03 | 20 | 0.3 | 20 | 86 | 86 | 16 | -2 | 97 | 17 | 1 | 01 | 16 | -1 | 04 | 18 | 2 | 08 | 18 | 0 | 06 | 19 | 1 | 08 | 20 | 1 | 14 | 21 | 1 | 16 | 22 | 1 | 17 | 22 | 0 | 21 | 21 | -1 | 17 | 22 | 1 |
| Cam-bodia | 22 | 33 | 0.3 | 33 | 29 | 39 | 32 | 0 | 47 | 31 | -1 | 59 | 30 | -1 | 67 | 29 | -1 | 72 | 29 | -1 | 72 | 29 | -1 | 72 | 30 | 1 | 83 | 29 | -1 | 95 | 28 | -1 | 03 | 27 | -1 | 15 | 24 | -3 | 04 | 24 | 0 |
| Qatar | 06 | 12 | 0.4 | 06 | 13 | 12 | 0 | 16 | 9 | -4 | 38 | 7 | -2 | 43 | 8 | 1 | 51 | 6 | -2 | 52 | 4 | -2 | 52 | 8 | 4 | 4 | 12 | 4 | 47 | 12 | 0 | 44 | 12 | -2 | 47 | 12 | 2 | 43 | 14 | 7 | |

| Country | 2002 | | 2003 | | 2004 | | 2005 | | 2006 | | 2007 | | 2008 | | 2009 | | 2010 | | 2011 | | 2012 | | 2013 | | 2014 | | 2015 | |
|--------------|-----------------|--------------|----------------|--------------|----------------|--------------|----------------|--------------|----------------|--------------|-----------|--------------|-----------|--------------|-----------|--------------|-----------|--------------|-----------|--------------|-----------|--------------|-----------|--------------|-----------|--------------|-----------|--------------|
| | SD M | posi tion | SD M | posi tion | SD M | posi tion | SD M | posi tion | SD M | posi tion | SD M | posi tion | SD M | posi tion | SD M | posi tion | SD M | posi tion | SD M | posi tion | SD M | posi tion | SD M | posi tion | SD M | posi tion | SD M | posi tion |
| Kazakhstan | 0.3 40 8 | 30 | 0.3 45 8 | 30 | 0.3 50 1 | 30 | 0.3 58 7 | 29 | -1 7 | 0.3 29 | -1 | 0.3 72 | 25 | -3 7 | 0.3 87 | 25 | 0.3 93 | 25 | 0.3 93 | 25 | 0.4 23 | -2 | 0.4 13 | 23 | 0.4 16 | 23 | 0.4 13 | 25 |
| Kirgizstan | 0.3 68 3 | 21 | 0.3 76 6 | 21 | 0.3 82 9 | 22 | 0.3 82 9 | 22 | 0.3 93 4 | 19 | -3 5 | 0.3 95 | 22 | 3 5 | 0.3 97 | 21 | 0.4 06 | 22 | 0.4 12 | 22 | 0.4 18 | 21 | 0.4 22 | 21 | 0.4 37 | 18 | 0.4 21 | 20 |
| South Korea | 0.4 59 9 | 3 | 0.4 63 4 | 2 | 0.4 68 4 | 2 | 0.4 72 4 | 2 | 0.4 74 4 | 2 | 0.4 81 | 1 | -1 2 | 0.4 83 | 3 | 1.78 5 | 0.4 84 | 3 | 0.4 90 | 2 | 0.4 90 | 2 | 0.4 89 | 2 | 0.4 90 | 2 | 0.4 84 | 2 |
| Kuwait | 0.4 16 3 | 8 | 0.4 20 7 | 8 | 0.4 20 3 | 10 | 0.4 24 4 | 15 | 0.4 28 2 | 13 | -2 7 | 0.4 29 | 12 | -1 6 | 0.4 32 | 10 | 0.4 32 | 13 | 0.4 23 | 17 | 0.4 22 | 19 | 0.4 26 | 19 | 0.4 24 | 20 | 0.4 31 | 19 |
| Lebanon | 0.3 86 5 | 18 | 0.3 86 7 | 19 | 0.3 94 6 | 17 | 0.3 95 6 | 18 | 0.3 99 7 | 21 | 3 5 | 0.3 96 | 21 | 0.4 02 | 0.4 04 | 20 | 0.4 12 | 19 | 0.4 16 | 20 | 0.4 21 | 20 | 0.4 22 | 20 | 0.4 19 | 22 | 0.4 18 | 21 |
| Malaysia | 0.4 38 7 | 4 | 0.4 34 6 | 4 | 0.4 48 7 | 4 | 0.4 48 7 | 4 | 0.4 45 5 | 4 | 0.4 47 | 6 | 2 2 | 0.4 45 | 8 | 2.44 5 | 0.4 54 | 5 | 0.4 60 | 6 | 0.4 64 | 6 | 0.4 64 | 6 | 0.4 66 | 6 | 0.4 63 | 7 |
| Mon-golia | 0.3 54 7 | 26 | 0.3 56 4 | 26 | 0.3 60 8 | 27 | 0.3 63 3 | 26 | 0.3 66 6 | -1 | 0.3 69 | 28 | 3 1 | 0.3 75 | 27 | -1.88 4 | 0.3 98 | 23 | 0.4 01 | 25 | 0.4 01 | 25 | 0.4 03 | 28 | 0.4 06 | 27 | 0.4 07 | 28 |
| Nepal | 0.3 88 8 | 17 | 0.3 91 5 | 16 | 0.3 93 6 | 20 | 0.3 93 7 | 19 | 0.3 99 3 | -1 | 0.4 07 | 16 | -1 3 | 0.4 07 | 19 | 3.09 4 | 0.4 18 | 18 | 0.4 24 | 16 | 0.4 27 | 17 | 0.4 32 | 17 | 0.4 43 | 14 | 0.4 38 | 17 |
| Oman | 0.3 46 7 | 28 | 0.3 42 3 | 31 | 0.3 50 4 | 29 | 0.3 52 7 | 30 | 0.3 58 7 | 32 | 0.4 4 | 0.4 32 | 0.4 32 | 0.4 63 | 32 | 0.4 67 | 0.4 71 | 31 | 0.4 69 | 32 | 0.4 77 | 33 | 0.4 85 | 31 | 0.4 88 | 31 | 0.4 82 | 33 |
| Pakistan | 0.3 47 4 | 27 | 0.3 50 7 | 27 | 0.3 58 5 | 28 | 0.3 61 7 | 27 | 0.3 68 7 | -1 | 0.4 69 | 26 | 0.4 74 | 0.4 79 | 30 | 2.71 3 | 0.4 80 | 29 | 0.4 88 | 30 | 0.4 86 | 31 | 0.4 89 | 32 | 0.4 87 | 30 | 0.4 83 | 31 |
| Singapore | 0.4 65 3 | 2 | 0.4 55 6 | 3 | 0.4 58 8 | 3 | 0.4 58 8 | 3 | 0.4 53 2 | 3 | 0.4 61 | 3 | 0.4 57 | 0.4 57 | 4 | 1.81 7 | 0.4 94 | 1 | 0.4 97 | 1 | 0.4 03 | 1 | 0.4 04 | 1 | 0.4 06 | 1 | 0.4 09 | 1 |
| Sri Lanka | 0.4 14 13 | 9 | 0.4 14 2 | 11 | 0.4 16 6 | 12 | 0.4 16 7 | 13 | 0.4 21 3 | 12 | -1 3 | 0.4 22 | 15 | 3 1 | 0.4 21 | 15 | 0.4 22 | 16 | 0.4 32 | 14 | 0.4 37 | 15 | 0.4 30 | 18 | 0.4 35 | 19 | 0.4 40 | 16 |
| Tadzhikistan | 0.3 43 6 | 29 | 0.3 49 2 | 28 | 0.3 52 6 | 31 | 0.3 52 3 | 30 | 0.3 59 9 | 29 | -1 2 | 0.3 69 | 27 | -2 4 | 0.3 77 | 28 | 0.3 79 | 28 | 0.3 89 | 28 | 0.3 89 | 29 | 0.3 91 | 30 | 0.3 88 | 32 | 0.3 92 | 30 |
| Thailand | 0.4 21 1 | 7 | 0.4 22 8 | 7 | 0.4 26 2 | 7 | 0.4 31 7 | 7 | 0.4 37 6 | 10 | 3 6 | 0.4 31 | 9 | -1 4 | 0.4 36 | 11 | 0.4 40 | 10 | 0.4 44 | 11 | 0.4 50 | 10 | 0.4 51 | 12 | 0.4 45 | 13 | 0.4 44 | 13 |
| Uzbekistan | 0.3 24 5 | 32 | 0.3 27 5 | 33 | 0.3 32 2 | 33 | 0.3 32 6 | 33 | 0.3 33 3 | 0.4 29 | 0.4 33 | 0.4 44 | 33 | 0.4 52 | 33 | 0.4 52 | 0.4 53 | 33 | 0.4 54 | 34 | 0.4 61 | 34 | 0.4 71 | 34 | 0.4 76 | 34 | 0.4 76 | 34 |
| Vietnam | 0.4 12 2 | 10 | 0.4 18 2 | 9 | 0.4 22 5 | 8 | 0.4 30 1 | 8 | 0.4 33 6 | 8 | 0.4 44 | 7 | -1 5 | 0.4 50 | 7 | 0.4 49 | 0.4 53 | 6 | 0.4 63 | 5 | 0.4 69 | 4 | 0.4 75 | 4 | 0.4 78 | 4 | 0.4 81 | 3 |
| Yemen | 0.2 53 1 | 36 | 0.2 68 6 | 35 | 0.2 73 1 | 36 | 0.2 78 4 | 36 | 0.2 83 9 | 36 | 0.2 92 | 36 | 0.2 99 | 0.2 99 | 36 | 0.2 99 | 0.2 99 | 36 | 0.2 99 | 36 | 0.2 99 | 36 | 0.2 99 | 36 | 0.2 99 | 36 | 0.2 99 | 36 |
| UAE | 0.4 26 4 | 6 | 0.4 25 2 | 6 | 0.4 33 3 | 5 | 0.4 37 9 | 5 | 0.4 39 8 | 5 | 0.4 44 | 4 | 0.4 50 | 0.4 56 | 5 | 0.4 52 | 0.4 56 | 4 | 0.4 64 | 4 | 0.4 68 | 5 | 0.4 71 | 5 | 0.4 75 | 5 | 0.4 72 | 5 |

Table 4. Synthetic measures for the distance from reference value in the years 2002-2015, Source: authors' estimations based on the World Development Indicators

| Specification | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|--|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Median | 0,3856 | 0,3867 | 0,3872 | 0,3946 | 0,3951 | 0,4041 | 0,408 | 0,4068 | 0,415 | 0,4177 | 0,4239 | 0,4283 | 0,4364 | 0,4318 |
| Min. value | 0,2531 | 0,2668 | 0,2632 | 0,2684 | 0,2779 | 0,2924 | 0,2996 | 0,2995 | 0,2979 | 0,2996 | 0,3087 | 0,3094 | 0,3075 | 0,3074 |
| Max. value | 0,4665 | 0,4686 | 0,4752 | 0,4783 | 0,4823 | 0,4811 | 0,4883 | 0,4817 | 0,4948 | 0,4979 | 0,5032 | 0,5042 | 0,5063 | 0,4996 |
| Difference quotient | 0,2134 | 0,2018 | 0,212 | 0,2099 | 0,2043 | 0,1888 | 0,1887 | 0,1822 | 0,197 | 0,1983 | 0,1945 | 0,1947 | 0,1989 | 0,1922 |
| Coefficient of variation (%) | 12,85% | 12,55% | 12,83% | 12,16% | 11,83% | 11,44% | 11,00% | 10,42% | 10,59% | 10,51% | 9,99% | 9,68% | 9,51% | 9,26% |
| Arithmetic mean | 0,3795 | 0,3827 | 0,3862 | 0,3907 | 0,3939 | 0,4005 | 0,406 | 0,407 | 0,4124 | 0,4172 | 0,4221 | 0,4255 | 0,4283 | 0,4276 |
| Standard deviation | 0,0488 | 0,048 | 0,0496 | 0,0475 | 0,0466 | 0,0458 | 0,0446 | 0,0424 | 0,0437 | 0,0439 | 0,0422 | 0,0412 | 0,0407 | 0,0396 |
| Pearson's linear correlation coefficient (analysed year against the previous year) | - | 0,9913 | 0,9964 | 0,9925 | 0,994 | 0,9954 | 0,9968 | 0,9891 | 0,9947 | 0,9925 | 0,9965 | 0,9962 | 0,9927 | 0,9902 |

countries. There are 48 independent countries in Asia: Afghanistan, Armenia, Azerbaijan, Bahrain, Bangladesh, Bhutan, Brunei, Cambodia, China, Cyprus, Georgia, India, Indonesia, Iran, Iraq, Israel, Japan, Jordan, Kazakhstan, North Korea, South Korea, Kuwait, Kyrgyzstan, Laos, Lebanon, Malaysia, Maldives, Mongolia, Myanmar, Nepal, Oman, Pakistan, Philippines, Qatar, Russia, Saudi Arabia, Singapore, Sri Lanka, Syria, Tajikistan, Thailand, Timor-Leste, Turkey, Turkmenistan, United Arab Emirates, Uzbekistan, Vietnam, Yemen. Cyprus, Russia and Turkey were excluded from the analysis as the more *European* countries, i.e. strongly influenced by the European continent in social, cultural and economic spheres. In the case of Russia and Turkey the aspect of partly European geographical location is also involved, whereas Cyprus is the European Union Member State. Additionally, in relation to aggregate measure it was decided to exclude North Korea because of extensive data gaps and the dictatorial regime ruling this country. Due to the significant data gaps in the process of aggregate measure construction the following countries were not covered by the analysis either: Afghanistan, Bhutan, Brunei, Maldives, Syria, Timor, Turkmenistan, Laos. In case of these countries, including North Korea, the analysis covered single indicators, for which sufficient data were available. The conclusions drawn from analysing individual indicators are presented later in the study.

Therefore, ultimately the aggregate measure was developed for 36 Asian countries. Every effort was made to ensure the most reliable results. The above mentioned exclusions of a few countries were justified (e.g. unavailable data) and should not distort the overall picture of the sustainable development concept implementation in Asian countries.

The values of statistical measures, helpful in interpreting the situation of individual countries and the occurring changes, were calculated for the particular years. (Table 4).

The situation of individual countries, in terms of the implementation of sustainable development in par-

ticular years presented small spatial diversification, confirmed by the low value of the coefficient of variation. This diversification was also reduced in the analysed years, as shown by the declining value of this indicator. In each subsequent year the countries were approaching the reference value, as evidenced by an ongoing increase in the median value and the minimum value, as well as the increase in the maximum value. A very high value of the Person's linear correlation coefficient indicates slight changes in the ranking positions of particular countries in a given year against the previous one. In the situation when such change occurred, it was mostly by one or two positions (down or up).

In 2002 the situation in 23 countries was described as unfavourable, whereas in the others as moderate. In 2003 and 2004 the situation in 21 countries was identified as unfavourable and in 15 as moderate. In 2005 the situation in 20 countries was unfavourable and in 16 moderate. In 2006, in 19 unfavourable, and in 17 moderate. In 2007, in 17 unfavourable, and in 19 moderate. In 2008, in 15 unfavourable, and in 21 moderate. In 2009, in 16 unfavourable, and in 20 moderate. In 2010, in 14 unfavourable, and in 22 moderate. In 2011, in 11 unfavourable, and in 25 moderate. In 2012, in 10 countries unfavourable, and in 26 moderate. In 2013, in 9 countries unfavourable, and in 27 moderate. In 2014, in 8 countries unfavourable, and in 28 moderate. In 2015, the situation in 7 countries was described as unfavourable, and in 29 as moderate (Fig. 1). It shows that each subsequent year the number of countries, in which the situation regarding the implementation of sustainable development standards can be described as moderate is systematically increasing.

In all analysed years, excluding 2003, Yemen was ranked at the lowest position. In 2003 this position was taken by Iraq, which in the other years was ranked last but one. In 2002-2006 and 2008 Japan was ranked the first. In 2007 South Korea was the leader, whereas in 2009-2015 Singapore was ranked at the very top.

4. Discussion, the analysis of individual factors

The analysis of the values of individual indicators selected for the study allows putting forward the following detailed conclusions. The value of GDP per capita (current thousand US\$) shows extensive differences between individual countries. The phenomenon raising concerns and pointing to the increasing differences between countries is the growing distance between the country featuring the lowest and the highest indicator value. The lowest GDP per capita, in almost all analysed years, was recorded in Afghanistan (in 2002 and in Burma in 2005). In turn, the highest level was recorded in Japan in 2002-2003, and in subsequent years in Qatar. These two countries also show positive results against the general situation in the implementation of sustainable development standards. Obviously, the level of GDP per capita, social wealth and the level of sustainable development cannot be referred to as equal, however, the aspect of the state's economic growth cannot be overestimated.

Foreign direct investment, net inflows (BoP, current thousand US\$) also shows high diversification. It results from the fact that this indicator shows a negative value in several countries (Kyrgyzstan 2002-2015, Saudi Arabia 2002-2004, Bahrain 2015, Indonesia 2003, Iraq 2002, Qatar 2013, Kuwait 2003 and 2008, Nepal 2002, 2004, 2006, Mongolia 2014, Oman 2015, Yemen 2003, 2005, 2011-2015, North Korea. China, in turn, has recorded the highest indicator value in each of the analysed years. Foreign direct investment, apart from its strictly economic aspect is also important in terms of the penetration of developmental models, management systems and organizational-institutional solutions. The analysis of Unemployment, total (% of total labour force) indicates average diversification in each of the analysed years. The lowest unemployment level was recorded in Burma, Cambodia and Qatar (except for the years 2002-2006). In these countries the unemployment rate did not exceed 1%, whereas the highest one was recorded in Oman, Iraq and Yemen. In 2005-2015 the maximum unemployment rate presented the level of 18%-19% and in 2003-2004 it was over 26%.

CO₂ emissions from solid fuel consumption (kt) show minimal diversification (at the level of 3%-5% in particular years). In each of the analysed years the highest indicator value was recorded in China. In the case of several countries – Saudi Arabia, Bahrain, Iraq, Qatar, Kuwait, Oman, Brunei, Maldives, Timor, Turkmenistan – the indicator value is 0. It is, in fact, beneficial for sustainable development, but it rather results from the existing economic conditions in these countries than from an excessive care for the natural environment. The systematically declining, each subsequent year, diversification of Asian countries regarding Access to electricity (% of population) is a positive phenomenon. The lowest percentage of population with access to electricity was rec-

orded in Afghanistan, North Korea and Indonesia. In 11 countries, 100% of the population had access to electricity throughout the entire analysed period: Saudi Arabia, Bahrain, Israel, Japan, Qatar, South Korea, Kuwait, Oman, Singapore, United Arab Emirates and Brunei. There occurs a simple convergence between access to electricity and the level of sustainable development, the higher the access, the more sustainable the development. This phenomenon is influenced by the dependence of civilization development on access to electricity. Fertilizer consumption (kilograms per hectare of arable land) is highly diversified. In the analysed years the lowest value was recorded in Kazakhstan, whereas the highest in 2002 in Bahrain, in 2003-2009 in Singapore, and in 2010-2015 in Qatar.

The indicator characterizing the Depth of the food deficit (kilocalories per person per day) can be used to analyse the problem of hunger. Asian countries are highly diversified and this disproportion continues to increase. In the analysed period the indicator value was 0 only in five countries: Bahrain, Israel, Japan, Qatar and Singapore. At the same time, these countries show a relatively high level of sustainable development among Asian countries. However, the highest indicator value was achieved in 2002-2004 in Burma, in 2005-2008 in Tadjikistan, and in the years to follow in North Korea.

Individuals using the Internet (% of population) - the indicator showing a significant downward trend regarding diversification, which should be considered positive. Year by year, the minimum and maximum values were also growing. North Korea is the only country with 0 indicator value. However, in the case of this country it predominantly results from ideological factors. In turn, the largest share of individuals using the Internet in 2002-2011 was recorded in South Korea, and in subsequent years in Bahrain.

The value of Unemployment, youth total (% of total labour force ages 15-24) (modelled ILO estimate) shows minor diversification. In each of the analysed years its value fell below 2%. In 2002 the minimum value was recorded in Afghanistan, in 2003-2005 in Burma and next in Cambodia. The maximum value was recorded in Oman (2002, 2005-2015) and in Iraq (2003-2004). The differences between individual countries in Birth rate, crude (per 1,000 people) were gradually decreasing. The minimum and maximum values were also in decline year by year. In the entire analysed period the minimum value was recorded in Japan, whereas the maximum one in 2002-2011 in Afghanistan, and in the subsequent years in Timor.

The share of Population ages 65 and above (% of total) was systematically growing year by year. However, this increase was small. It amounted to less than 1 percentage point in the period under analysis. The United Arab Emirates presented the lowest share of population ages 65 and above, amounting to 1%, in each analysed year. In turn, the largest share of such population was recorded in Japan. It is also

worth emphasizing that the discussed share was steadily increasing in this country. In 2002 it was 18%, and in 2015 over 26%.

Positive processes can be observed regarding Age dependency ratio (% of working-age population). Year by year its average value presented a continuous decline. In 2002 it was approx. 62% and by 2005 it went down by almost 10 percentage points. The diversification level between individual countries can be identified as average. In the years 2002-2010 and 2014-2015 the lowest value was recorded in the United Arab Emirates (ranging from 17% to 30%). In 2011-2013 the lowest ratio of 16% was observed in Qatar. In Afghanistan and Timor age dependence ratio reached approx. 100%.

Afghanistan was characterised by the lowest Life expectancy at birth, total, in each of the studied years. Life expectancy at birth in this country ranged from 55,6 years of age in 2002 up to 63,3 in 2015. An increasing life expectancy at birth is the only positive factor recorded for Afghanistan. The country with the longest life expectancy at birth is Japan. The indicator value ranges from 81,6 years of age in 2002 up to 83,8 in 2015. The systematically increasing average value of life expectancy at birth, total, is a positive phenomenon. It was 69,4 years of age in 2002 and 73,0 in 2015. It should be highlighted that year by year the differences between individual countries are being reduced. It is confirmed by the value of the coefficient of variation – 8,37% in 2002 and 6,68% in 2015. The tendency towards systematic extension of life expectancy at birth was actually recorded in all countries. The exceptions were: Syria in 2007-2014, Iraq in 2003-2007 and Georgia in 2007-2009. This situation can be, to some extent, explained by the ongoing armed conflicts in these countries.

The studied countries are highly diversified in terms of Mortality rate, infant (per 1,000 live births). It is shown by the high value of the coefficient of variation ranging from 83,4% in 2002 to 63,7% in 2015. However, the continuously decreasing diversification ratio remains a positive phenomenon. The lowest indicator value was achieved in Singapore in 2002-2013, and in subsequent years in Japan. Its value ranged from 2,7 to 2,0. The worst situation was recorded in Afghanistan (indicator value 86,1-83,6) in the years 2002-2003. In the years to follow the worst situation occurred in Pakistan, where the indicator value ranged from 81,7 in 2004 to 65,7 in 2015. A positive phenomenon, observed in all countries, was the decreasing average indicator value, from 34,9 in 2002 down to 20,45 in 2015. The level of Health expenditure, total (% of GDP) showed the occurrence of average disparities between individual countries. It was confirmed by the value of the coefficient of variation ranging between 48% and slightly below 65%. On average, Asian countries were spending less than 5% of GDP on health care in the period under analysis. This level was recorded in each of the analysed years. The highest share, in

all analysed years, was recorded in Kuwait – it ranged from 13,9% to almost 18,8%. The lowest – approx. 1% – occurred in Cambodia and Timor. At this point, taking into account the experience from other regions of the world, it should be observed, that not just the level of health expenditure proves its quality, but the effectiveness of the funds spent is equally important.

Asian countries are highly diversified in terms of CO₂ emissions (kg per 2010 US\$ of GDP) and this diversification was increasing in the analysed period. The countries with the lowest emissions against GDP are Singapore, Afghanistan and Laos. However, the highest value in each of the analysed years was recorded in Oman. An extensive diversification can also be observed in terms of the Renewable energy consumption (% of total final energy consumption). The largest share of renewable energy consumption was recorded in 2002-2011 in Bhutan, and next in Laos. In turn, the renewable energy sources were not used at all in Bahrain, Qatar, Kuwait and Oman. Total greenhouse gas emissions (kt of CO₂ equivalent) also show large diversification. In addition, this diversification increased in the analysed period. The minimum indicator value, in each of the analysed years, was recorded in Timor, whereas the maximum one in China. Average diversification is shown by the value of CO₂ emissions from transport (% of total fuel combustion). The minimum value was recorded in North Korea, whereas the maximum one in Cambodia. The indicator value of Fossil fuel energy consumption (% of total) presents high diversification in individual countries. This diversification was, however, slightly reduced. The minimum value was recorded in Nepal, and the maximum one, reaching 100%, in Bahrain, Qatar, Kuwait, Oman and Brunei.

An extensive diversification occurs regarding Air transport, passengers carried. In 2002-2009 the minimum value was recorded in Bhutan, in 2010-2012 in North Korea and next in India. In 2002-2003 Japan recorded the maximum value, and in subsequent years China. In turn, only slight diversification was observed in individual countries in terms of Air transport, freight (million ton-km). The maximum indicator value was reached in Saudi Arabia, whereas the minimum one in the Maldives (2002-2009), and in the following years in Yemen. It should be noted that air transport is changing the world (reducing communication, business, culture distance etc.) and its development can be expected in the years to come.

Due to the specificity of Asian continent, covered by deserts, tundra, taiga and also tropical forests, individual countries are highly diversified in terms of Forest area (% of land area). Qatar is the country with no forests at all, whereas 75% of Brunei and Laos are covered with forests. In the entire analysed period, the average forest area was at the level of

over 23%. In the case of European countries the indicator value is relatively strongly connected with the implementation of sustainable development. In Asia, due to the above mentioned continental diversity, such simple generalizations cannot be made. A very extensive diversification can also be observed in the Forest rents (% of GDP). The minimum value was recorded in the United Arab Emirates and Qatar and the maximum one in Laos, Burma and Bhutan. Having analysed the value of People using basic drinking water services (% of population), several positive phenomena can be observed. The minimum value doubled in the analysed period. The average value was systematically increasing year by year. In turn, the diversification, which was small in the entire analysed period, presented a downward trend. In each of the analysed years the minimum value was recorded in Afghanistan. However, the doubled percentage of people using basic drinking water services (from 30% in 2002 to approx. 63% in 2015) is a positive phenomenon. The indicator value was 100% only in four countries throughout the entire analysed period, i.e. Israel, Qatar, Kuwait and Singapore. Asian countries are highly diversified in terms of Total natural resources rents (% of GDP). The continuous decline of both average and maximum value is a positive trend. The minimum value was recorded in Singapore, and the maximum one in Iraq (2002-2005), Turkmenistan (2006-2007), Saudi Arabia (2008), Mongolia (2009) and Kuwait (2010-2015).

Import value index (2000 = 100) shows a small, however, steadily increasing diversification between individual countries in the analysed years. The minimum value occurred in Iraq (2002-2003), Burma (2004-2007), Philippines (2008-2012) and Syria (2013-2015). The maximum value was recorded in Afghanistan (2002), Azerbaijan (2003-2005), Mongolia (2006, 200-2011, 2015) and Georgia (2007-2008, 2012-2014). The systematically decreasing average diversification is visible in Imports of goods and services (% of GDP). The minimum value was recorded in Burma in 2002-2012, in Japan in 2013 and next in Pakistan. The maximum value was observed in Timor (2002) and in subsequent years in Singapore. The analysis of Improved water source (% of population with access) confirms positive trends. The diversification between individual countries is small and presents a continuous decline. The minimum and average values show an upward trend year by year. The minimum value was recorded in Afghanistan (2002-2013) and in Yemen (2014-2015). The indicator value was 100% in the following four countries throughout the entire analysed period: Bahrain, Israel, Japan and Singapore.

The best situation, in terms of the value of Voice and Accountability, in the whole analysed period occurred in Japan, whereas the worst in North Korea. Also in the case of the Rule of Law the worst situation was observed in North Korea and the best one

in Singapore. The highest value of Control of Corruption was true for Singapore. The worst situation was recorded in Iraq (2002), Burma (2003-2007, 2009-2011), Afghanistan (2008, 2013), Turkmenistan (2012), Yemen (2014) and Syria (2015).

5. Conclusions

In general, it can be concluded that the overall situation of Asian countries is still far from ideal regarding the implementation of sustainable development standards. Due to the fact that the continent remains extensively diversified in many respects (economic, social, cultural spheres, access to natural resources, location rent, historical determinants, including colonial past etc.), some of the countries have been recording increasingly satisfactory results, e.g. Singapore, Japan, South Korea, Qatar, United Arab Emirates, Malaysia, Israel, Vietnam. At the other end there are: Yemen, Iraq, Burma, Uzbekistan, Cambodia, Oman, Iran, Tajikistan, Azerbaijan and Pakistan. In these countries the scale of elements to be improved is significantly larger.

In turn, the gradually increasing group of countries characterised by a moderate situation against the group featuring an unfavourable situation is a clearly positive phenomenon, advancing over time. Suffice it to say that in 2002, 23 out of 36 analysed countries were included in the group presenting an unfavourable situation regarding the implementation of sustainable development concept. In 2015 the respective proportion was 7 to 29, which proves a significant progress and a good future perspective. It should, however, be borne in mind that in spite of the favourable trend none of the analysed countries were included in the group featuring either a favourable or highly favourable situation. In turn, no country presented a very unfavourable situation. The discussed situation has created space for constructing and strengthening the development based on a sustainable approach, therefore public policies, implemented by national governments, seem to be playing a crucial role in this respect.

References

1. *ACHIEVING the Sustainable Development Goals in South Asia, Key Policy Priorities and Implementation Challenges*, 2017, United Nations, Economic and Social Commission for Asia and the Pacific, South and South-West Asia Office, New Delhi.
2. ARCHER M., 2017, *Education for Sustainable Development*, in: *Children and Sustainable Development: Environmental education in a Globalized World*, eds. Battro A., Léna P., Sorondo M., Braun J., Springer International Publishing, Cham.
3. *ASIA-Pacific Sustainable Development Goals Outlook*, 2017, United Nations, Asian Development Bank, United Nations Development Programme, Bangkok.

4. BARTNICZAK B., RASZKOWSKI A., 2017, Sustainable development in the Russian Federation – indicator-based approach, in: *Problemy Ekorozwoju/ Problems of Sustainable Development*, 12(2), p. 133-142.
5. BATABYAL A., NIJKAMP P., 2016, *Introduction to Regional Growth and Sustainable Development in Asia*, in: *Regional Growth and Sustainable Development in Asia*, New Frontiers in Regional Science: Asian Perspectives, eds. Batabyal A., Nijkamp P., Springer, Cham, p. 3-22.
6. BORYS T., 2011, Zrównoważony rozwój – jak rozpoznać ład zintegrowany, in: *Problemy Ekorozwoju/ Problems of Sustainable Development*, 6(2), p. 75-81.
7. BORYS T., 2005, *Indicators for sustainable development – Polish experiences*, Ekonomia i Środowisko, Warszawa, Białystok
8. BORYS T., 2010, *Strategie i wskaźniki zrównoważonego rozwoju*, in: *Wyzwania zrównoważonego rozwoju w Polsce*, eds. Kronenberg, J., Bergier, Fundacja Sendzimira, Kraków, p. 217-234.
9. CHOI Y., 2018, Regional Cooperation for the Sustainable Development and Management in Northeast Asia, *Sustainability*, 10(2).
10. *DEFINING a Sustainable Transport Sector*, 1996, UK Roundtable on Sustainable Development.
11. *ENVIRONMENTAL Governance for Sustainable Development in Asia and the Pacific*, 2002, United Nations Development Programme, Economic and Social Commission for Asia and the Pacific, United Nations Publications, New York.
12. GENIAUX G., BELLON S., DEVERRE C., POWELL B., 2009, *Sustainable Development Indicator Frameworks and Initiatives*, System for Environmental and Agricultural Modelling, Linking European Science and Society, Report no. 49, SEAMLESS integrated project, EU 6th Framework Programme.
13. *HANDBOOK of National Accounting: Integrated Environmental and Economic Accounting 2003*, 2003, United Nations, European Commission, International Monetary Fund, Organisation for Economic Co-operation and Development, World Bank, *Studies in Methods*, Series F, 61(1), New York.
14. *INDICATORS of Sustainable Development: Guidelines and Methodologies*, 2007, Economic & Social Affairs, United Nations Publications, New York.
15. JAJUGA K., WALESIAK M., BAŁ A., 2003, *On the General Distance Measure*, in: *Exploratory Data Analysis in Empirical Research*, eds. Schwaiger M., Opitz O., Springer-Verlag, Berlin, Heidelberg.
16. JUDSON G., 2010, *A New Approach to Environmental education: Engaging Students' Imaginations in Their World*, Peter Lang Publishing, New York.
17. JUDSON G., 2017, *Engaging Imagination in Environmental education: Practical Strategies for Teachers*, University of British Columbia Press, Vancouver.
18. KOHL R., 2002, Globalisation and Inequality in Southern Asia, in: *Towards Asia's Sustainable Development: The Role of Social Protection, Emerging Economies Transition*, OECD Publishing, Paris, p. 23-48.
19. MITCHELL J., 2001, Business Improvement Districts and the 'New' Revitalization of Downtown, in: *Economic Development Quarterly*, 15(2), p. 115-123.
20. MORI A., 2013, Introduction: Sustainable development and environmental governance in East Asia, in: *Environmental governance for sustainable development: East Asian perspectives*, *Multilevel Environmental Governance for Sustainable Development*, ed. Mori A., United Nations University Press, Tokyo, p. 1-16.
21. PALMER J., 1998, *Environmental Education in the 21st Century: Theory, Practice, Progress and Promise*, Routledge, New York.
22. PAWŁOWSKI A., 2008, How many dimensions does sustainable development have?, in: *Sustainable Development*, 16(2), p. 81-90.
23. PRASAD K., 2017, Culture, Communication and Capacity for Sustainable Development, in: *Communication, Culture and Ecology: Rethinking Sustainable Development in Asia*, *Communication, Culture and Change in Asia*, ed. Prasad K., Springer, Singapore, p. 3-24.
24. RAMANATHAN V., HAN H., MATLOCK T., 2017, Education Children to Bend the Curve: For a Stable Climate, Sustainable Nature and Sustainable Humanity, in: *Children and Sustainable Development: Environmental education in a Globalized World*, eds. Battro A., Léna P., Sorondo M., Braun J., Springer, Cham.
25. RASZKOWSKI A., 2014, Culture-based creativity in relation to enterprise development strategies, in: *Academic Coordination Centre and Technology Transfer in Euroregion Neisse-Nisa-Nysa*, eds. Biniek K., Winnicki T., Karkonosze College in Jelenia Góra, Jelenia Góra, p. 73-81.
26. RASZKOWSKI A., GLUSZCZUK D., 2017, Contemporary developmental directions of revitalization projects: Polish experiences, in: *The 11th International Days of Statistics and Economics*, eds. Löster T., Pavelka T., Libuše Macáková, Melandrium, Prague, p. 1305-1314.
27. RASZKOWSKI A., GLUSZCZUK D., 2015, Regional creativity factors. Towards new dimensions of regional development, in: *The 9th International Days of Statistics and Economics*, eds. Löster T., Pavelka T., Libuše Macáková, Melandrium, Prague, p. 1375-1385.
28. SERVAES J., 2017, Introduction: From MDGs to SDGs, in: *Sustainable Development Goals in the Asian Context*, *Communication, Culture and Change in Asia*, ed. Servaes J., Springer Nature, Singapore, p. 1-22.
29. STARR F., 2013, *Corporate Responsibility for Cultural Heritage: Conservation, Sustainable Development, and Corporate Reputation*, Routledge Studies of Heritage, Routledge, New York.
30. *SUSTAINABLE development in the European Union, 2015 monitoring report of the EU Sustainable Development Strategy*, 2015, Eurostat Statistical Books, Luxembourg.
31. *SUSTAINABLE development in the European Union, Overview of progress towards the SDGs in an EU context*, 2017, Publications Office of the European Union, Luxembourg.
32. SUTTON S., 2010, Rethinking Commercial Revitalization: A Neighbourhood Small Business Perspective, *Economic Development Quarterly*, 24(4), p. 352-371.

33. *URBAN Environmental Governance for Sustainable Development in Asia and the Pacific: A Regional Overview*, 2005, Economic and Social Commission for Asia and the Pacific, United Nations, New York.
34. WANG W., LEE A., PENG L., WU Z., 2013, An integrated decision making model for district revitalization and regeneration project selection, in: *Decision Support Systems*, 54(2), p. 1092-1103.
35. *WORLD Development Indicators*, <http://data-bank.worldbank.org/data/reports.aspx?source=world-development-indicators&Type=TABLE&preview=on#> (23.02.2018).
36. ZHOU J., 2001, *Sustainable development in Asia, America and Europe with global applications: a new approach to land ownership*, Edward Elgar Publishing, Cheltenham.

Age Structures and Air Pollution: What Role Does Gender Play?

Struktura wiekowa i zanieczyszczenie powietrza: jaką rolę odgrywa płeć?

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Abstract

We investigate the influence of age structure and gender on air pollution, dividing the age structure into four groups and use CO₂ emissions as a measure of air pollution, which can be separated into four categories to obtain more complete findings, then employing panel cointegration techniques and panel-based error correction models. The data are collected from 29 OECD and 40 non-OECD countries in the period 1990-2014. For case of total CO₂ emissions, younger (people under 30) and older people (people 65 and above) emit less than people in the intermediate age group, but the impact of age group on CO₂ emissions is different when looking at CO₂ emissions from coal, gas, and oil. While we take gender into account, the causality between age structure and CO₂ emissions becomes significant, especially for the relationship between population and total CO₂ emissions in OECD and non-OECD countries. We also note that more people who are aged 15-29 increase total CO₂ emissions in OECD countries and more people who are aged 30-44 decrease CO₂ emissions from coal in non-OECD countries. Our findings suggest that an energy and environmental policy should consider both age structure and gender effects on environmental issues.

Key words: age structure; gender; carbon emissions; panel cointegration; panel causality

Streszczenie

Artykuł przedstawia wyniki badań odnoszących się do wpływu zmiennych struktury wiekowej i płci na zanieczyszczenia powietrza, wyróżniając cztery grupy wiekowe i wykorzystując poziom emisji CO₂ jako wskaźnik zanieczyszczeń powietrza, który można podzielić na 4 kategorie, a następnie wykorzystaliśmy techniki kointegracji paneli i oparte na panelach modele korekcji błędów. Dane zebrano z 29 krajów należących do OECD i 40 spoza tej organizacji, obejmują one lata 1990-2014. W przypadku całkowitej emisji CO₂ okazało się, że osoby młodsze (poniżej 30 roku życia) oraz starsze (powyżej 65 roku życia) odpowiedzialne są za mniejszą emisję niż osoby w wieku średnim, przy czym występują różnice odnoszące się do poszczególnych grup wiekowych w odniesieniu do emisji CO₂ z różnych źródeł: węgla, gazu i ropy. Biorąc pod uwagę płeć, zależność pomiędzy strukturą wiekową a emisjami CO₂ okazuje się być znaczącą, szczególnie w aspekcie relacji pomiędzy populacją a całkowitą emisją CO₂. Zauważyliśmy ponadto, że osoby w wieku 15-29 z krajów OECD bardziej przyczyniają się do wzrostu całkowitej emisji CO₂, a w przypadku krajów nie należących do OECD osoby w wieku 30-44 bardziej odpowiedzialne są za obniżenie emisji CO₂ z węgla. Przeprowadzone badania umożliwiają postawienie hipotezy, według której polityka energetyczna i środowiskowa w kontekście zagadnień odnoszących się do środowiska powinna uwzględniać zarówno strukturę wieku jak i płci.

Słowa kluczowe: struktura wiekowa, płeć, emisja ditlenku węgla, kointegracja paneli, przyczynowość panelu

1. Introduction

Energy consumption derives from energy demand in all sectors of life. A long-run relationship has been confirmed among energy consumption, CO₂ emissions, and economic growth (Khobai and Le Roux, 2017). The literature suggests that people's age could affect emission-relevant consumption patterns (Menz and Welsch, 2012). Many studies have drawn attention to the relationship among population age, environmental preferences, and environmental quality. In this sense, the demographic aspect is a main factor that affects environmental problems (Wang, et al., 2017). How a population influences energy consumption and carbon emissions has attracted widespread attention.

The literature has increasingly focused on energy consumption and carbon emissions from socio-economic aspects. Population growth is widely seen as a major driving factor for the increase of CO₂ emissions, but the impacts of different age group populations on CO₂ emissions are complex. The age composition may affect energy consumption and CO₂ emissions through per capita economic activity. Some studies found that a higher percentage of young people in a population lead to more CO₂ emissions, young people are more inclined to participate in sports and outdoor activities, and they are more educated and seem to actively participate in environmental legislative and regulatory processes. Farzin and Bond (2006) has indicated that a greater share of young people (aged under 15 years) emits more CO₂ emissions. Liddle (2011) confirmed that the age structure follows a U-shaped pattern with residential electricity consumption; a higher share of youngest and oldest cohorts leads to more electricity consumption. Some researchers noted that CO₂ emissions increase with a higher share of older people, they confirm that the willingness towards environmental protection declines with age growth (Israel and Levinson, 2004; Torgler, et al., 2008), mainly because the old are more likely to use energy less efficiently when they live alone and have a lower acceptance of *green taxes* and charitable donations (Rehdanz, 2007), a higher percentage of older people implies greater CO₂ emissions (Liddle and Lung, 2010; Menz and Welsch, 2012).

Different from these two opinions, An inverted U-shaped relationship between age composition and CO₂ emissions is presented in some studies. Shi (2003) confirmed that a higher ratio of working-age people increases CO₂ emissions and that in developing countries the impact of demographic change on CO₂ emissions is much more obvious than that in developed countries. The inverted U-shape between the two variables was confirmed in the transport sector in OECD countries (Liddle, 2011; Okada, 2012), the working-age group may exert more influence on CO₂ emissions. Jorgenson, et al. (2010) also concluded that, in less developed countries, a higher

share of adult urban population (aged 15-64 years) increases energy consumption, whereas people living in urban slum conditions exert a negative effect on it. From the discussion above, inconsistency still exists among the literature on the relationship between age structure and CO₂ emissions.

Gender as a major explanation for individual differences has become more important to study environmental issues (Nightingale, 2006). For the gender-environments issue, theories propose different views to explain the nexus. Women are considered closer to nature and men are closer to culture (Griffin, 2016). Women tend to understand and are concerned about the benefits to environmental protection from their unique perspective. In addition, men's and women's work practices play an important role in environmental protection and women have unique environmental knowledge (Nightingale, 2006). Building upon the two above, another theory argues that their role as subsistence providers promote women to master some knowledge about natural resources to guarantee their household survival (Rocheleau et al., 1996a). From the discussion above, women express greater environmental concern and pro-environmental behavior than men do (Boeve-de Pauw, et al., 2014).

Several previous works focusing on the gender-environment nexus focused on certain ages groups. Early research studies, gender differences in adult cohorts (Schahn and Holzer, 1990), while over the next few years gender differences among children and young adult cohorts also received wide attention (Zelezny, et al., 2000; Goldman, et al., 2006). Gender roles have been widely used to explain gender difference in some of the literature on environmental issues (Zelezny, et al., 2000). However, previous studies explored the effect of population and gender difference factors on CO₂ emissions separately. This observation raises an important question: how does gender with regard to environmental concern influence the relationship between age composition and carbon emissions?

This study fills this academic gap in several ways. First, we examine the role of gender between age structure and CO₂ emissions using the latest panel data covering 69 countries from 1990 to 2014. The main contribution of this research is that we consider both age structure and gender in environment concerns. Second, we focus on the role of gender in regards to the inconsistent conclusion over the relationship between age structure and CO₂ emissions by using four series of CO₂ emissions: coal, gas, oil, and the total of them. Third, Given the difference in females' social roles and status, a country's position in the development process also determines the correlation among the variables. Hence, we explore this correlation for different groups of countries, such as OECD and non-OECD nations. Fourth and finally, to overcome the shortcomings of previous studies that mostly used a questionnaire approach and case

Table 1. Panel unit root tests

| Variables | LLC | ADF | Variables | LLC | ADF |
|------------------------|--------------------------------|-------------------|---------------|----------------------|----------------------|
| POP1465 | -0.425 (0.335) ^b | -0.356 (0.361) | ΔPOP1465 | -4.667** (0.000) | -4.804** (0.000) |
| SEXRA-TIO1465 | 2.205 (0.986) | 0.884 (0.812) | ΔSEXRATIO1465 | -4.014** (0.000) | -2.374** (0.009) |
| POP1529 | 0.486 (0.686) | -0.510 (0.305) | ΔPOP1529 | -6.396** (0.000) | -2.980** (0.001) |
| SEXRA-TIO1529 | -0.130 (0.448) | -0.146 (0.442) | ΔSEXRATIO1529 | -2.965** (0.002) | -3.770** (0.000) |
| POP3044 | 1.411(0.921) | 2.355 (0.991) | ΔPOP3044 | -7.368** (0.000) | -10.671** (0.000) |
| SEXRA-TIO3044 | 7.293 (1.000) | 0.114 (0.546) | ΔSEXRATIO3044 | -5.082** (0.000) | -2.485** (0.007) |
| POP4564 | 1.218 (0.888) | 1.217 (0.888) | ΔPOP4564 | -8.339** (0.000) | -2.737** (0.003) |
| SEXRA-TIO4564 | -0.359 (0.360) | 1.652 (0.951) | ΔSEXRATIO4564 | -6.562** (0.000) | -3.691** (0.000) |
| TOTAL[69] ^a | 2.876 (0.998) | 5.002 (1.000) | ΔTOTAL | -26.486** (0.000) | -26.733** (0.000) |
| COAL[55] | -0.129 (0.449) | -0.577 (0.282) | ΔCOAL | -27.576** (0.000) | -22.010** (0.000) |
| GAS[57] | 0.926 (0.823) | 0.568 (0.715) | ΔGAS | -20.417** (0.000) | -17.905** (0.000) |
| OIL[69] | 7.918 (1.000) | 1.188 (0.883) | ΔOIL | -28.477** (0.000) | -23.459** (0.000) |

Notes: Δ denotes first differences. ** indicates that the estimated parameters are significant at the 5% level.

^a The values in [] parentheses denote sample size; ^b The values in () parentheses denote p-value.

studies that investigated the relationship between gender and environmental concern (Boeve-de Pauw, et al., 2014; Xiao and McCright, 2015; Chan et al., 2016), we develop and estimate an econometric model to look at the relationship among the three variables. This study provides cross-section and time-series panel data analyses and examines the relationship between age structure, gender, and CO₂ emissions using the panel cointegration approach as well as vector error correction model (VECM).

2. Empirical results and discussions

2.1. Model and econometric methodology

We estimate the panel cointegrated relationships among age structure, gender, and CO₂ emissions. Based on Pedroni's (1999) method of the panel cointegration test, we estimate the following equations with two variables and three variables separately:

$$CO_{2it} = \alpha_i + \delta_i t + \beta_i POP_{it} + v_{it}, i=1, \dots, N, t=1, \dots, T \quad (1)$$

$$CO_{2it} = \alpha_i + \delta_i t + \beta_i POP_{it} + \eta_i SEXRATIO_{it} + v_{it}, i=1, \dots, N, t=1, \dots, T \quad (2)$$

In this model, the observable variables CO₂, POP, and SEXRATIO have dimensions (N*T) × 1 and (N*T)×M. The sample countries include i=1,..., N members; the number of observations over time is expressed by t=1,..., T; the number of regression variables is expressed by M; ε_{it} is the residual; CO₂ represents the dependent variable, including CO₂ emissions from burning coal (COAL), gas (GAS), oil (OIL), and their total (TOTAL). POP represents the percentages of population in the countries and is proxied by people aged less than 15 years and aged

65 and above (POP1465), people aged 15-29 (POP1529), people aged 30-44 (POP3044), and people aged 45-64 (POP4564). SEXRATIO denotes the ratio of females to males and is proxied by SEXRATIO1465, SEXRATIO1529, SEXRATIO3044, and SEXRATIO4564.

Panel cointegration analysis is conducted by four stages. First, the panel unit root should be tested to examine if there exists a unit root for the variables. Second, as Pedroni (2004) mentioned, we examine the cointegration relationship between age structure, gender, and CO₂ emissions. Third, we use the fully-modified OLS (FMOLS) methods to estimate the parameters of the panel cointegration vector (Pedroni, 2000). Finally, we use a panel VECM to test the statistical causality hypothesis.

2.2. Data and the empirical results

These estimations are for the period 1990-2014 and cover 69 countries, including 29 OECD countries and 40 non-OECD countries. The data of CO₂ emissions come from the International Energy Agency (IEA). This paper uses three types of fossil fuels, coal, gas, and oil, and the CO₂ emissions data come from burning these fossil fuels as well as their total. Based on the four dependent variables (TOTAL, COAL, GAS, and OIL), the data we collect include separate samples of 69, 55, 57, and 69. Data of age structure and sex ratio collected from the World Development Indicators (WDI). Age group data come from the percentages of people aged under 15 years plus those aged 65 and older, and those aged 15-29,

Table 2. Results of the panel cointegration tests-Full sample

| Model: CO ₂ , POP1465 | | | | | Model: CO ₂ , POP1529 | | | |
|----------------------------------|----------|----------|----------|----------|----------------------------------|----------|----------|----------|
| | TOTAL | COAL | GAS | OIL | TOTAL | COAL | GAS | OIL |
| Panel v-statistic | 0.001 | -1.014 | 1.729** | 0.186 | 1.793** | 2.043** | 1.426* | 3.447** |
| Panel ρ | 0.357 | -0.320 | -0.101 | -0.455 | -0.233 | -2.713** | -0.482 | -1.590* |
| Panel PP | -2.702** | -3.831** | -2.160** | -3.960** | -3.202** | -6.750** | -2.518** | -4.826** |
| Panel ADF | -3.425** | -2.559** | -2.094** | -4.319** | -3.141** | -6.346** | -2.919** | -4.739** |
| Group ρ | 2.336 | 2.053 | 1.787 | 2.170 | 1.790 | 0.203 | 1.526 | 1.316 |
| Group PP | -1.877** | -2.786** | -1.584* | -2.776** | -2.521** | -5.481** | -1.692** | -3.575** |
| Group ADF | -3.230** | -2.376** | -2.080** | -4.461** | -2.450** | -5.670** | -3.044** | -4.538** |
| Model: CO ₂ , POP3044 | | | | | Model: CO ₂ , POP4564 | | | |
| | TOTAL | COAL | GAS | OIL | TOTAL | COAL | GAS | OIL |
| Panel v-statistic | 0.734 | 1.484* | 1.941** | 1.186 | 0.694 | 2.499** | 0.737 | 1.083 |
| Panel ρ | 0.068 | -1.573* | -1.387* | 0.402 | -0.481 | -3.152** | -1.321* | -0.167 |
| Panel PP-stat | -2.641** | -5.199** | -3.511** | -2.152** | -3.694** | -7.575** | - | -3.120** |
| Panel ADF | -2.557** | -4.534** | -3.699** | -2.298** | -3.065** | -6.748** | - | -3.588** |
| Group ρ | 1.912 | 1.191 | 1.231 | 2.386 | 1.647 | 0.013 | 1.191 | 2.120 |
| Group PP | -2.593** | -3.635** | -2.029** | -1.681** | -3.427** | -5.872** | - | -2.122** |
| Group ADF | -2.914** | -4.243** | -3.336** | -2.17** | -2.347** | -5.999** | - | -2.986** |

Note: The null hypothesis is no cointegration. * and ** indicate that the estimated parameters are significant at the 10% and 5% levels, respectively.

Table 3. Results of the panel cointegration tests-Full sample

| Model: CO ₂ , POP1465, SEXRATIO1465 | | | | | Model: CO ₂ , POP1529, SEXRATIO1529 | | | |
|--|----------|----------|----------|----------|--|----------|----------|----------|
| | TOTAL | COAL | GAS | OIL | TOTAL | COAL | GAS | OIL |
| Panel v-statistic | 0.428 | -0.837 | 0.429 | 0.076 | 2.371** | 0.433 | 1.493* | 1.759** |
| Panel ρ | -0.548 | -0.281 | -0.918 | 0.548 | -0.955 | -0.887 | -1.141 | 0.900 |
| Panel PP-stat | -6.491** | -6.047** | -6.272** | -4.705** | -7.120** | -6.908** | -6.071** | -3.936** |
| Panel ADF | -7.060** | -4.934** | -7.071** | -5.446** | -6.910** | -6.190** | -7.078** | -6.060** |
| Group ρ | 2.035 | 2.165 | 0.803 | 2.839 | 1.173 | 1.751 | 0.832 | 2.726 |
| Group PP | -5.897** | -5.514** | -6.690** | -4.357** | -7.608** | -6.288** | -6.423** | -4.889** |
| Group ADF | -6.943** | -4.619** | -7.247** | -6.449** | -7.131** | -6.579** | -7.883** | -7.426** |
| Model: CO ₂ , POP3044, SEXRATIO3044 | | | | | Model: CO ₂ , POP4564, SEXRATIO4564 | | | |
| | TOTAL | COAL | GAS | OIL | TOTAL | COAL | GAS | OIL |
| Panel v-statistic | 1.489* | 1.335* | 1.500* | 1.811** | 2.058** | 2.116** | -0.182 | 1.996** |
| Panel ρ | -0.591 | -1.655** | -1.815** | 0.324 | -0.977 | -1.358* | -1.003 | -0.462 |
| Panel PP-stat | -6.389** | -8.499** | -7.453** | -4.686** | -7.323** | -7.527** | -6.400** | -5.663** |
| Panel ADF | -6.654** | -8.773** | -7.977** | -6.433** | -7.026** | -7.967** | -6.880** | -5.686** |
| Group ρ | 1.650 | 1.277 | 0.866 | 2.497 | 1.396 | 1.498 | 1.276 | 2.547 |
| Group PP | -6.472** | -7.346** | -7.023** | -4.569** | -7.809** | -6.286** | -5.753** | -3.992** |
| Group ADF | -7.244** | -8.820** | -8.931** | -7.476** | -7.428** | -7.669** | -7.850** | -5.488** |

Note: The null hypothesis is no cointegration. * and ** indicate that the estimated parameters are significant at the 10% and 5% levels, respectively.

Table 4. Panel FMOLS estimates and panel causality tests: CO₂ vs. POP

| OECD | | | | | | | | |
|--------------------|----------------------|-------------|---------|-----------|---------|-----------|----------|-----------|
| Dependent variable | POP1465 ^a | λ^b | POP1529 | λ | POP3044 | λ | POP4564 | λ |
| Δ TOTAL | -0.51** | -3.54** | -0.06** | -2.89** | 0.27** | -3.80** | 0.36 ** | -0.88 |
| Δ COAL | -0.30** | -4.59** | 0.17** | -4.50** | 0.04** | -4.59** | -0.10 ** | -5.09** |
| Δ GAS | -0.05** | -2.62** | -0.15** | -1.20 | 0.09** | -1.69* | 0.08** | -1.42 |
| Δ OIL | -0.16** | -1.62 | 0.05** | -1.41 | 0.14** | -2.16** | -0.09** | -1.70* |
| Non-OECD | | | | | | | | |
| Dependent variable | POP1465 | λ | POP1529 | λ | POP3044 | λ | POP4564 | λ |
| Δ TOTAL | -0.06** | -2.06** | -0.06** | -1.72* | 0.10** | -2.50** | 0.25** | -1.43 |
| Δ COAL | -0.00** | -4.01** | -0.03 | -0.58 | 0.03* | -2.97** | 0.05** | -0.95 |
| Δ GAS | -0.01** | -1.04 | -0.01** | -1.09 | 0.08** | -0.99 | 0.18** | -0.82 |
| Δ OIL | -0.03** | -1.53 | -0.03** | -1.48 | 0.03** | -1.66* | 0.09** | -1.36 |
| Full Sample | | | | | | | | |
| Dependent variable | POP1465 | λ | POP1529 | λ | POP3044 | λ | POP4564 | λ |
| Δ TOTAL | -0.25** | -3.77** | -0.01** | -2.68** | 0.17** | -5.63** | 0.11** | -2.933** |
| Δ COAL | -0.17** | -5.94** | 0.08* | -5.23** | 0.04** | -6.663** | -0.03 | -6.123** |
| Δ GAS | -0.03** | -1.58 | -0.08** | -1.38 | 0.08** | -2.253** | 0.13** | -1.30 |
| Δ OIL | -0.08** | -2.61** | 0.01 | -2.23** | 0.07** | -3.503** | 0.01** | -2.29** |

Note: ** (*) indicates statistical significance at the 5% (10%) level.

^a Panel FMOLS estimates results are the same with the other sample test results.

^b λ indicates the long-run cointegrated relationship of the cointegrated process in VECM is the same as the other sample test results.

30-44, and 45-64. SEXRATIO is measured as the ratio of females to males in the population, and are calculated from the female and male population data of each age group.

2.2.1. Results of panel unit root tests and panel cointegration tests

Table 1 reports the findings of the full sample panel unit root tests. We use Levin–Lin–Chu (LLC) and panel ADF tests to examine whether each variable has a panel unit root. The results indicate that POP and SEXRATIO in each group and TOTAL, COAL, GAS and OIL have a unit root in level. On the contrary, the first-differences test results indicating that all variables follow the I(1) processes. We further examine if population, sex ratio, and CO₂ emissions have long-run relationships. Results of the full sample panel cointegration tests are presented in Table 2 and Table 3. The test results imply the existence of a long-run cointegration relationship among variables in the sample countries.

As the cointegration relationship is confirmed in sample countries, we further estimate the parameters of the panel cointegration vector in both the sub-samples and full sample. Table 4 shows the panel estimate results for the model that contains the variables of CO₂ and POP when TOTAL, COAL, GAS, and OIL are the dependent variable. The full sample results indicate that for TOTAL the coefficients of POP1465 and POP1529 are significantly negative; conversely, the coefficients of POP3044 and POP4564 are significantly positive, implying that increasing POP1465 and POP1529 will consistently

decrease total CO₂ emissions. For COAL, increasing POP1465 will consistently decrease CO₂ emissions; conversely, increasing POP1529 and POP3044 will consistently increase it. For GAS, the result is similar to TOTAL while OIL, increasing POP1465 will consistently decrease CO₂ emissions; conversely, increasing POP3044 and POP4564 will consistently increase it.

Table 5 exhibits the panel FMOLS results when the variable SEXRATIO is added. The results indicate that for TOTAL the coefficients of POP1465 and POP1529 are significantly negative; the coefficients of POP3044 and POP4564 are estimated to be the opposite, which are similar to the results shown in Table 4. Specifically, for COAL, only increasing POP1465 will consistently decrease COAL, while increasing POP1529, POP3044 and POP4564 will consistently increase it. For GAS, the results are similar to TOTAL. For OIL, the results illustrate that POP1465 negative impacts on OIL while POP3044 and have positive impacts on it.

In Table 4 the panel FMOLS results of TOTAL and GAS in the OECD countries are consistent with the full sample test results. For COAL and OIL, the results indicate that increasing POP1465 and POP4564 will consistently decrease COAL and OIL. The test results in non-OECD countries seem more consistent for different categories of CO₂ emissions. From the test results, except for the non-significant result for COAL of age group POP1529, increasing POP1465 and POP1529 will consistently decrease CO₂ emissions, while those for POP3044 and POP4564 run conversely.

Table 5 Panel FMOLS and panel causality tests results: CO₂, POP and SEXRATIO

| OECD | | | | | | | | | | | | | | | | | | | | |
|--------------------|----------------------|---------------------------|----------------|----------------------|---------------------------|----------------|----------------------|---------------------------|----------------|----------------------|---------------------------|----------------|--|--|--|--|--|--|--|--|
| Dependent variable | POP1465 ^a | SEXRATIO1465 ^a | λ ^b | POP1529 ^a | SEXRATIO1529 ^a | λ ^b | POP3044 ^a | SEXRATIO3044 ^a | λ ^b | POP4564 ^a | SEXRATIO4564 ^a | λ ^b | | | | | | | | |
| ΔTOTAL | -0.60** | 28.10** | -2.61** | 0.23** | 36.62 | -2.86** | 0.21** | -28.27** | -3.50** | 0.00** | -1.80** | -3.57** | | | | | | | | |
| ΔCOAL | -0.28** | 24.23** | -4.61** | 0.22** | 16.98 | -4.76** | 0.04** | -27.43** | -4.41** | 0.02 | 16.10** | -5.03** | | | | | | | | |
| ΔGAS | -0.11** | -6.65** | -2.10** | -0.14** | -4.08** | -1.056 | 0.05** | -7.39** | -1.65* | 0.04** | -14.95** | -1.39 | | | | | | | | |
| ΔOIL | -0.22** | 11.07** | -1.25 | 0.16** | 25.41 | -1.41 | 0.11** | 5.37** | -2.09** | -0.07** | -3.00** | -1.80* | | | | | | | | |
| Non-OECD | | | | | | | | | | | | | | | | | | | | |
| Dependent variable | POP1465 | SEXRATIO1465 | λ | POP1529 | SEXRATIO1529 | λ | POP3044 | SEXRATIO3044 | λ | POP4564 | SEXRATIO4564 | λ | | | | | | | | |
| ΔTOTAL | -0.10** | 14.01 | -2.46** | -0.12** | -7.84** | -3.36** | 0.05** | 1.15** | -4.68** | 0.17** | 8.15 | -4.22** | | | | | | | | |
| ΔCOAL | -0.04** | 3.46** | -1.09 | -0.04** | -1.01** | -0.94 | -0.05** | -11.36** | -3.30** | -0.02** | 8.91** | -0.84 | | | | | | | | |
| ΔGAS | -0.04** | 7.32 | -1.29 | -0.07** | -4.48** | -2.51** | 0.10** | -3.61* | -3.34** | 0.15** | -4.64** | -3.22** | | | | | | | | |
| ΔOIL | -0.05** | 5.47 | -1.58 | -0.05** | -3.65** | -1.76* | 0.02** | -3.45** | -2.16** | 0.08 | 6.03 | -2.39** | | | | | | | | |
| Full Sample | | | | | | | | | | | | | | | | | | | | |
| Dependent variable | POP1465 ^a | SEXRATIO1465 | λ ^b | POP1529 | SEXRATIO1529 | λ | POP3044 | SEXRATIO3044 | λ | POP4564 | SEXRATIO4564 | λ | | | | | | | | |
| ΔTOTAL | -0.31** | 19.93** | -3.85** | -0.02** | -10.85** | -4.01** | 0.12** | 11.21** | -6.45** | 0.10** | -3.97** | -4.82** | | | | | | | | |
| ΔCOAL | -0.17** | 14.41** | -5.21** | 0.10** | -8.48** | -5.53** | 0.00** | -9.09** | -6.65** | 0.00** | 12.70** | -6.10** | | | | | | | | |
| ΔGAS | -0.07** | 0.21** | -2.16** | -0.10** | -4.28** | -3.31** | 0.07** | 5.53** | -4.820** | 0.09** | -7.53** | -3.86** | | | | | | | | |
| ΔOIL | -0.12** | 7.83** | -2.77** | 0.04 | -8.56 | -2.40** | 0.06** | 0.25** | -3.68** | 0.01 | -2.23 | -2.93** | | | | | | | | |

Note: ** (*) indicates statistical significance at the 5% (10%) level.

^a The same as Table 4; ^b the same as Table 4.

The test results in Table 5 show that there are some differences when we take SEXRATIO into account. In OECD countries, the results of GAS and OIL are consistent with the results shown in Table 4, but for COAL the coefficient of age group POP4564 is insignificant. For TOTAL, the result indicate that increasing POP1529 will consistently raise total CO₂ emissions. In non-OECD countries, the results of TOTAL and GAS are consistent with the results shown in Table 4, but for OIL the coefficient of age group POP4564 is insignificant. For COAL, the result indicate that when we consider the role of SEXRATIO, increasing the population will consistently raise CO₂ emissions. Based on the result of the panel FMOLS estimate, POP, SEXRATIO, and CO₂ emissions exhibit long-run relationships.

2.2.2. Panel causality test results

When the long-run cointegrated relationships among these variables are confirmed, we further implement the causality tests using VECM to estimate the causalities among POP, SEXRATIO, and CO₂ emissions.

$$\Delta CO_{2it} = \theta_{1i} + \lambda_1 \varepsilon_{it-1} + \sum_k \theta_{11k} \Delta CO_{2it-k} + \sum_k \theta_{12k} \Delta POP_{it-k} + u_{1it} \quad (3)$$

$$\Delta CO_{2it} = \theta_{2i} + \lambda_2 \varepsilon_{it-1} + \sum_k \theta_{21k} \Delta CO_{2it-k} + \sum_k \theta_{22k} \Delta POP_{it-k} + \sum_k \theta_{23k} \Delta SEXRATIO_{it-k} + u_{2it} \quad (4)$$

Here, the variables in the models are defined above. Based on these models, we test the significance of the coefficients of dependent CO₂ emissions (TOTAL, COAL, GAS, and OIL) in equations (3), and (4) to examine the directions of causation. We test in equations (3) and (4) for long-run causality to investigate whether there exists causality among CO₂, POP, and SEXRATIO. The estimator in Table 4 and Table 5 presents the panel causality test results among variables. In the full sample test in table 4, for TOTAL, the evidence shows that higher POP1465 and POP1529 contribute to a decline of CO₂ emissions, however, higher POP3044 and POP4564 lead to greater CO₂ emissions in the long run. One possible reason is that, young people (aged less than 20) and old people (aged 65 and above) exhibit higher preferences for air quality (Menz and Welsch, 2010; Zhang, et al., 2018). Compared to working-age people, young people are not at their working age and older people past their peak working years consume fewer energy (Hasimoglu and Aksakal, 2015). Menz and Welsch (2012) raised a different opinion and claimed that people in the intermediate age group emit less emissions than younger and older people. This difference is probably because their sample spans the period 1960-2005, whereas the people in that group have become old in our sample. Moreover, they pointed out that for the general public in that period, people were unaware of the danger of CO₂ emissions on the environment, and that older people emit less today than they did in the past. For different sources of CO₂ emissions, higher POP1465 contributes to a drop in CO₂ emissions; conversely,

higher POP1529 and POP3044 lead to greater CO₂ emissions from COAL. For GAS, higher POP3044 contributes to increased CO₂ emissions. For OIL, higher POP1465 contributes to a decline in CO₂ emissions, but the POP3044 and POP4564 effects are the reverse.

We note that the CO₂ emissions from different fuel combustions mainly come from different age groups. One reason may be that most CO₂ emissions of each sector that directly relate to people's lives are derived from different fuel combustion. About 65.5% of coal is primarily used for the generation of electricity and commercial heat (IEA Statistics, 2017); with the quick pace of life, people's sleeping times are being shortened, which may lead to increasing electricity consumption of intermediate age groups, and the age trend is getting younger. According to IEA's investigation, the largest contribution to the increase in oil product demand comes from motor gasoline. In private travel, compared to young and older cohorts, people of the intermediate age groups tend to travel more, (Menz and Welsch, 2012).

In Table 5, for TOTAL the evidence shows that greater POP1465 and POP1529 decrease CO₂ emissions, however, greater POP3044 and POP4564 lead to increased CO₂ emissions in the long run, and the same goes for GAS. For GAS, the long-run causality between population and CO₂ emissions becomes more significant when adding the variable SEXRATIO. For COAL, the results indicate that greater POP1465 contributes to lower CO₂ emissions, conversely, other groups contribute to increase CO₂ emissions. Different from the test results of TOTAL, POP1529 increases CO₂ emissions from coal; one important reason may be that, young childless couples, young single people (aged under 30), tenants in social or private housing with one or two rooms (smaller than 70 m²) representing high electricity consumers (Lévy and Belaïd, 2018), residential electricity consumption is the main application of coal combustion (IEA statistics, 2017). pointed out that. For OIL, higher POP1465 contributes to lower CO₂ emissions, but higher POP3044 increases CO₂ emissions.

The OECD and non-OECD results in Table 4 and Table 5 show the panel cointegration test and long-run cointegrated relationship for the sub-samples. From the analysis of the results of OECD and non-OECD countries in table 4, we notice two obvious differences between them. First, the causality of population and CO₂ emissions from gas combustion is not confirmed in non-OECD countries, probably because the reasons for gas causing CO₂ emissions are seemingly complex. Second, the groups of people that produce CO₂ emissions by coal consumption in OECD countries are younger than those in non-OECD countries, probably because mostly young people are working in informal sectors or in the agriculture sector in developing countries (Djankov

and Ramalho, 2009; Choudhry, et al., 2012). This work pattern may consume less fuel compared to developed countries (Das, et al., 2014).

Compare to Table 4, the results in Table 5 indicate that when SEXRATIO added in the model, some relationships between population and CO₂ emissions become clearer. For TOTAL in both OECD and non-OECD countries, higher POP4564 contributes to greater CO₂ emissions. It is worth noting that a higher share of people aged 15 to 29 in OECD countries emits more CO₂ emissions when we take gender into account. A possible reason may be that in OECD countries, young women participate in more economic activities than non-OECD countries (Gaddis and Klasen, 2014). For COAL, the coefficient of POP4564 is statistically not significant, indicating that the relationship between POP4564 and CO₂ emissions needs more research in OECD countries. For GAS, in non-OECD countries, larger POP1529 decreases CO₂ emissions, while POP3044 and POP4564 increase CO₂ emissions. For OIL, the results are the same as Table 4 in OECD countries. In non-OECD countries, except for POP3044, higher POP1529 also decreases CO₂ emissions.

2.3. Policy implications

Based on the empirical results above, we can draw some policy implications about the relationship between population age structure and CO₂ emissions as well as the influence of a country's sex ratio on that relationship. The results indicate that total CO₂ emissions mainly come from working-aged (between 30 and 64) people. Countries should implement various carbon policies to promote low carbon technological innovation in the manufacturing industry in the production process (Kang, et al., 2018). The *green travel* behavior characterized by travel modes that take up low energy (Yang, et al., 2017). Governments should offer convenient and green modes of transportation to promote *green travel*. Countries with a younger population may provide a plentiful labor force for production and operating activities in the future and should offer education and publicity to deepen the environmental awareness and green consumption pattern. The population aging of countries to some extent decreases CO₂ emissions, but the aging process implies reduced labor supply (Wei, et al., 2018). As such, countries with population aging should take action to improve energy use efficiency, such as developing new technology (Fathabadi, 2015) and improving government efficiency (Chang, et al., 2018).

The impact of age structure on CO₂ emissions is heterogeneous across countries of different position in the development process as well as sources of CO₂ emissions. The energy consumed by people aged between 30 and 64 contributes more to CO₂ emissions in both OECD countries and non-OECD countries, but there exists little difference in age groups when we focus on different sources of CO₂ emissions. In

OECD countries, CO₂ emissions from burning coal mainly come from people aged between 15 and 44; from gas mainly from people aged between 30 and 64; and from oil mainly from people aged between 30 and 44. In non-OECD countries, CO₂ emissions from burning coal mainly come from people aged between 30 and 64 and that from oil mainly come from people aged between 30 and 44; the long-run causality between GAS and CO₂ emissions is not significant. The change in population age structure influences the energy consumption structure, and governments should forecast energy consumption and CO₂ emissions dependent upon the change of their country's age structure in order to maximize the effects of an energy optimization policy. Acceleration of the population aging process is more apparent in developed countries than in developing countries (Menz and Welsch, 2012). In OECD countries, renewable energy has helped decrease gas combustion by people heating households, which is one of the main source of gas combustion. Non-OECD countries' coal consumption is far more than OECD countries, and the coal consumption by intermediate age groups (between 30 and 64) is more than other groups. Thus, governments should consider to decrease coal consumption in the electricity sector and replace it by other fuels, such as that used by the iron and steel industry in China and India (IEA statistics, 2017).

When we take SEXRATIO into account, the causality between age structure and CO₂ emissions becomes more significant, especially for long-run causality between POP and GAS. In non-OECD countries, although a higher population aged between 30 and 64 contributes to greater CO₂ emissions, an increase in the ratio of the female population could mitigate the relationship. From IEA Statistics (2017), non-OECD countries have consumed gas more than OECD countries since 2008. Thus, countries suffering from a gender imbalance should attach importance to women's influence on the environment and give them more opportunities to help decrease environmental hazards (Chukwukere and Onyenechere, 2015).

According to the analysis above, we notice that except for the effect of POP3044 from COAL in non-OECD countries in Table 5, increasing the other group of women is unable to decrease CO₂ emissions when we consider the sex ratio. Even though women have an important role in their local environmental protection, the effects of these preferences depend on how they are put into practice. Women's participation in the decision-making process and have higher political status may prove invaluable for addressing climate change (Ergas and York, 2012; Chukwukere and Onyenechere, 2015). Because of the different levels of economic development and gender inequality between OECD and non-OECD countries, women in some countries are underrepresented in the climate change discussion. Governments should

listen more to women's suggestions on the environmental problem, and a certain proportion of decision-making positions given to women could guarantee their voices are not ignored. Strengthening the education of women, especially in regards to environmental knowledge, will support the due role that women play in this regard.

4. Conclusion

This paper has tested the effects of age structure on CO₂ emissions and investigated the role of gender in that relationship. We utilize the panel cointegration tests to examine the co-movement and causality among age structure, gender, and CO₂ emissions for 29 OECD countries and 40 non-OECD countries for the period 1990-2014. Generally speaking, we find that younger (less than 30) and older (65 and above) people emit less than people in the intermediate age group in full sample. The difference in CO₂ emissions depends on the age structure of each country. The results also indicate that the main type of energy consumption causes different results in the relationship between age structure and CO₂ emissions. As countries' energy structure changes in the future, the effect of age structure on CO₂ emissions may change in different periods. Thus, demographic and energy structure changes should be considered together. Our evidence also suggests that gender should be included in the research on the relationship between demographics and CO₂ emissions. For a gender's influence on the environment, studies should consider not only the amount of women, but also their economic and political status in their country. The findings of this study offer some suggestions to governments.

References

1. BOEVE-DE PAUW J., JACOBS K., VAN PE-TEGEM P., 2014, Gender Differences in Environmental Values: An Issue Of Measurement?, in: *Environment and Behavior*, 46(3), p. 373-397.
2. CHANG C.-P., WEN J., ZHENG M., DONG M., HAO Y., 2018, Is Higher Government Efficiency Conducive to Improving Energy Use Efficiency? Evidence from OECD Countries, in: *Economic Modelling*, p. 1-13.
3. CHOUDHRY M.T., MARELLI E., SIGNORELLI M., 2012, Youth Unemployment Rate and Impact of Financial Crises, in: *International Journal Of Manpower*, 33(1), p. 76-95.
4. CHUKWUKERE P.O., ONYENECHERE E.C., 2015, Gender and Climate Change Mitigation: A Review, in: *International Journal of Social Sciences and Humanities Review*, 5(1), p. 34-43.
5. DAS B.K., KADER M.A., HOQUE S.M.N., 2014, Energy Recovery Potential from Municipal Solid Waste In Rajshahi City by Landfill Technique, in: *International Journal of Renewable Energy Research*, 4(2), p. 349-354.
6. DJANKOV S., RAMALHO R., 2009, Employment Laws in Developing Countries, in: *Journal of Comparative Economics*, 37(1), p. 3-13.
7. ERGAS C., YORK R., 2012, Women's Status and Carbon Dioxide Emissions: A Quantitative Cross-National Analysis, in: *Social Science Research*, 41(4), p. 965-976.
8. FARZIN Y.H., BOND C.A., 2006, Democracy and Environmental Quality, in: *Journal of Development Economics*, 81(1), p. 213-235.
9. FATHABADI H., 2015, Two Novel Techniques for Increasing Energy Efficiency of Photovoltaic-Battery Systems, in: *Energy Conversion and Management*, 105, p. 149-166.
10. GADDIS I., KLASSEN S., 2014, Economic Development, Structural Change and Women's Labor Force Participation: A Reexamination of the Feminization U Hypothesis, in: *Journal of Population Economics*, 27 (3), p. 639-681.
11. GOLDMAN D., YAVETZ B., PE'ER S., 2006, Environmental Literacy in Teacher Training in Israel: Environmental Behavior Of New Students, in: *The Journal of Environmental Education*, 38(1), p. 3-22.
12. GRIFFIN S., 2016, *Woman and nature: The roaring inside her*, Harper and Row, New York.
13. HASIMOGLU S., AKSAKAL V., 2015, Per Capita (Pc) Versus Per Adult Human Unit Method (Pahum): A Net Assessment of Eu28-Population, Family/Household, Food Consumption and Environmental Impact, in: *Journal of Environmental Science and Engineering*, p. 336-351.
14. ISRAEL D., LEVINSON A., 2004, Willingness to Pay for Environmental Quality: Testable Empirical Implications of the Growth and Environment Literature, in: *Contributions in Economic Analysis & Policy*, 3(1), p. 1-29.
15. JORGENSON A.K., RICE J., CLARK B., 2010, Cities, Slums, and Energy Consumption in Less Developed Countries, 1990 to 2005, in: *Organization & Environment*, 23(2), p. 189-204.
16. KANG Z.-Y., LI K., QU J., 2018, The Path of Technological Progress for China's Low-Carbon Development: Evidence from Three Urban Agglomerations, in: *Journal of Cleaner Production*, 178, p. 644-654.
17. KHOBAI H.B., LE ROUX P., 2017, The Relationship Between Energy Consumption, Economic Growth and Carbon Dioxide Emission: The Case of South Africa, in: *International Journal of Energy Economics and Policy*, 7(3), p. 102-109.
18. LÉVY J.-P., BELAÏD F., 2018, The Determinants of Domestic Energy Consumption in France: Energy Modes, Habitat, Households and Life Cycles, in: *Renewable and Sustainable Energy Reviews*, 81, p. 2104-2114.
19. LIDDLE B., 2011, Consumption-Driven Environmental Impact and Age Structure Change in Oecd Countries: A Cointegration-Stirpat Analysis, in: *Demographic Research*, 24(30), p. 749-770.
20. LIDDLE B., LUNG S., 2010, Age-Structure, Urbanization, and Climate Change in Developed Countries: Revisiting Stirpat for Disaggregated Population and Consumption-Related Environmental Impacts, in: *Population and Environment*, 31(5), p. 317-343.
21. MENZ T., WELSCH H., 2010, Population Aging and Environmental Preferences in OECD Countries: The Case Of Air Pollution, in: *Ecological Economics*, 69(12), p. 2582-2589.

22. MENZ T., WELSCH H., 2012, Population Aging and Carbon Emissions in OECD Countries: Accounting for Life-Cycle and Cohort Effects, in: *Energy Economics*, 34(3), p. 842-849.
23. NIGHTINGALE A., 2006, The Nature of Gender: Work, Gender, and Environment, in: *Environment and Planning D: Society and Space*, 24(2), p. 165-185.
24. OKADA A., 2012, Is An Increased Elderly Population Related to Decreased CO₂ Emissions from Road Transportation? in: *Energy Policy*, 45, p. 286-292.
25. PEDRONI P., 1999, Critical Values for Cointegration Tests in Heterogeneous Panels with Multiple Regressors, in: *Oxford Bulletin of Economics and Statistics*, 61(S1), p. 653-670.
26. PEDRONI P., 2000, Full Modified OLS for Heterogeneous Cointegrated Panels, in: *Advances in Econometrics*, 15, p. 93-130.
27. PEDRONI P., 2000, *Nonstationary Panels Panel Cointegration and Dynamic Panels*, JAI Press.
28. PEDRONI P., 2004, Panel Cointegration: Asymptotic and Finite Sample Properties of Pooled Time Series Tests with An Application to the PPP Hypothesis, in: *Econometric Theory*, 20(3), p. 597-625.
29. REHDANZ K., 2007, Determinants of Residential Space Heating Expenditures in Germany, in: *Energy Economics*, 29(2), p. 167-182.
30. SCHAHN J., HOLZER E., 1990, Studies of Individual Environmental Concern: The Role of Knowledge, Gender, and Background Variables, in: *Environment and Behavior*, 22(6), p. 767-786.
31. SHI A., 2003, The Impact of Population Pressure on Global Carbon Dioxide Emissions, 1975-1996: Evidence from Pooled Cross-Country Data, in: *Ecological Economics*, 44(1), p. 29-42.
32. TORGLER B., GARCIA-VALINAS M.A., MACINTYRE A., 2008, Differences in Preferences Towards the Environment: The Impact of a Gender, Age and Parental Effect, *FEEM Working Paper*, no. 18.
33. WANG Y., KANG Y., WANG J., XU L., 2017, Panel Estimation for the Impacts of Population-Related Factors on CO₂ Emissions: A Regional Analysis in China, in: *Ecological Indicators*, 78, p. 322-330.
34. WEI T., ZHU Q., GLOMSRØD S., 2018, How Will Demographic Characteristics of the Labor Force Matter for the Global Economy and Carbon Dioxide Emissions? in: *Ecological Economics*, 147, p. 197-207.
35. WILSON D.C., VELIS C., CHEESEMAN C., 2006, Role of Informal Sector Recycling in Waste Management in Developing Countries, in: *Habitat International*, 30(4), p. 797-808.
36. YANG R., LONG R., BAI Y., LI L., 2017, The Influence of Household Heterogeneity Factors on the Green Travel Behavior of Urban Residents in the East China Region, in: *Sustainability*, 9(2), p. 1-17.
37. ZELEZNY L.C., CHUA P.P., ALDRICH C., 2000, New Ways of Thinking about Environmentalism: Elaborating on Gender Differences in Environmentalism, in: *Journal of Social Issues*, 56(3), p. 443-457.
38. ZHANG Z., HAO Y., LU Z.-N., DENG Y., 2018, How Does Demographic Structure Affect Environmental Quality? Empirical Evidence from China, in: *Resources, Conservation and Recycling*, 133, p. 242-249.

Social Dimensions of Sustainable Development in International Public Opinion

Społeczne wymiary zrównoważonego rozwoju w międzynarodowej opinii publicznej

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Abstract

The article examines opinions on various elements of the social pillar of sustainable development. The analysis is based on the ISSP Role of Government V (2016). The research sample consisted of over 35,600 respondents from 28 different countries. It has been assumed that the most important indicator is the opinion that a given element requires much more government spending than it receives now. From the point of view of public opinion, health and education seem to constitute the crucial elements of the social pillar of sustainable development, whereas security and especially culture and the arts are much less important.

Key words: sustainable development, government, ISSP

Streszczenie

W artykule przedstawiono analizę opinii o elementach społecznego filaru zrównoważonego rozwoju w oparciu o badania ISSP Role of Government V (2016). Próba badawcza liczyła ponad 35 600 osób z 28 krajów. Za najważniejszy wskaźnik przyjęto opinię, iż dany element wymaga znacznie większego finansowania ze źródeł rządowych niż to ma miejsce obecnie. Zdrowie i edukacja – to elementy społecznego filaru zrównoważonego rozwoju, które wydają się być najważniejsze w opinii społecznej. Bezpieczeństwo a zwłaszcza kultura i sztuka – to elementy znacznie mniej istotne.

Słowa kluczowe: rozwój zrównoważony, rząd, ISSP

Introduction

Three pillars of sustainable development (environmental, economic, and social) are commonly distinguished in the literature. This article will focus on the social pillar, which will be examined from the perspective of public opinion only.

Social sustainability can be described as a state in which participants in social life enjoy a sufficiently high quality of life resulting from a combination of various specific factors. As Robert Prescott-Allen puts it, *human wellbeing is a condition in which all members of society are able to determine and meet their needs and have a large range of choices and opportunities to fulfil their potential* (Prescott-Allen, 2001, p.13). However, the question of what these

factors or their combinations are, is still being discussed (e.g. Kokić Arsić, 2016). One of the most interesting proposals in this area is the Human Wellbeing Index (HWI) developed by the World Conservation Union (IUCN). It is a set of indicators calculated for 180 countries. These indicators are aggregated into two sub-indexes: *human wellbeing* and *ecosystem wellbeing*. The first one (HWI), which is interesting for our purposes, is a collection of indicators concerning population, health, wealth, knowledge, culture and justice. The HWI is a realistic measure of socio-economic conditions and covers many aspects of human wellbeing. It incorporates five dimensions (health and population, wealth, knowledge and culture, community, and equity), which can be further subdivided into the following

10 elements: health, population, national wealth, knowledge, culture, freedom and governance, peace and order, household equity and gender equity (Prescott-Allen, 2001).

Some of these elements can be measured by means of objective indicators included in statistical data and official documents, while others are based on subjective indicators such as views and opinions. Sometimes we have a combination of objective and subjective indicators; for example, the state of health can be measured with statistical data on morbidity rates, hospitalization etc, but also by asking people how they assess their own health (self-assessment of health condition). Both these aspects are equally important. Consequently, public opinion surveys are essential for analysing the social pillar of sustainable development.

The purpose of the article is to answer the following research questions: (1) What are the opinions of inhabitants of different countries about government spending in such areas as health, education, police and law enforcement, and culture and the arts? (2) which of these areas is the most important from the point of view of public opinion?

Methodology

The data analysed in this article come from the ISSP Role of Government V module. The ISSP is a long-term international research program implemented annually in member states. It was initiated as the bilateral cooperation of the German ALLBUS program (Allgemeinen Bevölkerungsumfragen der Sozialwissenschaften) and the American GSS (General Social Survey). Later the program was joined by the British BSA (British Social Attitudes Survey) and the Australian National University, represented by the Research School of Social Sciences. Presently, the ISSP covers many countries around the world. In its current form, it has been operating since 1985. Since then, 32 surveys have been realised – some of them were repeated studies (e.g. five editions of *Role of Government*, four editions of *Social Inequality*, *Family and Changing Gender Roles*, and *Work Orientations*, three editions of *Environment*, *National Identity*, etc.). The ISSP research modules are usually attached to other major nationwide surveys (more information on the ISSP can be found at issp.org).

The ISSP Role of Government V 2016 was selected for the analysis because it is the latest survey carried out worldwide that contains variables relating to the social pillar of sustainable development. The questionnaire included the following question: *Listed below are various areas of government spending. Please show whether you would like to see more or less government spending in each area. Remember that if you say 'much more', it might require a tax increase to pay for it.* This question concerned, among others, the following issues: environment,

Table 1. Selected elements of the Human Wellbeing Index and corresponding indicators in the ISSP Role of Government V database (Prescott-Allen, modified in 2001)

| HWI elements | HWI content | ISSP Role of Government V indicators |
|-----------------|---|---|
| Health | People enjoy long lives in good health | Government should spend money on health |
| Knowledge | People have the knowledge to innovate and cope with change, live well and sustainably, and fulfil their potential | Government should spend money on education |
| Culture | with avenues for spiritual growth, creativity; and self-expression | Government should spend money on culture and the arts |
| Peace and order | Communities coexist peacefully and protect their members from crime and violence. | Government should spend money on police and law enforcement |

Table 2. Sample structure by country

| | Frequency | Percent |
|----------------|-----------|---------|
| Chile | 1416 | 3.9 |
| Croatia | 1966 | 5.4 |
| Czech Republic | 1026 | 2.8 |
| Denmark | 1400 | 3.8 |
| Finland | 1138 | 3.1 |
| France | 1186 | 3.2 |
| Georgia | 1501 | 4.1 |
| Germany | 1487 | 4.1 |
| Great Britain | 1689 | 4.6 |
| Hungary | 1000 | 2.7 |
| Iceland | 1322 | 3.6 |
| Israel | 1248 | 3.4 |
| Japan | 1611 | 4.4 |
| Korea | 1051 | 2.9 |
| Latvia | 1002 | 2.7 |
| Lithuania | 1006 | 2.8 |
| New Zealand | 1350 | 3.7 |
| Norway | 1260 | 3.4 |
| Philippines | 1200 | 3.3 |
| Slovakia | 1150 | 3.1 |
| Slovenia | 1024 | 2.8 |
| Spain | 1834 | 5.0 |
| Sweden | 1140 | 3.1 |
| Switzerland | 1066 | 2.9 |
| Taiwan | 1475 | 4.0 |
| Thailand | 1563 | 4.3 |
| United States | 1390 | 3.8 |
| Venezuela | 1045 | 2.9 |
| Total | 36546 | 100.0 |

health, police and law enforcement, education, and culture and the arts. The respondents could choose from the following answers: spend much more, spend more, spend the same as now, spend less, spend much less. The table below shows the relations between the Human Wellbeing Index and the

Table 3. Opinions *Government should spend money on health* by country

| | | | Government should spend money on health | | | | |
|---------|----------------|-------|---|------------|-----------------------|------------|-----------------|
| | | | Spend much more | Spend more | Spend the same as now | Spend less | Spend much less |
| Country | Chile | Count | 688 | 558 | 87 | 31 | 9 |
| | | % | 50.1% | 40.6% | 6.3% | 2.3% | 0.7% |
| | Croatia | Count | 323 | 846 | 489 | 195 | 35 |
| | | % | 17.1% | 44.8% | 25.9% | 10.3% | 1.9% |
| | Czech Republic | Count | 405 | 471 | 113 | 25 | 7 |
| | | % | 39.7% | 46.1% | 11.1% | 2.4% | 0.7% |
| | Denmark | Count | 306 | 660 | 366 | 43 | 7 |
| | | % | 22.1% | 47.8% | 26.5% | 3.1% | 0.5% |
| | Finland | Count | 279 | 533 | 263 | 22 | 6 |
| | | % | 25.3% | 48.3% | 23.8% | 2.0% | 0.5% |
| | France | Count | 236 | 512 | 380 | 31 | 6 |
| | | % | 20.3% | 43.9% | 32.6% | 2.7% | 0.5% |
| | Georgia | Count | 304 | 574 | 480 | 85 | 9 |
| | | % | 20.9% | 39.5% | 33.1% | 5.9% | 0.6% |
| | Germany | Count | 845 | 497 | 92 | 7 | 0 |
| | | % | 58.6% | 34.5% | 6.4% | 0.5% | 0.0% |
| | Great Britain | Count | 490 | 754 | 377 | 24 | 7 |
| | | % | 29.7% | 45.6% | 22.8% | 1.5% | 0.4% |
| | Hungary | Count | 682 | 265 | 38 | 4 | 2 |
| | | % | 68.8% | 26.7% | 3.8% | 0.4% | 0.2% |
| | Iceland | Count | 644 | 576 | 80 | 6 | 3 |
| | | % | 49.2% | 44.0% | 6.1% | 0.5% | 0.2% |
| | Israel | Count | 599 | 437 | 171 | 18 | 1 |
| | | % | 48.9% | 35.6% | 13.9% | 1.5% | 0.1% |
| | Japan | Count | 333 | 467 | 520 | 92 | 45 |
| | | % | 22.9% | 32.1% | 35.7% | 6.3% | 3.1% |
| | Korea | Count | 197 | 500 | 312 | 26 | 7 |
| | | % | 18.9% | 48.0% | 29.9% | 2.5% | 0.7% |
| | Latvia | Count | 340 | 549 | 76 | 9 | 6 |
| | | % | 34.7% | 56.0% | 7.8% | 0.9% | 0.6% |
| | Lithuania | Count | 311 | 491 | 179 | 13 | 3 |
| | | % | 31.2% | 49.2% | 18.0% | 1.3% | 0.3% |
| | New Zealand | Count | 399 | 718 | 211 | 5 | 2 |
| | | % | 29.9% | 53.8% | 15.8% | 0.4% | 0.1% |
| | Norway | Count | 247 | 678 | 292 | 22 | 4 |
| | | % | 19.9% | 54.5% | 23.5% | 1.8% | 0.3% |
| | Philippines | Count | 525 | 599 | 53 | 20 | 2 |
| | | % | 43.8% | 50.0% | 4.4% | 1.7% | 0.2% |
| | Slovakia | Count | 448 | 498 | 152 | 35 | 4 |
| | | % | 39.4% | 43.8% | 13.4% | 3.1% | 0.4% |
| | Slovenia | Count | 302 | 492 | 195 | 17 | 5 |
| | | % | 29.9% | 48.7% | 19.3% | 1.7% | 0.5% |
| | Spain | Count | 717 | 891 | 174 | 16 | 6 |
| | | % | 39.7% | 49.4% | 9.6% | 0.9% | 0.3% |
| | Sweden | Count | 379 | 569 | 162 | 4 | 3 |
| | | % | 33.9% | 50.9% | 14.5% | 0.4% | 0.3% |
| | Switzerland | Count | 118 | 358 | 461 | 81 | 13 |
| | | % | 11.4% | 34.7% | 44.7% | 7.9% | 1.3% |
| | Taiwan | Count | 687 | 522 | 172 | 23 | 15 |
| | | % | 48.4% | 36.8% | 12.1% | 1.6% | 1.1% |
| | Thailand | Count | 486 | 816 | 201 | 9 | 0 |
| | | % | 32.1% | 54.0% | 13.3% | 0.6% | 0.0% |
| | United States | Count | 240 | 681 | 309 | 112 | 26 |
| | | % | 17.5% | 49.8% | 22.6% | 8.2% | 1.9% |
| | Venezuela | Count | 566 | 384 | 74 | 19 | 2 |
| | | % | 54.2% | 36.7% | 7.1% | 1.8% | 0.2% |
| Total | | Count | 12096 | 15896 | 6479 | 994 | 235 |
| | | % | 33.9% | 44.5% | 18.1% | 2.8% | 0.7% |

corresponding indicators in the ISSP Role of Government V database. As already mentioned, the HWI contains 10 components while the ISSP Role of Government V only 5, including the *environment* indicator, which is not a variable of the social pillar, but rather belongs to the environmental pillar of sustainable development. It seems, however, that it cannot be ignored in the analyses.

How should we interpret these indicators? The opinion that government should finance a given area in one way or another, reflects the respondents' attitude towards this area. So if respondents express the view that a given aspect should receive more financing, this shows their positive attitude towards it. In particular, the declaration *spend much more* is of great importance, as the respondents must be aware that increased expenditure may require a tax increase, and so affect them directly.

The ISSP Role of Government V survey was conducted on a sample of 36,546 people from 28 countries across the world. The sample structure by country is shown in the table 2.

Results

The Rio Declaration on Environment and Development (1992) in Principle I states that: *Human beings are at the center of concerns for sustainable development. They are entitled to a healthy and productive life in harmony with nature.* The essence of this element is the length of a (healthy) life, and this in turn requires expenditure.

The view that government spending on health should be substantially increased was most often expressed by inhabitants of Hungary (68.8%), Germany (58.6%), Venezuela (54.2%), Chile (50.1%), Iceland (49.2%), Israel (48.9%) and Taiwan (48.4%). On the other hand, residents of Switzerland (11.4%), the USA (17.5%), Croatia (17.1%), and Korea (18.9%) were the least likely to express this opinion. Surprisingly enough, rich countries can be found both in the group that favours higher spending on health and in the group that believes that such spending is not necessary (e.g. Germany, Taiwan, Israel vs. Switzerland, the USA, Korea). Hence, economic development is not a factor that accounts for the observed relationships. These could perhaps be explained by the nature of the health care system in those countries.

A subjective indicator of the HWI component that has been called *peace and order* is the opinion about government spending on police and law enforcement. This opinion can also be interpreted as the belief that it is necessary to provide more protection against violence and crime. Residents of Great Britain (27.9%), Venezuela (27.2%), Germany (24.2%), Sweden (25.7%), Iceland (25.3%), and Korea (23.2%) would like to see a significant increase in spending on police and law enforcement. This can be

explained by the complicated international or internal situation in those countries (Korea and Venezuela), but most of all by the problems connected with large numbers of unwanted immigrants or refugees. Not so long ago, countries such as Great Britain, Germany, Sweden, or Iceland seemed to be oases of security. This sense of security has now significantly decreased, as the data show. By contrast, in the US, a country with a very liberal policy on gun possession, the discussed indicator stands at only approx. 10.9%. The lowest percentage of the indicator which shows lack of security is noted in Japan and Switzerland (4.5% and 4.8% respectively), where the problem of unwanted immigrants or refugees practically does not exist.

As R. Presscott-Allen states, *knowledge helps people to lead more fulfilling and satisfying lives, deepening their understanding and enjoyment of the world and equipping them with the information and skills required to live well and sustainably* (Prescott-Allen, 2001, p. 36). In the absence of better empirically available tools, education (most often, the length and availability of education) usually serves as an indicator of *knowledge*.

The view that government spending on education should be significantly increased was most often expressed by residents of Germany (61%), Taiwan (57.6%), Venezuela (54.9%), Israel (54.6%), and the Philippines (50.4%); whereas residents of France (13.6%), Denmark (15%), Finland (16.6%), Sweden (18.1%) and Switzerland (18.4%) were the least likely to express this view. The presence of countries such as Venezuela or the Philippines in the first group can be easily explained, but it is much harder to understand why inhabitants of Germany or Taiwan would like to see more government spending on education. On the other hand, the make-up of the second group is not surprising, as it includes countries where much money is spent on education and education level is generally high.

Several important organizations (e.g. UNESCO and the Council of Europe) have recently recognized culture as an important aspect of sustainable development. However, there is an ongoing debate on what indicators should be used for culture treated as an element of the social aspect of sustainable development (Dessein et al., 2015).

The need to increase government spending on culture and the arts is most often noticed by Germans (30%), as well as the Taiwanese (21.6%) and Venezuelans (22.4%) while Danes (2.4%), Finns (2.9%), the French (2.1%), inhabitants of New Zealand (2.7%), Norway (2.7%) and Sweden (3%) rarely express this need. Just as it was the case with spending on education, it is not surprising that those living in rich countries, where culture and the arts are generously financed, do not see the need to significantly raise government spending for this purpose. What is interesting, however, is a high percentage of Ger-

Table 4. Opinions *Government should spend money on police and law enforcement* by country

| | | | Government should spend money on police and law enforcement | | | | |
|---------|----------------|-------|--|---------------|--------------------------|---------------|--------------------|
| | | | Spend much more | Spend more | Spend the same as now | Spend less | Spend much less |
| Country | Chile | Count | 156 | 486 | 489 | 173 | 46 |
| | | % | 11.6% | 36.0% | 36.2% | 12.8% | 3.4% |
| | Croatia | Count | 286 | 861 | 555 | 147 | 26 |
| | | % | 15.3% | 45.9% | 29.6% | 7.8% | 1.4% |
| | Czech Republic | Count | 100 | 350 | 386 | 132 | 50 |
| | | % | 9.8% | 34.4% | 37.9% | 13.0% | 4.9% |
| | Denmark | Count | 143 | 456 | 655 | 103 | 17 |
| | | % | 10.4% | 33.2% | 47.7% | 7.5% | 1.2% |
| | Finland | Count | 163 | 441 | 440 | 38 | 14 |
| | | % | 14.9% | 40.2% | 40.1% | 3.5% | 1.3% |
| | France | Count | 174 | 540 | 406 | 30 | 8 |
| | | % | 15.0% | 46.6% | 35.1% | 2.6% | 0.7% |
| | Georgia | Count | 166 | 454 | 692 | 94 | 23 |
| | | % | 11.6% | 31.8% | 48.4% | 6.6% | 1.6% |
| | Germany | Count | 335 | 412 | 515 | 96 | 26 |
| | | % | 24.2% | 29.8% | 37.2% | 6.9% | 1.9% |
| | Great Britain | Count | 460 | 802 | 347 | 36 | 5 |
| | | % | 27.9% | 48.6% | 21.0% | 2.2% | 0.3% |
| | Hungary | Count | 136 | 287 | 395 | 92 | 52 |
| | | % | 14.1% | 29.8% | 41.1% | 9.6% | 5.4% |
| | Iceland | Count | 327 | 707 | 242 | 13 | 6 |
| | | % | 25.3% | 54.6% | 18.7% | 1.0% | 0.5% |
| | Israel | Count | 254 | 443 | 406 | 83 | 26 |
| | | % | 21.0% | 36.6% | 33.5% | 6.8% | 2.1% |
| | Japan | Count | 61 | 165 | 902 | 159 | 60 |
| | | % | 4.5% | 12.2% | 67.0% | 11.8% | 4.5% |
| | Korea | Count | 242 | 453 | 323 | 20 | 4 |
| | | % | 23.2% | 43.5% | 31.0% | 1.9% | 0.4% |
| | Latvia | Count | 71 | 423 | 369 | 80 | 16 |
| | | % | 7.4% | 44.1% | 38.5% | 8.3% | 1.7% |
| | Lithuania | Count | 116 | 391 | 412 | 48 | 15 |
| | | % | 11.8% | 39.8% | 42.0% | 4.9% | 1.5% |
| | New Zealand | Count | 219 | 595 | 458 | 27 | 10 |
| | | % | 16.7% | 45.5% | 35.0% | 2.1% | 0.8% |
| | Norway | Count | 151 | 574 | 472 | 34 | 7 |
| | | % | 12.2% | 46.4% | 38.1% | 2.7% | 0.6% |
| | Philippines | Count | 255 | 648 | 211 | 68 | 11 |
| | | % | 21.4% | 54.3% | 17.7% | 5.7% | 0.9% |
| | Slovakia | Count | 71 | 270 | 551 | 188 | 37 |
| | | % | 6.4% | 24.2% | 49.3% | 16.8% | 3.3% |
| | Slovenia | Count | 161 | 518 | 281 | 24 | 10 |
| | | % | 16.2% | 52.1% | 28.3% | 2.4% | 1.0% |
| | Spain | Count | 223 | 695 | 718 | 103 | 21 |
| | | % | 12.7% | 39.5% | 40.8% | 5.9% | 1.2% |
| | Sweden | Count | 285 | 551 | 255 | 15 | 5 |
| | | % | 25.7% | 49.6% | 23.0% | 1.4% | 0.5% |
| | Switzerland | Count | 50 | 291 | 606 | 81 | 7 |
| | | % | 4.8% | 28.1% | 58.6% | 7.8% | 0.7% |
| | Taiwan | Count | 138 | 257 | 620 | 230 | 75 |
| | | % | 10.5% | 19.5% | 47.0% | 17.4% | 5.7% |
| | Thailand | Count | 218 | 692 | 552 | 32 | 7 |
| | | % | 14.5% | 46.1% | 36.8% | 2.1% | 0.5% |
| | United States | Count | 150 | 545 | 537 | 117 | 21 |
| | | % | 10.9% | 39.8% | 39.2% | 8.5% | 1.5% |
| | Venezuela | Count | 283 | 351 | 255 | 124 | 29 |
| | | % | 27.2% | 33.7% | 24.5% | 11.9% | 2.8% |
| Total | | Count | 5394 | 13658 | 13050 | 2387 | 634 |
| | | % | 15.4% | 38.9% | 37.2% | 6.8% | 1.8% |

Table 5. Opinions *Government should spend money on education* by country

| | | | Government should spend money on education | | | | |
|---------|----------------|-------|--|------------|-----------------------|------------|-----------------|
| | | | Spend much more | Spend more | Spend the same as now | Spend less | Spend much less |
| Country | Chile | Count | 547 | 635 | 136 | 40 | 7 |
| | | % | 40.1% | 46.5% | 10.0% | 2.9% | 0.5% |
| | Croatia | Count | 429 | 843 | 427 | 148 | 30 |
| | | % | 22.9% | 44.9% | 22.7% | 7.9% | 1.6% |
| | Czech Republic | Count | 427 | 485 | 89 | 17 | 4 |
| | | % | 41.8% | 47.5% | 8.7% | 1.7% | 0.4% |
| | Denmark | Count | 207 | 516 | 576 | 70 | 9 |
| | | % | 15.0% | 37.4% | 41.8% | 5.1% | 0.7% |
| | Finland | Count | 183 | 415 | 456 | 42 | 4 |
| | | % | 16.6% | 37.7% | 41.5% | 3.8% | 0.4% |
| | France | Count | 157 | 477 | 485 | 34 | 3 |
| | | % | 13.6% | 41.3% | 42.0% | 2.9% | 0.3% |
| | Georgia | Count | 300 | 496 | 541 | 91 | 10 |
| | | % | 20.9% | 34.5% | 37.6% | 6.3% | 0.7% |
| | Germany | Count | 880 | 449 | 104 | 9 | 0 |
| | | % | 61.0% | 31.1% | 7.2% | 0.6% | 0.0% |
| | Great Britain | Count | 763 | 682 | 185 | 10 | 6 |
| | | % | 46.4% | 41.4% | 11.2% | 0.6% | 0.4% |
| | Hungary | Count | 372 | 430 | 170 | 7 | 3 |
| | | % | 37.9% | 43.8% | 17.3% | 0.7% | 0.3% |
| | Iceland | Count | 334 | 623 | 297 | 26 | 7 |
| | | % | 26.0% | 48.4% | 23.1% | 2.0% | 0.5% |
| | Israel | Count | 666 | 387 | 153 | 13 | 1 |
| | | % | 54.6% | 31.7% | 12.5% | 1.1% | 0.1% |
| | Japan | Count | 355 | 487 | 545 | 40 | 18 |
| | | % | 24.6% | 33.7% | 37.7% | 2.8% | 1.2% |
| | Korea | Count | 185 | 406 | 371 | 65 | 11 |
| | | % | 17.8% | 39.1% | 35.7% | 6.3% | 1.1% |
| | Latvia | Count | 253 | 557 | 152 | 16 | 3 |
| | | % | 25.8% | 56.8% | 15.5% | 1.6% | 0.3% |
| | Lithuania | Count | 195 | 431 | 314 | 37 | 7 |
| | | % | 19.8% | 43.8% | 31.9% | 3.8% | 0.7% |
| | New Zealand | Count | 362 | 651 | 301 | 12 | 2 |
| | | % | 27.3% | 49.0% | 22.7% | 0.9% | 0.2% |
| | Norway | Count | 130 | 556 | 518 | 27 | 4 |
| | | % | 10.5% | 45.0% | 41.9% | 2.2% | 0.3% |
| | Philippines | Count | 604 | 522 | 57 | 15 | 0 |
| | | % | 50.4% | 43.6% | 4.8% | 1.3% | 0.0% |
| | Slovakia | Count | 287 | 502 | 301 | 39 | 3 |
| | | % | 25.4% | 44.3% | 26.6% | 3.4% | 0.3% |
| | Slovenia | Count | 229 | 444 | 306 | 20 | 4 |
| | | % | 22.8% | 44.3% | 30.5% | 2.0% | 0.4% |
| | Spain | Count | 762 | 843 | 169 | 12 | 7 |
| | | % | 42.5% | 47.0% | 9.4% | 0.7% | 0.4% |
| | Sweden | Count | 200 | 536 | 351 | 13 | 5 |
| | | % | 18.1% | 48.5% | 31.8% | 1.2% | 0.5% |
| | Switzerland | Count | 192 | 483 | 350 | 17 | 1 |
| | | % | 18.4% | 46.3% | 33.6% | 1.6% | 0.1% |
| | Taiwan | Count | 819 | 445 | 126 | 19 | 14 |
| | | % | 57.6% | 31.3% | 8.9% | 1.3% | 1.0% |
| | Thailand | Count | 329 | 748 | 402 | 22 | 3 |
| | | % | 21.9% | 49.7% | 26.7% | 1.5% | 0.2% |
| | United States | Count | 427 | 650 | 243 | 39 | 14 |
| | | % | 31.1% | 47.3% | 17.7% | 2.8% | 1.0% |
| | Venezuela | Count | 574 | 350 | 93 | 25 | 3 |
| | | % | 54.9% | 33.5% | 8.9% | 2.4% | 0.3% |
| Total | | Count | 12096 | 11168 | 15049 | 8218 | 925 |
| | | % | 33.9% | 31.4% | 42.3% | 23.1% | 2.6% |

Table 6. Opinions *Government should spend money on culture and the arts* by country

| Country | | | Government should spend money on culture and the arts | | | | |
|----------------|-------|--|--|---------------|--------------------------|---------------|--------------------|
| | | | Spend much more | Spend more | Spend the same as now | Spend less | Spend much less |
| | | | | | | | |
| Chile | Count | | 155 | 475 | 513 | 168 | 26 |
| | % | | 11.6% | 35.5% | 38.4% | 12.6% | 1.9% |
| Croatia | Count | | 172 | 636 | 683 | 263 | 57 |
| | % | | 9.5% | 35.1% | 37.7% | 14.5% | 3.1% |
| Czech Republic | Count | | 125 | 353 | 398 | 103 | 39 |
| | % | | 12.3% | 34.7% | 39.1% | 10.1% | 3.8% |
| Denmark | Count | | 33 | 219 | 759 | 255 | 86 |
| | % | | 2.4% | 16.2% | 56.1% | 18.9% | 6.4% |
| Finland | Count | | 32 | 107 | 364 | 339 | 244 |
| | % | | 2.9% | 9.9% | 33.5% | 31.2% | 22.5% |
| France | Count | | 24 | 101 | 440 | 359 | 207 |
| | % | | 2.1% | 8.9% | 38.9% | 31.7% | 18.3% |
| Georgia | Count | | 67 | 152 | 611 | 392 | 196 |
| | % | | 4.7% | 10.7% | 43.1% | 27.6% | 13.8% |
| Germany | Count | | 425 | 454 | 415 | 90 | 34 |
| | % | | 30.0% | 32.0% | 29.3% | 6.3% | 2.4% |
| Great Britain | Count | | 108 | 365 | 766 | 315 | 78 |
| | % | | 6.6% | 22.4% | 46.9% | 19.3% | 4.8% |
| Hungary | Count | | 82 | 231 | 469 | 131 | 57 |
| | % | | 8.5% | 23.8% | 48.4% | 13.5% | 5.9% |
| Iceland | Count | | 63 | 198 | 502 | 304 | 203 |
| | % | | 5.0% | 15.6% | 39.5% | 23.9% | 16.0% |
| Israel | Count | | 177 | 299 | 547 | 135 | 33 |
| | % | | 14.9% | 25.1% | 45.9% | 11.3% | 2.8% |
| Japan | Count | | 96 | 188 | 784 | 165 | 97 |
| | % | | 7.2% | 14.1% | 58.9% | 12.4% | 7.3% |
| Korea | Count | | 55 | 224 | 619 | 113 | 24 |
| | % | | 5.3% | 21.6% | 59.8% | 10.9% | 2.3% |
| Latvia | Count | | 65 | 325 | 459 | 77 | 22 |
| | % | | 6.9% | 34.3% | 48.4% | 8.1% | 2.3% |
| Lithuania | Count | | 67 | 251 | 495 | 97 | 46 |
| | % | | 7.0% | 26.3% | 51.8% | 10.1% | 4.8% |
| New Zealand | Count | | 35 | 146 | 674 | 343 | 115 |
| | % | | 2.7% | 11.1% | 51.3% | 26.1% | 8.8% |
| Norway | Count | | 33 | 125 | 529 | 367 | 171 |
| | % | | 2.7% | 10.2% | 43.2% | 30.0% | 14.0% |
| Philippines | Count | | 194 | 657 | 290 | 52 | 4 |
| | % | | 16.2% | 54.9% | 24.2% | 4.3% | 0.3% |
| Slovakia | Count | | 72 | 318 | 569 | 138 | 27 |
| | % | | 6.4% | 28.3% | 50.6% | 12.3% | 2.4% |
| Slovenia | Count | | 42 | 283 | 514 | 131 | 23 |
| | % | | 4.2% | 28.5% | 51.8% | 13.2% | 2.3% |
| Spain | Count | | 165 | 547 | 775 | 194 | 39 |
| | % | | 9.6% | 31.8% | 45.1% | 11.3% | 2.3% |
| Sweden | Count | | 32 | 129 | 545 | 257 | 119 |
| | % | | 3.0% | 11.9% | 50.4% | 23.8% | 11.0% |
| Switzerland | Count | | 38 | 153 | 568 | 226 | 37 |
| | % | | 3.7% | 15.0% | 55.6% | 22.1% | 3.6% |
| Taiwan | Count | | 296 | 470 | 536 | 49 | 17 |
| | % | | 21.6% | 34.4% | 39.2% | 3.6% | 1.2% |
| Thailand | Count | | 30 | 159 | 588 | 455 | 236 |
| | % | | 2.0% | 10.8% | 40.1% | 31.0% | 16.1% |
| United States | Count | | 39 | 254 | 653 | 328 | 84 |
| | % | | 2.9% | 18.7% | 48.1% | 24.2% | 6.2% |
| Venezuela | Count | | 232 | 319 | 405 | 74 | 7 |
| | % | | 22.4% | 30.8% | 39.1% | 7.1% | 0.7% |
| Total | Count | | 2954 | 8138 | 15470 | 5920 | 2328 |
| | % | | 8.5% | 23.4% | 44.4% | 17.0% | 6.7% |

Table 7. Opinions *Government should spend money on environment* by country

| | | | Government should spend money on environment | | | | | Variable of highest beta (p< 0.05) |
|---------|----------------|-------|--|------------|-----------------------|------------|-----------------|------------------------------------|
| | | | Spend much more | Spend more | Spend the same as now | Spend less | Spend much less | |
| Country | Chile | Count | 216 | 639 | 391 | 97 | 9 | |
| | | % | 16.0% | 47.3% | 28.9% | 7.2% | 0.7% | Place of living (+) |
| | Croatia | Count | 355 | 971 | 360 | 160 | 16 | |
| | | % | 19.1% | 52.1% | 19.3% | 8.6% | 0.9% | Education (-) |
| | Czech Republic | Count | 202 | 478 | 279 | 43 | 18 | |
| | | % | 19.8% | 46.9% | 27.4% | 4.2% | 1.8% | Place of living (+) |
| | Denmark | Count | 96 | 397 | 743 | 100 | 26 | |
| | | % | 7.0% | 29.1% | 54.6% | 7.3% | 1.9% | Job status (+) |
| | Finland | Count | 193 | 309 | 481 | 83 | 27 | |
| | | % | 17.7% | 28.3% | 44.0% | 7.6% | 2.5% | Education (-) |
| | France | Count | 94 | 327 | 576 | 110 | 25 | |
| | | % | 8.3% | 28.9% | 50.9% | 9.7% | 2.2% | Job status (+) |
| | Georgia | Count | 177 | 405 | 619 | 185 | 39 | |
| | | % | 12.4% | 28.4% | 43.4% | 13.0% | 2.7% | Education (-) |
| | Germany | Count | 525 | 497 | 281 | 82 | 13 | |
| | | % | 37.6% | 35.6% | 20.1% | 5.9% | 0.9% | Place of living (+) |
| | Great Britain | Count | 337 | 643 | 562 | 86 | 15 | |
| | | % | 20.5% | 39.1% | 34.2% | 5.2% | 0.9% | Job status (+) |
| | Hungary | Count | 188 | 393 | 368 | 20 | 7 | |
| | | % | 19.3% | 40.3% | 37.7% | 2.0% | 0.7% | Place of living (+) |
| | Iceland | Count | 192 | 528 | 460 | 70 | 18 | |
| | | % | 15.1% | 41.6% | 36.3% | 5.5% | 1.4% | Job status (+) |
| | Israel | Count | 220 | 466 | 416 | 71 | 16 | |
| | | % | 18.5% | 39.2% | 35.0% | 6.0% | 1.3% | Age (-) |
| | Japan | Count | 234 | 417 | 647 | 52 | 28 | |
| | | % | 17.0% | 30.3% | 47.0% | 3.8% | 2.0% | Education (-) |
| | Korea | Count | 148 | 509 | 334 | 36 | 11 | |
| | | % | 14.3% | 49.0% | 32.2% | 3.5% | 1.1% | Education (-) |
| | Latvia | Count | 42 | 245 | 512 | 95 | 29 | |
| | | % | 4.6% | 26.5% | 55.5% | 10.3% | 3.1% | Place of living (+) |
| | Lithuania | Count | 69 | 237 | 520 | 120 | 14 | |
| | | % | 7.2% | 24.7% | 54.2% | 12.5% | 1.5% | Place of living (+) |
| | New Zealand | Count | 184 | 446 | 604 | 59 | 6 | |
| | | % | 14.2% | 34.3% | 46.5% | 4.5% | 0.5% | Education (-) |
| | Norway | Count | 123 | 376 | 554 | 125 | 43 | |
| | | % | 10.1% | 30.8% | 45.4% | 10.2% | 3.5% | Education (-) |
| | Philippines | Count | 230 | 676 | 171 | 97 | 19 | |
| | | % | 19.3% | 56.7% | 14.3% | 8.1% | 1.6% | Job status (+) |
| | Slovakia | Count | 172 | 476 | 425 | 43 | 10 | |
| | | % | 15.3% | 42.3% | 37.7% | 3.8% | 0.9% | Place of living (+) |
| | Slovenia | Count | 111 | 500 | 355 | 27 | 6 | |
| | | % | 11.1% | 50.1% | 35.5% | 2.7% | 0.6% | Job status (+) |
| | Spain | Count | 238 | 709 | 597 | 144 | 13 | |
| | | % | 14.0% | 41.7% | 35.1% | 8.5% | 0.8% | Job status (+) |
| | Sweden | Count | 179 | 331 | 496 | 72 | 23 | |
| | | % | 16.3% | 30.1% | 45.0% | 6.5% | 2.1% | Education (-) |
| | Switzerland | Count | 143 | 392 | 424 | 56 | 11 | |
| | | % | 13.9% | 38.2% | 41.3% | 5.5% | 1.1% | Place of living (+) |
| | Taiwan | Count | 337 | 537 | 358 | 112 | 20 | |
| | | % | 24.7% | 39.4% | 26.2% | 8.2% | 1.5% | Place of living (+) |
| | Thailand | Count | 118 | 490 | 737 | 103 | 13 | |
| | | % | 8.1% | 33.5% | 50.4% | 7.0% | 0.9% | Education (-) |
| | United States | Count | 146 | 508 | 510 | 172 | 32 | |
| | | % | 10.7% | 37.1% | 37.3% | 12.6% | 2.3% | Age (+) |
| | Venezuela | Count | 200 | 391 | 309 | 102 | 28 | |
| | | % | 19.4% | 38.0% | 30.0% | 9.9% | 2.7% | Job status (+) |
| Total | | Count | 5469 | 13293 | 13089 | 2522 | 535 | |
| | | % | 15.7% | 38.1% | 37.5% | 7.2% | 1.5% | |

Table 8. Opinions *Government should spend much more money on...*

| | Responses | |
|---|-----------|---------|
| | N | Percent |
| Government should spend money on environment | 5469 | 14.7% |
| Government should spend money on health | 12096 | 32.6% |
| Government should spend money on police and law enforcement | 5394 | 14.5% |
| Government should spend money on education | 11168 | 30.1% |
| Government should spend money on culture and arts | 2954 | 8.0% |
| Total | 37081 | 100.0% |

mans and the Taiwanese who would like to see a substantial increase in expenditure on culture and the arts.

When analysing the data from the ISSP Role of Government V module, we cannot ignore opinions regarding government spending on environment. In this case, the table analysis is supplemented with the categorical regression (CATREG), where the dependent variable is the opinion on how much government should spend on environmental protection, while the independent variables include sex, age, size of the place of living, job status, education and subjective assessment of one's own social status. The table also includes columns with regression adjusted R square and the dependent variable of highest beta (unstandardised coefficient). This last column shows the names of independent variables that have the strongest influence (variable of highest beta)¹.

It turns out that pro-ecological attitude towards the natural environment is mostly dependent on size of the place of living, education and job status (8-9 indications each). Respondents who live in large urban centres, are well-educated and professionally active display stronger pro-ecological attitudes.

Strong pro-ecological attitude (reflected in the opinion that government spending on the environment should be significantly increased even if it involves raising taxes) was most often expressed by Germans (37.6%), the Taiwanese (24.7%), and the British (20.5%). This indicator was also high in Croatia, the Czech Republic, Finland, Hungary, Israel, the Philippines and Venezuela (approx. 19%). The lowest values were recorded in Latvia (4.6%), Lithuania (7.2%), and Denmark (7%).

Conclusions

The table 8 shows the frequency of responses *government should spend much more money on* for each

analysed element of the social pillar of sustainable development. What conclusions can be drawn from this? Health and education seem to be the most important elements of this pillar (30-33% on average). Security (police and law enforcement) is less important (approx. 15% on average), but still more important than culture and the arts (the average of 8%). The natural environment belongs to a different pillar of sustainable development, yet it is believed to be as important as security (the average of approx. 15%). Generally speaking, those elements of sustainable development that seem to be more closely related to the lives of most people (health, education) are more important for them than the ones that are as if further away from their life experiences (security, environment, and above all culture and the arts). These conclusions refer to the entire population surveyed and could illustrate some *general trend*. However, as shown in the tables, there are many differences (up to several dozen percent) between individual countries.

The article focuses on the analysis of the indicator represented by the *spend much more money* responses. The same dataset could be used to carry out an equally interesting analysis based on the *spend less* and *spend much less* responses (combined together, given a small number of answers in this category). It would also be worthwhile to compare the results of analyses based on indicators of opinions about government spending with the corresponding indicators based on other data.

References

1. ASH N. (ed.), 2005, *Ecosystems and human well-being: current state and trends*, Island Press, Washington D.C.
2. BORYS T., 2005, *Wskaźniki zrównoważonego rozwoju*, Wydawnictwo Ekonomia i Środowisko, Warszawa-Białystok.

¹ The plus or minus sign next to the variable indicates its direction, e.g. education (-) should be interpreted in the following way: the higher the level of education, the more respondents express the view that spending on environment should be increased. We must bear in mind the increasing rank of *negative* responses: '1' means that government should spend much more on the environment, while '5' signifies that government should spend much less on the environment. It may be justifiable to ask

whether the variable describing job status can be assigned direction, as in fact it does not have one. However, the value of this variable ranked as 1 means *in paid work* (over 50% of indications), while the remaining (higher) ranks refer to different ways of functioning outside the labour market. This makes it possible to determine the direction of this variable that by default is dichotomous (*in paid work* vs. *other occupational status*).

3. CARPENTER S.R., PINGALI P.L., BENNETT E.M., ZUREK M.B. (eds.), 2005, *Ecosystems and human well-being scenarios*, Island Press, Washington, D.C.
4. DESSEIN J., SOINI K., FAIRCLOUGH G., HORLINGS L. (eds.), 2015, *Culture in, for and as Sustainable Development*, Conclusions from the COST Action IS1007 Investigating Cultural Sustainability, University of Jyväskylä, Finland.
5. HARRIS J.M., WISE T.A. GALLA-GHER K.P., GOODWIN N.R. (eds.), 2001, *A Survey of Sustainable Development, Social and Economic Dimensions*, Island Press, Washington, Covelo, London.
6. HOLMBERG J., 1992, *Making Development Sustainable: Redefining Institutions*, Policy and Economics, Island Press, Washington.
7. KOKIĆ ARSIĆ A., M. MIŠIĆ, M. RADOJKOVIĆ, B. PRLINČEVIĆ, 2016, *Social Aspects of Sustainable Development of Enterprises*, International Conference on Quality of Life, Center for Quality, Faculty of Engineering, University of Kragujevac, p. 85.
8. LEHTONEN M., 2004, The environmental-social interface of sustainable development: capabilities, social capital, institutions, in: *Ecol. Economics*, 49(2).
9. PRESCOTT-ALLEN R., 2001, *The Wellbeing of Nations. A Country-by-Country Index of Quality of Life and the Environment*, Island Press, Washington, Covelo, London, p. 13-14.
10. REED D. (ed.), 1997, *Structural Adjustment, The Environment and Sustainable Development*, Earthscan, London.

Mechanism of Strengthening Social and Labor Potential of Sustainable Development

Mechanizm wzmacniania społecznego i pracowniczego potencjału rozwoju zrównoważonego

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Abstract

The article considers the conceptual basis for strengthening social and labor potential of sustainable development in the context of economic efficiency and social justice. The essence of the categories *social potential*, *social capital* and *social imperative* in their interrelation with the social and labor sphere of society with the account of the needs of sustainable development is specified. Strengthening of social potential is considered as a complex of actions in such areas as education, culture, health care, economic and social spheres, social relations. The paper focuses on strong interconnections work – employment – labor potential – social potential – human development – sustainable development. A mechanism of strengthening social and labor potential through the transformation of employment in the context of the paradigm of sustainable development is suggested.

Key words: social and labor potential, sustainable development, Sustainable Development Goals, social and economic efficiency, social and labor relations, transformation of employment, social capital, social justice

Streszczenie

Artykuł przedstawia podstawy pojęciowe dla wzmocnienia społecznego i pracowniczego potencjału zrównoważonego rozwoju w kontekście efektywności ekonomicznej i sprawiedliwości społecznej. Ukazano istotę kategorii *społeczny potencjał*, *kapitał społeczny* i *imperatyw społeczny* w ich współzależności ze sferą społeczną i pracowniczą społeczeństwa, z uwzględnieniem potrzeb zrównoważonego rozwoju. Wzmacnianie potencjału społecznego następuje poprzez złożone działania mające miejsce w sferach takich, jak edukacja, kultura, opieka zdrowotna, sfery ekonomiczne i społeczne, a także relacje społeczne. Artykuł koncentruje się na silnej współzależności: praca – zatrudnienie – potencjał pracy – potencjał społeczny – rozwój człowieka – zrównoważony rozwój. Ponadto ukazano mechanizm wzmacniania potencjału społecznego i pracowniczego w kontekście paradygmatu rozwoju zrównoważonego.

Słowa kluczowe: potencjał społeczny i pracowniczy, zrównoważony rozwój, cele zrównoważonego rozwoju, efektywność społeczna i ekonomiczne relacje społeczne i pracownicze, transformacja rozwoju, kapitał społeczny, sprawiedliwość społeczna

Introduction

The global process of sustainable development based on three basic imperatives: economic imperative which includes the formation of an effective economic system harmonized with the ecological factor; social imperative which affirms the human right to a high standard of living in safety conditions, and

ecological imperative defining the conditions and limits for the restoration of ecological systems as a result of their exploitation. Given the principled position of the sustainable development concept that the development must be carried out for the sake of human, primarily through an active participation and by forces of an individual, quality of social and labor potential of the society, including the nature of hu-

man labor and employment as its most common form, plays an important role for the consistency and synergy of the influence of all three above-mentioned imperatives.

Taking into account the statements and conclusions of the final report of the United Nations Summit on Sustainable Development *Transforming our world: the 2030 Agenda for Sustainable Development*, the *Human Development Report*, 2015; *Work for Human Development*, 2015, a number of other international reports (Navstrechu 'zelyonoy' ekonomike: puti k ustoychivomu razvitiyu i iskorene niyu bednosti, 2011; *Employment Implications of Green Growth: Linking jobs, growth, and green policies. The OECD report for the environment ministers*, 2017), we can state that in the next decades a driving force of social transformations towards sustainable development will be globalization, digitalization as a new stage in the technological revolution, based on computer technologies, and ecologization of production. Globalization fosters global interdependence, including job creation and destruction systems. The technological digital revolution and the growth of demand for *green* products open up new ways to attract people to socially useful activities, create new conditions of work, business and organizational models. They influence the distribution of labor demand across sectors of the economy, quantity and quality of jobs as well as the distribution of income and wealth (*Human Development Report*, 2015; *Work for Human Development*, 2015).

However, such transformations make changes in the nature of human life less linear and less predictable, bringing both new possibilities and new challenges and risks. According to the ILO report, *World Employment and Social Prospects 2015: The changing nature of jobs (World employment and social outlook 2015: The changing nature of jobs*, 2015) work is becoming more creative and flexible, but at the same time more complex and less secure. The traditional employment model, in which an employee performs paid work in the employment relationship with a particular employer, having a fixed workplace and full time, is less and less dominant in modern labor world, covering only a quarter of the employed population. The situation is complicated by the inability of the standard policy to ensure adequate protection for employees in all types of employment. Along with the flexibility, autonomy and meaningful diversification of work, most new forms of employment increase the risks of intensifying labor, increasing stress, blurring lines between work and private life.

Processes of digitalization of the economy are characterized by the dual nature of consequences. The Report to the Club of Rome of 2018 '*Come On! Capitalism, Short-termism, Population and the Destruction of the Planet*' (von Weizsäcker E.U., Wijkman A., 2018) states that almost half of workplaces are at high risk of automation, and in the next decade,

80% of all professions are expected to require STEM skills (Science, Technology, Engineering, Mathematics). Similar challenges also appear in the context of the trend of *greening* the economy, in particular in connection with the predictable elimination of the so-called brown jobs with mostly low- and middle-skilled workers, who, as the global experience of restructuring the old industrial regions shows, are often unable to quickly retrain and adapt to new conditions.

The formation of new challenges, both external and internal, requires the development of adequate measures to strengthen human, social and labor potential of the population, differentiated, flexible and advanced adaptive mechanisms of converting social potential into real prerequisites for sustainable development, and institutional support of these processes. Accordingly, the purpose of the paper is to reveal the conceptual basis of strengthening the social and labor potential of sustainable development in the context of economic efficiency and social justice. To achieve this goal it is necessary to clarify the essence of these categories in their relationship with the social and labor sphere of society, which is necessary to specify the regulatory role of the state and other institutions, mechanisms and tools of impact; to define the conceptual framework of the policy of strengthening social potential, its conversion through employment into sustainable development; to reveal priority activities on this way.

The essence of the categories of social and labor potential of sustainable development

Studying the problem of sustainable development, publications use the concepts of *social potential*, *social potential of society modernization*, *social resource*, *social capital*, *labor potential*, etc. Despite the common interpretation by many researchers the initial concepts of *potential*, *resource*, *capital*, there is no coherent understanding of the essence of social potential. First of all, we should proceed from the fact that it is a multilevel and multicomponent category. Human potential is not an arithmetic component of social potential (many researchers have exactly this opinion). Social potential can increase or decrease the social impact of human potential. Since positive sense of social potential manifests itself primarily in the level of harmonization of social relations in society as a whole and within certain functional and territorial communities on the basis of cooperation and partnerships, implementation of such relations ensures not only effective use of human potential, but also harmonizes social behavior of individuals within and beyond economic activity.

The key point of the approach of finding conceptual ways to strengthen sustainable development potential is the statement of multidirectional impact of social potential: it can provide *development or disinter-*

gration. That is, depending on the quality of social relationships (networks) and social institutions formed in society, they are a factor of restraint or, on the contrary, stimulate transition to sustainable development model.

It is necessary to distinguish between social potential in the broad and narrow sense of the word, namely, the possibility of society as a whole (social = public) and as a specific kind of potential which society possesses along with economic, financial, military and other kinds of potential. Since a person lives and works at the same time in many spheres of life, we can talk about social potential in relation to specific spheres of society's life, for example, economy, or employment, as well as systematically – about the sustainable development potential as an aggregate potential of social actors, social relations and social institutes ensuring the development of society on the principles of sustainability.

In turn, the category of *social capital* can be considered as one of the sections of social potential that relates to economic relations and has a positive (productive) orientation, whereas, as we have already mentioned talking about social potential, we do not exclude the possibility of its restrictive, destructive impact. In the monograph (Bandur S.I., Bohush L.H., Zaiats T.A., 2010) social capital as a social and economic category is considered as a potential of individual local social groups to organize their own action in such a way as to have higher competitiveness compared with other social groups in the same society. Social capital is defined as a potential of common and useful complementary and synergetical interaction of individual local social groups. Consequently, social capital is a social and institutional resource that ensures the achievement of the sustainable development goals through cooperation and partnership, trust and responsibility taking into account the overcoming of contradictions in the development of economic, ecological and social spheres (Bandur S.I., Bohush L.H., Zaiats T.A., 2010). Accepting *capitalism* or economic component of social capital is a key methodological postulate of the social and economic category, which, *characterizing the quality of social relations can at the same time eventually bring benefits to society as a resource invested in production* (Bandur S.I., Bohush L.H., Zaiats T. A., 2010).

According to the social and anthropological approach, social potential is generated, accumulated, shaped and used by people, but it is not limited to any one individual and cannot be attributed to a certain individual.

The social and economic dimension of this problem reflects the impact of the above-mentioned processes on the economy, focusing on such basic principles as the interaction of trust and economic development, interaction of human and economic development, institutional, social and humanitarian transformations, etc. Social potential of community (institutionalized

formally and informally consequences of joint actions) either creates opportunities for the realization of human abilities, integrates and invests human potential in the growth of human development, or restricts and prevents the concentration, manifestation and accumulation of a new quality of human abilities, as well as reduces human resources to the level lower than an individual would have in any single case.

Thus, social potential is considered a property as a result of joint action and interaction to increase human potential, to ensure its realization with actual outcomes (resources), or to reduce human potential and dampen its transformation into resources, which is a factor of the social exclusion of an individual. The field of social potential is heterogeneous. The growth of social potential can increase the resources of some groups and reduce them in others. Even at arithmetic equilibrium of additional and lost local social potential, the size of difference of the potentials is subject to exponential laws. Each increase in the difference of the human potential and resources, as well as the duration of this difference leads to a sharp drop of the constructive social potential and increase of the destructive potential, which must be considered in developing relevant government policies (social, regional, economic, etc.).

The difference of the potentials of different points in the social field generates tension and movement to overcome, or additional efforts are made for the artificial maintenance of the social field solidarity without reducing social tension. On the one hand, social tension of a certain degree and character increases searching for new variants and forms of joining social potential. On the other hand, the increase of social tension and its disorienting nature lead to the search for ways of destroying social potential or its localization. Thus, we can speak about Pareto efficiency principle. This optimality specifies the structure of opportunity field, satisfying the economic criteria (increases economic efficiency), but generates significant inequality (reduces social efficiency). Therefore, it is reasonable to introduce a concept of social optimum which states that the change in the difference of social potentials leading to disequilibrium of constructive and destructive social activity, is nonoptimal. (Bandur S.I., Bohush L.H., Zaiats T. A., 2010). The authors of the scientific report *A decent level and quality of life of population when forming the social potential of sustainable development* define social potential of sustainable development as accumulated possibilities of society to ensure such economic and social activity that satisfies the needs of effective and economical use of available resources, preservation of resource development opportunities for future generations, support of economic, social, ecological safety and formation of a self-reproducing cohesive ecological, social, and economic system (Antoniuk V.P., Hrinevska S.M., Prohniak O.D., 2012).

The structure of the social potential of sustainable development

They suggest including human potential, human factor of production, system of social relations, social consciousness, social infrastructure, social policy into the structure of the social potential of sustainable development. These processes provide the formation of production and consumer personal factor according to the requirements of sustainable development, as well as the formation of a conscious and socially responsible member of society that is the basis of transformation of sustainable development from target to reality.

To achieve this aim, it is necessary to change the behavior of humans who destroy resources for their existence in general, and especially for worthy existence today and in the future. The manifestation of socially irresponsible behavior is caused, on the one hand, by the rooting of its consumer model, and, on the other hand, by the priority of economic goals over social (economic efficiency over social one), when there is an imbalance between economic benefits, social interests, ecological costs. In practice, the implementation of modern resource saving technologies, increase of the efficiency of economic activity are often accompanied by the extension of consumption and subsequent increase of the burden on the environment.

According to A. Galchynskyi, one of the most challenging tasks of today is to seek tools to overcome the *consumer society* ideology, in which rationality of consumer demand is lost, there is a gap between consumption and satisfaction of real human needs, *false* virtual by their nature needs with primary motive of possessing are formed (Halchynskyi A., 2010). The logic of further development states the need for harmonization of social relations. To this end, a person and society should learn to live and act in a way that *makes social efficiency attractive*.

Based on these considerations, O. Novikova considers the social potential of sustainable development as a combination of opportunities, abilities, readiness of the society for transformation to satisfy the needs of preservation and development of human, resources for a decent life of present and future generations, balance and safety of economic, social and ecological spheres (Amosha O.

I., Novikova O.F., Antoniuk V.P., Zaloznova Yu. S., 2014). This definition emphasizes the importance of human potential in the structure of social potential and its role in defining the content and orientation of the society's needs in relation to other components of the social potential (social relations and social institutions, social sphere and infrastructure).

Social imperative in the context of sustainable development

To further study social potential in the context of economic efficiency and social justice, there is a need to expand the conceptual and categorial framework of this problem, since the concepts of *social imperative*, *social imperative of economic activity*, *social imperative of sustainable development*, etc. are increasingly used along with the concept of *ecological imperative* in publications. The dictionaries interpret the category of *imperative* as a set of the most general principles, requirements, orders, instructions to act in one way or another; or as one of the forms of strict guidelines created by the culture of a specific epoch as a model for universal imitation which is obligatory for all members of society. The relatively settled category of *ecological imperative* is mainly considered as a system of scientifically grounded norms and rules, regulations and prohibitions to strictly regulate human activities according to the laws of biosphere and formed in it natural biochemical cycles. Considering multidimensionality and complexity of interactions in the system *nature – individual – society* the ecological imperative under its specification can be represented as a system of derivative imperatives, namely, economic, social, legal, etc., reflecting various aspects of people's relationship between themselves, and with environment both in everyday life and economic activity. In this case, not only the factors of interaction between society and nature are analyzed, but primarily active nature-transforming (often nature-destroying) human activity which is an element of social consciousness as well. Even if science is able to determine the limits of marginal burden on nature (according to N. Moiseev (1993), there is no guarantee that people in their activities will keep to them and coordinate their actions and needs with the nature opportunities. In fact, the ecological imperative requires a new way of thinking, reorientation of most of the person's value scales, which necessarily requires a change in moral and ethical standards. (Khvesyk M.A., Stepanenko A.V., Obykhod H.O., 2014). Consequently, *social imperative in the context of ensuring sustainable development* should be considered as a set of basic requirements for social relations and interactions in society, whose implementation is necessary to maintain the sustainability of the social, ecological and economic system. In its most general form it can be defined as a total ecologization of individual's and society's consciousness and outlook. In this context, social imperative is the basic requirement and guideline for strengthening and forming social potential in accordance with the principles of modern paradigm of sustainable development.

Spheres of strengthening of social potential

Sustainable development as a result of the use of opportunities for the growth of social potential can be considered in several aspects. First, it can be considered as a dynamics of social system of a certain level, where the social optimum is achieved and is not destroyed under the influence of internal and external factors. Second, it can be examined as a system orientation for the implementation of the modern concept of sustainable development into the social practice. Thus, the strengthening of social potential leads to the realization of certain actions in various spheres.

In education it is the introduction of the so-called *education for sustainable development* into the traditional educational process. It expands the scope of noospheric and ecological education and allows all aspects of educational activities to develop in the context of sustainable development, the variety of topics of which makes it possible to create a systemic mechanism for the transformation of semio-life priorities at the individual level, to master competence of relevant social interactions (organization of social networks, public control, environmentally responsible social entrepreneurship, etc.), and therefore – to provide a proactive function of education to model social processes.

In culture it is the formation of ecological culture, and more broadly – of general culture of life and consumption of public goods. Sustainable development has a spatial association, therefore, ecological culture is seen as a territorial manifestation of ecological consciousness. It is a combination of ecological knowledge and ideas about ecocultural traditions at a person's place of residence, as well as its personal qualities, formed as a result of environmental education, reflecting the rules and norms of environmental behavior adopted in the particular society. Ecological education is an external behavioral manifestation of the level of ecological culture, and environmental responsibility is one of the criterion of the formation of a certain level of ecological culture.

In economic sphere it is the availability of economic conditions and opportunities for safe and decent life for present and future generations; rational attraction, consumption and use of natural resources; achievement of such technogenic loading that does not exceed the possibilities of the natural environment for self-restoration; predominant use of high-tech resource-saving technologies in production; socialization of the components of economic policy (structural, investment, pricing, budget, monetary, tax, etc.); economic stimulation of the subjects of production relations in the preservation of natural and material resources; state regulation of expenditures for social purposes in view of the requirements of economic growth; the balance (coherence) of the

economic, social components of sustainable development; stimulation of innovation development considering social and environmental requirements.

In social sphere, in social relations it is the acquisition of spiritual and moral values; formation and implementation of social norms and principles; sustainability of human development, reducing and minimizing economic, social and environmental risks; non-conflict integration of economic, social and environmental systems; ensuring sustainable processes of simple and expanded reproduction of human and labor potential, social and intellectual capital; observance of human rights and freedoms; active work of associations of citizens in the process of transition to sustainable development.

The identified directions of actions require the establishment of institutions for attracting individuals, different social groups and local communities, non-governmental organizations, as well as businesses to identify and introduce the basic values of sustainable development, to discuss and make managerial decisions on the use of limited resources, public safety, etc. The main components (mechanisms) here are: comprehensive information of the public on the initiatives of the authorities in the field of sustainable development, the content of relevant programs, projects, plans; involvement of the general public in the adoption and implementation of relevant decisions; support of public, non-governmental organizations. Issues of public information, as well as propaganda (spread of positive precedents) and explanations of new principles and procedures for the implementation of state policy are relevant.

In the field of healthcare, the implementation of modern concept of sustainable development needs focusing on determinants of health, in particular on harmful factors related to lifestyle, improving the health information system at all levels of society, creating a mechanism for rapid response to major threats to health and sanitary well-being. In our opinion, a healthy lifestyle is a form of life-oriented, focused on the preservation and reproduction of health, which is an important component of the human potential of each person. A healthy lifestyle can be implemented as a normal functioning that does not do any harm to the human body, and can become the society's active position – an element of social potential, when health is seen as a conscious life value that can only be realized in harmony with the environment. This is about the reasonability of the formation of a three-vector system of health at all organizational levels, where the ecological vector indicates the need to create an environment that promotes health improvement; the valeological vector emphasizes the stimulation of a healthy lifestyle and physical self-improvement; the medical vector enhances the availability of quality medical services for all social groups, and so on.

Realizing the complexity and multidimensionality of the concept of *social potential of sustainable development*, this study focuses on the relationship of **labor – employment – labor potential – social potential – human development – sustainable development**. Thus, in view of sustainable development processes, employment is a determining socially acceptable form of inclusion of the population in the economic process, a socially productive form of realization of human creative activity, a marker of social position within the social status hierarchy, and an organic dimension of human existence as such. Accordingly, the employment policy must fulfill social, macroeconomic, technological, environmental, humanitarian, cultural and other functions (*Staly i liudskiy rozvytok: zabezpechennia spravedlyvosti: Natsionalna dopovid*, 2012).

Forming the concept of the transformation of social and labor potential in the framework of transition to sustainable development, first of all, it is necessary to be guided by the axiomatic statement: the sphere of employment is not a monoobject, but a polystructural organism functioning on the basis of vertical and horizontal interactions and belongs to the system of world economic relations. According to this understanding, the presence of developed labor potential is a prerequisite (but not obligatory) of sustainable development. And if in the area of the problems of *labor potential*, knowledge and other productive abilities of the person are of interest in the context of the question about the possibility of realizing specific economic goals, then in the aspect of *social potential* – in terms of opportunities to realize labor potential in accordance with certain social goals, thereby influencing the quality of life of the owner of the labor potential and society as a whole.

Globalization of social and labor relations

Today, in the global dimension, *nature of social and labor relations is completely changing*. First, there are changes in the psychology, hierarchy of interests and values of the employed population, in particular, the material interest stops to be a priority, and the progress of modern society provides intangible values and interests. In the foreground there are new demands for more informative activity or activity which is recognized by the society as productive and corresponds to the interests of self-realization of an individual. However, with the increasing relevance of such processes, the problem of their impact on the stratification of society is exacerbated.

An important vector is the emergence of a new social and labor mentality and individualization, which is a socio-psychological and socio-cultural consequence of globalization. This is manifested through a gradual decrease in the social dependence of a person on a certain socio-occupational environment or a group, and there is an increase in professional mobility of the population. In this regard, a significant aspect of

labor potential is its flexibility, which generates new forms of employment: short-term employment contracts or their absence, employment without social guarantees, etc. Thus, for employment, there is an increase in the level of uncertainty, which, in turn, affects the human potential of a person and the social potential of society.

Globalization of social and labor relations, as another trend in contemporary social transformations, is accompanied by the expansion of the worker's social and labor space. First of all, this is manifested through the formation of a new character of social and labor relations, in which the need for strict regulation of labor activity disappears. Under such conditions, a *degree of rivalry between employees decreases*, as new activities related to management, processing of information, require continuous interaction between people, a certain team of like-minded people. In addition, relationship between human and society, employer and employee, business environment and civil society are transformed. Individualization determines dependence of the social status of a person on his/her labor potential, health, and education level. *The process of continuous education becomes a condition for the employee to maintain or increase social status*.

Social potential through the prism of employment is the aggregate possibilities of current and intermediate dynamics of social parameters of employment and its social protection in ensuring sustainable development, which are opened up by progressive transformations of employment adequately with current and perspective challenges. The examples of positive changes in social potential include: increasing labor and social mobility of the population, its competitiveness in the labor market; the opportunity to combine work with education and other useful activities (volunteer work, child care, etc.) due to flexible forms of employment; synchronized growth of labor productivity and wages; improvement of conditions and safety of work, including through *greening* of workplaces; expansion of professional development opportunities; strengthening social security, reducing the inequality of social conditions of employment.

Innovative employment practices that have reached the stage of technology (that is, a high standard of standardization and universalization) have the most powerful impact on social potential. They are considered as a deliberately organized way of interaction of individuals, their groups and organizations, which provides a quantitatively and qualitatively stable result in solving a certain task in the field of employment on the basis of conscious use of social transformations, while satisfying the criteria of universality, regularity, economic efficiency and social justice. Their important feature is the ability to deliberately change the social interaction of people, transform consciousness, public opinion, change social relations and structures. Accordingly, social technol-

ogies are an effective tool for transforming the social potential of employment into sustainable development. It is necessary to speak about a managed process of strengthening social and labor potential at different levels, and hence the need for adequate mechanisms of influence.

The mechanism of strengthening social and labor potential of sustainable development

The development of a *network society* and other recent social transformations make uncertainty a characteristic of modern management technologies, particularly in the workplace, which undermines solidarity and existing social structures and practices. The principal scheme of the mechanism of strengthening social and labor potential of sustainable development on the basis of social dialogue through the transformation of employment is presented in Fig. 1. That said, the tools of the mechanism should not be limited to changes in legislation, but should cover the whole range of adequate levers of influence, based on the assessment of opportunities and risks of social potential.

The content of the main ideas of sustainable development, understanding the role of social potential in its provision and possible mechanisms for building and implementing social potential in the social and labor sphere provide the necessary grounds to determine the conceptual framework for the establishment of the policy of employment transformation. The main complementary conceptual directions of strengthening social and labor potential of sustainable development through the transformation of employment include:

- developing social dialogue on the new institutional basis with the widest possible inclusion of various social actors in the process of achieving agreed goals in the field of social and labor relations, harmonized with the national system of goals of sustainable development;
- transforming the skills of the population both in terms of professional activity and in organizing social interactions while realizing their labor potential;
- ensuring the domination of human-preserving, ecologically acceptable, socially and economically productive forms of occupation of settlement. Socially productive employment ensures observance of social criteria of dignity and justice in relation to physical conditions and human relations in the workplace; creates socially acceptable conditions for reproduction of high-quality working capacity and motivation of the population; leaves time and effort for human self-development;
- raising the level of employment of the population. Reserve of employment forms not only unemployment, but also a significant stratum of economically inactive population of working

age. The introduction of innovative approaches and incentives to exit the state of economic inactivity lays the foundation for economic growth, lack of funds for social funds, and mitigation of social inequality;

- stimulating employment in ecologically safe economic activities, as well as in those demonstrating the tendencies of environmental protection and preservation reorientation, *greening* of employment;
- principal state support for the innovative search for forms of employment and social institutions for the implementation of economic activity of the population and patterns of employment organization. Within this direction, mechanisms should be created to preserve the conservation of any employment model, since the level of social productivity of its various forms and the degree of dominance of progressive ones among employment in general cannot be a constant. Such mechanisms should form a reliable channel for innovations, validation and legitimation of new forms of employment as socially acceptable and socially relevant, as well as their introduction into the full institutional space of social protection;
- modernization of mechanisms of social protection of the population in the area of social and labor relations. The impact of employment innovations can be multi-directional (both positive and negative). The volatility risks associated with objective processes of increasing the flexibility and differentiation of the labor market cannot be offset by traditional social technologies and institutions such as class labor legislation or state social insurance. There is a need for a new approach that can combine flexibility with adequate protection – the so-called flexicurity.
- Society needs to accumulate the possibilities of social potential to create conditions for addressing the socio-occupational sphere and directing its achievements to ensure sustainable development. This leads to the involvement of regulators in these processes, which formulate certain guidelines and ideas about the importance of the concept of sustainable development, and mechanisms for its achievement in the authorities, population, business, and public associations.

Conclusions

Based on the study, the following conclusions and recommendations have been made:

1. It has been established that in the next decades influential factors of social transformations will be globalization, digitalization and ecologization of the economy and society as a whole, which, among other things, will result in changes in the division of demand for labor by the sectors of the economy, quantitative and

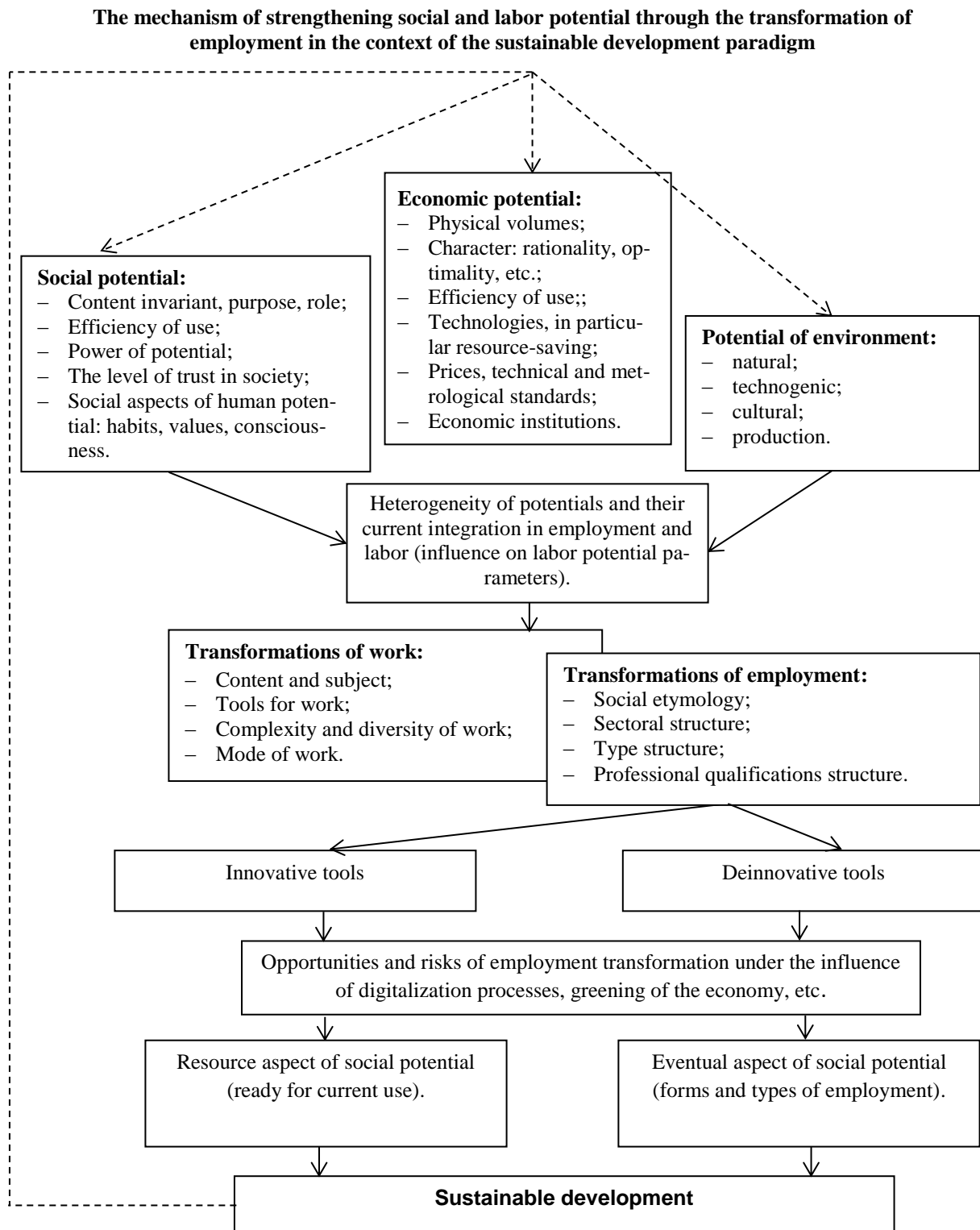


Figure 1. General scheme of the mechanism of strengthening social and labor potential through the transformation of employment, Developed by the authors on the basis of (Amosha O.I., Novikova O.F., Antoniuk V.P., Zaloznova Yu.S., 2014; *Sotsialnyi potentsial innovatsiinykh transformatsii zaniatosti: zvit pro NDR*, 2015; *Sotsialno-ekonomichniy potentsial staloho rozvytku Ukrainy ta y ii rehioniv: natsionalna dopovid*, 2014)

qualitative characteristics of jobs. These trends, along with new opportunities, will create new challenges and risks, making changes in the nature of human life less predictable.

2. It has been determined that in the context of the research objective, social potential should be considered as a property of current forms of joint action and interaction to increase human

potential, ensuring its realization into actual results (resources), or to reduce human potential, inhibiting its transformation into resources and creating risks of social exclusion and social tension. The social tension of a certain degree and character intensifies the search for new forms of joining social potential, but at some point its disorientating nature leads to the fact that the constructive social potential falls sharply and the destructive one increases, which needs to be taken into account when developing and implementing state policy (social, regional, economic, etc.).

3. *The social potential of sustainable development is seen as a combination of opportunities, abilities, society's readiness for transformation to meet the needs of human preservation and development, resources for the dignified life of present and future generations, the balance and security of the economic, social and environmental areas.* Concerning sustainable development processes, employment is a determining socially acceptable form of inclusion of the population in the economic process, a socially productive form of creative activity, a marker of social position within the socio-status hierarchy. The problem of strengthening social potential is suggested to be considered through the prism of interconnections *labor – employment – labor potential – social potential – human development – sustainable development*.
4. It has been established that social and labor potential should be considered in terms of criteria of economic efficiency and social justice. In the first case, one should keep in mind the relation of the additional economic results obtained as a result of the progressive transformations of employment (expressed in terms of the value of the additional gross product and saving of budget funds on social unemployment programs), to the costs of their implementation (including expenditures on the change of legislation, the implementation of relevant state programs or events, informing the public, etc.). Socially unfair changes are ones that lead to a disbalance in constructive and destructive social activity, including those that do not meet the criteria for decent work.
5. It has been grounded that the conceptual vision of the policy of strengthening the social and labor potential of sustainable development should be based on the principles of differentiating public administration, institutional influence and self-governing social and labor activity. This model should include not only hierarchical vertical and horizontal channels of interaction that determine the effectiveness (economic and social) of labor market, but also allow one to capture and control channels of reverse effect, which will make the system self-reproducing.

This approach allowed us to formulate a scheme of the mechanism of strengthening the potential, to offer the main conceptual directions of action.

6. An important task for European countries is to create *green* jobs, because they essentially cover all three aspects of sustainable development and best suit the main challenges of the 21st century: decent work for all, social inclusion, poverty eradication, reducing inequality, environmental sustainability.

References

1. ANTONIUK V.P., HRINEVSKA S.M., PROHNIMAK O.D., 2012, *Hidnyi riven ta yakist zhyttia naselennia v konteksti formuvannia sotsialnoho potentsialu staloho rozvytku: nauk. dopovid*, NAN Ukrainy, In-tu ekonomiky prom-sti, Donetsk.
2. AMOSHA O.I., NOVIKOVA O.F., ANTONIUK V.P., ZALOZNOVA YU.S., 2014, *Sotsialnyi potentsial staloho rozvytku: innovatsiini mekhanizmy formuvannia ta vykorystannia: monohrafiia*, NAN Ukrainy, In-t ekonomiky prom-sti, Donetsk.
3. BANDUR S.I., BOHUSH L.H., ZAIATS T.A., 2010, *Sotsialnyi kapital Ukrainy: teoretyko-metodolohichni osnovy formuvannia: monohrafiia*, RVPS Ukrainy NAN Ukrainy, Kyiv.
4. *Employment Implications of Green Growth: Linking jobs, growth, and green policies. OECD. Report for the G7 Environment Ministers*, 2017, <https://www.oecd.org/envi ronment/Employment-Implications-of-Green-Growth-OECD-Report-G7-Environment-Ministers.pdf> (15.08.2018).
5. Green growth knowledge platform, 2017, *Green industrial policy: concept, policies, country experiences*, <http://www.greengrowthknowledge.org/resource/green-industrial-policy-concept-policies-country-experiences> (15.08.2018).
6. HALCHYNSKYI A., 2010, Liberalizm – evoliutsiini transformatsii, in: *Ekonomika Ukrainy/ Economy of Ukraine*, 6, p. 23–34.
7. Instytut demohrafii ta sotsialnykh doslidzhen im. M.V Ptukhy NAN Ukrainy, 2015, *Sotsialnyi potentsial innovatsiinykh transformatsii zaniatosti: zvit pro NDR*, Kyiv.
8. International Labour Organization, 2015, *World employment and social outlook 2015: The changing nature of jobs*, https://www.ilo.org/global/research/global-reports/weso/2015-changing-nature-of-jobs/WCMS_368626/lang--en/index.htm (15.08.2018).
9. KHVESYK M.A., STEPANENKO A.V., OBYKHOD H.O., 2014, *Ekolohichna i pryrodno-tekhnohenna bezpeka Ukrainy v rehionalnomu vymiri: monohrafiia*, DU IEPSR NAN Ukrainy, Kyiv.
10. LIBANOVA E., KHVESYK M. (eds), 2014, *Sotsialno-ekonomichni potentsial staloho rozvytku Ukrainy ta yii rehioniv: natsionalna dopovid*, DU IEPSR NAN Ukrainy, Kyiv.
11. LIBANOVA E.M. (ed.), 2012, *Stalyi liudskyi rozvytok: zabezpechennia spravedlyvosti: Natsionalna dopovid*, Instytut demohrafii ta sotsialnykh doslidzhen im. M.V. Ptukhy, Vydavnycho-polihrafichnyi tsentr Vizavi, Uman.

12. MOISEEV N., 1993, *Voshozhdenie k Razumu. Lektsii po universalnomu evolyutsionizmu i ego prilozheniyam*, Moskva.
13. United Nations Development Programme (UNDP), 2015, *Human Development Report 2015 Work for Human Development*, http://hdr.undp.org/sites/default/files/2015_human_development_report.pdf (15.08.2018).
14. United Nations Environment Programme, 2011, *Navstrechu 'zelyonoy' ekonomike: puti k ustoychivomu razvitiyu i iskoreneniyu bednosti*, http://www.unep.org/greeneconomy_ (15.08.2018).
15. United Nations Ukraine, 2017, *national baseline report 'Sustainable Development Goals: Ukraine'*, <http://www.un.org.ua/ua/publikatsii-ta-zvity/un-in-ukraine-publications/4203-2017-natsionalna-dopovid-tsili-staloho-rozvytku-ukraina-iaka-vyznachaie-bazovi-pokaznyky-dlia-dosi-ahnennia-tsilei-staloho-rozvytku-tssr> (15.08.2018).
16. WEIZSÄCKER E.U. VON, WIJCKMAN A., 2018, *'Come On!' Capitalism, Short-termism, Population and the Destruction of the Planet: A Report to the Club of Rome*, Springer, New York.

Education in Defence of Biodiversity. Will the Ecological and Ethical Footprint Counteract Environmental Changes?

Edukacja w obronie bioróżnorodności. Czy ślad ekologiczno-etyczny zrównoważy zmiany środowiskowe?

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Abstract

At the turn of the 20th and 21st centuries, we collectively experienced, and still do, a new kind of border situation – a global environmental disaster. It connects with a newly recognised form of destruction, outside the sphere of biodiversity, which has been called solastalgia. The main source of both solastalgia and irreversible devastation of the biosphere seems to be the attitude of extractivism, that has been lasting steadily for last few centuries. There is hope that adequately selected teaching methods of the ecological footprint can effectively raise the sensitivity, empathy and environmental awareness of older and younger generations of consumers. A rescue for biodiversity seems to be biocentric education – perhaps ethical footprint, as an offshoot of ecological footprint, is able to transform *Homo sapiens* into *Homo sapiens* again.

Key words: biodiversity, ecological footprint, extractivism, solastalgia, *homo sapiens*

Streszczenie

Na przełomie XX i XXI wieku kolektywnie doświadczaliśmy i wciąż doświadczamy nowego rodzaju sytuacji granicznej – globalnej katastrofy środowiskowej. Łączy się ona z nowo zauważoną formą niszczenia, poza sferą bioróżnorodności, zwaną solastalią. Źródłem zarówno solastalii, jak i nieodwracalnej dewastacji biosfery, wydaje się być postawa ekstraktywistyczna, która trwa nieprzerwanie od kilku stuleci. Istnieje nadzieja, że adekwatnie dobrane metody nauczania śladu ekologicznego mogą efektywnie podnieść wrażliwość, empatię i świadomość ekologiczną starszych oraz młodszych generacji konsumentów. Ratunek dla bioróżnorodności wydaje się leżeć w biocentrycznej edukacji – być może ślad etyczny, jako efekt ekologicznego, jest w stanie przekształcić *Homo sapiens* ponownie w *Homo sapiens*.

Słowa kluczowe: bioróżnorodność, ślad ekologiczny, ekstraktywizm, solastalgia, *homo sapiens*

Introduction

Education is a prerequisite for sustainable, and therefore safe, lasting and effective development. In turn, the didactic and pedagogical consequence of the work is both individual development in the area of awareness, sensitivity and worldview, as well as collective development, in terms of cooperation, joint responsibility or improved quality of life. It will be no great misuse to state that ethics in the 21st century probably faces the greatest challenge in the history of philosophy and pedagogy – the actual

participation in saving life on Earth. At the turn of the 20th and 21st centuries, we collectively experienced, and still do, a new kind of *limit situation* or *Grenzsituation* – a global environmental disaster. Assuming that the attitude of people towards all forms of life is shaped e.g. by opinion-forming influencers, such as politicians, scientists, but also teachers at every level of human education, then ethical education of subsequent generations of the Earth's inhabitants acquires a unique relevance. It is not only a moral notion, but also an existential one. Thus, the existential challenge of raising the level of

knowledge, awareness and sensitivity in people especially concerns applied ethics and normative ethics, which take into account ecological issues and refer to the concepts of responsibility, duty (obligation) and the value and quality of life.

The article will outline a new form of deterioration – outside the sphere of biodiversity – referred to as *solastalgia*. Without anticipating specifics, it should be mentioned that solastalgia is associated with the mental aspect of modern people, and is caused by the cultural upholding of the myth of anthropocentrism and the claims arising from it towards our cultural environment. An effective strategy for minimizing various forms of deterioration seems to be the proposed involvement of the pedagogical community in shaping biocentric attitudes and behaviors of the young generation. A question arises as to what to teach and what educational methods to use? A didactic answer may be scenarios teaching the theory and practice of the so-called ecological footprint, which includes e.g. elements of fair consumption, fair trade and a responsible attitude towards the biosphere. It seems that adequately selected teaching methods of the ecological footprint can effectively raise the sensitivity, empathy and environmental awareness of audiences, pupils, and students. This notion was introduced to ecological research in 1994 by Prof. Mathis Wackernagel together with prof. Willhelm Rees, who was the promoter of his PhD thesis on this subject. Perhaps teaching about the ecological footprint translates into an increase in the so-called ethical footprint (Schaltegger et al., 2015, p. 65), i. e. the quantity and quality of implemented values of care, respect and responsibility, in all acts of consumption, in relation to one's natural and social environment.

The article does not focus on economic factors, instead emphasizing the role of education, including eco-ethical and biocentric education, as one of the strategies to change consumer thinking. After all while climatologists, environmentalists, zoologists and botanists refer to facts and scientific knowledge, they should be supported by an area of environmentally aware humanists to include moral principles, cultural norms and hierarchies of values in the information and education process.

Selected examples of biodiversity deterioration

The biosphere gives signals that some of its regions are becoming more and more disturbed. Few people outside the hermetic community of specialists are aware of this. It only took about half a century to trigger global changes. Currently, we have e.g. an accelerated increase in the concentration of carbon dioxide and methane in the atmosphere. And both these concentrations contribute year by year to the accelerated increase in the average temperature at the Earth's surface. We know this based on analyzes of the so-called Earth's sensitive climate points,

made thanks to the *Potsdam Institute for Climate Impact Research*, with a significant help from oceanographer and climatologist Stefan Rahmstorf. The first such point is the Arctic (Johannessen, Bengtsson et al., 2004) as the fastest-warming region on Earth, as well as Greenland (Gregory, Huybrechts, Raper, 2004) and West Antarctica (Bamber, Riva et al., 2009), where the complete disappearance of ice is already a matter of time in the current emission scenario of anthropogenic greenhouse gases. The second point involves the circulation systems of ocean water, including climate anomalies in the Pacific (Diaz, Hoerling, Eischeid, 2002) and the abatement of monsoons. A mere fifty years ago, monsoons intensively fed the Amazonian rains. Nowadays, they are getting weaker decade by decade, and the Amazon ecosystem is becoming steppe-like. Similarly, monsoons that mark their activity in the Indian Ocean also bring less and less rainfall to India and Bangladesh, which causes violent, troublesome and long-term drought (O'Brien, Leichenko et al., 2004). Here however, we are most interested in the third sensitive point of the Earth's climate, which is susceptible to destruction not only through the emission of carbon dioxide into the atmosphere, but also through daily direct interference of various social groups, more or less consciously exploiting this point. The issue at hand is the biosphere ecosystems that include forests.

In 2015, intentional grubbing and burning of forest areas in Borneo or Sumatra under the monocultural cultivation of oil palms led to the greatest environmental disaster so far in the 21st century. This involves drying out Indonesian peat forests, which causes fires and, as a result, kill animals (including the Bornean orangutan [*Pongo pygmaeus*], clouded leopard [*Neofelis nebulosa*], sun bear [*Helarctos malayanus*]) in the surrounding nature reserves. The events in Indonesia in 2015 were described in the media as crimes against humanity, where responsibility is dispersed between food concerns, their smaller subcontractors and local political authorities. *The fires devastating Indonesia have been called a 'crime against humanity'*, wrote reporter Oliver Balch for *The Guardian* (Balch, 2015). To make things worse, instead of the normally expected tropical rainfall, there were anomalous droughts in Borneo, which in turn, initiated huge uncontrollable fires in the autumn of 2015 (possibly created by burning forests). This was due to many forest areas were being grubbed up there for the cultivation of oil palm and eucalyptus. The lack of a normal biotic pump bringing about strong moisture became the cause of a massive drying of areas that were largely deforested. Apart from tropical forests and forest crops, peat bogs also burned, emitting huge amounts of carbon dioxide and methane to the atmosphere (Hashimotoa, Kojimab et al., 2000).

It is also worth mentioning that the drying up of the Amazon is a very alarming signal. There is less and

less precipitation in this geographical region. The direct cause is global warming, resulting in the weakening of incoming monsoons from west Africa (Fu, Yin et al., 2013), and the indirect cause – long-term clearing of the Amazon forests. Grubbing up causes the destruction of forests as a *buffer* stabilizing the climatic conditions on Earth, which strengthens the direct cause of drought – global warming (Phillips, Aragão, 2009).

The last example of biodiversity problems is the extinction and pollution of the seas and oceans. Both shallow and thermophilic (but up to 26°C) coral reefs from tropical areas, as well as deep-water and cold-water coral reefs from around the world, and especially from the North Atlantic waters off the coast of northern Europe, are just as exposed to temperature rise, acidification and deoxygenation. They ecosystems are very sensitive to climate change. Warming the world by just 1.5 degrees Celsius will mean the destruction of at least 90% of all reef populations worldwide. And warming temperatures by 2°C will bring about near-extinction of these ecosystems together with the corals that form them and other species dependent on reefs as an undersea habitat. The increasing temperatures come together with plastic water pollution, as the risk of coral reef diseases increases after contact with plastic found in marine waters. Worse still, many marine organisms cannot tell apart between plastic garbage and food, while those that do eat plastic will die of starvation, unable to digest it. Pollution with plastic is currently so high that it has become the [1] theme of the World Earth Day 2018 under the slogan *End plastic pollution*. It is worth noting that currently the largest garbage patch in the middle of the Pacific is 99.9% plastic; it weighs as much as 45-129 thousand tonnes and has an area of 1.6 million square kilometers, which is five times larger than the area of Poland (Ulanowski, 2018). It drifts between Hawaii and California due to the sea currents. Microplastic particles are already present in all water systems in the world, such as streams, rivers, lakes or seas, including the Arctic and Antarctic regions (Bucci, Rochman, 2018).

Are there any other dangers besides the deterioration of biodiversity, of which we may not be aware? The philosopher Glenn Albrecht answers this question positively – there is an additional psychological danger called solostalgia.

Threat: solostalgia due to extractivism

Albrecht created a concept describing a specific state of mental suffering that we can experience in a situation where our familiar places that we knew, loved and where we felt safe, are so extremely changed by the exploitation of raw materials and/or emerging buildings that they become foreign and unrecognizable to us. Albrecht calls such a condition *solostalgia* (Latin: *solace* – relief, consolation, and gr. *algos* – pain), which he defines as *anxiety and longing for*

home experienced when one is at home (Klein, 2014, p. 168). It is the anxiety, frustration and longing that one feels when returning to an old place, where one has had deep, positive feelings, and this place turns out to be so thoroughly changed in connection with the progress of urbanization and/or destruction of nature that it now is completely foreign and menacing. In such case, being in the right place geographically, we do not emotionally recognize this place. Friedrich Dürrenmatt described this phenomenon in his memoirs: *When I visited the village again several years ago, I only recognized the hills that surround it. The garden lacked trees, the church was rebuilt, everything became smaller, tighter, although the village itself has grown, and with a lot of industry. I felt alien* (Dürrenmatt, 1986, p. 23). Global climate change has led to a situation where the whole world – being a home – is revealed as unfriendly, menacing, and unpredictable. Furthermore, according to Albrecht, we collectively experience both local and global solostalgia. It is a combination of nostalgia with claustrophobia on a planetary scale, caused by our suicidal desolation of the entire Earth. Such exploitation is possible thanks to the collective psychological repression of the elements of socio-economic metabolism – it means repression of facts concerning the acquisition, consumption and excretion and biosphere contamination with waste. This denial of predatory exploitation along with unrestrained hyper-consumerism can be specified as the economic attitude of extractivism. It is this extractivism as a learned and uncritically upheld restitutionary attitude and consumption attitude towards the world, that seems to be the main source of both solostalgia (in mental area) and the source of irreversible devastation of the biosphere (in physical area). Let's take a closer look at this issue.

Said carelessness and psychological repression of the damage we do constitute the core of the economic model called extractivism, which consists in extracting more and more raw materials in accordance with the ideas of endless development and anthropocentric dominance. As Naomi Klein wrote, extractivism is the attitude and type of mentality that reduces biodiversity to a mere usable value, denying any other value of wildlife but the utility. Both the biosphere and its inhabitants are only perceived in terms of resources to be exploited. *Extractivism is a one-sided, domineering attitude to the Earth, relying solely on taking from it* (Klein, 2014, p. 169). It is the opposite of responsible, sustainable resource management. Klein combines the attitude of extractivism with the idea of destroying nature and people in the name of a higher, i.e. anthropocentric good. The Western culture most often understands good that sanctifies the means as the constant economic progress of a racially superior Europe. Thus, extractivism manifests itself in the activities of imperialist exploitation of the peripheries and the colonization of the world as an area of conquest, and not as a home

that requires care. A typical strategy of extractivism in the form of colonization has for hundreds of years consisted in conquering and exhausting the deposits, to then abandon the now-dead host and move elsewhere to exploit further riches (Klein, 2014, p. 170). A remedy to solastalgia and its source – the extractivist attitude – seems to be biocentric education that stimulates consumer awareness; sensitivity to suffering; a sense of responsibility for our shopping practices, an attitude of care and a sense of respect for nature. Such an educational project that combines said eco-friendly values seems to be the ecological footprint concept, that is, the task of making consumers aware of the measure of the individual demand for the planet's resources necessary to stay alive. In the next chapter, we will discuss how to consciously trace our own consumption path, determining what area of the ecosystem we need to fulfill our needs.

Ecological footprint, or rescue in education

Since people do not operate in an informational vacuum, a reliable eco-education should become a guidepost for our consumer activities. The current dominance of anthropocentric education has cemented the unconscious species chauvinism in our attitudes, preferences and choices. Teaching the theory of William E. Rees, called the ecological footprint, is a method of making young generations aware that, in a sense, each and every one of us has arisen from the food that they eat, that is, from the organic background that surrounds us. In the existential and even ontological aspect, we are completely integrated with the Earth. For this reason, the primary question of ecological education, which one should ask oneself and the next generations, should be: *how much of the world's surface is intended only to feed me personally and maintain a lifestyle that I'm used to?* The answer will be our *personal ecological footprint*. The *footprint* is a measure of human demand for the planet's resources and a symbol of our unsustainable position. The ecological footprint was defined as the total area of productive ecosystems, necessary to constantly keep alive any particular community or individual, whose location on the planet is irrelevant. This subsistence concerns above all the acquisition of fossil fuels and natural resources, so the ecological footprint is left by contemporary consumers of the industrial and post-industrial era.

The main educational task is to realize the amount of natural resources used during our consumption and further waste disposal. In other words, the footprint is the remnant of one's existence, which is reflected in a given area in the form of a habitat destroyed in the way of excessive or unsustainable exploitation of such habitat. An individual or group can always import a certain raw material that has run out, but such evasion does not solve the problem of an imprinted *havoc* footprint, as it only transfers exploitation to

another geographical area. Thus, the educational question is: how much land and raw materials, regardless of their location, is needed to extend the existence of individuals in a given region. Here we arrive to the issue of pro-ecological didactics, which may awaken a biocentric attitude among students and pupils. Pedagogically speaking, the most convenient are educational scenarios based on real *case studies*, concerning the exploitation of nature, human resources and the killing of animals. Therefore, teachers can use ready-made scenarios of fair, responsible consumption such as environmental and *fair trade* organizations have in the area of:

- a) food products – inform about the quantity of plastic used and accentuate preference for glass or paper (biodegradable) packaging;
- b) clothing – present, e.g. the harmful realities of keeping and breeding animals for fur;
- c) cosmetics – make people aware of the practice of testing chemicals on animals and the availability of cosmetics not tested on animals;
- d) mobile technologies – inform about toxic materials contained in computers and telephones and the need to recycle used equipment;
- e) waste – implement the 3R thinking scheme: *reduce, reuse, recycle* in every aspect of consumption.

Referring to shared values and social norms, these examples of ways of awakening responsibility, sensitivity and respect may translate into more moral, modest shopping behavior. This would be the first step towards halting hyperconsumerism.

Moreover, from a biocentric point of view, human existence, shown by Martin Heidegger as being-in-the-world, takes on a broader – ecological – aspect. Biocentrically speaking, in a sense, we have never been born. Placenta is the means by which the fetus receives nutrition. The umbilical cord is part of the placenta that is connected to the mother's womb. After childbirth, this relationship changes into a relationship with the Mother Earth. It is She who provides us with all the food and takes all our droppings away. A person transforms from an organism feeding inside a parent's body into an organism feeding in the womb of nature. Thus, a large dose of conceit and megalomania is characterized by placing humans at the top of the Aristotelian ladder, as the crowning achievement in the hierarchy of organic beings. Such unique features of *Homo sapiens* as creative shaping of our surroundings; understanding the world and oneself through symbolic forms, or creating mental extensions in the outside world, all this is paid for obtaining various means of livelihood and transforming the environment (exploitation of the bioproductive raw materials). Biocentric education should therefore accurately inform about the fact that our planet's capacity has its limits. The greater the portion of the biosphere *Homo sapiens* usurps, the less space is left to be used by other species who also deserve to be respected. Given that

millions of species have turned into a handful of specimens or are extinct, all consumers are in varying degrees responsible for the fact that only few survivors remain from the past population of life forms. When discussing the effects of hyper-consumerism as an ecological footprint, the consumers of First World countries – according to Rees – use four times more resources than they should. Free market competition provides tools that allow wealthy people to get much more than a balanced, fair distribution allows. Another educational issue is: at whose expense do wealthy people use more resources than they should? Why, at the expense of animals, all of nature, and at the expense of the inhabitants of Third World countries and the future generations. According to the data of the World Wide Fund for Nature (WWF) from 2015, we require 2.7 gha/person, yet we currently have 2.1 gha per person. The largest ecological footprint is found in the USA and China, with 9 gh in the US and only 2.11 in China. Poland is ranked 33rd with a footprint of 4 gha with a biological capacity of 2.1 gha. Finland (7.64 gha) and Sweden (6.07 gha) have the heaviest footprint in Europe. Whereas such countries as: Congo, Malawi, Haiti, Nepal, Bangladesh have 0.5 gha per person. It is worth noting that sustainable development can only be ensured if a country meets two criteria: the ecological footprint is less than 1.8 gha and the human development index (HDI) is higher than 0.8. These data are often approximate and change constantly, which is connected with the current consumption policy of the government of a given country in a given period of time.

To sum up, only the inhabitants of affluent countries participate in hyper-consumption, due to which over one billion people are overweight, i.e. with the largest (visible) ecological footprint and also the smallest ethical footprint. The population of malnourished people is just as numerous, because it is at their expense that over a billion of obese hyper-consumers live. In the second decade of the 21st century, the individual ecological footprint of a wealthy country inhabitant amounts to as much as 6 hectares of land with its resources, yet they are rightly entitled to no more than 1.5 hectares. The inhabitants of poor countries also use about twice as much natural resources than a safe number, since we all equally exploit the so-called natural capital that has been accumulating over millions of years of evolutionary time. Regardless of where and how we live, we sustain our existence by over-exploiting biodiversity. We deprive other species of their food sources, destroying forests, depleting the oil reserves, minerals, soils, and at the same time often do not have basic knowledge about the exploitation we carry out. Although this does not diminish our responsibility, we often unconsciously deny other organisms access to habitats and energy. Perhaps clear and thorough ecological education will minimize the acceptance of an

extractivist attitude towards the world, as such an attitude will not be a stereotypical habit, but a deliberately immoral choice. It seems that the role of humanists is to show the paradox that humanity is nowadays much more dependent on nature than in the past, because the survival of affluent countries has never been so much conditioned by the biosphere's stability. Therefore, the challenge for humanists is to overthrow the myth of anthropocentric species chauvinism, not only in the area of science but also in the broad sense of consumerism.

Conclusions

As humanity, we believe that we are separate from nature, when in truth we are the most powerful, most expansive organism, consuming every type of ecosystem. We consolidate the myth of civilization gradually disconnecting from nature, which is an economic nonsense. The answer to the anthropocentric conceit and its consequences – solastalgia and the extractivist attitude – may be education regarding one's own individual ecological footprint. Eco-education should result in clear knowledge that the price for our existence is obtaining all kinds of means to live, that is, to consume a bioproductive plane of raw materials. In other words, the existence of being-in-the world of a human individual is a synonym of the inevitable vital dependence on the environment, which took the form of a predatory, parasitic devastation. Such a destructive-parasitic realization of being-in-the-world would mean that *Homo sapiens* should actually be referred to – as John Gray preached – as *Homo rapiens* (Tallis, 2011, p. 148). The task of environmentally-oriented educators is to raise awareness that the modern world of the technology and information revolution and its inhabitants are a product of primitive fossil fuels. Each of us has the right to participate in the same plane of the planet's productivity – 1.7 hectares per person. There are no privileged individuals here, who due to inherent or acquired traits become favored in access to natural resources. People are equal in terms of their right to live and the right to sustain their life at the expense of nature. In other words, we are not only equal in the face of death and observance of the law, but also in the face of the availability of common natural wealth. Meanwhile, our right will end with drastic climate change or depletion of available resources, which is already happening. In the face of a catastrophe, the pedagogical-existential task is to move from anthropocentric conceit to biocentric humility, where humankind will understand itself in the form of a subset of the larger ecosphere. Otherwise, we are threatened by exceeding many critical points at once and a spectacular cataclysm.

Forecasts

The problem is that unreflective submission to the consumer's imperative of increasing one's comfort of life does not allow us to recognize and experience nature emotionally. A person with an extractivist attitude will not protect something they do not respect and perceive only in the criteria of hostility and conquest. The more we isolate ourselves linguistically and mentally from nature, thus cementing our anthropocentrism, the more we move away from the superhuman, interspecies values of responsibility, respect and care.

Once they grow up to be adults, our present newborns will never witness coral reefs or the Arctic ice – these will only be a memory. Desert ecosystems will enter southern Europe, North Africa, the western US and the Amazon, India, and western China. Decade by decade, we will all have to adapt to the desert world, just like to the greenhouse gas emissions. When today's newborns become old people, with the continued burning of fossil fuels at a rate observed in 2018, the climate will already be warmed by 3 degrees Celsius. Perhaps these people will view the people of the twentieth century as the greatest pests that had ever existed among the human race. The twentieth century residents seem to be cursed with indifference and greed, which will not help stop the global warming. This ignorance, indifference and greed makes us irresponsible and even insane when it comes to endangering future generations of people and the entire nature in the 21st century. Today's cynical denialism, which downright rejects scientific warnings of an impending cataclysm, can be described as insane.

In the face of visible indifference, we must trust educators that their local activities have a chance to transform into global actions to save the Earth. Starting from an ecological footprint, through an ethical footprint, the last step may be a social footprint in the form of ecologically friendly technologies, e.g. the widespread use of renewable energy sources. This way, successive generations have a chance – thanks to the ongoing commitment of pedagogues – to overcome the inborn frailty of *Homo sapiens*.

References

1. ALBRECHT G., The age of solastalgia, in: *The Conversation*, <http://theconversation.com/the-age-of-solastalgia-8337> (20.02.2018).
2. BALCH O., 2015, Indonesia's forest fires: everything you need to know, in: *The Guardian*, <https://www.theguardian.com/sustainable-business/2015/nov/11/indonesia-forest-fires-explained-haze-palm-oil-timber-burning> (15.03.2018).
3. BAMBER J. L., RIVA R., E. et al., 2009, Reassessment of the Potential Sea-Level Rise from a Collapse of the West Antarctic Ice Sheet, in: *Science*, 324(5929), p. 901-903.
4. BUCCI K., ROCHMAN Ch., Beyond our oceans: Microplastics pollute rivers and lakes too, in: *The Conversation*, <https://theconversation.com/beyond-our-oceans-microplastics-pollute-rivers-and-lakes-too-94559> (30.04.2018).
5. DIAZ H. F., HOERLING M. P., EISCHEID J. K., 2002, ENSO variability, teleconnections and climate change, in: *International Journal of Climatology*, vol. 21, issue 15, p. 1845-1862.
6. DÜRRENMATT F., 1986, *Labyrinth. Stoffe I-III*, Verlag, Zurich.
7. FU R., YIN L. et al., 2013, Increased dry-season length over southern Amazonia in recent decades and its implication for future climate projection, in: *PNAS*, 110(45), p. 18110-18115.
8. GREGORY J. M., HUYBRECHTS P., RAPER S. C., 2004, Climatology: Threatened loss of the Greenland ice-sheet, in: *Nature*, 428, p. 616.
9. HASHIMOTOA T., KOJIMAB K. et al., 2000, Changes in carbon storage in fallow forests in the tropical lowlands of Borneo, in: *Forest Ecology and Management*, 126(3), p. 331-337.
10. HOEGH-GULDBERG O., MUMBY P. J., et al., 2007, Coral Reefs Under Rapid Climate Change and Ocean Acidification, in: *Science*, 318(5857), p. 1737-1742.
11. JOHANNESSEN O. M., BENGTSSON L. et al., 2004, Arctic climate change: observed and modelled temperature and sea-ice variability, in: *Tellus*, 56(4), p. 328-341.
12. KLEIN N., 2014, *This Changes Everything. Capitalism vs. Climate*, Simon & Shuster, New York.
13. KLEIN N., Walczmy, zanim wszyscy trafimy przeżuci na halde, in: *Krytyka Polityczna*, <http://krytyka-polityczna.pl/swiat/klein-walczmy-zanim-wszyscy-trafimy-przezuci-na-halde/> (16.03.2018).
14. O'BRIEN K., LEICHENKO R. et al., 2004, Mapping vulnerability to multiple stressors: climate change and globalization in India, in: *Global Environmental Change*, vol. 14, issue 4, p. 303-313.
15. PHILLIPS O. L., ARAGÃO L. E. et al., 2009, Drought Sensitivity of the Amazon Rainforest, in: *Science*, 323(5919), p. 1344-1347.
16. REES W., WACKERNAGEL M., 1996, *Our Ecological Footprint: Reducing Human Impact on the Earth*. New Society Publishers, Gabriola Island.
17. SCHALTEGGER S. et al. (ed.), 2015, *Corporate Carbon and Climate Accounting*, Springer International Publishing, Switzerland.
18. TALLIS R., 2011, *Aping Mankind. Neuromania, Darwinitis, and the Misrepresentation of Humanity*, Routledge, London and New York.
19. ULANOWSKI T., Wielka Pacyficzna Wyspa Śmieci jeszcze większa, niż myśłano, in: *Gazeta Wyborcza: Nauka*, http://wyborcza.pl/7,75400,23169673,wielka-pacyficzna-wyspa-smieci-jeszcze-wieksza-niz-my-slano.html?utm_source=SARE&utm_medium=email&utm_campaign=wieczorny (28.04.2018).

Environmental Life-cycle Analysis as a Tool for Sustainability Studies: A Complete Learning Experience

Środowiskowa ocena cyklu życia jako narzędzie w studiowaniu zrównoważoności: kompletne doświadczenie edukacyjne

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Abstract

This article first presents Environmental Life-Cycle Analysis (E-LCA) as a complete learning experience for university students of environmental science/engineering, enabling the acquisition of the four levels of knowledge, of the Structure of the Observed Learning Outcome (SOLO) taxonomy. The four steps of an E-LCA, interestingly, mirror the hierarchy of knowledge-levels defined by the SOLO taxonomy. In the light of the fact that it is generally difficult to accomplish this ascent from declarative knowledge to functional knowledge, in a systematic manner, in many university courses, the complete learning experience guaranteed by E-LCA must stand out conspicuously.

Key words: Structure of the Observed Learning Outcome (SOLO), Environmental Life Cycle Analysis (E-LCA), declarative knowledge, functional knowledge, systems thinking, sustainability

Streszczenie

W artykule przedstawiono środowiskową ocenę cyklu życia (E-LCA) traktowaną jako kompletne doświadczenie edukacyjne dla studentów uczelni wyższych kierunków nauki o środowisku/inżynieria, pozwalające na zdobycie wiedzy na czterech poziomach ze Struktury Obserwowanych Efektów Kształcenia (SOLO). Cztery kroki E-LCA, odzwierciedlają hierarchię poziomów wiedzy z klasyfikacji SOLO. Wobec faktu, że ogólnie rzecz biorąc trudno jest osiągnąć przejście z wiedzy deklaratywnej do funkcjonalnej, w kwestiach systematycznych, dla wielu kursów uniwersyteckich, pełne doświadczenie edukacyjne gwarantowane przez E-LCA zdecydowanie się wyróżnia.

Słowa kluczowe: Struktura Obserwowanych Efektów Kształcenia (SOLO), środowiskowa ocena cyklu życia (E-LCA), wiedza deklaracyjna, wiedza funkcjonalna, myślenie systemowe, zrównoważoność

1. Introduction and literature review

1.1. Teaching and learning outcomes

The Structure of the Observed Learning Outcome (SOLO) taxonomy of action verbs encompassing the entire learning experience of students in universities is a four-step one, recommending the progress of the student from the *unistructural* level of knowledge through the *multi-structural* and the *relational*, to the *extended abstract* (Biggs and Tang, 2011). As students scale the heights, they ascend from theory

to practice/application; from the acquisition of declarative knowledge (cognitive skills) to functional knowledge (psychomotor skills) (see Table 1). The so-called action verbs, used to describe the intended learning outcomes are numerous, and few have been chosen and tabulated in Table 1, primarily for the purpose of presenting Environmental Life-cycle Assessment (E-LCA) as a complete learning experience for students.

Table 1. SOLO taxonomy – unistructural to extended abstract

| Knowledge level | Chosen action verbs |
|-------------------|--------------------------------|
| Unistructural | Identify, Define |
| Multi-structural | Classify, List |
| Relational | Analyse, Characterise, Compare |
| Extended Abstract | Generate, Create |

1.2. Sustainability and environmental education in general

Marshall et al. (2013) observed that there is some degree of change in the integration of sustainability into business schools. They refer to the strand of learning available for all students at the University of Leeds – Creating Sustainable Futures – which is based on the transition from *Learning about sustainability* to *Learning for sustainability*. Acevedo et al. (2013) defined sustainability studies as *a life-long learning process embedding practices and discussing ideas around the socio-cultural, economic and environmental impacts that students, lecturers and practitioners will make in the transformation of current lifestyles and practices*.

Systems-thinking, Creativity and Cooperation stand out as keywords, or rather key constituents of sustainability-education. ACUPCC (2014) has maintained that higher-education curricula need to be updated across a diverse range of academic disciplines to address climate adaptation – from business practices to the ecosystem management, from law to community planning, and from architecture to healthcare. Dobson et al. (2013) pointed out that at the University of Manchester, Sustainable Development is a compulsory component of engineering degrees, for students intending to become chartered engineers. NACUBO, USA / Second Nature, USA (2014) contend that higher education institutions need to lead by example by resorting to on-campus wind and solar energy generation, geothermal and biogas heating/cooling systems, lighting upgrades to improve energy efficiency, water conservation, weather-proofing initiatives, waste minimization and recycling, etc. At the Karlstad University in Sweden (to which the author of the paper is affiliated), it is mandatory for PhD students in the fields of science and engineering, to try to find how sustainability concepts could be incorporated into their research. According to Capra and Luisi (2014), *It will therefore be critical for present and future generations of young researchers and graduate students to understand the new systemic conception of life and its implications for a broad range of professions – economics and management, politics and medicine, psychology and law*. The Department of Chemical and Engineering Sciences at the Karlstad University, offers courses in sustainable development to engineering students from different disciplines at different stages in their bachelors' and masters programmes. In a survey of academicians in the depart-

ments of architecture at the Norwegian University of Science and Technology (Trondheim, Norway), and the University of Sarajevo (Sarajevo, Bosnia) – the results of which have been published in Venkatesh and Schwai (2016), most respondents have said that they are aware of the need for life-cycle thinking and believe it is indispensable if sustainability and energy efficiency have to be properly understood. It is good to see that a majority of them always introduce life-cycle thinking to students in their lectures. Of course, the nature of the subjects which the respondents teach, imposes some restrictions on the importance they could give to life-cycle thinking, but certainly the scope always exists.

1.3. Environmental LCA

We, humans, are dependent on the environment for our existence and will continue to be dependent on it. Dependence, instead of generating a feeling of gratitude, leads to mishandling and mistreatment and brings about a *taking-for-granted* attitude in its wake, more often than not. That, we have been witnessing around us; and still do, when we encounter self-serving, materialistic narcissists in our daily lives. Now, while it is an indisputable fact that humankind has wreaked some havoc on the environment on which it depends, one may wish to measure this *havoc* and understand what one can do, to hold back the rate at which the damage is occurring. If one can measure, one can manage. This is the philosophical basis of an environmental life-cycle assessment (E-LCA, sometimes also referred to environmental life-cycle analysis) – a basic understanding of our dependence on the environment and its vulnerability; and an ardent desire to set things right. This philosophical basis requires empathy and imagination (strengthening of the emotional and spiritual understanding of the dependence of humankind on the environment, as well as the interdependence among human beings on the planet), which is emphasized in Jensen (2017).

E-LCA, a technique for decision support and learning, is a useful and powerful tool for sustainability analysis, the application of which is taught to students of environmental science/engineering and industrial ecology in some universities around the world (Baumann et al, 2004 and Venkatesh, 2016). The steps to be followed in a systematic E-LCA have been standardized in ISO 14044 (2006), while ISO 14040 (2006) outlines the principles and framework. Let us start off with ISO 14044 (2006). This outlines the four steps in an E-LCA, and is essentially a consolidation of the earlier standards ISO 14041 (1998), ISO 14042 (2000) and ISO 14043 (2000), all three of them taken together. It describes the following:

Goal and scope definition. As the name of the step suggests, this is about *defining* why and for whom the E-LCA needs to be carried out and *identifying* the scope, assumptions to be made, limitations and the allocation methods for the analysis. The two action

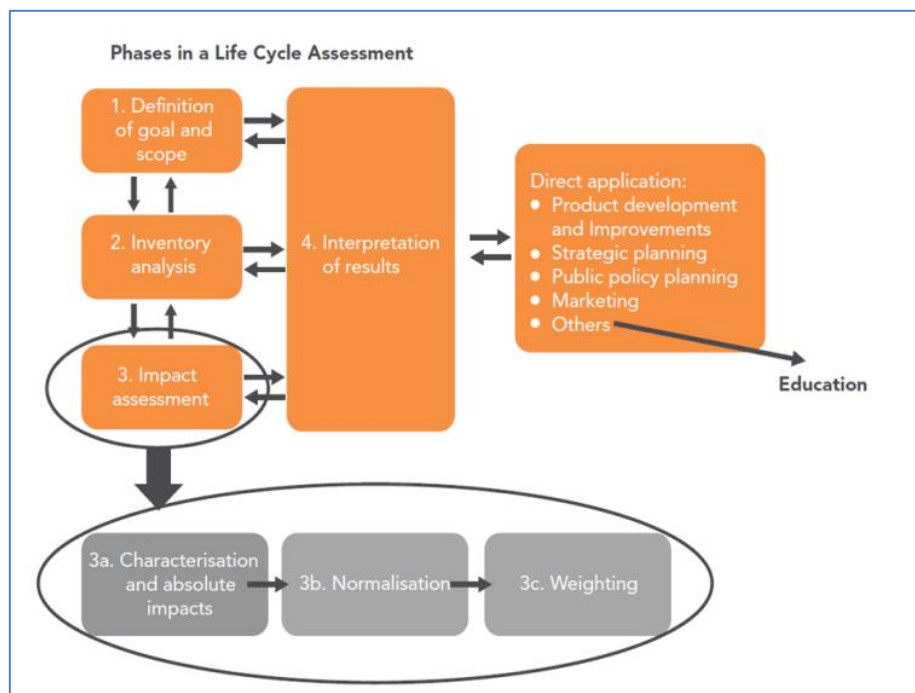


Figure 1. Phases in an E-LCA (Venkatesh, 2016, p. 23)

verbs (intended learning outcomes for students) within quotation marks are of the unistructural knowledge level (Table 1).

Inventory Analysis. The word *inventory* at once evokes the action verb *listing*. Even though this step is called an analysis, it is primarily a listing or *categorisation and classification* of the flows of resources (materials and energy) and emissions associated with the processes/products being studied in the E-LCA. Listing and classifying are action verbs of the multi-structural knowledge level.

Life-Cycle Impact Assessment, in which one graduates to the relational knowledge level. *Relating* the resource and emission flows to environmental impacts of different kinds, *characterizing* the emissions by using characterization factors, *normalising and weighting* and thereby introducing subjectivity (Venkatesh, 2016; chapters 4,5 and 6). Characterisation factors enable one to express emissions of different substances in terms of equivalents of a chosen substance, quite like expressing all currencies in US-dollar equivalents for example. Normalisation is expressing the environmental impacts from the system or life-cycle being studied as a percentage of the total impacts from a pre-defined larger area. Weighting, as the name implies is assigning relative degrees of importance to different kinds of environmental impact categories.

Interpretation or Improvement Assessment – This step is the culmination of the E-LCA, where the inventory analysis and impact assessment lead to an interpretation of the results, which calls for a slightly higher level of knowledge, bordering on the extended-abstract in Table 1. Recommendations and advice are *generated*, possibilities for improvement

which may not at once be visible are uncovered. It must be mentioned at this point that *being able to perform a case study* belongs to the extended abstract level and includes the other three sub-levels as requisites. In other words, after learning the four steps of E-LCA, students should be able to perform their own case studies by utilizing all the four levels of knowledge acquired in the process. As gathered from Figure 1, E-LCA is not complete if the final communication is not tailor-made for the intended recipient. Here, we are talking of action verbs on the relational knowledge level – *translate, explain, summarise*.

Teachers often find it challenging to define the learning outcomes of courses in an effective manner. What is on paper is often not achieved. No courses can be structured to enable students to achieve learning outcomes at all the four levels adequately. E-LCA, however, by the way it has been structured and standardized by the ISO, exposes students to all the four levels of knowledge (and thereby both the types – declarative and functional). E-LCA, as mentioned earlier, is an important tool for sustainability studies, which by virtue of its diversified nature, equips learners with a wide range of abilities (defined by the action verbs in the SOLO taxonomy), demonstrating at once that the unistructural ought to be linked up to the extended abstract, to be truly utilitarian and valuable to society, economy and environment.

2. Discussion

The author reached across to leading pedagogues in the field of E-LCA around the world, and elicited comments on the *impact and influence of, and inter-*

Table 2. Range of possible expectations which students may have before commencing on E-LCA studies in university

| |
|---|
| • To understand the range of applicability of the tool, in the industry and also how it is actually used in the industry |
| • To learn how the tool is used in practice |
| • To apply the tool to understand one's own lifestyle choices and their impacts on the environment |
| • To learn something new and exciting and relevant both in the present and in the future |
| • To go through completed LCA-studies to understand exactly how analysts had carried them out in practice |
| • To learn how LCA can be useful for a career as engineer in the energy sector |
| • To compare products holistically |
| • To move ahead from the <i>what</i> of environmental problems which we had learnt in some earlier courses, to <i>how</i> one could tackle them |
| • To do a complete LCA, all by myself, during the module |
| • To understand how human society affects the environment |
| • To master new ways to think and new techniques to apply to understand our relationships with the environment around us |
| • To get a better understanding of what some of the indicators – kg CO ₂ equivalents – we have introduced to an earlier course, actually meant and how they were derived |
| • To learn to use E-LCA software and gets hands-on experience in this respect |

est in E-LCA education and learning. Prof. Shabbir Gheewala (Gheewala, 2017) from King Mongkut's University of Technology Thonburi (Thailand) told the author that he has been using E-LCA as a metaphor for research methodology in general; quite in keeping with the SOLO taxonomy outlined in Table 1. He has promoted this approach to research while making E-LCA a compulsory course for all graduate students, regardless of their actual research topics. Assoc. Prof. Jeroen Guinee (Guinee, 2017) from Leiden University in the Netherlands, which has been in the forefront of developing E-LCA methodology, since the early days of this analytical tool, describes the evolution of E-LCA teaching at the university thus – *It started as a purely theoretical class, shifted towards an online course and can now best be described as an intensive engaging experience for students in which theory and practice are combined to provide students the basis to responsibly perform an LCA study.* The key phrase there is 'theory and practice'. Theory, after all, cannot be understood without empirical observation (or practice) and vice versa, as Arvidsson et al (2016) have stated, citing another paper. E-LCA is a tool to be applied, and thereby it is very necessary to train the students to do so, and understand the difficulties and challenges they would face out there *on-the-field*. Maybe a few more things...! Assoc. Prof. Henrikke Baumann (Baumann, 2017), one of the co-authors of Baumann et al (2004), responded elaborately to the author's e-mail request. She referred to the LC@chalmers network on which E-LCA research and educational issues are discussed frequently. The history of E-LCA teaching in Sweden for instance, can be traced back to 1992 and Chalmers (Tillman et al, 2002). Twenty-five years later, Chalmers is on the verge of launching some advanced PhD courses on more advanced forms of life-cycle modelling, which LCA-enthusiastic students from around the world must look out for. Apart from students and research-

ers, Baumann thinks, LCA education has to be necessarily imparted to industry professionals and decision-makers in governments; and Chalmers has been organising workshops and online courses to this effect. She outlines many reasons for the necessity of educating and training professionals – one of them being that practitioners tend to be very much tool-focused and in the process, fail to utilise life-cycle thinking in business in the manner it should be used. Professor Arun Kansal from The Energy Research Institute of India (TERI), in his foreword to Venkatesh (2016) writes, *During my teaching career of over 20 years, I have experienced young researchers struggling for guidance to fast-track their understanding of the LCA method and use it as an integral part of their research work. Students grapple with difficulties in defining system boundary, allocating environmental impact of various interactive products or systems and analysing the life cycle inventory.* These are issues to be addressed and borne in mind obviously, while teaching E-LCA. In the Afterword to in Venkatesh (2016), E-LCA practitioner and researcher Dr Geoffrey Guest from *Agriculture and Agri-Food Canada (Ottawa)*, opines thus about E-LCA *What was once a rather unpopular, academic and, if I may dare to say, geeky system of accounting turned into the go-to approach for corporate and government initiatives to measure, disclose, inform policy and improve the 'cradle-to-grave' environmental impacts of existing products.* Håvard Bergsdal (Bergsdal, 2017), a consultant from Norway tells the author how he began LCA studies in the late 1990s with a case study on diapers; and charts out his evolution to an LCA consultant carrying out sophisticated LCA analyses of large infrastructure systems.

These action verbs (Table 2) – *master, understand, do, get, move ahead, compare, learn, go through, apply* – can be correlated with the ones in Table 1, and slotted into the appropriate categories.

Table 3. Gleanings about E-LCA

- *It is imperative to impress upon the generations to come, the value of the resources they use. In fact, the more we go into the future, the more imperative it would get.*
- *It is important for youngsters to understand that the life of a product need not end when it is of no use anymore to the first user.*
- *The knowledge and understanding of E-LCA will be important and very useful in Sweden and the world in general, in the years to come.*
- *Even if someone will not be performing E-LCA in his/her career, knowledge is necessary to be able to read and follow reports prepared by analysts.*
- *Why youngsters, even older people must be encouraged to learn about E-LCA, before adding something to, or changing something in the anthroposphere.*
- *If little children could be made to understand in offbeat ways how their toys and clothes are made – the life-cycles of these products in other words – they would grow up to respect the limits to growth.*
- *It would be good if E-LCA is taught right from the beginning of the 5-year engineering programmes and not later on towards the end of it.*
- *With the passage of time, sustainable development would have been firmly entrenched in society and economy. Therefore, I will have no option other than to encourage my children in the future to develop an interest in systems thinking and tools like E-LCA.*
- *It is good if knowledge about how human actions impact the environment – positively or negatively – is inculcated to children by their parents and school-teachers in creative ways. I will support this in the future.*
- *The earlier the better. As all of us have to contribute to sustainable development, it is imperative that youngsters begin their contributions right from their primary school days. The positive effects of creating this mentality early enough cannot be overemphasized.*
- *Of course, I would certainly vouch for E-LCA as a tool to be learnt by students in the future, as it is likely to become more sought-after in the years to come.*
- *I think it takes a long time to understand E-LCA thoroughly and thereby earlier the learning starts, the better. E-LCA will help one to convince children why they should not waste energy or water or resources in general.*
- *Discussing about the life-cycle environmental impacts of products with children will make them grateful for what they have, and they will definitely pass on this wisdom to the generation after them.*
- *E-LCA, in principle, will enable one to make youngsters comprehend the truth behind the proverb 'Little drops of water make a big ocean'. It will also help in the application of another one – Prevention (of environmental damage) is much better than reacting after the damage has been done.*
- *In elementary school, environmental awareness and life-cycle thinking must be mandatory subjects just like mathematics and languages.*

As one moves up the *analysis cone* from characterisation and classification to normalisation, weighting and aggregation to a single index, communicability of the results becomes easier, while accuracy and the details get compromised. A single index is easier for non-experts to identify with and use as an input for decision-making, while researchers, analysts and scientists ought to know the *story behind the index*. Readers may refer to Venkatesh (2014), which exemplifies one possible output of E-LCA results – the definition and calculation of a so-called Green City Index, which makes cities compete to outperform the ones above them in the ranking. There is also the observation that the right questions need to be asked at the outset (harking back to the interesting Preface of Baumann et al (2004)), and the fact that the answers would change depending on the questions asked must be conveyed to the recipient of these answers – the decision-makers in government for example. Even for a layperson, who may perhaps decide to utilise the information obtained from E-LCA in the choices he/she makes in his/her daily life, the knowledge that two similar-looking products at the factory-gate, could have entirely different life-cycles and contribute differently to life-cycle environmental impacts depending on how and how long they are used and handled at the ends of their respective life

times, can be a veritable eye-opener. The role of the media in disseminating findings from E-LCA reports, in a reader-friendly manner, should not be overlooked, though this would make it necessary for the media-persons to make sure that they are interpreting the results correctly.

With the aid of graphs and flowcharts, communication of information to the layperson can be simplified and a person who does not even realise that a product he/she is consuming is indirectly and directly responsible for several hundreds of kilometres of road/air/sea-travel and thereby transport-related GHG emissions, can at once be enlightened. The communicator has a responsibility on his shoulders, which he needs to fulfil. He cannot misinterpret. If he interprets right, he cannot misguide the listeners/readers. Just labelling the electric car as an environmental-friendly alternative to diesel cars because it does not emit anything when it is on the road may make people who do not think beyond what they see/read/hear, believe without questioning or probing. Systems thinking in this case would entail understanding where the electricity that charges the batteries of the electric cars in the city comes from. Statistics however are misleading...in the communication step, E-LCA results may sometimes be *twisted* to look better than what they

actually are. Neutral reviews of reports are therefore indispensable, in order to ensure that faith is never lost in the deliverables of this valuable tool.

3. Conclusions

Focusing only on *teaching to do* or *learning how to do* will get students and teachers only that far. *Learning how to do* is the first step, but that needs to be followed *de rigueur* by *re-learning by doing and re-doing*. It is necessary to make sure that whatever is taught to students about E-LCA must teach them something new and generate greater interest in them to learn E-LCA in greater *depth and width* in the future.

E-LCA can be looked upon as something that needs to be handed down the generations, like an heirloom to be developed and adapted to changing times. In universities, its importance is passed on by word-of-mouth from seniors to juniors. Out in society, life-cycle thinking has to be taught by parents and elders to youngsters. Table 3 lists some viewpoints of the students at Karlstad University to whom E-LCA was introduced by yours sincerely last autumn.

The leitmotif of this article was the presentation or interpretation of E-LCA as a complete learning experience for university students of environmental science/engineering, enabling the acquisition of the four levels of knowledge, of SOLO taxonomy – unistructural, multi-structural, relational and extended abstract; the graduation upwards from identifying to creating. The steps in an E-LCA (ISO 14044, 2006) neatly mirror these four levels of the said taxonomy. Selected reviews of published papers, books and documents on sustainability and environmental education, and e-mail communications with some E-LCA pedagogues and practitioners helped to set things in perspective.

E-LCA is indeed a useful and powerful tool in the hands of researchers, industry professionals and decision-makers in the government (if the last-named wish to acquire some knowledge about it). Life-cycle and systems thinking is gradually entrenching itself firmly and tools like E-LCA will continue to support decisions which would lead societies and economies of the world towards sustainability.

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References

1. ACEVEDO B., JOHNSON S., 2013, *Chapter 8: Sustainability in practice – Action learning and the green impact initiative*, eds. Atfield R., Kemp P., Higher Education Academy, UK, https://www.hracacademy.ac.uk/sites/default/files/ESD_Acevedo_final_0.pdf (1.06.2018).
2. ACUPCC: American College and University President's Climatic Commitment, 2014, *Higher Education's role in adapting to a changing climate*, <http://www.presidentsclimatecommitment.org/files/documents/higher-ed-adaptation.pdf> (1.06.2018).
3. ARVIDSSON R., HILDENBRAND J., BAUMANN H., ISLAM K.M.N., PARSMO R., 2016, A method for human health impact assessment in social LCA: lessons from three case studies, in: *International Journal of Life Cycle Assessment*, 23, p. 690-699.
4. BAUMANN H., TILLMAN A.-M., 2004, *The Hitch Hiker's Guide to LCA*. Studentlitteratur AB, Lund, Sweden.
5. BAUMANN H., 2017, *Personal e-mail communication on 6th and 11th October*, Chalmers University, Gothenburg, Sweden.
6. BERGSDAL H., 2017, *Personal e-mail communication on the 6th of October*, AsplanViak, Trondheim, Norway.
7. BIGGS J, TANG C., 2011, *Teaching for Quality Learning at University*, Open University Press, McGraw Hill Education, England.
8. CAPRA F., Luisi P.L., 2014, *The Systems View of Life – A Unifying Vision*, Cambridge University Press, Cambridge, United Kingdom.
9. DOBSON H., TOMKINSON B., 2013, Chapter 3: Practical education for sustainable development through interdisciplinary problem-based learning; in: *Enhancing education for sustainable development in business, management, hospitality, leisure, marketing and tourism*, eds. Atfield R, Kemp P., Higher Education Academy, UK, https://heacademy.ac.uk/sites/default/files/ESD_Dobson_final_0.pdf (1.06.2018).
10. GHEEWALA S., 2017, *Personal e-mail communication on the 5th of October*, Life Cycle Sustainability Assessment Lab Joint Graduate School of Energy and Environment (JGSEE), King Mongkut's University of Technology, Thailand.
11. GUINEE J., 2017, *Personal e-mail communication on the 5th and 6th of October 2017*, Leiden University, The Netherlands.
12. ISO 14040, 2000, *Environmental Management – Life Cycle Assessment – Principles and framework*, International Organisation for Standardisation, Geneva, Switzerland.
13. ISO 14044, 2006, *Environmental Management – Life Cycle Assessment – Goal and scope definition, Inventory Analysis, Impact Assessment and Interpretation*,

- International Organisation for Standardisation, Geneva, Switzerland.
14. JENSEN S., 2017, Empathy and Imagination in Education for Sustainability, in: *Canadian Journal of Environmental Education*, 21, p. 89-105.
 15. MARSHALL P.M. & LAING A., 2013, Chapter 1: Why should business schools care about sustainability – Overview of chapters; in: *Enhancing education for sustainable development in business, management, hospitality, leisure, marketing and tourism*, eds. Atfield R., Kemp P., Higher Education Academy, UK, https://www.heacademy.ac.uk/sites/default/files/ESD_Marshall_final_0.pdf (1.06.2018).
 16. NACUBO, 2014, *Higher Education: Leading the nation to a safe and secure energy future*, Second Nature, <http://www.presidentsclimatecommitment.org/files/documents/leadingthe-nation-policy-brief.pdf> (1.06.2018).
 17. TILLMAN A.-M., BAUMANN H., 2002, After 10 years and 300 students: Our LCA teaching experience, in: *Engineering Education in Sustainable Development*, p. 611-616.
 18. VENKATESH G., 2014, A critique of the European Green City Index, in: *Journal of Environmental Planning and Management*, 57(3), p. 317-328.
 19. VENKATESH G., 2016, *Environmental Life-Cycle Analysis – A primer*, Bookboon, Copenhagen, Denmark, <http://bookboon.com/en/environmental-life-cycle-analysis-a-primer-ebook> (1.06.2018).
 20. VENKATESH G., SHWAI M., 2016, Overhauling Higher Education by Factoring Sustainability into University Curricula: Discussion Based on a Survey, in: *Metamorphosis of Architectural Education in Post Transitional Context, Monograph of conference proceedings, HERD project*, eds. Burazor M., Schwai M., Zagora N., Ibrišimbegović S., University of Sarajevo, NTNU, Trondheim.

Landscape and Health in Sustainable Development

Krajobraz i zdrowie w zrównoważonym rozwoju

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Abstract

The article discusses the correlations between health, landscape, and sustainable development. In the first part, the basic concepts are defined. Attention is drawn to the therapeutic effect of landscape, and the subject of therapeutic parks and gardens is discussed. Based on the conducted analyses, characteristics of landscape with therapeutic properties are proposed, and the practical application of research on the landscape-health relationship is indicated. Perception is identified as the key to understanding the therapeutic properties of landscape. Taking care of the therapeutic values of landscape should be part of sustainable development.

Key words: landscape, health, perception, green therapy

Streszczenie

W artykule przedstawiono rozważania dotyczące zależności jakie zachodzą pomiędzy zdrowiem, krajobrazem i zrównoważonym rozwojem. W pierwszych rozdziałach zdefiniowano podstawowe pojęcia. Kolejno zwrócono uwagę na oddziaływanie terapeutyczne krajobrazu oraz omówiono tematykę parków terapeutycznych. Na podstawie przeprowadzonych analiz zaproponowano cechy krajobrazów o właściwościach terapeutycznych oraz dostrzeżono przydatność badań nad relacjami krajobraz-zdrowie w praktyce. Wykazano, że kluczem do zrozumienia terapeutycznych właściwości krajobrazu jest percepcja. Dbłość o terapeutyczne wartości krajobrazu powinna być elementem zrównoważonego rozwoju.

Słowa kluczowe: krajobraz, zdrowie, percepcja, zielona terapia

1. Introduction

Health is one of the most important values in the life of people around the world (GUS, 2017). Socio-economic development allows greater possibilities with regard to general access to healthcare and pro-health measures, but it also entails greater hazards to human health. These hazards are linked to increased motor traffic, urbanisation, chemicalisation of agriculture and food, and the resulting pollution of air, water, and soil as well as landscape degradation (e.g. Dobrzańska et al., 2008; Francis the Pope, 2015). As Mazur-Wierzbicka observes (2017), social and economic inequalities also pose a threat as they can considerably reduce the possibilities of providing adequate healthcare and prevention of disease. Human health thus depends not only on natural environment

determinants (such as climate change, availability of natural resources) but also on economic and social determinants (e.g. degree of affluence, unemployment). Therefore, public health and the attainment of a high quality of life by society are recognised as key challenges and indicators of sustainable development (e.g. Dobrzańska et al., 2008; *Health in the Framework of Sustainable Development* 2014; Bernat et al., 2017). It should be noted that since the publishing of the *Our Common Future* report (WCED, 1987), sustainable development is defined as development where the needs of the present generation may be satisfied without diminishing the opportunities of the future generations to satisfy their needs. The first principle of sustainable development formulated in the *Rio Declaration on Environment and Development* (1992) indicates that *human be-*

ings are at the centre of concerns for sustainable development. They are entitled to a healthy and productive life in harmony with nature. In accordance with sustainable development, the fulfilment of the material needs should be accompanied by the spiritual development of human beings (e.g. Borowska, 2012). The previous models of values and desires as well as consumption patterns must be changed (Kozłowski, 2005). Sustainable development means the necessity of preserving the equilibrium in the natural and the socio-economic environment, as well as the spiritual balance of human beings. This development is understood comprehensively in the ecological, cultural and economic sense (Kozłowski, 2005). The forms and dynamics of economic activity, institutions, lifestyles (mainly the volume of consumption) and population size should ensure an appropriate quality of life to every person in the present and future generations, and all aspects of this development will be secured by the availability of natural resources, ecosystems and life-supporting systems (Bergh, Nijkamp, 1991).

According to the idea of sustainable development, the progress of civilisation, which seeks to improve the quality of life of the present and future generations, may not occur at the expense of our environment. The preservation of the resources of this environment in such a condition that subsequent generations can use them is a key objective of the idea. From the ecological perspective, there is a call for limiting the pressure on the natural environment and for the fullest possible protection of natural resources. It is also necessary to correlate the objectives of sustainable development with the management of cultural landscape (Myga-Piątek, 2010) that should be treated as a strategic resource, similarly to the environment. According to Myga-Piątek (2011), what contributes to the shaping of diverse landscape and preservation of its identity and familiar character is sustainable tourism focused on reconciling the needs of tourists, the natural environment and local communities.

Nowadays, one can observe an intensification of efforts to identify and preserve landscape assets. There is a growing awareness of their significance for the tangible quality of life, the preservation of the identity of regions and communities inhabiting them. All these aspects are reflected in the *European Landscape Convention* (2000).

Already 40 years ago Daniłowa (1977) observed that the favourable influence of scenic landscapes on human health was indisputable. However, it is difficult to develop scientific methods to assess the psychological impact of different kinds of landscape. Daniłowa also noted that *some question the usefulness of such actions. The reality is that the findings of these studies have a practical application and can be used in choosing tourist regions* (Daniłowa, 1977, p. 239).

Numerous international conferences devoted to health and landscape have been held in recent years. The results of research on the subject have been reported in numerous publications, mainly in English. However, there is still a need for continued research, particularly in the context of sustainable development.

The objective of the analyses whose results are presented herein is to identify the correlations between health, landscape, and sustainable development. A number of questions were posed in the research process, including:

- What characteristics should landscape have to perform a therapeutic function?
- What places and landscapes should have a particularly positive therapeutic effect?
- What is the significance of the therapeutic values of landscape in sustainable development?

2. The basic concepts

According to the World Health Organization, the term *health* encompasses three spheres of life and denotes *a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity* (Constitution of the World Health Organization, 1948). This definition of health, despite varying opinions of it, has played a major role in recognising the importance of *positive health* and its environmental determinants (Kalamucka, 2017).

Based on an analysis of international literature from recent years, Kretowicz (2013) observes that the traditional understanding of health as the absence of disease has been replaced by regarding it as an experience. Woynarowska (2008) found more than 300 definitions of health, which proves the multiple dimensions of health and the difficulty of defining it accurately. For example, Bircher and Kuruvilla (2014: 363) define health as *a state of wellbeing emergent from conducive interactions between individuals' potentials, life's demands, and social and environmental determinants*. Aleksandrowicz and Woszczenko (1990) define health as the felt state of physical, mental and social fitness adequate and proportional to one's age. The condition of human health should be defined by at least two borders: objective physical and social fitness on the one hand, and the subjective border of one's well-being, ambitions, and aspirations. Therefore, classifications by various authors mention at least three dimensions of health – physical, social and psychological – while some indicate as many as six aspects of health (Walentynowicz-Moryl, 2017). Alongside the ones already mentioned, the intellectual, spiritual, emotional, professional and environmental aspects are mentioned. According to Hales (2012), the environmental dimension of human health refers to the interaction with the external, physical environment over which we have only limited control.

In the most general terms, human health is linked with a harmonious physical and mental development, and good adaptation to the surrounding environment, vital energy, physical fitness, ability to live actively and creatively, optimism, happiness; it is an asset, a positive, desired and highly valued state. The main factor determining the health of an individual and society is lifestyle, which accounts for more than 50% of the health potential (Woynarowska, 2008). Physical activity is by far the most important part of a healthy lifestyle.

The concept of health is linked with the concept of quality of life that directs attention to the positive aspects of human life and expands the objective measures such as health or affluence to include the subjective concept of well-being. In many concepts of quality of life, health is among values regarded as the most significant, and the semantic scope of health as broadly understood well-being is close to the quality of life in its subjective sense. Quality of life is determined by, among others, the possibility of leisure and recreation, the condition of the immediate surroundings and environment as well as ecological safety (Campbell et al., 2007). Studies on quality of life serve as a handy technique for acquiring information on changes taking place in healthcare, particularly the well-being of patients, that can prove useful in undertaking further treatment and restoring health. The usefulness of these studies depends on how accurately the state of health of an individual or group can be identified using quality of life measurement (Kałamucka, 2017)¹.

In the concept of health promotion, defined as the actions of the entire population regarding its every life (Karski, 1994), aimed at the achievement of physical, mental, and emotional well-being, the subjective sense of state of health was recognised, which has consequently made health research independent from the exclusively medical interpretation of health and one-sided assessment criteria complying with the norms adopted by physicians. It was emphasised that health is linked with various aspects of societal life and the life of individuals. Thus, the promotion of health denotes actions that influence the relationships between *health and the economy*, *health and the environment*, *health and the society as well as*

health and the individual (Słońska, 2008, p. 83). Therefore, the goal of health promotion is to enable individuals and communities to improve their state of health by controlling all modifiable factors, including the physical environment, that determine health (Słońska, 2008). It should be noted that already the *Constitution of the World Health Organization* (1948) stressed that *healthy development of the child is of basic importance; the ability to live harmoniously in a changing total environment is essential to such development*. Thus, a correlation was indicated between sustainable socio-economic development and the state of health throughout human life, particularly in the youngest age group.

Colloquially speaking, landscape is most often regarded as the view, the scenery that surrounds us. In science, however, the term *landscape* is construed as a multi-layered reality, the information system of the environment, a set of actually existing processes, a system of interrelated processes, a set of stimuli perceived by various human senses (including a set of views), a set of values, and a system providing actual and potential services for various groups of users (e.g. Richling, Solon, 2011). The European Landscape Convention (2000) defines landscape as *an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors*. It is regarded as a key element of the welfare of the entire society and individuals, and its preservation and planning entail certain duties for every person. Landscape is experienced universally; hence it impacts the quality of people's life wherever they might live: in towns, cities and rural areas, in environmentally valuable and degraded areas, in special and ordinary places. As the explanatory reports the European Landscape Convention show, the perception² of landscape has a multisensory character. The sound and smell as well as the touch and taste contribute to a positive or negative overall assessment of landscape by people, and influence the quality of life (*Landscapes and individual and social well-being*, 2003; *Landscape and sustainable development*, 2006). Landscape enhances and develops sensory experiences. Limited experiences and sensations result in reduced quality of life. Contributing to the development of high-quality landscapes in order

¹ It should be stressed that Kałamucka (2017) analysed the concepts for research on quality of life, ecosystem services and securing livelihood; she also systematised knowledge on the subject, taking into account the role of geographical factors. She proposed a new, synthetic approach where quality of life, being the most comprehensive term, widely adopted as a measure of the effects of sustainable development and a desired life goal, remains a key concept. The new research proposal allows combining a static assessment of quality of life, captured in a specific time frame, with a description of ways of securing livelihood, with the concept of ecosystem services included in the structure of quality of life.

² Perception is not the same as seeing: it is an active process where we perceive an object or phenomenon with

our senses (sensory and motor aspect), and we process the information thus obtained in a way that is determined by our pre-existing knowledge and emotions (semantic and emotional aspect) as well as the specific situation, the here and now. This process leads to remembering the perceived image or another sensory experience, but we remember it in our own way (Pawłowska, 2008). According to Wojciechowski (1994), the perception of landscape is an element of the perception of the environment in its broad understanding, as perceiving, sensing and experiencing, then as interpretation through conscious and subconscious association with the models stored in the mind, and finally, as the formation of attitudes to the perceived objects, their mutual relations, and the situation of the perceiver in such systems.

to improve the quality of life of European citizens was recognised as the basic objective of the *European Landscape Convention (Landscape and sustainable development, 2006)*.

3. The therapeutic effect of landscape

There is a close relationship between people and the landscape in which they live. Kozłowski (2005) observes that it is to landscape that we owe not only our living conditions but also many traits of our character. Landscape is a source of numerous values for people: symbolic (the sacred, the *genius loci*), emotional (familiarity, tradition, identity), aesthetic (grandeur, beauty, harmony, natural state, diversity), source of information (content, antiquity, historic nature, authenticity, representative nature, uniqueness, otherness), economic and utilitarian values (Myga-Piątek, 2012) as well as therapeutic values (Kopczyński, Skoczylas 2008) resulting from the positive impact of harmonious landscape on human psyche. The contemplation of a beautiful landscape allows one to forget about everyday worries and can provide relaxation and restoration of energy. Thus, landscape can be an environment where people can recuperate, where their physical and mental state can be improved and their stress levels can be reduced (Chwalibóg, Wolski, 2015).

As early as the 1980s, Wojciechowski (1986) observed that the aesthetic values of landscape constitute a very significant component of quality of life (perceived at all times), and play an important role in the shaping of several significant spiritual qualities of a human individual. The richness of positive experiences coming from landscape enriches the human psyche, strengthens the cognitive and creative passion and, finally, enhances the joy of life. On the other hand, ugliness, chaos, the littering and degradation of the environment frequently result in spiritual poverty, and can even lead to violence, aggression or apathy (Bernat, Kałamucka, 2008). The components and characteristics of landscape thanks to which the basic human needs according to Maslow's hierarchy (1954), i.e. biological and social needs, can be satisfied include: the existence of high-quality green areas and other recreation areas ensuring healthy conditions; the possibility of reducing noise and other kinds of pollution; suitable conditions for enhancing the sensory and emotional apparatus; conditions inspiring creative activity and conducive to emotional experiences; and the potential to build and strengthen the identity of individuals (Wojciechowski, 2004).

The aesthetic values of landscape are significant for the formation of a special emotional bond between a person and a place based on a sense of belonging or

ownership (Pawłowska, 2001). The landscapes of native places shape people's perception habits, the perspective through which they perceive reality. One can talk about the familiarity of landscape, a quality specific to spaces perceived as giving a sense of safety and comfort. A specific image of familiarity accompanies people throughout their lives, as they move with this image inscribed in their memory and *domesticate* new places.

Although experiencing landscape is personal, it is a point of reference for social interactions. Satisfaction with life in a harmonious landscape can be a significant factor shaping positive relations among people. Harmonious landscapes also contribute to an increase in civic engagement and a stronger sense of belonging to a particular place (Chwalibóg, Wolski, 2015). A great number of local associations are established in areas characterised by high-quality landscape, often with the aim of preserving it. The appropriate shaping of landscape protects society against losing its roots and fosters the creation of interpersonal ties (*Landscape and sustainable development, 2006*).

Experimental studies confirm the conclusions mentioned above. As early as the 1980s, Ulrich (1984) indicated that a view from the window should be treated as conducive to the recovery of hospital patients. His research findings clearly show that the possibility to see the natural surroundings out of the window of a hospital room speeds up the recovery of patients after surgery and reduces the amount of painkillers used in comparison with patients whose rooms had windows facing a wall (Ulrich, 1984).

Studies conducted in the Netherlands show that a view of a park from the window of an apartment increases its market value by 8%, and the proximity of the park increases the value by 6% (Luttik, 2000), which is probably linked with the awareness of the influence of landscape values on health and quality of life. According to Wilson (1984, 2008), who introduced the biophilia hypothesis³, people having the option to choose a place to live or work, prefer places that allow them to look at the surroundings from a distance, i.e. some kind of open areas of the savannah type (grassy areas with scattered copses of trees), places characterised by the presence or proximity of water bodies, even if these only have an aesthetic function. As Kaplan and Kaplan (1989) proved, looking at a harmonious landscape with the predominance of plant components is soothing and accelerates recovery from mental fatigue. Osikowska and Przetacznik (2007) observed that a park or garden, water, and wooded hills are the landscape features that raise property prices to the greatest extent. Furthermore, the possibility of looking at an interesting panoramic view is important. Landscape

³ The biophilia hypothesis explains the natural innate mechanism thanks to which connecting with nature alleviates stress and reduces muscle tension (Trojanowska, 2017).

features that generate noise (e.g. industrial and transport facilities, etc.) are undesirable and can reduce property prices. The presence of noise has a significant impact on the value of property, particularly residential property (e.g. Senetra et al., 2014) because, more and more often, it is regarded as a serious threat to health (e.g. Edworthy, 1997; Seidman, Stranding, 2010). In the light of the European Environment Agency Report *Quiet areas in Europe* (2016), only 18% of Europe's area (particularly countries with low population density: Finland, Iceland, Norway and Sweden) can be regarded as tranquil while the potential impact of noise pollution can be observed in 33% of the area. As much as 20% of protected areas are exposed to high noise levels. Therefore, tranquil areas must be protected to ensure the protection of human health and preservation of biodiversity.

In the 1940s, the term *landscape potential* was introduced to denote all resources and assets of landscape (its physical and aesthetic properties) enabling it to satisfy human physical and mental needs, at present and in the future, and to maintain this capacity through self-adjusting and self-protecting mechanisms (Kistowski, 1997). The following basic potentials of landscape are distinguished: self-adjusting and self-protecting, resource-related and functional, perception-related and behavioural⁴, the latter construed as landscape's capacity to influence human senses and stimulate human behaviour (Przeżoński, 1991). The resource-related and functional potential comprises, for example, the recreational-balneological potential, i.e. the landscape's capacity to satisfy human needs with regard to recreation and health.

In the 1980s, standards (definitions) concerning landscapes, their protection and rational use, were developed for Comecon countries. One of them was *comfort of landscape* denoting a measure of the medical-biological and social-psychological benefits of living conditions in a specific landscape. *Comfort of landscape* can be achieved by observing the environmental quality standards (including noise standards) and taking into consideration inhabitants' opinions with regard to the emotional ties with the surroundings, the sense of familiarity and security.

In the 1990s, the term *ecosystem services* was introduced to denote the benefits derived, directly or indirectly, by the human population from the functioning of ecosystems (Constanza et al., 1997). In recent years, this term has been replaced by the term *landscape services* that is deemed more appropriate due to the integration of natural environment and cultural aspects, and the inclusion of spatial models and involvement of stakeholders, particularly in the context of local landscape planning (e.g. Verburg et al.,

2009). Landscape services are divided into four main groups: provisioning, regulatory, auxiliary, and cultural. The last group above includes aesthetic, recreational, spiritual, scholarly, and educational functions (e.g. Constanza et al., 1997; Dłużewska, 2016). Vallés-Planells et al. (2014) noticed that, in the classification of landscape services, cultural services should also refer to intangible resources obtained through people's contact with ecosystems. Therefore, they distinguished four categories within cultural services: mental and physical health, entertainment, social fulfilment and self-fulfilment. In the last category, they distinguished, among others, spiritual and inspiring experiences.

In the 1990s, Gesler (1992) put forward the concept of therapeutic landscape, described by him as varying places, situations, spaces, backgrounds, interiors, encompassing both the tangible and non-tangible (psychological) environment, associated with therapy or treatment, influencing physical, mental and spiritual healing. Therapeutic landscapes are places of everyday health promotion, conducive to the restoration of physical and mental health, e.g. through contact with nature and possibility of experiencing it with various senses. Therapeutic places, a concept linked with therapeutic landscapes, are places with an established reputation as supporting the health recovery process (Gesler, 2003), e.g. health resorts, mountain and seaside areas, pilgrimage centres. These places are usually accompanied by valuable natural assets (mineral springs, forests), attractive landscapes, and, in the case of religious sites, an atmosphere of mysticism (Gesler, 1996; Williams, 2010; Perriam, 2015). The idea of therapeutic landscapes was developed by Williams (1999, 2007), recognising spirituality as the most intangible dimension of these landscapes. Highlighting the relationship of health with the quality of the environment in the place of residence, Kearns and Andrews (2010) observed that the geographic scope of research should be expanded to include therapeutic landscapes, and that geography should participate in research on the individual and collective experience of places. The subject of the impact of landscape on health and quality of life has also been studied by scholars such as Abraham et al. (2010), Thompson (2011), Rose (2012), Doughty (2013), Tsunetsugu et al. (2013), Bell et al. (2015), Houghton and Houghton (2015), Liamputtong and Suwankhong (2015), Meijering et al. (2017). This is related to the wide range of positive changes in brain activity, blood pressure, heart action and muscle tension. As demonstrated by Wolf and Flora (2010), the therapeutic role of landscape is manifested in the improved mental state in persons affected by various mental conditions, including depression from which

⁴ According to Malinowska (2006), the perception-related and behavioural potential is the subjectively perceived pleasure of staying in a particular place, generally evaluated visual attractiveness, stress-relieving properties,

accessibility, presence of extensive views, occurrence of positive or negative non-visual stimuli, including auditory and olfactory ones.

about 350 million people currently suffer, according to WHO. According to Velarde et al. (2007), generally natural and open landscapes have a more positive impact on health as compared to urban, closed landscapes: they improve well-being, alleviate anxiety and pain, and reduce stress, blood pressure, heart rate, muscle tension and electrical conductivity of the skin (Ulrich, Simons, 1986). An important role is played by vegetation (including vegetation seen from the window and within a one-kilometre radius from one's place of residence) and water as they have a regenerating effect on physical and mental fatigue (e.g. Gesler, 1992). It is necessary to search for functional landscape models conducive to human health and sustainable development. Using the research findings in the planning and designing of landscape is a key research challenge for the future. Menatti and de Rocha (2016) observe that perception is the key to understanding the health–landscape relationship.

According to Trojanowska and Sas-Bojarska (2013), the therapeutic properties of landscape should be part of the assessment of investment projects impact on health and landscape. An in-depth study of potential landscape transformations, including the lost therapeutic values, is necessary already at the initial planning stage of an investment project. Landscape must be properly shaped to ensure the strengthening of health.

A particularly important factor supporting the therapeutic effect is the presence of natural landscapes or natural elements in landscape. Green areas, providing a kind of refuge and giving a sense of comfort, safety, peace and attachment, are regarded as a significant form of support in therapy. The focus on health is a source of demand for tourism in natural landscapes (Toczek-Werner, Sołtysik, 2012). Innovative forms of health or wellness tourism are implemented in environmentally valuable areas (Pietrzak-Zawadka, Zawadka, 2016).

Green therapy, i.e. treatment of minor mental and emotional disorders where the administration of drugs is replaced by direct contact with nature and the beneficial effect of natural landscapes, the smells and sounds of nature on human psyche, becomes an integral part of the treatment and rehabilitation process (Poskrobko, 2013). Experiencing nature as a way to improve one's mood and concentration, and to alleviate stress, has led to the development of horticultural therapy, forest therapy and terrain therapy. Horticultural therapy is a form of treatment and rehabilitation that involves gardening and is used to

treat individuals with psychological, mental, physical, sensory, geriatric, addiction or social disorders, in order to improve their physical and mental condition as well as their interactions with other people (Dorn, Relf, 1995). Forest therapy uses the therapeutic effect of forests (e.g. Karjalainen et al., 2010). Experimental studies show that a fifteen-minute walk in the forest causes profound changes in the human nervous and hormonal system (Park et al., 2010). Terrain therapy is based on various forms of dynamic physical exercise in terrain with varying scenery and landforms (Ponikowska, Marciniak, 1988). The therapeutic effect of this method is linked with the influence of meteorological and landscape factors and physical exercise. Its goal is to improve the motor function and motor coordination, enhance physical fitness and increase blood supply to bodily organs through a beneficial effect on the cardiovascular and respiratory system.

Recent years have seen a growing interest in designing therapeutic gardens, whose origins go back to ancient and mediaeval times (Pudelska et al., 2016). Therapeutic parks and gardens, specially designed to support treatment and use the healing properties of nature, should be equipped with attributes conducive to the restoration of health; among other effects, they should stimulate all human senses (Trojanowska, 2017). The following kinds of therapeutic parks can be distinguished: spa parks⁵, established to improve the physical and mental health of residents; open areas with a sports and leisure function, adapted to a specific group of users; hospital, sanatorium and nursing home parks and parks in housing developments for elderly people; parks (or sections of parks) designed for horticultural therapy (e.g. Hazen, 1995; El-Barmelgy, 2013, Jaszczak, 2016). Such parks, both public and of a specialist character, are popular in the United States and western Europe (Trojanowska, 2017). Here are a few examples of special-purpose parks designed for patients with specific kinds of medical conditions: Portland Memory Garden (USA), supporting the treatment of dementia and Alzheimer's disease; Jardin Grain de Vie (*Grain of Life*) of the Pierre and Marie Curie Institute in Paris (France), supporting the treatment of cancer disease; the therapeutic garden at the Swedish University of Agricultural Sciences in Alnarp (Sweden). Biblical gardens⁶ constitute a peculiar variety of therapeutic gardens. They are described as *spaces for spiritual relaxation, an imitation of the image of paradise, and peculiar spa parks* (Włodarczyk, 2013). These are themed gardens where various forms of expression

⁵ At present, there are approximately 1500 various spas and health resorts, most of them being located in Germany (350), Italy (300), Spain (128) and France (107). Europe's largest spa park, with an area of 52 ha, is located in Baden bei Wien (Austria).

⁶The first biblical garden was established in Carmel-by-the-Sea, California (USA) while the first such garden in Europe was founded in Wales (United Kingdom) in 1961.

Since 2005, the number of biblical gardens has been growing rapidly, particularly in Germany where there are 30 gardens (Włodarczyk, 2013). Alongside the countries mentioned above, biblical gardens can be found in Australia, Austria, Croatia, Spain, the Netherlands, Ireland, Israel, Japan, Switzerland, Poland, Ukraine and other countries.

are used to build scenery imitating the Holy Land, its landscapes and famous buildings. The vegetation in biblical gardens is composed of plants mentioned in the Gospel. They are accompanied by quotations and biblical scenes in which these plants appear. Biblical gardens perform a number of complementary functions and, as it turns out, satisfy several human needs. On the one hand, they have an educational purpose in that they teach about the world and life in biblical times; they act as a cultural medium, and can be used both in evangelisation and ecumenical work. By becoming tourist attractions, they can be conducive to the shaping of desirable moral attitudes, also in relation to landscape. On the other hand, they are tranquil places for rest, reflection and prayer, allowing one to discover the meaning of life. Thanks to their visual, auditory and other values, they convey positive aesthetic models, give joy, and enable recreation and relaxation; sometimes they even have a therapeutic function (Włodarczyk, 2013).

4. Conclusions and final remarks

The *European Landscape Convention* is right in stating that landscape requires legal protection because of its unique value to individuals and society. It should be added, however, that the value of landscape also encompasses health. Comprehensive measures to improve the health of individuals and societies should take into account the therapeutic effect of landscape to a greater extent.

Perception is the key to understanding the therapeutic properties of landscape. It is through perception that we establish relationships with landscape which influences our health in its mental (intellectual, emotional), physical, social, and spiritual dimension. It should be noted, however, that the therapeutic effect of landscape depends on many individual factors, e.g. the traits of the individuals perceiving landscape and their expectations, and the context that is influenced, for example, by atmospheric conditions. That is why the attributes of a therapeutic landscape cannot be determined with great precision. The therapeutic properties of landscape are usually associated with its natural character (vegetation, water), beauty, harmony, diversity, familiarity, uniqueness, rich symbolism, open views, and presence of positive multisensory stimuli.

Environmentally valuable areas (especially national parks and nature reserves) have a particularly positive therapeutic effect. Other green areas, including city parks, also play an important therapeutic function. Spas and health resorts (especially spa parks located in the so-called A zone) as well as places of religious cult and their surroundings should also be

regarded as unique therapeutic places. Besides those mentioned above, ordinary local landscapes, particularly those of special emotional value to the individual perceiving them, can also have a therapeutic effect.

The therapeutic values of landscape are of great importance in sustainable development. Therapeutic landscapes are places of health promotion, conducive to the restoration of physical, mental, and spiritual health, e.g. through contact with nature and possibility of experiencing it with various senses. They are also a source of comfort, providing advantageous living conditions for people, which is linked with the compliance with environmental quality standards, among other factors. The protection of therapeutic landscapes should be one of the goals of sustainable development because it involves, *inter alia*, the protection of the natural and cultural environment (especially in environmentally valuable areas), and lots of benefits in the economic and social sphere, including the strengthening of health and spiritual development of the human population on which sustainable development is focussed after all. The therapeutic values of landscapes also offer a possibility for the development of sustainable tourism, which often constitutes an opportunity for the economic development of a given region. It should also be remembered that healthy landscapes influence the quality of life of present and future generations.

In response to social demand, it is necessary to use the possibilities of strengthening health by properly shaping landscape and utilising its therapeutic values, e.g. through the proper maintenance of green areas, water bodies, and tranquil areas, particularly in urbanised areas. Typically, cities are not a source of varied and positive sensory experiences. As Czałczyńska-Podolska and Rzeszotarska-Pałka (2016) observed, spaces with a therapeutic and integrating function should be an inspiration to design human-friendly cities. According to Gehl (2014), urban design must take into account the human dimension, which is manifested in strengthening the role of pedestrians and the role of urban space as a gathering place. Urban design should also recognise the role of the senses, particularly vision, as the basis for behaviours, actions and communication in space. Therefore, Gehl emphasises the need to protect interesting, unobstructed views and the acoustic climate (low noise levels)⁷. The accomplishment of the above goals will result in *human-friendly cities*, cities that are full of life, safe and healthy. The creation of a healthy urban environment (free of pollution, noise, with numerous green areas) is also one of the goals of sustainable development (e.g. Naess, 2001).

⁷ Corburn (2009) also pointed at the acoustic environment as a key factor in the creation of healthy cities. This issue was also the subject of the conference in Stockholm (Eu-

ropean Green Capital, 2010), entitled *Designing Sound-
scape for Sustainable Urban Development*.

References

1. ABRAHAM A., SOMMERHALDER K., ABEL T., 2010, Landscape and well-being: a scoping study on the health-promoting impact of outdoor environments, in: *Int. J. Public Health*, 55(1), p. 59-69.
2. ALEKSANDROWICZ J., WOSZCZENKO P., 1990, Środowisko w perspektywie medycznej: humanizm ekologiczny szansą przetrwania, in: *Człowiek – środowisko – zdrowie*, eds. Kopczyński J., Siciński A., Zakład Narodowy im. Ossolińskich, PAN, Wrocław.
3. BELL S., PHOENIX C., LOVELL R., WHEELER B., 2015, Seeking everyday wellbeing: The coast as a therapeutic landscape, in: *Social Science & Medicine*, 142, p. 56-67.
4. BERGH J.C.J.M., NIJKAMP P., 1991, Operationalizing sustainable development: dynamic ecological-economic model, in: *Ecological Economics*, 4, p. 11-23.
5. BERNAT S., KAŁAMUCKA W., 2008, The 'landscape experienced' in empirical research conducted by Lublin scholars, in: *Methods of landscape research*, eds. Plit J., Andreychouk V., Dissertation Commission of Cultural Landscape of Polish Geographical Society no 8, Sosnowiec, p. 21-33.
6. BERNAT S., FLAGA M., KAŁAMUCKA W., 2017, The shaping of sustainable landscape in the context of the European Landscape Convention and the Encyclical *Laudato Si'*, in: *Problemy Ekorozwoju/Problems of Sustainable Development*, 12(2), p. 123-131.
7. BIRCHER J., KURUVILLA S., 2014, Defining Health by Addressing Individual, Social, and Environmental Determinants: New Opportunities for Healthcare and Public Health, in: *Journal of Public Health Policy*, 35, p. 363-386.
8. BOROWSKA A., 2012, Rozwój zrównoważony a rozwój duchowy człowieka, in: *Economy and Management*, 2, p. 20-27.
9. CAMPBELL F., BODLEY A., BERKELEY C., 2007, *Measuring Quality of Life: Does Local Environmental Quality Matter?*, ENCAMS Research Report.
10. CHWALIBÓG K., WOLSKI P., 2015, To co ważne dla przeciwdziałania destrukcji krajobrazu, in: *Krajobraz kulturowo-przyrodniczy z perspektywy społecznej*, eds. Ratajski S., Ziółkowski M., Polski Komitet ds. UNESCO, Narodowe Centrum Kultury, Warszawa, p. 71-95.
11. *CONSTITUTION of the World Health Organization*, WHO, New York 1948.
12. CORBURN J., 2009, *Toward the Healthy City: People, Places, and the Politics of Urban Planning*, The MIT Press Cambridge, Massachusetts, London, United Kingdom.
13. COSTANZA R., D'ARGE R., DE GROOT R., FARBER S., GRASSO M., HANNON B., LIMBURG K., NAEEM S., O'NEILL R.V., PARUELO J., RASKIN G.R., SUTTON P., VAN DER BELT M., 1997, The value of the world's ecosystem services and natural capital, in: *Nature*, 387, p. 253-260.
14. CZAŁCZYŃSKA-PODOLSKA M., RZESZOTARSKA-PĄŁKA M., 2016, Spaces that heal and integrate as inspiration for a new look on the modern city, in: *Space & Form*, 28, p. 165-180.
15. DANIŁOWA N., 1988 (1977), *Przyroda i nasze zdrowie*, Wiedza Powszechna, Warszawa.
16. DŁUŻEWSKA A., 2016, Cultural Ecosystem Services – Framework, Theories and Practices, in: *Problemy Ekorozwoju/Problems of Sustainable Development*, 12(1), p. 101-110.
17. DOBRZAŃSKA B., DOBRZAŃSKI G., KIELCZEWSKI D., 2008, *Ochrona środowiska przyrodniczego*, PWN, Warszawa.
18. DORN S., RELF D., 1995, Horticulture: Meeting the needs of special populations, in: *Hort Technology*, 5(2), p. 94-103.
19. DOUGHTY K., 2013, Walking together: The embodied and mobile production of a therapeutic landscape, in: *Health & Place*, 24, p. 140-146.
20. EDWORTHY J., 1997, Noise and its effects on people: an overview, in: *International Journal of Environmental Studies*, 51(4), p. 335-344.
21. EL BARMELGY H., 2013, Healing Gardens' Design, in: *International Journal of Education and Research*, 1(6), p. 4.
22. *EUROPEAN Landscape Convention*, The Council of Europe, Florence 2000.
23. FRANCIS THE POPE, 2015, Encyclical *Laudato Si'*, Vatican.
24. GEHL J., 2014, *Miasta dla ludzi*, RAM, Kraków.
25. GESLER W., 1992, Therapeutic landscapes: medical issues in light of the new cultural geography, in: *Social Science and Medicine*, 34(7), p. 735-746.
26. GESLER W., 1996, Lourdes: healing in a place of pilgrimage, in: *Health and Place*, 2(2), p. 95-105.
27. GESLER W., 2003, *Healing places*, Rowman & Littlefield, Lanham.
28. GUS, 2017, *Jakość życia w Polsce w 2015 r., wyniki badania spójności społecznej*, Studia i Analizy Statystyczne GUS, Warszawa.
29. HALES D., 2012, *An invitation to health: choosing to change*, Wadsworth Cengage Learning, Belmont.
30. HAZEN T., 1995, Therapeutic Garden Characteristics, in: *The American Horticultural Therapy Association*, 41(2), p. 3.
31. HEALTH IN THE FRAMEWORK OF SUSTAINABLE DEVELOPMENT, 2014, *Technical Report for the Post-2015 Development Agenda*, Sustainable Development Solutions Network.
32. HOUGHTON F., HOUGHTON S., 2015, Therapeutic micro-environments in the Edgelands: A thematic analysis of Richard Mabey's *The Unofficial Countryside*, in: *Social Science & Medicine*, 133, p. 280-286.
33. JASZCZAK A., 2016, 'Zielona' i 'niebieska' terapia w niemieckich uzdrowiskach (na przykładzie Kurortu Bad Bevensen), in: *Hortiterapia – terapia wspomagająca rehabilitację dzieci i dorosłych*, ed. Płoszaj-Witkowska B., Wydawnictwo UWM, Olsztyn, p. 35-47.
34. KAŁAMUCKA W., 2017, *Jakość życia i zabezpieczenie egzystencji z perspektywy geograficznej*, Wyd. UMCS, Lublin.
35. KAPLAN R., KAPLAN S., 1989, *The Experience of Nature: a Psychological Perspective*, Cambridge University Press, Cambridge.
36. KARJALAINEN E., SARJALA T., RAITIO H., 2010, Promoting human health through forests: overview and major challenges, in: *Environmental Health and Preventive Medicine*, 15, p. 1-8.
37. KARSKI J.B., 1994, Zdrowie i promocja zdrowia. Aspekt ewolucyjny, in: *Promocja zdrowia. Wprowadzenie do zagadnień krzewienia zdrowia*, eds. Karski

- J.B., Słońska Z., Wasilewski B.W., Sanmedia, Warszawa, p. 15-24.
38. KEARNS R.A., ANDREWS G., 2010, Geographies of well-being, in: *The SAGE Handbook of Social Geographies*, SAGE, eds. Smith S.J., Pain R., Marston S., Jones J. P., London, p. 309-328.
 39. KISTOWSKI M., 1997, Studium związków pomiędzy strukturą i potencjałem krajobrazu młodoglacjalnego (na przykładzie okolic Elku), in: *Prace i Studia Geograficzne, 21, Studia Geoekologiczne*, Uniwersytet Warszawski, Wydział Geografii i Studiów Regionalnych, p. 43-64.
 40. KOPCZYŃSKI K., SKOCZYŁAS J., 2008, *Krajobraz przyrodniczy i kulturowy. Próba ujęcia interdyscyplinarnego*, Badania Interdyscyplinarne UAM w Poznaniu, no 13, UAM, Poznań.
 41. KOZŁOWSKI S., 2015, *Przyszłość ekorozwoju*, Wyd. KUL, Lublin.
 42. KRETOWICZ P., 2013, Nowe podejścia badawcze w geografii zdrowia w literaturze anglosaskiej, in: *Przegląd Geograficzny*, 85(4), p. 549-571.
 43. *LANDSCAPES and Individual and Social Well-being*, 2003, European Landscape Convention Report Theme of the 2003 Workshop, Council of Europe Strasbourg 2003.
 44. *LANDSCAPE and Sustainable Development: Challenges of the European Landscape Convention*, 2006, Council of Europe, Strasbourg.
 45. LIAMPUTTONG P., SUWANKHONG D., 2015, Therapeutic landscapes and living with breast cancer: The lived experiences of Thai women, in: *Social Science & Medicine*, 128, p. 263-271.
 46. LUTTIK J., 2000, The value of trees, water and open spaces as reflected by house prices in the Netherlands, in: *Landscape and Urban Planning*, 48, p. 161-167.
 47. MALINOWSKA E., 2006, Zmiany walorów wizualnych krajobrazu w dolinie Narwi, in: *Problemy Ekologii Krajobrazu*, vol. XVIII, Zakład Ochrony Środowiska UMCS Lublin, p. 305-313.
 48. MASLOW A.H., 1954, Motivation and personality, in: *Journal of Personality*, 22(3), p. 326-347.
 49. MAZUR-WIERZBICKA E., 2017, Zdrowie publiczne jako element zrównoważonego rozwoju – analiza komparatywna. Polska na tle Unii Europejskiej, in: *Studia Ekonomiczne* 310, Zeszyty Naukowe Uniwersytetu Ekonomicznego w Katowicach, p. 53-67.
 50. MEIJERING L., LETTINGA A., NANNINGA CH., MILLIGAN CH., 2017, Interpreting therapeutic landscape experiences through rural stroke survivors' biographies of disruption and flow, in: *Journal of Rural Studies* 51, p. 275-283.
 51. MENATTI L., DA ROCHA A.C., 2016, Landscape and Health: Connecting Psychology, Aesthetics, and Philosophy through the Concept of Affordance, in: *Front Psychol.* 7, p 571.
 52. MYGA-PIĄTEK U., 2010, Przemiany krajobrazów kulturowych w świetle idei zrównoważonego rozwoju, in: *Problemy Ekorozwoju/ Problems of Sustainable Development*, 5(1), p 95-108.
 53. MYGA-PIĄTEK U., 2011, Koncepcja zrównoważonego rozwoju w turystyce, in: *Problemy Ekorozwoju/ Problems of Sustainable Development*, 6(1), p. 145-154.
 54. MYGA-PIĄTEK U., 2012, *Krajobrazy kulturowe. Aspekty ewolucyjne i typologiczne*, Uniwersytet Śląski, Katowice.
 55. NAESS P., 2001, Urban planning and sustainable development, in: *European Planning Studies* 9(4), p. 504-524.
 56. OSIKOWSKA W., PRZETACZNIK J., 2007, Problemy percepcji i oceny estetycznej krajobrazu Krakowa, in: *Roczniki Geomatyki*, 5(8), p. 79-88.
 57. PARK B.J., TSUNETSUGU Y., KASETANI T., KAGAWA T., MIYAZAKI Y., 2010, The physiological effects of Shinrin-yoku (taking in the forest atmosphere or forest bathing): evidence from field experiments in 24 forests across Japan, in: *Environ Health Prev Med.*, 15(1), p. 18-26.
 58. PAWŁOWSKA K., 2001, Idea swojskości krajobrazu kulturowego, in: *Krajobraz kulturowy. Idee, problemy, wyzwania*, ed. Myga-Piątek U., Wydział Nauk o Ziemi Uniwersytetu Śląskiego, Oddział Katowicki Polskiego Towarzystwa Geograficznego, Sosnowiec, p. 95-101.
 59. PAWŁOWSKA K., 2008, *Przeciwdziałanie konfliktom wokół ochrony i kształtowania krajobrazu. Partycypacja społeczna, debata publiczna, negocjacje*, PK, Kraków.
 60. PERRIAM G., 2015, Sacred Spaces, Healing Places: Therapeutic Landscapes of Spiritual Significance, in: *J Med Humanit*, 36, p. 19-33.
 61. PIETRZAK-ZAWADKA J., ZAWADKA J., 2016, Obszary przyrodniczo cenne jako miejsce realizacji innowacyjnych form turystyki zdrowotnej na przykładzie lasoterapii, in: *Studia Ekonomiczne i Regionalne*, 9(3), p. 112-120.
 62. PONIKOWSKA I., MARCINIAK K., 1988, *Ciechocinek – terenoterapia uzdrowiskowa*, PWN, Warszawa.
 63. POSKROBKO B., 2013, Zielona terapia i rekreacja jako nowy produkt turystyczny, in: *Problemy Turystyki i Rekreacji*, 3, p. 5-23.
 64. PRZEWOŹNIAK M., 1991, *Krajobrazowy system interakcyjny strefy nadmorskiej w Polsce*, Wyd. Uniwersytetu Gdańskiego, Gdańsk.
 65. *PUBLIC Health and Landscape, Creating Healthy Places*, 2013, Landscape Institute Position Statement, London.
 66. *QUIET Areas in Europe. The Environment Unaffected by Noise Pollution*, 2016, EEA Report No 14.
 67. PUDELSKA K., DUDKIEWICZ M., DURLAK W., PARZYMIES M., 2016, Ranga dawnych i współczesnych ogrodów terapeutycznych, in: *Acta Sci. Pol. Form. Circumiectus*, 15(1), p. 125-137.
 68. RICHLING A., SOLON J., 2011, *Ekologia krajobrazu*, PWN, Warszawa.
 69. ROSE E., 2012, Encountering place: A psychoanalytic approach for understanding how therapeutic landscapes benefit health and wellbeing, in: *Health & Place*, 18, p. 381-1387.
 70. SEIDMAN M. D., STANDRING R.T., 2010, Noise and Quality of Life, in: *Int. J. Environ. Res. Public Health.*, October, 7(10), p. 3730-3738.
 71. SENETRA A., SZCZEPAŃSKA A., WASILEWICZ-PSZCZÓŁKOWSKA M., 2014, Traffic noise as a factor driving apartment prices-a case study of a large European urban agglomeration, in: *Acoustics Australia*, 42 (1): 47-50.

72. SŁOŃSKA Z., 2008, Nowe oblicze medykalizacji: redefinicja i marginalizacja promocji zdrowia, in: *Socjologia i antropologia medycyny w działaniu*, eds. Piątkowski, Płonka-Syroka B., Arboretum, Wrocław.
73. THOMPSON C., 2011, Linking landscape and health. The recurring theme, in: *Landscape and Urban Planning*, 99, 3-4, p. 187-195.
74. TOCZEK-WERNER S., SOŁTYSIK M., 2012, Orientacja na dobrostan i zdrowie jako źródło popytu na turystykę w naturze i naturalnych krajobrazach. Zdrowotnej, in: *Zeszyty Naukowe Uniwersytetu Szczecińskiego. Ekonomiczne Problemy Usług*, 83, p. 279-292.
75. TROJANOWSKA M., 2017, *Parki i ogrody terapeutyczne*, PWN, Warszawa.
76. TROJANOWSKA M., SAS-BOJARSKA A., 2013, Ocena wpływu inwestycji na zdrowie w świetle badań nad terapeutycznymi właściwościami krajobrazu, in: *Architektura Krajobrazu*, 40(3), p. 94-107.
77. TSUNETSUGU Y., LEE J., PARK B.-J., TYRVÄINEN L., KAGAWA T., 2013, Physiological and psychological effects of viewing Urban forest landscapes assessed by multiple measurements, in: *Landscape and Urban Planning*, 113, p. 90-93.
78. ULRICH R.S., 1984, View through a window may influence recovery from surgery, in: *Science*, Vol. 224(4647), p. 420-421.
79. UN, *The Rio Declaration on Environment and Development*, 1992, Rio De Janeiro.
80. VALLÉS-PLANELLIS M., GALIANA F., VAN EETVELDE V., 2014, A classification of landscape services to support local landscape planning, in: *Ecology and Society*, 19(1), p. 44.
81. VELARDE M.D., FRY G., TVEIT M., 2007, Health effects of viewing landscapes – Landscape types in environmental psychology, in: *Urban Forestry & Urban Greening*, 6, p. 199-212.
82. VERBURG P. H., VAN DE STEEG J., VELD-KAMP A., WILLEMEN L., 2009, From land cover change to land function dynamics: A major challenge to improve land characterization, in: *Journal of Environmental Management*, 90, p. 1327-1335.
83. WALENTYNOWICZ-MORYL K., 2017, Wielowymiarowe modele zdrowia, in: *Hygeia Public Health*, 52(1), p. 1-5.
84. WCED (WORLD COMMISSION ON ENVIRONMENT AND DEVELOPMENT), 1987, *Our Common Future*, Oxford University Press, New York 1987.
85. WILLIAMS A., 1999, Therapeutic landscapes in holistic medicine, in: *Social Science & Medicine*, 46(9), p. 1193-1203.
86. WILLIAMS, A. (ed.), 2007, *Therapeutic landscapes*, London, Ashgate Publishing.
87. WILLIAMS A., 2010, Spiritual therapeutic landscapes and healing: A case study of St. Anne de Beaupre, Quebec, Canada, in: *Social Science & Medicine*, 70, p. 1633-1640.
88. WILSON E.O., 1984, *Biophilia. The human Bond with other species*, Harvard University Press, Cambridge.
89. WILSON E.O., 2008, The nature of human nature, in: *Biophilic Design*, eds. Kellert S., Heerwagen J., Mador M., New Jersey: John Wiley & Sons, p. 21-25.
90. WŁODARCZYK Z., 2013, Ogród biblijny – nowy typ ogrodu tematycznego, in: *Zeszyty Naukowe Uniwersytetu Rolniczego im. Hugona Kollątaja w Krakowie*, 499, Rozprawy, 376.
91. WOJCIECHOWSKI K.H., 1986, *Problemy percepcji i oceny estetycznej krajobrazu*, UMCS, Lublin.
92. WOJCIECHOWSKI K.H., 1994, O przydatności badań percepcji krajobrazu, in: *O percepcji środowiska Zeszyty Naukowe PAN nr 9*, ed. J. Bogdanowski, Komitet Naukowy przy Prezydium PAN 'Człowiek i Środowisko', Warszawa, p. 109-124.
93. WOJCIECHOWSKI K.H., 2004, Miejsce postrzegania krajobrazu w całościowym ujęciu jakości życia, in: *Annales UMCS. Sectio B*, 59(13), p. 213-229.
94. WOLF K.L., FLORA K., 2010, Mental Health and Function – A Literature Review, in: *Green Cities: Good Health, College of the Environment*, University of Washington, Washington.
95. WOYNAROWSKA B., 2008, *Edukacja zdrowotna*, PWN, Warszawa.

Sustainable Creative Economy in Cities: Comparative Analysis of Capital Cities in the EU

Zrównoważone gospodarki kreatywne w miastach: analiza porównawcza stolic państw UE

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Abstract

This article compares levels of creative economies in capital cities in European Union (EU), identifies groups of cities with similar characteristics, and approaches to developing a sustainable creative cities. At the urban level, creativity represent an important element of economic activity, enable the development of creative cities and contribute to all pillars of sustainable development. An essential aspect of creative economy is its quantity and quality in a particular area, which is often measured by the extent of cultural and creative industries and some other indicators. Therefore, in the article, creative economy is analysed by three indicators (Cultural vibrancy, Creative economy and Enabling environment) to assess and compare its levels in capital cities in EU. Data were collected from the database of the Cultural and Creative Cities Monitor. The comparison of capital cities by three indicators identified four groups of cities according the differences in their developmental levels of creative economy. The findings show that the differences and the relative performance regarding the creative economy among capital cities in EU are still remarkable, and that particular groups of cities focus and consequently sustainably develop specific aspects of creative economy.

Key words: creative economy, cultural and creative cities, sustainable development, cluster analysis, capital cities, European Union

Streszczenie

W artykule porównano poziomy osiągnięte przez gospodarki kreatywne w stolicach państw Unii Europejskiej (UE), wskazując na miasta o podobnych cechach i podejściach do tworzenia zrównoważonych miast kreatywnych. Na poziomie miasta kreatywność stanowi istotny element aktywności ekonomicznej, prowadzący do rozwoju miast kreatywnych i powiązany ze wszystkimi trzema filarami rozwoju zrównoważonego (społecznym, ekonomicznym i ekologicznym). Istotnym aspektem gospodarki kreatywnej jest jej ilość i jakość w określonym obszarze, która jest często mierzona m.in. przez poziom osiągnięty przez aktywność kulturową i kreatywną. W tym artykule gospodarka kreatywna jest dyskutowana w oparciu o trzy wskaźniki (kulturowość, ekonomię kreatywną i sprzyjające środowisko), co umożliwia ocenę i porównanie ich poziomów osiągniętych w stolicach UE. Wykorzystane dane pochodzą z bazy Cultural and Creative Cities Monitor. Porównanie stolic w oparciu o trzy istotne wskaźniki pozwala sklasyfikować grupy miast w oparciu o występujące różnice odnoszące się do poziomu rozwoju kreatywnej gospodarki. Uzyskane wyniki pokazują, że różnice i względna wydajność w kontekście kreatywnej gospodarki, występujące wśród stolic krajów UE jest ciągle znacząca, przy czym nie brakuje miast, które konsekwentnie – i w sposób zrównoważony – rozwijają określone aspekty kreatywnej gospodarki.

Słowa kluczowe: Gospodarka kreatywna, kulturowe i kreatywne miasta, zrównoważony rozwój, analiza klastrów, stolice, Unia Europejska

Introduction

In knowledge societies, creative economies are increasingly being developed and are becoming an important aspect of development of cities, regions and countries. Not only are industries in creative economies replacing obsolete industries, they are also innovating immensely and producing new products and services that are used in other industries. Because of their significant development, they have become a central point of interest in many developed countries and the concept of creative economies has become popular. Creative economies are determined by the extent of creative and cultural industries (Howkins, 2001). The development of creative and cultural industries is determined by the creative class (Florida, 2002), which is a group of professional, scientific and artistic workers whose outputs create economic, social and cultural dynamics, especially in urban areas. In the era of creativity, economic growth is influenced by three factors, namely technology, talent and tolerance, otherwise known as the 3T-theory (Florida, 2002). According to this theory, talent promotes growth and attracting human capital to a specific geographic area requires tolerance. The importance of creative economy and its support have enabled it to develop and to see above average growth. Creative economy development has even attracted the attention of national economies; as such creativity represents a central pillar of new economies in all aspects of life. Therefore, it is also reasonable and necessary to support the development of creative economy in general and its expressive parts (creative and cultural industries, supportive environment). This is also one of the objectives of the European Commission as covered in the *Europe 2020 strategy for growth and jobs* (European Commission, 2010a, 4). The European Commission has identified several priorities in the field of (creative and cultural industries (CCIs), among which are (European Commission, 2010a): (1) fostering changing skills needs by promoting innovation in education, (2) supporting mobility of artists, (3) coordinating with EU member countries to reform environments for CCIs, and (4) developing policies and initiatives to promote market access for and investment in CCIs. These priorities are complemented through a variety of actions and initiatives. In order to increase support for cultural and creative industries, in 2010 the European Commission issued the Green Paper *Unlocking the potential of cultural and creative industries* (European Commission, 2010a) to facilitate appropriate conditions for the development of creativity and innovation in a new entrepreneurial culture throughout the EU. It represents an invitation to EU Member States to realize the importance of promoting and developing culture and creativity as drivers of local and national development. Such an emphasis on supporting CCIs places it as one of central industries in the EU. Countries use different approaches to

implement policies aimed at supporting and developing creative economy and can be grouped into several categories (United Nations/UNDP/UNESCO, 2013, 53), namely: (1) CCI policy in accordance with human development thinking, (2) consumption driven CCI policy, (3) limited sector-driven CCI policy, (4) awareness about CCIs but without formal CCI policy, and (5) countries that did not recognize CCIs as such.

Creative economies contribute to economic, social, cultural and sustainable development in several ways. Economic impact is seen through promotion of economic diversification, revenues, trade and innovation. Social impact of creative economy is seen through its contribution to employment, particularly for disadvantaged groups, and through fostering social inclusion. On the local level, creative economy link different social groups and contribute to social cohesion and contribute to individuals' education, culture, happiness and well-being. As such, creative economy plays an important role in the economy and influences individuals' lives. This paper aims to unveil the extent of creative economies in capital cities in EU. Capital cities, because of their size, economic, cultural and social impact should have well-developed different aspects of creativity, which contribute significantly to the cities' economic activity. The article starts with an overview of creative economy with an emphasis on creative cities. Second, the role of creative economy in creating sustainable development is analysed. Further, in the empirical part of the paper, creative economies in capital cities in EU are compared regarding three indicators, namely Cultural Vibrancy Index, Creative Economy Index and Enabling Environment Index as contributors to sustainable development of creative economy in cities. The final section presents the conclusion and recommendations for further research.

The concept of creative economy and creative cities and their relationship with sustainable development

Creativity and its importance for economic development are raising attention and research in the academic and policy fields. Creative economies are developing fast and are influencing the rest of the economy. The value of trade of creative products and services doubled from 2002 to 2011 and amounted to USD 624 billion in 2011 (United Nations/UNDP/UNESCO, 2013). Consequently, the concept of the creative economy emerged. The scope of the creative economy is defined by the size of activity and industries that are considered cultural and creative. CCIs are variously defined mainly regarding the scope they cover. However, creative industries are those industries that are based on individual creativity, skill and talent, and which have the potential to create wealth and jobs through developing intellectual property (DCMS, 2009). The DCMS

(2009) definition includes the following activities as creative industries: advertising, architecture, art and antiques markets, computer and video games, crafts, design, designer fashion, film and video, music, the performing arts, publishing, software, television and radio, excluding the heritage sector. Other definitions of CCIs are broader, defining it as a part of the whole creative economy that generates growth and development (e.g., van der Pol, 2013). Howkins (2001, xiii) defined four sectors of the creative industries: industrial copyrights, patents, trademarks and designs. According to this definition, the revenue of the creative economy industry should have been USD 2.2 billion in 2000 and should continue to grow 5% annually (Howkins, 2001).

Simultaneously with the development of the creative economy concept, the concept of creative cities has evolved. Creative cities represent a complex urban centre as the venue for various creative and cultural activities and are an important part of social and economic functioning of the city (Landry, 2012), the city's economic and social life, and include intellectual capital applied to products, processes and services (Deisburly, Basu, 2010; Bielińska et al., 2014). The dynamics of urban life, design and type of functioning allows for greater diversity, expressive autonomy and represents a larger market compared to a rural type of life. The link between culture and creative industries in city life is represented through varieties of cultural activities that move between the commercial and the non-commercial, the subsidized and the entrepreneurial with great fluidity (O'Connor, 2007, 35). Cities are places where people and ideas mix most effectively. Consequently, creative cities can establish two types of strategies (Smith, Warfield, 2008): (1) culture-centric orientation and (2) econo-centric orientation. The first perceives the creative city as a place with strong prosperous arts and culture, creative and diverse expressions and inclusivity, artistry and imagination in which creativity is related to identity, rights, beliefs and social well-being. The second perceives the creative city as a place that is driven by strong, innovative, creative, competitive, cultural and creative industries and economically sustainable artists and arts organizations. The importance of developing creative cities is increasing; therefore, various initiatives appear to promote their development. Among them is the *Creative Cities Network* founded in 2004, whose purpose is to promote the development of creative clusters around the world. Key features of creative cities (Petrikova et al., 2015) are that they enable interaction and openness at all levels of city's functioning, promote innovative cluster interactions that could lead to unexpected synergies and outcomes, and encourage the development of creative universities and their partnerships with other innovative clusters. The UNESCO Creative Cities Network (2016) was set up in 2004 to promote cooperation with and among cit-

ies that have identified creativity as a strategic factor for sustainable urban development.

There exist several reasons why creative industries are concentrated in urban areas. The main factors are: (i) importance of specific local labour markets; (ii) spillovers from one specific creative industry to another; (iii) firms' access to dedicated infrastructure and collective resources; (iv) project-based work; (v) synergistic benefits of collective learning; and (vi) development of associated services, infrastructure and supportive government policies. (European Commission, 2010b). Additionally, national policies pay an increasing amount of attention to CCIs, led by the United Kingdom, followed by other developed countries, such as Australia, New Zealand and the USA. Recently, additional countries, i.e., Brazil and many African and Asian countries have recognised the importance of creativity in all levels of life. As policy makers and researchers strive to quantify each phenomenon, several indexes have been developed to measure CCIs on particular levels of analysis (e.g., national, cities), among the most-recognised are Florida's Creative Index (2002), the Euro Creativity Index, the Hong-Kong Creative Index, the Czech Creative Index, the Composite Index of the Creative Economy, the Creative City Index, the European Creativity Index, that Baltimore Creativity Index, Landry's Creative City Index and the Global Creative Index (Landry, 2012; Hartley et al., 2012). One of the most-used creative indexes is Florida's 3T-theory or framework – talent, technology and tolerance (Florida, 2002). According to this framework, cities must focus not only on building infrastructure and industrial locations, but also on capturing the imagination of talented individuals by successfully attracting them. Additionally, the successful transformation of creative class activities into creative economic outcomes, such as new ideas, new businesses and regional growth, is needed. Cities with greater numbers of artists, musicians, professors, scientists, high-tech workers, foreigners, homosexuals and high bohemians will have higher levels of economic development (Florida, 2002, 12). Extensions of the framework have added a fourth T–territory (territorial, infrastructural and communal facilities, e.g., universities, water, transportation (rail and airports), affordable housing and historic buildings, proximity to jobs, etc.) (Acs, Zegyesi, 2009; Marlet, van Woerkens, 2004). The Global Creativity Index, based on the 3T-theory, ranks 139 included countries (Florida et al., 2015) and rankings of EU countries are provided in Table 1.

As seen in Table 1, the most creative countries in EU are Denmark and Finland, ranking 5th on the Global Creativity Index. On the other side, the worst ranked EU country is Romania, in 68th place. Although all EU countries rank relatively high on the list, there are notable differences in sub-indexes, namely talent, technology and tolerance. They are quite differ-

Table 1. Global creativity index for some characteristic countries (Florida et al., 2015)

| Country | Technology rank | Talent rank | Tolerance rank | Global creativity index | Global creativity index rank |
|-----------------|-----------------|-------------|----------------|-------------------------|------------------------------|
| Austria | 12 | 26 | 32 | 0,788 | 20 |
| Belgium | 28 | 18 | 14 | 0,817 | 18 |
| Bulgaria | 78 | 38 | 47 | 0,505 | 48 |
| Croatia | 60 | 39 | 81 | 0,481 | 58 |
| Cyprus | 96 | 44 | 45 | 0,446 | 66 |
| Czech Republic | 29 | 30 | 80 | 0,609 | 35 |
| Denmark | 10 | 6 | 13 | 0,917 | 5 |
| Estonia | 33 | 16 | 87 | 0,625 | 33 |
| Finland | 5 | 3 | 20 | 0,917 | 5 |
| France | 16 | 26 | 16 | 0,822 | 16 |
| Germany | 7 | 28 | 18 | 0,837 | 14 |
| Greece | 39 | 43 | 101 | 0,484 | 54 |
| Hungary | 34 | 33 | 41 | 0,673 | 28 |
| Ireland | 23 | 21 | 7 | 0,845 | 13 |
| Italy | 25 | 31 | 38 | 0,715 | 21 |
| Latvia | 54 | 22 | 77 | 0,563 | 40 |
| Lithuania | 65 | 12 | 105 | 0,490 | 51 |
| Luxembourg | 20 | 48 | 32 | 0,696 | 25 |
| Malta | 73 | 49 | 25 | 0,550 | 43 |
| Netherlands | 20 | 11 | 6 | 0,889 | 10 |
| Poland | 46 | 25 | 101 | 0,516 | 46 |
| Portugal | 35 | 36 | 22 | 0,71 | 23 |
| Romania | 65 | 60 | 76 | 0,425 | 68 |
| Slovak Republic | 69 | 42 | 66 | 0,484 | 54 |
| Slovenia | 17 | 8 | 35 | 0,822 | 16 |
| Spain | 31 | 19 | 12 | 0,811 | 19 |
| Sweden | 11 | 8 | 10 | 0,915 | 7 |
| United Kingdom | 15 | 20 | 5 | 0,881 | 12 |

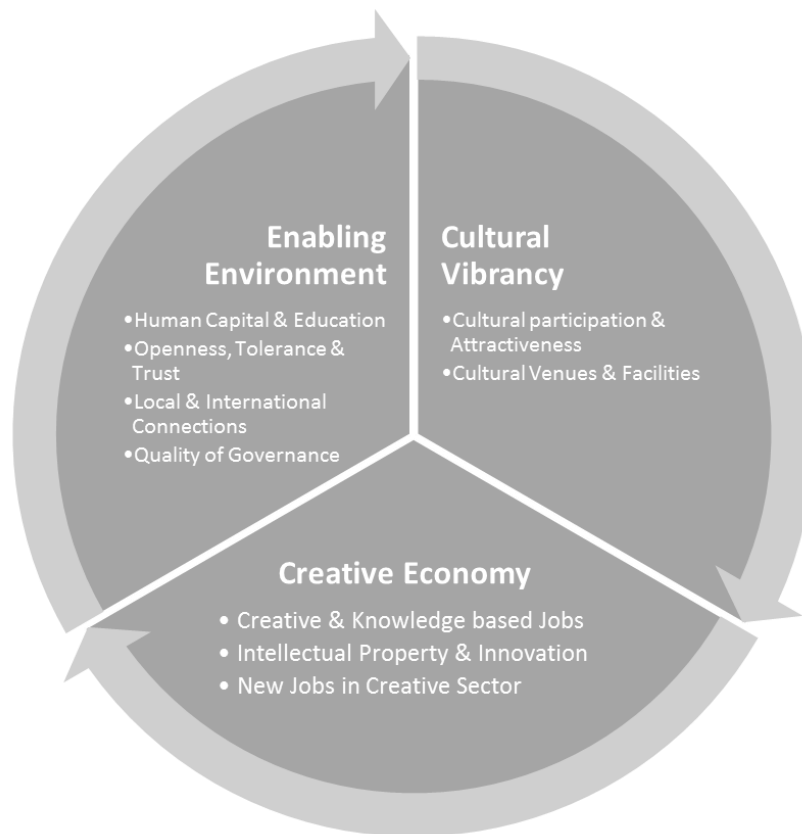
ent for particular countries, such as for example in Poland, where talent and technology are relatively high, while the tolerance is low ranked.

As the creative economy is determined by the extent of CCIs, the CCIs are directly connected to entrepreneurship and expressed through creative ideas and their development towards commercialization to enable profit (HKU, 2010, 54). However, in creative and cultural economic activities, the profit itself is not a driver, but rather it is creativity, self-fulfilment, and the ability to create something and to perform one's own creative ideas that drive entrepreneurship. It is, therefore, a combination of entrepreneurship and creativity is the most successful, because an artist's creativity needs to be combined with an entrepreneurial spirit and with the specific environment in which creative companies operate. Entrepreneurs in creative industries use their inner creativity (Howkins 2001). Entrepreneurs in CCIs typically operate in challenging market conditions and enabling framework conditions, produce outputs that are by their nature *cultural* and cooperate with individuals who are primarily targeted at the content of a particular product or service, rather than in its commercialization. Consequently, entrepreneurial activity in creative and cultural economic activities often takes place in small business entities, operating on the basis of long-term cooperation with others (HKU, 2010, 58). Achieving a balance between creativity

and entrepreneurship is not easy because the entrepreneur needs to find the right balance between internal artistic value and external market success. Small- and medium-sized enterprises (SMEs) dominate in CCIs (UNCTAD, 2011, 83) and many entrepreneurs are self-employed. In some countries (e.g., the United Kingdom), SMEs have to compete with very large companies in industries such as advertising, film production and software. Therefore, various policies have prepared specific measures for different sized groups of companies and focuses in particular on supporting SMEs. Among the biggest obstacles for SMEs in CCIs is the access to financing (UNCTAD, 2011, 84) for creative projects. Extensive financial resources that require long-term investment are often required for the development of creative ideas, and the positive effects of those projects take a while before they are apparent. As companies in CCIs are considered to be above-average risks, traditional funding with loans is hard to obtain even in the most developed countries. Therefore, large companies represent one source of funding for creative ideas of SMEs, while a second one represents measures of a supportive environment, which can be differently enabling.

The concept of sustainable development became widely recognized after the well-known report *Our common future* or the *Brundtland Report* (World Commission on Environment and Development,

Figure 2. The Cultural and Creative Cities Monitor's conceptual framework (European Commission, 2017)



1987). It introduced the most widely used definition of sustainable development into the policy discourse: *Development which meets the needs of the current generations without compromising the ability of future generations to meet their own needs*. This definition is based on achieving balanced development by equally implementing economic growth, environmental protection and social equity and developed into the triple-bottom line or the three pillars of sustainability, namely economic, environmental and social (Elkington, 1994). However, sustainable development is a dynamic process that helps people to realise their potential and improve their quality of life while simultaneously protecting and enhancing the life support systems (Bennie, Sherwin, 2010). During its development, the concept was criticized for the tri-partitions of the model, instead of being praised for its connections, interdependencies and relationships (e.g., Vanclay, 2004; Boström, 2012; Milne, Gray, 2013). Some others exposed the shortcomings of the three pillars model and added more pillars in efforts to make it more robust (e.g., Godschalk, 2004; Seghezze, 2009), but the meaning and associated objectives of the social pillar remained vague. However, there is an approach developing that adds a missing dimension to the three pillars of sustainable development, namely culture, which is considered as a fundamental dimension (Hawkes, 2001; Litting, Griessler, 2005; Murphy, 2012; Dahl, 2012). A broader definition of culture

(cultural vitality), as the complex of distinctive spiritual, material, intellectual and emotional features that characterize social group or a society (Hawkes, 2001, 25), should represent a fundamental missing dimension of a healthy society in the sense of well-being, creativity and diversity. Links between creative and cultural activities and sustainable development can be well seen from a territorial perspective, as all activities take place in the community, neighbourhoods and cities. As provided in Table 2, they contribute to all three pillars of sustainable development, but the cultural and creative aspects are the bottom line or link between all the pillars.

As exposed by United Nations (2015), the CCIs shall include principles that will guide through its values and the economic dynamics of the sustainable development. Those values will support a fair redistribution of income, better quality of life, access and citizenship for the inhabitants, etc. To measure creative economy of cities from the sustainability point of view, there exist several approaches. One of the newest is the Cultural and Creative Cities Monitor (European Commission, 2017) which assess the performance of cultural and creative cities in 168 cities (93 European Capitals of Culture, 22 UNESCO Creative Cities and 53 cities hosting international cultural festivals) in 30 European countries (the EU-28 with Norway and Switzerland), using both quantitative and qualitative data.

Table 2. Contribution of CCIs to the pillars of sustainable development

| Economic pillar | Environmental pillar | Social pillar |
|-----------------------------|---|--|
| Income, added value, profit | Innovative solutions on the level of lessening inputs, using alternative resources (e.g., recycled resources) | Social inclusion |
| Jobs creation, employment | Innovative solutions of products and services (e.g., design) | Well-being |
| Innovativeness, innovations | Lessening the environmental impact in total product life-cycle | Aesthetic pleasures, happiness, satisfaction and other psychological effects |

The above-mentioned model measures the creative economy from three aspects, broader than just economic impact of creativity, considering also two additional aspects. They are in line with the sustainable development, namely, the Creative Economy Index is related to the economic pillar of sustainable development concept, the Enabling Environment Index is related to environmental pillar, and the Cultural Vibrancy Index to the social pillar. The Creative Economy Index is focused mainly on the contribution of cultural and creative sectors to a city's economy in terms of employment, job creation and innovation. The Enabling Environment Index is focusing on the tangible and intangible assets that help cities attract creative talent and stimulate cultural engagement (European Commission, 2017). This index is focused on the social pillar of sustainable development. Namely, the creative people contribute to the long-term development of creative and cultural activities in different sector, but they have to be motivated to act in such a way and to stay in a particular location (in our case in particular city). However, the third index, the Cultural Vibrancy Index, measures the cultural *pulse* of a city in terms of cultural infrastructure and participation in culture. It means that there has to be not only the offer of creative and cultural activities and their outcomes, but also the critical level of demand in the particular area (again in the city in our case). In addition, this index is related to the social pillar of sustainable development. Namely, the supply of cultural and creative activities and outcomes will develop long-term in a particular area only, if there will be enough demand. Additionally, supply and demand are leveraging each other and therefore raising their levels.

Methodology

To make the comparison of creative cities in EU, used was the database from European Commission,

The Cultural and Creative Cities Monitor (European Commission, 2017). It is a tool to promote mutual exchange and learning between cities to boost culture-led development. The data is available for year 2017. Monitor's quantitative information is captured in 29 indicators relevant to nine dimensions reflecting three major facets of cities' cultural, social and economic vitality (European Commission, 2017):

- Cultural Vibrancy Index measures the cultural *pulse* of a city in terms of cultural infrastructure and participation in culture;
- Creative Economy Index captures how the cultural and creative sectors contribute to a city's employment, job creation and innovative capacity;
- Enabling Environment Index identifies the tangible and intangible assets that help cities attract creative talent and stimulate cultural engagement.

From the database used were several data, which are collected in Table 3 as initial data for further analysis:

- Countries and city name: obtained were data for 27 capital cities from EU (data for Luxembourg is missing);
- C3 Index: data on composite index for 27 capital cities of EU;
- Cultural Vibrancy: data on index for 27 capital cities of EU;
- Creative Economy: data on index for 27 capital cities of EU;
- Enabling Environment: data on index for 27 capital cities of EU;
- Demographic data on population, GDP and employment.

To ascertain similarities or differences among capital cities of EU countries in terms of creative economy in a broader sense, a cluster analysis was employed to group cities with similar characteristics. The cluster analysis is an explorative analysis that tries to identify structures within the data and is a method, generally used to group data with similar characteristics. According to the literature (e.g., Cramer, 2003; Hair et al., 2006; Xu and Wunsch II, 2008), a cluster analysis is often applied to determine how cases can be grouped together. The cluster analysis procedure creates clusters from the observations supplied that display similar characteristics. The classification of similar objects into groups has always played an essential role in science. Not only for identifying a structure already present in the data, but also for imposing a structure on a more or less homogeneous data set that has to be split up in a rational way. The cluster analysis in the article was performed to reduce the complexity and compare capital cities' creative economy levels. Clustering offers the opportunity to determine which capital cities are similar and explore the relationships between variables driving cluster membership. Understanding heterogeneity between EU capital cities makes it

Table 3. Initial data on creative cities (European Commission, 2017)

| | Country | City | Popu- lation* | GDP** | Employ- ment*** | C3 Index | 1. Cultural Vibrancy | 2. Creative Economy | 3. Enabling Environment |
|----|-----------------|------------|------------------|-------|--------------------|----------|-------------------------|------------------------|----------------------------|
| 1 | Austria | Vienna | 1 | 1 | 3 | 35,002 | 37,855 | 28,52 | 42,258 |
| 2 | Belgium | Brussels | 1 | 1 | 4 | 36,023 | 26,756 | 49,027 | 28,547 |
| 3 | Bulgaria | Sofia | 1 | 3 | 2 | 20,721 | 8,968 | 36,97 | 11,727 |
| 4 | Croatia | Zagreb | 2 | 3 | 4 | 25,878 | 23,193 | 28,34 | 26,325 |
| 5 | Cyprus | Nicosia | 4 | 4 | 4 | 22,394 | 32,142 | 13,53 | 20,625 |
| 6 | Czech Republic | Prague | 1 | 2 | 1 | 38,439 | 44,106 | 40,568 | 22,848 |
| 7 | Denmark | Copenhagen | 2 | 1 | 1 | 49,876 | 53,851 | 50,027 | 41,626 |
| 8 | Estonia | Tallinn | 3 | 3 | 1 | 30,038 | 30,124 | 30,563 | 28,815 |
| 9 | Finland | Helsinki | 2 | 1 | 1 | 34,564 | 26,172 | 41,538 | 37,4 |
| 10 | France | Paris | 1 | 1 | 2 | 63,205 | 56,641 | 77,41 | 47,924 |
| 11 | Germany | Berlin | 1 | 3 | 1 | 34,648 | 28,699 | 40,766 | 34,311 |
| 12 | Greece | Athens | 2 | 3 | 5 | 25,659 | 33,051 | 18,645 | 24,905 |
| 13 | Hungary | Budapest | 1 | 2 | 3 | 30,069 | 31,538 | 30,76 | 25,751 |
| 14 | Ireland | Dublin | 2 | 1 | 3 | 42,076 | 46,854 | 33,67 | 49,331 |
| 15 | Italy | Rome | 1 | 2 | 4 | 26,825 | 22,735 | 33,543 | 21,567 |
| 16 | Latvia | Riga | 2 | 3 | 1 | 19,11 | 15,906 | 22,307 | 19,124 |
| 17 | Lithuania | Vilnius | 2 | 2 | 1 | 31,759 | 19,506 | 45,25 | 29,281 |
| 18 | Malta | Valetta | 4 | 4 | 4 | 20,753 | 22,499 | 16,19 | 26,387 |
| 19 | Netherlands | Amsterdam | 2 | 1 | 1 | 45,512 | 46,558 | 47,42 | 39,606 |
| 20 | Poland | Warsaw | 1 | 1 | 1 | 27,311 | 18,929 | 40,04 | 18,614 |
| 21 | Portugal | Lisbon | 2 | 3 | 3 | 42,581 | 54,326 | 36,407 | 31,438 |
| 22 | Romania | Bucharest | 1 | 1 | 4 | 27,716 | 11,653 | 46,597 | 22,084 |
| 23 | Slovak Republic | Bratislava | 3 | 1 | 1 | 34,237 | 21,731 | 50,734 | 26,253 |
| 24 | Slovenia | Ljubljana | 3 | 3 | 3 | 32,729 | 35,088 | 33,307 | 26,858 |
| 25 | Spain | Madrid | 1 | 2 | 4 | 28,611 | 21,881 | 29,803 | 39,683 |
| 26 | Sweden | Stockholm | 2 | 1 | 1 | 42,123 | 39,257 | 44,877 | 42,345 |
| 27 | United Kingdom | London | 1 | 1 | 1 | 34,705 | 22,889 | 38,11 | 51,527 |

Notes:

| | *Population | **GDP | ***Employment |
|---|---------------------|-----------------|---------------|
| 1 | > 1 million | > 35,000 | > 74% |
| 2 | 500,000 - 1 million | 30,000 - 35,000 | 71-74% |
| 3 | 250,000 - 50,000 | 25,000-30,000 | 68-71% |
| 4 | 100,000 - 250,000 | 20,000-25,000 | 65-68% |
| 5 | 50,000 - 100,000 | < 20,000 | < 65% |

Table 3. Results of Cluster analysis for all indicators – cluster centres and number of cases

| Clusters | Number of cases in each cluster | Cluster centres | | | |
|-----------|------------------------------------|-----------------|----------------------------|---------------------------|---------------------------------|
| | | C3_index | Cultural Vibrancy Index | Creative Economy Index | Enabling environ- ment Index |
| Cluster 1 | 1 | 63.21 | 56.64 | 77.41 | 47.92 |
| Cluster 2 | 7 | 42.23 | 46.12 | 40.21 | 38.49 |
| Cluster 3 | 10 | 31.03 | 20.72 | 41.88 | 29.94 |
| Cluster 4 | 9 | 25.94 | 27.36 | 25.24 | 24.48 |

easier to diagnose creative and cultural activities and their contribution to sustainable development. Such a cluster-based approach offers a new way of dividing and understanding cities in these particular areas to formulate enhanced policy measures and actions. The first step in the analysis used the agglomerative hierarchical clustering process. In the second step, a *k*-means non-hierarchical clustering process was employed. All indicators in Table 2 were used simultaneously in the cluster analysis. The clusters were formed using Ward's minimum variance approach to ensure the least within-cluster variation.

Empirical results and discussion

The hierarchical cluster analysis using squared Euclidean distance and Ward linkage was performed on a sample in order to determine the appropriate number of clusters. According to the initial process of the hierarchical clustering process, we decided to use four clusters for each indicator. In the next step, we used a *k*-means cluster analysis to extract four clusters. The results are represented for each indicator used in the analysis. Clusters are indicated from 1 to 4, where Cluster 1 includes cities with the highest

result and Cluster 4 includes cities with the lowest results. The summarized results of the cluster analysis for all indicators are presented in Table 3.

The results show that at the least countries are in the Cluster 1, which has all four indicators with the highest cluster centres. In the Cluster 2, there are 7 countries and in the Cluster 3 are 10 countries. In the Cluster 4 there are 9 countries with the lowest cluster centres. However, Table 4 provides cities' membership for each cluster.

Table 4. Cluster membership of analysed cities

| Clusters | Cities with countries |
|-----------|--|
| Cluster 1 | Paris, France |
| Cluster 2 | Vienna, Austria; Prague, Czech Republic; Copenhagen, Denmark; Dublin, Ireland; Amsterdam, Netherlands; Lisbon, Portugal; Stockholm, Sweden |
| Cluster 3 | Brussels, Belgium; Sofia, Bulgaria; Berlin, Germany; Madrid, Spain; Helsinki, Finland; Vilnius, Lithuania; Warsaw, Poland; Bucharest, Romania; Bratislava, Slovak Republic; London, UK |
| Cluster 4 | Nicosia, Cyprus; Tallinn, Estonia; Athens, Greece; Zagreb, Croatia; Budapest, Hungary; Rome, Italy; Riga, Latvia; Valletta, Malta; Ljubljana, Slovenia |

The results indicate that the Paris forms its own Cluster 1, because it represents a unique environment and differs immensely from all other compared cities in EU with the highest scores in all three indexes, namely Cultural Vibrancy Index, Creative Economy Index and Enabling Environment Index. The city of Paris represents a creative hub in Europe with its own particular access to cultural and creative services with supportive framework, which accelerate its performance. Synergies of enabling environment and cultural vibrancy leverage creative economy and sustainably contribute to Paris development in the area of creative economy.

In the Cluster 2 are seven cities (Vienna, Prague, Copenhagen, Dublin, Amsterdam, Lisbon and Stockholm). Those cities on average the best performed in Cultural Vibrancy Index, while the worst in the Enabling Environment Index. It means that they offers many cultural services and events, but their engagement in developing and stimulate cultural activity lacks behind. For example, Vienna has outstanding offer of museums, concert halls, art nouveau buildings and high-profile fashion and design events. However, Vienna's companies in CCIs contribute significantly to the value of city's economic area, with supportive environment for creative entrepreneurship in fields as diverse as design, music and architecture. Prague, for example offers hundreds of concert halls, museums, galleries, movie theatres, music clubs and internationally acclaimed festivals. The same is truth for Copenhagen and Dublin, where there are numerous museums, galleries, architectural

works, and music venues available. Amsterdam performs best in two indicators, namely Cultural Vibrancy Index and Creative Economy Index. The city has new and renowned cultural centres and they turned warehouses into offices for creative start-ups, which enable long-term development of new enterprises. For Lisbon, characteristic are sustainable long-term international events in fashion and film industry, as well as creativity-related events. Stockholm, on the other site, actively supports access to culture for all interested and invests in education in art. As it can be seen through short presentations of each city in Cluster 2, all of them are developing unique approaches to sustainably develop cultural liveliness.

In the Cluster 3 are ten cities (Brussels, Sofia, Berlin, Madrid, Helsinki, Vilnius, Warsaw, Bucharest, Bratislava and London). Those cities on average perform the best in the Creative Economy Index, while other two indexes show lower performance. The results indicate that cultural and creative sectors as well as innovative capacity importantly contribute to employment and job creation in this group of cities. Brussels achieves a notable performance in new jobs creation in CCIs (they should represent more than 6% of employment in the city). Similarly, Sofia promotes and supports access to funding for the CCIs. Berlin also supports growth of creative economy by several measures and supporting programmes, and by long-term international events in fashion and music. Madrid is not as important as other Spanish cities in terms of creativity, with lower levels of all three indicators compared to for example Barcelona. Nevertheless, it also contributes to cultural activity in the city. Helsinki contributes importantly to jobs in CCIs and to development of enterprises in those industries (e.g., shops, restaurants, showrooms, galleries, design studios etc.). In Vilnius CCIs provides majority of new jobs in the city as well as CCIs represent a half of these sectors in the country. Similarly, Bratislava performs well in new jobs creation in CCIs. Warsaw developed special programme to support CCIs in the city. Bucharest promotes culture as a driver of sustainable economic development and social cohesion. London represents a cultural powerhouse and as such mostly contributes to CCIs with high productivity. All cities in the Cluster 3 mainly support and help to develop CCIs in those cities with various approaches and measures. However, the most important is that all are long-term and sustainably oriented.

In the Cluster 4 are nine cities (Nicosia, Tallinn, Athens, Zagreb, Budapest, Rome, Riga, Valletta and Ljubljana). Most of them perform the best in the Creative Vibrancy Index, and some in the Creative Economy Index. However, all scores are considerably lower than in Clusters 1 and 2. This group of cities the worst performs in index the Enabling Environment Index. It means that they lack behind leading capital cities in Europe (e.g., cities in Cluster 1

and 2) regarding all three aspects of cultural and creative elements, which shows the developmental levels of cities in this area. Nicosia, for example, performs best in cultural vibrancy with some important museums and churches, but in smaller amount compared to cities in other clusters. Tallinn has a significant number of cultural attractions (e.g., theatres, cinemas, museums), but is relatively small city, therefore its contribution is less significant than for example in cities from Cluster 2. Athens has very rich cultural and historical heritage, but its capitalization and exploitation is not as good as in other capital cities from the best-performed clusters. Zagreb best performs in creative jobs and identifies CCIs as key factors to boost its competitiveness. Budapest is the city with well-developed cultural vibrancy with museums, theatres, galleries and exhibitions. Rome is compared to other cities in Italy (e.g., Milan) performing lower. However, the city is working to make its rich heritage more attractive for tourists as well as for entrepreneurs. Generally, Latvia is among countries that started to develop its creative economy relatively late. However, Riga has importantly developed creativity in all its forms. Valletta on the other side provides support to CCIs. Ljubljana performs best in cultural vibrancy with thousands of cultural event. However, cities in the Cluster 4 are mainly smaller than in other three clusters with lesser impact of creative economy. It does not mean that in those cities creative economy is not present, but those cities are lagging behind the leading cities because of their size, approaches of supportive environment or the timing of starting to support it.

Conclusions

This article has compared the key attributes of creative economy of capital cities in EU. The discussion has outlined how important different aspects of creative economy are in promoting economic activity, and sustainable development of creative cities. The article compared creative economies in selected cities by three indexes, namely - Cultural Vibrancy Index, Creative Economy Index and Enabling Environment Index.

Regarding the sustainable development of creative economy in the cities, our results show several implications. First, the majority of capital cities in EU focuses, supports and develop only one aspect of three measured in the article. The exception is the city of Paris, where all three measured indexes are equally developed and supported. Consequently, it could be stated that only Paris managed to implement sustainable development of its creative economy. Its performance of all three indicators is so different from other compared cities that it builds its own cluster. Unfortunately, all other compared cities are not able to equally successful develop all three

aspects. Second, as already mentioned, all other capital cities (except Paris) are more or less focusing on and sustainably developing only one or two indicators. This is seen in cities from Cluster 2, where they are performing best in Cultural Vibrancy Indicator. The short overview of cities' most developed and supported part exposed that they are focused on cultural liveliness, services and events. However, on average they perform worst in Enabling Environment Index. Cities in Cluster 3 perform best in Creative Economy Index, while other two indexes are at much lower level. Those cities are supporting and developing cultural and creative sectors, which importantly contribute to cities' employment and job creation. Majority of them also offer some measures and funding for CCIs. However, cities in Cluster 4 have on average similar results of all three indexes but at importantly lower levels. It means that creative economy is in those cities less developed and does not represent as important factor of cities' life as in other cities. However, all these cities have a potential to develop creative economy with exploring their heritage, attracting different events, and attract and support people with creative potential to exploit and capitalize it in different entrepreneurial behaviours. Results of analysing each cluster indicate that cities use different approaches and support particular aspects of creative economies. It means that cities are focusing mainly on development of one or two of measured aspects of creative city. Regarding the support of creative economy's sustainable development, cities should build initiatives and measures that will sustainably support creative economy, motivate creative people to stay and develop their talent and creativity in their home cities or even attract new ones, protect and present the historical, cultural, social and spiritual values, knowledge and skills. On the other side cities should develop a financial background for investments in creative economy and support small innovative entrepreneurs in creative and cultural economy, and last but not least create conditions for development of cooperation among different stakeholders, improve cross culture cooperation, which support the creative activities, dialog and cooperation.

It could be concluded, that cities should support creative development on all three pillars of sustainable development. First, from the economic aspects, creative activity should be supported to enable individuals and enterprises in CCIs to develop, innovate and grow, because they generates more jobs. In addition, small, innovative and independent entrepreneurs in CCIs should be supported. Individuals in CCIs need appropriate education possibilities, need to be motivated to stay and develop their creativity in their home location. Second, the role of cities as supportive environments and policy creators is to develop appropriate urban living conditions that will enable individuals to express their creative potential, net-

working possibilities among various actors/stakeholders of creative economy, and last but not least to develop the open-minded and tolerant culture of the city. Such measures can have various broader impacts, including attracting foreign investments, creating a tolerance environment and increasing the employment, regional GDP and more.

As presented research has some limitations and shortcomings, they represent a foundation for further research of creative economy in the cities. First, the number of compared cities could be broader in Europe or extended to global level. Second, in-depth analysis of each city creative economy could provide valuable insight into its specific characteristics. Third, the analysis could be based on more indicators to get broader picture of creative economies in the cities. Fourth, the present study is static, but the longitudinal analysis would give an important insight into the sustainability of supporting and developing creative economies on the city levels.

References

1. ACS, Z., ZEGYESI, M., 2009, Creativity and industrial cities: A case study of Baltimore, in: *Entrepreneurship & Regional Development* 21(4).
2. BENNIE, F., SHERWIN, C., 2010, *The creative industries sustainability beacon project, final report*, <https://www.forumforthefuture.org/sites/default/files/project/downloads/creativeindustriessustainabilitybeaconproject.pdf> (10.10.2017).
3. BIELIŃSKA, E.J., BARAN, S., PAWŁOWSKI, L., JÓŹWIAKOWSKI, K., FUTA, B., BIK-MAŁODZIŃSKA, M., MUCHA, Z., GENEROWICZ, A., 2014, Theoretical aspects of the integrated protection of suburban areas, in: *Problemy Ekorozwoju/ Problems of Sustainable Development*, 9(1), 127-139.
4. BOSTRÖM, M., 2012, A missing pillar? Challenges in theorizing and practicing social sustainability: introduction to the special issue, in: *Sustainability: Science, Practice, & Policy*, 8(1), p. 3-14.
5. DAHL, A.L., 2012, Achievements and gaps in indicators for sustainability, in: *Ecological Indicators*, 17, June 2012, p. 14-19.
6. DCMS, 2009, *Creative Industries Economic Estimates Statistical Bulletin*. Department for culture, media and sport, UK.
7. DEISBURY E.S., BASU, S.R., 2010, The creative economy leading trade and innovation, in: *United Nations Conference on trade and development*, http://www.unece.org/ceci/ppt_presentations/2010/ic/basu.pdf (10.10.2017).
8. ELKINGTON, J., 1994, Towards the sustainable corporation: win-win-win business strategies for sustainable development, in: *Californian Management Review*, 36(2), p. 90-100.
9. EUROPEAN COMMISSION, 2010a, *Unlocking the potential of cultural and creative industries, Green paper*, http://ec.europa.eu/culture/our-policy-development/doc/GreenPaper_creative_industries_en.pdf (10.07.2017).
10. EUROPEAN COMMISSION, 2010b, *European Competitiveness Report*, <https://publications.europa.eu/en/publication-detail/-/publication/0aa58b94-f925-45df-9252-5b0a58f66f20/language-en> (10.07.2017).
11. EUROPEAN COMMISSION, 2017, *The Cultural and Creative Cities Monitor. 2017 Edition*, <http://publications.jrc.ec.europa.eu/repository/bitstream/JRC107331/kj0218783enn.pdf> (12.03.2018).
12. FLORIDA, R., 2002, *The Rise of the Creative Class... and How It's Transforming Work, Leisure and Everyday Life*, Basic Books, USA.
13. FLORIDA, R., MELLANDER, C., KING, K., 2015, *Global Creativity Index 2015*, Martin Prosperity Institute, <http://martinprosperity.org/media/Global-Creativity-Index-2015.pdf> (10.10.2017).
14. GODSCHALK, D.R., 2004, Land Use Planning Challenges: Coping with Conflicts in Vision of Sustainable Development and Livable Communities, in: *Journal of the American Planning Association*, 170(1), p. 5-13.
15. HARTLEY, J., JASON POTTS, J., MACDONALD, T., 2012, *(C²I)²=CCI-CCI: The CCI Creative City Index 2012*, ARC Centre of Excellence in Creative Industries and Innovation, Queensland University of Technology, Australia.
16. HAWKES, J., 2001, *The Fourth Pillar of Sustainability: Culture's Essential Role in Public Planning*, Common Ground Publishing Pty Ltd in association with the Cultural Development Network. Victoria, Australia.
17. HKU, 2010, *The entrepreneurial dimension of the cultural and creative industries, a Report prepared for the European Commission*, http://ec.europa.eu/culture/documents/edcci_report.pdf (22.01.2018).
18. HOWKINS, J., 2001, *The Creative Economy: How People Make Money From Ideas*, Penguin Press, London.
19. LANDRY, C., 2012, *The Creative City: A Toolkit for Urban Innovators, 2nd Edition*, Comedia / Earthscan, London.
20. LITTIG, B., GRIESSLER, E., 2005, Social sustainability: a catchword between political pragmatism and social theory, in: *International Journal of Sustainable Development*, vol. 8, no 1-2, p. 65-79.
21. MARLET, G.A., VAN WOERKENS, C., 2004, Skills and creativity in a Cross-section of Dutch Cities, in: *Discussion Paper Series /Tjalling C. Koopmans Research Institute*, p. 4-29.
22. MILNE, M., GRAY, R., 2013, W(h)ither Ecology? The Triple Bottom Line, The Global Reporting Initiative, and Corporate Sustainability Reporting, in: *Journal of Business Ethics*, vol. 118, no 1, p. 197-198.
23. MURPHY K., 2012, The social pillar of sustainable development: a literature review and framework for policy analysis, in: *Sustainability: Science, Practice, & Policy*, vol. 8, no 1, p. 29-44.
24. O'CONNOR, J., 2007, *The cultural and creative industries: a review of the literature*, Creative Partnerships, London.
25. PETRIKOVA, K., VANOVA, A., BORSEKOVA, K., 2015, The role of creative economy in Slovak Republic, in: *AI & Soc*, vol. 30, no 2, p. 271-281.
26. SEGHEZZO, L., 2009, The five dimensions of sustainability, in: *Environmental Politics*, 18(4), p. 539-556.
27. SMITH, R., WARFIELD, K., 2008, The Creative City: a matter of values, in: *Creative cities, cultural*

- clusters and local development*, eds. Cooke P., Lazzaretti L., Edward Elgar, London.
28. UNCTAD, 2011, *Creative Economy Report 2010*, <http://www.unctad.org/Templates/WebFlyer.asp?intItemID=5763&lang=1> (22.09.2017).
 29. UNESCO CREATIVE CITIES NETWORK, 2016, *Ljubljana: about the creative city*, <http://en.unesco.org/creative-cities/ljubljana> (22.09.2017).
 30. UNITED NATIONS, 2015, *Cabo Verde's Creative economy: Leveraging culture and creativity for sustainable development*, UN, New York and Geneva.
 31. UNITED NATIONS/UNDP/UNESCO, 2013, *Creative economy report: widening local development pathways, 2013 special edition*, UNDP /UNESCO, New York, Paris.
 32. VAN DER POL, H., 2013, *Key role of cultural and creative industries in the economy*, UNESCO Institute for Statistics, Canada, <https://www.oecd.org/site/worldforum06/38703999.pdf> (12.06.2017).
 33. VANCLAY, F., 2004, The Triple Bottom Line and Impact Assessment: How do TBL, EIA, SIA, SEA and EMS relate to each other?, in: *Journal of Environmental Assessment Policy & Management*, 6(3), p. 265-288.
 34. WCED (WORLD COMMISSION ON ENVIRONMENT AND DEVELOPMENT), 1987, *Our Common Future*, UN, New York, <http://www.un-documents.net/our-common-future.pdf> (12.06.2017).

Neuroscience in Linguistic Patterns of Communication Campaigns for Environmental Sustainability

Neuronauka we wzorcach lingwistycznych kampanii komunikacyjnych o ochronie środowiska w kontekście zrównoważonego rozwoju

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Abstract

Neuroscience is the scientific study of the nervous system and the brain, with the aim to unravel their function. Although the importance of this discipline in the social sciences has been widely discussed (Adolphs, 2009), there are no studies that use this potential for environmental sustainability-related applications. To the author knowledge investigations on environmental problems communication from the linguistic perspective in the context of neuroscience have been scarcely examined. The purpose of this article is to shed light on this gap, indicate the potential of neuroscience in communication campaigns, and highlight the role of linguistics elements as factors enforcing change in human proenvironmental behavior. The author hypostatizes that the future of sustainability efforts must increasingly be seen in a systemic and holistic way and neuroscience should be seen as an alternative remedy for environmental problems. Moreover, the author examines a potential of neuroscience based on linguistic model of communication that could facilitate behavior change in the context of environmental problems and sheds light on relationship between two disciplines: linguistics and the field that investigates unconscious variables that determine human's behavior – neuroscience. This article is a call for action to incorporate findings made in the field of neuroscience in mass communication message design to promote environmental sustainability more effective.

Key words: environmental sustainability, communication campaigns, linguistic pattern, neuroscience

Streszczenie

Neuronauka jest dyscypliną naukową zajmującą się badaniem systemu nerwowego i mózgu, która ma na celu zgłębienie zasad funkcjonowania tych organów. Pomimo faktu, że znaczenie tej dziedziny w naukach społecznych było już szeroko dyskutowane (Adolphs, 2009), kwestia wykorzystania potencjału neuronauki w kontekście ochrony środowiska nie została jeszcze poddana dogłębnej analizie. Zgodnie z wiedzą autorki, kwestia komunikacji o problemach zanieczyszczenia środowiska z perspektywy lingwistycznej w kontekście neuronauki nie została jak dotąd w szerokim zakresie zbadana. Celem niniejszego artykułu jest zwrócenie uwagi na tę lukę w badaniach, wskazanie na potencjał neuronauki jako aspektu wpływającego na efektywność kampanii komunikacyjnych i podkreślenie roli lingwistycznych aspektów jako czynników determinujących zmiany w zachowaniu człowieka w kontekście ochrony środowiska. Autorka niniejszego opracowania wysuwa hipotezę, że przyszłe starania zmierzające do osiągnięcia zrównoważonego rozwoju powinny mieć charakter systematyczny i holistyczny, a neuronauka powinna być postrzegana jako alternatywne rozwiązanie problemów środowiskowych. Ponadto, w niniejszym artykule autorka bada potencjał neuronauki w oparciu o lingwistyczny model komunikacji, który mógłby w pozytywny sposób wpłynąć na zmianę zachowania w odniesieniu do problemów środowiskowych, oraz podkreśla związek między dwoma dyscyplinami: lingwistyką i neuronauką – dyscypliną, która zajmuje się nieświadomymi czynnikami determinującymi zachowanie ludzkie. Niniejszy artykuł jest wezwaniem do uwzględnienia wyników badań z dziedziny neuronauki w koncepcie przekazu komunikacji masowej w celu efektywniejszej promocji ochrony środowiska.

Słowa kluczowe: zrównoważoność środowiskowa, kampanie komunikacyjne, wzorzec lingwistyczny, neuronauka

Introduction

Sustainable development that is widely understood as development that meets the needs of the present without compromising the ability of future generations to meet their own needs seems to be nowadays the most comprehensive challenge facing mankind (WCED, 1987). In the last years, environmental change became a critical issue in the debate on sustainable development. Many scholars recognize environmental problems as one of the most serious sustainability risks of the twenty-first century that calls for immediate actions (Nakicenovic & Swart, 2000; Houghton et al., 2001). It is well known that Earth system changes, including rising temperatures, increasing climate variability, increased rainfall in some areas and drought in others, and more frequent severe weather events. These shifts cause many social and health problems. This situation calls for moving beyond additional actions based on short-term pragmatic considerations and toward the development of widespread global actions that are necessary to deal with environmental change (Beddow et al., 2009; Fisher et al., 2007).

For the past years, most research in the field of environmental management have focused on technology innovation or organizational change (Bazerman and Hoffman, 1999). Recently, we witness growth in number of publications that suggest more holistic approach to this problem (Bazerman et al. 2001; Hoffman and Bazerman, 2007). In this sense, it is necessary to remember that technology or organization-based solutions should be combined with human aspects to be successful (Jabbour and Oliveira, 2011). Most of environmental problems are human caused. The evidence from this finding points towards the idea that changing individual behavior is central to achieve a sustainable future (McKenzie-Mohr, 2000). Therefore, considering psychological behavior change theories (Peattie and Peattie, 2009) seem to be relevant to achieve a shift in society in the context of proenvironmental behavior (McKenzie-Mohr, 2000).

The importance of influencing behavior to achieve desired positive outcomes is increasingly recognized and has led to several reviews and reports. Some of these cover the use of behavior change models in general (Darnton, 2008) while others focus on behaviors relevant to specific contexts such as climate change (Southerton et al., 2011), sustainable consumption (Jackson, 2005), or the impact of volunteering on environmental behavior (Hine et al., 2008).

The research process is identified into two key phases that are the literature review and the main study. The presented contents are based on the critical literature review regarding communication pattern of environmental sustainability in term of public campaigns and its impact on human behavior. The

research was carried out 2017 using keywords: sustainability, sustainable behavior, environmental sustainability, behavior change, and climate change. The sources of information were papers published on international scientific internet platforms as well as data collection platforms.

Psychology and environmental sustainability

Over years many psychologists and sociologists have been arguing for the relevance of psychology to environmental topics and tried to explore the roots of environmental action (Oskamp, 2000; Kazdin, 2009; Swim et al., 2011). The findings show that psychology indeed provides a set of potentially powerful answers to the question what barriers for proenvironmental behavior are. A certain mix of variables drives every human behavior. Focus on behavior rather than on the brain processes has created a broad range of interesting insights that contradict previous theoretical work on the presumably rational motivations of behavior. This is demonstrated with ideas such as prospect theory (Kahneman and Tversky, 1979), and nudging (Thaler and Sunstein, 2009). The growing interest in psychological roots of environmental degradation was demonstrated in conception of environmental psychology- the science exploring the connections between environmental attitudes and pro-environmental behaviors (Kahneman and Tversky, 1979).

Cvetkovich and Wener (1994) argue that psychology applied to issues of relationships between human and environment can contribute in important ways to evaluating and shaping environmental policy as well as generally increasing awareness of the connection of humans to their physical environment. According to Kollmuss and Agyemann (2002) the answer to the questions what are motives for people to act environmentally and what are the barriers to proenvironmental behavior seems to be extremely complex. Both authors suggest that achieving proenvironmental behavior change is a very complex process including: environmental knowledge, values, attitudes, and action. This complexity is embedded in personal values and shaped by personality features and other internal and external determinants.

Communication and Human Behavior

As stated above, climate change is an extremely complex issue that has exercised the minds of experts and policy makers with renewed urgency in recent years. It has prompted an explosion of writing in the media, on the internet and in the domain of popular science and literature. It seems that media have evolved into a powerful actor in the production, exchange, and dissemination of proenvironmental ideas within the science, policy, and public spheres. Many attempts have been made to investigate the

role of communication in the behavior change process. In their groundbreaking papers of Schoenfeld (1979); Spector and Kitsuse (1977) points out that the mass-media are key actors in the identification and interpretation of environmental issues and it plays a key role in shaping the terrain where people may be galvanized into action (Bord et al., 2000). This approach is also supported by Gardner and Stern (2002) who define communication as an instrument to alter environmental behavior that influences important variables responsible for decision making process that are attitudes, beliefs, personal norms, and social context. Rothman and Salovey (1997) proposed strategic application of persuasive communication by tailoring and framing messages to affect behaviors and to shape how people construe behaviors. According to Van (2014) the way that people perceive and process information and organize their knowledge can have a significant impact on their behavior. Pelletier and Sharp (2008) claim that an intervention using persuasive messages is the first step in efforts to encourage individuals to change specific behavior.

Building on these findings, the author of this dissertation concludes that communication seems to be an essential key in unlocking the potential for positive change in the direction of a proenvironmental behavior.

As reported above, increasing attention has been paid in recent years to the ways in which the environmental change is reported in the print media. However, although there is an extensive literature on green media, limited research has investigated communication strategies for attaining more effective environmental message transfer. This gap was signalized in research papers of Davis (1993), Obermiller (1995), Schuhwerk and Lefkoff-Hagius (1995), Chan and Rau (2004), Hartmann and Apaolaza-Ibanez (2009), Leonidou et al. (2011).

Trumbo (1996) traced the influence of the news media in the framing of climate change and in shaping discourses about climate change. A thorough analysis of the influence of the journalistic norm of bias in the coverage of global warning in the press was undertaken by scientists Boykoff and Boykoff (2004). Carvalho and Burgess (2005) and Smith (2005) critically examined the role of the media in constructing public perceptions of climate risk. Presented investigations contribute to the wider discourse on how environmental change risks are constructed by multiple public audiences and how these constructions translate into individual or collective action (Lorenzoni et al., 2005).

As stated at the beginning of this paper, the author's intention is to present how the findings in neuroscience may be applied in mass communication campaigns to achieve alterations in human behavior. Among various channels of mass communication, the author claims that public campaigns are appropriate subjects for further investigations on this field.

Other mediums of mass communication including advertising are not the subject of this research paper. However, for further research reasons it is important to distinguish these two tools. The reason the author will not elaborate on advertising as a potential instrument for behavior change is that advertising by itself and in contrast to public campaign focuses on feelings and perceptions towards products and does not lead to attitude change. Moreover, advertising is based on the idea of satisfying desires and wants and tries to stay with the tide of public opinion wants. Finally, it will not result in fundamental changes in behavior. Public campaigns, on the contrary are an attempt to shape behavior toward desirable social outcomes (Weiss and Tschirhart, 1994). They may not be in line with prevailing attitudes and opinions, and it is usually difficult to specify individual desires and wants. In advertising, a personal, short term outcomes and rewards are usually easy to see, and outcomes can usually be quantified, whereas in campaigns the outcomes and reward are not instant and difficult to see. Finally, campaigns usually relate to a social concern while advertising concerns slight modifications. Thus, the author indicates public campaigns as a channel of mass communication and an instrument accelerating behavior change.

Already in early 20th century E. Sapir (1921) came to conclusion that description of the structure of a language and its function in speech might help to explain the processes of perception and cognition in humans and provide a better insight into human behavior. Benjamin Lee Whorf, under the influence of Sapir, hypothesized that the structure of a language may influence the way a person conceives and perceives the world (Wardhaugh, 2002). In this context, also communication can be classified as a source of enabling factors that affects the process of behavior modelling. Communication scholars who have reviewed the communication campaigns literature, have tended to reach similar conclusions that mass media interventions, by themselves or in combination with other programs, can significantly influence the behaviors of populations (Rogers and Storey, 1987). Lewitt, Coate, and Grossman (1981) for example concluded that youth smoking rates were reduced by messages broadcast on radio and television. However, the effects of communication campaigns are typically only modest in size. Even though there are clear exceptions to this rule—i.e., campaigns that have had dramatic behavior change impacts (Holder and Treno, 1997) as well as campaigns that have had no behavior change impact—the rule itself applies to a broad range of public media campaigns.

Mass media campaigns have long been a tool for promoting certain behavior being widely used to expose high proportions of large populations to messages through routine uses of existing media, such as television, radio, and newspapers. The great promise of mass media campaigns lies in their ability to dis-

seminate well defined behaviorally focused messages to large audiences repeatedly, over time, in an incidental manner, and at a low cost per head. Mass media campaigns have generally aimed primarily to change knowledge, awareness, and attitudes, contributing to the goal of changing behavior. As a change in behavior is the highest priority in any public campaign, however, most of the mass media change knowledge and awareness more easily than behavior.

Generally, the behavior change is influenced by motivation from others (external influence) as well as through internal influence. The literature points to the following individual-level factors as being predictive of health behaviors: cognitions (e.g., knowledge and beliefs, self-efficacy, and outcome expectancies) (Bandura, 2004), emotions, skills (Brown and Eisenberg, 1995), motivation, and intentions (Fishbein, 2000). Biological predispositions (e.g., sensation seeking and demographic factors (Marmot et al., 1991) are additional individual-level factors that may be used to stratify audiences and target messages. Mass media campaigns have sought to influence these factors for their own sake, and to change behavior.

Mass media campaigns can work through direct and indirect pathways to change the behavior of whole populations. Many campaigns aim to directly affect individual recipients by invoking cognitive or emotional responses. Such programmes are intended to affect decision-making processes at the individual level. Anticipated outcomes include the removal or lowering of obstacles to change, helping people to adopt healthy or recognize unhealthy social norms, and to associate valued emotions with achieving change. These changes strengthen intentions to alter and increase the likelihood of achieving new behaviors.

Behavior change might also be achieved through indirect routes. First, mass media messages can set an agenda for and increase the frequency, of interpersonal discussion about a particular issue within an individual's social network, which, in combination with individual exposure to messages, might reinforce specific changes in behavior. Second, since mass media messages reach large audiences, changes in behavior that become norms within an individual's social network might influence that person's decisions without them having been directly exposed to or initially persuaded by the campaign.

Effective public mass media campaigns typically have two important qualities: they feature well-designed messages, and those messages are delivered to their intended audience with sufficient reach and frequency to be seen or heard and remembered (Hornik, 2002). The science on effective mass message design continues to develop. Hornik (2002) noted that the public communication field has been perhaps too focused on issues of message design and not adequately focused on the more costly challenge

associated with achieving sufficient levels of message exposure among members of the target audience. The actions promoted by the campaigns also vary, ranging from messages related to abstinence or moderation to more specific behavioral recommendations. Decisions related to message content are generally made based on the opinions expressed by experts or focus groups rather than on evidence of effectiveness in changing behavior. Another aspect of message content relates to the optimal amount of anxiety produced. The effectiveness of fear-based campaigns is the subject of a long-standing controversy. Some level of anxiety arousal is generally seen as a desirable motivator. However, several authors have cautioned that generating intense anxiety by emphasizing the severity of a problem and the audience's susceptibility to it can cause some people to ignore or discount the campaign messages. Although this caution appears to be justified, increasing the strength of a fear appeal also increases the probability that the audience will change their attitudes, intentions, and behaviors. These changes are maximized, and defensive avoidance minimized, when the anxiety-arousing message is accompanied by specific information about actions that people can take to protect.

Even though mass media campaigns are used extensively, considerable debate continues over their effectiveness. As changing behavior is the highest priority in any public campaign, however, most of the mass media will change knowledge and awareness more easily than behavior. Theoretically, the mass media are supposed to be most effective in achieving awareness. The literature is beginning to amass evidence that targeted, well-executed mass media campaigns can have small-to-moderate effects not only on knowledge, beliefs, and attitudes, but on behaviors as well, which can translate into major public impact.

However, various hindrances to the success of mass media campaigns exist. Exposure to mass media messages is generally passive (Wakefield et al., 2010) and such campaigns are frequently competing with factors, such as pervasive product marketing, powerful social norms, and behaviors driven by addiction or habit, exposure of audiences to the message might not meet expectations, hindered by inadequate funding, the increasingly fractured and cluttered media environment, use of inappropriate or poorly researched format (e.g., boring factual messages or age-inappropriate content), or a combination of these features. Moreover, persuasive marketing for competing products or with opposing messages, the power of social norms, and the drive of addiction frequently mean that positive campaign outcomes are not sustained. The careful planning and testing of campaign content and format with target audiences are, therefore, crucial.

Changes in audience behavior are frequently achievable, and it is important for the campaign planner to

set modest and realistic expectations about what can be achieved. A promotion campaign might be considered successful or effective if about five percent of the target audience does adopt measurable changes in health behavior over the longer-term (Rogers and Storey, 1987).

The above findings show that providing people with information and teaching them how they should behave does not always lead to desirable change in their behavior. However, when there is a supportive environment with information and communication then there is a desirable change in the behavior of the target group. Thus, an instructional intervention which has a close interface with education and communication need to be implemented. It is a strategic and group-oriented form of communication to perceive a desired change in behavior of target group. However, it is not as easy as it sounds, as there is no one-size-fits all strategy for any intervention.

Moreover, reviews of the public communication literature are limited in an important way. Most of what we know about the potential of public mass campaigns comes from campaigns that sought to influence population behavior by targeting individual-level antecedents to the behavior of concern (such as knowledge, perceptions, and self-efficacy). As such, extant literature reviews can reveal only a constrained view of the potential of public health communication. A more complete view-one that is more in line with contemporary thinking in public-requires that we gain an understanding of mass media campaign potential across the full range of factors.

There is a general perception that mass media campaigns are most likely to reduce undesired attitudes if other efforts reinforce their messages. Reinforcing factors may include law enforcement efforts, grass-roots activities, and other media messages. While there is universal agreement that the design of public communication campaigns needs to improve, there is not complete agreement about what direction it should take. Some argue that the field needs to focus on more rigorous evaluation that delivers information on cause and effect. Others argue that evaluation needs to be more practical and process-oriented.

Quite recently, considerable attention has been paid to the role of language itself in shaping desired behavior. This was demonstrated in many scientific discourses surrounding climate change: Corbett and Durfee (2004); Patt (2007) investigated the ways scientific uncertainties are contextualized, communicated, and understood. Linder (2006) argued the use of semiotics in advertising. A lot of attention was also given to the use and power of linguistic metaphors which is demonstrated in works of e.g. Moser & Dilling (2004); Nerlich (2009) and novel terms (Thelwall and Nerlich, 2010).

There is also emerging a vigorous debate about the efficacy of scientific language in communication strategies. In a variety of papers and initiatives sci-

entist are urged to adapt their language to suit the tastes, meanings, and concerns of ordinary people as they are said to employ a lexicon of caution and speak in a language of probability, which usually does not translate smoothly into the unequivocal messages that are valued in the press (Weingart et al., 2000). According to Hassol (2008) scientific communications on environment change are formulated the way that use words that mean something very different too much of the public. Therefore, scientific findings usually require translation into language that is more comprehensive to laypeople.

Another approach to the issue of proenvironmental behavior from a linguistic perspective is represented by Jill Ereaut and Nat Segnit (2006). In the report *The Warm Words* the authors examine different storylines called linguistic repertoires and suggest that these storylines shape the way in which public perceptions about climate change is developed. Moreover, there is still considerable ambiguity regarding efficacy of a discourse of catastrophic climate change (Ereaut and Segnit, 2006; Risbey, 2008). Scholars draw our attention to the fact that most of current environmental communication strategies evoke negative feelings like fear, guilt, or shame appeals, in order to highlight the urgency of the communicated issues. Although fear and risk communication research typically find that people must feel personally threatened for messages to influence behavior (Moser and Dilling, 2011) the climate change literature contains frequent warnings to avoid fearful messages (Moser, 2007). As a result, fear-based communication strategies raise no interest or concern at all (Moser and Dilling, 2011; O'Neill and Nicholson-Cole, 2009) and frequently fail in achieving desired behavioral outcomes (e.g. Nicholson-Cole, 2005; Lorenzoni et al., 2007).

Several communication studies therefore, point out that communicators of climate change should aim to achieve meaningful engagement in all three facets: understanding, emotion, and behavior. This calls for exploration in the field of cognitive barriers to individual engagement with climate change. Over years psychologists and scientists have explored factors that can affect individual decisions and public opinion on climate policy. Thus, they point to the relevance of emotions (Lorenzoni et al. 2006; Wolf and Moser 2011), cultural cognition (Kahan et al., 2011), ideologies (McCright and Dunlap, 2000; Weber, 2010), communicative strategies, and the individual experience of climatic events (Dessai et al., 2004; Spence et al., 2011).

Neuroscience and human behavior

All of above presented findings lead to conclusion that individual decision-making is not as much conscious as it was supposed and thus the model of *homo economicus* seems to be already outdated. The conclusion that reasoning cannot be regarded as ra-

tional anymore (Bechara and Damasio, 2005) resulted in increased attention paid to emotions and unconscious processes that influence human behavior (e.g. Camerer et al., 2005; Oehler and Reisch, 2008). Due to this new approach, in the past few years we witness growing interest in neuroscience that seems to provide a set of potentially powerful answers to the question on what are those unknown unconscious variables that determine human's behavior.

There is certain proof indicating brain as the main determinant of human decision-making process (Murphy et al, 2008). Moreover, some results show that in most cases, people are unable to express their reasons for certain behavior (Vecchiato et al., 2011). Thus, it seems that the argumentation by Kenning and Plassmann (2005) seem to be correct. Both authors claim that neuroscience takes neural processes as the basis for the explanation of human behavior. Neuroscience explores decision-making variables that are related to unconscious and are processed in an automated form (Martin and Morich, 2011) and thus tries to understand human behavior (Esch et al., 2008; Kumlehn, 2011).

Based on this approach, the author of this dissertation suggests that the knowledge that has been generated in the field of neuromarketing may be used in communication strategies related to environmental issues, as the search for explanations of neuroscience to understand the process of decision making can bring new perspectives for environmental problems. The greater understanding of how to increase the emotional engagement of people in favour of sustainable decisions is one of these possibilities. Understanding whether environmental messages in mass media are effectively being successful or failing in reaching their awareness goals are examples of these new research lines for sustainability.

In the light of the above discourse the author of this dissertation hypothesizes, that from the neuro-perspective people have an instinctual reaction to words and language. The key is to recognize which words will elicit the desired reaction, depending on the target group. Building on recent advances in the cognitive sciences as well as on rapidly evolving technological support tools for studying the mind, a neuroscience approach promises new insights that could increase humans' ability to shape the necessary social change in the transition to a sustainable future. This approach implies that neuroscience can fill the gap of environmental knowledge awareness transferred in messages and the right decisions in benefit of the proenvironmental behavior.

Discussion

As reported above, social development as well as the protection of environmental resources are areas of growing importance for consumers, businesses, governments, and the society at large (e.g., Grinstein and Nisan, 2009; Menon and Menon, 1997; Peattie and

Peattie, 2009) which prompt wide discourse in scientific literature and mass media. This media-boom leads to situation when communication channels are oversaturated with information-based messages on environmental change and the possible actions to prevent further environment deterioration. However, many findings showed that enhancing knowledge and creating supportive attitudes often has little or no impact on behavior change. Several surveys indicate that people are well informed and aware of the ecological danger that is around us. According to Ockwell et al. (2009) existing communication approaches often fail to meaningfully engage, as they do not consider the holistic aspects of proenvironmental behavior.

Although growing interest in the relationship of personality variables and consumer behavior is demonstrated in plenty of papers, past attempts to understand and predict human behavior using personality variables have resulted in disappointing results (Kakkar and Lutz, 1981). Many researches showed that individual decisions depend in 80% on unconscious behavior. Scholars observed that research examining personality effects on human behavior was often conducted without the guidance of general theoretical frameworks. As a result, little understanding of the processes by which a personality variable ultimately influenced preferences or behavior has been gained. Thus, it could be concluded that even if there are intense and well-structured awareness campaigns related to environmental problems, they may not be effectively reaching the proposed objectives, as they would not influence the decision and be changing deeply rooted unconscious variables.

To sum up, although there are many publications on research strategies to motivate people to act proenvironmental, and many proenvironmental change intervention have been implemented so far, we could question the extent to which the field is moving forward as numerous theoretical frameworks have been developed to explain the gap between the possession of environmental knowledge and environmental awareness and displaying pro-environmental behavior. Although many hundreds of studies have been undertaken, no definitive explanation has yet been found.

Some of these insights lead to the conclusion that there are fundamental internal and unconscious obstacles to climate action: people might simply do not change, even if they are fully informed about the problem and aware of the different perspectives regarding the problem and its solution. This raises questions about the effectiveness of current communication efforts, and the ability of their audiences to implement change in response to these communications. Moreover, research findings have showed that some of the traditional communication strategies used to motivate people can result in proenvironmental behavior change (Bamberg and Moser, 2007). However, these have only short-term effect - a long-

term maintenance of these behaviors has been a rocky problem. People seem to react favorably to the strategies initially, but their behavior declines over time, and more importantly, behavior returns to baseline if the source of motivation is withdrawn (Lehman and Geller, 2004). The immediate strategies for consumers to change their behavior are often reported to be weak or nonexistent (Osterhus, 1997). Several scholars signalize existence of a gap between environmental knowledge and awareness which is demonstrated in media, and active behavior change (e.g. Kollmuss and Agyeman, 2002; Tobler et al., 2011). Attempts to answer the question on how to fill this gap have drawn upon social and behavioral psychology (e.g. Lowe, 2006; Leiserowitz, 2006) and the communication sciences (e.g. Nicholson-Cole, 2005; Moser and Dilling, 2007). It seems that not only the persuasiveness of the messages, but also the more alternative/holistic approaches to communication are needed to determine the variables that influence the behavior change.

The discussion about the use of brain science outside the health care system is gaining prominence. Advances in neuroscience raise ethical, social, and legal issues in relation to the human person and the brain. Nowadays there are many businesses offering neuroscientific methods under the umbrella term neuroscience. However, one should not lump everything that is related to brain science together. There are purely academic studies try to develop and derive recommendations for practical fields. It is to highlight that debates over neuromarketing tend to lack a differentiation between scientific and commercial for-profit applications. Especially in the public ethical discussion, it is important to distinguish academic studies that use neuroscientific methods from those purely for the purposes of commercial marketing. It is not taken into consideration, that scientific studies often focus on the consumer's point of view, while commercial ones try to apply findings to sell a product.

Conclusion

It can be concluded that the future of sustainability efforts must increasingly be seen in a systemic and holistic way and neuromarketing as an alternative remedy for environmental problems is the best example. Advances in neuroimaging technology have led to an explosion in the number of studies investigating the living human brain, and thereby our understanding of its structure and function. The insights of neuroscience are only just becoming available for the study of mass communication. Thus, the author of this article claims that the findings made in the field of neuroscience should be incorporated in the process of the mass communication message design. Further research on the relation of these two fields and its ethical aspect is needed.

References

1. ADOLPHS R., 2009, The social brain: neural basis of social knowledge, in: *Annual Review of Psychology*, 60(1), p. 693-716.
2. BAMBERG S., MOSER G., 2007, Twenty years after Hines, Hungerford and Tomera: A new meta-analysis of psycho-social determinants of pro-environmental behavior, in: *Journal of Environmental Psychology*, 27, p. 14-25.
3. BANDURA A., 2004, Health promotion by social cognitive means, in: *Health Education & Behavior*, 31, p. 143-164.
4. BAZERMAN M. H., HOFFMAN A. J., 1999, Sources of Environmentally Destructive Behavior: Individual, Organizational, and Institutional Perspectives, in: *Research in Organizational Behavior*, 21.
5. BAZERMAN M. H., BARON J., SHONK, K., 2001, *You Can't Enlarge the Pie: Six barriers to effective government*, Basic Books, New York.
6. BECHARA A., DAMASIO A.R., 2005, The somatic marker hypothesis: a neural theory of economic decision, in: *Games and Economic Behavior*, 52, p. 336-372.
7. BEDDOE R., COSTANZA R., FARLEY J., GARZA E., KENT J., KUBISZEWSKI I., 2009, Overcoming systemic roadblocks to sustainability: The evolutionary redesign of worldviews, institutions, and technologies, in: *Proceedings of the National Academy of Science*, 106(8), p. 2483-2489.
8. BORD R.J., O'CONNOR R.E., FISHER A., 2000, What sense does the public need to understand global climate change?, in: *Public Understanding of Science*, 9, p. 205-218.
9. BOYKOFF M.T., BOYKOFF J.M., 2004, Balance as bias: global warming and the US prestige press, in: *Global Environmental Change*, 14, p. 125-136.
10. BROWN S.S., EISENBERG L., 1995, *The Best Intentions: Unintended Pregnancy and the Well-Being of Children and Families*, National Academy Press, Washington DC.
11. CAMERER C., LOEWENSTEIN G., PRELEC D., 2005, Neuroeconomics: How neuroscience can inform economics, in: *Journal of economic literature*, p. 9-64.
12. CANTRILL J., 1992, Understanding environmental advocacy: inter-disciplinary research and the role of cognition, in: *Journal of Environmental Education*, 24(1).
13. CARVALHO A., BURGESS J., 2005, Cultural circuits of climate change in UK, in: *Broadsheet newspapers 1985-2003*, 25, p. 1457-1469.
14. CHAN R.Y.K., LAU L.B.Y., 2004, The effectiveness of environmental claims among Chinese consumers: Influences of claim type, country disposition and eco-centric orientation, in: *Journal of Marketing Management*, 20 (3), p. 279-319.
15. CORBETT J.B., DURFEE J.L., 2004, TESTING public (un)certainly of science media representations of global warming, in: *Science Communication*, 26(2), p. 129-151.
16. CVETKOVICH G., WENER R., 1994, How Can Psychology Help Save the Planet? A Research Agenda on Environmental Problems, in: *American Psychological Association*, 1.

17. DARNTON A., 2008, Practical Guide: An overview of behaviour change models and their uses, in: *Government Social Research Unit*, 2.
18. DAVIS J.J., 1993, Strategies for environmental advertising, in: *The Journal of Consumer Marketing*, 10 (2).
19. DESSAI S., ADGER W. N., HULME M., TURNPENNY J., KÖHLER J., WARREN R., 2004, Defining and Experiencing Dangerous Climate Change, in: *Climatic Change*, 64(1/2), p. 11-25.
20. MCKENZIE-MOHR D., 2000, New Ways to Promote Proenvironmental Behavior. Promoting Sustainable Behavior: An Introduction to Community-Based Social Marketing, in: *Journal of Social Issues*, 56(3), p. 543-554.
21. SAPIR E., 1921, *Language: An Introduction to the Study of Speech*, Harcourt, Brace and company, New York.
22. ENGEL J. F., BLACKWELL R. D., MINIARD P. W., 1986, *Consumer behavior*, Dryden, New York.
23. EREAUT G., SEGNET N., 2006, Warm words: how are we telling the climate story and can we tell it better?, in: *Institute for Public Policy Research*, 32.
24. ESCH F. R., MÖLL T., ELGER C. E., NEUHAUS C., WEBER, B., 2008, Wirkung von arkenemotio-nen: Neuromarketing als neuer verhaltenswissen-schaftlicher Zugang, in: *Marketing ZFP*, 30(2), p. 111-129.
25. FISHBEIN M., 2000, The role of theory in HIV pre-vention, in: *AIDS Care*, 12, p. 273-78.
26. FISHER, J. 2007, Mind the sustainability gap, in: *Trends in Ecology and Evolution*, 22(12), p. 621-624.
27. GARDNER G.T., STERN, P.C., 2002, *Environmental problems and human behavior*, Pearson Custom Publishing, Boston.
28. GRINSTEIN A., UDIN, 2009, Demarketing, Minorities and Marketing Attachment, in: *Journal of Marketing*, 73(2), p. 105-22.
29. HARTMANN P., APAOLAZA-IBÁÑEZ V., 2009, Green advertising revisited: conditioning virtual nature experiences, in: *International Journal of Advertising*, 28(4), p. 715-739.
30. HASSOL S.J., 2008, Improving how scientists communicate about climate change Eos, in: *Weekly Journal of the American Geophysical Union*, 89, p. 106-107.
31. HINE R., PEACOCK J., PRETTY J., 2008, *Evaluating the impact of environmental volunteering on behaviors and attitudes to the environment. Report for BTCV Cymru*, Department of Biological Sciences, University of Essex, Colchester.
32. HOFFMAN A., BAZERMAN M. H., 2007, Changing practices on sustainability: Understanding and overcoming the organizational and psychological barriers to action, in: *Organizations and the Sustainability Mosaic*, eds. Sharma S., Starik M. & Husted B., Edward Elgar Publishing.
33. HOLDER H. D., TRENO A. J., 1997, Media advocacy in community prevention: news as a means to advance policy change, in: *Addiction*, 92, p. 189-199.
34. HORNICK R., 2002, Evidence for Behavior Change, in: *Public Health Communication*, Lawrence Erlbaum Associates, Mahwah, NJ, p. 419-437.
35. HOUGHTON J.T., DING Y., GRIGGS D.J., NOGUER, M., VAN DER LINDEN P.J., DAI X., MASKELL K., JOHNSON C.A., 2001, *Climate Change 2001. The Scientific Basis – Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change*, Cambridge University Press.
36. JABBOUR C.J.C., OLIVEIRA J.H.C., 2011, Some issues concerning the non-technological side of green technologies, in: *International Bulletin of Business Administration*, 12, p. 79-83.
37. JACKSON T., 2005, Motivating Sustainable Consumption. A review of evidence on consumer behaviour and behavioral change, A report to the Sustainable Development Research Network, in: *Journal of Risk Research*, 9(3).
38. KAHAN D. M., JENKINS-SMITH H., BRAMAN D., 2011, Cultural cognition of scientific consensus, in: *Journal of Risk Research*, 14(2), p. 147-174.
39. KAHAN D. M., PETERS E., WITTLIN M., SLOVIC P., OUELLETTE L. L., BRAMAN D., MANDEL G., 2012, The polarizing impact of science literacy and numeracy on perceived climate change risks, in: *Nature Climate Change* (2), p. 732-735.
40. KAHNEMAN D., TVERSKY A., 1979, Prospect Theory: An Analysis of Decision under Risk, in: *Econometrica*, 47(2), p. 263-291.
41. KAKKAR P., LUTZ R. J., 1981, Situational influences on consumer behavior: A review, in: *Perspectives in consumer behavior*, eds. Kassarian H.H., Robertson T. S., Scott, Foresman, Glenview, IL, p. 204-214.
42. KAZDIN A., 2009, Psychological science's contributions to a sustainable environment, in: *American Psychologist*, 64, p. 339-356.
43. ENNING P., PLASSMANN H., 2005, NeuroEconomics: An overview from an economic perspective, in: *Brain Research Bulletin*, 67(5), p. 343-354.
44. KOLLMUSS A., AGYEMAN J., 2002, Mind the gap: why do people act environmentally and what are the barriers to pro-environmental behavior?, in: *Environmental education research*, 8(3), p. 239-260.
45. KUMLEHN M., 2011, *Consumer Neuroscience: Pricing research to gain and sustain a cutting edge competitive advantage by improving customer value and profitability*.
46. LEHMAN P. K., GELLER E. S., 2004, Behavioral analysis and environmental protection: Accomplishments and potential for more, in: *Behavioral and Social Issues*, 13, p. 13-24.
47. LEISEROWITZ A., 2006, Climate change risk perception and policy preferences: the role of effect, imagery, and values, in: *Climatic Change*, 77, p. 45-72.
48. LEONIDOU L., LEONIDOU C., PALIHAWADANA D., HULTMAN M., 2011, Evaluating the green advertising practices of international firms: a trend analysis, in: *International Marketing Review*, 28 (1), p. 6-33.
49. LEWIS E.M. et al., 1981, The effects of government regulations on teenage smoking, in: *Journal of Law and Economics*, 24, p. 545-570.
50. LINDER S.H., 2006, Cashing-in on risk claims: on the for-profit inversion of signifiers for 'global warming', in: *Social Semiotics*, 16(1), p. 103-132.
51. LORENZONI I., LEISEROWITZ A., DORIA M. D. F., POORTINGA W., PIDGEON N. F., 2006, Cross-National Comparisons of Image Associations with 'Global Warming' and 'Climate Change' Among Laypeople in the United States of America and Great Britain, in: *Journal of Risk Research*, 9, p. 265-281.

52. LORENZONI I., NICHOLSON-COLE S.A., WHITMARSH L., 2007, Barriers perceived to engaging with climate change among the UK public and their policy implications, in: *Global Environmental Change*, 17, p. 255-273.
53. LORENZONI I., PIDGEON N.F., O'CONNOR R.E., 2005, Dangerous climate change: the role of risk research, in: *Risk Analysis*, 25(6), p. 1387-1398.
54. LOWE T.D., 2006, Is this climate porn? How does climate change communication affect our perceptions and behavior?, in: *Tyndall Centre Working Paper*, 98, p. 37.
55. MARMOT M. G., SMITH G. D., STANSFELD S., PATEL C., NORTH F., HEAD J., WHITE I., BRUNNER E., FEENEY A., 1991, Health inequalities among British civil servants: The Whitehall II study, in: *Lancet*, 337, p. 1387-1393.
56. MARTIN N., MORICH K., 2011, Unconscious mental processes in consumer choice: Towards new model of consumer behavior, in: *Journal of Brand Management*, 18 (7), p. 483-505.
57. MCCRIGHT A. M., DUNLAP R. E., 2000, Challenging Global Warming as a Social Problem: An Analysis of the Conservative Movement's Counter-Claims, in: *Social Problems*, 47(4), p. 499-522.
58. MENON A., MENON A., 1997, Enviropreneurial Marketing Strategy: The Emergence of Corporate Environmentalism as Market Strategy, in: *Journal of Marketing*, 61(1), p. 51-67.
59. MOSER S., DILLING L., 2004, Making climate hot: communicating the urgency and challenge of global climate change, in: *Environ.*, 46, p. 32-46.
60. MOSER S.C., DILLING L., 2011, Communicating climate change: closing the science – action gap, in: *The Oxford Handbook of Climate Change and Society*, eds. Dryzek J. S., Norgaard R. B. & Schlosberg, D., OUP Oxford, Oxford, p. 103-120.
61. MOSER S.C., 2007, More bad news: the risk of neglecting emotional responses to climate change information, in: *Creating a climate for change: communicating climate change and facilitating social change*, eds. Moser SC, Dilling L., Cambridge University Press, New York, p. 64-80.
62. MURPHY E. R., ILLES J., REINER P. B., 2008, Neuroethics of neuromarketing, in: *Journal of Consumer Behavior*, 7, p. 293-302.
63. NAKICENOVIC N., SWART R., 2000, *IPCC Special Report: Emissions Scenarios*, Cambridge University Press.
64. NERLICH B., KOTEYKO N., BROWN B., 2009, Theory and language of climate change communication, in: *Wiley Interdisciplinary Reviews: Climate Change*, 1, 97-110.
65. NICHOLSON-COLE S., 2005, Representing climate change futures: a critique on the use of images for visual communication Computers, in: *Environment and Urban Systems*, 29, p. 255-273.
66. OBERMILLER C., 1995, The baby is sick/ the baby is well: a test of environmental communication appeals, in: *Journal of Advertising*, 24(2).
67. OCKWELL D., WHITMARSH L. E., O'NEILL S., 2009, Reorienting climate change communication for effective mitigation forcing people to be green or fostering grass-roots engagement ?, in: *Science Communication*, 30(3), p. 305-327.
68. OEHLER A., REISCH L.A., 2008, *Behavioral economics – eine neue Grundlage für Verbraucherpolitik?* Eine Studie im Auftrag des Verbraucherzentrale Bundesverbandes, Verbraucherzentrale Bundesverband, Berlin.
69. O'NEILL S., NICHOLSON-COLE S., 2009, Fear Won't Do It: Promoting Positive Engagement With Climate Change Through Visual and Iconic Representations, in: *Science Communication*, 30(3), p. 355-379.
70. OSKAMP S., 2000, A sustainable future for humanity: How can psychology help? in: *American Psychologist*, 55, p. 496-508.
71. OSTERHUS T., 1997, Pro-Social Consumer Influence Strategies: When and How Do They Work?, in: *Journal of Marketing*, 61, p. 16-29.
72. PATT A., 2007, Assessing model-based and conflict-based uncertainty, in: *Global Environmental Change*, 17(1), p. 37-46.
73. PEATTIE K. A., PEATTIE S., 2009, Social Marketing: A Pathway to Consumption Reduction?, in: *Journal of Business Research*, 62 (2), p. 260-68.
74. PELLETIER L.G., SHARP E., 2008, Persuasive communication and proenvironmental behaviors: How message tailoring and message framing can improve the integration of behaviors through self-determined motivation, in: *Canadian Psychology*, 49(3), p. 210-217.
75. RIK P., BIJMOLT T., VAN RAAIJ F., DE KRUIJK MARK, 1998, Consumers' Attributions of Proenvironmental Behavior, Motivation, and Ability to Self and Others, in: *Journal of Public Policy & Marketing*, 17, 215-225.
76. RIEDL R., HUBERT M., KENNING P., 2010, Are there neural gender differences in online trust? An fMRI study on the perceived trustworthiness of eBay offers, in: *Mis. Quarterly*, 34(2), p. 397-428.
77. RISBEY J.S., 2008, The new climate discourse: alarmist or alarming?, in: *Global Environmental Change*, 18(1), p. 26-37.
78. ROGERS E. M., STOREY J. D., 1987, Communication campaigns, in: *Handbook of communication science*, eds. Berger C. R., Chaffee S., Sage publications, Beverly Hills, p. 817-846.
79. ROTHMAN A. J., SALOVEY, P., 1997, Shaping perceptions to motivate healthy behavior: The role of message framing, in: *Psychological Bulletin*, 12, p. 3-19.
80. SANFEY A. G., LOEWENSTEIN G., MCCLURE S. M., COHEN J. D., 2006, Neuroeconomics: cross-currents in research on decision-making, in: *Trends in cognitive sciences*, 10(3), p. 108-116.
81. SCHOENFELD A.C., MEIER R.F., GRIYN R.J., 1979, Constructing a social problem: the press and the environment, in: *Social Problems*, 27 (1), p. 38-61.
82. SCHUHWERK M.E, LEFKOFF-HAGIUS R., 1995, Green or non-green? Does type of appeal matter when advertising a green product? in: *Journal of Advertising*, 24, p. 45-54.
83. SMITH N.W., JOFFE H., 2009, Climate change in the British press: the role of the visual, in: *Journal of Risk Research*, 12, p. 647-663.
84. SOUTHERTON S., MCMEEKIN A., EVANS D., 2011, *International review of behaviour change initiatives: climate change behavior's research programme*, Government Social Research Unit.
85. SPECTOR KITSUSE J., 1977, *Constructing Social Problems*, Menlo Park, Cummings, USA.

86. SPENCE A., POORTINGA W., BUTLER C., PIDGEON N. F., 2011, Perceptions of climate change and willingness to save energy related to flood experience., in: *Nature Climate Change*, 1, p. 46-49.
87. STERN P., 2000, Psychology and the science of human-environment interactions, in: *American Psychologist*, 55(5), p. 523-530.
88. SWIM J., CLAYTON S., HOWARD G., 2011, Human behavioral contributions to climate change: Psychological and contextual drivers, in: *American Psychologist*, 66(4), p. 251-264.
89. THALER R. H., SUNSTEIN C. R., 2009, *Nudge: Improving Decisions About Health, Wealth, and Happiness*, Penguin, New York.
90. TOBLER C., VISSCHERS V.H.M., SIEGRIST M., 2011, Eating green. Consumers' willingness to adopt ecological food consumption behaviors, in: *Appetite*, 57(3), p. 674-682.
91. TRUMBO C., 1996, Constructing climate change: Claims and frames in US news coverage of an environmental issue, in: *Public Understanding of Science*, 5(3).
92. VAN DER LINDEN S., 2014, Towards a new model for communicating climate change, in: *Understanding and governing sustainable tourism mobility: Psychological and behavioural approaches*, eds. Cohen S., Higham J., Peeters P., Gössling S., Routledge: Taylor and Francis Group, p. 243-275.
93. VECCHIATO G., ASTOLFI L., DE VICO FALLANI F., TOPPI J., ALOISE F., BEZ F., 2011, On the use of EEG or MEG brain imaging tools in neuromarketing research, in: *Comput. Intell. Neurosci.* 2011.
94. WAKEFIELD M. A., LOKEN B., HORNIK R. C., 2010, Use of mass media campaigns to change health behavior, in: *The Lancet*, 376, p. 1261-1271.
95. WARDHAUGH R., 2002, *An introduction to sociolinguistics*, Blackwell Publishers, Oxford, p. 220.
96. WEBER E. U., 2010, What shapes perceptions of climate change? in: *Wiley Interdisciplinary Reviews: Climate Change*, 1(3), p. 332-342.
97. WEINGART P., ENGELS A., PANSEGRAU P., 2000, Risks of communication: discourses on climate change in science, politics, and the mass media, in: *Public Understanding of Science*, 9 (3), p. 261.
98. WEISS J.A., TSCHIRHART M., 1994, Public Information Campaign as Policy Instruments, in: *Journal of Policy Analysis and Management*, 13, p. 82-119.
99. WOLF J., MOSER S. C., 2011, Individual understandings, perceptions, and engagement with climate change: insights from in-depth studies across the world, in: *Wiley Interdisciplinary Reviews: Climate Change*, 2(4), p. 547-569.
100. WCED (WORLD COMMISSION ON ENVIRONMENT AND DEVELOPMENT), 1987, *Our Common Future*, Oxford University Press, New York.

Media Discourses of Mekong Dams: A Thematic Analysis

Dyskursy medialne o zaporach na rzece Mekong: analiza tematyczna

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Abstract

Economic and political stability in Southeast Asia has led to a surge in Mekong dam development and construction in the 2010s. But, not only has the logistics of dam construction changed dramatically in the 35 years since Mekong hydroelectric development began; the public discourse surrounding hydroelectric development in the region has also expanded and diversified. The Mekong, while still seen by some throughout the region as a source of untapped economic opportunity, is also a source of growing concern for states who are losing control of the dams' ecological impact. Both of these visions of the river are framed in the public imagination of various states by their respective media's chosen depiction of the issue of dam development. Through an examination of the discourse surrounding Mekong hydro development in the four Mekong River Commission (MRC) states, this paper explores the divergent interests of states currently engaged in a complex water diplomacy. Themes drawn from the English-language press coverage in Laos, Thailand, Cambodia, and Vietnam are compared to determine how the unique geographic and economic positioning of each state shapes their media's depiction of Mekong dam development. Shared concerns about environmental damage, MRC weakness, and economic futures are also explored.

Key words: dams, discourse analysis, Mekong, Laos, Cambodia, Thailand, Vietnam

Streszczenie

Ekonomiczna i polityczna stabilizacja w południowo-wschodniej Azji doprowadziła po 2010 r. do podjęcia decyzji o budowie zapór na rzece Mekong. Od czasu, gdy 35 lat temu rozpoczął się rozwój energetyki wodnej na rzece Mekong wiele się zmieniło i to nie tylko od strony logistycznej, także dyskusja publiczna odnosząca się do przyszłości hydroenergetyki w regionie uległa rozszerzeniu. Rzeka nadal postrzegana jest przez wielu jako potencjalne źródło ekonomicznego wzrostu, zarazem jest przedmiotem rosnących obaw dla krajów, które wydają się nie być w stanie utrzymać pod kontrolą ekologicznych konsekwencji budowy zapór. Oba podejścia trafiają do obiegu publicznego w poszczególnych krajach dzięki doniesieniom medialnym. W niniejszym artykule dokonano przeglądu dyskursu wokół rozwoju hydroenergetyki na rzece Mekong w czterech krajach należących do Komisji ds. rzeki Mekong (Mekong River Commission. MRC), ukazano rozbieżności w preferencjach poszczególnych krajów, zaangażowanych w skomplikowaną dyplomację wodną. Porównano treści publikowane w anglojęzycznej w Laosie, w Tajlandii, Kambodży i Wietnamie, w celu ustalenia, w jaki sposób unikalne położenie geograficzne i gospodarcze każdego państwa kształtuje obraz ich mediów w kontekście budowy kolejnych zapór na rzece Mekong. Omówiono również wspólne obawy dotyczące szkód wyrządzonych środowisku naturalnemu, słabości komisji MRC i konsekwencji tego stanu dla przyszłości ekonomicznej regionu.

Słowa kluczowe: zapory, analiza dyskursu, Mekong, Laos, Kambodża, Tajlandia, Wietnam

Introduction

Long before there were borders and governments, the Mekong connected peoples along its banks in both ecology and livelihoods. The Mekong ties the history, economics, and futures of Laos, Cambodia, Thailand, and Vietnam, forcing regional cooperation or conflict. The river winds through the landscape of these modern nation-states, while discussion of this waterway's future winds its way through public discourse and local media. The river and its development has long served as a symbol of identity and economic promise, and in the 21st century, water diplomacy has become symbolic of the larger economic relationships in the region.

The construction of hydroelectric dams along a river that travels through multiple states both requires and implies regional stability and consultation. In many ways, the Mekong River, and discourses around it, have become emblematic of larger regional cooperation and conflict. Development and dam-construction mean that the river is seen as either an opportunity or an obstacle, depending on how much agency a state's government maintains in directing the flow of the river. Dams also result in environmental damage in both the country hosting the dam, and countries downstream. Indeed, while hydroelectric dams can potentially make a contribution to sustainable development, they are also associated with high environmental and social costs (Delang, 2011; Delang, 2013; Skudder, 2012) which make them particularly contentious. All these factors combine to shape the discourse surrounding dam development, resulting in some shared themes between regional English-language presses and some country-unique debates shaped by geography, economic situation, and energy needs.

While there are some early examples of Mekong dams dating from the 1970s and 1980s, the last decade has seen a significant increase in the number of new dam projects being developed, especially in Laos. The resulting coverage in the English-language presses of the four Mekong River Commission (MRC) countries (Laos, Thailand, Cambodia and Viet Nam) illuminate the values and concerns of their respective publics. Through discourse analysis, some overarching themes emerge, albeit to varying degrees in each country's press: uncertainty about the future of hydroelectricity; fear of environmental damage; mistrust of the MRC; and belief in the importance of water diplomacy. The degree to which states control dam development also plays a role in media coverage. By examining central themes in each press, and then comparing coverage between states, this paper demonstrates how geographic realities shape media coverage of massive public infrastructure projects. While some differences in discourse are due to political relations between the involved states, each country's press coverage and public discourse surrounding Mekong dam develop-

ment is most heavily dependent on its geographic and ecological location, as well as its position as a buyer or seller of hydroelectricity.

Geography and History of Mekong Development

The Mekong River is born from the waters of China's Qinghai province, travelling over 2,700 miles through six countries. After moving through China, it forms the border between Myanmar (Burma) and Laos, and then Laos and Thailand, before cutting south through Cambodia and emptying out through Vietnam's fertile Mekong Delta region into the South China Sea. It remains the 10th largest river by volume. Over 80 million people throughout six countries in the region share the river and its tributaries, utilizing the Mekong for food, water, transport, electricity, and other daily activities. The river is also a collection of irreplaceable ecosystems, with a diversity of fish second only to the Amazon. China plays a major role in controlling dam development on the Mekong. Chinese dams are opened and closed at the will of the Chinese government, at times causing flooding that severely impacts agriculture in Thailand, Cambodia, and Vietnam. This power dynamic sours how Thailand, Cambodia, and Vietnam view Chinese investment in, and support of, regional dam development. Chinese funding is involved in nearly all dam projects in Laos and Cambodia, while more and more NGOs are conceding that Chinese interests are overwhelming the MRC (Harris, 2018a).

When discussing the construction of dams along the Mekong, scholars and policy-makers alike generally divide their analysis between dams on the Lancang, or Upper Mekong as it travels through the Yunnan province of China, and dams on the lower Mekong, constructed in Laos, Cambodia, and Thailand. Dams which are up river in China have had a major impact on the flow and volume of the Mekong downstream, and are thus of interest to all countries in the region. But for the countries of the lower Mekong river, regional cooperation and conflict stems from shared planning through the MRC.

The lower Mekong region, consisting of the watershed areas downstream of China and Myanmar, includes parts of Thailand and Vietnam and almost all of Laos and Cambodia. This region constitutes roughly 75% of the total catchment and contributes approximately 80% of the river's flow (Rothert, 1995), mostly in Laos. The population of the lower Mekong region is approximately 60 million, with nearly 40% of that population within 15 km of the water (MRC, 2018), and much of this population survives at a poverty level that, when faced with ecological damage to their livelihoods, cannot easily adapt.

Plans to develop the lower Mekong began in earnest in the 1950s. The United Nations, the US Department of the Interior, and private companies ran hy-

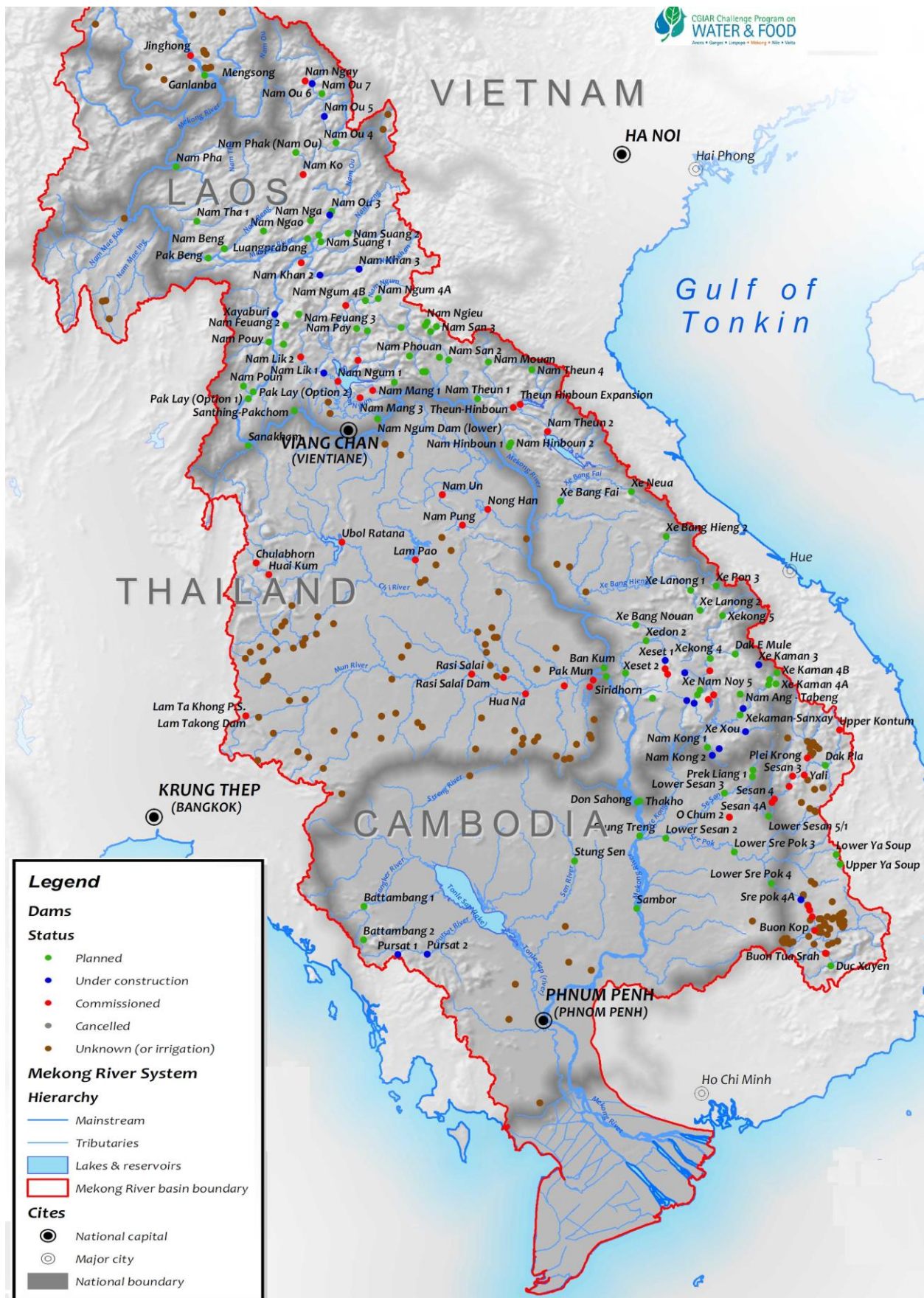


Figure 1. Mekong dams, planned, under construction, commissioned and cancelled Source: CGIAR Challenge Program on Water and Food (2013)

dro-development studies, focusing primarily on irrigation and agricultural development (Schaaf and Field, 1963). Using the Mekong to create seaport alternative for landlocked Laos was also considered (Chomchai, 1987).

An initial Mekong Commission was formed in 1957 between Cambodia, Thailand, Vietnam, and Laos, guided by the international community. The vast majority of its projects never came to fruition. The Indochina conflicts that dominated the region for decades largely stalled any development of the Mekong downstream other than those constructed in Thailand. In 1978, Thailand, Laos, and Vietnam agreed to form an Interim Mekong Commission without Khmer Rouge Cambodia.

In 1991, the Paris Peace Accords brought an end to regional conflicts between Cambodia and Vietnam, and global economic and political patronage relationships changed as the USSR disbanded. Vietnam joined ASEAN in 1995, Myanmar and Laos joined in 1997, and Cambodia joined in 1999¹, heralding an era of regional cooperation not only on issues of security, but also in regards to environmental policy.

In 1995, the Mekong River Commission (MRC) reformed, including the four riparian states of Thailand, Laos, Cambodia, and Vietnam. The organization serves today as a scientific, economic, and social cooperative effort to ensure fair and environmentally-secure development of the river and its tributaries. China began sharing flood data and other information with the MRC in 2002, and acts as a *dialogue partner*, though the ability of the MRC to question or affect China's policies is negligible (Käkönen and Hirsch, 2009).

The mid-1990s also brought the growing importance of water diplomacy to the fore. Water diplomacy refers to the political negotiations and cooperative frameworks that result from the need to develop environmental policy, water management strategies, and engineering solutions to address water-resource problems. For riparian states that share a joint waterway, successful water diplomacy ensures minimized environmental damage and diminished impact on local livelihoods. Water diplomacy occurs at all levels, from the local level as the state negotiates with displaced citizens to the regional level as states condemn how flooding is caused downriver. Water diplomacy is a mentality that connects resource management with the political actions of state governments (Middleton Garcia & Foran, 2009).

The overall result of political shifts and new alliances in the 1990s was that major dam projects in the region that had been delayed for decades could be considered again, creating new opportunities for resource development and regional conflict or cooperation. The delay in development also means that

much of the rhetoric surrounding the Mekong focuses on its state as *pristine* and *natural* (Bakker, 1999, p. 211-214), a trend which is beginning to change.

In recent years, investment, both regional and from further afield, has funded dozens of projects with varying success, many of which have required international cooperation and the use of collaborative engineering and planning. Projects have included land and water transport networks as well as various forms of energy development, including hydroelectric generation and natural gas transportation (International Rivers, 2017). Individual state's development programs, as well as the rhetoric which surrounds each of them, are laid out in more detail. First, however, it is necessary to examine the discourse surrounding Mekong dam development from previous decades, before the most recent resurgence of dam construction.

Previous Content Analysis of the Mekong River Basin Discourse

Traditionally, in *Southeast Asia*, water provided a bridge rather than a barrier between distant communities (Rigg, 1992, p. 1), and the river has become a cultural symbol of sharing and cooperation with other peoples in the mythoses of many of the riparian states. Many of the empires and peoples who lived in Southeast Asia existed independent of the territorial divisions created during the Indochina period of French colonization in the 19th and 20th century. Previous to this, the river was a connection for these peoples rather than a boundary of territory. Unsurprisingly, most media coverage across the region in regards to dams recognizes the interconnectivity of all the riparian peoples along the Mekong.

Much of the discourse surrounding the Mekong river and its hydroelectric development through dam construction was highly optimistic in the 1990s, with emphasis on the energized, exciting opportunities of dam construction, even when at the expense of citizens. Lohmann (1998) outlines several themes surrounding optimism and energy in public discourse during the 1990s. He argues that Thai public discourses surrounding dam projects require constant reimagining of those projects to counter any unrest in the face of flooding and damage. He compares this discourse to a theatrical drama, in which unrealistic dreams give way to dissatisfied citizens and government manipulation, all played out on the stage of the Thai public sphere. Today, Thai media coverage of Mekong dams avoids this drama altogether by focusing on dams in other countries; many other states, however, are at the tail end of similar trajectories from optimism to rejection in their discourses.

¹Cambodia was originally slated to join in 1997 with Myanmar and Laos, but wide-spread rioting in the summer of

1997 resulted in a delay. Thailand was already in ASEAN, joining as a founding member in 1967.

Previous analyses of the debate surrounding Mekong dams notes that this discourse overemphasizes themes of regional cooperation and a wild, underdeveloped river. Bakker (1999) argues that the narrative of the Mekong as an underdeveloped resource requiring regional cooperation is exaggerated, to the benefit of both individual states and their collective regional efforts. She argues that narratives surrounding Mekong development were less about the actual dams themselves, and more about reaffirming the regional political order. She argues that the shared narratives of the 1990s served to *legitimise a new post-Indochina War set of regional geopolitical relationships* (Bakker, 1999, p. 220). Bakker continues by noting that several states, including Thailand, China, and Laos, had already built dams on the Lancang/Mekong by 1999, yet still claimed in their discourse that the river was untapped and unutilized. In the public discourse of the 1990s, *the river is thus more heavily utilised than the language of underdevelopment implies* (1999, p. 220). Her points regarding the political nature of Mekong dam development discourse reflect the river's role in regional water diplomacy.

One conclusion of the analysis done of recent riparian states' media is that these themes of underdevelopment and untouched nature have largely disappeared from regional discourse. Nevertheless, understanding how themes of proper and improper development, rather than underdevelopment, are woven through various 21st century national narratives is important to understanding how countries are choosing to portray their role in regional water politics. While the exact language has changed, using the Mekong as a symbol in regional geopolitical posturing is still common practice in public discourse.

Flooding is vital to agriculture throughout the region but especially in Cambodia and Vietnam. Conceptually, floods are both natural processes familiar to residents, and now systematized events controlled by powers upstream (predominantly China); this is changing how the Mekong is understood on a physical, ecological, cultural, and even spiritual level. Floods, especially massive ones, traditionally have been characterized as a *hazard* or *danger* to be *controlled* in media sources (Jacobs and Wescoat, 1994), and remain a central topic in regional media coverage today. The anxieties surrounding flooding, and the notion of flooding as a controllable/uncontrollable process, currently permeate the public discourse of many Mekong riparian states.

In order to examine modern discourses, this paper utilizes English-language media from the four MRC countries, examining the themes that are unique to each before comparing overarching trends in the debates present in regional presses. As Bakker (1999) notes, dam construction and the consequences of dam construction are more public than other forms of resource extraction (such as mining) because the entire river and all who live along it are affected; yet

the public understanding of dams and surrounding issues is weak because the science behind dam construction and maintenance is extremely complex.

The countries which make up the MRC are at very different levels of industrialization, infrastructure networks, and market integration, meaning that the discourse surrounding dams will be very different throughout the region. The current status of energy development within the region was concisely articulated in the Vietnamese English-language press:

In Cambodia, the priority is to substitute domestically produced hydropower for expensive diesel and electricity imports. In Laos, the priority is to generate revenue by drawing in foreign investment in dams and export excess electricity to its neighbors, with Thailand as its biggest market. In Viet Nam, which has already built out most of its hydropower potential, the priority is to meet a projected tripling in energy demand by 2030 while protecting the economically vital Mekong Delta from the impacts of upstream dams (VNS, 2018b).

Understanding how each country's English-language press coverage of Mekong dams differs thematically can help to understand how each population conceptualizes Mekong dam development. It is also important to examine public discourses surrounding dam development because these discourses shape the public imagination that motivates the environmental activism and local protest actions that are themselves topics regularly featured in press coverage.

Laos: Government-Mandated Optimism

After the Lancang travels through China, it enters Laos, becoming the Mekong and traversing the country. Thus, the vast majority of non-Chinese dams on the Mekong and its tributaries have been in Laos, and the majority of new construction projects have been proposed or started in Laos. There are over a dozen large-scale dams on tributaries of the Mekong throughout Laos that have been completed or nearing completion, the most notable of which is the controversial Xayaburi dam. Nearly all of these dams were built after 2000, financed by Chinese, Thai, and even Vietnamese investments. Though there has been speculation and potential development of several dozen dams, there currently appear to be nine dams with significant financing, development, and construction underway, including the Don Sahong dam, which has been under construction since 2016. These more recent projects are overwhelmingly funded by Chinese and Thai investment, with almost no funding from the Laotian government itself. General regional consensus is that Laotian dam development has progressed with little regard for environmental impact.

There is very little press coverage of Mekong dams in the Laotian English-language press, even though Laos is the country which is seeing the majority of

construction today. This is primarily because the only wide-scale English-language press in Laos, the *Vientiane Times*, is produced by the Laotian government. When there is coverage, Mekong dams are always discussed in terms of Laos' economic future. Not only does the Laotian government believe in the economic potential of hydroelectric production, but the English-language press informs Laotians that the international community agrees, explaining that, *a World Bank economist team has projected that economic growth in Laos will start to recover from 2019 onwards after major hydropower plants begin commercial operation this year* (Phouthonesy, 2018). China is described as a partner in this economic opportunity. Specific numbers are rarely used, and the promised economic benefits seem vague and long-term.

One theme related to dam development projects that runs throughout the government-produced *Vientiane Times* is that the MRC is a successful, efficient coalition of equal states, working to ensure proper Mekong development. This perspective stands in stark contrast to the non-governmentally controlled English-language presses of every other member of the MRC; each heavily criticizes the MRC for incompetence. For example, according to the *Vientiane Times*, *the Mekong River Commission (MRC) will remain a key driving force in bringing unity and sustainability to the development of areas along the mighty river despite the reduced budget projected for the upcoming decade* [the MRC's CEO Pham Tuan Phan] *denied speculations that international organisations were cutting their funding because of the MRC's inability to ensure sustainable development of the Mekong region* (Phouthonesy, 2018b). What in other countries is described as a breakdown of trust in the MRC, Laos reimagines, declaring that *in the joint declaration, leaders of the Lower Mekong nations reaffirmed their support for the MRC's ongoing institutional reform, which will see the Commission transform itself into a lean, efficient, and financially self-sufficient organisation* (Phouthonesy, 2018a).

The impression the reader is intentionally left with is that Laos is complying with the MRC, cooperating with other regional players at their behest, and improving its economic future. The details of dam development are largely absent from the *Vientiane Times'* coverage of Mekong dams. Unlike in the Cambodian or Thai presses, the funding of dam construction is not debated publicly in Laos' media. Likewise, unlike in the Vietnamese and Cambodian presses, environmental impacts of dams are not brought to the public's attention in Laos. Regional concerns about Laotian dam construction are miss-

ing entirely, and unsurprisingly, from the government-backed *Vientiane Times'* coverage.

Thailand: Ready to Shop Elsewhere?

Because of elevation and landscape, Thailand does not have significant stretches of Mekong for its own hydroelectric development. Small dams on tributaries have been constructed since the 1970s, but Thailand's interest in dam development in the region is that of an investor and a consumer. Thailand's energy consumption is much larger than that of its regional neighbors, though recent economic growth in Vietnam has also increased their demand. Dam construction in Laos in particular is heavily fueled by Thai investment; Thailand is also the primary market for Laotian hydroelectricity. Bakker (1999) notes that energy consumption was one industry that was less hindered by the Thai 1997 financial crisis. However, recent interest in alternative energies with less environmental impact might be the cause of a slowdown in Thai dam development investment since 2017.

The Thai English-language press² regularly present stories which emphasize that Thai citizens should be engaged with dam construction, protesting the environmental impact, and determining how energy is purchased and distributed in the region. Thais in the Chiang Rai region were given favorable coverage for protesting Thai governmental support for dam construction in Thailand (Ngamkham, 2017). The *Bangkok Post* argues that [Thai] *women's voices must be central to decision-making on hydropower, and in broader energy planning for Thailand and the region because impacts of hydropower and other large infrastructure projects can disproportionately affect women, particularly women from minority ethnic and indigenous communities and rural areas* (Harris, 2018b), when dams cause environmental damage that affect the horticultural activities of women. Thai citizens are described as understanding that dams will impact their future and willing to demand accountability from their government; for example, *people in the northeastern region relying on fish in the Mekong and its tributaries realise what could happen to them* (Marukatat, 2018) if fish spawning patterns are disrupted. More so than other countries' presses, the Thai press calls for active citizen engagement.

One of the central themes of Thai English-language press coverage of Mekong dams is that Thailand is part of a trio of Mekong regional powers: Thailand, China, and a conglomerate Indochina region. This worldview includes concerns that the Indochina trio is falling into increased discord, as *divergent inter-*

² The two most important English language newspapers are the *Bangkok Post* and *The Nation*, both of which are independent and rather critical of the government. *The Bangkok Post* is one of the oldest newspapers in Thailand, being well-respected since they began publishing in 1946. *The*

Nation, founded in 1971 and part of the Asian News Network, often features complex quantitative and policy analysis op-eds which are oriented toward as educated audience.

ests have brought the three countries into increasingly open disagreement (Brunner and Eyler, 2018). However, it is also the case that Cambodia, Laos and Vietnam can each offer its neighbours something they cannot achieve by themselves (Brunner and Eyler, 2018), meaning cooperation is still possible. Thailand, however, is usually described in ways that suggest it is above such frays.

Instead, the Thai press often depicts China and Thailand as the primary forces shaping Mekong development. Thai activists opposed to Thai funding of controversial dams in Laos are quoted saying that, *the post-war Lao alliances to Cambodia and Vietnam may be taken over by Thai and Chinese corporate interests* (DPA, 2013). When Thailand's delays in funding stopped dam construction in Laos, the press claimed Thailand's impact was so massive that it *calls into question the future of hydropower development in the Mekong region* (Eyler and Weatherby, 2018). On the other hand, opinion pieces by International Rivers, the leading regional Mekong development NGO, supporting China's role as leader of regional energy development strategies argue that, *China is showing global leadership in building solar and wind power capacity at home, and has financing and technological expertise that is sorely needed to drive the energy revolution in Lower Mekong* (Harris, 2018a).

Thus, Thailand and China are, in the Thai press, depicted as two sides fighting over the Mekong: in some cases, articles emphasize that, *Thailand's rising energy demand has been the major driver for damming the Mekong* (Eyler and Weatherby, 2018); in others, the Thai prime minister is warned to be vigilant against *alleged insistence by Beijing to be the controlling – perhaps the only – voice in management of the Mekong* (Bangkok Post Editorial, 2018). Mekong dams are discussed as a hydroelectric opportunity, but not in the same way that they are in other regional English-language presses: the Thai press presents Mekong dams as an opportunity for Thai investment to lead regional interests; and dams could create electricity that will then be available for sale in Thailand to boost the Thai economy (Ngamkham, 2017). Either way, the Thai press depicts Thailand as a country which controls the actions of other states, as opposed to one which asks others to consider their actions (as both Cambodia and Vietnam are depicted by their respective presses).

However, there is also an underlying current of frustration that hydroelectric development may not be necessary for Thailand, meaning that environmental

damage caused by Mekong dams is not necessitated by energy requirements. Because the Thai government has overestimated how much electricity has been used in the country during the last several years, some in Thailand are questioning the need for further dam development. The economics of energy have also changed in recent years. Jake Brunner and Brian Eyler (2018) argue in the Thai and Cambodian presses that *whether or not these dams make economic sense is increasingly open to question given the dramatic decline in the price of solar and wind power, which have contributed to Thailand's decision to suspend the power purchase agreement for the Pak Beng dam in Laos* (Brunner and Eyler, 2018). The Thai English-language press publishes opinion pieces which argue that, *a review of Thailand's energy plans reveals an abundant electricity supply that vastly exceeds demand. So in the midst of this energy glut, why are we pushing hard to build more problematic hydroelectric dams in our neighbours' territories?* (Deetes, 2017). This and other commentaries also call on the Thai government to strive for more accuracy when predicting future energy needs in the first place.

Cambodia: Damning Coverage of Dams

While Thailand may be looking for other energy futures, Cambodia is only beginning to seriously address its energy needs. Because the Mekong first traverses China, Laos, and Thailand, the people of Cambodia are heavily impacted by foreign dam development, and are only beginning to develop a discourse around their own hydroelectric future. Indeed, hydroelectric development of Cambodia was not even a topic of interest in the country until the end of the war in 1992; planning began in earnest in 2006, and significant construction of Cambodian dams on the Mekong did not begin until 2014. In November 2017, the Cambodian government completed construction on the Lower Sesan 2 (LS2) dam on the Sesan tributary; it is expected to be completely operational by the fall of 2018. Construction is planned for three additional dams on the Mekong: the Stung Treng, the Sambor, and the Lower Seko Treng, all funded by businessman Kith Meng's Royal Group (Zsombor and Sokhean, 2017).

Mekong dams are discussed in the Cambodian English-language press³ in reference to two phenomena: dams built/being built upstream in Laos and Thailand, and dams undergoing construction in Cambodia. In both cases, dams are discussed negatively and

³ The main English-language Cambodian news sources are the *Cambodia Daily* and the *Phnom Penh Post*. Founded in 1992, the Phnom Penh Post is heavily read by Cambodia's educated citizens, foreign expatriates, and NGOs. It continues to provide generally unbiased coverage of Cambodian government and society, at times publishing significant criticisms of the prime minister and his government. The *Cambodia Daily*, the outlet of the pair that was more

scathing of the Cambodian government, was forced to shutter its Cambodian offices and move exclusively online on Sept 4, 2017 as a result of intense government pressure. The publication now only reposts externally produced content. Unsurprisingly, some of the harshest critiques of the LS2 dam and the consultation process were published in the *Cambodia Daily*.

consistently described as *dangerous* and *controversial*. The Cambodian press argues that the bodies which construct and regulate dams, including the Cambodian government and the MRC, are not to be trusted. The Cambodian press is notably antagonistic toward the concept of Mekong dams, as evident by their choice of focus and use of evidence from NGOs and anonymous sources that are critical of dams.

One of the main themes surrounding dams in the Cambodian press is that dams cause environmental damage; in many cases, discussions of this theme include the accusation that dams are built in spite of reports that they will have a significantly negative ecological impact. In particular, Laotian dams are critiqued for destroying fish passages and stocks (Retka, 2017), while NGO leaders are quoted questioning the Thai funding of Laotian dams and imploring the country to *seriously rethink Thailand's investments in environmentally destructive energy projects* (Nachemson, 2018). Vietnamese environmentalists are quoted voicing concerns about saltwater intrusion, and are described as predictive of future environmental concerns for Cambodia (Narim, 2016). Other effects, both short and long term, are put into the context of how specific dams will damage the immediate region and the peoples within it. The most likely reason that the discourse over Mekong dams in Cambodia in particular is so critical is that the first major construction project – the Lower Sesan 2 (LS2) dam – has caused massive environmental change, displaced thousands of Cambodians, and disrupted livelihoods, without any clear benefit to Cambodians themselves. Citizens pushed to relocate are described as being forced to *say goodbye to ancestral homes* (Seangly, 2017) and made to *rue their losses* (Seangly and Nahemson, 2018). Even when Cambodia's significant power shortages are acknowledged, the power produced by the LS2 dam is contrasted with the pain caused to those forced to relocate (Maza and Seangly, 2017).

One of the central critiques of dam construction centers around distrust of the construction process and the organizations tasked with ensuring that the environment and Cambodian people are protected. The Mekong River Commission is rarely portrayed positively in the Cambodian press; the most common evaluation is that the MRC is *weak* (Kossov, 2016) and *still reeling from the blowback over its handling of the consultation process around the Don Sahong and Xayaburi dams in Laos* (Down, 2016) with little ability to force its member countries, especially Laos, to follow guidelines or behave responsibly. Discussions of MRC guideline enforcement demonstrate little confidence in the organization, with the Cambodian press quick to note that *conservationists*

expressed doubts about whether such guidelines would make a difference (Sassoon, 2018). Anti-government conservationists are openly quoted in the Cambodian press; when expressing skepticism that the prime minister would fulfill a promise to stop environmentally dangerous dam construction, the Cambodia Daily boldly published a quote that, *the government's greed and ignorance eventually supersedes all decision-making and all relevant laws, as we have seen time and again in Cambodia* (Zsombor, 2017).

In the Cambodian Press, a consistent theme discussed is that the MRC consultation process is a sham, and should not be trusted. The Phnom Post quotes an anonymous source that *"Mekong member countries consider the [MRC] 'consultation process' as a complete failure and will imminently take benefit of this weakness to promote and carry out their own controversial projects* (Roeun, 2017). After reporting that Cambodian Prime Minister Hun Sen was consulting with the Laotian government on a controversial new dam near the border, the Cambodia Daily countered by noting that, *with much of Stung Treng already buying cheap electricity from Laos, however... Cambodians should be informed about what exactly they should be thankful for, and how the [new dam] will change electricity access and costs* (Roeun, 2017). The consultation process is largely described with cynicism and mistrust.

Vietnam: Diplomacy and Environmentalism

The people of Vietnam are heavily dependent on the Mekong Delta as a source of food, transportation, and identity. The ability of China and Laos to control the flow of the Mekong, causing flooding at their will and affecting the livelihoods of millions of farmers and fishermen in Vietnam, is a source of great frustration as expressed in the Vietnamese English-language press⁴. There are several dams on tributaries in Vietnam, but these are discussed primarily in relation to local power generation; the majority of the discussion in the press focuses on the implications of upstream dams, rather than on the dams themselves. Because dams along the Mekong are primarily in China, Laos, and Thailand (and soon in Cambodia) rather than Vietnam itself, the discourses regarding Mekong dams in the Vietnamese press focus on hydropower, environmental impact, and water diplomacy.

With far more consistency than in other countries, dams are directly connected to the idea of hydropower in the Vietnamese English-language press; they are often referred to directly as hydro-electric dams, a term rarely found in other English-language

⁴ The primary English-language news source in Vietnam is *Viet Nam News*, which began its publication in 1991. Today, it publishes a daily paper in the country and provides up-to-date coverage online. Though the editors are critical

of government failings, the publication is not known as oppositional. Most of the coverage is not attributed to specific authors, however, providing some coverage to express harsh critiques of environmental impacts of dam in particular.

presses. The Vietnamese readers of English-language press are aware that large amounts of Vietnamese electricity is purchased from other countries' dams; therefore, foreign dams are always discussed in terms of a hydropower vs. environmental calculus. The Vietnamese press also covers other energy alternatives, such as solar and wind, placing hydropower into a larger discussion of Vietnam's energy strategy (VNS, 2018b). This includes limited development of potential Vietnamese dam sites, with the Vietnamese English-language press reporting that, *in a major shift in perspective, the Government is viewing small scale projects as the best, most sustainable way of tapping the nation's hydropower potential* (VNS, 2018).

Perhaps the most prominent theme in the Vietnamese press coverage of Mekong dams is the focus on livelihoods, especially in relation to livelihoods directly connected to the environment. Dam development is praised by quoted government officials as an opportunity for *livelihood diversification* (VNS, 2017b). On the other hand, ecological damage such as *significant decline in fish stocks and even the disappearance of many species and depletion of alluvial soil and the vital nutrients it brings* (VNS, 2018a) is so dangerous that the livelihood of 18 million people is at stake (VNS, 2018a). Livelihoods imply a way of living, an identity, not just an economic position, lending gravitas to discussions of the pros and cons of dam development.

One of the central themes in the Vietnamese press is the idea that Mekong dams are an environmental disaster, which the press describes and quantifies for readers. The Mekong is usually described as *blighted* (VNS, 2017a) by dams, with coastal erosion, sand loss, and saltwater intrusion discussed as *dangerous* (VNS, 2017) consequences of other countries' policies. Major cultural cities and tourist attractions like Hoi An are described as under serious threat as *too many hydropower projects, poor environmental impact assessments of their dams, and overexploitation of sand are haunting Hoi An City* (VNS, 2016). Environmentalist groups are often quoted in the Vietnamese English-language press, in almost all cases attributing environmental damage to other countries, such as arguing that the upcoming Don Sahong dam *would be meaningful on the economic side of Laos, but it will ruin the ecology in the Mekong sub-region, as well as the future of affected communities in neighboring Cambodia and Viet Nam* (VNS, 2015). Thus, environmental damage is conceived of as part of a diplomatic calculus.

Another theme in the Vietnamese press is the importance of water diplomacy. This water diplomacy extends beyond the dams themselves, as discussed earlier, but also to mitigating the ecological damage of dams and adapting to other, related ecological challenges. For example, government officials are quoted as arguing that, *it is imperative to develop different scenarios or projects on climate change with*

neighbouring countries (VNS, 2017b). Not only does the Vietnamese press encourage water diplomacy by publishing articles on the subject (VNS, 2017b), but it also publishes MRC press releases and statements (VNS, 2017d) which support dam development and international cooperation, thus allowing the newspaper to become a part of the water diplomacy itself. Above all, the press often emphasizes the importance of water diplomacy to prevent future disasters and mitigate damage, arguing that *smart planning can save Mekong Delta from worst effects of dams* (VNS, 2017c).

Discussion

The governments and peoples of all four countries of the MRC care deeply about the future of Mekong dam development, which is why the topic appears heavily in each of their respective English-language presses. Each country's coverage focuses on different core themes, which have been described above. However, there are some significant discourses and themes which appear across the regional English-language media scene, reverberating differently in each press but connecting in core ways.

Ultimately, a country's media stance on a given issue roughly correlates with geographic location. While Laotian media shows little concern for environmental impact downstream, concerns about environmental damage are a dominant theme in the Vietnamese press. The further upstream a country, the more likely dams are described as an opportunity; the further downstream, the more often they are described as a threat.

In the majority of these comparative themes, the Laotian English-language press is an exception, often contradicting the tone of the other three presses. While Laos' specific geographic and developmental characteristics shape the Laotian English-language press's coverage of many relevant aspects of the Mekong dam issue, governmental control and censorship are the reasons the Laotian press's coverage deviates from the other three MRC's states so consistently. One would not expect the Laotian government to produce English-language press coverage that was negative or contradictory to the government's position. The other three presses, however, participate in some striking shared discourses.

One common discussion is whether or not hydroelectricity is the best route to regional energy independence, especially as solar and wind prices drop. Buyer countries (Thailand and Vietnam) have English-language presses which are openly debating alternative energies. Seller countries (Laos and Cambodia) still primarily describe dam construction as an economic opportunity worth the environmental threat.

One interesting similarity between the Thai, Cambodian, and Vietnamese English-language presses is

that they all rely heavily on Vietnamese environmentalists for quotes and statistics. While international NGOs and external research is occasionally discussed, Vietnamese environmentalists serve as the *regional authorities* to be trusted throughout all the MRC countries' presses. For example, when the Thai press is discussing whether to support dam construction in Laos, writers choose to cite environmental studies of fish stocks, flooding damage, and soil degradation researched and produced by Vietnamese groups (Marukatat, 2018).

The issue of water diplomacy, as Bakker (1999) notes, has always been a part of the discourse surrounding Mekong dam development, and this still rings true in the regional English-language presses. The MRC is consistently described as necessary for water diplomacy but incompetent at it (except in the Laotian press for reasons discussed earlier). In the Thai, Cambodian, and Vietnamese press, governments are encouraged to engage in water diplomacy beyond the purview of the MRC (VNS, 2017b). The tenuous positions of each state were well summed up by Jake Brunner and Brian Eyler (2018) in the Thai and Cambodian English-language presses:

We seem to have reached a stalemate. Vietnam has adopted a victim mentality, protesting against dams but without presenting any alternatives. In Laos, hydropower is almost entirely dictated by foreign, mostly Thai and Chinese, firms and receives very little revenue from dams built under 30-year build-own-operate-transfer contracts. Cambodia is keeping its options open. Instead of bringing these countries together, the discordant development of the Mekong is pushing them apart.

Discourse analysis of the English-language presses of Laos, Thailand, Cambodia, and Vietnam confirms Brunner and Eyler's position. Vietnam's concern for the environment and inability to control flooding from upstream dams shades the public discourse surrounding dams. Laos's government mandated coverage projects an image of opportunity and progress, in discordance with other, less censored regional press coverage. Cambodia's coverage is perhaps a bit more pessimistic than Brunner and Eyler project, while Thai coverage validates the Thai public's belief that their economy is still regionally dominant.

Conclusion

Each country's English-language media represents these central concerns and values through the way they choose to present the issue of Mekong dam development to their respective populations. For Lao-tians, government-mandated optimism stems from a bright economic future. For Thai readers, new economic opportunities in alternative energies might be a better route to stay competitive with China. For Cambodians, public interest is a necessary part of protecting livelihoods from an over-eager govern-

ment and hazy foreign interests. And for the Vietnamese, water diplomacy is the best hope to mitigate environmental damage caused by forces beyond Vietnamese control. Understanding how these interlocking goals and discourses inform public opinion throughout the region is an important part of understanding how dam development will be conceptualized by the peoples of the Mekong.

References

1. BAKKER K., 1999, The politics of hydropower: developing the Mekong, in: *Political Geography*, 18, p. 209-232.
2. BANGKOK POST EDITORIAL, 2018, Developing the Mekong, in: *Bangkok Post*. <https://www.bangkokpost.com/opinion/opinion/1393322/developing-the-mekong/>.
3. BRUNNER J., EYLER B., 2018, To avoid Mekong damnation, make the problem bigger, in: *The Nation and The Phnom Penh Post*, <http://www.nationmultimedia.com/detail/opinion/30342673/>.
4. CGIAR CHALLENGE PROGRAM ON WATER AND FOOD, 2013, *Dams in the Mekong Basin: Commissioned, Under Construction and Planned Dams in May 2013*, <http://HDL.HANDLE.NET/10568/34803/>.
5. CHOMCHAI P., 1987, The Mekong project: an exercise in regional cooperation to develop the lower Mekong basin, in: *Water Resources Policy for Asia*, eds. Ali M., Radosevich G.E., and Khan A.A., Boston: A.A. Balkema.
6. DEETES P., 2017, Dam projects require serious debate, in: *Bangkok Post*, <https://www.bangkokpost.com/opinion/opinion/1328339/dam-projects-require-serious-debate/>.
7. DELANG, C.O., TORO, M., 2011, Hydropower-induced displacement and resettlement in the Lao PDR, in: *South East Asia Research*, 19(3), p. 567-594.
8. DELANG, C.O., TORO, M., CHARLET-PHOM-MACHANH, M., 2013, Coffee, mines and dams: conflicts over land in the Bolaven Plateau, southern Lao PDR. *The Geographical Journal*, 179(2), p. 150-164.
9. DOWN A., 2016, As Budget Drops, Commission Prepares for New Laos Dam, in: *The Cambodia Daily*, <https://www.cambodiadaily.com/news/budget-drops-commission-prepares-new-laos-dam-117439/>.
10. DPA, 2013, Xayaburi dam stirs debate on Mekong River Commission, in: *Bangkok Post*, <https://www.bangkokpost.com/news/world/330603/xayaburi-dam-stirs-up-debate-on-mekong-river-commission/>.
11. EYLER B., WEATHERBY C., 2018, Pak Beng dam delay paves way for cleaner solutions, in: *Bangkok Post*, <https://www.bangkokpost.com/opinion/opinion/1429791/pak-beng-dam-delay-paves-way-for-cleaner-solutions/>.
12. HARRIS M., 2018a, Can regional cooperation secure the Mekong's future?, in: *Bangkok Post*, <https://www.bangkokpost.com/opinion/opinion/1393266/can-regional-cooperation-secure-the-mekongs-future/>.
13. HARRIS M., 2018b, Women must be central to Mekong dam decisions, in: *Bangkok Post*, <https://www.bangkokpost.com/opinion/opinion/1424310/women-must-be-central-to-mekong-dam-decisions/>.

14. INTERNATIONAL RIVERS, 2017, A Dangerous Trajectory for the Mekong River: Update on the Status of Mekong Upstream Dams, in: *International Rivers Report*.
15. JACOBS J.W., WESCOAT J.L., 1994, Flood-hazard problems and programmes in Asia's large river basins, in: *Asian Journal of Environmental Management*, 9(2), p. 96-108.
16. KÄKÖNEN M., HIRSCH P., 2009, The anti-politics of Mekong knowledge production, in: *Contested Waterscapes in the Mekong Region: Hydropower, Livelihoods, and Governance*, eds. Molle F., Foran T., and Käkönen M., Earthscan, London.
17. KOSSOV I., 2016, Mekong River in danger, but MRC is 'weak', in: *Phnom Penh Post*, <https://www.phnompenhpost.com/national/mekong-river-danger-mrc-weak>.
18. LOHMANN L., 1998, Mekong dams in the drama of development, in: *Watershed*, 3(3), p. 50-60.
19. MAZA C., SEANGLY P., 2017, Sesan dam to bring power, pain, in: *Phnom Penh Post*, <https://www.phnompenhpost.com/national-post-depth/sesan-dam-bring-power-pain>.
20. MARUKATAT S., 2018, Fight to save key Mekong rapids not over, in: *Bangkok Post*, <https://www.bangkokpost.com/news/asean/1355019/fight-to-save-key-mekong-rapids-not-over/>.
21. MEKONG RIVER COMMISSION, MRC, 2018, *People*, <http://www.mrcmekong.org/topics/people/>.
22. MIDDLETON C., GARCIA J., FORAN T., 2009, Old and New Hydropower Players in the Mekong Region: Agendas and Strategies, in: *Contested Waterscapes in the Mekong Region: Hydropower, Livelihoods, and Governance*, eds. Molle F., Foran T., and Käkönen M., Earthscan, London.
23. NACHEMSON A., 2018, Thais weigh merit of Mekong dam, in: *Phnom Penh Post*, <https://www.phnompenhpost.com/national/thais-weigh-merit-mekong-dam/>.
24. NARIM K., 2016, Mekong Dams Not Cause of Drought, Prime Minister Says, in: *The Cambodia Daily*, <https://www.cambodiadaily.com/news/mekong-dams-not-cause-of-drought-pm-says-111220/>.
25. NGAMKHAM W., 2017, Pak Beng dam project riles locals, in: *Bangkok Post*, <https://www.bangkokpost.com/news/general/1264439/pak-beng-dam-project-riles-locals/>.
26. PHOOTHONESY E., 2018, Economic growth remains bright in medium term: World Bank, in: *Vientiane Times*, http://www.vientianetimes.org.la/FreeContent/FreeContent_Economic.php/.
27. PHOOTHONESY E., 2018a, Mekong leaders renew political support for MRC, in: *Vientiane Times*, https://www.vientianetimes.org.la/FreeContent/FreeContent_Mekong.php/.
28. PHOOTHONESY E., 2018b, MRC to protect Mekong despite budget reduction, in: *Vientiane Times*, http://www.vientianetimes.org.la/FreeContent/FreeContent_MRC.php/.
29. RETKA J., 2017, Laos Dam Poses Environmental Dangers to Lower Mekong Basin, in: *The Cambodia Daily*, <https://www.cambodiadaily.com/news/laos-dam-poses-environmental-dangers-to-lower-mekong-basin-129139/>.
30. RIGG J., 1992, Introduction: the gift of water, in: *The Gift of Water: Water Management, Cosmology and the State in South-East Asia*, ed. Rigg J., School of Oriental and African Studies, London.
31. ROEUN V., 2017, Hun Sen Visits Laos Dam Site, Again Promises Cheap Power, in: *The Cambodia Daily*, <https://www.cambodiadaily.com/news/hun-sen-visits-laos-dam-site-again-promises-cheap-power-123248/>.
32. ROTHERT S., 1995, *Lessons Unlearned: Damming the Mekong River*, International Rivers Network, Berkeley.
33. SASSOON A.M., 2018, Mekong River Commission to revise dam guidelines, in: *Phnom Penh Post*, <https://www.phnompenhpost.com/national/mekong-river-commission-revise-dam-guidelines/>.
34. SCHAAF C.H., FIFIELD R.H., 1963, *The Lower Mekong: Challenge to Cooperation in Southeast Asia*, Van Nostrand, Princeton.
35. SCUDDER, T.T., 2012, *The future of large dams: Dealing with social, environmental, institutional and political costs*, Routledge, London.
36. SEANGLY P., 2017, As dam's waters rise, holdout Sesan village leaves villagers say goodbye to ancestral homes, in: *Phnom Penh Post*, <https://www.phnompenhpost.com/national/dams-waters-rise-holdout-sesan-village-leaves-villagers-say-goodbye-ancestral-homes/>.
37. SEANGLY P., NAHEMSON A., 2018, Our pain is like an ocean, in: *Phnom Penh Post*, <https://www.phnompenhpost.com/national-post-depth/life-after-flood-sesan-dam-holdouts-rue-their-losses-see-fragile-victory/>.
38. VNS, 2015, Environment group voices concerns over Mekong dam, in: *Viet Nam News Service*, <http://vietnamnews.vn/environment/276048/environment-group-voices-concerns-over-mekong-dam.html#A17P25Dgf5245g7e.97/>.
39. VNS, 2016, Hoi An, biosphere under serious threat, in: *Viet Nam News Service*, <http://english.vietnamnet.vn/fms/environment/167680/hoi-an-biosphere-under-serious-threat.html/>.
40. VNS, 2017, Mekong basin dams pose danger: experts, in: *Viet Nam News Service*, <http://vietnamnews.vn/society/377343/mekong-basin-dams-pose-danger-experts.html#UiL7MviysvtGbcit.97/>.
41. VNS, 2017a, Mekong blighted by river erosion, in: *Viet Nam News Service*, <http://vietnamnews.vn/environment/378469/mekong-blighted-by-river-erosion.html#kcCwzgsTphM7fWvx.97/>.
42. VNS, 2017b, Mekong water diplomacy vital, in: *Viet Nam News Service*, <http://vietnamnews.vn/environment/372179/mekong-water-diplomacy-vital.html#YwKa5KRYssPe8Qw8.97/>.
43. VNS, 2017c, Smart planning can save Mekong Delta from worst effects of dams: experts, in: *Viet Nam News Service*, <http://vietnamnews.vn/society/418781/smart-planning-can-save-mekong-delta-from-worst-effects-of-dams-experts.html#G4UjpvqyTqbkKvf.97/>.
44. VNS, 2017d, Smooth flows: some benefits of dams, water diplomacy, in: *Viet Nam News Service*, <http://vietnamnews.vn/environment/375588/smooth-flows-some-benefits-of-dams-water-diplomacy.html#Vw6xpbOU5BE9kXXj.97/>.
45. VNS, 2018, Energy policy could prioritise small scale projects, in: *Viet Nam News Service*, <http://vietnamnews.vn/environment/423330/energy-policy-could-p>

- rioritise-small-scale-projects.html#oA8LtT6t7ak76c8B.97/.
46. VNS, 2018a, Forum slams Mekong dam construction, warns livelihoods at stake, in: *Viet Nam News Service*, <http://vietnamnews.vn/society/424857/forum-slams-mekong-dam-construction-warns-livelihoods-at-stake.html#7ks0PFbiGpiQ20wJ.97/>.
 47. VNS, 2018b, Solar, wind may boost Mekong region energy, in: *Viet Nam News Service*, <http://vietnamnews.vn/opinion/421529/solar-wind-may-boost-mekong-region-energy.html#S0oVdiv8YkdLypmj.97/>.
 48. ZSOMBOR P., 2017, NGO Wary of Promise to Cancel Hydropower Dam Project, in: *The Cambodia Daily*, <https://www.cambodiadaily.com/news/ngowary-of-promise-to-cancel-hydropower-dam-project-126565/>.
 49. ZSOMBOR P., SOKHEAN B., 2017, Kith Meng Backs Plans for Three Hydropower Dams, in: *The Cambodia Daily*, <https://www.cambodiadaily.com/news/kith-meng-backs-plans-for-three-hydropower-dams-124528/>.

The idea of *landscape cultivation* by Adam Wodziczko

Idea uprawy krajobrazu Adama Wodziczki

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Abstract

The article presents the concept of *landscape cultivation* of Adam Wodziczko, a Polish naturalist and propagator of environmental protection in Poland in the 1920s and 1940s. It demonstrates the importance of his idea of the contemporary trend of *landscape ecology*; his merits in the field of building the basics of the science of nature conservation; and the role he played in nature conservation in Poland.

Key words: history of Polish ecological thought, *landscape cultivation*, landscape ecology, nature protection, the science of nature conservation, Adam Wodziczko

Streszczenie

Artykuł prezentuje koncepcję *uprawy krajobrazu* Adama Wodziczki, polskiego przyrodnika i propagatora ochrony środowiska naturalnego w Polsce w latach 20-40 XX stulecia. Ukazuje znaczenie jego idei dla współcześnie popularnego nurtu *ekologii krajobrazu*; zasługi, jakie położył w zakresie budowy podstaw nauki o ochronie przyrody; oraz rolę, jaką odegrał w Polsce na gruncie ochrony przyrody.

Słowa kluczowe: ekologia krajobrazu, historia polskiej myśli ekologicznej, nauka o ochronie przyrody, ochrona przyrody, *uprawa krajobrazu*, Adam Wodziczko

The beginnings of the Polish thought concerning care for the natural environment date back to the end of the 19th century. They are related to the creation of numerous organisations and associations in Cracow and Lviv at that time whose objective was to popularise the idea of environmental protection. At the beginning of the 20th century, the first theoretical concepts in this respect were formulated. Their authors were Marian Raciborski and Jan Gwalbert Pawlikowski (Gawor, 2018). From that moment on,

the state of nature subjected to pressure from man became the object of reflection for many Polish naturalists and those who were passionate about providing special care to nature. Eminent thinkers and activists in this field included Walery Goetel (Gawor, 2013), and subsequently Julian Aleksandrowicz (Gawor, 2016) or Henryk Skolimowski (Gawor, 2012). Undoubtedly, a prominent place among these persons was occupied by Adam Wodziczko¹, a naturalist and a professor of botany at the University of

¹ Adam Wodziczko (1887-1948) attended gymnasiums in Sanok, Tarnów, Cracow and Jasło. Later, in the years 1906-1910, he studied natural sciences at the Jagiellonian University. In 1912, he became an assistant professor in the Chair of Plant Anatomy and Physiology at the Jagiellonian University, where he taught general botany. In 1916, he was awarded a doctoral degree in botany. In the years 1915-1918, he served in the Austrian army as a microbiologist. In December 1919, he took up the position of a deputy professor of plant anatomy and physiology at the Agricultural University in Bydgoszcz. In autumn 1920, he became a deputy professor and the head of the Institute of Botany at the University of Poznań. In 1921, he was

awarded the habilitation degree at the Faculty of Philosophy at the Jagiellonian University. Between 1924 and 1948 (excluding the period of the Second World War), he performed the function of the director of the Botanical Garden in Poznań. In 1925, he was appointed to the position of an associate professor at the Faculty of Mathematics and Natural Sciences at the University of Poznań. In 1936, he was awarded the title of full professor of plant anatomy and physiology. In 1938, he initiated the activities of the Interfaculty Seminar in Biocenology and Environmental Protection. After the Second World War broke out, he was deported to the General Government with his family. In March 1945, he came back to Poznań. Thanks to his ef-

Poznań. In Poland of the interwar period and the years right after the war, he was a scientist of great and uncontested authority as an expert on nature conservation (Szafer, 1973; Leńkowa, 1986; Skowroński, 2005).

In 1946, Wodziczko published a short book entitled *Na straży przyrody* (*Guarding nature*; Wodziczko, 1967). It was a summary of the ideas concerning environmental protection, which constituted one of the main areas of his academic activities, apart from botany, in the years preceding the Second World War (Wodziczko, 1924-1939).

According to the Polish scientist, the environmental protection movement is of dynamic character; its objectives and tasks have been evolving since the moment of its creation in the mid-19th century, giving rise to various concepts. From this point of view, he distinguished three stages in the development of thought concerning nature protection to date, with their particular distinctive theoretical constructions. The Polish scientist dates the first stage at the first 25 years of the 20th century. It is characterised by understanding environmental protection as an activity which is limited only to the remnants of pristine nature, referred to as natural monuments. The guiding idea of this stage of nature conservation thought is natural conservation or natural monuments studies (Wodziczko, 1967, p. 8), based on an analogy to historical monuments. Just as souvenirs and monuments of the past are cherished, precious testimonies of pristine nature should be treated the same, as they are a value in themselves. With respect to his, attention was mainly drawn to larger natural areas, unaffected by human intervention and protected by creating nature reserves and national parks. But most of all, protection should be given to all rare elements of nature (unusual rock formations, picturesque waterfalls, old tree specimens). What is striking at this stage of environmental protection is the lack of an appeal for repairing the damages inflicted on nature by humans; no emphasis is placed on active restitution of the areas of nature which have already been destroyed. Therefore, *nature conservation* is quite an accurate name for this stage of development of the idea of environmental protection. The leading representatives of *natural museology* in Europe at that time included the Prussian natural scientist, a promoter of the idea of national parks, the creator of the first European Office of Nature Conservationist, established in 1906 in Gdańsk, Hugo Conventz; while in Poland – the pioneer of the idea of protecting native nature, the most prominent Polish scientist in bi-

ology of the end of the 19th and the beginning of the 20th century, a botany professor at the University of Lviv and the Jagiellonian University, Marian Raciborski.

The second stage of shaping the nature protection thought concerns the interwar period. In this period, which Wodziczko calls *biocenologic* (*life, in Greek: bio + ceno-, from Greek koinosis = community*), *scientists' attention and concern in implementing the plans of protective activities are focused around the communities of plants and animals existing in nature. In this case, it is no longer just about protecting small remnants of wild nature, but mostly about preserving entire organised systems. (...) In the light of research it was demonstrated that the methods of farming, forest and water management to date, impoverishing original biocenoses and upsetting their natural balance, are detrimental in the long term* (Wodziczko, 1967, p. 8). What the Polish scientist has in mind, then, is the emergence in protective activities of the awareness of the fact that nature functions within homeostatic ecosystems. They are exemplified by nature reserves, national parks or protected areas. Moreover, he believes that there is a growing perception of the detrimental effect that unreasonable human economic activities have on nature, though for utilitarian reasons it is unavoidable. Thus, he writes that practical environmental protection in this period *mainly amounts to economic-protective activities which through the use of economic methods referring to the functioning of natural biological factors, or more 'biological' methods, strive to preserve the wealth and variety of forest, meadow, soil and water biocenoses, and to retain their ability to self-regulate, so that the forces operating within these biocenoses can be used for human benefit* (Wodziczko, 1967, p. 9). It is worth pointing out here that in the above-mentioned context Wodziczko was the first naturalist in the country who drew attention to the economic significance of environmental protection. He was convinced that nature will always provide sustenance for people, but under the condition that its balance will not be upset and human economic activity in this sphere will be rational. Such a perspective is nowadays called *green economy*. According to Wodziczko, the way to achieve the objectives of this stage of environmental protection are all those activities which are intended to change people's attitude towards nature. Among them, he includes e.g. the promotion of the biocenologic concept (by Liga Ochrony Przyrody, or the League for the Preservation of Nature, created in 1927, as well

forts, the first independent Department of Environmental Protection and Landscape Cultivation in Poland was established in 1945 at the Chair of General Botany at the University of Poznań. Wodziczko was the leading populariser of the idea of environmental protection in the interwar period. For his achievements in scientific research in botany, his name was given to a newly-discovered fungus *Protomyces wodziczkoii*. Wodziczko's significant contribution to

the Polish environmental thought is the idea of *landscape cultivation*. He was the first person in Poland to give academic lectures in environmental protection referred to as *physiotactics* – a new branch of science he postulated, concerned with shaping man's appropriate attitude to the natural environment. He was the author of over 200 scientific papers and articles on conservation. (Łobarzewska A., 1981).

as by tourist and sightseeing associations), disseminating the idea of environmental protection in primary school education (this idea was present in the education system since 1933), as well as teaching about the principles of *Nature Protection Act*, passed on 10 March 1934 and innovative on a European scale. The most important representative of the biocenologic direction in environmental protection in Poland was, according to him, Jan Gwalbert Pawlikowski, a social animator and a co-creator of the above-mentioned act.

The third stage of environmental protection began, according to Wodziczko, after the Second World War. It is characterised by two fundamental features. Firstly, the main object of protective activities was the landscape. In the understanding of the Polish botanist, the landscape is not a geographical, spatial view of the area; he gave this term a connotation mainly related to nature. *It turned out that the natural landscape is an organic whole richer than biocenosis; that thanks to self-regulatory processes, balance is maintained within it between its main elements: soil, plants and climate. (...) This whole comprising biocenosis and habitat (biotope) is called physiocenosis (Greek physis = nature + Greek koinosis = community)* (Wodziczko, 1967, p. 10). In this perspective, the landscape is viewed as the synonym of holistically conceptualised nature, which is treated as a single organism. Therefore, concern for an unaffected shape of the landscape definitely transcends activities protecting nature on a scale of a reserve or a national park; its object is the whole of man's natural environment.

Secondly, Wodziczko takes into consideration the intervention of human operations into the landscape, mainly in terms of economic activities. It results in any disturbance of a component of this organism (e.g. cutting down forests) affecting the remaining structure of the landscape (e.g. steppe formation, disturbances in water economy or extinction of forest species of animals). Therefore, Wodziczko calls for introducing clear rules of land use planning, *which would take into account all the interrelated elements of the landscape which is being transformed for various purposes. Such a plan decides the fate of the landscape, whether its innate qualities are preserved and enhanced; thus, the current period in the movement of environmental protection is known as the planning period* (Wodziczko 1967, p. 10).

It was this phase of the evolution of nature protection thought, emphasising the need for humans' active and dedicated protection of nature, that the Polish scientist most fully identified himself with, at the same time appreciating its former stages. An expression of that was formulating the concept of **landscape cultivation**.

Specifying the understanding of the key term of his project, Wodziczko describes landscape as: *The whole of nature on a given fragment of the Earth's surface (...) in which balance is kept between its*

main elements (...); this balance is a condition for maintaining the health of the landscape and its productive forces (Wodziczko, 1946). At this point, the Polish scientist introduces a significant distinction: *Landscape created by nature, with no permanent traces of human influence, is called 'primeval' by the author, while landscape used by humans which has not lost the main features of its original character is referred to as a natural landscape. When changes go deeper and the natural balance of landscape is upset so much that it can only be maintained by permanent measures of human economy, a cultivated or exploited landscape is formed, known as a cultural landscape* (Szyszkiewicz, 2018). This distinction also serves the purpose of determining one more scope of environmental balance; this time not between the elements of a given landscape, but between the natural and the cultural landscape; between pristine nature and the extent to which humans are present in it. Such balance, in his view, should take into account the vital interests of both sides: preserving the Earth's natural landscape to the greatest extent possible, while simultaneously exploiting natural resources which ensure human welfare. This proposal forms the most general framework of *landscape cultivation*. It should be pointed out here, and not as a marginal note, that this proposal clearly anticipates the idea of sustainable development.

An active human attitude towards landscape, according to Wodziczko, is its cultivation, or *measures aimed at preserving its value, regenerating it or healing it. Therefore, landscape cultivation has mainly biological, and not only aesthetical purposes, on which the main emphasis was placed before in relation to the so-called landscape architecture* (Wodziczko, 1967, p. 151). Therefore, an accurate term for describing such works can be *landscape engineering*. It should encompass, as the professor from Poznań strongly stresses, activities in three fundamental, closely connected areas: **landscape protection, maintenance and shaping**.

1. Landscape protection is aimed at preserving pristine and natural conditions as well as natural values to the greatest extent possible. It mainly concerns non-built-up areas, unaffected by excessive human intervention (e.g. through technical infrastructure – energy or railway networks). In this case, it is manifested through protective activities, creating national parks and nature reserves. However, landscape protection is also obligatory in built-up areas, especially in relation to urban green and water management, which should be subjected to the principles of environmental protection. On this plane, according to Wodziczko, close cooperation should take place with urban planning (in this respect, he was a promoter of obligatory green belts in cities, which also attests to his visionary perception of the problems and tasks of contemporary urban planning). He saw the special role of landscape protection with respect to industrialised areas, which should be planned in

such a way that they upset the original biological balance of these places to the smallest extent possible. What deserves particular attention is the fact that Wodziczko placed the question of the health of the population within the area of landscape protection. Namely, he claims, clearly referring to Pawlikowski's reflections, that *our physical and spiritual health also depends on the character and state of the landscape* (Wodziczko, 1967, p. 151-152). The thread relating the state of nature and human health was later extensively and originally developed in Poland in the 1960-80s by a professor of Cracow Medical University, Julian Aleksandrowicz.

2. In turn, landscape maintenance *consists in employing permanent measures which remove the damages inflicted on the landscape, as well as prevent upsetting the biological balance* (Wodziczko, 1967, p. 153). Human activities in this area should focus, according to Wodziczko, on two matters. Firstly, since all the elements of landscape (soil, climate, plants, animals and humans) are united in a single whole, we should strive to preserve the harmony ensuing from this connection. What is necessary to achieve it is the awareness of the homeostatic functioning of nature. Human activities should be aimed at repairing the damages brought about by the development of civilisation, such as the erosion of soil or water and air pollution. Secondly, a wide range of economic-protective measures should be employed, aimed for example at *restoring and preserving natural tree species composition in forests, as well as varied biocenosis; adapting agriculture to habitat conditions, restoring natural grass and herb species composition to meadows and pastures, adapting plant and livestock farming to particular habitats* (Wodziczko, 1967, p. 153). In general, it should result in - to the extent to which it is possible - restoring biologically varied landscape, respecting biodiversity and giving careful attention to preserving its relatively natural form for the future.

3. Finally, shaping landscape constitutes the most difficult and at the same time the most important task. It consists in the reconstruction of landscapes destroyed by humans, based on respect for the laws governing nature. At the same time, such reconstruction has to take into consideration local natural conditions. These activities are to result in *the possibility of exploiting all forces of nature for human purposes without violating its rights. Just the opposite; imitating its patterns will lead to creating a new, natural habitat for organic life. Such measures will bring us closer to nature not in the sense of the ideals of J. J. Rousseau, but in the sense of reconciliation with nature which has so far been undervalued* (Wodziczko, 1967, p. 154). What is especially notable in this point is the Polish scientist's special emphasis placed on the existential significance for humans of the explo-

itation of natural resources, but in a way which is respectful for nature, causing the least damage possible and not intervening in its self-regulatory mechanisms. In essence, it is a call for a symbiotic and mutually symmetric shape of the relationship between humans and nature.

Landscape shaping has yet another dimension, particularly emphasised by Wodziczko. It concerns the connection between environmental protection and patriotism, which had earlier been described in Poland by Raciborski and Pawlikowski. They addressed the special significance of contact with native nature as the simplest way to build a sense of national identity in the awareness of the young generation (Gawor, 2018, p. 89-91). According to the professor from Poznań, the relationship between the Polish national community and native nature, just as his predecessors believed, should consist in the nation cultivating nature and in constantly caring for it in order to preserve its possibly most pristine appearance. (Wodziczko, 1967, p. 154).

Wodziczko's concept of *landscape cultivation* is of clearly programmatic and utilitarian character. It focuses on setting out tasks of nature protection; it is based on the knowledge of the functioning of nature, but it attaches less importance to presenting as much as a framework of the manners of practical implementation of its recommendations. On the other hand, the Polish author outlines in his considerations such a model of environmental protection which, taking care of its well-being, should most of all contribute to human welfare. People's benefits derived from well-functioning nature, which is a value in itself, constitute the dominating perspective. It is discussed in the above-mentioned quotations and such phrases as *economic and protective activities* or *exploiting all forces of nature for human purposes*. As far as this meaning is concerned, the idea of the Polish author should be situated within the current of modern environmental thought known as anthropocentric and exemplified, among others, by the views of J. Passmore (Tyburski, 2006).

But most of all, Adam Wodziczko's idea of *landscape cultivation* constitutes an important link in the construction of theoretical foundations of environmental protection. It should be recognised as a pioneering contribution of the Polish naturalist to the contemporary scientific discipline which is only being shaped - landscape ecology². It is suggested in the very terminology of the concept of the scientist from Poznań and that of the project of the new ecological science. Above all, however, the contents of the project of *landscape cultivation* formulated in the 1940s are surprisingly analogous to the substantive contents of the idea of *landscape ecology*. Wodziczko's descriptions of *landscape cultivation* mentioned above are especially similar to those concern-

² The term was introduced in 1939 by the German scientist C. Troll; other names are *landscape studies* or *geoecology*.

ing landscape ecology: *Landscape ecology is a sub-discipline of ecology concerned with studying interdependencies between the ecosystems comprising a landscape. It provides a basis for rational management of natural resources* (Landscape ecology – *Leksykon* 2018); or: *it is a discipline concerned with analysing the components of the landscape and the relations between them (...) it provides a theoretical foundation for formulating guidelines for the purposes of rationally shaping and exploiting the environment in landscape architecture, environmental protection, agriculture and land use planning* (Richling, Solon, 2011). These definitions and objectives of landscape ecology to a large extent coincide with the understanding of the subject matter and the tasks of the concept of *landscape cultivation* suggested by Wodziczko (Richling, 2009). Therefore, the idea of the Polish naturalist is an expression of his mental acuity and the pioneering character of the theory of environmental protection he put forward. It is especially highlighted by Polish environmentalists (*Ochrona środowiska*, 1994; Richling, Solon, 2011; Szyszkievicz, 2018; Pietrzak, 2018).

Wodziczko's views concerning landscape engineering were innovative in his time not only in relation to landscape ecology. They also carried a more general message. At its core lay the conviction that environmental protection is not incidental to the development of human civilisation, but just the opposite - it is closely related to it (Grąbecka, 1991). For Wodziczko, it meant a revaluation of the traditional dominating position of the human in the relation with nature. Man should renounce an essentially disrespectful treatment of nature and become its equal partner. Therefore, *instead of busying ourselves with details and saving this or that, removing slight disharmonies in the process of 'overcoming nature', the time has come to reach deeper and, employing scientific methods: 1. make an accurate diagnosis of the diseases of the contemporary civilisation, ensuing from an erroneous attitude to nature; 2. examine in detail devastation and damages which nature – as well as humans as its element – has suffered and is still suffering as a result; 3. devise a plan of thorough causal treatment; in particular, determine the hierarchy and order of medical treatments. These are the main premises of this new area of scientific knowledge, which wishes to optimally shape man's attitude to nature* (Wodziczko, 1935b). Today, this suggestion comes as no surprise, but it needs to be borne in mind that when it was first formulated in the 1930s, or when nobody even thought about an ecological perception of the world, it was truly revolutionary. And this is where lies the meaning of Wodziczko's reflection for the development and formation of the contemporary thinking about the protection of humans' natural environment.

What deserves special mention in Adam Wodziczko's achievements concerning environmental protection

are his teaching and popularising activities in this area. They had their source in two convictions. The first one concerned the adequate attitude to nature as the basis of current and especially future human existence; if humans fail to develop an adequate attitude to nature, they will sooner or later deprive themselves of the natural surroundings of their lives and simply disappear as a species. An adequate approach to nature is simply practical respect and an attitude of care and protection towards it. This issue in the considerations of the Polish scientist was called *physiotactics* and was presented in *Ochrona Przyrody* magazine in 1932 in an article entitled *Environmental protection as a new branch of knowledge (Ochrona przyrody nową gałęzią wiedzy)*. In the article, Wodziczko wrote: *Every organism is subject to the influences of its surroundings and occupies a determined position in relation to the stimuli affecting it. Humans' position in relation to nature can be defined with the term known to every naturalist: physiotaxis (physis – nature, taxis – arrangement, order, attitude) (...). Thus, physiotaxis literally signifies: occupying a certain position in relation to nature, orientating oneself in relation to nature, taking a position on nature. We are clearly discussing human attitude to nature here, and the science concerned with it could be most generally called physiotactics (the science concerned with physiotaxis)* (Wodziczko, 1932a). For the purposes of *physiotactics*, this new scientific discipline still in the process of being designed, Wodziczko distinguished and described its particular subdisciplines, such as the science of balance in nature, the science concerned with shaping nature and landscape harmoniously, practical environmental protection, the science concerned with the influence of wild nature on the human, *physiotactical pedagogy* (Wodziczko, 1934a; 1939). According to him, *physiotactics* should be an independent natural-social science, though of interdisciplinary nature, among other branches of science, and it should be introduced as a separate teaching subject. Wodziczko tried to implement this project as a part of his classes at the University of Poznań, conducting a practical seminar on the subject. The crowning achievement of his nature protection activities, as far as the academic context is concerned, was creating in 1945 the first independent Department of Environmental Protection and Landscape Cultivation in Poland at the Chair of General Botany at the University of Poznań.

Moreover, Wodziczko believed that shaping an adequate attitude toward nature should begin already in childhood, in nursery school. Therefore, basing on this conviction, he spared no efforts to popularise this idea (Wójcik, 1992). In 1932, in a multi-author publication *Skarby przyrody i ich ochrona (Treasures of nature and their protection)*, he published an article entitled *Environmental protection at school (Ochrona przyrody w szkole; Wodziczko, 1932b)*,

addressed to teachers. In the article, he wrote about the need for preparing a textbook in the methodology of teaching environmental protection in educational institutions of different levels, as well as the need for familiarising children and adolescents with the rules of respecting nature and caring for it. In another text (Wodziczko, 1934b), he offered guidelines concerning working with adolescents in terms of familiarising them with the idea of environmental protection: how to come into contact with nature without destroying it and being cruel to animals, how to observe the living nature; how to inspire interest in nature and an emotional attitude towards the natural environment; or how to set up and cultivate school botanical gardens. The professor from Poznań wrote quite a lot of such works (e.g.: Wodziczko, 1935a, 1937), and all of them include one of his fundamental messages: in order for the idea of environmental protection to be implemented, it has to be an important element present in the processes of teaching and educating. The activities of the Polish scientist, as well as his merits in the field of propagating environmental protection in the period of the Second Polish Republic were invaluable.

Wodziczko also holds a special place in the history of environmental protection activities in the interwar Poland as a social animator and organiser of many national parks of the country. The idea of protecting areas of great natural value, with the qualities of natural or even primeval landscapes, was particularly close to him and he was strongly committed to its implementation. He was the initiator of establishing the Wielkopolski National Park in the Voivodeship of Poznań (functioning since 1933, though officially since 1957); he worked on the creation of the following National Parks: Tatra (which after many years of efforts was finally established in 1954), Pieniny (1930) and Babia Góra (1934). He also planned the demarcation of other protected areas of natural environment, which became national parks after the war: the Wolin (1960) and Słowiński National Park (1967). His activities in this field attested to his ability to accurately select areas which should be protected in terms of their natural features. The subsequent implementations of his ideas in this area demonstrated that it was justified to make efforts to preserve to the greatest extent possible the pristine character of these lands (Dzięczkowski, 1985; Wysokiński, 2011). He was also active in the field of environmental protection on a national scale: he was an active member of the Temporary Commission for Nature Conservation, established in 1919, and subsequently, from 1926 to his death, of the State Council for Environmental Protection.

Wodziczko's activities in the area of environmental protection live on in the memories of the subsequent generations and were symbolically honoured by making him the patron of two strictly protected areas: Prof. Adam Wodziczko Hornbeam Forest Protected Area in the Wielkopolski National Park, and

Prof. Adam Wodziczko Protected Area in the Wolin National Park. Moreover, a memorial stone was set up in his honour in the Wielkopolski National Park, and two commemorative plaques were placed in the executive building and the Museum and Didactic Centre of the same Park in Jeziorki. Wodziczko is also the patron of numerous schools (Adam Wodziczko, 2018).

* * *

In the interwar period and in the years after the war, Adam Wodziczko was one of the leading Polish naturalists. His research in botany brought him recognition in the world of science. However, his true passion was environmental protection. In this area, he had remarkable organisational, popularising, and, most of all, programmatic achievements. His commitment to establishing nature reserves was significant. What was also very valuable was the contribution of his writings in the interwar period to popularising the idea of protecting nature and shaping human ecological sensitivity, especially of the young generation, to nature. His projects of physiotactics and landscape cultivation (engineering) were original notions and useful conceptualisations of ideas of environmental protection, whose innovative character was a few decades ahead of other advocates of the protection of the natural environment. It is particularly noticeable in relation to one of the contemporary ecological sciences – landscape ecology; in this respect, his views are still acknowledged. Moreover, what deserves a special mention are also these threads of his reflections which fit well the current manner of environmental thinking in the categories of sustainable development. To conclude, the activities and the thought of the scientist from Poznań fully justified the fact that, as the editors of the reprint of his book *Na straży przyrody* (*Guarding Nature*) wrote, he was called *one of our most prominent pioneers of the modernly conceptualised movement of environmental protection* (Wodziczko, 1967, p. 5).

References

1. DZIĘCZKOWSKI A., 1985, Adam Wodziczko, twórca nauki o ochronie przyrody. W 50-lecie fizjotaktyki, in: *Studia z dziejów ochrony przyrody w Polsce*, eds. Babicz J., Grębecka W., Wójcik Z., Ossolineum, Wrocław-Warsaw, p. 58-75.
2. EKOLOGIA krajobrazu, in: *Leksykon ekologii i ochrony środowiska*, <http://www.ekologia.pl/wiedza> (01.09.2018).
3. GAWOR L., 2012, Historiozoficzny aspekt ekofilozofii Henryka Skolimowskiego, in: *Problemy Ekorozwoju/ Problems of Sustainable Development*, 7(1), p. 95-103.
4. GAWOR L., 2013, Walery Goetel and the idea of Sozology, in: *Problemy Ekorozwoju/ Problems of Sustainable Development*, 8(1), p. 83-89.
5. GAWOR L., 2016, The anthropocentric sozology of Julian Aleksandrowicz, in: *Problemy Ekorozwoju/ Problems of Sustainable Development*, 11(1), p. 51-52.

6. GAWOR L., 2018, From the Genealogy of the Environmental Thought: Marian Raciborski and Jan Gwalbert Pawlikowski, in: *Problemy Ekorozwoju/ Problems of Sustainable Development*, 13(1), p. 87-93.
7. GRĄBECKA W., 1991, Poglądy Adama Wodziczki na tle nauki o ochronie środowiska czasów międzywojennych, in: *Kwartalnik Historii Nauki i Techniki*, 2, p. 74-75.
8. LENKOWA A., 1986, Ochrona przyrody w Polsce, in: *Człowiek przeciw sobie*, ed. A. Leńkowa, PAX, Warsaw, p. 100.
9. ŁOBARZEWSKA A., 1981, *Adam Wodziczko*, the General Board of Liga Ochrony Przyrody, Warsaw.
10. OCHRONA środowiska. Źródła, 1994, eds. Boć J., Samborska-Boć E., Kolonia Limited, Wrocław, p. 47-51.
11. PIETRZAK M., *Wprowadzenie do ekologii krajobrazu – istota krajobrazu i rozwój badań*, <http://www.isrl.poznan.pl/ekologia/index.php/ekologia-krajobrazu> (09.09.2018).
12. RICHLING A., 2009, *Perspektywy rozwoju ekologii krajobrazu*, in: *Ekologia krajobrazu – problemy badawcze i uptytarne*, eds. Balon, Jodłowski M., Instytut Geografii i Gospodarki Przestrzennej UJ, Cracow.
13. RICHLING A., SOLONJ., 2011, *Ekologia krajobrazu*, PWN, Warsaw, p. 25, 27.
14. SKOWROŃSKI A., 2005, Wydarzenia i ludzie początków prawnej ochrony przyrody w Polsce, in: *Studia Ecologiae et Bioethics*, 3, p. 365.
15. SZAFAER W., 1973, Dzieje ochrony przyrody w Polsce i innych krajach, in: *Ochrona przyrodniczego środowiska człowieka*, eds. W. Szafer, W. Michajłow, PWN, Warsaw, p. 20-21.
16. SZYSZKIEWICZ H., 2018, Wprowadzenie do ekologii krajobrazu, in: *Ekologia krajobrazu – Instytut Środowiska Rolniczego i Leśnego PAN*, http://www.Wprowadzenie_do_ekologii_krajobrazu_M_Szyszkiewicz_Golis.ppt (02.09.2018).
17. TYBURSKI W., 2006, Powstanie i rozwój filozofii ekologicznej, in: *Problemy Ekorozwoju/ Problems of Sustainable Development*, 1(1), 2006, p. 11.
18. WODZICZKO Adam, 2018, entry in: *Wikipedia. The Free Encyclopedia* (02.09.2018).
19. WODZICZKO A., 1967, *Na straży przyrody*, 2nd ed., PZWS, Warszawa. This edition is the source of quotations for the present article (1st ed., 1946).
20. WODZICZKO A., 1924-1939; important texts about environmental protection published in scientific journals and in daily press:
1924, Polskie Parki Narodowe, in: *Kurier Poznański*, 29-33.
1932, Ochrona przyrody nową gałęzią wiedzy, in: *Ochrona Przyrody*, 12.
1932, Ochrona roślin, in: *Skarby przyrody i ich ochrona*, ed. Szafer W., Kasa im. Mianowskiego and Instytut Popierania Nauki, Warszawa.
1934, Praca młodzieży na polu ochrony przyrody, in: *Ochrona Przyrody*, 14.
1934, Czy Polska pozwoli na handel Tatrami?, in: *Kurier Poznański*, no. 273.
1935, Naukowo-organizacyjne zagadnienia ochrony przyrody w Polsce, in: *Kosmos*, 60(1).
1935, Pojednanie z przyrodą, in: *Ochrona Przyrody*, 15.
1936, Ochrona przyrody wczoraj, dziś i jutro, in: *Ochrona Przyrody*, 16.
1936, *Sprawa Parku Narodowego wobec otwarcia kolejki na Kasprowy*, Wyd. Oddziału Poznańskiego Ligi Ochrony Przyrody, Poznań.
1938, O dobrej i złej turystyce, in: *Kurier Poznański*, 204;
1938-1939, Tatry w naszej kulturze, in: *Młody Przyrodnik*, 2(3).
1939, Tatrzański Park turystyki ułatwionej, in: *Kurier Poznański*, 1.
1939, Kolejka na Giewont, in: *Kurier Poznański*, 262.
21. WODZICZKO A., 1932a, Ochrona przyrody nową gałęzią wiedzy, in: *Ochrona Przyrody*, 2, p. 89.
22. WODZICZKO A., 1932b, Ochrona przyrody w szkole, in: *Skarby przyrody i ich ochrona*, ed. Szafer W., Kasa im. Mianowskiego i Instytut Popierania Nauki, Warsaw, p. 316-334.
23. WODZICZKO A., 1934a, Fizjotaktyka – nowa gałąź wiedzy o stosunku człowieka do przyrody, in: *Sprawozdanie Poznańskiego Towarzystwa Przyjaciół Nauki*, 3, p. 117-118.
24. WODZICZKO A., 1934b, Praca młodzieży na polu ochrony przyrody, in: *Ochrona Przyrody*, 14, p. 8-14.
25. WODZICZKO A., 1935a, Hodowla roślin i zwierząt w nowych programach szkolnych, in: *Akwarium i Terrarium*, Poznań 1935, 10-12, p. 75-76.
26. WODZICZKO A., 1935b, Pojednanie z przyrodą, in: *Ochrona Przyrody*, 15, p. 16.
27. WODZICZKO A., 1937, Dzień lasu i ochrona przyrody w naszych szkołach, in: *Kwartalny Biuletyn Informacyjny o Ochronie Przyrody*, Cracow, 7, p. 20.
28. WODZICZKO, 1939, Co to jest fizjotaktyka, in: *Biologia a Życie*, 1, p. 114-118.
29. WODZICZKO A., 1946, Projekt polskiego mianownictwa w nauce o przyrodzie żywej, in: *Sprawozdanie Poznańskiego Towarzystwa Przyjaciół Nauk za lata 1945/1946*, Poznań 1946.
30. WÓJCIK Z., 1992, Adam Wodziczko jako nauczyciel i propagator ochrony przyrody, in: *Kwartalnik Historii Nauki i Techniki*, 37(4), p. 47-57.
31. WYSOKIŃSKI J., 2011, Adam Wodziczko – botanik ze Słotwiny, in: *Dziki Życie*, 5.

Formation of Theoretical and Methodological Assumptions in the Assessment of Significance of the Bioeconomy in the Country Economy

Tworzenie założeń teoretycznych i metodologicznych w ocenie znaczenia biogospodarki w ogólnej gospodarce kraju

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Abstract

In order to ensure sustainable development of the modern economies, there is a need for transforming the linear economy model to circular or green economy model. Bioeconomy can contribute to this goal by ensuring the use of bioproducts and biotechnologies. The flow of material and energy in the bioeconomy is based on the use of biomass and renewable sources for food, feed, and materials production. Circulation principle reduces the amount of waste and increases the efficiency of resources use. It is important to discuss the notions of bioeconomy as described in the strategical and legal documents for bioeconomy development. This research mainly focuses on the theoretical and methodological assumptions of bioeconomy, the main measures for stimulating the development of bioeconomy. We also review the trends of the development of bioeconomy across different countries.

Key words: bio economy, sustainable development, renewable resources, bio based resources

Streszczenie

Aby zapewnić zrównoważony rozwój współczesnych gospodarek, niezbędne jest przekształcenie linearnego modelu ekonomicznego w cyrkulacyjny lub zielony. Bioekonomia może się przyczynić do osiągnięcia tego celu wprowadzając na rynek bioprodukty i biotechnologie. Przepływ materii i energii w bioekonomii oparty jest na wykorzystywaniu biomasy i odnawialnych surowców w produkcji żywności, pasz i różnorodnych materiałów. Zasada cyrkulacji zmniejsza ilość odpadów i zwiększa efektywność wykorzystania surowców. W tym kontekście ważna jest dyskusja samego pojęcia bioekonomii, tak, jak jest ono rozumiane w dostępnych strategicznych i prawnych dokumentach. Niniejsze badania koncentrują się głównie na teoretycznych i metodologicznych założeniach bioekonomii, a więc głównych środkach stymulujących rozwój bioekonomii. Ponadto przeanalizowano trendy w rozwoju bioekonomii w wybranych krajach.

Słowa kluczowe: bioekonomia, zrównoważony rozwój, zasoby odnawialne, zasoby bio

1. Introduction

The adoption of the Paris Agreement at COP21 in 2017 created the preconditions for updating and development of the new global and EU climate change policies. The ambitious target to limit global warming below 2°C and possibly even to 1.5°C above pre-industrial levels creates substantial reductions in

global greenhouse gas emissions (GHG) and gives a new motivation to the EU's long-term objective to reduce green gas house emissions by 80-95% by 2050 compared to 1990. (Behrens, 2016). The European Commission (EC) has recently (2015) published the Circular Economy Package, containing the initiatives for reduction of wastes and increasing of the durability of products, and provided the guideline

for bio economy development, changing the use of fossil resources by renewable and bio based resources. These targets together stimulate long term strategies in the action of all economic sectors and unite all stakeholders from political, public and private sectors towards reducing the consumption of natural and exhaustible resources and improve the natural environmental conditions. Political, economic and social supports are essential preconditions providing the base for the development of bio economy. Main theoretical and methodological factors for the development of bio economy have to be based on an attractive vision by the majority of stakeholders. There is a need to create consistent indicators for evaluation of achievements across the EU. The theoretical principles for setting policy objectives regarding the promotion of circular and bio economy, thus, need to be identified.

The major problem undermining the traditional economy is that the demand for the resources is virtually unlimited, yet the resource stocks can be depleted if renewable resources do not appear as factor inputs. Unsuitable and inefficient use of fossil and non-renewable resources has a negative impact to the ecosystem and natural environment. Sustainable and efficient use of fossil resources is a crucial factor for encouraging economic growth and improving the social and natural environment. According sustainable development paradigm *development that meets the needs of the present without compromising the ability of future generations to meet their own needs* is necessary to concentrate efforts to protect and save the environment. The need for measurement of progress in sustainable development has been stressed in the literature (Rees, 1999; Rifkin, 2012). Such notions as third industrial revolution (Rifkin, 2012), prosperity without growth (Jackson, 2009) or the society of green capital (Meadows, 1992) also require additional insights into the process of sustainability and measurement thereof.

Bioeconomy development is a complex system where many stakeholders and economy sectors are interacting with environment. The use of fossil and local resources, increase the efficiency are one of the main factors influencing the local regional development. The use of bio-based and renewable resources is another important aspects where with the use of biotechnologies, science, research and innovation forms the framework of bioeconomy. One of the primary goals for bioeconomy development is to bring bio-based resources closer to consumers, use more renewable resources and promote biotechnologies. Consequently consumers can produce more bio-resources than they use. This overload or uptake of local and renewable resources is based on methodology of circular and bioeconomy, where every region has its own and specific local resources with specific environment and services for conversion of these resources to a value added products.

The scientific problem of this paper what are the main the theoretical and methodological preconditions of the development of bio economy in the economy of the country and which measures can increase the development of bio economy in Lithuanian agriculture?

The objective of the paper is after the analysis of bio economy sector and its development data and trends to identify aspects that influence the development of agricultural sectors and penetrates the energy and RES development opportunities in the Lithuanian agriculture. According sustainable development concept and the methodology of a process network synthesis method the measures for the development of bio economy in agricultural sector were analysed. The following tasks are formulated: (1) status quo analysis of bio economy sector emphasizing the development of biotechnology, agriculture and energy sectors; (2) theoretical and methodological preconditions for the development of bio economy; (3) trends, opportunities and factors for the development of bio economy; (4) measures for the development of bio economy and biotechnologies optimizing the use of local and renewable energy resources in the agricultural sector.

2. Overview of bio economy and its development trends

2.1. Economy development towards the use of bio-based resources

The main problem the humanity facing is the global overpopulation, rapidly growing economy which depletes the non-renewable resources, the pollution and degradation of natural environment which influence the climate change. Consequently all the stakeholders of our economy are searching for solutions to cope with these problems. It was noticed that the processes in the nature are a perfect example of self-sustainable activities. Nature can provide self-regulation mechanism and waste-free solutions. So the best will be to copy the natural processes and try to implement it into practice, so the priorities of economic activities should be given to reductions of the amount of waste increasing the efficiency of use of resources. One of the primary goals to solve above mentioned problems is to bring resources closer to consumers, use more renewable resources and promote smart or biotechnologies. These phenomena creates prerequisite to establish so called prosumers which are not only consuming but also producing the certain amount of resources and energy. An uptake of local and renewable resources is based on methodology of circular economy, where every prosumer and every region has its own and specific local resources and can establish a specific environment for conversion of these resources to a value added products. The primary technical solution to tackle these problems is to develop the science, apply new tech-

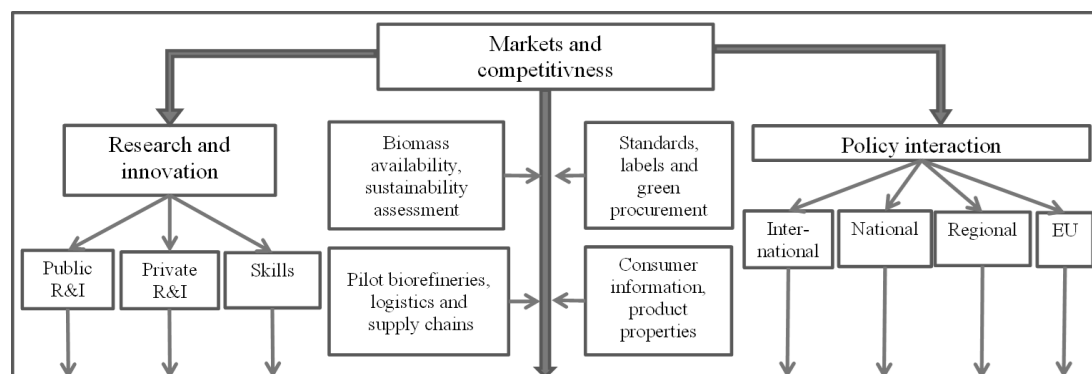


Figure 1. Bioeconomy observatory pillars

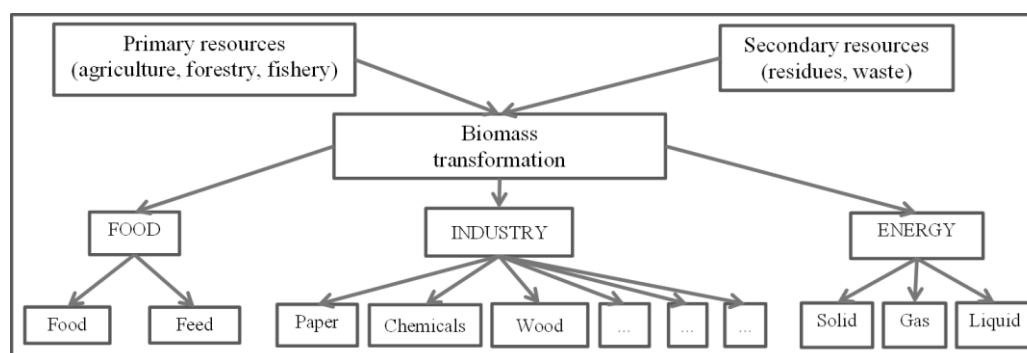


Figure 2. Bioeconomy chain

niques and technologies, especially in the field of biological and IT science. These tasks are set out in the theoretical and methodological definition of bioeconomy described in the strategical and legal documents of bioeconomy development.

2.2. The assumptions for development of the bioeconomy

Bioeconomy can contribute to the development of the economy in a number of ways (McCormick K, 2013). The use of biotechnologies creates unique environment for resource utilization (Birekland, 2008). However the exploitation of renewable resources must not exceed the resilience limits of nature otherwise renewable resources can be treated as non-renewable resources (Čiegis, Gamtos išteklių ir aplinkos ekonomika, 2009). Dynamic development of science, technique and technology, especially in the field of biological and IT science, supports bioeconomy development (M. Adamowicz, 2017). The development of bioeconomy according principals of sustainable development is encouraging the use of a wide range of local and renewable resources (Pledger, 2013). The concept of circular economy and the development approach from cradle to cradle is investigated by A. Wijkman, J. Rockstrom, Walter R. Stahel, M. Braungart, W. McDonough. They stated that wastes generated in the economy can be reduced by increasing the efficiency of use of primary resources, promoting the new technologies, choosing eco-friendly products and materials whose components are less harmful to the environment.

Also they argued that the negative impact to environment can be reduced through more efficient use of non-renewable and renewable resources in the economy. These improvements can be achieved implementing the principles of circular economy and bioeconomy applying new development and technology models.

The complex challenges related to the bioeconomy in Europe is the competition between different biomass uses and potential impact on food prices (McCormick, 2013). There is a need to establish a basis for seeking synergies in policies and initiatives for development of bioeconomy. The European strategy for development of bio economy has various objectives such as: (1) to strengthen competitiveness of EU in the biological research, optimizing the innovation and research systems in the state, public and private institutions; (2) fostering the agricultural transformation for production of biomass and bio-based food and feed; (3) developing the low carbon industries reducing the emission of CO₂, greenhouse gases and wastes. During EU Bioeconomy observatory meeting which took part in December 2013 year, the principal of the actions under three pillars of bioeconomy (see figure 1) were suggested: (1) investments in research, innovation and skills; (2) reinforced policy interaction and stakeholder engagement; and (3) enhancement of markets and competitiveness in bioeconomy sectors.

The observatory pillars along and other strategic objectives of bioeconomy emphasise the need of innovation and research, transformation of industry in co-

operation of agriculture for development of bio-based technologies and production of food, feed, materials and energy, the competitiveness and growth of EU economy through policy interaction at EU, National and regional level. The definition of the bioeconomy concepts emphasise the possibilities for economic growth, higher employment, sustainable development of rural, coastal and industrial areas.

The basic purpose of bioeconomy is the use bio-based and renewable resource for production of biomass, food, feed, biofuels, bionergy and bio-based materials. Bioeconomy can be considered from the micro, mezzo and macroeconomic perspective where enterprises can be specialised in the innovative production of various products and services associated with living organisms for food and utility purposes and where regions can choose bioeconomy as the leading smart specialisation of development (M. Adamowicz, 2017).

The definition of bioeconomy is a new theoretical concept within economy theory however the principals of bio-based technologies and biomass production are well known processes. These bio-based technologies were usually wide used and still in use in agriculture, fisheries, forestry and processing of biological materials. However due to the use of fossil fuel resources and the development of mass production industry the bio-based technologies were not taken into account as a valuable and efficient technologies. Nowadays, in the threshold of global and climate changes, the bioeconomy became particularly important in the development of sustainable economy. Bioeconomy covers a specific chain of processing and value-creation, in which products from the biomass primary production sectors move through the processing sectors, trade and distribution chains, reaching final users in the form of food, biomaterials for further production and industrial bioproducts and consumption (M. Adamowicz, 2017). A scheme of this bioeconomy system in the European Union was outlined in the European Union documents of 2010 (Fig. 2).

Three essential chains of bioeconomy were identified: biomass transformation in the agricultural, industrial and energy sectors using primary bio-base resource such as biomass and secondary biodegradable resources such as bio-based residues and waste. This structure of bioeconomy is developed via the system of knowledge, science and innovation. According to the official work plan of Bioeconomy Information system and observatory project (JRC, 2014) the following tasks related to the sustainability assessment of bioeconomy chains were identified: (1) developing relevant key environmental indicators concerning biomass production, logistics and use; (2) comparative life-cycle based assessment of example bio-based products and their supply chains, from the primary production of biological resources to end-of-life processes. These tasks has to ensure the food security, sustainable management of natural

resources and increase dependence from non-renewable resources, mitigate environmental and climate change, create jobs and maintain EU competitiveness.

3. The methodology of bioeconomy development using sustainable development paradigm

3.1. The role of bioeconomy in the country's economy

Bioeconomy sector is based on development of economic policies in **agricultural, forestry, food production, biotechnology and energy sectors** where the relationships are regulated through sectoral policies. These cross-sectoral policies usually have common goals in protecting the environment, increase the share of use of renewable biological based resources and get rid of using non-renewable resources, increase the net added value in the chain of production, reducing wastes and move towards circular economy. (Include reference about bioeconomy). The use of biomass is treated as one of the priority because it produces wastes and by-products which have added value. Biotechnologies can be used in agro, chemical and other industries for production of bio-based products such as bioplastics, biochemical and medicines. Biotechnologies and the production of biomass create a value added products in health care sector.

To ensure the cross-sectoral interactions and the efficient transition to circular economy there is a need to evaluate the net value of products, materials and resources decreasing the amount of waste in the life cycle of consumption and production. This circular principal helps to develop the sustainable chain of use of bioresources in the different sectors of economy and to ensure that bio wastes generated in one sector becomes a bioresource for another sector. This is so called cascading principle of resources usage and this is one of the important principles in the circular economy because bio resources have to be first of all be used in the production of products with the highest added value. This principle provides possibility to ensure goal-oriented economic policy however the cascading principle is shifting production to the most valuable products which usually are pharmaceutical and cosmetics ingredients, bioplastics and polymers, lacking the opportunity to use bio resources such as biomass for production of low value products such as food and energy. Agricultural products and their wastes utilized for energy production have an impact on supply and demand of agricultural products. Emerged new market of bio-based products is increasing the prices of agricultural products, reducing the supply of food and increasing the competitiveness of products. (Biekša, 2015). Bio-based resources used for energy production is also can be used for other economic activities such as agriculture; therefore, the use of renewable resources

should be balanced with the other economic activities, and the use of renewable resources should not compete with agricultural resources.

3.2. Bioeconomy strategy and its development trends

The challenge of agricultural and other economic activities are to support the food productivity and supply of energy and other resources to global population which will increase from 7 to 9 billion people by the year 2050. The demand for global food production is estimating to increase by at least 70 percent. In order to cope with this problem there is a need to increase productivity of crop cultivation and efficiency of food production. This can be done either by developing new biotechnologies or by changing the behaviour of consumption. Food productions systems can be utilized by converting different feedstuffs into high-quality protein sources and contribute to food security without initiating the food feed competition with natural resources. Consumption behaviour can be changed by developing sharing and circular economy principals or adapting the new social networking systems. Production technologies can be changed improving resource and energy use efficiency and substituting the fossil resources by renewable. All these measures are positively influencing the environment as well. So there is a need to find solution and implement it to tackle with upcoming problems.

A new concept of economic development is associated with the new criteria, which give the meaning to human and nature interaction. Economist Jackson in the book *Prosperity without growth* argues that well-being and a better quality of life are possible in another economic dimension, where communities and their created social capital but not the capital, net added value or gross domestic product are the main driving force. Welfare of a new economy driven by the green capital will be developed using smart management and control methods in accordance with the ideas of sustainable development concept.

There is a need for the holistic approach to the system in order to reach sustainability in the society, where the system works as an ecological loop in the nature, where plants produce oxygen and other materials needed for animals, and animals produce carbon dioxide and residues needed for plant growth. Sustainable economy has to be balanced with the natural environmental cycles, and at the same time, it has to be connected with other regions without harming the environment. This is a step towards a green and bioeconomy that emphasises principles of sustainability. This modification of linear economic approach to a green, circular and bioeconomy have to be achieved without diminishing the life and social well-being and damaging the environment. The main challenge of this transformation is to substitute non-renewable and exhaustible resources with biodegradable and renewable resources which are available in the abundance in the living nature. The tran-

sition towards green, circular and a bio economy creates a high potential for economic growth, rural development and decreases the dependent from the fossil resources. However this is a challenging way because there is a need to overcome many obstacles in all levels of our economic and social life.

To realize it and provide benefits to our social and economic well-being it is necessary to implement new technologies, create conditions for key players in the economy and increase the competitiveness of companies in at EU and National level. There is a need to recognizes and establish main stakeholders in research, practical demonstration and organization of advanced bio-based products and biofuels, as well biotechnologies. Foremost there is a need to establish a good policy based and financial support mechanisms as well to find and define the priority sectors which can facilitate the development of bioeconomy. Feasibility studies, strategies and supportive legal documents is first step towards to sustainable development of bioeconomy. The second practical step is to apply biotechnologies for production of biomass and renewable resources and increase the net added value of by-products and services. The third practical step is to strengthen the security of resources supply and reduce the primary consumption of fossil resources, consequently to decrease the imports of resources. The forth practical step is to develop biotechnologies for production of bio-based products and materials with creation of a chain of added value products and services. The fifth step is to mitigate the climate change problems by reducing the greenhouse gas (GHG) and other emissions applying cost-efficient and effective solutions.

The European Union (EU) strategy *EU 2012 European Bioeconomy* defines bioeconomy as *the production of renewable biological resources and the conversion of these resources and waste streams into value added products, such as food, feed, bio-based products as well as bio-energy*. The Bioeconomy Strategy recognised that *in order to cope with an increasing global population, rapid depletion of many resources, increasing environmental pressures and climate change, Europe needs to radically change its approach to the production, consumption, processing, storage, recycling and disposal of biological resources*. The major aim of this strategy is *to pave the way to a more innovative, resource efficient and competitive society that reconciles food security with the sustainable use of biotic renewable resources for industrial purposes, while ensuring environmental protection*. To achieve this aim, the Bioeconomy strategy identifies five objectives: (1) ensuring food security, (2) managing natural resources sustainably, (3) reducing dependence on non-renewable resources, (4) mitigating and adapting to climate change, and (5) creating jobs and maintaining EU competitiveness. These five objectives addressed via the strategy's Action Plan are focused on 3 areas of action with a total of 12 actions, subdivided into 54

Table 1. Analysis of documents and legal acts of bioeconomy

| No. | Title of documents | Year and country of issue | | Definition | Defined sectors | | |
|-----|---|---------------------------|------|--|---|--------------------------------------|---|
| | | 2 | 3 | | Agriculture | Industry | Energy |
| 1 | Innovating for Sustainable Growth: A Bioeconomy for Europe | 2012 | EU | Production of renewable resources and conversion of RES to value added projects | Agriculture, forestry, fisheries | Biotechnologies, chemical | |
| 2 | Bioeconomy ERA-NET Actions, European Research Area Networks of the 6th and 7th FP | 2007 | EU | Production of renewable biological resources and conversion it food, feed, bio-based products, bioenergy | Agriculture, forestry, fisheries | Biotechnologies, chemical | Bioenergy |
| 3 | A Bioeconomy for Europe | 2011 | EU | Production based on biological processes | Natural ecosystems | Waste free technologies | Energy efficiency |
| 4 | A strategy for a bio-based economy. Green New Deal | 2012 | EU | Production based on biomass | Resource efficiency | | |
| 5 | The Application of Biotechnology to Industrial Sustainability | 2001 | OECD | The use of renewables | Bio products | Eco-efficient processes | Bioprocesses |
| 6 | Industrial Biotechnology and Climate Change. Opportunities and | 2011 | OECD | Bio-based economy, no fossil fuel use | No fossil fuel | | |
| 7 | International Futures Project The Bioeconomy to 2030: Designing a Policy Agenda | 2009 | OECD | Transforming science, knowledge | Competitive products | Eco-efficient processes | Sustainable energy |
| 8 | Baltic Sea Region | 2014 | IS | Optimal utilization of biological resources | Maritime and terrestrial resources | | |
| 9 | Towards a Belgian and Regional Strategy for the Economy | 2013 | BE | Conversion of renewable feedstock | Biomass and organic waste | Biotechnology based on plant sources | Energy derived from plant-based sources |
| 10 | Denmark as growth hub for a sustainable bioeconomy | 2014 | DK | Use of renewable resources | Bio products | Bio-based products | Bioenergy |
| 11 | National Bioeconomy profile | 2014 | FIN | Use of renewable resources | Food | Products and | Energy |
| 12 | National Bioeconomy Policy Strategy: Renewable resources and biotechnological processes | 2014 | DE | Knowledge-based production | Biological processes | Sustainable systems | |
| 13 | National Bioeconomy profile: Italy | 2014 | IT | Relocation and reorganization of production | Reorganization of the natural resources | | |
| 14 | National Bioeconomy profile: The Netherlands | 2014 | NL | Production of bio-based materials | | Vegetable raw materials | Bioenergy |
| 15 | Swedish Research and Innovation Strategy for Bio-based Economy | 2012 | SE | Sustainable production of biomass | | Reduce the use of fossil based | Biomass |
| 16 | Bioeconomy facts and figures 2015. Driving economic growth and productivity | 2015 | UK | Bioscience based processes | Food | Fuel, Bio-chemicals | |
| 17 | National Bioeconomy Blueprint | 2012 | USA | Economy powered by research and innovation | | | |

sub-actions. The Action Plan of 2012 EU Bioeconomy Strategy is mobilised R&I funding, in particular under Horizon 2020, as well fostered R&I investments in EU Member States, and it has also delivered on standards for bio-based products and supported private investment with major deliverables such as the launch of the Bio-Based Industries Joint Undertaking.

Analysis of the definitions and the priorities within sectors of bioeconomy has highlighted three main activities: (1) sustainable production of bio resources; (2) conversion these resources to value added products and (3) the use of biological and bio-based resources for production of food, fuel, chemicals and energy. The type of industry and production

includes the conversion of plants, biological and animal wastes. The use of advanced, new technologies and innovations are the main preconditions for development of bioeconomy. The knowledge-based innovation and research is essential for the development of bioeconomy based on bioscience and the use of biomass. Analysis of the definitions within strategic documents and legal acts have shown that the development of bioeconomy is based on three main pillars: (1) the increase of efficiency of use of resources; (2) replacement of fossil resource by biological, bio-based and renewable sources; (3) conservation of present production to biotechnologies and bio-based processes. (Include reference about bioeconomy development in EU countries). These

changes are possible with cooperation of science, innovation and research sectors.

4. Analysis of bioeconomy sectors and their main development trends

4.1. Strategic documents and their major promotion sectors

Many countries followed by European Commission action on Bioeconomy *Innovating for Sustainable Growth: a Bioeconomy for Europe* (nuoroda) have prepared their own National Bioeconomy strategies or have released a number of documents and reports for development of bioeconomy linking the scientific disciplines and innovations with biotechnologies. Other important common reports on development of bioeconomy are as follow: *Bioeconomy to 2030* prepared by the OECD, the report on industrial biotechnology prepared World Wildlife Fund, the report on the future of industrial bio-refineries prepared by the World Economic Forum, the French *Agrimonde* study, the British study on the future of food and farming, the 3rd foresight report of the Standing Committee on Agricultural Research, the BECOTEPS final report and KBBE-Net analyses (*Innovating for sustainable growth: A Bioeconomy for Europe*. European Commission, 2012)

EU countries such as Germany, the Netherlands, Finland, France, Belgium and Sweden have also initiated the number of bioeconomy initiatives. Analysis of the definitions of bioeconomy and the defined sectors within documents of EU institutions and other organizations are provided in a figure below. The analysis of strategic documents for development of bioeconomy in EU and other countries showed that the development of bioeconomy is based on the following principles: 1) to give the priority to food security; 2) to combine food security with sustainable use of renewable resources for industrial purposes and assurance of environmental protection; 3) to apply the cascading principle in the biomass value chain, first of all using biomass in the production of the highest value added products.

Several EU states have already approved the draft version of bioeconomy strategies: Belgium and Germany in 2013 year, Finland in 2014, Spain and Italy in 2016. Germany has also approved the National Research Strategy BioEconomy 2030 in 2011. Sweden approved *Research and Innovation Strategy for a Bio-based Economy* in 2012. Denmark still has no approved bioeconomy strategy however their National bioeconomy advisory council introduced bioeconomy relevant policy document *Growth Plan for Water, Bio and Environmental solutions*.

Germany among EU was a first country which has adopted *National Research Strategy BioEconomy 2030* in 2011. The priorities were towards the promotion of research and innovation in the food sector (food security), sustainable agriculture, healthy nutrition, industrial processes and bioenergy. After-

ward the Nordic Council of Ministries and Finland in 2014 has adopted the strategies such as *Future opportunities for bioeconomy in the West Nordic Countries* and *The Finnish Bioeconomy Strategy*. Nordic Council of Ministries has identifies the priorities within bioeconomy sectors in Denmark, Finland, Iceland, Norway, Sweden, Greenland, Faroe Islands and Aland. They was given a lot of attention to the development of fishing industry since it represents a large part of the region's GDP. Finland has prioritized the development of renewable resources as the biomass in the forests, including as well soil, fields, water bodies and the sea, and fresh water because forestry is the fundamental economic sector. The Spain has adopted *The Spanish Bioeconomy Strategy* in 2015 and it strategy is based on the sustainable and efficient production and use of biological resources with targeted sectors such as food and agriculture, as well as forestry, conditioned by water availability. The Spanish bioeconomy strategy also includes the development of industrial bioproducts and bioenergy obtained from other sources of biomass. Norway has adopted *Norwegian Bioeconomy Strategy* in 2016 with integrated approach to Bioeconomy and Climate, Green shift, Circular economy, Resource effectivity, Low carbon society. France is the last country in EU so far which has adopted the strategy called *A Bioeconomy Strategy for France* where they have emphasised bioenergy, green chemicals, clusters and circular economy. An overview of the countries which already have adopted bioeconomy policies and the countries which have introduced bioeconomy relevant policies are shown in a table 2.

Other EU countries so far have prepared feasibility studies or other type of documents identifying priorities and trends for the development of bioeconomy. Ireland, Estonia and Latvia are currently at the final stage of preparation of the strategy. Lithuania has also prepared *Lithuanian Bioeconomy Development Feasibility Study* in 2017. Its main action plan is set for the development of bioeconomy in the food, agriculture and biotechnology sectors based on the integration of stakeholders to ensure sustainable growth of bioeconomy via the biomass value chain. The analyses of legal documents within bio economy showed that the priority was giving to the development of food sector while bioenergy, biofuels and biomass production was placed in the second position. Consequently the all the efforts in the development of bioeconomy policies and practical applications was made towards the development of 2nd and 3rd generation of sustainable production of biofuels. Abandoned agricultural land and the inappropriate land for agricultural purpose have be utilized for growing of biomass for biofuels production. The analysis of research of EU countries and good practice of bioproducts created by their companies revealed the following trends: 1) the use of waste as biomass; 2) integration of sectors of bioeconomy; 3) the use of biomass in the production of high value

Table 2. Overview of EU Member States and third countries with bioeconomy policies

| No | Country | Title of strategy | Year of adoption | The major trends within bioeconomy | | |
|----|-------------------|---|------------------|------------------------------------|---------------------------|------------|
| | | | | Agriculture | Industry | Energy |
| 1 | France | A Bioeconomy Strategy for France | 2017 | | Green chemicals | Bio Energy |
| 2 | Spain | The Spanish Bioeconomy Strategy | 2015 | Bio-based resources | | |
| 3 | Italy | Bioeconomy in Italy | 2016 | | | |
| 4 | Finland | The Finnish Bioeconomy Strategy | 2014 | Biomass Forestry | | |
| 5 | Germany | National Research Strategy BioEconomy 2030 | 2011 | Food security | Industrial processes | Bio Energy |
| 6 | USA | National Bioeconomy Blueprint | 2012 | | Bio medicine | |
| 7 | Japan | National Plan for the Promotion of Biomass Utilization | 2010 | | Industrial use of biomass | |
| 8 | Malaysia | Bioeconomy Transformation Programme (BTP) | 2013 | | Bio technologies | |
| 9 | South Africa | The Bioeconomy Strategy - Partnership for Action on Green Economy | 2014 | | Training Education | |
| 10 | Norway | Norwegian Bioeconomy Strategy | 2016 | | Low carbon society | |
| 11 | Nordic Council of | Future opportunities for bioeconomy in the West Nordic Countries | 2014 | Fisheries | | |

added products; 4) replacement of one type of biomass by another; 5) search for alternative forms of biomass; 6) development of circular economy (Vitunskienė, 2017).

4.2. The size of bioeconomy and its values

The bioeconomy is important for the country's sustainable and rational use of resources, employment and creation of the national product. According European Commission documents (2012) the overall annual value of bioeconomy sector is worth 2.2 trillion Euros in turnover and accounting for 9% of the EU's workforce, and therefore it plays a central role in addressing a number of key interlinked challenges. Approximately 55 % of employment is linked with agriculture, 20 % with food industry and almost 14 % with forestry (European Commission (2012). Commission Staff Working Document Accompanying the document, Communication on Innovating for Sustainable Growth: A Bioeconomy for Europe, reference). The effects of employment in agriculture in the form of turnover are only partly counted as effects of the sector because these effects are transferred to other sectors and shows in the production value of food and other products from outside the very agriculture sector (M. Adamowicz, 2017). The bioeconomy sector such of food, beverages and tobacco industry in 2014 year generated more than a half of bioeconomy turnover in EU, where agriculture accounted for 17 % (0.38 trillion

EUR), biomass production – accounted for 20 % and its contribution into the overall employment of bioeconomy was 55 % (Vitunskienė, 2017).

An average turnover of EU-28 countries was 4400 Euros per person. The leaders of generated the added value in the bioeconomy sector amongst EU-28 countries were Germany (150 bill. of EUR), Italy (110 bill. of EUR) and France (75 bill. of EUR) however Ireland, Finland and Denmark were at the top compare turnovers per person (about 8800 EUR). Belgium, the Netherlands, Sweden and Austria were at the second place with 6200 – 6900 Euros of turnover. Lithuanian bioeconomy sector turnover so far is around 3800 Euro per person which is below an average level compare with other EU-28 countries (Piotrowski, 2018; Lietuvos bioekonomika, 2017). The bioeconomy in EU countries employs 18.5 million people in total. The primary biomass production, mainly agriculture plus forestry and fishery, generates a lot of employment (55%) but low turnover (20%). The bioeconomy sector of Eastern European countries such as Poland, Romania and Bulgaria are stronger in less value added sectors of the bio-based economy consequently it generate a lot of employment (Piotrowski, 2018). In comparison, Western and Northern European countries generate much higher turnover compared to the employment generated (Piotrowski, 2011).

In the period from 2004 to 2014 the number of persons employed in the EU bioeconomy decreased by

Table 3. The countries which have introduced bioeconomy relevant policies

| No | Country | Title of documents | Year | The major trends within bioeconomy sectors | | | |
|----|---------------|---|------|--|-------------------------------|--------------------|-----------------|
| | | | | Agriculture | Industry, Clusters | Energy (bioenergy) | Health, Biotech |
| 1 | Austria | Research, Technology and Innovation Strategy for Biobased Industries in | 2014 | | Agro-Timber industry | | Health care |
| | | Policy Paper on Bioeconomy | 2013 | | | | |
| 2 | Great Britain | Agri-Tech strategy | 2014 | | Agro-industry | | |
| | | UK Bioenergy Strategy | 2012 | | | | |
| | | UK Cross-Government Food Research and Innovation Strategy | 2010 | | | | |
| | | Natural Environment White Paper | 2011 | | | | |
| | | S&I strategy for Forestry in Great | 2010 | | | | |
| | | Marine Science Strategy | 2012 | | | | |
| 3 | Ireland | Harnessing our Ocean Wealth | 2012 | | Agro-Timber industry | | Health care |
| | | Delivering our Green Potential | 2012 | | | | |
| | | Towards 2030 | 2008 | | | | |
| 4 | Lithuania | National Industrial Biotechnology Development Programme (2007-2010) | 2007 | | Chemistry, Bioplastics | | Health care |
| 5 | Netherlands | Groene Groei: voor een sterke, duurzame | 2013 | | Bio-based chemicals | | |
| | | Groene Groei – van Biomassa naar | 2012 | | | | |
| | | Frameworkmemorandum on the Biobased Economy | 2012 | | | | |
| | | Green deal Program | 2011 | | | | |
| 6 | Belgium | Bioeconomy in Flanders + Action Plan | 2014 | | Agro-industry | | |
| 7 | Denmark | Growth Plan for Water, Bio and Environmental solutions | 2013 | | Industry cosmetics, chemicals | | |
| | | Growth Plan for Food | 2013 | | | | |
| 8 | Portugal | Estrategia Nacional para o Mar (2013-2020) | 2013 | Aquaculture | Cosmetics | | |

Table 4. Bioeconomy sectors and its gross added value in EU countries (Information source used by authors is the European Commission science and knowledge service Hub, <https://datam.jrc.ec.europa.eu/datam/mashup/BIOECONOMICS/index.html>)

| Economic Activities (by NACE) | LT | LV | EE | BE | DK | FI | FR | DE | IT | NL | PL | SE |
|--|----------------------|-------|-------|--------|--------|--------|-----------|---------|---------|--------|-----------|--------|
| | Turnover (mill. EUR) | | | | | | | | | | | |
| Food, beverage and tobacco | 4.057 | 2.130 | 2.285 | 45.887 | 26.947 | 19.277 | 1.153.006 | 205.734 | 131.770 | 71.657 | 1.153.006 | 17.921 |
| Agriculture | 2.664 | 1.711 | 1.811 | 9.970 | 9.711 | 10.936 | 380.164 | 49.322 | 49.142 | 23.458 | 380.164 | 13.853 |
| Wood products and furniture | 1.774 | 1.277 | 833 | 8.143 | 9.494 | 6.711 | 186.616 | 40.407 | 46.850 | 7.285 | 186.616 | 11.035 |
| Forestry | 1.609 | 939 | 668 | 5.374 | 2.523 | 4.616 | 177.044 | 36.736 | 22.341 | 5.758 | 177.044 | 6.097 |
| Paper | 418 | 120 | 222 | 4.439 | 1.334 | 3.659 | 173.724 | 36.196 | 21.801 | 4.044 | 173.724 | 5.444 |
| Bio-based textiles | 341 | 116 | 113 | 1.765 | 642 | 1.913 | 103.497 | 9.249 | 19.372 | 614 | 103.497 | 4.726 |
| Bio-based chemicals, pharmaceuticals, plastics and rubber (excl. biofuels) | 235 | 100 | 51 | 1.308 | 622 | 829 | 50.101 | 8.854 | 1.787 | 446 | 50.101 | 908 |
| Liquid biofuels | 116 | 75 | 40 | 746 | 600 | 728 | 12.194 | 2.197 | 1.491 | 254 | 12.194 | 823 |
| Fishing and Aquaculture | 58 | 20 | 16 | 411 | 290 | 553 | 11.650 | 156 | 1.461 | - | 11.650 | 263 |
| Bio-based electricity | 38 | - | 3 | 82 | 96 | 94 | 10.831 | | 882 | - | 10.831 | 173 |

2.2 million (or 10.5 percent), while bioeconomy turnover increased by EUR 140 billion (or 7 percent). It should be noted that the greatest reduction in the number of employees was in agriculture (by 1.2 million) due to its constant restructurization, also, in manufacture of wood and furniture made of wood (by 390 thousand), bio-based textile and clothes (300 thousand) and food, beverages and tobacco (by 200 thousand). It should be noted that the growth of the EU bioeconomy turnover was mainly

determined by the development of food production (the turnover increased by EUR 98 billion), and slightly less – by changes in agriculture, where the turnover increased by EUR 26 billion, also in the production of chemical substances, medicines, plastics and rubber based solely or partially on raw materials of biological origin (Lietuvos bioekonomika, 2017).

Every EU country has own strategy and priorities in bioeconomy with different specialisation and contri-

bution to national economy. Every sector of bioeconomy can be characterized by the added gross value and by the turnover which values are presented in table 4.

5. Conclusions

The bioeconomy policy is oriented towards mitigation of primary and secondary wastes in the production processes and at the end user and creation of value added product using bio-based resources and biotechnologies. Both EU and Lithuanian legislation documents give attention to the reduction of bio-waste, especially in the food sector in order to decrease the food waste, organizing and managing the collection system of food wastes and implement measures allowing reducing the generation of food waste. Reduction of food waste, extension the chain of the use of food and provide by-products in feed production is prioritized policies in the bioeconomy legal documents. It also emphasized the education and information management systems which plays an important role in awareness of public about reducing the food wastes.

Meanwhile EU and OECD strategic documents emphasize the bioeconomy strategy on three areas: investment in research and innovation (R&I), improvement of innovation and skills; strengthening policy interaction and participation of stakeholders; increase the competitiveness of bioeconomy sector. The attention is given to the development of biotechnologies, because they are centre of bioeconomy sectors. Biotechnologies provide the knowledge-based development for competitive industrial and service sectors creating the higher value added. The highest added value products are created in the pharmaceutical sector because it is innovation and knowledge intensive industry based on of the use of high level of technologies. Manufacture of chemicals and bio-based plastics is a medium-high-technology industry while production of biomass is considered as low technology industry. Currently, the contribution to production of biomass and bioenergy is a priority of bioeconomy sector in Lithuania since the manufacture of bio-based chemicals and pharmaceutical products using advanced biotechnology processes is poor due to its small scale. However, biotechnologies and its applications have a high potential because of generated high added value, consequently it expected as the most promising development sector because of attracting investments in R&I and qualified employees.

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References

1. BEHRENS A., 2016, Time to connect the dots: What is the link between, in: *CEPS Policy Brief, Climate change policy and the circular economy?* 33(7).
2. EUROPEAN Commission, 2009, *Directive 2009/28/EC of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC*, 5.6.2009, L 140/16.
3. FAHLÉN E., AHLGREN E.O., 2012, Accounting for external environmental costs in a study of a Swedish district-heating system – an assessment of simplified approaches, in: *Journal of Cleaner Production*, 27, p. 165-176.
4. HALSZ L., POVODEN M., NARODOSLAWSKY M., 2005, Sustainable processes synthesis for renewable resources, in: *Resources, Conservation and Recycling*, 44, p. 293-307.
5. JACKSON T., 2009, *Prosperity without growth. The transition to a sustainable economy*, Sustainable development Commission, 134 p.
6. JORDAN A., 2008, The governance of sustainable development: taking stock and looking forwards, in: *Journal of Environment and Planning: Government and Policy*, 26, p. 17-33.
7. FIDGE F., HAHN T., 2004, Sustainable value added-measuring corporate contributions to sustainability beyond eco-efficiency, in: *Ecological economics*, 48, p. 173-187.
8. KLEVAS V., 2010, Regional approach for policies and measures aiming to sustainable energy development, in: *Paths to sustainable energy*, InTech, Croatia, p. 117-132.
9. KLEVAS V., BIEKŠA K., KLEVIENĖ A., BUBELIENĖ J., STANKEVIČIUS M., 2010, Principles of energy development sustainability evaluation, in: *Journal of Power Engineering*, 56, p. 92-102.
10. KLEVAS V., ŠTREIMIKIENĖ D., KLEVIENĖ A., 2009, Sustainability assessment of the energy projects implementation in regional scale, in: *Journal of Renewable and Sustainable Energy Reviews*, 13, p. 155-166.
11. KLEVAS V., ANTINUCCI M., 2004, Integration of national and regional energy development programs in Baltic States, in: *Energy Policy*, 32, p. 345-355.
12. KNAPEK J., 2010, Effectiveness of feed-in tariff scheme- a lessons learned from Czech Republic. 11th IAAE European conference on energy economy, policies and supply security: surviving the global economic crisis, Vilnius, Lithuania, International Association for Energy Economics, p. 1-10.
13. STATISTICS Lithuania, 2011, *Energy consumption in households 2009*, Vilnius.
14. STOEGLERHER G., NARODOSLAWSKY M., 2009, How sustainable are biofuels? Answers and further questions arising from an ecological footprint perspective, in: *Journal of Bioresource Technology*, 100(16), p. 3825-2830.
15. REVIEW of the 2012 European Bioeconomy Strategy. European Commission, p. 88.
16. SILVERA S., 2015, *Opportunities for bioenergy in the Baltic Sea Region. Security of energy supply, promotion of the bio-economy, nutrient recycling, and innovation are prioritized policy areas in the EU Strategy for the Baltic Sea Region*, EU Commission Staff Working Document.
17. *Bioeconomy Information System and Observatory (BISO) – Environmental sustainability assesement. Explanatory note and agenda. EC, JRC- Institute for environment and sustainability. 2014.*
18. BIEKŠA K. 2015, *Energy economic model of green settlements*, Doctoral dissertation, Kaunas.
19. PIOTROWSKI S., Carus M., Carrez D., 2018, *European Bioeconomy in Figures 2008-2015*, Nova-Institute for Ecology and Innovation, Hurth, Germany, 2018. p. 18.
20. VIRGINIA H. DALE K.L., 2016, Klein and et al. Incorporating bioenergy into sustainable landscape designs, in: *Renewable and sustainable energy review*, 56, p. 1158-1171).

Humanistic Perspectives of Biocultural Diversity

Humanistyczne perspektywy różnorodności biokulturowej

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Abstract

It is widely recognised that biocultural diversity is an important element of world heritage. Until recently, the focus was mainly on biodiversity, but since the 1980s, attention has also been drawn to the importance of cultural and linguistic diversity. Konrad Lorenz suggests that civilisational processes are threatening not only the diversity of Earth's heritage, but also humanity itself. This study aims at showing the interrelationships between biocultural diversity and the biological and cultural *layers* of humans. This study draws on Luisa Maffi's concept of biocultural diversity and Lorenz's *layered* concept of humans. The research conducted confirms the existence of mutual dependencies between various forms of terrestrial heritage and human *layers*. It also suggests that strong biocultural diversity positively affects the human condition and, vice versa, the good condition of humans positively affects the quality of the Earth's diversity. The research leads to the conclusion that research teams analysing civilisational processes cannot be limited only to representatives of natural, technical, economic or legal sciences, but should also include humanists. This will allow a better understanding of the complexity characterising civilisational processes and find more adequate solutions.

Key words: biocultural diversity, biodiversity, cultural diversity, linguistic diversity, waning of humaneness, Konrad Lorenz

Streszczenie

Powszechnie zauważa się, że różnorodność biokulturowa jest ważnym elementem światowego dziedzictwa. Do niedawna koncentrowano się głównie na różnorodności biologicznej. Od lat 80 XX w. zwrócono także uwagę na znaczenie różnorodności kulturowej i językowej. Konrad Lorenz wskazał, że procesy cywilizacyjne zagrażają już nie tylko różnorodności ziemskiego dziedzictwa, ale nawet człowieczeństwu człowieka. Opracowanie to stawia sobie za cel pokazanie wzajemnych zależności pomiędzy różnorodnością biologiczną, kulturową i językową a biologiczną i kulturową *warstwą* człowieka. Podstawą tego opracowania była koncepcja różnorodności biokulturowej Luisy Maffi oraz warstwowa koncepcja człowieka wg Konrada Z. Lorenza. Przeprowadzone badania potwierdzają istnienie wzajemnych zależności między różnymi formami ziemskiego dziedzictwa a *warstwami* człowieka. Wskazują też, że dobra kondycja różnorodności biokulturowej wpływa pozytywnie na kondycję człowieka. Podobnie dobra kondycja człowieka pozytywnie wpływa na jakość ziemskiej różnorodności. Przeprowadzone badania prowadzą do wniosku, że zespoły badawcze, które dokonują analiz procesów cywilizacyjnych nie mogą ograniczać się do przedstawicieli nauk przyrodniczych, technicznych, ekonomicznych i prawnych. W zespołach tych powinni być także humaniści. Pozwoli to lepiej uchwycić złożoność zachodzących procesów cywilizacyjnych i odpowiedzieć na nie w sposób bardziej adekwatny.

Słowa kluczowe: różnorodność biokulturowa, różnorodność biologiczna, różnorodność kulturowa, różnorodność lingwistyczna, regres człowieczeństwa, Konrad Lorenz

Introduction

The diversity of Earth's heritage is such an important good that it calls for responsible and foresighted care. While experiencing the contemporary ecological crisis, people have begun to realise the ongoing process which is depriving them of this heritage. It has been noticed that the advancing scientific and technical civilisation is accompanied by the simultaneous, constantly accelerating extinction of various flora and fauna species. Over time, people have also realised that, along with the loss of biodiversity, an analogous loss of cultural diversity is taking place and, what is more, that Earth's heritage in all its manifestations is interrelated. This heritage can thus only be preserved if every part of Earth's diversity is protected in an integral and collective way (Sadowski, 2017). Analyses of civilisational processes taking place today have also shown that it is the humanness of people itself that is at risk. Progressing civilisation processes often have a destructive effect not only on the world of nature or the world of culture, but also on humans themselves, and they thus lead to the loss of specifically human abilities. According to Lorenz, civilized humanity is characterized by a technocratic system, in which technology plays the role of a *tyrant*. This is due to the fact that technology, in the strive towards satisfying human needs, is increasingly besieging humanity, ultimately taking the form of a straitjacket, which, admittedly, provides a guarantee of humanity's safety, but at the same time hampers its freedom. Consequently, technology prevents actualization of specifically human predispositions (Lorenz, 1989).

An analysis of the civilisational challenges currently faced by biocultural diversity, as well as the civilisational challenges faced by humanity, makes it clear that the above-mentioned processes are interrelated and mutually interacting. The phenomenon of biocultural diversity has already been well recognised and described, the latest research indicates both the advantages of this concept and its drawbacks (Brosius, Hitchner, 2010; Caillon, Degeorges, 2007; Sterling, et al., 2017). Most often, it is defined as *the diversity of life in all its manifestations: biological, cultural, and linguistic – which are interrelated (and possibly coevolved) within a complex socio-ecological adaptive system* (Maffi, 2007, p. 269).

The civilisational challenges that people face today are much less known, however. Konrad Lorenz made an original attempt to identify these processes, noticing that they take place simultaneously in the world of nature and in the world of culture. The scientist also pointed to the incommensurable manner in which these processes occur and to the resulting threat to the human condition (Lorenz, 1989). In order to explain Lorenz's position, it is necessary to provide at least an outline of the concept of humans formulated by the scientist. Without this, it is impossible to understand the civilisational challenges, their

causes, and the mutual dependencies that he identified.

Inspired by Nicolai Hartmann's concept of the real world's *stratification* (Hartmann's theory of the *strata of existence*), Konrad Lorenz developed his own idea of the reality. Harking back to the concept of fulguration (*fulguratio* or the *creative flash*), he distinguished biological and cultural layers in humans (Lorenz, 1978, p. 37-39, 29-30). This division was based on the so-called fulguration of humanisation, within which the human mind emerged and which, according to Lorenz, marks the beginning of a new kind of life, namely, the life of the human mind (Lorenz, 1978, p. 172).

According to Lorenz, humans consist of the body, soul and mind. The first two elements constitute their biological component and develop in accordance with the rules of biological evolution. According to this approach, the soul is a component responsible for people's emotional life and one that they share with many representatives of the animal kingdom. The mind, on the other hand, is a specifically human disposition that manifests itself in various forms of culture and therefore develops in accordance with the rules of cultural evolution. The mind is the *layer* of a human, which makes them capable of conceptual thinking and verbal language. These abilities, in turn, condition a human's creativity and enable them to participate in the world of culture (Lorenz, 1989, p. 55-56).

Konrad Lorenz also points out that while the human body and soul have remained practically unchanged in their physiological aspect for thousands of years, the human mind has changed enormously over this time. According to Lorenz, this situation is a consequence of the difference in the pace of biological and cultural evolutions. The scientist notes that while biological evolution is proceeding extremely slowly, cultural evolution is constantly accelerating, reaching a dizzying pace. As a consequence, the biological layer of humans is unable to keep up with its cultural layer. This leads to a kind of *stratification* of humans, which results in the waning of humaneness (Lorenz, 1978: 180; Lorenz, 1989, p. 55).

The civilised human faces completely new, unprecedented challenges. They not only constitute a threat to the biological survival of individuals or local communities, but, by leading to the regression of specifically human abilities, they threaten humanity itself. Lorenz even claims that the deepening of our knowledge about the world of nature, which was supposed to lead to scientific and technological progress, paradoxically, instead of relieving human suffering, brought on a deadly danger to humanity: the destruction of mankind (Lorenz, 1974, p. 12).

The aim of this study is to show that contemporary civilisational processes not only may have a negative impact on the world of nature and culture, but also on human beings themselves. On the one hand, they may lead to the gradual disappearance of biological,

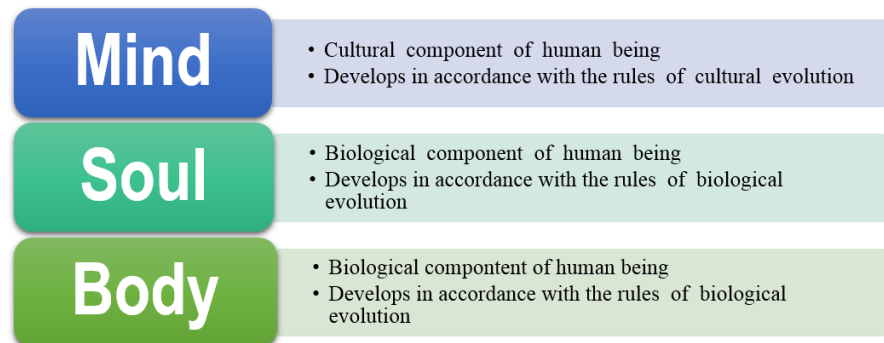


Figure 1. Konrad Lorenz's concept of human being (created by the author).

cultural and linguistic diversity and, on the other, they may result in the loss of specific human abilities. This, in turn, may lead to the destruction of humanity. The author's intention is, moreover, to demonstrate that biocultural diversity and the human condition are interrelated. This means that the loss of diversity in Earth's heritage implies a deterioration of the human condition, and vice versa, that an improvement in the human condition positively affects the condition of biocultural diversity.

1. Civilisational challenges to the world's diversity

The desire for development and progress inherent in human nature gave rise to the unprecedented success of humanity; at the same time however, it became a deadly threat (Sadowski, 2016, p. 195). Over the millennia, dangers resulting from such an expansive development of civilisation have been entirely overlooked. While struggling with nature, people were convinced that it was eternal and indestructible (McKibben, 1989, p. 3-5). Modern times, however, brought with them changes resulting in a radically different approach towards science which, in turn, made possible the development of technology allowing humans to interfere in nature on an unprecedented scale. The most important inspirers of these changes seem to have been Francis Bacon and René Descartes, who – each in his own way – contributed to the development of Western civilisation.

It was in the development of Western science rather than in the spiritual improvement of an individual as postulated in the Middle Ages, that Bacon saw hope for human happiness and a chance to take control of the world. The philosopher conceived a project aimed at eradicating diseases and poverty with the help of knowledge. He encapsulated this thought in the statement *human knowledge and human power meet in one* (Bacon, 1989: book 1, aphorism 3).

Bacon understood human power as the ability to control nature acquired by people in the process of learning the laws governing it, and that these laws could be discovered by means of the empirical method and technique. The contribution of Descartes to the creation of modern science consisted, in turn, primarily

in rejecting the classical division of reality into animate and inanimate matter, as well as in the statement that this reality is divided into the thinking thing (*res cogitans*) and the extended thing (*res extensa*) (Descartes, 2015; Descartes, 2008, part 1, no 53). Descartes' proposal laid a foundation for a division between natural sciences and the humanities, as well as for the mathematical description of the world. As a result, nature, which began to be studied only with respect to its measurable features, became an excellent object of exact sciences. This, consequently, led to an unprecedented development of these sciences, advanced technology, and ultimately influenced the dynamic development of Western civilisation.

Modern thinkers were convinced that the progress of science and technology would enable people to emancipate themselves from nature and to build in it an autonomous *kingdom of man* (*imperium homini*) (Bacon, 2009, book 1, aphorism 68) where people will gradually move from the position of servant and nature's translator to that of its absolute ruler (Bacon, 2009, book 1, aphorism 1 and 129). There are many indications that such a reckless realisation of this modern dream, however, instead of leading to the ultimate eradication of diseases and poverty, gave rise to new threats which brought unprecedented dangers to both current and future generations.

The dynamic development of civilisation caused danger to the entire planet, posing a threat to Earth's heritage in all its dimensions. An analysis of the effects of the ecological crisis allows us to perceive the threats faced by the natural environment today. This is especially clearly reflected in the ongoing loss of biodiversity. Culture, which in all its complexity and diversity is undergoing globalisation processes, is in a similarly difficult situation, or perhaps even more difficult due to the fact that it is less recognised. Globalisation, which affects culture, may result in its impoverishing unification, manifested, among other things, in the loss of cultural and linguistic diversity. Paradoxically, the success of Bacon's program, instead of ensuring a stable, safe and successful existence for humanity, brought about uncertainty, threats and tragedies that both people and the surrounding

world had never experienced before. Humans fell victim to their own success and, consequently, had to face completely new challenges (Horkheimer, Adorno, 2002, p. 34). Earth's heritage is today becoming subject to difficulties which threaten not only its use, but also its survival. This is clearly visible in the example of the threats endangering Earth's diversity in both its natural and cultural spheres.

The civilisational challenges faced by our planet's natural heritage are now well identified and described. A loss of biodiversity has been taking place for millions of years, but its pace accelerated considerably with increased human activity (Kolbert, 2014). This pace is proportional to the technological potential, which enables an ever-increasing human interference in the environment. This is why, along with the development of technical civilisation, the depletion of biodiversity is constantly accelerating. Despite numerous measures undertaken with the aim of protecting the endangered species, it is estimated that, depending on the adopted research methodology and baseline data, in the year 2100 it will be possible to preserve only 80-98% of the flora and fauna species that lived on Earth in 2000 (Skutnabb-Kangas, 2002, p. 13).

Loss of biodiversity poses a real threat to human civilisation, for which biodiversity was a prerequisite of emergence. It is to the wealth of species that we owe food, water, air, clothing, medicines, fuel and other resources. Nature is an important element of human aesthetic and moral experience. It has a significant impact on human well-being (Diaz, et al., 2006; Cardinale, et al., 2012). This issue is of such vital importance that it was raised by Pope Francis, who noted that the protection of biodiversity cannot be motivated only by utilitarian purposes. Initiatives aimed at preserving our planet's biological heritage should arise from our noticing the intrinsic values of creatures and their significance for cultures and poor people (Pope Francis, 2015, no 190).

Civilisational challenges facing the cultural heritage of our planet seem to be even more serious than those threatening the natural heritage (Pope Francis, 2015, no 145). This is due to the fact that challenges to cultural diversity are more difficult to identify and less understood since their effects are usually distant in time. Important factors affecting the loss of cultural diversity are contemporary globalisation processes and communication technologies which, on the one hand, facilitate communication among people and help promote indigenous traditions but, on the other, often lead to rejection of those traditions, popularisation of global mass culture, and consequently, to the unification of culture. The UN, recognising these challenges, declared 1988-1997 the World Decade for Cultural Development (UN, 1986).

UNESCO is actively engaged in activities associated with preserving cultural diversity. This organisation undertook a number of initiatives, which led to the

adoption of the *UNESCO Universal Declaration on Cultural Diversity*, the *Convention on the Protection and Promotion of the Diversity* (2005) and two reports – *UNESCO and the Question of Cultural Diversity 1946-2007: Review and Strategies* (2007) and *Investing in Cultural Diversity and Intercultural Dialogue* (2009) (Sadowski, 2017, p. 39). The European Union, which declared 2008 as the European Year of Intercultural Dialogue, also attaches great importance to the protection of cultural diversity, and the European Parliament presented a report on the role of intercultural dialogue, cultural diversity and education in promoting EU fundamental values. Cultural diversity and intercultural dialogue are naturally combined with linguistic diversity. This manifestation of the diversity of Earth's heritage currently seems to be facing the greatest challenges. An analysis of the state of linguistic diversity reveals its natural geographical imbalance. Europe, where only 287 languages have been noted, is the poorest continent in this respect. The total number of languages in both Americas comes to 1062, in the Pacific to 1313, and in Africa to 2139, while in Asia there are as many as 2296 languages (Lewis, et al., 2016).

Recently conducted research indicates that the loss of linguistic diversity proceeds at a much faster pace than the loss of biological or cultural diversity. In the years 1970-2005 alone, 20% of the languages known at that time became extinct. The estimated rate of linguistic diversity depletion in this period was 0.3% per year, and the current rate is approximately 1% per year (Harmon, Loh, 2010, p. 110). The latest forecasts predict that only 10-50% of languages used in 2000 will still be used in 2100, (Skutnabb-Kangas, 2002, p. 13).

The languages most vulnerable to extinction are those used by relatively few human communities. This specifically involves communities in developing countries and occupying areas that are attractive to large international investors. Any changes in the management practices employed in such areas result in the migration of these communities to cities, or the arrival of a large number of migrant populations (Pope Francis, 2015, no 146). This is confirmed by studies presenting data from Latin American countries, according to which as many as 49% of indigenous people live in urban settings, while 51% live in rural settings (World Bank, 2015, p. 31). In these cases, both language vitality and the culture of the indigenous community may be adversely affected. This is particularly evident in the case of local communities migrating to cities, where they are most often dispersed, and where their language and traditions are at risk.

This is well illustrated by research, according to which in recent decades 20% of South American residents who identify themselves as indigenous people have lost the ability to speak their language. This applies mainly to the younger generation, which mainly uses only Spanish or Portuguese. According

to research from 2012, only 41% of Bolivia's residents identify themselves as indigenous people, and only 29% still use indigenous language. Similar processes are observed in Mexico, where the percentage is, respectively, 15% and 7%, and in Ecuador, where it reaches 7% and 5% respectively (World Bank, 2015, p. 27).

Another civilisational challenge that affects linguistic diversity are globalisation processes and the ever-stronger position of the English language, which is becoming the dominant tongue of the modern world. This, on the one hand, results in the diminishing importance of *niche* languages, discontinuation of creative activity in these languages and in their potential extinction. On the other hand, modern communication techniques provide the means of easy and cheap communication among people thousands of kilometers away, which helps in the preservation of rare languages and stimulates creativity in these languages. Carolyn Stephens emphasizes that the process of indigenous peoples migration into cities has both positive and negative effects on their culture. Research shows, however, that these migrations mostly induce negative effects. Positive effects usually occur when the urban indigenous communities have become stronger and more organized (Stephens, 2015, p. 60).

Our planet in all its manifestations is currently facing many civilisational challenges which pose a real threat to the quality of life and even to life itself as regards both people and other living beings. These threats manifestly affect the natural world, but their negative effects are also becoming increasingly noticeable in the world of culture.

2. Civilisational challenges to humaneness

It seems that despite the passage of time, the civilisational challenges facing humanity noted by Konrad Lorenz in 1973, when he presented them upon receiving the Nobel Prize, are still relevant today. Lorenz expanded his ideas a year later in a book published in English entitled *Civilized Man's Eight Deadly Sins*. According to the scientist, these challenges constitute a real threat to both the natural and human world. While the threats facing the natural world are quite obvious, the threats to the human world are less conspicuous, and therefore require broader explanation.

Konrad Lorenz was convinced that contemporary civilisational processes threaten humanity *by a progressive decline of all those attributes and attainments that constitute humanity* (Lorenz, 1989, p. 3). In his opinion, the main source of the civilisational challenges facing humanity is the growing dissonance between the biological and cultural layer of humanity. The first of these consists of the human body and soul, and the other constitutes the human mind. Lorenz noticed that we are now dealing with opposition between the soul and the mind. The con-

stantly accelerating pace of cultural development, resulting from the activity of the mind, has changed the human environment so much that a human's biological layer (body and soul) is incapable of adapting to the changing living conditions. This is due to the fact that, while the biological layer of humans (the somatic and emotional sphere) has not in fact undergone any significant changes since the time of human creation, the human mind is subject to dynamic and constant changes. As a consequence, the biological layer of humans faces new, unknown challenges generated by the mind and it is unable to meet them (Lorenz, 1989, p. 121-123).

Lorenz defined the most dangerous challenges faced by civilised humans today as deadly sins. He borrowed this term from the language of religion. In the spiritual context, a deadly sin is an offense against the commandments that brings spiritual death. In the context of civilisation, Lorenz interpreted deadly sins as offenses against humanity and its integrity, leading to the waning of humaneness (Lorenz, 1974). In Lorenz's view, the civilisational changes experienced by modern humans threaten the integrity of the human structure, which rests on harmonious cooperation of the body, soul and mind. This integrity is threatened by processes triggered by the difference in the pace of cultural and biological evolutions (Lorenz, 1974, p. 12).

Lorenz distinguishes eight processes which, in his opinion, lead to the waning of humaneness, and calls them the deadly sins of the civilised humans. Among these sins he includes: 1) overpopulation, 2) devastation of the environment, 3) humanity's race against itself, 4) entropy of feelings, 5) genetic decay, 6) break in tradition, 7) increased indoctrinability of humankind and 8) nuclear weapons (Lorenz, 1974, p. 101-103).

Lorenz, rather than viewing the issue of overpopulation in the context of natural and economic challenges related to the size of the human population, perceives it from the perspective of the psychological consequences ensuing from living in a crowd. An excessive concentration of people not only fails to improve the relationships between them, but also makes it difficult to establish deep and mature ties. As Lorenz contends, this results from the fact that people are phylogenetically adapted to living in small communities, which allow for the natural development of deep interpersonal relationships. Failing to take this biological human trait into account and placing people in conditions that they are not prepared for, often leads to aggression or indifference towards others (Lorenz, 1974, p. 11-14).

Raising the issue of environmental degradation, Lorenz focuses on the consequences of this phenomenon for the human mind, because he considers them a more serious threat than the natural and economic consequences of the ecological crisis. In Lorenz's opinion, contact with nature is a necessary condition for full human development. As a result of exper-

encing nature's beauty and harmony, people can shape their aesthetic sensitivity, which in turn has an impact on their ethical sensitivity (Lorenz, 1974, p. 20). Otherwise, having no stable ethical beliefs due to the aesthetic underdevelopment which follows, the lack of contact with the beauty of nature, people gives priority to economic calculation over the state of the natural environment.

The third deadly sin of the civilised human pointed out by Lorenz, is humanity's race against itself. In the philosopher's opinion, in their pursuit of success many inhabitants of developed countries begin to live at a pace that distances them from the purpose of their activities and from reflection on the sense of undertaken actions. Lorenz also highlights the fact that the human body and soul are not adapted to such a pace of life, and that this often affects people's health. As the scientist contends, however, it is the resignation from the inherently human ability of self-reflection that poses the greatest threat to humanity. This is clearly confirmed by people's efforts to suppress the fear of failure in the constant race for success. The life of modern humans is thus almost deprived of the silence that would allow them to reflect on the purpose and meaning of their actions (Lorenz, 1974, p. 24-30).

The next civilisational challenge described by Konrad Lorenz is the entropy of feelings, which he interprets as the waning of all strong feelings and emotions, caused by overindulgence. Lorenz traces the origin of this phenomenon to the widespread, excessive use of painkillers. On the one hand, this causes a lack of resistance to pain and on the other, results in an indifference to pleasure. As a consequence, people lose the ability to make any substantial sacrifices or undertake painstaking work to accomplish tasks that do not offer hope of immediate gratification. Humans, stupefied with anaesthetics, becomes increasingly bored, blasé and soft, unable to face life's challenges. Another consequence of the unnatural satisfying of the need for pleasure is the phenomenon referred to by Lorenz as *neophilia*. This is based on a constant striving to replace the things used so far with new ones, since everything quickly loses its attractiveness for someone who is so easily bored. Lorenz emphasises that this phenomenon relates not only to objects, but also to pets, friends and even spouses (Lorenz, 1974, p. 31-42).

The fifth civilisational challenge pointed out by Lorenz is genetic decay. As in the case of the previous challenges, he focuses on the negative consequences related to the cultural layer of humans. Lorenz draws attention to the disappearance of the healthy norms of social behaviour, and to the unification of cultures. He points to the disturbing phenomenon of infantilism among adults who fail to carry out their duties and resort to social parasitism. *If the progressive infantilism and the increasing juvenile delinquency are, as I fear, signs of genetic decay, humanity as*

such is in grave danger. In all probability, our instinctive high valuation of goodness and decency is the only factor today exerting a fairly effective selection pressure against defects of social behavior (Lorenz, 1974, p. 58).

Another civilisational challenge facing humans today is the break with tradition. This challenge undermines the very foundations of culture. Although tension between generations is not a novel phenomenon, nowadays, instead of tension, we are rather dealing with a radical break in intergenerational bonds. Lorenz remarks that *today's rebellious youth react to the older generation in the same way that a culture group or 'ethnic' group reacts to a foreign, hostile one* (Lorenz, 1974, p. 64). It seems that this phenomenon is caused by disturbed family relationships experienced in adolescence. In this period of life, young people most often reject their parents' system of values and look for a peer group with whom they can identify. Lorenz defines this phenomenon as *physiological neophilia* (Lorenz, 1974, p. 68).

The seventh deadly sin of civilised humans is the increased indoctrinability of humankind. Lorenz notes that our trust in the information passed down by tradition is a prerequisite for the existence and development of culture. Never before in human history have humans possessed such a vast scope of information and means of communication. This increases the risk of widespread manipulation and indoctrination even more. *We ostensibly free, Western, civilised people are no longer conscious of the extent to which we are being manipulated by the commercial decisions of the mass producers* (Lorenz, 1974, p. 88). According to Lorenz, indoctrination is a real threat to humanity as it leads to the unification of culture and distorts the natural interplay of the diverse elements which constitute its foundation. Differences in views and independent thinking precondition culture's development.

Lorenz devotes the least space to the last civilisational challenge. In his opinion, this threat is so obvious that it does not require a detailed analysis. Nuclear weapons constitute a deadly sin of civilised humans which, by being the most evident of all, is the easiest to counteract. The juxtaposition of nuclear weapons with other threats is supposed to bring people to the realisation of the dramatic situation in which they face a real danger of losing their greatest wealth, namely their humaneness (Lorenz, 1974: 99-100).

3. Civilisational interrelationship between the world's diversity and humaneness

While analysing the dependencies between humaneness and various manifestations of world heritage, it should be noted that these interrelationships have a mutual character. On the one hand, the deadly sins



Figure 2. Diagram illustrating the dependence between civilisational sins and biocultural diversity (created by the author).

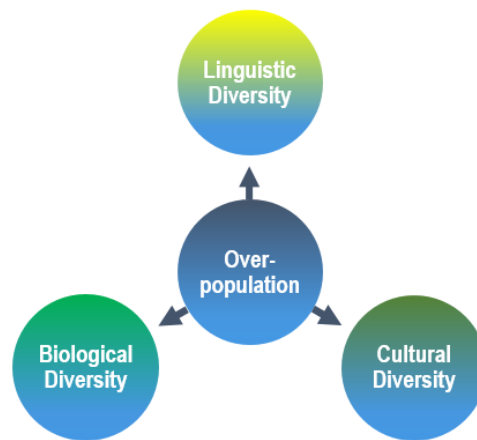


Figure 3. Diagram illustrating the impact of the first sin, i.e. overpopulation, on biocultural diversity. In the same way, the other sins of civilised humanity influence biocultural diversity (created by the author).

of civilised humans affect the state of biological, cultural and linguistic diversity, and on the other hand, all manifestations of Earth's diversity affect the state of humaneness, in both its biological and cultural layer.

All the deadly sins mentioned by Konrad Lorenz affect the diversity of the world's heritage in all its manifestations. Overpopulation, described as the first civilisational sin, adversely affects linguistic and cultural diversity, leading to its decline. The fast-paced urbanisation processes induce a global change in the structure of our planet's inhabitancy. In 2008, for the first time in the history of the world, more than half of the human population lived in a city. It

is estimated that in 2030, in developing countries, the percentage of inhabitants in urban agglomerations will amount to 80% (UNFPA, 2007). We are thus seeing a dynamic influx of the representatives of local cultures to large cities. At best, this phenomenon may lead to the weakening of these cultures and at worst, to their irreversible extinction. Modern research on anthropogenic stress confirms that big cities have a much more detrimental effect on the environment than small urban agglomerations. This undoubtedly influences the decline of biodiversity (Schumacher, 2014).

Environmental degradation, described by Lorenz as the second deadly sin, obviously affects biodiversity,

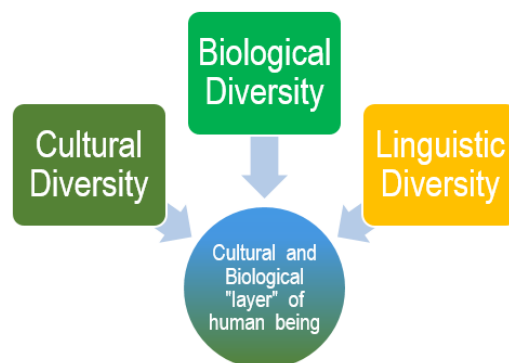


Figure 4. Diagram illustrating the impact of biological, cultural and linguistic diversity on the cultural and biological *layers* of a human being (created by the author).

however, by obstructing people's contact with nature, it also indirectly prevents them from developing aesthetic human sensibility, which entails the weakening of their ethical sensitivity. A weakened aesthetic sensitivity, in turn, undoubtedly influences human attitudes to culture, while the weakening of ethical standards means that the attitudes of humans towards nature and other people begin to be determined by utilitarian-economic arguments. As a consequence, care for biological, cultural and linguistic diversity is marginalised.

Humanity's race against itself is another contemporary civilisational sin, which affects the condition of Earth's heritage in all its manifestations. The civilised human is so engrossed in a neurotic drive for success and career that they begin to limit or even completely renounce contact with nature and culture. Short and rare moments of respite are more and more often filled with noise, which suppresses questions about the meaning and purpose of human activity. This sin constricts people's contact with nature and culture in a different way than does the previous sin, but in a similar way it results in a lack of concern for the natural and cultural heritage of the Earth.

Entropy of feelings is a sin that, as Lorenz puts it, undermines people's ability to take on ambitious challenges requiring greater effort and sacrifice. This is particularly the case when the intended goal is remote and its achievement uncertain. It seems that this type of offense against humaneness also induces the weakening of cultural, linguistic and biological diversity. The creative process that underlies cultural development provides a good example here. This process requires great commitment and enormous sacrifice from artists without offering any guarantee of success. Similarly, an in-depth knowledge of a new culture, and even more of a new language, also entails systematic and long-lasting effort. The contemporary environmental crisis is, in turn, a kind of challenge that requires radical sacrifices and actions on the part of the current generation for the benefit of future generations. People, weakened with respect to their own humaneness, will not be able to provide proper care for the Earth they inherit.

The genetic decay mentioned by Lorenz is another civilisational sin against humaneness, which undermines biocultural diversity. Lorenz claims that genetic factors, up to a certain degree, determine human behaviour. In specific instances, genetic defects lead to pathological behaviours which can affect human life and health, the safety of works of art, and the state of the natural environment. The genetic decay observed today is leading to the widespread disappearance of sound social norms. This is particularly evident in the progressive infantilism of many adult inhabitants of developed countries, which is manifested in people's inability to take responsibility for their own lives or for the world around them. Consequently, it has a negative impact on the wealth of Earth's heritage in all its manifestations.

The sixth sin of civilised humanity is the break with tradition. It seems that radical questioning and even rejection of tradition is particularly dangerous for cultural and linguistic diversity, as it may lead to the threat of cultural unification and the abandonment of native languages by local communities. The rebellion of the young generation in questioning the old order may also turn against the environment. It seems, however, that it often finds its manifestation in young people's radical and uncompromising defence of the environment, often with the help of illegal methods. In most such cases, however, such actions turn out to be counter-effective and they ultimately have a harmful effect on nature.

A serious challenge facing civilised humanity is people's increased indoctrinability. This civilisational sin seems particularly threatening in the era of globalisation processes and the internationalisation of large corporations. Having huge financial resources and access to global mass media, such corporations have the necessary tools to shape global public opinion in a way that allows them to achieve defined economic goals, usually at the expense of the natural and social environment. Global indoctrination can also shape consumer mentality, with a simultaneous weakening of sensitivity to social, cultural and ecological problems. This danger is even more serious as the interests of large corporations seem to stand in

opposition to, at least in the short term, concern for the natural environment and support for local cultures. Another serious threat to cultural and linguistic diversity is the fact that growing susceptibility to indoctrination leads to the unification of culture and disturbs the natural interplay of the diverse elements which provide its foundation.

The last sin of civilised humanity listed by Konrad Lorenz is the existence of nuclear weapons. This type of civilisational challenge constitutes an evident threat to Earth's heritage in all its manifestations. Nuclear war could lead to the destruction of all forms of life, and even to Earth's annihilation and the resulting loss of all its wealth.

Just as we can discern the influence of civilisational sins on biological, cultural and linguistic diversity, we can also observe the influence of all manifestations of Earth's heritage on both the biological and cultural layers of humans.

The protection of biodiversity and a concern for the good state of the natural environment undoubtedly translate into the good condition of the biological layer of humans, including both somatic and emotional aspects. While the link between the good condition of the human body and a good state of the environment is quite clear, the influence of the environment on the emotional sphere of humans may require some clarification. This issue was addressed by Lorenz, when he referred to the devastation of the environment and humanity's race against itself. Both sins, although each in its own way prevent or at least obstruct, direct human contact with nature, which, as postulated by Lorenz, disturbs people's full and harmonious emotional development.

It seems that the natural environment in its richness and mystery also affects the cultural layer of humans. Nature has always inspired artistic creation. This is particularly evident in painting and literature. In painting, the subject of nature is especially popular among representatives of trends referred to as landscape painting and animalistic painting. A literary genre known as nature writing is similarly of special note here. This trend focuses on the subject of people in nature and people's attitude towards it. The positive influence of natural heritage on the cultural development of humans is thus beyond question (Elder, Finch, 2002).

Linguistic and cultural diversity have a direct, and thus obvious influence on the cultural layer of humans. It seems, however, that both kinds of diversity also affect human biological layers. Contact with cultural heritage means that people become more sensitive and empathetic, with respect to both their attitude towards others and nature. As a result, people begin to take more care of the natural environment, which in turn positively affects the condition of their biological layer. The phenomenon of an indirect impact on the biological layer of humans can be seen even more clearly in the case of linguistic diversity. It is the endangered languages that pre-

serve the traditional knowledge about the environment which has been acquired by local communities sometimes over thousands of years. This knowledge now helps in the better understanding and protection of nature in all its diversity. This, doubtless, also has an impact on improving nature's condition and at the same time affects the biological layer of humans.

Conclusions

Humans are the only creatures inhabiting the Earth that are capable of a rational analysis of changes taking place in the world, the identification of emerging threats and of undertaking actions aimed at dealing with these threats. The deepening ecological crisis, together with the development of scientific and technical civilisation, has revealed the dangers facing the world of nature today. An in-depth analysis of civilisational phenomena has shown, however, that the world of culture is equally endangered. The civilisational threats faced by humanity itself have also been acknowledged. It seems that humanity is becoming increasingly aware of the risks associated with the development of civilisation as well as with the threats pointed out by Konrad Lorenz. Many people actively counteract these threats and thus strive to protect human condition and earthly heritage in all its dimensions.

There are many indications that only the integral protection of biological, cultural and linguistic diversity with simultaneous care for the condition of humans with all the wealth of their body, soul and mind may give hope of preserving the diverse and unique heritage of Earth. The protection of biocultural diversity leads to an improvement of the human condition, and at the same time, people, fortified in their humanness, may guarantee the effective protection of our planet's diversity in all its manifestations.

It seems that the tendency to separate humans from nature and treat them independent of it, results in contemporary analyses that rarely take into account the full relationship between humans and nature. Those analyses are usually limited to fairly obvious relationships between the state of the natural environment and the biological and psychological condition of human beings. The world's complexity and the complicated mixture of the mutual dependencies of all its elements forces us to undertake more and more refined analyses, which should aim at discovering the complex mechanisms governing the processes taking place in the world.

The present situation therefore calls for interdisciplinary teams that will investigate the current civilisational processes and their consequences for the Earth's ecosystem and humaneness in all its richness. It is important that these teams should include representatives of the humanities, who will add their own perspective to the analyses proposed by the representatives of the exact and social sciences. This is especially important since there are tendencies to

combine technologies with economics, which together aspire to create a monopoly on finding solutions to the problems of the modern world. In fact, they are not able to see the full complexity of the Earth's reality, and therefore they propose actions that, while solving some problems, most often give rise to new challenges, often much more dangerous than the previous ones.

References

1. BACON F., 2009, *The New Organon: or True Directions Concerning the Interpretation of Nature*, Dodo Press, Gloucestershire 2009.
2. BROSIUS J.P.; HITCHNER S.L., 2010, Reconceptualising the link between cultural diversity and biodiversity: beyond the biocultural perspective, in: *International Social Science Journal*, 61(199), p. 141-168.
3. CAILLON S., DEGEORGES P., 2007, Biodiversity: negotiating the border between nature and culture, in: *Biodiversity and Conservation*, 16(10), p. 2919-2931.
4. CARDINALE B.J., et al., 2012, Biodiversity loss and its impact on humanity, in: *Nature*, 486(7401), p. 59-67.
5. DESCARTES R., 2015, *Meditations on First Philosophy*, Cambridge University Press, Cambridge.
6. DESCARTES R., 2008, *Principles of Philosophy*, Barnes & Noble, New York.
7. DÍAZ S., et al., 2006, Biodiversity Loss Threatens Human Well-Being, in: *PLOS Biology*, 4(8), DOI: <https://doi.org/10.1371/journal.pbio.0040277>.
8. ELDER J.; FINCH R., 2002, *Nature Writing: the Tradition in English*, W W Norton & Company, New York.
9. FRANCIS (pope), 2015, *Praise be to You - Laudato Si: On Care for our Common Home*, Ignatius Press, San Francisco.
10. HARMON D., LOH J., 2010, The Index of Linguistic Diversity: A New Quantitative Measure of Trends in the Status of the World's Languages, in: *Language Documentation & Conservation*, 4, p. 97-151.
11. HORKHEIMER M., ADORNO Th.W., 2002, *Dialectic of Enlightenment. Philosophical Fragments*, Stanford University Press, Stanford.
12. KOLBERT E., 2014, *The Sixth Extinction: An Unnatural History*, Henry Holt and Company, New York.
13. LEWIS M.P., et al., 2016, *Ethnologue: Languages of the World*, SIL International, Dalla.
14. LORENZ K., 1978, *Behind the Mirror. A Search for a Natural History of Human Knowledge*, Harcourt Brace Jovanovich, New York.
15. LORENZ K., 1974, *Civilized Man's Eight Deadly Sins*, Harcourt Brace Jovanovich, New York.
16. LORENZ K., 1989, *The Waning of Humaneness*, UNWIN Paperbacks, London.
17. MAFFI L., 2007, Biocultural Diversity and Sustainability, in: *The SAGE Handbook of Environment and Society*; ed. Pretty J., et. al., SAGE, London, p. 267-277.
18. McKIBBEN B., 1989, *The End of Nature*, Random House, New York.
19. SADOWSKI R., 2016, Genetic Engineering in the Light of Dialectic of Enlightenment, in: *Return to the Oikos. Ways to Recover our Common Home*, ed. Kurethadam J.I., et. al., LAS, Rome, p. 194-212.
20. SADOWSKI R.F., 2017, Call for Integral Protection of Biocultural Diversity, in: *ProblemyEkorozwoju/ Problems of Sustainable Development*, 12(2), p. 37-45.
21. SCHUMACHER E.F., 2014, *Small is Beautiful. Economics as if People Mattered*, Harper Perennial, New York.
22. SKUTNABB-KANGAS T., 2002, *Why Should Linguistic Diversity be Maintained and Supported in Europe? Some Arguments*, Council of Europe, Strasbourg.
23. STEPHENS C., 2015, The indigenous experience of urbanization, in: *State of the World's Minorities and Indigenous Peoples 2015*, ed. Grant P., Minority Rights Group, London, p. 54-61.
24. STERLING E.J., et al., 2017, Biocultural approaches to well-being and sustainability indicators across scales, in: *Nature ecology & evolution*, 1(1), p. 1798-1806.
25. UNFPA, 2007, *State of the World Population 2007. Unleashing the Potential of Urban Growth*, UNFPA, New York.
26. UNITED NATIONS, 1986, *Proclamation of the World Decade for Cultural Development*, UN, New York.
27. WORLD BANK, 2015, *Indigenous Latin America in the Twenty-First Century. The First Decade*, World Bank Group, Washington.

Decoupling Analysis of Energy Consumption and Economic Growth of V4 Countries

Analiza rozprężenia relacji pomiędzy poziomem konsumpcji energii a wzrostem ekonomicznym krajów grupy V4

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Abstract

Energy is a sector that has a direct impact on citizens' quality of life and the economic growth of the countries. The production and use of energy satisfies human needs, but also gives rise to a host of adverse environmental pressures, such as greenhouse gas emissions, air pollution and the generation of nuclear waste. Energy use leads to noise, water pollution, and ecosystem degradation. Energy-related air pollution also has significant negative effects on human health. To avoid these problems, many countries are closely monitoring their energy intensity and implement the politics and tools to its improvement. The aim of the paper is to perform quantitative evaluation on the relationship between economic development and energy consumption based on decoupling model theory. The paper focuses on the case of V4 countries in the period of 1991-2015. Throughout the more than 20 years examined, the countries spread out into many different forms of decoupling. The results of analysis suggest that in most observed partial variables occurs the strong decoupling of economic growth and energy consumption, what can be considered as positive trend. Though decoupling elasticity convey a positive message, the V4 countries will need to accelerate their implementation of new policies, while restructuring the ways how they meet their demand for energy.

Key words: energy consumption, economic growth, decoupling, decoupling elasticity, V4 countries

Streszczenie

Sektor energetyczny wywiera bezpośredni wpływ na jakość życia ludzi i wzrost ekonomiczny krajów. Produkcja i wykorzystywanie energii zaspokaja ludzkie potrzeby, ale wywiera także silną negatywną presję na środowisko, związaną z emisją gazów cieplarnianych, zanieczyszczeniem środowiska, czy wytwarzaniem odpadów jądrowych. Użytkowanie energii powiązane jest z hałasem, zanieczyszczeniami wód i degradacją ekosystemów. Zanieczyszczenia powietrza z sektora energetycznego mają ponadto znaczący negatywny wpływ na ludzkie zdrowie. Aby zmniejszyć skalę tych zagrożeń, wiele krajów szczegółowo monitoruje energochłonność i wdraża polityki i narzędzia mające poprawić obecną sytuację. W tym artykule dokonano ilościowej oceny relacji pomiędzy rozwojem ekonomicznym a poziomem konsumpcji energii, w oparciu o koncepcję rozprężenia (decoupling, odnoszącej się do odłączenia tempa wzrostu gospodarczego od tempa zużywania surowców). Omówiono przypadek krajów grupy V4, wykorzystując dane za lata 1991-2015. W ciągu ponad 20 lat kraje te realizowały wiele różnych form rozprężenia. Wyniki analizy sugerują, że w przypadku większości obserwowanych zmiennych cząstkowych występuje silne rozprężenie wzrostu ekonomicznego i zużycia energii, co można uznać za trend pozytywny. Jednak kraje grupy V4 i tak będą musiały przyspieszyć wdrażanie nowych polityk, jednocześnie starając się zaspokoić ich zapotrzebowanie na energię.

Słowa kluczowe: konsumpcja energii, wzrost gospodarczy, rozprężenie, elastyczność rozprężenia, kraje V4

Introduction

Energy and power industry are among the most important strategic policies of the European Union. Forming a common EU energy policy and cross-border cooperation with neighbors at governmental, non-governmental and business levels creates a key framework for decision-making and consideration of further development of the energy sector (e.g. Stoenoiu, 2018; Velkin and Shcheklein, 2017; Zelazna and Golebiowska, 2015). Regarding sustainable development of energy production and use, the term of energy efficiency is frequently used.

The emergence of resource and energy efficiency as well as the low-carbon economy as European policy priorities is grounded in a recognition that the prevailing model of economic development – based on steadily growing energy and material consumption is not sustainable from the long term point of view. That is the reason why these issues have emerged as central themes in global discussions on the transition to a green economy (OECD, 2014; UNEP, 2014b). The fundamental importance of these issues to future prosperity is likewise reflected in Europe's medium- and long-term planning. For example, one of the priority objectives of the 7th Environment Action Programme emphasizes the need to *turn the Union into a resource-efficient, green, and competitive low-carbon economy* (EU, 2013).

At the strategic level, EU policy sets out a broad framework for resource efficiency and climate change policy, including a variety of long-term (non-binding) objectives. For example, the Roadmap to a Resource Efficient Europe (EC, 2011) includes a vision for 2050, wherein the EU's economy has grown in a way that respects resource constraints and planetary boundaries, thus contributing to global economic transformation. These are complemented by policies addressing specific pressures and sectors. The EU's 2020 targets on greenhouse gas emissions and energy consumption (EC, 2010) are prominent examples. These and other policies share similar goals and in different ways seek to balance social, economic and environmental considerations. Implementing and strengthening them can help to push science and technological frontiers, create jobs, improve the quality of the environment and enhance competitiveness.

The issue of energy efficiency resonates in the V4 countries also in the context of the 20-20-20 commitments. While the Union as a whole is doing well in reducing emissions as well as in increasing the share of renewables, unfortunately, there are countries still far from their goal. This means that in the coming years, energy efficiency has to get to prominent positions in programs and major projects. This concerns not only the EU and the Member States, but also regions, industries, businesses, housing and households.

Material and Method

There is a long-standing debate on the relationship between economic growth and the state of the environment. It has been widely discussed since the second half of last century. Many authors argue that continued economic expansion in a finite world is not possible, therefore the use of material resources to produce economic growth cannot go on forever and there has been a growing concern that such a grow will cause irreparable damage to our planet (e.g. Daly, 1997; Stern, 2004; Anderson, 2010; Drastichova, 2017; Hronec, Huttmanová and Chovancová, 2009; Huttmanová, Adamišin and Chovancová, 2013).

Different indicators have been used for measuring both the economic and environmental variables (Huttmanová, 2011; Adamišin and Vavrek, 2015; Chovancová and Rusko, 2008). The economic variable is usually GDP, either in absolute or per capita form, though many authors has noted, that GDP has some shortcomings, as it clusters diverse resources by weight, obscuring huge differences in scarcity, value and associated environmental impacts. It also provides a distorted picture of resource demands from overseas, because it includes only net imports of resources, rather than encompassing the raw materials consumed in producing imports (Anderson, 2010; Kotulič and Adamišin, 2012).

Many different environmental indicators have been used, and the results depend on the chosen indicator. Among environmental indicators related to energy sector can include energy productivity, CO₂ productivity, Energy intensity in different sectors of the economy, share of energy from renewable sources in gross final energy consumption etc.

The dilemma of expanding economic activities while attempting to stabilize the rate of resource use and reduce environmental impacts poses an unprecedented opportunity and challenge to society. Since most of the world's economies are striving towards economic growth, ways to achieve it with less environmental harm are being sought for. There have been several concepts proposed for this. These include increased eco-efficiency, de-materialisation, immaterialisation, de-linking and decoupling. The drawback in these approaches is to get more from less, which means using resources more efficiently to produce the same value with less material. The environmental impact remains the same, but only the economy grows faster. This is called the rebound effect (e.g. Binswanger, 2001).

Within environmental research these approaches has been applied to several areas, e.g. de-linking of material resources from economic growth (Vehmas, Luukkanen and Kaivo-oja, 2007), decoupling of GDP from traffic volume and CO₂ emissions from transport (Tapio, 2005), decoupling of carbon dioxide emissions per capita from income per capita in developed countries (Marzio, 2003), etc.

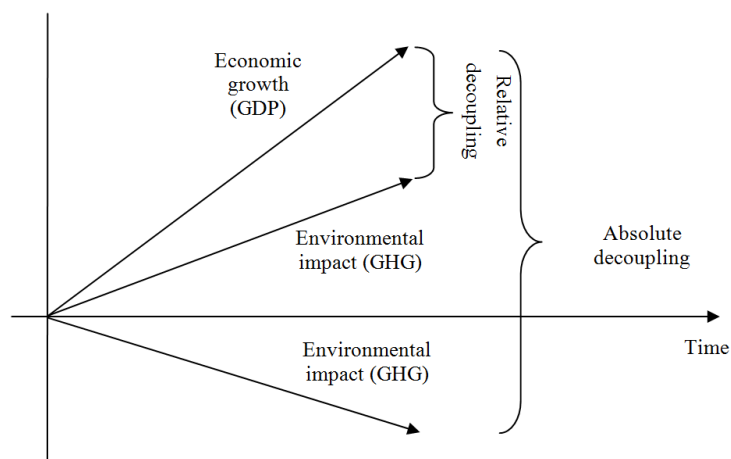


Figure 1. Relative and absolute decoupling (modified from UNEP, 2011)

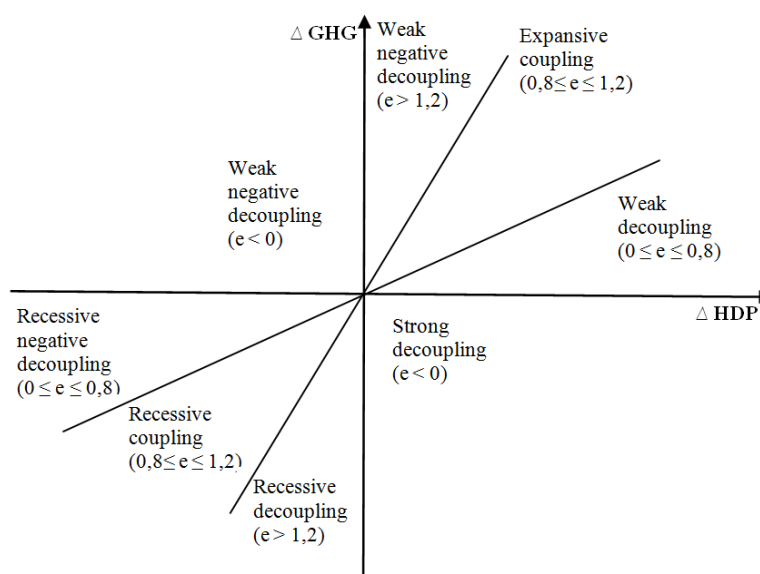


Figure 2. Decoupling model (modified from Finel and Tapio, 2012)

There are two basic forms of decoupling: absolute and relative decoupling (e.g. Ballingall, Steel and Briggs, 2003; UNEP, 2011). Relative decoupling of resources or impacts means that the growth rate of the environmentally relevant parameter (resources used or some measure of environmental impact) is lower than the growth rate of a relevant economic indicator (for example GDP). The association is still positive, but the elasticity of this relation is below 1 (Mudgal et al., 2010). Such relative decoupling seems to be fairly common. With absolute decoupling, in contrast, resource use declines, irrespective of the growth rate of the economic driver. This latter relation is shown by the Environmental Kuznets Curve that claims that if prosperity rises beyond a certain point, the environmental impact of production and consumption decreases. Absolute reductions in resource use are rare (De Bruyn et al., 2009; Steger and Bleischwitz, 2009); they can occur only when the growth rate of resource productivity exceeds the growth rate of the economy. Graphically is this distinction illustrated in fig. 1.

The aim of this paper is to quantitatively assess the relationship between economic growth and energy consumption in the V4 countries using decoupling method. The ratio between the gross inland consumption of energy and the gross domestic product (GDP) can be referred as energy intensity. This indicator measures the energy consumption of an economy and its overall energy efficiency. The gross inland consumption of energy is calculated as the sum of the gross inland consumption of five energy types: coal, electricity, oil, natural gas and renewables.

The used data we obtained from the databases of the World Bank (GDP in mil. USD in current prices) and the Eurostat (Energy intensity of the economy – Gross inland consumption of energy divided by GDP (kg of oil equivalent per 1 000 EUR)).

To compare countries and time periods it is necessary to set the levels, respectively subcategories of decoupling. A similar method used in his research (Tapio, 2005) and (Finel, and Tapio, 2012), which distinguishes 8 subcategories of decoupling, as illustrated in fig. 2.

Table 1. Decoupling elasticity of the V4 countries in the period 1991-2012

| | | S1 (1991-1995) | S2 (1995-1999) | S3 (1999-2003) | S4 (2003-2007) | S5 (2007-2011) | S6 (2011-2015) |
|-----------------------------|-------|-------------------|-------------------|-------------------|-------------------|-------------------|----------------|
| Czech Republic (CZ) | %ΔGIC | -8,47 | -6,86 | 12,42 | 3,62 | -6,21 | -3,17 |
| | %ΔGDP | 50,36 | 7,85 | 34,89 | 47,35 | 16,99 | -22,01 |
| | e | -0,17 | -0,87 | 0,36 | 0,08 | -0,37 | 0,14 |
| Hungary (HU) | %ΔGIC | -5,34 | -0,90 | 1,76 | 1,53 | -2,99 | -3,36 |
| | %ΔGDP | 25,14 | 5,60 | 42,37 | 38,99 | 0,66 | -14,57 |
| | e | -0,21 | -0,16 | 0,04 | 0,04 | -4,52 | 0,23 |
| Poland (PL) | %ΔGIC | -2,13 | -6,51 | -1,65 | 5,70 | 3,98 | -5,64 |
| | %ΔGDP | 39,85 | 16,25 | 21,98 | 49,33 | 18,81 | -10,78 |
| | e | -0,05 | -0,40 | -0,08 | 0,12 | 0,21 | 0,52 |
| Slovakia (SK) | %ΔGIC | -10,27 | 1,51 | 4,19 | -5,17 | -2,66 | -5,88 |
| | %ΔGDP | 44,77 | 15,39 | 34,92 | 45,85 | 12,10 | -12,21 |
| | e | -0,23 | 0,10 | 0,12 | -0,11 | -0,22 | 0,48 |
| EU (current composition) | %ΔGIC | 0,23 | 2,54 | 4,79 | 0,27 | -6,53 | -4,39 |
| | %ΔGDP | 18,28 | 18,22 | 14,96 | 18,60 | 1,54 | 10,79 |
| | e | 0,01 | 0,14 | 0,32 | 0,01 | -4,24 | -0,41 |

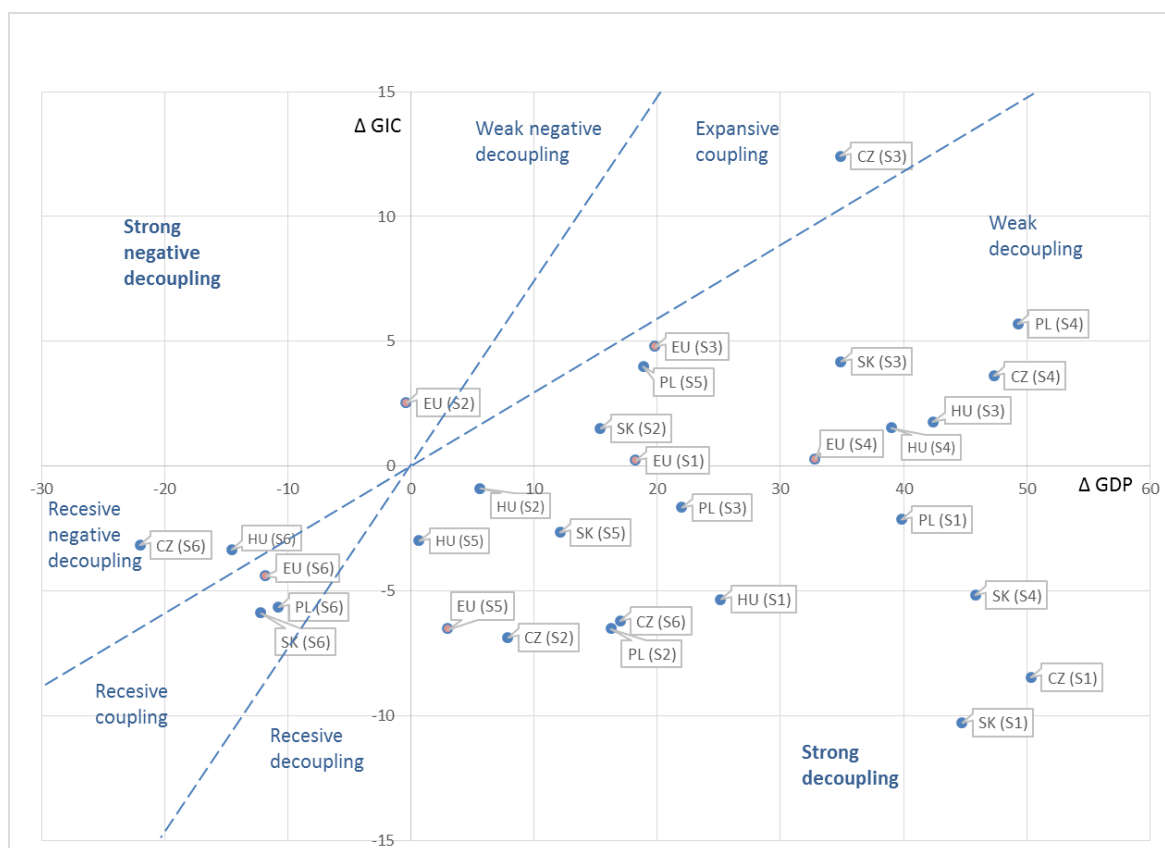


Figure 3. The distribution of the V4 countries into sub-categories of decoupling

Decoupling of energy intensity and economic growth can be calculated as the ratio of percentage units of changes of gross inland consumption of energy and percentage units of changes in GDP in the analysed period of time. The result will be decoupling elasticity e:

$$e = \% \Delta \text{GIC} / \% \Delta \text{GDP}$$

The ration of changes in gross inland consumption of energy (ΔGIC) and GDP (ΔGDP) can be represented according to (Finel and Tapio, 2012) as strong

decoupling, weak decoupling, coupling, or expansive negative decoupling.

In order to better interpretation of the results, the elasticity value was divided into eight subcategories as recorded in the decoupling model illustrated at fig. 2.

Results and discussion

In this study, we will analyse the relationship between Gross Domestic Production (GDP) and Gross

Inland Consumption (GIC) of energy in V4 countries (Czech Republic, Hungary, Poland and Slovakia) in the period of 1991 – 2015. For comparison, the EU average is added in table 1. The analysed period is divided into six sections S1 – S6 (see tab. 1). Values $\% \Delta GIC$ and $\% \Delta GDP$ were calculated using data from available databases of the World Bank (GDP) and Eurostat (GIC). Subsequently the value of decoupling elasticity was calculated using the equation.

Based on the results of the analysis, we have created a model of decoupling (Fig.3) in which countries are divided within each period in the following sub-categories:

Expansive coupling: in this sub-category both energy consumption and GDP grew at a similar rate. There is only one case represented in this subcategory – Czech Republic in the period of 1999-2003.

Weak decoupling: in this sub-category, GDP and gross inland consumption of energy both increase, but the GDP grows faster than the energy consumption. Decoupling occurs to some extent, because energy consumption grows more slowly than the GDP, but it is weak, since the absolute amount of consumed energy nevertheless continues to grow. This sub-category includes Czech Republic in the period of years 2003-2007, Hungary in the period 1999-2003 and 2003-2007, Poland in the period of 2003-2007 and 2007-2011 and Slovakia in the period of 1995-1999 and 1999-2003. The development in European Union shows weak decoupling in three out of six periods under review; particularly in years 1991-1995 and 1999-2007.

Strong decoupling: in this sub-category the GDP increases and gross inland consumption of energy decrease. Thus the GDP elasticity of gross inland consumption of energy is below 0. This is the case of absolute decoupling and the best case for both the economy and the environment. This sub-category is in our survey the most frequent – exactly 50% of analysed cases belong to this group, which can be considered as a positive fact.

Recessive decoupling: in this sub-category both GDP and gross inland consumption of energy decrease, but the energy consumption decrease more rapidly than the GDP. The GDP elasticity of gross inland consumption of energy is over 1.2. In this sub-category we have no representatives.

Recessive coupling: in this sub-category both energy consumption and GDP have decreased at a similar rate. There are two cases present in this subcategory – Poland and Slovak Republic in the period of 2011-2015, but as can be seen in the fig. 3, the average of EU countries belongs to this subcategory in this period.

Recessive negative decoupling: In this sub-category GDP and gross inland consumption of energy both decrease but GDP decreases faster than the emissions. Decoupling elasticity is over 0.8. There

are two cases present in this subcategory – the Czech Republic and Poland in the period of 2011-2015.

Strong negative decoupling: In this sub-category GDP decreases and gross inland consumption of energy increase and $e < 0$. Strong negative decoupling might be characterized as the worst case of development. In this subcategory there is only one representative: the European Union in the period 1995-1999. In this period the economic growth of the Union decreased slightly but energy consumption increased.

In category of **weak negative decoupling** we have no representatives, which can be considered as a positive finding.

In the European context, the V4 countries are among *the richer out of poor* EU countries and GDP ranges between 66% (Hungary) to 82% (Czech Republic) of the EU-28 average. Energy intensity have fallen since 1991, mainly due to the collapse of inefficient industries, increasing energy efficiency and the launch of new carbon-free energy sources. Though energy intensity of V4 countries remains significantly above the EU average – Czech republic in 2015 had the third highest energy intensity, Poland was in fourth place, Hungary had sixth highest energy intensity and Slovakia had seventh highest energy intensity in the EU 28. The main reason is the high share of energy consumption by industry on gross inland consumption. For evidence, in Slovakia, the steel industry, which is the biggest energy consumer, has been mainly responsible for this development.

Here comes up a question, how could the V4 countries support new political and technological solutions towards new energy efficient economy. It has to be mentioned that increasing energy efficiency in the long term is considered to be economically beneficial but in the short and medium term is expensive. Therefore part of the investments should go to research and development, in order to launch a wave of progressive innovation.

Throughout almost 25 year examined period, countries spread out into different forms of decoupling. The largest group of examined periods falls under the subcategory of strong decoupling, which can be seen as a very positive. But as with all studies, this study has limitations. First, the decoupling elasticity does not reveal the environment's capacity to sustain, absorb or resist pressures of various kinds. Elasticity values cannot convey the message of whether the economic growth is sufficiently decoupled from negative environmental impacts. Constant environmental impacts or decreased environmental impacts over time do not guarantee that human economic activity is within the physical limits of biosphere. Even if strong decoupling could be achieved, this would not necessarily ameliorate the environmental impacts of economic growth.

We also have to state that even absolute decoupling at the individual country level, may not indicate that energy use is actually decreasing with increasing GDP. It may just indicate that more energy intensive operations has been off-shored (Wiedmann, 2013). Developed nations experience an increase in imports of semifinished and finished products and a change in economic structure toward service economies, which add high value to the GDP. These trends make developed countries look more resource-efficient, but they actually remain deeply anchored to a material foundation underneath.

Though using this method can bring a lot of advantages. The quantification of the extent of decoupling makes it possible to assess if decoupling strategies are sufficient to reach the goal of environmental sustainability. We can track the trends; compare the extent of decoupling among countries and set future decoupling targets. Results of decoupling analysis can facilitate environmental policy making processes.

Conclusion

The issue of reduction of energy consumption directly affects all European Union member states, whose vision is to reduce energy consumption by 20% relative to business-as-usual projections. In this study, we focused on the V4 countries which have several common features – historical, political, economic or geographic. Also in energy sector we can determine some common features, such as (1) high dependence on imports of primary energy sources, (2) high energy intensity of the economies and (3) relatively low share of renewable energy sources in energy mix.

Using the method of decoupling, we determined the rate of decoupling elasticity, thus disengaging economic growth and gross inland consumption of energy in the individual V4 countries within the monitored periods. On the basis of the analysis can be concluded prevailing strong decoupling, which means that the economies of these countries grow, while production of energy consumption is declining. Despite this positive finding of this study and quite a number of reforms within energy sector implemented in V4 countries, these countries belong to the EU countries with higher energy intensity.

Ensuring a cost-efficient transformation of the energy system of V4 countries necessitates a diverse mixture of actions addressing both supply and demand at the continental scale. On the supply side, breaking the continuing dominance of fossil fuels will require a strong commitment to improving energy efficiency, deploying renewable energy, and continuous climate and environment proofing of energy projects. Substantial investments and regulatory change will be needed to integrate networks and facilitate the growth of renewables. On the demand

side, there is a need for fundamental changes in society's energy use. Smart meters, appropriate market incentives, access to finance for households, energy saving appliances, and high performance standards for industrial companies can all contribute.

Reducing energy consumption and switching to alternative energy sources in V4 countries is essential to cutting reliance of on fossil fuels and achieving the EU's 2050 climate policy goals. It would also deliver substantial additional economic, environmental and social benefits, such as balanced economic growth, price stability, a highly competitive social market economy, green-jobs opportunities and overall improvement of the quality of the environment.

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References

1. ADAMIŠIN P., VAVREK R., 2015, Analysis of the links between selected socio-economic indicators and waste management at the regional level in the Slovak republic, in: *5th Central European conference in regional science – Conference proceedings*, p 1-9.
2. ANDERSON D. A., 2010, *Environmental economics and natural resource management*, Routledge, Abingdon.
3. BALLINGALL J., STEEL D., BRIGGS P., 2003, *Decoupling economic activity and transport growth: the state of play in New Zealand*, AT RF 03, New Plymouth.
4. BLEISCHWITZ R., 2012, *Towards a resource policy unleashing productivity dynamics and balancing international distortions*. Wuppertal Institute for Climate, Environment and Energy, Wuppertal.
5. CHOVANCOVÁ J., RUSKO M., 2008, The application of environmental indicators in environmental reports of companies, in: *Environmental management for education and edification*, 5(1), p. 18-25.
6. DE BRUYN S. et al., 2009, *Resource productivity, competitiveness and environmental policies*, CE Delft, Delft.
7. DRASTICHOVA M., 2017, Decomposition Analysis of the Greenhouse Gas Emissions in the European Union, in: *Problemy Ekorozwoju/ Problems of Sustainable Development*, 12(2), p. 27-35.
8. EC, 2010, *Europe 2020 – A strategy for smart, sustainable and inclusive growth*, COM, Brussels.
9. EC, 2011, *Analysis associated with the Roadmap to a Resource Efficient Europe*. COM, Brussels.
10. EU, 2013, *Decision No 1386/2013/EU of the European Parliament and of the Council of 20 November 2013 on a General Union Environment Action Programme to 2020 Living well, within the limits of our planet*, EU, Brussels.
11. FINEL N., TAPIO P., 2012 *Decoupling transport CO₂ from GDP*, Finland futures research center, Helsinki.

12. HUTTMANOVÁ E., 2011, *Národohospodárstvo*, Vydavateľstvo Prešovskej univerzity v Prešove, Prešov.
13. HUTTMANOVÁ E., ADAMIŠIN P., CHOVCOVÁ J., 2013, Assessment of the current state of environment in the Slovak republic with the use of green growth indicators, in: *Ecology, economics, education and legislation: conference proceedings, volume II: 13th international multidisciplinary scientific geoconference SGEM 2013*, p. 133-140.
14. KOTULIČ R., ADAMIŠIN P., 2012, Economic Effects of the Foreign Direct Investments Management on the Development of Slovak Regions, in: *Conference proceedings Valtice, 15th International Colloquium on Regional Sciences*, p. 288-295.
15. MARZIO G., 2003, Environment and Economic Growth: Is Technical Change the Key to Decoupling?, in: *Social Science Research Network Electronic Paper Collection*, p. 21.
16. MUDGAL S. et. al., 2010, *Preparatory study for the review of the thematic strategy on the sustainable use of natural resources*. Final report for the European Commission, Paris.
17. OECD, 2014, *Economic policies to foster green growth*, <http://www.oecd.org/greengrowth/greeneco> (26.06.2018).
18. STEGER S., BLEISCHWITZ R., 2009, Decoupling GDP from resource use, resource productivity and competitiveness: a cross-country comparison, in: *Bleischwitz, Raimund (Hrsg.): Sustainable growth and resource productivity: economic and global policy issues*, p. 172-193.
19. STOENIOU C. E., 2018, Pattern of Energy Productivity and Gross Domestic Product Among European Countries, in: *Problemy Ekorożwoju/ Problems of Sustainable Development*, 13(2), p. 113-123.
20. TAPIO P., 2005, Towards a theory of decoupling: degrees of decoupling in the EU and the case of road traffic in Finland between 1970 and 2001, in: *Transport Policy*, 35, p. 137-151.
21. UNEP, 2011, *Decoupling natural resource use and environmental impacts from economic growth*, <https://wedocs.unep.org/handle/20.500.11822/9816> (25.06.2018).
22. UNEP, 2014. *Green economy – What is GEI?*, <http://www.unep.org/greeneconomy/AboutGEI/WhatisGEI/tabid/29784/Default.aspx> (25.06.2018).
23. VEHMAS J., LUUKKANEN J., KAIVO-OJA J., 2007, Linking analyses and environmental Kuznets curves for aggregated material flows in the EU, in: *Journal of Cleaner Production*, 15, p. 1662-1673.
24. VELKIN V. I., SHCHEKLEIN S. E., 2017, Influence of RES Integrated Systems on Energy Supply Improvement and Risks, in: *Problemy Ekorożwoju/ Problems of Sustainable Development*, 12(1), p. 123-129.
25. WIEDMANN T. O. et. al., 2013, The material footprint of nations, in: *Proceedings of the National Academy of Sciences* 112(20), p. 6271-6276.
26. ŻELAZNA A., GOŁĘBIEWSKA J., 2015, The Measures of Sustainable Development – a Study Based on the European Monitoring of Energy-related Indicators, in: *Problemy Ekorożwoju/ Problems of Sustainable Development*, 10(2), p. 169-177.

Theoretical Foundations of Human Capital Education in Economic Growth and Development Management

Teoretyczne podstawy kształcenia kapitału ludzkiego w zarządzaniu wzrostem gospodarczym i rozwojem

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Abstract

In this paper we try to answer the following questions: How will the nature of science change? And How will the education of human capital change and what will it be like, as a result of changing the nature of science, in structural and functional terms and what consequences for the management of growth and development will it have? Change in the nature of science consists of negating the basic axiom, which is the principle of contradiction YES≠NO replacing it with paradigm of deregulation YES=NO=MAYBE. Modify in quality of the education of human capital, the restriction of general education; the limitation of competencies resulting from general education may have adverse effects in the demanding technology market and may eliminate advantages in the processes of automation and robotization. The most important conclusions from the discussion are that science and education are strategic categories and determine the quality of human capital and the nature of science and education in the strategic dimension cannot be determined solely by neither short-term market needs, nor by research teams that are narrowly specialized and guided by their own determinants and priorities, education in the strategic dimension cannot be managed according to the rules of crisis management, ad hoc and for market needs.

Key words: wisdom (Greek *sophia*), skill (Greek *techne*), education, human capital, management, the principle of contradiction, the code of civilization, the principle of deregulation, the Constitution of the World, paradigm, development, economic growth

Streszczenie

Celem niniejszego artykułu jest odpowiedź na pytania: na czym będzie polegać zmiana natury nauki? W jaki sposób zmieni się i na czym będzie polegać kształcenie kapitału ludzkiego, gdy natura nauki zmieni się w ujęciu strukturalnym i funkcjonalnym i jakie konsekwencje będzie miało to dla zarządzania wzrostem i rozwojem? Zmiana natury nauki polega na negacji podstawowego aksjomatu, jakim jest zasada sprzeczności TAK ≠ NIE i na zastąpieniu go paradygmatem deregulacji: TAK = NIE = BYĆ MOŻE. Ograniczenie kompetencji wynikających z kształcenia ogólnego może mieć negatywne skutki na wymagającym rynku technologicznym i pozbawić przewag w procesach automatyzacji i robotyzacji, może także deregulować zarządzanie rozwojem i wzrostem gospodarczym. Najważniejsze wnioski wynikające z rozważań są takie, że nauka i kształcenie są kategoriami strategicznymi i decydują o jakości kapitału ludzkiego oraz o naturze nauki i kształceniu w wymiarze strategicznym nie mogą decydować doraźne potrzeby rynkowe, ani zespoły badawcze wąsko wyspecjalizowane i kierujące się własnymi uwarunkowaniami i założeniami, a kształcenie w wymiarze strategicznym nie może być zarządzane według reguł zarządzania kryzysowego, doraźnie i na potrzeby rynku.

Słowa kluczowe: nauka (gr. *sofia*), umiejętność (gr. *techne*), kształcenie, kapitał ludzki, zarządzanie, zasada sprzeczności, kod cywilizacyjny, zasada deregulacji, Konstytucja Świata, paradygmat, rozwój, wzrost gospodarczy

Introduction

The subject of this article is justified by two reasons: 1) of an economic nature and 2) of a non-economic, civilization-related nature. They are not inseparable. Categories such as economic growth and development are not inseparable, either, but are not synonymous. Development is a superior category, and economic growth is its component. It is important, however, that there is a qualitative difference between economic growth and development. Development is a normative category, and economic growth is not. The manner of using human, as well as economic and natural capital in the process of economic growth and development can also be highly diversified (Piontek, Piontek, 2017).

These conditions are superimposed by the globalist principle of deregulation and the paradigm: the model of the 21st century 20:80 (Martin, Schumann, 1998). Hence the question: to what extent do the abovementioned differences and conditions influence and will influence the diversification and change in the nature of human capital education for economic growth and development management? Economic reasons justify addressing the topic of this article.

A. and H. Toffler point to the reasons of civilization-related nature in the book entitled *Creating a New Civilization (...): the basis for the monumental political transformation is the transformation of the role, importance and nature of knowledge* (Toffler, Toffler, 1995). A side effect of these conditions is discrepancies in defining key concepts (Papuziński, 2013).

Knowledge is a *product* of science collected at various stages. This *product* includes methodological achievements (science in structural terms). The relationship between science and broadly defined education is based on the relationship between science in structural terms and science in functional terms (Piontek, Piontek, 2016).

If we assume that as a result of transformation, science (knowledge) will change its nature, the need to reflect on the questions that are the purpose of this article is justified:

- How will the nature of science change (knowledge – Latin *scientiae*, Greek *sophia*)?
- How will the education of human capital change and what will it be like, as a result of changing the nature of science, in structural and functional terms and what consequences for the management of growth and development will it have?

Answers to these questions remain closely related to the question: will the priority of education be focused on economic growth or broadly defined development, a component of which is economic growth? The following research hypotheses were adopted in the article:

- change in the nature of science consists of negating the basic axiom, which is the principle of contradiction YES \neq NO (and in a broader sense, also the negation of constituent norms of the Constitution of the World) and replacing it (them) with paradigms;
- for science (knowledge), this change results in shifting science from the sphere of *sophia* (wisdom) to the sphere of *techne* (skill);
- for the educational process, change in the nature of science (knowledge) results in change in quality of the education of human capital and the restriction of general education;
- the limitation of competencies resulting from general education may have adverse effects in the demanding technology market and may eliminate advantages in the processes of automation and robotization.

Procedures that allow for achieving the objectives and proving the hypotheses adopted in this article are as follows:

- the nature of science in terms of the achievements of civilization;
- the essence of change in the nature of science in structural and functional terms;
- the education of human capital based on the paradigm of variability and its results;
- challenges to preserve the nature of science and the nature of education for development and growth management.

1. The nature of science in terms of the achievements of civilization

A starting point for the discussion in the article is the difference between two key categories indicated by the Greeks such as *wisdom* and *skill*.

Citing after S. Świeżawski, we can assume that since the very beginning, the Greeks equated science with the category of wisdom rather than with the category of skill. As S. Świeżawski points out, the word science, understood as wisdom, appeared in the earliest Greek texts, in the works of Homer and Hesiod. At the turn of the 6th and 5th centuries BC, words such as *a friend of wisdom* appeared in the works by Heraclitus. With the development of philosophy a remarkably significant development of sciences could be observed, which were gradually isolated from the first field, which was initially considered not only as one science or general science, but which was equated with wisdom (Świeżawski, 2000). As regards the issue addressed in this article, i.e. change in the nature of science and its effects in the process of educating human capital for the management of development and growth, and the achievement of sustainability, this statement is of great importance. Wisdom has always meant the intellectual, spiritual and ethical development of man. It referred to the surrounding reality (things and phenomena). Wis-

dom was focused on getting to know everything that was important, but also looking for the answer *why and how* it exists. These two orientations of a cognitive process led to distinguishing two subsets in science: *causes* and *laws* that should be included in the definition of the category of science.

At the same time, it should be noted that science, in traditional terms, was understood in two ways:

- as a subjective cognitive process, therefore in functional terms;
- as a product (outcome) of this process, it is a coherent system of tasks (statements), that is in objective (structural) terms.

Taking into account the distinguished subsets, science in the functional (subjective) terms is the process of learning things and phenomena by their causes or by laws.

The product (outcome) of research activities described is specific statements (truths and paradigms), usually recorded, i.e. established. Their essence is that they should be linked to a specific system. They should have the attributes of truth and high probability, the certainty of statements formulated.

Thus, in the objective (structural) sense, in traditional terms, science is defined as a coherent system of tasks expressing true, highly probable or certain statements about things and phenomena in light of causes and laws (Kowalewski, 1959; Piontek, Piontek, 2017).

The discussion shows that science defined in traditional terms has been a synonym of wisdom.

The process of educating human capital in the traditional understanding of science comprises education in functional and structural terms as well as causes and laws that science studies. Reflection on the traditional understanding of the *science* category justifies the formulation of two questions:

- 1) Did the Greeks, who equated *science* with *wisdom*, do it correctly and in a justified way?
- 2) What criteria should *science* meet in order to be equated with *wisdom*?

If the essence of wisdom and science is to learn about reality (the world) through causes and laws, further questions should be formulated:

- does the principle of homogeneity or the principle of diversity underlie the existence of the world (of beings, things and phenomena)?
- are there principles (rules, norms, and criteria) of a fundamental nature that determine the functioning of the world in its basic dimensions?

Reflection on the reality that surrounds us allows for noticing that contrary to other views expressed, the principle of diversity (duality, pluralism) underlies the existence of the world. It essentially translates into the processes of development and growth management in both public and private spheres.

The adoption of the principle of diversity was justified in the works (Piontek, Piontek 2017).

The logical consequence of the adoption of the principle of diversity should be the search for fundamental principles that allow for shaping the structural order in the basic dimensions of development and growth management. These principles should not be equated either with determinism or exclusion of any randomness. The representatives of astrophysics and quantum physics are in favor of the existence of principles according to which the world functions and the order is shaped (Kaku, 2018).

Using the principle of analogy allowed in methodology and science as well as a logical point of view, a question should be asked whether it is possible that man – as an entity and a functional being, existing and functioning in the world that is based on the principle of diversity – is not equipped with principles, norms, rules, inscribed in their nature? Such norms enable the proper functioning, allow for defining the sense of human existence and action, ensuring the structural order, sustainability in development and growth management (management is understood as a set of procedures, and man is equipped with competencies to make decisions, and relationality between procedures and competencies define the constituent norms of the Constitution of the World).

The superior position of man as a functional being in the world requires the criteria of norms and principles that enable their functioning and that have the attributes of truth and high certainty in the area of cognition and action.

Thus, if the essence of science is cognition by causes and law, and the essence of wisdom is the functioning of man (a superior functional being) according to the fundamental norms inscribed in their nature, science and wisdom are equivalent categories, and the Greeks understood these categories in a proper way, according to the actual state.

Principles that combine science and wisdom in a compatible way and enable proper education of human capital are norms, the components of the Constitution of the World.

The Constitution of the World is a set of basic norms that define the principles of the functioning of a human being in the achievement of development, that is the meaning of existence and action, including the structural order, understood as the formation of relationality.

We distinguish three subsets in the set of norms of the Constitution of the World:

- 1) axioms, or basic, self-evident statements whose truth does not need to be proven (they are unprovable). They cannot be falsified, either. They are the basis for rational cognition. They are the laws of logic and epistemology;
- 2) natural law – in synthetic terms, it is the dictate to do good and avoid evil, inscribed in the nature of every human being; it directs action (shaping relationality) and has its real dimension, among others in the golden rule of business;

3) superior values are weights (shape preferences), attributed to the variables of choice.

Synthetically speaking, the problem of the functioning of the constituent norms of the Constitution of the World can be summarized as follows: these norms protect the existence and control (verify) action in shaping the structural order and sustainability. As regards the issue addressed in this article, an axiom that underlies the principle of contradiction is important. It is a claim that something cannot be both true and false, good and evil, beauty and ugliness. We note this axiom as the principle of contradiction in the language of logic:

YES \neq NO

Aristotle considers this axiom as the first principle, and G. W. Leibnitz classifies it as the basic principles of rational cognition.

This axiom essentially determines that science belongs to the area of wisdom, not to the sphere of skills. And the notation is the basis for the nature of science in terms of the achievements of civilization and is crucial for shaping sustainability and order in the ongoing processes of automation and robotization as well as requirements in the technological labor market. Thus, it is also of fundamental importance for educating human capital to manage development and growth. K. Bochenek (Bochenek, 2010) also paid attention to the appropriateness of presenting the issue of development in terms of civilization achievements. It should be remembered that a demanding technology market will require more competencies and also even more wisdom.

In this article human capital is defined, in terms of civilization and the economy, as man in their existence and action, in the achievement of development and growth. In this respect, civilization achievements of human capital are a certain value.

2. The essence of change in the nature of science in structural and functional terms

The Lisbon Group points to three principles of global competition: the liberalization, privatization and deregulation of the economy (Lisbon Group, 1996).

In this article, the process of changing the nature of science is analyzed and presented in terms of the globalist principle of deregulation. This approach is of great importance for the issue, and it is seldom addressed in the available literature

The principle of deregulation is not something new or unprecedented in the history of civilization. The use of this principle in the process of globalization was recorded in the decree of Antiochus IV Epiphanes, king of the Seleucid family (since 175 BC). The decree was addressed to the whole state, to which he included other nations, also Israel (IMc, 1.1-40):

- everyone has to be one nation,
- everyone has to give up their customs.

A written executive order to this decree contained, among others, a recommendation: behavior according to customs which were foreign to the country. If we compare the deregulation contained in the Antiochus's IV decree with the deregulation of science, his decree was focused on the third subset of the constituent norms of the Constitution of the World, and the deregulation of science is focused on the first subset of these norms (axioms), in particular, on the principle of contradiction discussed above: YES \neq NO. This logical notation can be explained by the category used by A. and H. Toffler: a code of civilization (Toffler, Toffler, 1995). The above notation (a principle of contradiction) determines the foundations of civilization: truth, good, and beauty. In this sense, it acts as a code of civilization. Therefore, it must be stated that the deregulation of the nature of science is related to breaking a code of civilization. A. and H. Toffler do not explain deregulation, i.e. breaking a code of civilization by pointing out the essence of this undertaking. They describe it by indicating output, i.e. at the output (the effect of the so-called *pipe end*): *propagation of theories, hypotheses, ideas, new assumptions, languages, codes and logical systems* (Toffler, Toffler, 1995).

The principle of deregulation and breaking a code of civilization are noted as follows in the language of logic:

YES = NO = MAYBE

Its effectiveness can be described by the following examples:

- A new civilization is primarily technological in nature (Toffler, 1980);
- It negates the criteria that determine the foundations of civilization (cf. the constituent norms of the Constitution of the World) such as truth, good and beauty;
- In structural terms, change in the nature of science results in change in the content of the *product* of scientific cognition:
 - no real and highly certain statements (this is prevented by the lack of the principle of contradiction);
 - lack of paradigms – a product of cognition by causes and laws with high epistemological value;
 - *the product* of cognition is paradigms for changing conditions and assumptions, formulated institutionally (Kuhn, 1962, Piontek, Piontek, 2017).
- In functional terms – as a process of transfer of cognition procedures and criteria by causes and laws – science is limited in learning the truth and other foundations of civilization, including the sense of human existence and action. A cognition process is focused on changing conditions and individual assumptions (Vatimo, Paterlini, 2010).

- The principle of deregulation makes that science (in structural and functional terms) cannot be equated with wisdom: science \neq wisdom.

As a result of deregulation and breaking the code of civilization, science changes its nature and is transferred to the sphere of *techne*:

SCIENCE = SKILL

- its material object cannot be the search for truth and high certainty of formulated statements (this results from the notation);
- its object includes the formulation of paradigms (for specific conditions) and assumptions, as well as the fields of technical and technological knowledge.

Science (knowledge) has changed its nature. It has been moved to the sphere of *techne*. The problem lies in the fact that robotization and automation require new competencies and education based on foundations resulting from the constituent norms of the Constitution of the World. The omission of this postulate does not ensure any control or verification of *techne* by *sophia*. In light of the theses formulated by M. Kaku (Kaku, 2018), the above statements and reservations deserve attention.

The deregulation of science, and as a result, an educational process, refers mainly to categories (concepts) through the functioning of many definitions of the same concept and the *newspeak* is possible – the term used by A. Bihr (Bihr, 2008). This *newspeak* results in the fact that today there are no unambiguously formulated theoretical concepts. In practice, this means the possibility of defining categories (interpreting law, facts and phenomena, setting priorities and objectives) depending on the existing conditions and circumstances. It also happens that the same concepts and formulations appearing in different concepts are oppositely understood and this creates chaos. It also results in the fact that priorities formulated and adopted are often vague on the one hand and detached from the real possibilities on the other hand.

A deregulation paradigm noted in the language of logic is implemented in the real sphere, which is reflected in management processes as well as in the sphere of human capital education.

It should also be noted that in the real sphere, a dichotomous method based on the principle of contradiction (YES \neq NO) is sometimes limited by specific determinants, the possibility of their cognition and a principle (the axiom of the greatest certainty in the decisions made). This results in the notation:

| | | |
|-----|--------|----|
| YES | \neq | NO |
| | $=$ | |

↑

The principle of the highest certainty conditioned by the possibilities of their cognition

However, this notation does not exclude the criterion-related functions of the constituent norms of the Constitution of World and cannot be equated with the principle of deregulation and breaking the code of civilization.

3. Human capital education based on the paradigm of variability and its effects

The issue of human capital education in the globalization process and for the management of economic growth and development was addressed in 2007/2008 (Piontek, Piontek, 2007/2008). Then a thesis was formulated that general education should be based on universal norms (currently recognized as norms, the components of the Constitution of the World). As a result of further research focused on the principle of deregulation, breaking the code of civilization and changing the nature of science, the thesis formulated needs to be supplemented and specified. The following questions must be formulated:

- What conditions for human capital education are generated by a globalist principle of deregulation, breaking the code of civilization and change in the nature of science?
- How will the process of human capital education be conducted in new conditions?

A shift of science from the sphere of wisdom to the sphere of skills results in the transfer of education, in structural and functional terms, to the sphere of *techne*.

Presenting the change in the nature of education (in structural and functional terms) synthetically, it should be stated:

- education of human capital limited to the sphere of *techne*, prepares narrowly specialized contractors, which seems to be a threat in the ongoing processes of robotization and automation;
- it is primarily focused on an appropriate rate of economic growth. We do not question the need to achieve the right pace of economic growth, but economic growth, as a component of the category of development, may not translate into development under specific conditions;
- in order to achieve development it is necessary to shape the appropriate relationality between science (knowledge and wisdom) and skill (*techne*);
- not every contractor has to possess knowledge from the sphere of *sophia*, but they should know the basic norms that determine wisdom, which allow for evaluating and verifying activities in the field of *techne*.

At this point it should be noted that the presented discrepancies and changes in the nature of human capital education were noticed by Spanish Professor J. Ortega Y Gasset in his work in 1932, who indicated the proportions between general and sectoral educa-

tion. The change in the nature of science and education was analyzed first of all in terms of generating effects both in the sphere of science and in the real sphere. This article analyzes the issue in terms of causes and assumptions. The presented position does not exclude but even postulates the need for trade-related and highly specialized education at various levels. However, it highlights the need for education that ensures relationality between *sophia* and *techne*, which is crucial for maintaining the structural order in the processes of automation and robotization of the economy and in the demanding technology market. The postulated relationality is also important for the management of development and growth as well as sustainability processes.

4. Challenges for the preservation of the nature of science and the nature of education for the management of development and growth

Analysis and reflection on the principle of deregulation, breaking the code of civilization, change in the nature of science and education justify the question: who is and who should be the guardian of behavior and build the right relationality between *sophia* and *techne* – in the creation of a new civilization?

In the real sphere, a question is: who is or should be the *guardian* of the structural order that includes development – economic growth and broadly defined relationality?

Challenges that today's education faces can be formulated in the form of the following questions:

- to what extent do modern education systems report a need for education in the sphere of *sophia*?
- to what extent does modern society report such demand?
- are institutions responsible for the quality of education prepared to fulfill their functions focused on the sphere of *sophia* and to what extent? This question should be diversified into specific questions:
 - what goals and criteria determined, in the classification of sciences at subsequent stages, the elimination of metaphysics, epistemology, and even logic, and made philosophy exact science?
 - what goals and reasons justify K. Popper's demarcation line, which disqualified philosophy as unfalsifiable and unscientific? The empirical studies by J. Eccles challenged K. Popper's thesis (see: Piontek Piontek, 2017);
 - does the diversification of science into *n* fields and *n* disciplines detached from each other ensure mutual translatability of their

results? What is the openness of modern science to *sophia*?

- what reasons weigh in favour of the fact that in less important fields of science the disciplines distinguished try to function independently of their fields?
- are the standardization of the discovering processes (T. Kuhn's model), the *pointability* as a quality criterion (often obtained by the requirements of citing specific publications, the practice used in most journals in the world) factors that limit relationality with *sophia*?

Formulated questions and challenges are more important than giving precise answers. However, they allow for formulating a conclusion: neither knowledge nor the lack thereof determines the proper nature of science and the nature of education. This is determined by the decision-making will, which is a necessary and sufficient condition for ensuring the structural order and for managing development and economic growth in basic dimensions.

Conclusions

Conclusions resulting from the discussion in the article are as follows:

- science and education are strategic categories and determine the quality of human capital;
- the nature of science and the nature of education are closely related. Violating and transforming their nature results in consequences that are difficult to reverse;
- the nature of science and education in the strategic dimension cannot be determined solely by neither ad hoc market needs, nor by research teams that are narrowly specialized and guided by their own determinants and priorities;
- education in the strategic dimension cannot be managed according to the rules of crisis management, ad hoc and for market needs;
- in strategic terms, solutions aimed at temporarily satisfying demand in the labor market should not be created in science and education. Shortages in the labor market should be supplemented by various forms of further training;
- shaping the nature of science and the nature of education cannot be subordinated to exogenous and political influences, omitting any verification and supervision criteria;
- the constituent norms of the Constitution of the World can ensure proper relationality between *sophia* and *techne*, and between science and education, also in the strategic dimension;
- the decision-making will is of fundamental importance in this respect.

References

1. BIHR A., 2008, *Nowomowa neoliberalna. Retoryka kapitalistycznego fetyszyzmu*, Książka i Prasa, Warsaw.
2. BOCHENEK K., 2010, Some of the Theoretical Sustainable Development Aspects in the Reflection of Christian Middle Ages Philosophy, in: *Problemy Ekorozwoju/ Problems of Sustainable Development*, 5(1), p. 71-79.
3. LISBON GROUP, 1996, *Granice konkurencji/The Borders of Competition*, Poltex, Warsaw.
4. KAKU M., *String Theory*, <http://mkaku.org/home/tag/string-theory/> (12.11.2018).
5. KOWALSKI M., 1959, *Logika*, Pallotinum, Poznań 1959.
6. KUHN T.S., 1962, *The Structure of Scientific Revolutions*, University of Chicago Press, Chicago.
7. KUNZMANN P., BURKARD F.P., WIEDMANN F., 1999, *Atlas filozofii*, Warszawa.
8. MARTIN H.P., SCHUMANN H., 1998, *The Global Trap: Globalization and the Assault on Prosperity and Democracy*, Pluto Press.
9. ORTEGA y GASSET J., 1932, *The Revolt of the Masses*, Norton.
10. PAPUZIŃSKI A., 2013, The Axiology of Sustainable Development an Attempt at Typologization, in: *Problemy Ekorozwoju/ Problems of Sustainable Development*, 8(1), p. 5-25.
11. PIONTEK B., PIONTEK F., 2017, *Development from Theory to Practice*, Shaker Verlag.
12. PIONTEK F., PIONTEK B., 2016, . *Teoria rozwoju*, PWE, Warsaw, p. 60-65.
13. ŚWIEŻAWSKI S., 2000, *Dzieje europejskiej filozofii klasycznej*, PWN, Warszawa, Wrocław, p. 404.
14. TOFFLER A., TOFFLER H., 1995, *Creating a New Civilization: The Politics of the Third Wave*, Turner Publishing.
15. TOFFLER A., 1980, *The Third Wave*, Bantam Books.
16. VATIMO G., PATERLINI P., 2010, *Not Being God: a Collaborative Autobiography*, Columbia University Press.

Environmental Crimes of Early Romanian Communism: Focus on the *Enemies of Agriculture*

Przestępstwa środowiskowe wczesnego komunizmu w Rumunii: działania wobec tzw. wrogów rolnictwa

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Abstract

The early beginning of the communist regime in Romania was influenced by transformations of agriculture (including husbandry and fishing), forced to develop intensively (replacing traditional technologies with mechanical ones) and extensively (by taking over natural systems, such as the wetlands). Since the yield did not increase as expected, the conflict with nature was aggravated by finding enemies among the species situated at the top of food chains, blamed for the losses. In order to expedite the outcomes of fighting against these species, media campaigns were developed in parallel with awards given to hunters and people who became part of the war. This paper attempts to correlate the environmental impact of campaigns against certain species with the loss of biodiversity based on statistical data. The analysis indicated that there were direct campaigns to eliminate species conflicting with economy and collateral victims. Each case study illustrates a different point; bustards were eliminated by carelessness (although protected, their status was not enforced); the pelican was eliminated due to insufficient knowledge and contrasting recommendations; and wolf was sentenced to death consciously. The results indicate that although many authors parallel nowadays communist and environmentalist policies, the real communist practices had a strong deleterious environmental impact despite a pro-environmentalist appearance.

Key words: pelican, wolf, bustard, vulture, extinction, degradation, agriculture

Streszczenie

Początkom reżimu komunistycznego w Rumunii towarzyszyły istotne transformacje w rolnictwie (odnoszące się m.in. do hodowli i rybołówstwa), będące zarazem intensywne (mechanizacja w miejsce tradycyjnych metod gospodarowania) i ekstensywne (przekształcanie naturalnych ekosystemów, takich jak mokradła). Ponieważ plony nie wzrosły zgodnie z oczekiwaniami, konflikt z naturą został wzmocniony przez poszukiwanie wrogów wśród gatunków znajdujących się na szczycie łańcucha pokarmowego i obwinianie ich winą za straty. W celu poprawy rezultatów walki z tymi gatunkami, przygotowano kampanie medialne, równolegle wprowadzając nagrody dla myśliwych i innych osób, które stały się częścią wojny. W tym artykule, opierając się na danych statystycznych, podjęto próbę połączenia przyrodniczych skutków wspomnianych kampanii z ich wpływem na zmniejszenie bioróżnorodności. Przeprowadzona analiza wykazała, że wśród przeprowadzonych kampanii medialnych wskazać można na te, które miały na celu wyeliminowanie konkretnych gatunków, nie pasujących do przyjętej ekonomii. Każdy przypadek odzwierciedla inne uwarunkowania; dropie zostały wyeliminowane przez niedbalstwo (chronione tylko formalnie, a nie w rzeczywistości); Pelikan został wyeliminowany z powodu niewystarczającej wiedzy i sprzecznych zaleceń; a wilk został skazany na śmierć świadomie. Należy podkreślić, że choć wielu autorów promuje obecnie politykę komunistyczną i ekologiczną, to rzeczywiste praktyki komunistyczne wywarły zdecydowanie szkodliwy wpływ na środowisko, pomimo ich pozornie proekologicznego wyglądu.

Słowa kluczowe: pelikan, wilk, drop, sęp, wyginięcie, degradacja, rolnictwo

1. Introduction

On August 23 1959 the Romanian people celebrated one decade and half since the liberation from the fascist oppression, important milestone in the history of our country. The victory of the armed insurrection and fall of the military fascist dictatorship under the leadership of the Communist Party (...) meant the beginning of the popular revolution when our country conquered for the first time its true national independence and sovereignty and the working people became the master and constructor of its new socialist life. The fifteen years (...) are a brief historical period, when the most daring dreams and most precious aspirations of the working people started being achieved (Cozma, 1959). These words, written into the incomprehensible language of the age, illustrated a sinister truth. At that time, Romania was becoming part of the socialist family – a milestone for social and environmental changes with effects seen until nowadays. The question we are trying to answer in this paper relates to the relationship between the shift of political regimes and these transformations, with a particular focus on the environmental ones.

This article is built on the premise that environmental protection was only part of the communist propaganda, but in fact the attitude towards nature was different when conflicting with economic interest, particularly in fields resulting into direct encounters, such as agriculture (Benedek, 2018). The aim of this paper is to analyze the literature (scientific and popularized) from the very beginning of Romanian communist regime (1950-1960, with few years before and after) in an attempt to demonstrate that, despite the ideological resemblance between communism and environmentalism, the real actions taken during this period had a deleterious effect against the environment with serious consequences lasting until today. This demonstration is based on a hypothesized historical scenario, according to which: (a) the communist regime replaced the traditional means of production with foreign methods of soviet inspiration; (b) the communist regime needed to legitimate itself and also show the value of the *innovations*; (c) due to the unsuitability of communist practices and imported methods, the production did not increase as expected; (d) the *guilt* was found among the human *enemies of the people*, who were exterminated systematically; (e) since the enemy was annihilated, but the production did not increase, *natural enemies were identified*. This is the hypothesized rationale beyond the direct conflicts with species blamed for the low productivity of economy, especially agriculture. (f) Later, although the Soviet regime denounced Stalin's practices during Khrushchev's Thaw (1950-1960), Romanian communists did not change their practices, despite the fact that the country gradually distanced from the Soviet Union (Watts, 2011, 2013); (g) consequently, the campaigns against wild-

life continued even during the 70's. Overall, the underlying hypothesis is that Romania communism was environmentalist in theory and anti-environment in practice.

2. Materials and methods

The study was a documentary research aimed at identifying any official document from the period, including without limiting to: scientific literature (journals and books), popular literature (magazines, almanacs, newspapers) and official documents (legislation), in search for the communist policies with selected environmental impacts, their dissemination and official statistics of the outcomes. The indirect and very well-documented direct impacts, such as the pollution generated by the development of industry or intensive agriculture, significant land use transformations – expansion of agriculture and industry (Filip and Cocean, 2012; Ianoș et al., 2012), over-harvesting of natural resources, construction of dams and irrigation systems, were not the primary focus of this research. The main interest was on direct conflicts between man and animal species, generated by the development of agriculture, leading to the extinction or near extinction of the *enemies of the state*.

Two kinds of sources were used in order to get an overall picture: data on agriculture from specialized journals, magazine and newspapers, and hunting data from magazines, almanacs and newspapers, mostly edited by the National Association of Hunters and Fishermen. In addition to these, books and statistical year books were used if available.

In order to document the results of the campaign directed against the wolf, data were gathered from several sources. The average values were computed eliminating values found in a single source if they differed substantially from those found in the other sources. Of particular interest was a graph found in Georgescu (1970), used to determine the actual values by digitally measuring their corresponding heights.

3. Results and discussion

The study aimed to prove a historical scenario according to which the conflicts with wildlife appeared as means of justifying the failures of communist practices of soviet inspiration. The results of the bibliographical study are organized in two sections. The first one justifies the hypothesized historical scenario and the second takes an in-depth look at the campaigns and their outcomes, detailing two case studies – the wolf and pelican.

3.1. A historical perspective of man-wildlife conflicts during the early communist period

While the new communist *plans* affected the environment by developing a polluting and resource-de-

pleting industry – *socialist industrialization* (Anonymous, 1951), this research focuses on the direct conflicts between humans and wildlife. These conflicts were mostly due to the change of agricultural practices, although the extinction or near-extinction of some species was also caused by industrial pollution or over-harvesting of resources. Early Romanian communism was inspired by the soviet model: *the treasure of revolutionary experience of the communist (bolshevist) party* (Anonymous, 1951). The socialist transformation of agriculture was done through the *program for the creative application of the genial cooperative plan of great Lenin to the concrete conditions of Romania* (Cozma, 1959) started in 1949, involving the extensive development (increasing agricultural areas) and the intensive one (mechanical and chemical agriculture – machinery, irrigation and/or draining, fertilizers and pesticides, in parallel with applying Michurin's practices and introduction of new breeds from Russia) (Anonymous, 1951; Feneșan et al., 1958; Cozma, 1959; Anonymous, 1959; Murgescu, 1960; Central Directorate for Statistics, 1961). An important increase was in the number of machines; the number of tractors increased over 800% by 1959, compared with 1938 (reference year used in the official statistics of that period) (Murgescu, 1960). The extension of agriculture was done through the *collectivization*, consisting of confiscating the private ownership parcels and aggregating them in large lots, suitable for the mechanical agriculture.

These new practices were set in the context of a new goal – *victory in the historical competition between the socialist and capitalist systems* (Cozma, 1959), or *anti-imperialist fight for peace* (Anonymous, 1951). This involved increasing the yield (Anonymous, 1957; Cozma, 1959), in order to legitimate the communist regime and new agricultural practices. Statistics seemed to indicate that the outcomes were as expected, suggesting an increase of the cereal production, number of animals and their yield (Anonymous, 1959; Murgescu, 1960; Central Directorate for Statistics, 1961).

However, if the overall figures, compared with the situation of 1938 or for large periods, appeared to legitimate the new regime, the yearly situation was different. Data from the Central Directorate for Statistics (1961) show the situation of sheep meat, milk and wheat yield. In the early years of the communist regime, the variations (especially losses) could be attributed to natural causes due to the climate variability (draughts, floods etc.) (Teodoreanu, 2017). However, this could not be done always, and was also ideologically against the ideas of Michurin and Lysenko, who considered that in the socialist system man can always defeat nature (Lecourt, 1977).

Moreover, assigning the losses to the *enemies* allowed the communist regime to legitimate its oppressive actions against its opponents. The political ideologists defined different categories: those who

owned land (especially large surfaces) and opposed to the collectivization process the *kulaks*; those who were not giving out the share requested by the government; those who were sabotaging the new economy. Newspapers like *The factory and the field* or *The new agriculture* abounded in titles like *For the liquidation of the consequences of right deviationism in the issue of collection*, *Thieves must be severely sanctioned*, *Kulak Marin Istrățescu of Ungureni – Râncaciov is still trying to exploit the poor peasants*, *Kulak Florescu took out pieces from the thresher*, *Punishing some sabotaging kulaks*, *Kulak Elena Dișescu of Gemenea Commune, allowed to sabotage without consequences*, *Sabotaging kulaks*, *Hostile elements removed from the cooperation etc.*; each of them meant an individual or family tragedy, as they were executed, sent to prison or died in the labor camps and their families suffered severe consequences as well.

3.2. Campaigns against the natural enemies

The elimination of human enemies did not result into a spectacular increase of the agricultural production. We hypothesize that the *natural enemies of the people* were identified in an attempt to find an explanation for the failures. An *advertisement* from 1954 magazine *Sportive hunter and fisherman* (Anonymous, 1954a) reads, *A wolf destroys yearly 52 animals weighting 1,000 kg. Through 3,125 wolves destroyed in 1953, 3,000,000 kg of meat were saved for the economy of the country. Through 200,000 stray dogs destroyed in 1953, 18,000,000 kg of food were saved for the economy of the country. 250,000 damaging birds destroyed in 1953 represent an economy of 2,000,000 kg of seeds, eggs and meat. 20,000 cormorants destroyed in 1954 [mean] 6,000,000 kg of fish saved for the economy of the country*; the text identifies the main enemies: wolves, stray dogs, seed-eating birds and cormorants. It is important to note that the stray dogs constituted an issue in areas other than the urban ones, in opposition to the current situation (Ioja et al., 2011).

Although many species suffered due to the communist policies or due to the lack of protective policies, the situation differs from one case to another. In a 2010 interview, Dr. Dumitru Murariu, Director of *Grigore Antipa* National Museum of Natural History, mentions four cases: (a) the wolf, result of a campaign, (b) all scavenging vultures (populations shrunk in sizes, the bearded vulture (*Gypaetus barbatus*) extinct), as side victims of the wolf campaign, particularly through poisoning (Bardan, 1951), (c) the pelican, again as a result of a campaign, (d) the bustard (*Otis tarda*), due to the lack of protective actions (Gheorghe, 2010). In the following sections, a special attention will be paid to two well-documented campaigns, against the pelican and the wolf. The bustard situation is controversial. While the official attitude was favorable and its protection recommended, populations were endangered by illegal

collection of eggs, direct elimination by dogs joining the peasants to field works, capturing the hatch (Anonymous, 1952), and especially massive killings during the winters, when their wings were covered by ice and peasants killed them with wood bats (Anonymous, 1952; C. B., 1954; Gheorghe, 2010), such as the 1938 episode described by C. B. (1954). In addition, ice resulted killed them by freezing or due to the natural predators (C. B., 1954).

3.2.1. Pelicans – a controversial campaign

Although the pelican campaign occurred during the communist period (Gheorghe, 2010), its roots are earlier (Botezat and Linția, 1942). In fact, the literature review indicates a gradual change of attitude, from considering it an enemy in the beginning up to considering it at most a menace.

In the early stages, an article by Botezat and Linția (1942) suggests that the pelican has a selective role, but concludes that it is destructive and clearly recommends the destruction of nests and hatch.

On a milder note, Șumuleanu (1958) shows that, even though the results of research are controversial, the pelican *should be protected despite the damages of fishing economy*, keeping the population level at approximately 2,000 as a *treasure of our fauna*. The arguments are that pelicans have sufficient nesting sites and sufficient numbers (*i.e.*, the estimated 1,500 is not realistic and the true population exceeds 10,000). The economic arguments *against* the pelican include the fact that although they select the fish, the pelicans consume only the healthy one; the approximately 5,000 pelicans in the Delta (although, again, the population is really around 10,000) consume not 2, but 4 kg of fish/day (and lethally wound an equal amount) 2,250,000 kg of fish, equivalent to 5,500 cattle. A similar figure (200,000,000 kg of fish/year) is given in other studies (Anonymous, 1949). Rădulescu (1966) cites studies showing that pelicans produce damages to the fishing economy and adds that they can transmit parasite eggs through their dejections. During the early communist regime, pelicans were not the main target, although their status was not certain. While officially protected, the literature of that period includes statements like: pelicans and cormorants produce serious damages and therefore *the fight against these birds damaging fish culture must be systematically organized by hunting associations* (Pojoga, 1959). On the other hand, Cătuneanu (1950b) and Dimitrie (1952a, b, 1957) point out that although destroying the fish, pelicans have a selective role. Although pelicans and cormorants wound and spare fishes and occasionally hunt together (Dimitrie, 1952b), the authors recommend that pelicans should be protected, whilst cormorants should be *killed without any fear that they could disappear* (Dimitrie, 1952a). The same thesis is sustained by other articles (Anonymous, 1949; Dimitrie, 1952b; Cătuneanu, 1950b). The hunting association of the two species is known by biologists; pelicans

form a circle and flap their wings, cormorants dive and catch some of the fish; those who are trying to escape going to the surface of the water are caught by the pelicans (Melian et al., 2005). For this reason, it is likely that the campaign against cormorants had its contribution to the near extinction of pelicans. It is important to mention that the campaign against cormorants was a clear consequence of the communist policies. An advertisement (Anonymous, 1954a) also indicates that *by killing 20,000 cormorants in 1954, 6,000,000 kg of fish were saved for the economy of the country*. Killing of cormorants was a *duty of the hunters, in order to increase the fish production for [feeding the] working class* (Cătuneanu, 1950a); in addition to killing fish, cormorants were also responsible for sickening them (Anonymous, 1948). Despite all these, the near extinction of pelicans is attributed to the antipathy of fisherman, who illegally destroyed the nests and hatch, or is a *collateral consequence* of the campaign against fish-eating birds (Anonymous, 1949).

3.2.2. Wolves – a systematic campaign

The campaign for the extermination of wolves was organized in such a systematic way, that it continued longer. Even after the separation from the Soviet policies, articles advocating the extermination of wolves were still present (Georgescu, 1970). Given the coherent and planned campaign, its presentation is organized in several sections.

Rationale. The wolf campaign was not a Romanian creation. Its roots are in the soviet policies. Ideologically, the campaign is based on the recommendations of soviet biologists Mantefjel and Larin (1951), cited by others (Lazăr, 1953; Galațchi, 1954; General Association of Sportive Hunters and Fishermen in Romania, 1954; Gavriț, 1957), according to whom *the selection [of game species] must be done by man, not by the wolf* (General Association of Sportive Hunters and Fishermen in Romania, 1954), or, more exactly, *in the socialist state, man does not only observe nature, but intervenes, directing laws to the benefit of the people* (Almășan, 1950). Moreover, the proliferation of predators, particularly wolves, was part of the *problematic inheritance of the bourgeois regime* (Lazăr, 1953; General Association of Sportive Hunters and Fishermen in Romania, 1954) and resulted into the incapacity of obtaining the maximum hunting yield (General Association of Sportive Hunters and Fishermen in Romania, 1954). The ideological fight involved even the reinterpretation of fairy tales, in order to induce in the young generations the hate against wolves (Andronache, 1954). Attempting to offer a *balanced* viewpoint, the author offers a literature review, according to which some authors discuss the selective role of wolves without opposing their extermination, excepting for the *inhuman* means – poison and traps, while others try to charge wolves with all possible crimes, concluding that the growth of their populations must be con-

trolled. However, Almășan (1950) calls for the total eradication, so that the word *wolf* would be present *only in the stories*. Consequently, the literature of that period called the wolf *enemy no. 1 of domestic animals and furry game* (Andronache, 1954), *plague* (Almășan, 1949), *enemy of the hunting economy* (Iacobi, 1956), or *greatest enemy of the game* (Popescu, 1955a). The cruelty of wolf was also described in texts like: *the endless hunger of these cruel predator beasts heavily endangers the cattle in village households, but especially the precious game of our forests* (Iotici, 1949).

Substantiation. The main argument against wolf is an economic one. Wolves were accused of destroying domestic animals and all species of interest for the hunters. Different authors have compiled a *menu* for the wolf, including: stag (*Cervus sp.*), elk (*Cervus elaphus*), deer (*Capreolus sp.*), rabbit (*Lepus sp.*), wild boar (*Sus scrofa*), chamois (*Rupicapra rupicapra*), capercaillie (*Tetrao urogallus*), grouse (*Tetrastes bonasia*), partridge (*Perdix sp.*), wild goose and duck, sheep, deer, small and large cattle, horse, chicken, goose (Schnell, 1948; Witting, 1948; Almășan, 1949; Lazăr, 1953; General Association of Sportive Hunters and Fishermen in Romania, 1954, 1955; Stanca, 1954; Popescu, 1955a, b; Rudescu, 1955; Iacobi, 1956; Bodea, 1957; C. B., 1958; Georgescu, 1970). Obviously, the list is exaggerated; it is unlikely for wolves to reach the chamois or attack the very large species included in the diet. The figures are even less credible: thousands of cattle and sheep yearly (Lazăr, 1953); millions of kilograms of game meat and domestic animals from people's households (C. B., 1958); 2,700,000 kg of meat consumed by the 4-5,000 wolves (Stanca, 1954) or 4,000,000 kg of meat consumed by 4,000 wolves (Galațchi, 1954); 52 cattle weighting 1,040 kg (Andronache, 1954). The advertisement from 1954 read that by killing 3,125 wolves in 1953, 3,000,000 kg of meat were saved, as a wolf kills yearly 52 animals weighting 1,000 kg (Anonymous, 1954a). In addition to the damages, wolves were also found responsible for the rage (Popescu, 1955a). Another argument, meant for the hunters, is that wolves must be destroyed so that the stags won't be all killed (Schnell, 1948). Nevertheless, in compensation, wolves did not have too much to offer, as even their fur was of little value, especially compared to the fur of the game destroyed by it (Andronache, 1954).

Mobilization. The legal basis of the campaign consists of the Government Decision 108/1953 on the wolf combating campaign (Andronache, 1954), replaced by the decision on the action of destroying wolves from the territory of People's Republic of Romania (Stoica, 1957). The laws mobilized the hunters, including economic stimulants: awards, paid vacation during the 5 mandatory yearly campaigns (Lazăr, 1953). Moreover, the total destruction of wolves was a public, yet honoring duty (Lazăr, 1953), justified by the increasing demand of people

for *more milk, meat, cheese, wool and leather* (Lazăr, 1953). The power of examples was also used; the magazine *Sportive hunter and fisherman* published the account of a Bulgarian old hunter who destroyed 161 in only one year (Anonymous, 1954c).

Weapons. In a similar way to the ideological campaign, weapons were also of soviet inspiration. Brochures were translated from Russian and distributed to the hunters (Savițchi, 1951). The methods included poisoning with letholine and strychnine, catching babies and adults in their burrows, shooting (collective sessions, chasing, using dogs or vultures, sledges or aircrafts), traps, snares and pitfalls (Iotici, 1949; Andronache, 1954; Galațchi, 1954; General Association of Sportive Hunters and Fishermen in Romania, 1954, 1955; Anonymous, 1955; Popescu, 1955a; Nicolae, 1956; Bodea, 1957; C. B., 1958). Gavriț (1957) provides a calendar of the different methods. The calendar indicates that the wolf can be killed without any restriction at any time (Almășan, 1949, 1950; Lazăr, 1953; General Association of Sportive Hunters and Fishermen in Romania, 1955). With respect to the usage of methods, 1609 wolves were shot, 343 poisoned, 75 trapped and 477 killed in their burrows in 1954 (C. B., 1958). Similar figures are reported by Popescu (1955a).

Results. Disparate figures were found in the literature; they indicate that 600 baby wolves (Bodea, 1957) and 3,000 adults (Anonymous, 1954a) were killed yearly. Although the figures from different sources vary drastically (after all, they rely on hunting accounts), Fig. 1 shows a graph obtained by averaging the values from different authors for the number of killings (Almășan, 1950; Andronache, 1954; Anonymous, 1954a; Popescu, 1955a; Nicolae, 1956; Gavriț, 1957; Georgescu, 1970) and Georgescu (1970) for the population size. In the second case, a single source was preferred, as the others referred to a single year and figures differed substantially. The graph shows that the number of killed wolves keeps increasing, most likely because the set of methods used expands beyond traditional hunting campaigns to include the most bestial ones, such as poisoning, killing the wolf offspring in their borrows, or trapping. The increase stopped when almost all existing wolves were killed; from here on, lesser wolves are killed each year, but enough to prevent the restoration of the overall population. Furthermore, despite the variations, the attitude is consistent and all authors agree that too few wolves were killed (General Association of Sportive Hunters and Fishermen in Romania, 1954; Stanca, 1954; Popescu, 1955a; Popescu, 1959). Georgescu (1970) also discusses the relationship between the decrease of wolf population and the increase of stag population, supporting the statements of Schnell (1948) and explaining it through the theory developed by Lotka and Volterra.

The side victims – scavenging vultures – were mostly killed by poisoned carcasses, due to the re-

commendation to replenish the poison as soon as the poisoning sites were visited (Anonymous, 1954b). *Time span.* As it the cited literature shows, the wolf campaign started almost at the same time with the seizure of power by the communist regime (1948). Its peak was in the 50's, but, as it can be seen in Fig. 1, the campaign was still going on in 1966. Furthermore, the tone of the book of Georgescu (1970) does not show any change, despite the fact that some of Stalin's policies were condemned immediately by Khrushchev and Romania started developing its own communist system after 1965.

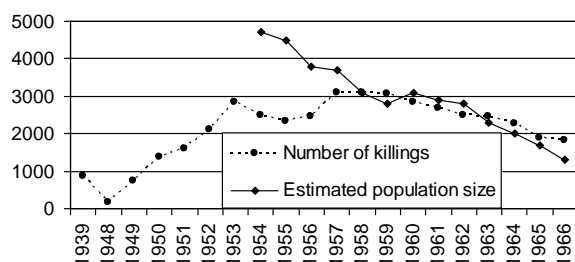


Figure 1. Results of the wolf campaign: killings and estimated population size. Values reflect averages of Almășan, 1950; Andronache, 1954; Anonymous, 1954a; Popescu, 1955a; Nicolae, 1956; Gavrilă, 1957; Georgescu, 1970.

3.3. Discussions

The analysis presented in this article aimed to show that, despite the *care for the environment* stated by the Romanian communist regime, its actions had been directed against the environment. In order to sustain this claim, three cases of species eliminated totally or partially during the early communist period in Romania were presented. Each of them illustrates a different point; bustards were eliminated by the carelessness showing that although protected, the status of the bustard was not enforced; the pelican, also protected, was eliminated due to the lack of sufficient knowledge and contrasting recommendations; and the wolf was sentenced to death consciously. The underlying premise is that the extensive and intensive development of agriculture results into a conflict with the species from natural ecosystems, as a particular side of the conflict between economy and the environment (Marinescu and Coman, 2010). This relationship was discussed in the literature of the communist period and used as an ideological weapon. Popescu (1955b) argues that *only rudimentary agriculture leads to the destruction of game and rational, scientific agriculture practiced on large surfaces* does not have this effect. Obviously, his comments (not based on facts or a literature review) are meant to support the collectivization process. However, the results presented in this article clearly affirm his theses. The *new* agriculture failed and wild species, such as the wolf (*enemy of husbandry*) and fish eating birds ('enemies of the fisheries') were direct victims. Other species (pelicans too) were eliminated to the lack of protection; apart

from the individual protection status (rarely enforced), only two reserves existed before 1989: Danube Delta and Retezat Massif. Nevertheless, they missed an administrative structure and any plans of management, similar to the findings of other studies (Khabibullov, 1991; Mazursky, 1991; Ostergren and Jacques, 2002). On a different note, these case studies show that giving science a *political sense* is unproductive and the science created to serve political interests is a fake one, losing even its scientific character. The examples consisted of political statements without scientific support and substantiation from facts/data. Moreover, it is hard to distinguish a different tone or approach between scientific and popular literature. All illustrate the *socialist science*, which was meant to substantiate the new policies. Conclusions such that a species can be eliminated without consequences or is detrimental to the ecosystem where it belongs denote the lack of scientific ethics and respect for the environment (Ianoș et al., 2009). However, Romania did not learn from these lessons. In 2015, a senator planned to sign a petition showing that the 10,000 protected bears became a menace and some 4,000 should be killed (Dărămuș, 2015), similar to the wolves killed during the communist period. In the same year the skylark was threatened by excessive hunting, lacking a protection status similar to its status in other European Union countries (Benedetti, 2015), repeating the tragic story of the bustard during the communist eve.

With respect to the theoretical framework, the three cases sustain the initial claim. The bustard and pelican were legally protected, but their status did not save the bustard from the hungry peasants and did not stop the occasional campaigns against the pelican. In addition, campaigns against the cormorant affected the pelican, because the relationship of the two species, particularly the joint fishing efforts, was insufficiently known. This is an indication that, despite the claim of *safeguarding the environment*, the Romanian communist regime did not support related research before taking concrete actions. The most obvious example is provided by the campaign against the wolf, which had, in addition to the concrete actions, an ideological side (i.e., the interpretation of the fairy tales, meant to induce in children the hate against wolves). However, it is noteworthy mentioning that different *interpreted* images of the wolf are not necessarily a communist innovation, as exist also in the American literature, without being used as ideological weapons (Jones, 2010, 2011).

All the three examples resulted into an attempt to eliminate (deliberately, in the case of the wolf and occasionally the pelican) entire species. There is no doubt that pro-environmentalist policies can have such effects; therefore, the actions of the communist regime were anti-environmentalist.

Another question is how much such campaigns had to do with communist ideologies versus local particularities. The wolf campaign took place during the

same period in Russia (Andronache, 1954) and Bulgaria (Anonymous, 1954c), due to the soviet influence. Historical records show that in 1357 severe winters determined the wolves entering the human settlements in Finland; the king issued a decree requiring their extermination on April 16, 1357 (Teodoreanu, 2017). Wolves were also presented as pests during 1700-1850 in the Prussian Brandenburg (Sprenger, 2015). However, in the West such campaigns were only accidental, took place for a very limited amount of time and were not meant for the complete extermination of a species. A campaign similar to the one directed against the wolf in Romania took place in China against the *four pests*, killing 1 billion sparrows brutally, by scaring them away and preventing their landing by keeping clapping until the birds fell down dead, resulting into a loss of crops due to the insects that would have been eaten by them (Hesketh and Zhu, 1997) forcing China to import sparrows from the Soviet Union (Bernstein, 2014), 1.5 billion rats, 100 million kilograms of flies and 11 million kilograms of mosquitoes (Lampton, 1972). However, the Chinese example does not necessarily illustrate a communist anti-environmental policy in its very nature, but rather consequences of the conflict between agriculture and the environment, although the size of effects is certainly possible only in a centralized economy. Similar conflicts existed in Europe; during 1700-1850, Prussian Brandenburg adopted measures for controlling the agricultural (migratory locusts) and silvicultural (pine caterpillars) pests (Sprenger, 2015).

Despite the dual possible interpretation of the Chinese example, the examples from the communist countries point out to the communist ideology of intervening against nature.

As it could be seen, old ethics, present in the literature discussed in the study, rarely questioned the morality of intervening against nature, but discussed issues such as, *should we keep the pelicans or destroy all, how many of them are enough*; in the case of wolf, its elimination is advocated without any ethical questioning. Current ethics considers that man has no right to tackle with the ecosystem laws (Taylor, 1981; Loftin, 1984; Mittelstra, 2003; Horta, 2010; Gache, 2013) and certainly no right to determine the extinction of species (Scott, 1973), obviously, such principles not taken into account by the actions of the communist regime.

There are several possible explanations of the cleavage between the communist pro-environmentalist policies in theory and the practice of drawing entire species near their extinction. On the one hand, the interpretation of the environment during the communist period was based on an anthropocentric perspective (Petrișor, 2016) and subject to political interpretations (Gare, 1993); the environmentalist policies were not conceived in a holistic manner and were approached separately from the hunting or agricultural ones. As a result, those responsible for

managing, at a national level, the fishing, hunting, or agricultural activities considered a campaign against entire species perfectly legitimate, since their policies were not correlated with those from the environmental sector. Second, the communist regime did not include the environment among its highest priority (Earnhart, 1997; Nawrotzki, 2012); in Romania, communists were continuators of the socialists and their primary focus was represented by social issues. As a consequence, anti-environmental actions were permitted if they were serving a purpose considered more important. Third and tightly related, law enforcement was not as strict in the sectors of lesser importance, such as the environmental issues (Khabibullov, 1991), as in the very important ones, particularly those related to the communist ideology (private/state property, private/state economy, control of mass-media etc.). Fourth, communist propaganda had means of diverting people's attention from the real problems by creating fictive issues and enemies (Lasswell, 1951); as it has been stated in the beginning, the wild animals were held responsible for the failure of agricultural policies, following the extermination of political enemies for the same reasons.

4. Conclusions and recommendations

Starting from an analysis on the literature comparing communism and environmentalism, which seems to indicate that the two are similar and belong to the *left* side of the political range, this article attempted to analyze the early communist regime literature in Romania, hypothesizing that *new* policies had direct adverse environmental consequences with political roots. The analysis indicated that there were direct campaigns to eliminate species conflicting with some economy branches (e.g., conflict between wolf and husbandry or hunting, between the pelican and cormorant and fishing economy) and collateral victims (poisoned scavenging vultures, elimination of bustards and pelicans due to the non-enforcement of existing protective policies or their lack).

The examples analyzed above show clearly that, far away from being environmentally friendly, the communist regime of Romania had a deleterious effect against species and ecosystems all over its duration; some of the environmental consequences of communist actions are still visible today.

Moreover, the analysis shows the ethical consequences of political ideologies. While modern ethics limit human interventions over nature, particularly at the scale of sentencing a species to death, results can be disastrous when specific political ideologies do not show any respect for the environment. It can only be hoped that the examples remain painful lessons of the past and their repetition – in other places, with other ideologies – is impossible nowadays. In a nutshell, the analysis of the Romanian communist regime shows a huge cleavage between the seemingly

pro-environmentalist policies in *theory* and the anti-environmentalist *practice* of drawing entire species near their extinction.

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References

1. ALMĂȘAN A., 1949, Menace of the wolf, in: *Vânătorul*, 1(13), p. 3.
2. ALMĂȘAN A., 1950, The wolf destruction campaign, in: *Vânătorul și pescarul sportiv*, 2(3), p. 3.
3. ANDRONACHE I., 1954, *Hunting as an economic, sportive and scientific factor*, General Association of Sportive Hunters and Fishermen in Romania, Bucharest, Romania.
4. ANONYMOUS, 1948, Kill the water birds, in: *Foaia pescarului*, 2, p. 6.
5. ANONYMOUS, 1949, The pelican, in: *Vânătorul*, 1(11), p. 7-8.
6. ANONYMOUS, 1951, 30 years of glorious fight for freedom, peace and socialism, in: *Probleme agricole*, 3(4-6), p. 1-5.
7. ANONYMOUS, 1952, Bustards and ice, in: *Vânătorul și pescarul sportiv*, 4(12), p. 5.
8. ANONYMOUS, 1954a, Agenda of sportive hunter and fisherman, in: *Vânătorul și pescarul sportiv*, 6(1).
9. ANONYMOUS, 1954b., Contribution of hunters to increasing the amount of widely consumed products, in: *Vânătorul și pescarul sportiv*, 6(11), p. 14-15.
10. ANONYMOUS, 1954c, How I killed 161 wolves, in: *Vânătorul și pescarul sportiv*, 6(12), p. 21-22.
11. ANONYMOUS, 1955, Let's intensify the action for combating the predators, in: *Vânătorul și pescarul sportiv*, 7(6), p. 2.
12. ANONYMOUS, 1957, 40 years from the Great Socialist Revolution of October, in: *Probleme zootehnice și veterinare*, 11, p. 5-10.
13. ANONYMOUS, 1959, 15 years since the liberation of the country, in: *Probleme agricole*, 11(8), p. 7-13.
14. BARDAN A., 1951, Combating the wolves, in: *Vânătorul*, 3(10), p. 2.
15. BENEDETTI L., 2015, *Romanian hunting law threatens wild birds and violates the Birds Directive*, BirdLife International, Cambridge, UK, <http://www.birdlife.org/europe-and-central-asia/news/romanian-hunting-law-threatens-wild-birds-and-violates-birds-directive> (06.08.2018).
16. BENEDEK K., 2018, Aspects in Romanian Nature Conservation – A Review, in: *Environmental Engineering and Management Journal*, 17(1), p. 95-106.
17. BERNSTEIN T. P., 2014, Mao, Chinese communism, and the USSR, in: *Journal of Cold War Studies*, 16(2), p. 108-127.
18. BODEA M., 1957, Catching baby wolves at their burrow, in: *Vânătorul și pescarul sportiv*, 10(4), p. 12-13.
19. BOTEZAT E., LINȚIA D., 1942, The pelican faces the economic exploitation of the Delta, in: *Carpații: Vânătoare. Pescuit. Chinologie*, 10(1), p. 173-177.
20. C. B., 1954, The bustards, in: *Vânătorul și pescarul sportiv*, 6(4), p. 4-5.
21. C. B., 1958, Combating wolves at their burrow, in: *Vânătorul și pescarul sportiv*, 7(5), p. 9-10.
22. CĂTUNEANU I. I., 1950a, Current aspects of the bird colonies from the Danube Delta, in: *Vânătorul*, 2(8), p. 7.
23. CĂTUNEANU I. I., 1950b, Few data on fish-eating birds, in: *Vânătorul*, 2(7), p. 5-8.
24. CENTRAL DIRECTORATE FOR STATISTICS, 1961, *Development of People's Republic of Romania's Agriculture*, Central Directorate for Statistics, Bucharest, Romania.
25. COZMA I., 1959, The agriculture of People's Republic of Romania on its ascending trend towards socialism, in: *Revista internațională pentru agricultură*, 6, p. 14-25.
26. DĂRĂMUȘ N. R., 2015, Killing the bear with a glance: the gaze of senator Tanczos, in: *Kamikaze*, 6(29), p. 7.
27. DIMITRIE R., 1952a, Fish-eating birds and their combating, in: *Vânătorul*, 4(12), p. 12-13.
28. DIMITRIE R., 1952b, Fish-eating birds from Romania and their combating, in: *Vânătorul*, 4(11), p. 12-13.
29. DIMITRIE R., 1957, The pelican, a species that is getting lost, in: *Vânătorul și pescarul sportiv*, 10(4) p. 12-13.
30. EARNHART D., 1997, Enforcement of environmental protection laws under communism and democracy, in: *The Journal of Law and Economics*, 40(2), p. 377-402.

31. FENEȘAN O., FRĂSIE D., LUCA I., ONICĂ P., ROMANOVICI A., VASCAN O., VASILIU C., 1958, *Development of agriculture in People's Republic of Romania*, Editura Agro-Silvică de Stat, Bucharest, Romania.
32. FILIP S., COCEAN P., 2012, Urban industrial brownfields: constraints and opportunities in Romania, in: *Carpathian Journal of Earth and Environmental Sciences*, 7(4), p. 165-174.
33. GACHE C., 2013, Environmental ethic values through ecological education in one Romanian master degree program, in: *Natura Montenegrina*, 12(3-4), p. 1-8.
34. GALAȚCHI N., 1954, Destruction of wolves at their burrow, in: *Vânătorul și pescarul sportiv*, 1(13), p. 3.
35. GARE A., 1993, Soviet environmentalism: The path not taken, in: *Capitalism Nature Socialism*, 4(4), p. 69-98.
36. GAVRILEȚ I., 1957, Forestry and hunting personnel in the wolf combating action, in: *Vânătorul și pescarul sportiv*, 10(1), p. 15.
37. GENERAL ASSOCIATION OF SPORTIVE HUNTERS AND FISHERMEN IN ROMANIA, 1954, *Destroying the wolves in their burrows during the spring and summer*, General Association of Sportive Hunters and Fishermen in Romania, Bucharest, Romania.
38. GENERAL ASSOCIATION OF SPORTIVE HUNTERS AND FISHERMEN IN ROMANIA, 1955, *Destroy the predators*, General Association of Sportive Hunters and Fishermen in Romania, Bucharest, Romania.
39. GEORGESCU M., 1970, *The bear and wolf in our Carpathians*, General Association of Sportive Hunters and Fishermen in Romania, Bucharest, Romania.
40. GHEORGHE D., 2010, Wolves and vultures from Romania, executed as 'enemies of the people', in: *România liberă*, 6082, p. 6.
41. HESKETH T., ZHU W. X., 1997, From Mao to market reform, in: *British Medical Journal*, 314(7093), p. 1540-1542.
42. HORTA O., 2010, The ethics of the ecology of fear against the nonspeciesist paradigm: a shift in the aims of intervention in nature, in: *Between the Species*, 13(10), p. 163-187.
43. IACOBI R., 1956, Enemy of the hunting economy, in: *Vânătorul și pescarul sportiv*, 9(1), p. 17, 19.
44. IANOȘ I., PEPTENATU D., ZAMFIR D., 2009, Respect for environment and sustainable development, in: *Carpathian Journal of Earth and Environmental Sciences*, 4(1), p. 81-93.
45. IANOȘ I., ȘÎRODOEV I., PASCARIU G., 2012, Land-use conflicts and environmental policies in two post-socialist urban agglomerations: Bucharest and Chișinău, in: *Carpathian Journal of Earth and Environmental Sciences*, 7(4), p. 125-136.
46. IOJĂ I. C., ROZYLOWICZ L., PĂTROESCU M., NIȚĂ M. R., VÂNĂU G. O., 2011, Dog walkers' vs. other park visitors' perceptions: The importance of planning sustainable urban parks in Bucharest, Romania, in: *Landscape and Urban Planning*, 103(1), p. 74-82.
47. IOTICI N., 1949, Let's prepare for combating the wolves, in: *Vânătorul*, 13(1), p. 7-8.
48. JONES K., 2010, From Big Bad Wolf to Ecological Hero: *Canis Lupus* and the Culture(s) of Nature in the American-Canadian West, in: *American Review of Canadian Studies*, 40(3), p. 338-350.
49. JONES K., 2011, Writing the Wolf: Canine Tales and North American Environmental-Literary Tradition, in: *Environment and History*, 17(2), p. 201-228.
50. KHABIBULLOV M., 1991, Crisis in Environmental Management of the Soviet Union, in: *Environmental Management*, 15(6), p. 749-763.
51. LAMPTON D. M., 1972, Public health and politics in China's past two decades, in: *Health Services Reports*, 87(10), p. 895-904.
52. LASSWELL H. D., 1951, The Strategy of Soviet Propaganda, in: *Proceedings of the Academy of Political Science*, 24(2), p. 66-78.
53. LAZĂR F., 1953, Destruction of wolves, a communitarian action, in: *Vânătorul*, 5(12), p. 3-4.
54. LECOURT D., 1977, *Proletarian science?*, NLB, London, UK.
55. LOFTIN R. W., 1984, The Morality of Hunting, in: *Environmental Ethics*, 6(3), p. 241-250.
56. MANTEJFEL P. A., LARIN S. A., 1951, *Wolves and their combating*, Physical Culture and Sport Press, Bucharest, Romania.
57. MARINESCU B., COMAN C., 2010, The ethics of animals testing, in: *Romanian Journal of Bioethics*, (8)3, p. 197-204.
58. MAZURSKY K. R., 1991, Communism and the Environment, in: *Forum for Applied Research and Public Policy*, 5(4), p. 39-44.
59. MELIAN I., TODERAȘ I., CIOCÎRLAN V., 2005, *Birds – systematic, biology, ecology*, State University of Moldova, Chișinău, Moldova.
60. MITTELSTRA J., 2003, The impact of the new biology on ethics, in: *Romanian Journal of Bioethics*, 1(2), p. 1-8.
61. MURGESCU C. (ed.), 1960, *Problems of developing and consolidating the socialist agriculture*, Academy of People's Republic of Romania Press, Bucharest, Romania.
62. NAWROTZKI R. J., 2012, The politics of environmental concern: A cross-national analysis, in: *Organization & Environment*, 25(3), p. 286-307.
63. NICOLAE S., 1956, Combat the wolves in their burrow, in: *Vânătorul și pescarul sportiv*, 9(5), p. 8.
64. OSTERGREN D., JACQUES P., 2002, A Political Economy of Russian Nature Conservation

- Policy: Why Scientists have Taken a Back Seat, in: *Global Environmental Politics*, 2(4), p. 102-124.
65. PEPPER D., 1985, Determinism, idealism and the politics of environmentalism – a view point, in: *International Journal of Environmental Studies*, 26(1-2), p. 11-19.
 66. PETRIȘOR A.-I., 2016, Brief critical analysis of concepts used for assessing the market value to ecosystem goods and services in urban and spatial plans, in: *Journal of Urban and Landscape Planning*, 1-2, p. 98-108.
 67. POJOGA I., 1959, *Fish culture*, State Agriculture and Forestry Press, Bucharest, Romania.
 68. POPESCU A., 1955a, Let's continue the action for combating the wolves in: *Vânătorul și pescarul sportiv*, 9(9), p. 20.
 69. POPESCU A., 1959, Let's destroy the wolves, greatest enemies of the game, in: *Vânătorul și pescarul sportiv*, 7(2), p. 8.
 70. POPESCU E., 1955b, On hunting and agriculture, in: *Almanahul vânătorului și pescarului sportiv*, 5, p. 86-88.
 71. RĂDULESCU I., 1966, Pelicans as predators and possible vectors of parasitic diseases to hatchery fishes, in: *Buletinul Institutului de Cercetări Piscicole*, 25(1), p. 75-78.
 72. RUDESCU L., 1955, Game and hunting in the Danube Delta, in: *Almanahul vânătorului și pescarului sportiv*, 5, p. 152-158.
 73. SAVIȚCHI A., 1951, The wolf combating campaign, in: *Vânătorul*, 3(1), p. 8-10.
 74. SCHNELL E., 1948, Decrease of our stag populations, in: *Calendar vânătoresc*, eds. Witting O., Coresi, Romania, p. 26-31.
 75. SCOTT P., 1973, Species Extinction in Birds, in: *Bird Study*, 20, p. 93-102.
 76. SPRENGER J., 2015, An Ocean of Locusts – The Perception and Control of Insect Pests in Prussian Brandenburg (1700-1850), in: *Environment and History*, 21(4), p. 513-536.
 77. STANCA I., 1954, How much does a wolf cost?, in: *Vânătorul și pescarul sportiv*, 6(1), p. 19.
 78. STANCA I., 1954, How much does a wolf cost?, in: *Vânătorul și pescarul sportiv*, 6(1), p. 19.
 79. STOICA C., 1957, Decision on the action of destroying wolves from the territory of People's Republic of Romania, in: *Vânătorul și pescarul sportiv*, 10(10), p. 18.
 80. ȘUMULEANU B., 1958, Should we protect or destroy the pelican?, in: *Buletinul Institutului de Cercetări Piscicole*, 17(3), p. 55-58.
 81. TAYLOR P. W., 1981, The ethics of respect for nature, in: *Environmental Ethics*, 3(3), p. 197-218.
 82. TEODOREANU E., 2017, *Searching for the lost time. A historical climatology sketch*, Paideia, Bucharest, Romania.
 83. WATTS L. L., 2011, *With Friends Like These. The Soviet Bloc's Clandestine War against Romania*, RAO Press, Bucharest, Romania.
 84. WATTS L. L., 2013, *The First Shall Be Last. Romania and the End of the Cold War*, RAO Press, Bucharest, Romania.
 85. WITTING O. 1948, Conspectus of the hunting economy, in: *Calendar vânătoresc*, ed. Witting O., Coresi, Brașov, Romania, p. 20-25.

Is the Economic Mechanism of Quantity-Quality Tradeoff Sustainable?

Czy ekonomiczny mechanizm kompromisu pomiędzy ilością i jakością jest zrównoważony?

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Abstract

The contemporary economic debate on population ageing points out low fertility and the economic threats to pensioners, although the global population increased more than two and a half times in 1950-2015. The socio-economic problems are conflicting with the ecological debate and the attempts to stabilise population growth within a sustainable scale. This paper researches a tradeoff mechanism between quality and quantity of children offered by G. Becker from a global evolutionary perspective postulated in the conception of sustainable development. The balance between quality and quantity results in the lower fertility typical of many developed countries. However, it does not correspond with the lower ecological deficit in these countries according to the determinants postulated in IPAT. The conclusion here is that there is no effective economic mechanism to balance affluence and population change. This research shows that the present demographic problems are rooted in the socio-economic institutions and there is no problem with lower fertility or ageing population from the global perspective.

Key words: IPAT, quality-quantity theory, demographic change, net reproduction rate, ecological footprint

Streszczenie

Współczesna debata gospodarcza na temat starzenia się ludności wskazuje na niską płodność i zagrożenia ekonomiczne dla emerytów pomimo tego, że w latach 1950-2015 liczba ludności na świecie zwiększyła się ponad dwa i pół razy. Problemy społeczno-gospodarcze są w konflikcie z debatą ekologiczną i próbami stabilizacji wzrostu populacji na zrównoważoną skalę. W niniejszym artykule zbadano mechanizm kompromisu pomiędzy jakością i ilością dzieci przedstawiony w koncepcji G. Beckera z globalnej perspektywy ewolucyjnej postulowanej w koncepcji zrównoważonego rozwoju. Równowaga pomiędzy jakością a ilością prowadzi do niższej płodności typowej dla wielu krajów rozwiniętych. Tym niemniej, nie skutkuje to niższym deficytem ekologicznym w tych krajach, zgodnie z uwarunkowaniami postulowanymi w IPAT. W rezultacie nie istnieje skuteczny mechanizm ekonomiczny równoważący zamożność i zmiany wielkości populacji. Niniejsze badania wskazują na to, że obecne problemy demograficzne są zakorzenione w instytucjach społeczno-ekonomicznych i z perspektywy globalnej nie istnieje problem niższej płodności czy starzenia się populacji.

Słowa kluczowe: IPAT, teoria ilości-jakości, zmiana demograficzna, stopa reprodukcji netto, ślad ekologiczny

1. Introduction

The steady-state conception by Daly (1991) postulates an economy with both the stable levels of a population and its consumption. This is the fundamental attribute of the sustainable scale for the global economy within the global ecosystem's capacity (Daly &

*Mankind's predicament is rooted primarily in economic and social structures and behaviour within and between countries
The Cocoyoc Declaration, 1974*

Farley, 2011). The overpopulation issue has been extensively discussed in economics particularly since the works by Malthus (1798). In turn, contemporary Western societies portray concern for low fertility (Vos, 2009), although the global population has been continuing to grow (Lee & Mason, 2011a).

The contemporary economic debate on population ageing points out the lower fertility in developed countries and the threats to pensioners and these economies. However, the economic problems are conflicting with the ecological debate and the attempts to stabilise population growth and the ecological footprint. The socio-economic problems following both lower fertility and population ageing mask the overpopulation problem in terms of the global sustainable scale. The global population continuous to grow although the countries experience lower fertility and they debate reversal of the latter¹. The global population increased more than two and a half times in 1950-2015 while the global fertility rate halved in the same period. Moreover, the populations in countries which in 2015 approached a net reproduction rate below 1.0 (i.e., the replacement level) have doubled (United Nations, 2015).

The contemporary forecasts such as those presented by Lutz et al. (2001) suggest demographic stabilisation before the end of the era at the level of around 10 billion people². These estimates meet the expectations of steady-state economics, particularly that even the current human activity has been reported to be beyond the sustainable scale (Bodini & Klotz, 2009; WWF, 2014); however, the economic mechanism of demographic stabilisation is related to negative changes in consumption patterns in terms of their environmental impact, which can further deepen ecological problems.

Lutz et al. expressed a hope that *the prospect of an end to world population growth is welcome news for efforts towards sustainable development* (Lutz et al., 2001, p. 544). However, population growth is interrelated with affluence as presented in many theories of behavioural economics and there is no research provided to define whether the tradeoff of level of affluence for demographic stabilisation is sustainable. Consequently, in light of the excessive human-related burdens of the present ecosystem of Earth (WWF International, 2016), the tradeoff between affluence and population size should hamper further environmental burdens.

A significant increase in consumption, among others, is negatively correlated with fertility trends. The trends correspond with the ecological perspective according to the key assumptions presented in the

IPAT³ model, however, the phenomena are not conducive to stability in terms of socio-economic systems. Population ageing confirms the challenges of the simplistic formulas such as IPAT proposed in the 1970s pointing to the demographic structural transitions of the human population and their role in the sustainable development of socio-economic systems (Dietz & Rosa, 1994). There are circumstances in which the lower fertility forecasts seriously challenge economic stability and hence there is implemented policy to increase fertility, particularly in developed countries.

Furthermore, there is no effective economic mechanism to balance affluence and population change from both the global perspective and the limits to affluence. The former results in the structural problems related to the unequal distribution of affluence and population and local policies detached from the global situation, while the latter does not take into account environmental burdens resulting from this balance. In other words, in the latter, there is no effective mechanism of human fertility regulation according to the level of affluence tolerated by natural ecosystems from the perspective of intra- and inter-generational sustainability. These issues have to be politically regulated from the global perspective.

This paper analyses the economic challenges for sustainable development determined by the demographic transitions. Three main aspects of the problems are analysed: 1) the structural character of the contemporary stage of population ageing, 2) the correlation between consumption level and fertility and 3) the biocapacity and ecological footprint of the present economies. These phenomena help us to understand the problems of a steady-state economy from the perspective of the demographic transition in this century. It is aimed at local actions and global thinking; therefore, national policies take into account the global conditions. It is an evolutionary perspective that deals with three main perceptions of the adaptation of human beings to the environment indicated in the debate about sustainable development: ecology, economy and society.

The research in this paper does not tend to diminish the threats of a serious long-run decline in fertility such as those reported in some studies in German-speaking countries when the childbearing-related support has been reduced (Goldstein et al., 2003). There are serious complications from the present perspective of the national economies related to the difficulties in resolving these problems, for example, by increasing immigration⁴. However, the research refers to the global perspective of the steady-state global economy and it emphasizes the evolutionary

¹ For example, Zimmer (2016) reported the measures of German policy-makers who placed their hopes in migration and family policies to counter population ageing.

² There are also less optimistic forecasts such as those presented by Gerland et al. (2014).

³ $I = P \times A \times T$ (I – human impact on the environment, P – population, A – affluence, T – technology).

⁴ For example, the United Nations report suggested that demographic problems can only partially be offset by immigration because of its socio-economic impact (*Replacement Migration: Is It a Solution to Declining and Ageing Populations?* 2000). See also similar concerns: Bloom et al. (2010), Holzmann et al. (2005), Bongaarts (2004), or Jackson (2002).

perspective to address the issue. According to this, the global ecosystem capacity remains unchanged regardless of the problems of local economies. This paper points out the maladjustments between the local socio-economic settings and the global situation; additionally, it points out the quality and quantity disparities between the factors of the IPAT model that result from incoherency with the conception of sustainable development.

2. The world population, fertility and longevity from the evolutionary perspective

The economic debate on population ageing frequently raises concerns about economic performance and the future burdens generated by pension systems (Hinz et al., 2012; ESF, 2010; Sikken et al., 2008; Bakshi & Chen, 1994). The demographic transition has been linked with both low fertility and longer lives. Additionally, some temporary economic problems have been reported related to the generation of baby boomers born in the 1960s (Kang, 2013; Mankiw & Weil, 1989). Mostly considering the unfunded pension schemes⁵, these studies suggest a financial gap between the pension benefits at their retirement age and the contribution burdens of their fewer children (Howe & Strauss, 1992). The threats to economic growth related to the coverage gap results in measures toward higher fertility, although the global population continuous to grow. For example, Burger and Delong (2016) question from the evolutionary perspective the predicted stabilisation of population growth. They call for a policy to both keep fertility low and include evolutionary and ecological theory into the demographic debate on population ageing. The postulates would be supported by the model of a long-run stationary population offered by Espenshade et al. (1982) for a society with fertility below replacement and a constant number and age distribution of immigrants.

The replacement fertility level, which stabilises a population size, is usually estimated at 2.1 lifetime births per woman in terms of the total fertility rate (TFR). However, there are differences in the replacement fertility level between developing and developed countries. Espenshade et al. (2003) estimated the level in 1995-2000 from 1.4 in the latter to 3.5 in the former countries. Therefore, the net reproduction rate (NRR) is usually recommended to approximate the replacement fertility level. The index estimates the number of female children per woman subjected during her life to the fertility and mortality rates of a given year.

The global NRR in 2015 approximated replacement level (1.09) with TFR over 2.5 lifetime births per woman; both indices decreased by 35 and 50 per cent, respectively, since 1950 (United Nations, 2015). These explain the present estimates of stabilisation in the near future. However, many countries are effectively reversing the downward fertility trends and the socio-economic problems following from an ageing population challenge the positive population changes from the ecological perspective. A significant sign of these changes is the end of the controversial one-child policy in China in 2015 (Feng et al., 2016; Hesketh et al., 2015). The negative aspects of the policy as well as its limited efficacy should be noted, although there is no reason to increase (or even to stabilise) the Chinese population from the perspective of the population impact on their environment (Fu et al., 2007 or Tubilewicz, 2006). In some developed countries, the downward fertility trends in terms of NRR have been slowed down or reversed since 2000-2005⁶. The high consumption levels of these populations and their downward population trends were in line with the postulates of the sustainable scale.

Table 1 and Figure 1 show that human population has been constantly growing since the 1950s even in the countries with the lowest net reproduction rate and despite the changes in fertility. The populations with NRR below replacement level (i.e., 1.0) represent close to 45 per cent of the world population and their consumption level per capita was three times higher than in the rest of the world in 2015; moreover, these populations have doubled since 1950. The dynamics of life expectancy significantly decreased in this group, however, there is a lack of consensus on biological limits (European Commission, 2014; Kirkwood, 1997)⁷. For example, projections for the European Union countries estimate further growth in life expectancy at birth of 6-7 per cent on average in 2013-2060 (European Commission, 2014).

Demographic speculations should be carefully applied and their probability is strongly limited in the long run. Moreover, there are no arguments for further population growth in terms of human beings' adaptation to the environment (i.e., the ecological perspective). The socio-economic arguments in the population ageing debate are structural phenomena and they need national actions from the global perspective as postulated in the sustainable development debate. The global ecological perspective determines the most required measures from the perspective of a long-run global situation and it frames national policy, pointing out the most suitable tools from all achievable tools for each country.

⁵ In the schemes, pension programmes are paid out of the current contribution of taxpayers.

⁶ For example, Germany, France, United Kingdom or Japan (United Nations, 2015).

⁷ The biological maximum is presently estimated at about 120 years.

Table 1. Demographic transitions in 1950-2015 and GDP per capita in 2015, Purchasing power parity (PPP – current international \$). The countries have been divided into two groups according to whether the net reproduction rate (NRR) is below or above the population replacement level (i.e., 1.0). Source: United Nations, 2015; The World Bank, 2017.

| Variable | Group of countries | Descriptive statistics | | | | | |
|--|--------------------|------------------------|---------------|----------------|---------------|----------------|---------------|
| | | Mean | Median | Std. deviation | Minimum | Maximum | Range |
| NRR [2015] NRR change 1950-2015 [%] | NRR > 1.0 | 1.59 79% | 1.50 76% | 0.49 | 1.00 88% | 3.15 105% | 2.15 115% |
| | NRR ≤ 1.0 | 0.80 49% | 0.79 51% | 0.12 | 0.58 67% | 1.00 35% | 0.42 21% |
| TFR [2015] TFR change 1950-2015 [%] | NRR > 1.0 | 3.66 57% | 3.33 51% | 1.32 | 2.08 66% | 7.63 95% | 5.56 115% |
| | NRR ≤ 1.0 | 1.67 41% | 1.66 46% | 0.25 | 1.19 60% | 2.10 29% | 0.91 17% |
| Life expectancy [years] Life expectancy change 1950-2015 [%] | NRR > 1.0 | 66.64 153% | 67.61 161% | 8.10 | 49.19 182% | 82.07 119% | 32.88 78% |
| | NRR ≤ 1.0 | 77.47 130% | 77.14 126% | 3.77 | 68.88 233% | 83.73 115% | 14.85 34% |
| Old age dependency [2015] Old age dependency change 1950-2015 [%] | NRR > 1.0 | 7.69 111% | 6.60 105% | 3.94 | 1.42 76% | 28.38 148% | 26.96 155% |
| | NRR ≤ 1.0 | 20.71 200% | 20.64 198% | 8.08 | 1.34 41% | 43.32 235% | 41.98 277% |
| Child dependency [2015] Child dependency change 1950-2015 [%] | NRR > 1.0 | 59.22 82% | 56.61 78% | 19.59 | 18.63 49% | 107.48 106% | 88.84 141% |
| | NRR ≤ 1.0 | 26.41 49% | 25.32 53% | 5.54 | 16.39 58% | 41.71 40% | 25.32 33% |
| Population density [persons/sq. km in 2015] Population density change 1950-2015 [%] | NRR > 1.0 | 149 433% | 68 523% | 251 | 2 1900% | 1812 623% | 1810 622% |
| | NRR ≤ 1.0 | 601 273% | 106 159% | 2438 | 3 388% | 19652 299% | 19649 299% |
| GDP per capita, PPP [current international \$] | NRR > 1.0 | \$10818 | \$5535 | \$17779 | \$619 | \$141543 | \$140924 |
| | NRR ≤ 1.0 | \$32028 | \$26950 | \$21957 | \$5049 | \$111497 | \$106448 |
| Group characteristic [2015]: NRR > 1.0: Number of countries: 122; Population: 3935470634; Population change 1950-2015 [%]: 377% Afghanistan, Algeria, Angola, Antigua and Barbuda, Argentina, Azerbaijan, Bahrain, Bangladesh, Belize, Benin, Bolivia, Botswana, Burkina Faso, Burundi, Cabo Verde, Cambodia, Cameroon, Central African Republic, Chad, Comoros, Congo, Côte d'Ivoire, Curaçao, DR Congo, Djibouti, Dominican Republic, Ecuador, Egypt, Equatorial Guinea, Eritrea, Ethiopia, Fiji, French Guiana, Gabon, Gambia, Ghana, Grenada, Guadeloupe, Guam, Guatemala, Guinea, Guinea-Bissau, Guyana, Haiti, Honduras, India, Indonesia, Iraq, Israel, Jordan, Kazakhstan, Kenya, Kiribati, Kuwait, Kyrgyzstan, Lao PDR, Lesotho, Liberia, Libya, Madagascar, Malawi, Maldives, Mali, Mauritania, Mayotte, Mexico, Micronesia, Mongolia, Morocco, Mozambique, Myanmar, Namibia, Nepal, New Caledonia, Nicaragua, Niger, Nigeria, Oman, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Qatar, Réunion, Rwanda, Samoa, Sao Tome and Principe, Saudi Arabia, Senegal, Seychelles, Sierra Leone, Solomon Islands, Somalia, South Africa, South Sudan, Sri Lanka, State of Palestine, Sudan, Suriname, Swaziland, Syrian Arab Republic, Tajikistan, Timor-Leste, Togo, Tonga, Tunisia, Turkmenistan, Uganda, UR Tanzania, US Virgin Islands, Uzbekistan, Vanuatu, Venezuela, Western Sahara, Yemen, Zambia, Zimbabwe. | | | | | | | |
| NRR ≤ 1.0: Number of countries: 81; Population: 3400398310; Population change 1950-2015 [%]: 199% Albania, Armenia, Aruba, Australia, Austria, Bahamas, Barbados, Belarus, Belgium, Bhutan, Bosnia and Herzegovina, Brazil, Brunei Darussalam, Bulgaria, Canada, Channel Islands, Chile, China, Hong Kong, Macao, Colombia, Costa Rica, Croatia, Cuba, Cyprus, Czech Republic, DPR Korea, Denmark, El Salvador, Estonia, Finland, France, French Polynesia, Georgia, Germany, Greece, Hungary, Iceland, Iran, Ireland, Italy, Jamaica, Japan, Latvia, Lebanon, Lithuania, Luxembourg, Malaysia, Malta, Mauritius, Montenegro, Netherlands, New Zealand, Norway, Poland, Portugal, Puerto Rico, Republic of Korea, Republic of Moldova, Romania, Russian Federation, Saint Lucia, Saint Vincent and the Grenadines, Serbia, Singapore, Slovakia, Slovenia, Spain, Sweden, Switzerland, TFYR Macedonia, Thailand, Trinidad and Tobago, Turkey, Ukraine, United Arab Emirates, United Kingdom, United States of America, Uruguay, Viet Nam. | | | | | | | |

Moreover, population speculations since T. Malthus have been showing that the socio-economic and ecological limits for demographic expansion posited in scientific debates are challenged by multifactorial continuous changes. For example, the distribution of human population in terms of population density, such as those in Macao which accounted for 20 000 people per sq. km (United Nations, 2015), suggests a far more extensive capacity of Earth. However, it should be investigated from the perspective of the uneven distribution of population (e. g., there are only 50 people per sq. km in the US) and the socio-economic and ecological relationships between different regions of the earth. The resources for life in the most populated countries are provided by the other parts of the world similar to the example of

rainforests, which are perceived as the lungs of the planet (Kesel & Sedlak, 2014).

The evolutionary approach is not predictive and its explanatory meaning only refers to the present and past conditions (Norgaard, 1994). Consequently, both the *distinctive character* and the *future-open development* of evolutionary processes, as have been described by Hayek (Dopfer, 2016, p. 177), are restrictions for the adoption of the future limits for human population growth. Therefore, the research presented here is not an argument for the determination of the absolute number of human population on Earth. It is a long-run global perspective of sustainable development, which refers the demographic changes to the contemporary socio-economic and ecological postulates.

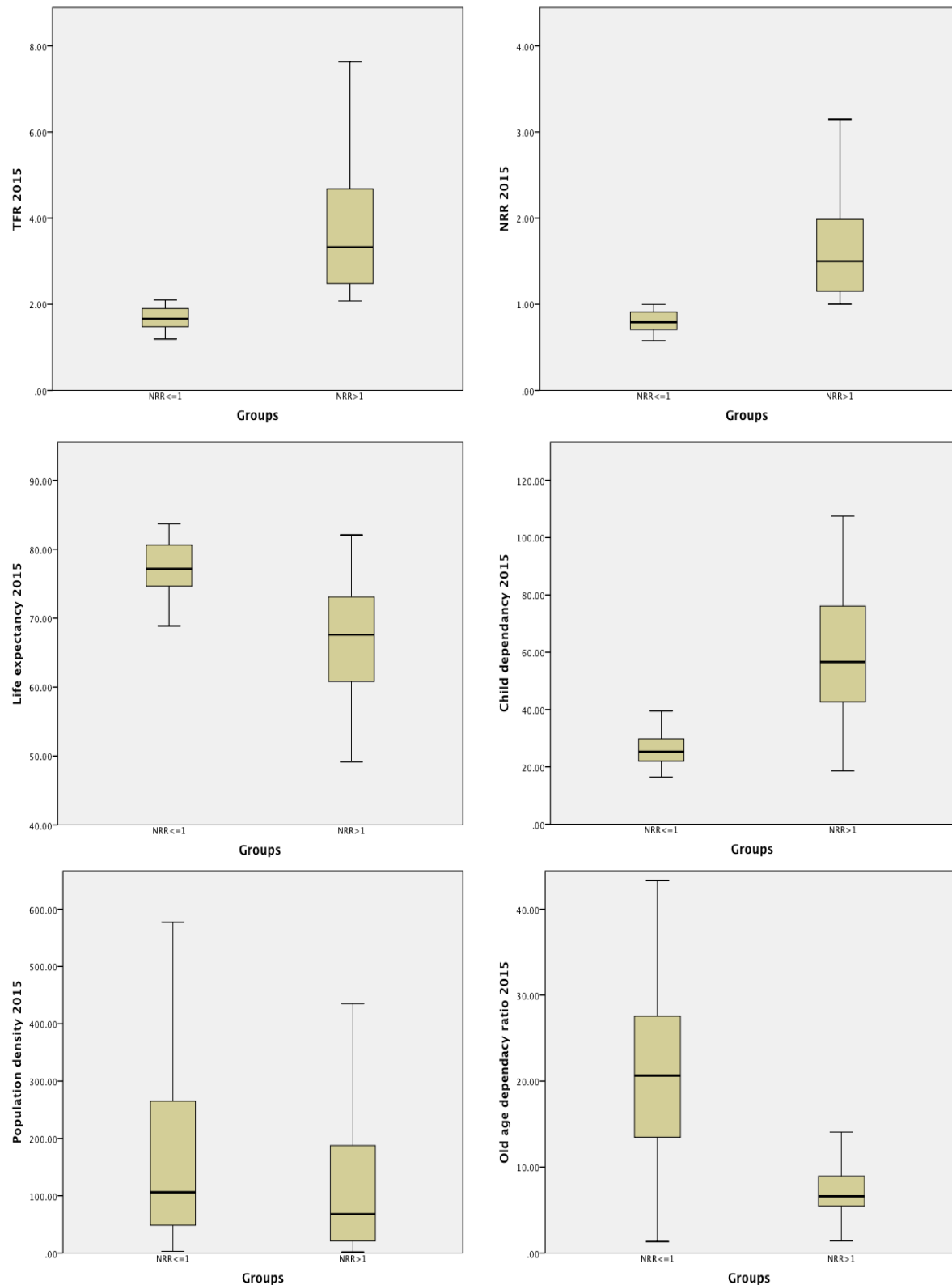


Figure 1. Differences between two groups of countries classified according to their net reproduction rate in 2015. Groups: $NRR \leq 1$ (left side) and $NRR > 1$ (right side). Variable included: Total fertility rate (TFR), net reproduction rate (NRR), population density, old age dependency ratio, child dependency ratio, life expectancy. Line – median; hinges – 25% and 75%; fences – 95%. Source: United Nations, 2015.

3. Structural character of demographic problems

The expected stabilisation of the human population postulated in the concept of sustainable development⁸ is challenged by the socio-economic problems resulting from the demographic transitions. The key problems of developed countries discussed are as follows: inadequate pension schemes, an increase of public transfers related to social security, a decrease of savings and physical capital formation and socio-cultural problems with immigrants. The character of political power and ideological biases influence the postulates of regulations and solutions. These problems are rooted in the socio-economic structures of national economies and the resources and solutions exist from within the global perspective.

The inadequateness of pension schemes usually is related to unfunded ones, which were launched in many developed countries after World War II. However, at this time the solution seemed to be the most effective and justified by the demographic and economic settings. The advantageous ratio of workers to pensioners⁹, the ability to benefit regulations in line with the economic performance, population growth as well as a lack of funds by seniors in the post-war period favoured unfunded schemes (Kuné, 2001).

The unique in human history demographic transition follows two convergent trends associated with economic growth. Lower fertility is linked with the need for both significant investments in human capital as suggested in the quality-quantity theory by Becker (1960) and socio-cultural factors indicated by Easterlin (1975; 1971; 1961) or Caldwell (2006). These investments will continue to be stimulated in the knowledge-based economy because of the increase of childbearing costs and emphasis on the quality of offspring at the expense of their quantity.

In turn, longevity brings a new socio-economic role for seniors. The social significance of this cohort rises with the increase of both its political power and quality of life commensurate with its quantity of years (Angel & Settersten, 2013). Therefore, the economic position of seniors is also of importance as their economic activity substantially decreases and consumption rises together with the growth in health care spending (mostly publicly provided) and the new models of lifestyle¹⁰ (e. g., they tend to run separate households or continue their formal education) (Lee & Mason, 2011b).

Today, these two trends mainly challenge unfunded pension systems and social security policy in developed countries. The socio-economic transitions are linked to industrial revolutions characterized by an

increase of both investments in human capital and leisure activities of seniors as well as the shift of social security costs to the State. Table 2 shows some economic changes between hunter-gatherer groups that dominated at the beginning of human history and industrial societies from the perspective of the position of elderly people. The latter is distinguished by rises in consumption, leisure activities and upward transfers to elderly people, particularly in high-income countries. All these changes challenge the economic growth and social security systems of industrial societies.

Table 2. The present hunter-gatherer groups and industrial societies from the perspective of the economic position of elderly people. *Source: own elaboration from Lee and Mason, 2011b.*

| | Hunter-gatherer groups | Industrial societies |
|------------------------------|---|--|
| Consumption | Relatively constant across all adult ages | Rises strongly with age, mainly because of publicly funded health care and long-term care |
| Dependency range | Only children depended on adults | Children and elderly are dependent |
| Working age | Income starts and peaks earlier; Adults remain net producers even in old age | Income starts and peaks later; and declines precipitously to nearly zero |
| Private and public transfers | Private transfers flow downward; Net direction of public transfers is downward (old to young) in most societies | Private transfers flow downward; Net direction of public transfers is downward (old to young) in some societies and upward in others (mostly rich) |

For example, the time series data research originally presented by Feldstein (1974) or later by Pfau (2005) suggested a significant decrease in personal savings (up to 50 per cent) accompanying social security programs. The US Congressional Budget Office in 1998 claimed that one dollar of social security wealth decreases other assets up to fifty cents; however, it ranged from zero to fifty cents in different countries (Page, 1998). The contrary evidence mainly indicates either methodological problems with the time series data or incoherence (Lesnoy & Leimer, 1985; Darby, 1979; Barro, 1978; Esposito, 1978; Munnell, 1974).

The discourse can also be referred to Ricardian equivalence theory (Ricardo, 1888)¹¹ and government expenditures, which may limit resource accessibility for private sectors subsequently reducing pri-

⁸ An operational principle presented among others in the Brundtland Report (WCED, 1987) or Daly (1990).

⁹ It was the *baby boom* period characterized by a high birth rate.

¹⁰ The attitudes toward post-retirement lifestyles and consumption patterns are presented by Hopkins et al. (2006) or Hung & Lu (2014), among others.

¹¹ An increase in government spending raises expectations of future tax expansion, therefore, it has no effect on aggregate demand.

vate savings. The dominant conclusion from the latest research suggests only a partial private saving offset to a public sector deficit (McMorrow & Roeger, 2004). Various distorting variables are indicated, such as bequest and precautionary motives, information asymmetry or behavioural proficiencies (Schwarz et al., 2014; McConnell, 2013; Holzmann et al., 2005; Willmore, 1998).

These studies usually involve recommendations on the reforms of social security systems and changes favouring funded pension schemes. An increase of private savings is conducive to capital formation and further economic growth. However, the interdependence of economic growth on various factors such as ineffective or instable financial markets (Bebczuk & Musalem, 2009; Holzmann et al., 2005), capital depreciation because of a lower interest rate affecting private asset gains (Mason & Lee, 2011; Hemming, 1999) or many other determinants of investments among others posited by Keynes (1964) or Kalecki (1951) should be noted.

The complex character of socio-economic systems pictured in the debate on population ageing leads to policy recommendations that take into account various functions and both social and economic goals. For example, World Bank researchers postulate multi-pillar pension systems, which simultaneously involve funded and unfunded, voluntary and mandated as well as privately and publicly provided schemes (Schwarz et al., 2014; Holzmann et al., 2005; The World Bank, 1994). These systems balance social security postulates related to the function of unfunded schemes (e. g., resulting from unemployment and the situation of low income groups) with the economic performance presented in the reforms toward funded ones.

The economic problems are linked to the relation between productive and non-productive age cohorts. The analyses are reflected in the numerous types of relations such as total dependency ratio or old age and child dependency ratios¹². The world total dependency ratio decreased in 1950-2015 by 20 per cent, however, the old age dependency ratio increased by 50 per cent over the same period (United Nations, 2015). The adverse effects are particularly noticed in some countries (see Table 1), in which old age dependency ratio has doubled on average while simultaneously child dependency ratio has decreased by half.

These disadvantageous demographic structures in these countries draw attention to family policy and reproduction measures. Tsui (2001) reported that 9 per cent out of 156 countries in 1976 launched policy to raise fertility and 25 per cent tried to lower it. Twenty years later 13 per cent out of 179 countries raised fertility, while 45 per cent lowered it. The most advanced public policies reached a level of

over 3.5 per cent of the GDP in 2007 in the Organisation for Economic Co-operation and Development countries: United Kingdom, France, Denmark and Iceland (Luci-Greulich & Thévenon, 2013). However, population density, for example in the United Kingdom, reached 268 persons per sq. km in 2015 and it increased by 28 per cent in 1950-2015 (United Nations, 2015). It is one of the most populated countries in Europe in terms of both population density and total population.

The average population density in Europe increased by 35 per cent in 1950-2015, achieving 33 persons per sq. km in 2015. The density index among the above-mentioned countries has been much below the European level only in Iceland with only 3 persons per sq. km (United Nations, 2015). There is no reason to continue demographic expansion from the ecological point of view even at the national level in the rest of these European countries. The rise in fertility in the developed countries results from both the economic policy in terms of capital accumulation as well as the present socio-economic institutions shaped by national economies.

The developed countries with lower fertility experience serious problems with social security due to the socio-economic changes typical for industrial societies (see Table 2). Additionally, the economic policies are based on the idea of a market economy shaped by neoclassical economists in which an economic policy without quantity effects threatens welfare. Wan (1971) noticed that the neoclassical and post-Keynesian conceptions of growth lack the conception of natural resources in their analyses. They are mostly focussed on the relationships between investments and savings and the demographic changes threaten their increases (Feldstein, 1974; McMorrow & Roeger, 2004; Pfau, 2005)¹³ resulting in capital destruction. The sustainable development idea presented, among others, in the conception of steady-state economics by Daly (1991) assumes stable levels of both human and physical capital stocks due to the limits set by the environment. This is in line with the works by Mill who emphasizes quality changes in a stationary state economy (Buckley, 2011; Mill, 1871).

The demographic issue is a structural problem both at the global and very often also national levels. There are enough labour force stocks within the present economic settlements as well as policy measures in line with the requirements of the ecological system. Population growth is usually related to the process of capital accumulation and labour force growth, as in the seminal neoclassical one-sector model of growth by Solow (1999). The relationship between technical progress as well as labour and capital stock growth determines economic performance. An upward shift of the path of the capital-

¹² The ratios of the number of economically inactive people (i.e., children and seniors) compared to the number of working age people (i.e., usually 15-64) (Eurostat, 2016a).

¹³ It has to be noticed that the scientific analyses are inconclusive as presented in many other studies, see: Esposito (1978) or Lesnoy & Leimer (1985).

labour ratio in a long-run equilibrium is only induced by technical progress; nevertheless, the output is only limited by supplies of labour and capital.

There is usually a selection of effective solutions specific for a country or a group of countries. The population ageing debate provides all the possible measures, such as the increase of the working age period and/or the decrease of pension benefits (Schwartz, 2006), but the global perspective enforces some of them due to the situation in other socio-economic systems and ecological settings. The condition of the present ecological systems presented in research suggests, in many Western countries, a migration policy and major socio-cultural and economic reforms to rebuild economic systems and pension policies. For example, a longer working age period particularly can be provided in societies with higher capital intensity characteristically associated with the automation of production processes.

Additionally, immigration policy in the Western countries raises many concerns (Givens, 2013; Bloom et al., 2010; Holzmann et al., 2005, or Jackson, 2002). For example, the United Nations report suggested that demographic problems can only partially be offset by immigration because of its socio-economic impact (United Nations, 2000). The difficulties were evident in 2015 when the European migration crisis began and the existing migration policy proved ineffective (Baldacchino & Sammut, 2016), but they have also been witnessed in the US since the very beginning, although there are a lot of successful examples of coexistence within a multicultural society. Finally, some societies are much less experienced and the integration policy has been poorly developed seriously limiting the population ageing measures. However, even having an immigration policy is seen as the key solution (or even the only one) in Japan (Nagy, 2015).

In turn, the migration apprehensions Espenshade (2001) perceived as short-run problems are alleviated in the longer (intergenerational) run when new generations of immigrants arrive. The global political consequences of the changes should also be noticed. For example, Bouvier (2001) speculated that the present demographic transition from the global perspective is a *tectonic change in population distribution* (Bouvier, 2001, p. 381) and accordingly a shift of political power into the new parts of the world (i.e., China or India).

4. The balance between fertility and consumption from the perspective of behavioural economics

Becker's works (Becker, 2007; 1960; Becker et al., 1990; Becker & Barro, 1988; Becker & Lewis, 1974) paid attention to the relationships between economic growth and fertility. They proposed an economic

mechanism to explain the demographic changes and showed that an economic policy needs to take into account the socio-economic interdependencies. The quantity-quality theory suggests that households tradeoff between the number of children and the quality of their upbringing within a given budget constraint. A rise in income increases quantity (a positive income effect) and investments in quality (a negative substitution effect). The latter increases the costs of upbringing per child. The net effect results from the two opposite strategies which can lead to lower fertility (Doepke, 2015).

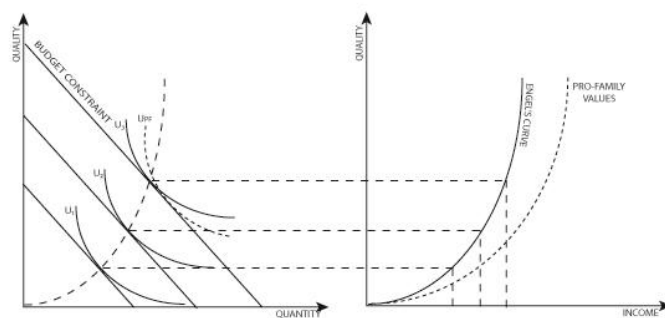
The two-generational model of Becker and Barro (1988) assumed altruistic motives in the behaviour of parents toward their children. The conception of a dynastic utility function assumes that the utility of parents is also determined by the utility of their children. Therefore, the basic analytical unit in microeconomics has been shifted from an individual to a household level and intergenerational relationships. Dynastic utility depends on the utility and quantity of the next generations. Fertility corresponds positively with the real interest rate, the time preference factor and the degree of altruism but negatively with the rate of consumption growth per capita across generations. Individuals tradeoff between the latter costs and benefits in terms of dynastic utility maximization.

In turn, Easterlin (Table 3) attributed fertility to two main counter-balancing determinants of demand for children: 1) the subjective tastes of parents for goods and children and 2) the constraints of price (related to childrearing) and their income. Consequently, the preferences for abundant material lifestyle of potential parents hampers fertility if the parents are not satisfied with their economic situation, and economic growth generally increases demand for children who are treated as normal economic goods (Figure 2). Therefore, Easterlin posited that taste formation is crucial to change the decreasing fertility trends as the other determinants are external (Easterlin, 1975).

The taste variable also explains the determinants provided by the quality-quantity theory by Becker. However, the latter claims that the tradeoff between quantity and quality is determined by economic conditions, while Easterlin attributed it to cultural settings (i.e., individual tastes for family size or investments in quality); additionally, he pointed to biological (physiological) and other social determinants of natural fertility that includes the costs of fertility regulation (such as access to information or the prices of specific regulation techniques) (Easterlin, 1975). The socio-biological angle of fertility demand in the works of G. Becker is mostly related to altruism although it is a fixed determinant understood similarly to the idea presented in the works of Hamilton (1972; 1964)¹⁴.

¹⁴ The idea of altruism originally has been presented in biological sciences by Hamilton. He presented a genetic mathematical model

of kin selection and inclusive fitness to explain selfish motives of pro-social behaviour (see Pieńkowski, 2009). In this model, the



U₁, U₂, U₃ – utility curves related to different income levels

Figure 2. Engel's curve illustrates demand for quality as a function of income regarding Becker's and Easterlin's theories. Children are normal goods with different quality characteristics. Quality is considered as a luxury good, while quantity as a necessary one. Pro-family values shift Engel's curve to the right (tastes, altruism). Source: modified from Merella, 2006.

Table 3. Selected theories of fertility and their relation to economic development. Source: own elaboration.

| | R. A. Easterlin <i>Easterlin hypothesis</i> | G. Becker <i>Quality-quantity tradeoff</i> | J. C. Caldwell <i>Transition theory</i> |
|------------------------------|--|---|--|
| Main dependant variable | system of values | consumption per capita | social patterns of wealth transfer |
| Proximate cause | social | economic | social |
| Role of economic growth | increase fertility | decrease fertility | secondary to social patterns |
| Character of economic growth | cyclic | secular | secular |

Easterlin utilized the socio-economic determinants to explain fertility fluctuations using the concept of Kuznets (Easterlin, 1961). He suggested that cyclical fluctuations in fertility are naturally generated by the different sizes of cohorts and the standard of living related to them. An increase in fertility is caused by a decline in the size of the children's cohort because lower competition in labour markets and higher wages increase the material conditions of the children. However, the next generation will have to tackle the new conditions in the labour markets resulting from the increase in fertility, and the number of grandchildren will decrease together with the lower material conditions in the next stage of development. The changes are determined by the new socio-economic settings, which require distinctive strategies to ensure successful adaptation to the new environment (Easterlin, 1971; Easterlin et al., 1990). Caldwell (2006) referring to Marx's ideas emphasized the role of socio-biological factors (e. g., sexual behaviour such as polygamy or a more honourable position for women with many children) which determine family sizes and changes in fertility. The economic determinant in this theory is a dichotomous variable (i.e., indefinitely large number of children or childless). Since in modern societies downward transfers of money, goods, and other resources dominate, singlehood is the most rational behaviour from the economic point of view, contrary to the previous stages of development. In this theory, the crucial economic determinant is related to the patterns of wealth transfer between generations and the cost

of childrearing; changes arising because of the long-term education of children in place of their participation in both labour markets and household duties. However, the economic consequences are secondary to the social revolution that caused the new patterns of familial obligations (Caldwell, 1976).

In turn, Cox and Stark (2007) suggested potential motives for private downward transfers and childbearing. They studied behavioural drivers of private resource flow direction in a three-generation analysis domain (i.e., children, parents and grandparents) finally indicating two-way transfer motives. Downward transfers were in the form of tied transfers¹⁵ to encourage the production of grandchildren, while upward ones in the form of help and assistance to instil values desired by parents in their children (to secure parents' own old-age). They coined the term *demonstration effect* to explain parents' demand for grandchildren. The parents expect better treatment by their children as they enter retirement age by providing desired behaviour patterns. However, the mechanism only works when the children have someone to demonstrate the values; thus, it explains the downward transfers (Cox & Stark, 2007). The behaviour historically occurs (and still remains in special rituals in many societies) in the form of arranged marriages by parents to secure family fortunes and resources for parents' future (Sevelius, 2013).

Additionally, Bongaarts (2004) noticed a mechanism that secures the elderly group revealing that high public transfers ratio is accompanied by a

level of altruism in a given interaction between two individuals is based upon the genetic relations between them. The probability of altruism increases together with the coefficients of relationship between children and parents as the former hold 50 per cent of the genes of the latter; the same ratio holds between siblings but identical (monozygotic) siblings hold the same genes. However, the

probability decreases between grandparents and grandchildren as the latter hold only 25 per cent of the genes of grandparents and between cousins it decreases further (12.5 per cent).

¹⁵ *Tied transfers* – transfers to purchase particular goods such as a house (Cox & Stark, 2007).

higher number of pensioners per worker. The association has been explained by reciprocal causation. An increase in retirement age politically empowers that cohort resulting in higher demand for public benefits, while higher public transfers are conducive to early retirement. It can be remarked that the lack of political power by grandchildren secures grandparents' interests at the cost of downward transfers. However, longevity can result in the rise of the grandparents' attention to grandchildren if they enter working age still having grandparents. Investments increase the grandchildren's production power substantially, improving their capacity to support the grandparents' cohort. The grandparents can both politically and by private transfers support their grandchildren.

The above theories depicted the main factors of fertility patterns showing the complexity of interdependencies between the social, biological and economic determinants of fertility; Becker's works particularly paid attention to the economic perspective of decision making. The tradeoff between the quality and quantity of children observed in many developed countries suggests an increase in affluence at the cost of offspring quantity. However, the affluence needed to achieve the demographic stabilisation in developed countries would exorbitantly increase environmental burdens even at the present level of world population. The world ecosystem is strained even with the present level of affluence attributed to less than 50 per cent of the world population.

5. Is the quality-quantity tradeoff sustainable?

The concept of sustainability is multifaceted and there are many perspectives to measure it. Also discussed is the conception of ecological footprint as an indicator of environmental burdens generated by human beings (Costanza, 2000; Wackernagel et al., 1999). They are presented in terms of the ecological deficit resulting from the balance between the supply of ecosystem services and the demand for them created by human populations. The former is defined as biocapacity and represents productivity of ecological assets, while the latter is defined as ecological footprint and it measures the use of the assets including services such as absorption of carbon emissions, which are heavily debated from the perspective of global climate change. The factors are accounted for in global hectares, which are standardized hectares with world average productivity (Global Footprint Network, 2017a).

The calculations based on this concept reveal an increasing gap between the two factors of sustainability. The ecological footprint of contemporary global society accounted for 2.87 gha per person on average in 2013, while the biocapacity of the world ecosystem was supposed to be 1.71 gha per person over the

same period. This means that the contemporary human population consumes almost double what is acceptable from the perspective of ecosystem stability (at the level of resource demands globally replicable). Therefore, as the negative trend has already been taking place since the 1970s, the ecological concerns are increasingly accompanied by political action.

However, the balance between quality and quantity, resulting in the lower fertility typical for many developed countries, does not correspond with lower ecological deficit in these countries. Most of the countries in the group with NRR below 1 (Table 1) have exceeded their biocapacity at the present stage of development (Table 4). The gap in this group of countries amounted to -89 gha per person with a median of -1.5 gha, while the group of countries with NRR higher than 1 revealed a reserve of 257 gha per person with a median of -0.4 gha (Global Footprint Network, 2017b).

Spearman's correlations were run to determine the relationship between ecological footprint and both NRR and GDP per capita values (PPP – current international \$) in 2013 (for most of the countries in Table 4, which have provided both values). There was a strong negative monotonic correlation between ecological footprint and NRR ($r_s = -0.69$, $n = 182$, $p < 0.001$) and very strong positive one between ecological footprint and GDP per capita ($r_s = 0.89$, $n = 170$, $p < 0.001$). The analyses suggest that the countries with higher rates of fertility (in the terms of NRR) usually related with lower affluence as presented in the quality-quantity theory do not contribute to such serious environmental burdens as do affluent (measured in the terms of GDP) developed countries with fertility problems. The depopulation in the developed countries resulting from the increase in wealth needed to reduce environmental burdens does not compensate the extent to which the wealth growth is needed to keep a country at a sustainable level of development.

The differences between these groups classified by the level of NRR shows some significant statistical differences in terms of GDP per capita, ecological footprint and ecological deficit between the countries with NRR lower than 1 and the rest of the countries with positive reproduction rates (Table 5). However, the ecological footprint should additionally be related to the biocapacity of each country as they vary in their biological conditions. There were 55 countries with ecological reserves in terms of their ecological footprint and only 15 countries among them belong to the group of countries with $NRR \leq 1$ (e. g., Scandinavian countries without Denmark, Canada, Russian Federation, Brazil and Australia). In the other words, taking into account national perspectives there are only ecological grounds for the increase of population in these countries.

Table 4. Ecological deficit in two groups of countries (with $NRR > 1$ and $NRR \leq 1$) in gha per capita. *Source: own elaboration from Global Footprint Network, 2017b.*

| Group of countries | $NRR > 1.0$ n = 109 | $NRR \leq 1.0$ n = 73 |
|--|--|---|
| Ecological deficit | 257.3 | -89.3 |
| Median | -0.4 | -1.5 |
| Standard dev. | 14.7 | 3.4 |
| Minimum | -11.4 | -11.5 |
| Maximum | 103.7 | 7.4 |
| Mann-Whitney U test = 2475 $n_1 = 109, n_2 = 73$, $p < 0.001$ K-S test = 0.32741, $p < 0.01$ S-W test = 0.32232, $p < 0.001$ | Afghanistan, Algeria, Angola, Antigua and Barbuda, Argentina, Azerbaijan, Bahrain, Bangladesh, Benin, Bolivia, Botswana, British Virgin Islands, Burkina Faso, Burundi, Cabo Verde, Cambodia, Cameroon, Central African Republic, Chad, Comoros, Congo, Congo, Democratic Republic of, Côte d'Ivoire, Djibouti, Dominican Republic, Egypt, Equatorial Guinea, Eritrea, Ethiopia, Fiji, French Guiana, Gabon, Gambia, Ghana, Grenada, Guadeloupe, Guatemala, Guinea, Guinea-Bissau, Guyana, Haiti, Honduras, India, Indonesia, Iraq, Israel, Jordan, Kazakhstan, Kenya, Kuwait, Kyrgyzstan, Lao People's Democratic Republic, Lesotho, Liberia, Libyan Arab Jamahiriya, Madagascar, Malawi, Mali, Mauritania, Mexico, Micronesia, Mongolia, Morocco, Mozambique, Myanmar, Namibia, Nepal, New Caledonia, Nicaragua, Niger, Nigeria, Oman, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Qatar, Réunion, Rwanda, Samoa, Sao Tome and Principe, Saudi Arabia, Senegal, Sierra Leone, Solomon Islands, Somalia, South Africa, South Sudan, Sri Lanka, Sudan, Suriname, Swaziland, Syrian Arab Republic, Tajikistan, Tanzania, United Republic of, Timor-Leste, Togo, Tonga, Tunisia, Turkmenistan, Uganda, Uzbekistan, Vanuatu, Venezuela, Bolivarian Republic of, Yemen, Zambia, Zimbabwe. | Albania, Armenia, Aruba, Australia, Austria, Bahamas, Barbados, Belarus, Belgium, Bhutan, Bosnia and Herzegovina, Brazil, Brunei Darussalam, Bulgaria, Canada, Chile, China, Colombia, Costa Rica, Croatia, Cuba, Cyprus, Czech Republic, Denmark, El Salvador, Estonia, Finland, France, French Polynesia, Georgia, Germany, Greece, Hungary, Iran, Islamic Republic of, Ireland, Italy, Jamaica, Japan, Latvia, Lebanon, Lithuania, Luxembourg, Macedonia TFR, Malaysia, Malta, Martinique, Mauritius, Montenegro, Netherlands, New Zealand, Korea, Democratic People's Republic of, Norway, Poland, Portugal, Romania, Russian Federation, Serbia, Singapore, Slovakia, Slovenia, Spain, Saint Lucia, Saint Vincent and Grenadines, Sweden, Switzerland, Thailand, Trinidad and Tobago, Turkey, Ukraine, United Kingdom, United States of America, Uruguay, Viet Nam |

Table 5. Man-Whitney U test in two groups of countries (with $NRR > 1$ and $NRR \leq 1$) for GDP, ecological footprint and ecological deficit. *Source: own elaboration from Global Footprint Network, 2017b and The World Bank, 2017.*

| | U | Z adjusted | p | N_1 | N_2 |
|---|------|------------|-------|-------|-------|
| GDP per capita (PPP - current international \$) | 848 | -8.3 | 0.001 | 100 | 69 |
| Ecological footprint per capita (gha) | 1185 | -8.0 | 0.001 | 109 | 73 |
| Ecological deficit per capita (gha) | 2475 | 4.3 | 0.001 | 109 | 73 |

Spearman's correlations were run to determine the relationship between ecological deficit and both NRR and GDP per capita values (PPP – current international \$) in 2013 (for most of the countries in Table 4, which have provided both values). There was a moderate, monotonic correlation between these variables (respectively $r_s = 0.44$, $n = 182$, $p < 0.001$ for NRR and $r_s = -0.45$, $n = 170$, $p < 0.001$ for GDP). The analysed factors are dependent on many other socio-cultural and environmental determinants discussed in the previous sections together with such as the Chinese direct regulation of a one-child policy or the pro-ecological technological advancements in many developed countries. Moreover, these are very simplistic estimates even from the national perspectives because of many other structural or quality factors such as the uneven distribution of population typical for urban areas, which should be further investigated.

Nevertheless, the European countries such as those mentioned above with fertility policies – United Kingdom, Denmark and France¹⁶ – are far above their biological capacities according to this research. The biocapacity in the United Kingdom was 1.27 gha per person in 2013 and 4.57 and 2.91 gha per person for Denmark and France, respectively, with

3.24 gha per person for Europe. However, the ecological footprint was on average 2–4 times higher in these countries (5.05, 6.11 and 5.06 gha per person, respectively) with 4.87 gha per person for Europe (Global Footprint Network, 2017b). There are no ecological arguments for a fertility policy aimed at population increases in these three countries or even their stabilisation at the present levels without policies toward both new pro-ecological consumption patterns and/or technological advancements.

The research shows that the quality-quantity tradeoff lacks sustainable patterns of development even in the countries with far advanced ecological policy and technology such as Denmark among the European Union members. For example, the energy intensity ratio¹⁷ of the Danish economy is one of the lowest in the European Union (see Pieńkowski, 2012). Denmark was also the only net exporter of primary energy in the European Union for many years, although this was reversed in 2013 and the energy dependency rate¹⁸ is now positive like in the rest of the European Union members (Eurostat, 2016b). Nevertheless, an ecological deficit has been occurring despite the highly technological advancements and the decrease in population for many recent years with the deficit reaching over 1.5 gha per person in 2013; in turn, Nigeria with one of the highest NRR in the world

¹⁶ Iceland was not included in the dataset provided by the Global Footprint Network.

¹⁷ *Energy intensity of the economy* – gross inland consumption of energy divided by GDP (kg of oil equivalent per 1 000 EUR) (Eurostat, 2016b).

¹⁸ *Energy dependency rate* – the proportion of energy that an economy must import (Eurostat, 2016b).

(over 2 in 2013) has a deficit of only 0.4 gha per person in the same year (Global Footprint Network, 2017b).

These quantity-quality estimates are to be treated as an initial indication of trends for national policies, as both the fertility and wealth are heavily dependent on many other factors. The gap between biocapacity and ecological footprint of contemporary societies has to be reduced by technology or sustainable balance between the present population size and its affluence. However, the behavioural economic research challenges the possibilities and it will be difficult to achieve this without a global policy.

The socio-economic determinants of fertility are interrelated. The economic settings should be treated as an element of social development; simultaneously, they substantially shape the behaviour of individuals and social values. This explains dissimilarities of market economies and the specific conditions of policy in particular countries or groups of countries (Hall & Soskice, 2001). It is clear even to the most liberal economists that market economy has to be designed and protected by institutions (Nozick, 2013). Ageing policy is then an element of social development and it should respond to the economic as well as social settings of each country; there is no one universal measure to regulate the specific conditions.

6. Conclusion

This view assumes that the present demographic problems are rooted in the socio-economic institutions and there is no problem of lower fertility or ageing population from the global perspective. The biocapacity of the globe also does not constitute limits for further population growth providing there are changes in consumption patterns and other socio-economic changes. However, population growth for the needs of an economy, which exposes the society to further environmental problems, is harmful; the socio-economic institutions should be changed to meet the present demographic changes.

If a family policy is accepted for the needs of an economy as occurs in many countries, the reverse policy should also be accepted for the needs of ecological systems. Both policies are aimed at the quality of life and human beings despite their opposing directions resulting from different perspectives. These policies also have their own ethical reasons and each may contain some form of restriction of freedom if based on direct regulations, for example, punishment for abortion (Blofield, 2013; David et al., 1988) or punishment for another child.

The postulates of population limits in developing countries should be related to their economic growth, while the socio-economic institutions in developed countries should work out new ways of dealing with the demographic transition aimed at changes in pen-

sion systems and other socio-economic changes including technological advancements. Developed countries' consumption should be lowered, while in developing countries it should increase – both processes will stabilise the situation according to quality-quantity theory.

Becker et al. (1990) claim that there are two steady state economies in the present world. In this theory, there are Malthusian and neoclassical steady state economies; however, the approach relates to the criteria of capital accumulation taking into account some national perspectives. The global point of view still seems to be Malthusian as global population is growing and the problems seem to be more related to the distribution of natural resources and incomes than a relative lack of resources. Moreover, the overpopulation problem is even more vital when a fertility increase policy is postulated in some countries, while overpopulation characterizes many others.

The sustainable development perspective is based on global thinking and inter- and intragenerational dimensions. The present local action in many countries lacks the global perspective in their socio-economic policies. Moreover, the economic mechanism of quality-quantity tradeoff presented by Becker and other conceptions are determined by cultural and socio-economic factors. Therefore, the tradeoff between the growth of a population and its consumption level postulated in the IPAT model is unbalanced. The local policies will further deepen the global problems because of the structural character of the problems at the global level.

References

1. ANGEL J.L. & SETTERSTEN R.A., 2013, The New Realities of Aging: Social and Economic Contexts, in: *New Directions in the Sociology of Aging*, eds. Waite L.J. & Plewes T.J., National Academies Press, Washington D.C., p. 95-119.
2. BAKSHI G.S. & CHEN Z., 1994, Baby Boom, Population Aging, and Capital Markets, in: *The Journal of Business*, 67(2), p. 165-202.
3. BALDACCHINO G. & SAMMUT C., 2016, The Migration Crisis: No Human is Illegal, in: *The Round Table*, 105(2), p. 231-233.
4. BARRO R.J., 1978, *The impact of social security on private saving: evidence from the U.S. time series*, American Enterprise Institute for Public Policy Research, Washington, D.C.
5. BEBCZUK R.N. & MUSALEM A.R., 2009, Does Investing in Emerging Markets Help? in: *Aging Population, Pension Funds, and Financial Markets*, ed. Holzmann, R., World Bank Publications, Washington D.C., p. 97-118.
6. BECKER G.S., 1960, *An Economic Analysis of Fertility*, in: *Demographic and Economic Change in Developed Countries*, National Bureau of Economic Research, Inc., Washington D.C., p. 209-240.
7. BECKER G.S., 2007, Health as human capital: synthesis and extensions, in: *Oxford Economic Papers*, 59(3), p. 379-410.
8. BECKER G.S. & BARRO R.J., 1988, A Reformulation of the Economic Theory of Fertility, in: *The Quarterly Journal of Economics*, 103(1), p. 1-25.
9. BECKER G.S. & LEWIS G.H., 1974, Interaction between Quantity and Quality of Children, in: *Economics of the family: marriage, children, and human capital*, eds. Schultz T.W., University of Chicago Press, Chicago, p. 81-90.

10. BECKER G.S., MURPHY K.M. & TAMURA R., 1990, Human capital, fertility, and economic growth, in: *Journal of Political Economy*, 98(S5), p. 12-37.
11. BLOFIELD M., 2013, *The Politics of Moral Sin: Abortion and Divorce in Spain, Chile and Argentina*, Routledge, New York-London.
12. BLOOM D.E., CANNING D. & FINK G., 2010, Implications of Population Aging for Economic Growth, in: *Oxford Review of Economic Policy*, 26(4), p. 583-612.
13. BODINI A. & KLOTZ S., 2009, *Ecology – Encyclopedia of Life Support Systems*, vol. II, EOLSS Publication/UNESCO, Oxford, UK.
14. BONGAARTS J., 2004, Population Aging and the Rising Cost of Public Pensions, in: *Population and Development Review*, 30(1), p. 1-23.
15. BOUVIER L.F., 2001, Replacement Migration: Is it a Solution to Declining and Aging Populations? in: *Population and Environment*, 22(4), p. 377-381.
16. BUCKLEY M., 2011, John Stuart Mill and the Idea of a Stationary State Economy, in: *Humanistic Ethics in the Age of Globality*, eds. Dierksmeier C., Amann W., von Kimakowitz E., Spitzack H. & Pirson M., Palgrave Macmillan, Hampshire UK, p. 137-147.
17. BURGER O. & DELONG J.P., 2016, What if fertility decline is not permanent? The need for an evolutionarily informed approach to understanding low fertility, in: *Philosophical Transitions of the Royal Society B*, 371(1692), p. 2015-2157.
18. CALDWELL J.C., 1976, Toward A Restatement of Demographic Transition Theory, in: *Population and Development Review*, 2(3/4), p. 321-366.
19. CALDWELL J.C., 2006, *Demographic transition theory*, Springer, Dordrecht.
20. COSTANZA R., 2000, The dynamics of the ecological footprint concept, in: *Ecological economics*, 32(3), p. 341-345.
21. COX D. & STARK O., 2007, On the Demand for Grandchildren: Tied Transfer and the Demonstration Effect, in: *Journal of Public Economics*, 89(9-10), p. 1665-1697.
22. DALY H.E., 1990, Toward some operational principles of sustainable development, in: *Ecological Economics*, 2(1), p. 1-6.
23. DALY H.E. & FARLEY J., 2011, *Ecological Economics: Principles and Applications*, Island Press, Washington D.C.
24. DARBY M.R., 1979, *The Effects of Social Security on Income and the Capital Stock*, American Enterprise Institute for Public Policy Research, Washington D.C.
25. DAVID H.P., FLEISCHHACKER J. & HOHN C., 1988, Abortion and Eugenics in Nazi Germany, in: *Population and Development Review*, 14(1), p. 81-112.
26. DIETZ T. & ROSA E.A., 1994, Rethinking the environmental impacts of population, affluence and technology, in: *Human Ecology Review*, 1(12), p. 277-300.
27. DOEPKE M., 2015, Gary Becker on the Quantity and Quality of Children, in: *Journal of Demographic Economics*, 81(1), p. 59-66.
28. DOPFER K., 2016, Evolutionary Economics, in: *Handbook on the History of Economic Analysis Volume III: Developments in Major Fields of Economics*, eds. Faccarello G. & Kurz H. D., Edward Elgar Publishing, Cheltenham UK, p. 175-193.
29. EASTERLIN R.A., 1961, The American Baby Boom in Historical Perspective, in: *American Economic Review*, 51(5), p. 869-911.
30. EASTERLIN R.A., 1971, Does Human Fertility Adjust to the Environment? in: *American Economic Review*, 61(2), p. 399-407.
31. EASTERLIN R.A., 1975, An economic framework for fertility analysis, in: *Studies in family planning*, 6(3), p. 54-63.
32. EASTERLIN R.A., MACDONALD C. & MACUNOVICH D.J., 1990, How Have American Baby Boomers Fared? Earnings and Economic Well-Being of Young Adults, 1964-1987, in: *Journal of Population Economics*, 3(4), p. 277-290.
33. ESPENSHADE T.J., 2001, 'Replacement Migration' from the Perspective of Equilibrium Stationary Populations, in: *Population and Environment*, 22(4), p. 383-389.
34. ESPENSHADE T.J., BOUVIER L.F. & ARTHUR W.B., 1982, Immigration and the stable population model, in: *Demography*, 19(1), p. 125-133.
35. ESPENSHADE T.J., GUZMAN J.C. & WESTOFF C.F., 2003, The Surprising Global Variation in Replacement Fertility, in: *Population Research and Policy Review*, 22(5-6), p. 575-583.
36. ESPOSITO L., 1978, Effect of Social Security on Saving: Review of Studies Using U.S. Time-Series Data, in: *Social Security Bulletin*, 41(5), p. 9-17.
37. EUROPEAN COMMISSION 2014, *The 2015 Ageing Report: Underlying Assumptions and Projection Methodologies*, EC, Directorate-General for Economic and Financial Affairs, Luxembourg, no. 8.
38. EUROSTAT, 2016a, *Glossary, EUROSTAT: Statistics Explained*, http://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:Young-age-dependency_ratio (28.11.2016).
39. EUROSTAT 2016b, *Energy Production and Imports, EUROSTAT: Statistics Explained*, http://ec.europa.eu/eurostat/statistics-explained/index.php/Energy_production_and_imports (10.05.2017).
40. FELDSTEIN M., 1974, Social Security, Induced Retirement, and Aggregate Capital Accumulation, in: *Journal of Political Economy*, 82(5), p. 905-926.
41. FENG W., GU B. & CAI Y., 2016, The End of China's One-Child Policy, in: *Studies in Family Planning*, 47(1), p. 83-86.
42. FU B., ZHUANG X., JIANG G., SHI J. & LU Y., 2007, Environmental Problems and Challenges in China, in: *Environmental Science & Technology*, 41(22), p. 7597-7602.
43. GERLAND P., RAFTERY A.E., ŠEVČÍKOVÁ H., NAN LI, GU D., SPOORENBERG T., ALKEMA L., FOSDICK B.K., CHUNN J., LALIC N., BAY G., BUETTNER T., HEILIG G.K. & WILMOTH J., 2014, World Population Stabilization Unlikely this Century, in: *Science*, 346(6206), p. 234-237.
44. GIVENS T.E., 2013, Immigration and National Security: Comparing the US and Europe, in: *Whitehead Journal of Diplomacy and International Relations*, 11(1), p. 79.
45. GLOBAL FOOTPRINT NETWORK, 2017a, *Ecological Footprint*, <http://www.footprintnetwork.org/our-work/ecological-footprint/> (7 May 2017).
46. GLOBAL FOOTPRINT NETWORK, 2017b, *Ecological Footprint Explorer*, <http://data.footprintnetwork.org/> (7 May 2017).
47. GOLDSTEIN J., LUTZ W. & TESTA M.R., 2003, The emergence of Sub-Replacement Family Size Ideals in Europe, in: *Population Research and Policy Review*, 22(5-6), p. 479-496.
48. HALL P. & SOSKICE D., 2001, *Varieties of Capitalism: The Institutional Foundations of Comparative Advantage*, Oxford University Press, Oxford UK, New York.
49. HAMILTON W.D., 1964, The Genetical Evolution of Social Behaviour, in: *Journal of Theoretical Biology*, 7(1), p. 1-16.
50. HAMILTON W.D., 1972, Altruism and Related Phenomena, Mainly in Social Insects, in: *Annual Review of Ecology and Systematics*, 3(1), p. 193-232.
51. HEMMING R., 1999, Should Public Pensions Be Funded? in: *International Social Security Review*, 52(2), p. 3.
52. HOLZMANN R., HINZ R.P. & GERSDORFF H. von, 2005, *Old-Age Income Support in the 21st Century: An International Perspective on Pension Systems and Reform*, World Bank, Washington D.C.
53. HOPKINS C.D., ROSTER C.A. & WOOD, 2006, Making the transition to retirement: appraisals, post-transition lifestyle, and changes in consumption patterns, in: *Journal of Consumer Marketing*, 23(2), p. 87-99.
54. HOWE N. & STRAUSS W., 1992, *Generations: The History of America's Future, 1584 to 2069*, Reprint edition, Quill, New York.
55. HUNG J.-Y. & LU K.-S., 2014, Research on the Healthy Lifestyle Model, Active Ageing, and Loneliness of Senior Learners, in: *Educational Gerontology*, 40(5), p. 353-362.

55. JACKSON R., 2002, The Global Retirement Crisis, in: *The Geneva Papers on Risk and Insurance*, 27(4), p. 486-511.
56. KALECKI M., 1951, *Theory of Economic Dynamics: An Essay on Cyclical and Long Run Changes in Capitalist Economy*, Allen and Unwin, London.
57. KANG J.M., 2013, Retirement of Baby Boomers and Its Impact on the Financial Market, in: *Korean Economic and Financial Review*, 18(3), p. 57-61.
58. KESEL J. & SEDLAK V., 2014, Global Climate Change and Security Threats, in: *European Scientific Journal*, 10(20), p. 31-51.
59. KEYNES J.M., 1964, *The General Theory of Employment, Interest, and Money*, Brace & World, Harcourt.
60. KIRKWOOD T.B.L., 1997, Is There a Biological Limit to the Human Life Span? in: *Longevity: To the Limits and Beyond*, eds. Robine J.-M., Vaupel J.W., Jeune B. & Allard M., Springer, Berlin-Heidelberg, p. 69-76.
61. KUNÉ J.B., 2001, The Controversy of Funding Versus Pay-As-You-Go: What Remains of the Debate? in: *The Geneva Papers on Risk and Insurance. Issues and Practice*, 26(3), p. 418-434.
62. LEE R.D. & MASON A. eds. 2011a, *Population Aging and the Generational Economy: A Global Perspective*, Edward Elgar & International Development Research Centre, Cheltenham UK – Northampton US.
63. LEE R.D., and MASON A., 2011b, Lifecycles, support systems, and generational flows: patterns and change, in: *Population Aging and the Generational Economy: A Global Perspective*, eds. Lee R.D. & Mason A., Edward Elgar & International Development Research Centre, Cheltenham UK – Northampton US, p. 79-106.
64. LESNOY S.D. & LEIMER D.R., 1985, Social Security and Private Saving: Theory and Historical Evidence, in: *Social Security Bulletin*, 48(1), p. 14-30.
65. LUCI-GREULICH A. & THÉVENON O., 2013, The Impact of Family Policies on Fertility Trends in Developed Countries, in: *European Journal of Population/Revue européenne de Démographie*, 29(4), p. 387-416.
66. LUTZ W., SANDERSON W. & SCHERBOV S., 2001, The End of World Population Growth, in: *Nature*, 412(6846), p. 543-554.
67. MALTHUS T.R., 1798, *An Essay on the Principle of Population As It Affects the Future Improvement of Society, with Remarks on the Speculations of Mr. Goodwin, M. Condorcet and Other Writers*, J. Johnson in St Paul's Church, London.
68. MANKIW N.G. & WEIL D.N., 1989, The Baby Boom, the Baby Bust, and the Housing Market, in: *Regional Science and Urban Economics*, 19(2), p. 235-258.
69. MASON A. & LEE R.D., 2011, Population Aging and the Generational Economy: Key Findings, in: *Population Aging and the Generational Economy: A Global Perspective*, eds. Lee R.D. & Mason A., Edward Elgar & International Development Research Centre, Cheltenham UK – Northampton US, p. 3-31.
70. McCONNELL M., 2013, Behavioral economics and aging, in: *The Journal of the Economics of Ageing*, 1-2, p. 83-89.
71. McDANIEL, S.A. & ZIMMER, Z., 2016, *Global Ageing in the Twenty-First Century: Challenges, Opportunities and Implications*, Routledge, New York.
72. McMORROW K. & ROEGER W., 2004, *The economic and financial market consequences of global ageing*, Springer, Berlin-New York.
73. MERELLA V., 2006, Engel's Curve and Product Differentiation: A Dynamic Analysis of the Effects of Quality on Consumer's Choice, in: *Rivista Internazionale di Scienze Economiche e Commerciali*, 53(2), p. 157-182.
74. MILL J.S., 1871, *Principles of Political Economy*, Longmans, Green, Reader and Dyer, London.
75. MUNNELL A.H., 1974, The Impact of Social Security on Personal Savings, in: *National Tax Journal*, 27(4), p. 553-567.
76. NAGY S.R., 2015, *Japan's Demographic Revival: Rethinking Migration, Identity and Sociocultural Norms*, World Scientific, Singapore.
77. NORGAARD R.B., 1994, *Development Betrayed: The End of Progress and a Coevolutionary Revisioning of the Future*, Routledge, New York.
78. NOZICK R., 2013, *Anarchy, State, and Utopia*, Basic Books, New York.
79. PAGE B., 1998, *Social Security and Private Saving: A Review of the Empirical Evidence*, Congressional Budget Office, Washington D.C.
80. PFAU W.D., 2005, The Effects of Social Security on Private Savings: A Reappraisal of the Time Series Evidence, in: *Sophia International Review*, 27(1), p. 57-70.
81. PIENKOWSKI D., 2009, Selfishness, Cooperation, the Evolutionary Point of View and its Implications for Economics, *Ecological Economics*, 69(2), p. 335-344.
82. PIENKOWSKI D., 2012, Paradoxs Jevons'a a Konsumpcja Energii w Unii Europejskiej, in: *Problemy Ekorozwoju/Problems of Sustainable Development*, 7(1), p. 105-116.
83. RICARDO D., 1888, Essay on the Funding System, in: *The Works of David Ricardo*, John Murray, London, p. 513-548.
84. SCHWARTZ A.M., 2006, Pension System Reforms, in: *SP Discussion Paper*, no. 0608, Washington, D.C.
85. SCHWARZ A.M., ARIAS O.S., ZVINIENE A., RUDOLPH H.P., ECKARDT S., KOETTL J., IMMERSVOLL H. & ABELS M., 2014, *The Inverting Pyramid: Pension Systems Facing Demographic Challenges in Europe and Central Asia*, World Bank Publications, Washington, D.C.
86. SEVELIUS G.G., 2013, *The Nine Pillars of History: A Guide for Peace*, Author House, Bloomington.
87. SIKKEN B., DAVIS N., HAYASHI C. & OLKKONEN H., 2008, *The Future of Pensions and Healthcare in a Rapidly Ageing World: Scenarios to 2030*, World Economic Forum, Cologny-Geneva.
88. SOLOW R.M., 1999, Neoclassical Growth Theory, in: *Handbook of Macroeconomics, Handbooks in Economics*, eds. Taylor, J.B. & Woodford, M., Elsevier, Amsterdam, p. 637-667.
89. THE WORLD BANK, 1994, *Averting the Old Age Crisis: Policies to Protect the Old and Promote Growth*, The World Bank, Washington, D.C., no. 13584.
90. THE WORLD BANK, 2017, *The World Bank International Comparison Program database*, <http://data.worldbank.org/indicator/NY.GDP.PCAP.PP.CD> (16.01.2017).
91. TSUI A.O., 2001, Population Policies, Family Planning Programs, and Fertility: The Record, in: *Population and Development Review*, 27(Supplement), p. 184-204.
92. UNITED NATIONS, 2000, *Replacement Migration: Is it a Solution to Declining and Ageing Populations?* Population Division Department of Economic and Social Affairs United Nations Secretariat, New York, no. ESA/P/WP.160.
93. UNITED NATIONS, 2015, *World Population Prospects 2015 – Population Division, Monitoring – Global Population Trends*, <https://esa.un.org/unpd/wpp/Download/Other/Documentation> (24.10.2016).
94. VOS A.E., 2009, Falling fertility rates: New challenges to the European welfare state, in: *Socio-Economic Review*, 7(3), p. 485-503.
95. WACKERNAGEL M., ONISTO L., BELLO P., LINARES A.C., FALFÁN I.S.L., GARCÍA J.M., GUERRERO A.I.S. & GUERRERO M.G.S., 1999, National Natural Capital Accounting with the Ecological Footprint Concept, in: *Ecological Economics*, 29(3), p. 375-390.
96. WAN H.Y., 1971, *Economic Growth*, Harcourt Brace Jovanovich, New York-Chicago-San Francisco-Atlanta.
97. WILLMORE L., 1998, *Social Security and the Provision of Retirement Income*, Pensions Institute Discussion Paper, no. PI-9805, The Pension Institute, London.
98. WCED (WORLD COMMISSION ON ENVIRONMENT AND DEVELOPMENT), 1987, *Our Common Future*, Oxford University Press, Oxford-New York.
99. WWF, 2014, *Living Planet Report 2014*, World Wild Fund, Switzerland.
100. WWF INTERNATIONAL, 2016, *Living Planet Report 2016. Risk and Resilience in a New Era*, WWF International, Gland, Switzerland.

Education for All and Sustainable Development: An Empirical Study on Family Cognition and Household Resource Using in China

Edukacja dla wszystkich i zrównoważony rozwój: badania empiryczne nad rodziną i wykorzystaniem zasobów w gospodarstwach domowych w Chinach

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Abstract

Education for sustainable development has achieved a lot in the past decade. However, the extent to which sustainable development education can achieve sustainability is still unclear. This article uses the survey data of Chinese families and establishes an empirical analysis model. By using the transition of China's sustainable development education mode as a recognition strategy and using DID method to analyze this issue, we found out that the sustainable education in schools can only help families correctly understand the status quo of sustainable development, but it cannot improve the household sustainability. After implementing the education for sustainable development for all (ESDFA), the average monthly electricity use of the affected Chinese households has decreased by 79.6124 kWh, which is a drop of 41.56%; household carbon dioxide emissions has decreased by 123.8958 kg, which is a drop of 49.16%. Among them, households with their heads aged 40-55 were the most significant. The mechanism analysis shows that the greater the scope of the population covered by ESDFA, the more obvious the effect of reducing family resource use, and there may be a mechanism similar to the herding effect.

Key words: Education for all, sustainable development, Chinese family cognition, family resource use

Streszczenie

W ramach edukacji dla zrównoważonego rozwoju udało się osiągnąć już wiele. Zarazem pytanie o to, w jakim zakresie ta edukacja wspomaga rzeczywiste osiągnięcie zrównoważoności pozostaje bez odpowiedzi. W artykule wykorzystano wyniki badań odnoszących się do chińskich rodzin, opracowując empiryczny model analizy. Odnosząc się do obserwowanej zmiany w chińskim systemie edukacji dla zrównoważonego rozwoju, ponadto wspierając się metodą DID, ustaliliśmy, że edukacja w szkołach może tylko pomóc rodzinom w zrozumieniu koncepcji zrównoważonego rozwoju, ale jest niewystarczająca dla poprawy poziomu zrównoważoności na poziomie gospodarstw domowych. Natomiast po wprowadzeniu programu *Edukacja dla zrównoważonego rozwoju dla wszystkich* (ESDFA) okazało się, że w chińskich gospodarstwach domowych średnie miesięczne zużycie energii elektrycznej zmniejszyło się o 79.6124 kWh, co stanowi spadek o 41.56%, a emisja ditlenku węgla obniżyła się o 123.8958 kg, co stanowi spadek o 49.16%. Najbardziej znaczące wyniki osiągały gospodarstwa, w których głowy rodzin stanowiły osoby w wieku 40-55 lat. Szczegółowa analiza wykazała ponadto, że im większa część populacji poddana zostaje programowi ESDFA, tym większy efekt redukcji zużycia zasobów w gospodarstwie domowym, co prawdopodobnie uwarunkowane jest działaniem mechanizmu podobnego do tzw. efektu stada.

Słowa kluczowe: Edukacja dla wszystkich, rozwój zrównoważony, chińskie rodziny, zużywanie zasobów w gospodarstwach domowych

1. Background and literature

The issue of sustainable development has become the greatest human challenge in this century (UNESCO, 2005), and every phase of our education system is being asked to declare its support for education for sustainable development (ESD) (Vare, 2007). Education can foster public awareness and ideas of sustainability, which is the basic requirement for sustainable development. After people realize the importance of sustainable development, many countries have successively introduced many education policies for sustainable development. Among them, the most significant is the *UN Decade of Education for Sustainable Development* (DESD) that was implemented during the 10-year period from 2005 to 2014. A series of literatures show that these sustainable development education projects have achieved great success globally, and the level of the awareness of sustainable development has been greatly enhanced in the educated population (De Haan, 2006; Lozano, 2013; Huckle, 2015; Wals, 2012), but a fundamental question that is still crucial has not been answered yet: the extent to which sustainable development education can improve the sustainability of development.

Education for sustainable development (ESD) comes from the early environment education for sustainable development (EEFSD) (Sauvé, 1996). Hopkins proposed in 2002 that ESD should include four dimensions: social and economic dimensions, conservation & management of resources, strengthening the Role of major groups, means of implementation (Hopkins, 2002), UNESCO has added humane concepts such as anti-poverty, human rights, equality, etc. (UNESCO, 2005) and gradually formed today's concept of sustainable development education. However, some scholars oppose adding social issues to the content of sustainable development education. For example, Kopnina (2014) believes that ESD masks its anthropocentric agenda and may in fact be counterproductive to the efficacy of environmental education in fostering a citizenry that is prepared to address the anthropogenic causes of environmental problems, for discourse on sustainable development singles out economic development, which we may have created the current ecological problems in the first place, as part of the solution. We deeply agree with this, because although the education for sustainable development covers a wide range of topics, its core content should still be environmental protection and sustainable use of resources. Therefore, the next part of this article will only discuss the issue of education for sustainable development on environmental and resource issues.

From the perspective of sustainable use of resources, sustainable development requires less resource use and higher efficiency in the use of re-

sources. The former leads to a reduction in certain marginal utility of economic participants, while the latter means higher technical costs. Therefore, according to the basic principles of economics, rational people pursuing utility maximization lack sufficient incentives to choose sustainable economic participation modes unless they can obtain additional utility from resource-saving behaviour.

In fact, education for sustainable development in China illustrates this issue. In 2003, the central government formally put forward the theory of the scientific development concept and emphasized the sustainability of economic development. As it was listed as a political task, the government introduced a series of policy measures such as energy saving and consumption reduction subsidies. Since 2005, China's unit GDP resource consumption has been decreasing year by year. For example, energy consumption per 10,000 yuan of GDP has decreased from 1.40 tce in 2005 to 1.13 tce in 2010 and 0.71 tce in 2015. But at the same time, as there is no household-oriented resource policy, the resource consumption of Chinese households has been increasing rapidly in the past 10 years. By 2014, the energy consumption of Chinese households was 472 million tce, which is 71.6% higher compared to 275 tce in 2005¹.

From 2005 to 2014, it was the time of the *UN Decade of Education for Sustainable Development*. In China, the DESD project was undertaken by the Ministry of Education. The targeted education population were mainly all levels of school students. If the education for sustainable development has induced some effects then such effects can be reflected first in students' family rather than in the production enterprises. Therefore, the fact that the consumption of household resources in China has risen significantly indicates that the DESD project in China may only increase the awareness of sustainable development of the educated population. Due to the lack of an effective incentive mechanism, this policy does not really bring about improvement of sustainability on the household level.

After 2014, China changed its previous *government-school-student-family* education model for sustainable development. In 2014, the *Environmental Protection Law of China* passed a major revision and was implemented on January 1, 2015. The new Environmental Protection Law added to the original version that citizens should adopt low-carbon lifestyle, comply with environmental protection laws and regulations, and sort living garbage according to the waste classification regulation, so as to reduce the damage caused by daily life to the environment. At the same time, the governments at all levels should strengthen publicity and popularization of environmental protection, encourage grassroots self-government organizations, social organizations, and

¹ The above data comes from: *China Statistical Yearbook*.

environmental protection volunteers to carry out propaganda on environmental protection laws and regulations and environmental protection knowledge, and create a good atmosphere to protect the environment. Educational administrative departments and schools should incorporate environmental protection knowledge into school education content and cultivate teenagers' awareness of environmental protection.

The new environmental protection law has actually changed from the single mode that education for sustainable development was only carried out in schools, to a new *government-family* education of sustainable development for all (ESDFA). On one hand, this mode has expanded the scope of the subjects of receiving education for sustainable development, making the concept of sustainable development a common knowledge in the entire society. Citizens can obtain some kind of utility from the *herd behaviour* of saving resources. On the other hand, as the law clearly give citizens the right to protect the environment, citizens now have the incentive to report violations of sustainable development and increase the opportunity cost of wasting resources. Therefore, compared with before, the new mode for all people can carry out education for sustainable development more extensively, and better encourage citizens to save resources, which will help reducing the damage to the environment caused by the household use of resources.

In terms of these changes, compared to the above intuitive analysis, we are more interested in the impact of different education modes on household sustainability, and whether the empirical data analysis supports the above argument. Generally, empirical studies are rarely used for such issues. One major reason is that the results of education for sustainable development are difficult to quantify. The method used by Kopnina (2013) provides a viable idea for this purpose. He used the Ecocentric and Anthropocentric Attitudes toward the Sustainable Development (EAATSD) scale as a variable to measure the outcome of education for sustainable development, and conducted an empirical study. This article refers to this idea and use similar scales to measure the achievements of China's sustainable development education, and conducts empirical study on the changes in China's sustainable development education mode, hoping to find the reasons for the changes in the sustainability of China's household use of resources, as well as the role of education for sustainable development in this process, and the effectiveness and mechanism of the for-all education mode for the sustainable development.

2. Data management

This article uses China Family Tracking Survey (CFPS) data for research. This data was started in 2010 and is released every two years. Since 2012, it

has added in the survey data of the family subjective scale. Therefore, we adopt the micro family data for three years of 2012, 2014, and 2016 to study the issues we concern.

An important goal of education for sustainable development is to enable educators to objectively understand the status quo of sustainable development issues. Because China has a large population and low per capita resources, China's sustainable development situation is relatively severe. Therefore, in China, Education for sustainable development means recognizing the seriousness of environmental problems. Similar to the study by Kopnina (2013), we use the cognitive scale of the family on environmental issues as a variable to measure the outcome of education for sustainable development. CFPS survey results show that the average ratings of environmental problems in Chinese households in 2012, 2014, and 2016 were 5.42, 6.56, and 5.87 (particularly severe = 10, particularly insignificant = 0), showing a trend of first increase and then decline.

If families recognize the seriousness of environmental issues through education for sustainable development and decide to contribute to sustainable development, then the most possible response of families is to reduce the use of various resources in daily life. Resource usage can be used as a variable that reflects the level of sustainability at the household level. As can be seen from Table 1, from 2012 to 2014, the use of various household resources has increased significantly, and from 2014 to 2016, only the use of electricity has increased significantly, with the increase rate decreasing significantly. Even the use of fuel has decreased. The families' awareness of the severity of environmental problems also shares the similar trend of change, which shows an increase in 2014 and a decrease in 2016. Therefore, we can make a preliminary judgment, that in the period around 2014, the impact of the education for sustainable development on Chinese families' use of resources had changed.

In Table 1, *water*, *electric*, and *fuel* are respectively the household's monthly water consumption, electricity consumption, and fuel consumption in the unit of natural gas usage, deducted from the monthly resource use cost dividing the local living resource price. *CO₂* indicates the carbon dioxide emissions from domestic consumption of resources calculated based on China's current production levels. *Evaluation* is the cognitive scale of the surveyed households on the severity of environmental problems in China. Since the scales are large, they can be considered as continuous variables for econometrical analysis. Table 1 also gives the descriptive statistics for other major family characteristics and household head personal characteristics variables, where *health* is the self-assessment of their own health by household heads, and *view1* is the assessment of the government's integrity by household heads (particularly uncorrupted = 10, particularly corrupted = 0), *view2* is the degree of trust in the local government (particu-

Table 1. Statistics Description of Variables

| Variables | Year 2012 | Year 2014 | Year 2016 | Year 2014 - 2012 | Year 2016 - 2014 |
|-----------------------|------------------------|------------------------|------------------------|-------------------------|------------------------|
| Water (ton) | 3.3258 (5.2086) | 4.6654 (8.6867) | 4.7544 (8.1729) | 1.3396*** (0.2369) | 0.0889 (0.2870) |
| Electric (kw·h) | 149.6630 (234.3885) | 191.5469 (259.5056) | 206.4719 (239.3240) | 41.8840*** (8.4808) | 14.9249* (8.4776) |
| Fuel (L) | 18.9210 (34.3078) | 29.9033 (82.4464) | 25.7718 (36.4213) | 10.9823*** (2.0378) | -4.1315** (2.0213) |
| CO ₂ (kg) | 206.8421 (292.4752) | 252.0340 (326.2513) | 259.1454 (265.2255) | 45.1919*** (10.6189) | 7.1113 (9.9619) |
| ESD | 5.4191 (2.9057) | 6.5563 (2.8781) | 5.8729 (2.8436) | 1.1372*** (0.0999) | -0.6833*** (0.0961) |
| Infinc (RMB) | 9.1871 (1.5552) | 9.6388 (2.0358) | 9.8207 (2.0003) | 0.4517*** (0.0642) | 0.1820*** (0.0691) |
| Infinc^2 (RMB) | 86.8196 (26.9781) | 97.0476 (29.9518) | 100.4462 (30.1284) | 10.2279*** (1.0178) | 3.3986*** (1.0310) |
| Infasset (RMB) | 7.5565 (4.9984) | 8.2331 (5.0362) | 8.8403 (4.8570) | 0.6766** (0.1403) | 0.6072*** (0.1713) |
| Infexp (RMB) | 9.9005 (1.0319) | 9.4385 (1.6730) | 9.6633 (1.4700) | -0.4620*** (0.0497) | 0.2248*** (0.0539) |
| Inhouse (RMB) | 2.4127 (1.4107) | 2.7126 (1.5184) | 2.6860 (1.4216) | 0.2999*** (0.0599) | -0.0266 (0.0593) |
| Height (cm) | 155.9137 (34.5342) | 157.9880 (29.6206) | 159.6011 (45.2466) | 2.0743* (1.0986) | 1.6131 (1.3524) |
| Weight (0.5kg) | 117.2600 (27.8350) | 118.9206 (26.0963) | 120.0638 (25.1459) | 1.6607 (0.9144) | -1.1431 (0.8451) |
| Health | 3.4626 (1.1780) | 3.2754 (1.2743) | 3.3113 (1.2489) | -0.1872*** (0.0406) | -0.0359 (0.0414) |
| Gender (male=1) | 0.4828 (0.4992) | 0.4915 (0.5001) | 0.5260 (0.4994) | -0.1087*** (0.0303) | 0.0344** (0.0164) |
| Age | 55.5733 (18.0015) | 55.0547 (17.3704) | 55.0442 (17.0236) | -0.5214 (0.5917) | -0.0105 (0.5641) |
| Education (college=1) | 0.0747 (0.2630) | 0.0970 (0.2961) | 0.0794 (0.2705) | -0.0222** (0.0092) | -0.0176* (0.0092) |
| View1 | 5.3237 (3.5669) | 6.7440 (3.2317) | 5.9201 (3.1618) | -1.4203*** (0.1185) | -0.8239*** (0.1073) |
| View2 | 2.3193 (1.2435) | 2.3418 (1.2783) | 2.4027 (1.0758) | -0.0225 (0.0434) | 0.0609 (0.0389) |
| N | 983 | 858 | 1485 | 1841 | 2343 |

Table 2 OLS regression results (\mathcal{Y}_1)

| Resource | Water | Electric | Fuel | CO ₂ |
|----------|-----------|----------|----------|-----------------|
| 2012 | 0.0625* | 2.8103* | 0.3456 | 3.8655** |
| | (0.0344) | (1.5487) | (0.2920) | (1.9795) |
| 2014 | 0.1701*** | 2.6155 | 1.0891 | 4.8318* |
| | (0.0721) | (2.1688) | (1.0437) | (3.0070) |
| 2016 | 0.0271 | 0.3228 | -0.3110 | -0.2443 |
| | (0.0573) | (1.8567) | (0.3358) | (2.0703) |

larly trust = 5, particularly distrust = 0), control of these two variables can eliminate the subjective evaluation bias caused by personal optimism or pessimism.

3. Empirical analysis

The basic idea of the empirical analysis of this paper is to examine whether the results of sustainable development education can bring about the improvement of the sustainability at the family level, that is, whether the family con-

serves resources and reduces carbon emissions. Therefore, the basic model can be set as:

$$Resource_i = \gamma_0 + \gamma_1 ESD_i + X\beta + u_i$$

To examine the differences among different years, the model can be further set as:

$$Resource_{it} = \gamma_0 + \gamma_1 ESD_{it} + \gamma_2 year_{it} + \gamma_3 ESD_{it} * year_{it} + X\beta + u_{it}$$

Table 2 shows the main results of the basic OLS regression for different household resource usage in different years.

Table 3 OLS regression after adding cross items

| | 2012&2014 | | | | 2014&2016 | | | |
|-----------------------------------|-----------------------|--------------------------|-----------------------|--------------------------|------------------------|-------------------------|---------------------|--------------------------|
| | Water | Electric | Fuel | CO ₂ | Water | Electric | Fuel | CO ₂ |
| ESD | 0.0693 (0.0731) | 2.7328 (2.7012) | 0.0714 (0.6323) | 3.9334 (3.4118) | 0.0836 (0.0755) | 1.8400 (2.3544) | 1.2420 (1.3472) | 4.2705 (3.5127) |
| year | 0.2580 (0.3197) | 17.1622* (10.2564) | 2.9503 (4.1038) | 15.5044 (13.9804) | 0.4463 (0.4424) | 22.3152 (15.3094) | 3.0159 (3.9190) | 28.3847 (18.3067) |
| ESD*year | 0.0214 (0.0945) | -2.3095 (3.6429) | 1.3072 (1.3713) | -1.0473 (4.8117) | -0.0700 (0.0919) | -2.8099 (2.8185) | -1.8510 (1.2312) | -6.3822* (3.7691) |
| Infinc | -0.8614** (0.3627) | -60.1101*** (19.6531) | -13.1651 (12.6074) | -87.0673*** (30.4815) | -1.6802*** (0.3072) | -52.5412*** (9.9817) | -5.1459 (4.8738) | -63.6899*** (14.1155) |
| Infinc^2 | 0.0855** (0.0347) | 4.3899*** (1.1769) | 0.7027 (0.5927) | 5.9144*** (1.7260) | 0.1544*** (0.0275) | 4.4912*** (0.7517) | 0.3054 (0.2294) | 5.1985*** (0.9656) |
| Regional characteristics | yes | yes | yes | yes | yes | yes | yes | yes |
| Family variables | yes | yes | yes | yes | yes | yes | yes | yes |
| Head of household characteristics | yes | yes | yes | yes | yes | yes | yes | yes |
| N | 1841 | | | | 2343 | | | |

Table 4. Results of Regression of Households of Different Ages

| | 2014&2016 | | | | | | | |
|-----------------------------------|-----------------------|--------------------------|-----------------------|-------------------------|------------------------|-------------------------|-----------------------|--------------------------|
| | Age<40 | | | | Age≥40 | | | |
| | Water | Electric | Fuel | CO ₂ | Water | Electric | Fuel | CO ₂ |
| ESD | 0.1521 (0.1873) | -8.6842 (11.0609) | -3.5646 (4.3825) | -15.2923 (14.1741) | 0.0934 (0.0852) | 3.3441 (2.3614) | 2.0187 (1.5479) | 7.0110* (3.7626) |
| year | 0.0637 (1.1812) | -19.2314 (41.5328) | -27.3036 (22.5604) | -70.9925 (62.5149) | 0.7854 (0.5661) | 32.4037** (14.6131) | 8.2909* (4.8871) | 50.1777*** (17.9806) |
| ESD*year | -0.1157 (0.2832) | 12.4560 (11.4344) | 4.2313 (4.4372) | 20.3529 (14.7764) | -0.0776 (0.1023) | -4.6662* (2.7763) | -2.8949** (1.4376) | -10.1491*** (3.9060) |
| Infinc | -1.7672** (0.7660) | -116.2122** (55.3855) | 8.4053 (6.9854) | -101.5017* (60.8305) | -1.4932*** (0.3362) | -39.4597*** (8.4851) | -6.9935 (5.5326) | -56.2508*** (13.8768) |
| Infinc^2 | 0.1782** (0.0709) | 8.2974** (3.8466) | -0.6701 (0.6326) | 7.1615 (1.7260) | 0.1361*** (0.0304) | 3.6352*** (0.6938) | 0.4297* (0.2478) | 4.7836*** (0.9119) |
| Regional characteristics | yes | yes | yes | yes | yes | yes | yes | yes |
| Family variables | yes | yes | yes | yes | yes | yes | yes | yes |
| Head of household characteristics | yes | yes | yes | yes | yes | yes | yes | yes |
| N | 405 | | | | 1938 | | | |

It is clear to see from the table that in 2012 and 2014, the family's awareness of environmental sustainability is positively related to the increased use of household resources. This shows that the sustainability education achievements of 2014 and before had not turned into sustainable increase in household resource use. Instead, households that recognize the seriousness of sustainable development issues tend to use more resources. In 2016, the situation changed, the coefficient of OLS regression was no longer significant, and the coefficient of the influence of household cognition on fuel and carbon dioxide emissions also became negative. Although the coefficient is not significant, based on such changes, we still have reasons to believe that between 2014

and 2016, the use of family resources may have undergone some changes due to family cognition.

For this reason, we continue to investigate the OLS regressions with cross terms. The results are shown in Table 3.

It can be seen that for the samples of 2012 and 2014, the cross-term coefficients are not significant, indicating that the impact of family cognition on resource consumption did not change significantly from 2012 to 2014. The cross-term coefficients are significantly negative between 2014 and 2016, which means that during this period of time, families' perception of sustainable development had brought about a reduction in the consumption of household resources.

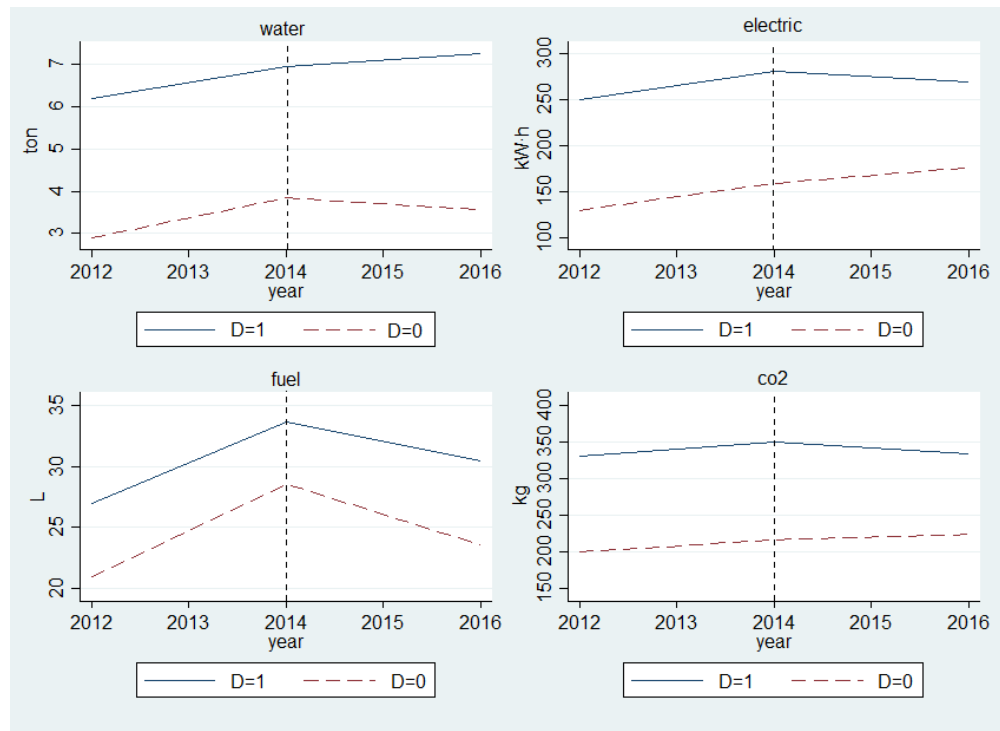


Figure 1. Consumption of household resources in different processing states

Before 2014, because the DESD project was mainly aimed at students at school, the younger family members had a higher probability of receiving education for sustainable development at school, while the older family members were less likely to be affected. After 2014, the for-all sustainable development education is mainly carried out through community residents' committees. Since the current young Chinese labors usually choose to migrate to employment in large cities, the possibility of education for sustainable education among younger family members is low. The older family members are more likely to receive education for sustainable development. Therefore, families whose households are in different age groups may have different effects. If grouped according to the age of the household head, the results of OLS regression are as that in Table 4. From 2014 to 2016, most of the reduction in resource consumption brought about by changes in the cognitive level of household heads over the age of 40 is significant. As the family recognizes the need to protect the environment, the monthly electricity use was reduced by 4.6662 kilowatts, which is a decrease of 2.45%; fuel use reduced 2.8949 liters of natural gas, which is a drop of 9.68%; and carbon dioxide emissions decreased 10.1491 kg, which is a decrease of 4.03%. At the same time, although household heads under the age of 40 had experienced changes in their awareness of sustainability, their household resource consumption had not been significantly reduced. Since the student population targeted by the DESD project were no more than 22 years old (22 years old is the average graduation age of Chinese college students), they will not be more than 40 years old by

2016. Therefore, the results of Table 4 illustrate once again the sustainable development education on students is ineffective for improving sustainability.

In summary, although the concept of sustainable development has been enhanced, the sustainability on the family level has not been improved under the *government-school-student-family* model of sustainable development. Instead, after implementing the *government-family* for-all sustainable development education, families' resource consumption has been effectively reduced, and sustainability has been improved. In the following sections, we will identify the effectiveness of education for sustainable development that began in 2014.

In China, the ways of education for all include face-to-face education, television, radio, newspapers, text messaging, and the Internet. Since media organizations are all state-owned and promoted by national policies, this kind of sustainable education for the entire nation is comprehensive. In terms of effective scope, the Internet may have become the most important education for all, followed by television, radio, and face-to-face education, and traditional methods such as newspapers and text messaging are the least efficient. Therefore, families who use the Internet, television, etc. as the main information channel have greater possibilities to recognize the importance of sustainable development issues and choose more resource-efficient lifestyles. Relatively, households that use newspapers, text messages, etc., as the main information channel lack the awareness of the importance of sustainable development may not necessarily save resources. Therefore, we use the *whether use the network as the main information*

Table 5. Double Difference Regression Results

| | Water | Electric | Fuel | CO ₂ |
|-----------------------------------|------------------------|--------------------------|-----------------------|--------------------------|
| <i>D</i> | 1.1972 (0.8348) | 61.9886*** (24.1719) | 5.1534 (11.3719) | 72.6835** (34.6026) |
| <i>year</i> | 0.2290 (0.7419) | 42.2511 (28.1593) | -5.1922 (6.4019) | 32.4676 (32.7374) |
| <i>D x year</i> | -0.1194 (0.9604) | -60.6773** (28.8710) | -3.5188 (11.9872) | -67.2896* (39.3535) |
| ESD | 0.0244 (0.0505) | -0.2912 (1.4323) | 0.2468 (0.6473) | -0.2212 (1.9496) |
| Infinc | -1.7657*** (0.5912) | -58.2597*** (16.5588) | -4.319*** (2.4971) | -67.8986*** (19.2827) |
| Infinc^2 | 0.1808*** (0.0615) | 6.0273*** (1.6854) | 0.5137** (0.2455) | 7.1498*** (1.9598) |
| Regional characteristics | yes | yes | yes | yes |
| Family variables | yes | yes | yes | yes |
| Head of household characteristics | yes | yes | yes | yes |
| N | 2343 | 2343 | 2343 | 2343 |

Table 6. Double Difference Regression Results for Non-processed Years

| | Water | Electric | Fuel | CO ₂ |
|-----------------------------------|---------------------|-----------------------|-----------------------|-----------------------|
| <i>D</i> | 1.0247 (0.9252) | 54.5372 (23.7472) | 4.2408 (13.1289) | 61.1654 (36.7190) |
| <i>year</i> | 1.3232 (0.9049) | 56.4270 (24.4339) | 16.6106 (10.2019) | 65.1278 (33.6314) |
| <i>D x year</i> | 0.0203 (0.9870) | 20.8921 (17.3923) | 1.2939 (3.9586) | 10.3922 (20.2320) |
| ESD | 0.0771 (0.0605) | 0.9386 (1.9052) | 0.8843 (1.0918) | 2.9094 (2.8973) |
| Infinc | -0.8129 (0.3876) | -57.4509 (19.4039) | -12.9931 (12.1653) | -84.1211 (29.5281) |
| Infinc^2 | 0.0818 (0.0366) | 4.1865 (1.1601) | 0.6887 (0.5634) | 5.6882 (1.6811) |
| Regional characteristics | yes | yes | yes | Yes |
| Family variables | yes | yes | yes | Yes |
| Head of household characteristics | yes | yes | yes | Yes |
| N | 1841 | 1841 | 1841 | 1841 |

Table 7. DID regression results for households with different ages

| | Electric | | | | CO ₂ | | | |
|-----------------------------------|-----------------------|------------------------|----------------------|---------------------|-----------------------|--------------------------|----------------------|-----------------------|
| | <25% | 25%~50% | 50%~75% | ≥75% | ≥25% | 25%~50% | 50%~75% | ≥75% |
| Age | <40 | 40~55 | 55~68 | ≥68 | ≥40 | 40~55 | 55~68 | ≥68 |
| <i>D x year</i> | -65.3902 (66.4934) | -79.6124* (45.0628) | -8.4129 (49.9361) | 4.8017 (50.9178) | -33.5692 (85.4424) | -123.8958** (64.7572) | 34.8001 (63.3916) | -24.4606 (59.4498) |
| Regional characteristics | yes | yes | yes | yes | yes | yes | yes | yes |
| Family variables | yes | yes | yes | yes | yes | yes | yes | yes |
| Head of household characteristics | yes | yes | yes | yes | yes | yes | yes | yes |
| N | 405 | 673 | 664 | 558 | 405 | 673 | 664 | 558 |

channel as a processing state variable for the recognition of the education policy of the nation, using the method of double difference (DID).

The DID method requires that the data meet the common trend assumption that the two types of households with different processing states have the same

change trend before 2014. Figure 1 shows the household resource consumption of two types of households from 2012 to 2016. It is easy to see that the common trend assumptions are satisfied here, that the two types of families have the same trends from 2012 to 2014, and the trends from 2014 to 2016 have changed. Therefore, the DID method is feasible for the analysis.

The empirical model for DID analysis can be set as:

$$Resource = \gamma_0 + \gamma_1 D_i + \gamma_2 year_i + \delta D_i \times year_i + X\beta + u_i$$

D_i is the state variables, and the coefficient δ of double difference terms $D_i \times year$ reflect the impact of the changes in the education mode of sustainable development. Table 5 shows the results of DID regression.

From the table, we can see that the coefficient of the double difference term is significant for household electricity use and CO₂ emissions. ESDFA has brought household electricity use down by 60.6773 kWh, which is a decrease of 31.68%, and household CO₂ emissions down by 67.2896 kg, which is a decrease of 26.70%.

In comparison, the same DID analysis process was performed for non-processed years. The results are shown in Table 6.

Obviously, all the coefficients in Table 6 are insignificant, which shows that the impact on families' perception of sustainable development in the non-processed years on family resource use has not changed. Therefore, by combining Tables 5 and 6, it can be concluded that China's ESDFA has achieved remarkable success since 2015, and households that have received education for sustainable development have reduced their electricity use and CO₂ emissions significantly, and also water and fuel use to some extent.

Given the age characteristics of the ESDFA target, Table 7 shows the differences in families with household heads at different ages.

It can be seen that families with household heads aged between 40 and 55 are more affected by ESDFA, whose monthly electricity use and CO₂ emissions are reduced by 79.6124 kWh (41.56%) and 123.8958 kg (49.16%) respectively. While there is no significant effect in families with the household heads in other age groups.

Education for sustainable development from other sources, apart from internet, may also have an impact on households. For this reason, we also provide DID regression results with different processing state in terms of other information channels such as television, radio, etc., as shown in Table 8.

It can be seen that when households that use SMS as the main information channel experience changes in family cognition, a reduction in the use of family resources will take place. While the families that use other channels are just in the opposite situation, that their resource use increases. The reason for the former may be that mobile phones have become very popular and mobile phone text messages can be

quickly read by the owner. Similar to the internet, a wide range of sustainable education audience groups can be reached through short message channels so that each family can gain some additional benefits from the actions to increase sustainability. The latter indicates that families who rely on delivered information from other people cannot receive ESDFA. Therefore, the DID analysis conducted by selecting different channels as processing state variables shows that only when sustainable development education is accepted by the general public through influential channels, can the results lead to a reduction in the use of family resources. This also confirms the argument at the beginning of this article that when all relatives and friends around think that it is necessary to reduce the use of resources, the family's behavior of saving resources can bring additional benefits, so that ESDFA can reduce the use of family resources while school education cannot.

Endogenous issues

There are three main sources of endogenous problems, missing variables, reverse causality, and sample selection biases. In the article, we have controlled regional characteristics, family characteristics, and household head characteristics as much as possible. Therefore, the bias of missing variables is not serious. The family's perception of sustainability is mainly based on ESDFA. As sustainable development is a global macro problem, subject to the constraints of its own conditions, it is impossible for a typical family to have knowledge of sustainable development issues on its own, so the reverse causation problem does not exist. Sample selection bias is not serious, CFPS survey on families choice is random, so there is no sample selection bias at the survey level, the use of resources such as water and electricity is essential for family life, the key variables are not obviously missing, so there are no survivor biases. Therefore, in general, there is basically no endogenousness to be solved in the impact of family cognition on sustainability. The results of the paper are reliable.

4. Conclusion and policy implications

Through the empirical analysis method of DID, this paper studies the impact of China's family-level sustainable development education on the level of sustainable development. It was found that before 2014, education for sustainable development was only targeted at students at school and there was no incentive to save resources. The mechanism, therefore, has no obvious impact on the use of family resources; education for sustainable development from 2015 onwards is conducted through various channels for propaganda and education, establishing the idea of saving glory and wasting shameful and constraining from the legal level, not only Residents can correctly recognize the status quo of sustainable development,

Table 8. DID regression results for different processing status variables

| | TV | | | | Broadcast | | | | Newspaper | |
|--------------------|------------------------|-------------------------|---------------------|--------------------------|------------------------|--------------------------|-----------------------|--------------------------|------------------------|----------------------|
| | Water | Electric | Fuel | CO ₂ | Water | Electric | Fuel | CO ₂ | Water | Electric |
| <i>D</i> | 0.3693 (0.5200) | -4.6845 (19.5421) | 2.5203 (7.2069) | 0.4542 (24.6525) | 0.8847 (0.7762) | 16.4483 (18.7689) | 17.1242 (11.1922) | 49.7399 (30.2027) | -0.5439 (0.5400) | -0.5439 (14.7568) |
| <i>year</i> | 0.7808 (0.8771) | 26.0770 (32.0604) | -4.0445 (8.5029) | 19.0249 (37.8984) | 0.5729 (0.7491) | 29.1410 (26.9774) | -5.2812 (6.9663) | 19.5407 (32.1037) | 0.4544 (0.7415) | 0.4544 (26.9072) |
| <i>D x year</i> | -0.4426 (0.6877) | 0.7174 (23.2661) | -2.2014 (7.6379) | -3.8702 (28.6332) | -0.8731 (0.9108) | -16.3499 (22.7348) | -10.2456 (11.7073) | -36.5620 (33.7050) | 0.1712 (0.6680) | 0.1712 (18.1480) |
| ESD | 0.0391 (0.0500) | 0.0700 (1.4135) | 0.0622 (0.6777) | 0.2236 (1.9659) | 0.0359 (0.0498) | -0.0058 (1.4212) | -0.0212 (0.6505) | -0.0133 (1.9299) | 0.0429 (0.0507) | 0.0429 (1.4125) |
| Lnfin | -1.6851*** (0.3078) | -52.4695*** (9.9309) | -5.2284 (4.9529) | -63.7795*** (14.2062) | -1.6750*** (0.3058) | -52.4814*** (10.0045) | -4.9933 (4.8026) | -63.3355*** (14.0454) | -1.6780*** (0.3071) | -1.6780 (9.9859) |
| Lnfin ² | 0.1548*** (0.0276) | 4.4879*** (0.7490) | 0.3118 (0.2339) | 5.2076*** (0.9691) | 0.1537*** (0.0273) | 4.4813*** (0.7502) | 0.2863 (0.2236) | 5.1516*** (0.9589) | 0.1543*** (0.0275) | 0.1543 (0.7512) |
| Regional | yes | yes | yes | yes | yes | yes | yes | yes | yes | yes |
| Family variables | yes | yes | yes | yes | yes | yes | yes | yes | yes | yes |
| Head of household | yes | yes | yes | yes | yes | yes | yes | yes | yes | yes |
| N | 2343 | 2343 | 2343 | 2343 | 2343 | 2343 | 2343 | 2343 | 2343 | 2343 |

| | Newspaper | | SMS | | | | Tell the others | | | |
|--------------------|-----------------------|--------------------------|------------------------|-------------------------|---------------------|--------------------------|------------------------|-------------------------|-------------------------|--------------------------|
| | Fuel | CO ₂ | Water | Electric | Fuel | CO ₂ | Water | Electric | Fuel | CO ₂ |
| <i>D</i> | 15.1743 (10.4197) | 21.2708 (24.8095) | 1.1957 (0.6963) | 57.8992*** (20.0105) | -6.3432 (6.2841) | 46.7616* (25.5243) | -0.3557 (0.5342) | -3.4154 (14.2258) | -12.5112*** (3.8858) | -26.7218 (17.4621) |
| <i>Year</i> | -4.4348 (6.6200) | 19.9390 (31.8078) | 0.3931 (0.7373) | 39.9335 (26.9137) | -7.2699 (7.6744) | 26.3587 (32.3275) | 0.4274 (0.8378) | 23.5328 (29.1074) | -18.7411*** (8.5077) | -83.8112** (35.6607) |
| <i>D x year</i> | -10.9007 (10.7549) | -23.1438 (27.6224) | -0.1157 (0.8248) | -46.1807** (23.2186) | 5.3168 (6.1226) | -36.0455 (28.3578) | -0.0049 (0.6622) | 5.6854 (17.6670) | 19.4647*** (7.4380) | 114.5189*** (33.4208) |
| ESD | -0.0212 (0.6416) | 0.1169 (1.9266) | 0.0347 (0.0505) | -0.1435 (1.4231) | 0.0865 (0.6891) | 0.0529 (1.9932) | 0.0436 (0.0508) | 0.0429 (1.4154) | 0.1054 (0.6938) | 0.2826 (1.9834) |
| Lnfin | -5.2254 (4.8698) | -63.7981*** (14.1469) | -1.6762*** (0.3051) | -52.7421*** (9.8757) | -5.1726 (4.8992) | -63.9371*** (14.1265) | -1.6755*** (0.3070) | -52.6037*** (9.9875) | -5.0978 (4.8591) | -63.6563*** (14.1149) |
| Lnfin ² | 0.3139 (0.2321) | 5.2137*** (0.9688) | 0.1535*** (0.0273) | 4.4987*** (0.7459) | 0.3089 (0.2315) | 5.2118*** (0.9638) | 0.1541*** (0.0275) | 4.4982*** (0.7530) | 0.3037 (0.2290) | 5.2020*** (0.9664) |
| Regional | yes | yes | yes | yes | yes | yes | yes | yes | yes | yes |
| Family | yes | yes | yes | yes | Yes | yes | yes | yes | yes | yes |
| Head of household | yes | yes | yes | yes | Yes | yes | yes | yes | yes | yes |
| N | 2343 | 2343 | 2343 | 2343 | 2343 | 2343 | 2343 | 2343 | 2343 | 2343 |

and can also make residents save resources to obtain a certain effect, thereby reducing the amount of household resources used and improving the level of sustainability. In particular, although the conclusions of this paper show that the improvement of the level of sustainability depends on the incentive mechanism in the education model rather than the educational achievement itself, this does not mean that the role of education for sustainable development in the previous decade is denied. As Huckle (2015) put it, the rationale for the Decade was idealistic and that global education for sustainability citizenship a more realistic focus for such an initiative. The conclusion of this paper may suggest that based on previous

school education, now It may be time to turn education for ESDFA.

Subject to the level and objective conditions, this article will inevitably have some deficiencies, mainly the following two points:

First, the results and methods of this study are severely limited by the data. Among the available Chinese micro-survey databases, only the CFPS conducted household cognition surveys. The CFPS began in 2010 and family cognition issues were only added in 2012, resulting in the investigation of this article. With only 3 years of data, the verification of common trend hypotheses may be less persuasive when performing DID analysis.

Second, the OLS analysis of this paper is based on the assumption that the use of household resources is technically neutral, that is, with the development of technological level, there is no obvious time trend in the use of family resources. But in fact, because China is a rapidly developing country, with the development of economy and the advancement of science and technology, the development of new types of Internet industry and automobile industry will inevitably bring about the increase in the use of resources such as electricity and fuel. This stage of the

family resources There should be an ever-increasing trend in the use of time, so the OLS estimate should be higher than the true value, which is probably the reason why the OLS estimation coefficient is positive. Of course, we have not taken more measures on this issue. This is because trends that are limited by data are difficult to measure. On the other hand, we use the DID method to estimate the value of the processing and control groups. The differential process eliminates this type of time trend, and the results of the DID estimation are not biased.

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- **Źródła Internetowe:**
Nazwa strony, adres, czas dostępu. Przykład:
Problemy Ekorozwoju/Problems of Sustainable Development,
ekorozwoj.pollub.pl (2.01.2014).

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Prace do druku proszę przysyłać drogą elektroniczną na adres: a.pawlowski@pollub.pl