QUALITY OF LIFE AND ENVIRONMENT IN V4 COUNTRIES – SELECTED PROBLEMS

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Abstract

The study focuses on evaluating selected research problems related to economic growth and quality of life, objective but the subjective approach to perception and evaluation of the quality of life through selected indicators. Factors such as economic growth and its material and energy intensity, the structure of the economy and its structural changes, or the application of environmental legislation can be classified as economic factors that threaten the quality of the environment. Quality of life is often used in everyday life and scientific and political environments. The aim is to highlight approaches to the perception of evaluation. We will focus on comparing selected indicators that we can consider in part of the comparisons of V4 countries - opinions and controversies from different perspectives on the perception of different aspects of quality of life. We aim to highlight changes in V4 countries in the context of selected economic and environmental indicators.

Keywords: *Quality of life, environment, economy, indicators, multi-criteria analysis*

JEL Classification: Q52, B23, A14

Introduction and theoretical background

Increased economic activity impacts the quality of the environment and, thus, the quality of life. A positive impact arises when economic activity manifests

itself in economic growth, but at the same time not at the expense of an excessive burden on the environment, which is achieved by, for example, economic – environmentally sound technologies. On the contrary, the negative effect arises when, together with economic growth, the burden on the environment increases and thus negatively affects the quality of life. The author's opinions on the relationship between environmental quality and economic factors vary (Koišová et al., 2019). On the one hand, there are opinions of authors dealing with current environmental, health care, human health and economic development issues, but the possibilities for long-term economic growth without knowing the causes and consequences are questioned (Bravo, 2014). On the other hand, the COVID-19 pandemic, changes in consumer behaviour, the current issues of tackling domestic energy sources as well as rising energy prices, and the development of economies in EU countries (Burström & Tao, 2020), especially in post-socialist economies, are significantly exacerbated (Moretti et al., 2017). Therefore, diversification of sources and authors' views on economic growth in the context of the development of the world economy while respecting environmental problems vary (Slottje, 2019).

On the other hand, the authors show that economic growth can reduce environmental pollution. To this end, it is necessary to set up an environmental policy promoting environmental education, education, and environmentally sound technologies (Stofkova et al., 2021). This requires the objectivity of impact measurement and the search for sustainable, balanced social and economic development to which a mature and conscious society contributes. The positive examples of the Nordic countries are apparent. Quality of life is a multidimensional concept based on the causality of relations between selected problems and their associated indicators. According to (Murgaš & Klobučník, 2016), quality of life lacks standardized uniform methodology and terminology.

Quality of life is a broad term that refers to overall well-being in society. However, there is no agreed definition of this term in academic and political discourse (Băndoi et al., 2020). The concept of quality of life has three main characteristics: it reflects the life situations of individuals and their perceptions rather than the quality of life in the country; it is a multidimensional concept covering several areas of life, such as housing conditions, access to and interaction between institutions and public services; it combines objective information about living conditions with subjective opinions and attitudes in order to provide an image of overall well-being in society (Hadad et al., 2013).

Many definitions of quality of life include cognitive assessments of individuals' own standards of living; however, the literature includes research examining the quality of life in two dimensions (Costa et al., 2021). Accordingly, quality of life can be considered both subjective and objective. Subjective quality of life refers to satisfaction and appreciation of their living conditions. For example, opinions about the personal security of income, the degree to which an individual feels safe on the street, and the degree of satisfaction with education and health are the subjective quality of life (Veenhoven, 2006). Objective quality of life refers to whether observable criteria of the good life are met. Criteria include, for example, ensuring personal income, the safety of the street and the environment in which a person lives, good health care and education. Thus, the general, subjective quality of life deals with the personal assessment of living conditions and the objective quality of life concerns the impartial assessment of living conditions (Rusche, 2010).

Quality of life is usually determined by two indicators: a subjective dimension and an objective dimension. However, most researchers focused on indicators of

the objective dimension of quality of life. They included a set of observable indicators and direct measurements such as working conditions, income levels, social and economic status and the amount of support available from the network social relations. Research findings show that focusing on the quality of life indicators is only a tiny fraction of the dispersion in overall quality of life estimates. Therefore two dimensions of quality of life are determined. The first is the subdimension, which means the extent of personal satisfaction in life, the feeling of happiness of a person. The second is the objective dimension, which includes physical and mental health, social relationships, community activities, work, life philosophy, leisure, the standard of living, family relationships and education (Lee & Park, 2017).

In 2015, 193 member states approved the 2030 Agenda for Sustainable Development. It is an ambitious plan that aims to achieve prosperity that respects the planet and its inhabitants. This agenda consists of 17 Sustainable Development Goals (SDGs) and is further developed into 169 targets to be met by 2030. The 2030 Agenda is a continuation of the UN Millennium Development Goals (2000-2015), which were the first international consensus to address global challenges such as eradicating extreme poverty and hunger and promoting improved access to education (Suganthi, 2020)

Environmental performance is considered a multidimensional construct that includes not only the results and impacts of the company on stakeholders and the environment but also the principles of environmental responsibility and the processes of environmental sensitivity of the company that determine future results and impacts (Henchoz et al., 2015).

The analysis of the levels and types of quality of life revealed that the essence of the concept of quality of life could be more precisely determined not by seeking to define the concept but by a more detailed analysis of the factors and their groups affecting the quality of life. Many authors agree that the internal and external environment determines the quality of life. The country's level of development and the political and socio-economic environment allows people to live well and seek a quality of life (Murray et al., 2017). On the other hand, individuals can use the external environment and strive for higher physical and personal development and material and social well-being, which is determined by the internal environment (Abdul Mohit, 2018). On this basis, two groups of factors determining the quality of life can be identified. The first group includes factors that may not be regulated by public policy measures (climate conditions and their indicators, the geographical position of the country) and those affected by public policy activities (political stability, social security, corruption, economic growth). The second group of factors consists of those factors that a person as a holder of rights and freedoms can exercise significant control over himself (health status, educational attainment, family, leisure) (Sachs, 2015).

Material and methods

For the needs of this work, it is necessary to determine the objects of examination in our case selected countries: Slovakia, the Czech Republic, Poland and Hungary. Therefore, we used multi-criteria analysis for analysis (Ardielli, 2019).

The multi-criteria analysis takes place in two basic steps:

1. Determine the weighting of the criteria against which alternatives are evaluated.
2. Choose the correct decision method to evaluate variants/alternatives.

Weights of criteria can be determined in different ways. The choice of the appropriate method depends on whether or not the criteria preferences are known

and whether the assessment should be objective or subjective and thus tailored to the tasking authority (Baltussen et al., 2019).

The TOPSIS method uses cardinal information to identify a compromise variant as close as possible to the positive-ideal solution and as far away from the negative-ideal solution as possible. If there is a positive-ideal solution and it is possible to achieve it, then the positive-ideal solution and compromise variant match. The positive-ideal solution acquires the best values with respect to all specified criteria and is represented by a vector $h_1, h_2, ..., h_n$. The negative-ideal solution acquires the worst possible values in all criteria and is represented by a vector $(d_1, d_2, ..., d_n)$ where n indicates the number of criteria that are taken into account in the analysis (Feneri et al., 2015).

The TOPSIS method can be described in the following steps:

- Construct the criteria matrix $Y=(y_{ij})$ created of the input data:

$$Y = \begin{pmatrix} y_{11} & y_{12} & \cdots & y_{1n} \\ y_{21} & y_{22} & \cdots & y_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ y_{m1} & y_{m2} & \cdots & y_{mn} \end{pmatrix}$$

The element y_{ij} of the matrix Y represents the value of the i-th alternative according to the j-th criterion.

- Construct the normalized matrix $R=(r_{ij})$ as follows:

$$r_{ij} = \frac{y_{ij}}{\sqrt{\sum_{i=1}^{m} y_{ij}^2}} ; i = 1, 2, \ldots, m;\ j = 1, 2, \ldots, n.$$

- Construct the weighted normalized matrix $Z=(z_{ij})$ by using the formula:

$$z_{ij} = w_j r_{ij}; i = 1, 2, ..., m; j = 1, 2, ..., m$$

Determine the positive-ideal solution $h = (h_1, h_2, ..., h_n)$ and the negative-ideal solution $d = (d_1, d_2, ..., d_n)$, where:

$$h_j = \max_i z_{ij} ; j = 1, 2, \ldots, n$$

$$d_j = \min_i z_{ij} ; j = 1, 2, \ldots, n$$

- Calculate the distance between each alternative and the positive-ideal and the negative-ideal solution as follows:

$$d_i^+ = \sqrt{\sum_{j=1}^{n} (z_{ij} - h_j)^2} ;\ i = 1, 2, \ldots, m$$

$$d_i^- = \sqrt{\sum_{j=1}^{n} (z_{ij} - d_j)^2} ;\ i = 1, 2, \ldots, m$$

- Finally, the variants are ranked according to the values of the relative indicators (the higher value the better alternative) (Triantaphyllou, 2000).

Results and discussion

In economics, the Human Development Index (HDI) is used as a basic quantitative assessment of human capital. The Human Development Index (HDI) is a comprehensive index that characterizes the level of human development in countries and regions. This index is an integral part of measuring a country's health and longevity performance, education and the real incomes of its citizens. The HDI should indicate the level of human development achieved in the country and thus assist policymakers in shaping policies enabling the country's socio-economic progress.

The Environmental Performance Index (EPI) is an index of quantification of the environmental performance of policies developed by the University of Yale (EPI Yale Index). It provides access to relevant environmental data in an organized manner that is easy to understand, useful and encourages intense competition. It also allows countries to compare their performance in selected groupings. Furthermore, thanks to time series, countries can see changes in their performance and look for ways to solve societal problems and public funding priorities for environmental activities (Cerenio Adriatico et al., 2019).

EPI uses the best global environmental performance datasets available, but data quality and availability are alarmingly low. The absence of widely collected and methodologically consistent indicators for even the most fundamental problems, such as soil quality, and the complete lack of time series data for most countries hamper efforts to shift pollution control and management of natural resources to more empirical foundations. Policymakers should invest in monitoring environmental data, indicators and reporting to address these gaps. They should set clear policy lines for essential issues and environmental protection efforts with performance metrics at global, regional, national, state/provincial, local and corporate levels.

The Environmental Performance Index (EPI) points to the country's efforts to counter environmental pressures. Thus, analyses of the behaviour and influence factors of the EPI will provide a solid basis for practical policy-making. This can help to understand the determinants of environmental progress and maximize the rate of return to ensure environmental sustainability (Stoian et al., 2022).

The Environmental Performance Index (EPI) provides a comprehensive overview of the state of sustainability worldwide based on data. Using 32 performance indicators in 11 problem categories, the EPI assesses 180 countries regarding environmental health and ecosystem vitality. These indicators provide a measure at the national level of how close countries are to the stated environmental policy objectives. In addition, the EPI offers a scoreboard that points environmental leaders backwards and provides practical guidance for countries seeking to move toward a sustainable future (Wendling et al., 2020).

In the theoretical part, we stated that the Environmental Performance Index (EPI Index 2020) measures 180 countries. In our work, we focused specifically on four of them. Table 1 shows our selected countries, the EPI score for the years under review and the ranking of those countries in the EPI index. The reporting years will be 2010, 2016, 2018, and 2020 because the EPI index publishes its results every two years.

Table 1 EPI 2010-2020

Country	2010	Position	2016	Position	2018	Position	2020	Position
Czechia	71,6	22	84,67	27	67,68	33	71	20
Slovakia	74,5	13	85,42	24	70,6	28	68,3	26
Hungary	69,1	33	84,6	28	65,01	43	63,7	33
Poland	63,1	63	81,26	38	64,11	50	60,9	37

Source: own processing

An analysis of the location of our V4 countries, which finished last in comparison with others, shows that lower scores can be caused precisely because of per capita greenhouse gas emissions performance. Slovakia finished in first place among V4 countries. In 2016, it was ranked 24th. In 2018 declined and finished 28th, but in 2020 it improved its position and dropped to 26th. In 2010, it was ranked 12th. Looking at ecosystem vitality, it ranks 10th in 2020 and 34th in health. The worst health position is the PM2.5 particles, mainly caused by the combustion of pollutants, especially from cars.

The Czech Republic ranks second after Slovakia but finished in eighth place compared to other countries. However, if we compare 2020, it has a better location this year than Slovakia. In 2016, the Czech Republic ranked 27th with a score of 84.67, finished 33 in 2018 and improved to 20th in 2020. In 2020, it ranked 7th for ecosystem vitality, three places lower than Slovakia and ranked 32nd in health.

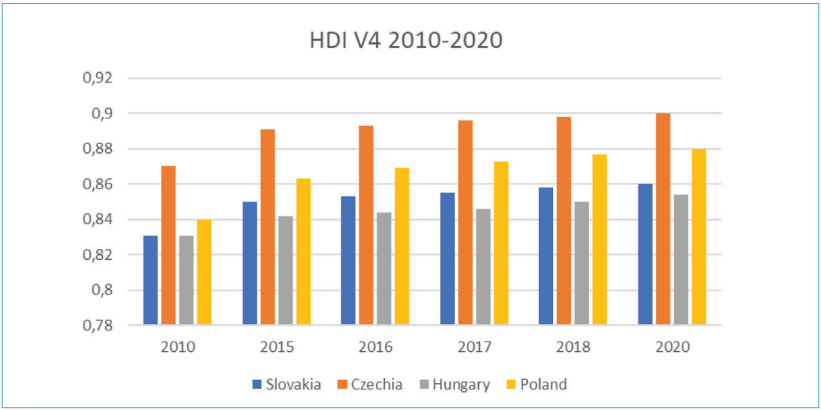
Hungary finished in 10th place in a comparison of all countries and third in a comparison of V4 countries. Hungary's worst place was in 2018, ranking 43 rd in the EPI. In 2020, Hungary improved and ranked 33 rd. When comparing health and ecosystem vitality, health was ranked 54th. The worst position is for solid household fuels, PM2,5 and ozone.

Poland ranked last among all countries. Moreover, Poland was still in more than 30th place for the reporting period. The worst place was in 2018, when it was ranked 50th. In 2020, it improved and finished in 37th place.

In the case of Poland, the values were the second highest. The highest value for the reporting period was recorded in 2017 at 8.9 tonnes per capita and the lowest in 2020. Values increased from 2015 to 2016 and have been declining since 2017.

Natural processes such as forest fires also contribute to PM2.5 in the air. These particles are also the main reason for the occurrence of smog. Exposure to PM2.5 has several short and long-term health effects, including short-term irritation of the eyes, nose and throat, coughing, sneezing and shortness of breath. Prolonged exposure to PM2.5 can cause permanent respiratory problems such as asthma, chronic bronchitis and heart disease.

Figure 1 HDI 2010-2020



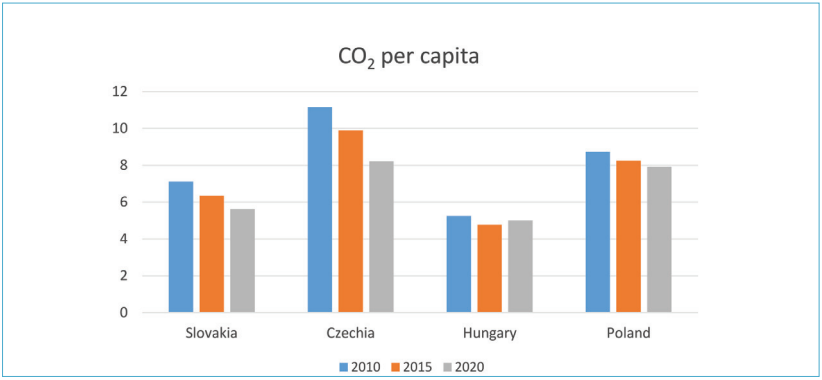
Source: own processing

Figure 1 compares the human development index in V4 countries for 2010 and 2015-2020. All countries have values above 0.8, and countries are among the countries with very high HDI.

In Poland, the HDI value rose by 0.017 between 2015 and 2020, the highest increase, but the Czech Republic still ranks first in the V4 countries. Poland was ranked third, fourth in Slovakia and last in Hungary. For global rankings, Slovenia ranked 22nd, the Czech Republic 27th, Poland 35th, Slovakia 39th and Hungary 40th.

The TOPSIS method also considers the amount of CO_2 per capita reported in tonnes to be a critical parameter. Figure 2 shows its evolution from 2010-2020.

Figure 2 CO_2 per capita 2010-2020



Source: own processing

Using the TOPSIS method, the ranking of our selected countries was determined based on the values of quality of life indicators. The ranking of countries

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based on multiple criteria and selected indices has been established, leading to a broader perception of the interdependence of the environmental performance of selected countries and economic growth in achieving adequate quality. The period analyzed was 2010, 2015, and 2020.

Criteria :

K1 – EPI index
K2 – CO2 per capita in tonnes
K3 – HDI index
K4 – GDP per capita in USD
K5 – Years of Healthy Life (HLY)
K6 – CIP Index – Industrial Competitiveness Index

These criteria are commonly used in the quality of life examined (Tab.2).

Table 2 TOPSIS 2010-2020

2010	di+	di-	ci	Rank
Slovakia	4400,766	176,8558	0,038635	2
Czechia	4236,311	341,3104	0,074561	1
Hungary	4555,139	22,49248	0,004914	3
Poland	4577,618	0,870632	0,00019	4

2015	di+	di-	ci	Rank
Slovakia	3860,33	163,2272	0,040568	2
Czechia	3783,634	239,9251	0,05963	1
Hungary	4018,151	5,432216	0,00135	3
Poland	4023,557	0,753138	0,000187	4

2020	di+	di-	ci	Rank
Slovakia	4511,633	166,6903	0,03563	2
Czechia	4303,831	374,4925	0,080048	1
Hungary	4667,257	11,08182	0,002369	3
Poland	4678,322	0,747324	0,00016	4

Source: own processing

Slovakia ranked last in all indicators. When evaluating the Human Development Index, this country ranks penultimately but still ranks among the countries with a very high HDI. Middle years of life increased yearly but were lower than in other countries. From the Health Index, Slovakia ranked 34th, and the biggest problem is air quality and particulate matter PM2.5, where Slovakia ranked 80th out of 160 countries. With ecosystem vitality in case of the growth rate of black carbon, Slovakia is at 73 rd place and with a 10-year change was a decrease of 38.4, and with the trend of greenhouse gas intensity, a shift to 39th place was recorded. As part of this index, one of Slovakia's most significant environmental problems is waste management and air quality, where

Slovakia is lagging more. Appropriate financial support for environmental and energy policy, economic policy and eco-innovation in line with the recovery plan can focus on addressing these challenges.

Using the TOPSIS method, other EU countries have also been analyzed and when compared to other EU countries — especially the Nordic countries- they are lagging more in the performance of the V4 country. An interesting feature of this extensive research, which goes beyond the scope of this publication, is that Slovenia in demographic development comparable to the V4 countries that ended before the Czech Republic. V4 countries do not reach 75 % of the EU average GDP.

Conclusion

Slovakia has stagnated in such an assessment. We can say that Slovakia is poorer by a quarter compared to the EU average and the country's main objective is to catch up with developed EU countries. When building on Slovakia's recovery plan, namely the green economy, the country should focus on reducing greenhouse gas emissions from industrial and agricultural production, which would help to end the combustion of lignite in power plants. The Czech Republic is in first place among V4 countries. The biggest problem is the CO_2 pollution in tonnes, a highly represented industry. The areas where this industry is represented are also reflected in the population's health status. Poland ranked last in the Environmental Performance Index, but overalls moved 13 points higher compared to 2018, which can be assessed positively. One of Poland's biggest problems is air pollution by particulate matter. This country invests the least in waste management. Hungary's results show us that environmental performance needs to be improved — e.g. Hungary produces the lowest CO2 emissions. A small amount of the population is connected to wastewater treatment plants. They are accelerating the reduction of PM10 and PM2.5 emissions and concentration precisely by reducing emissions from energy production and heat from solid fuels. Examining the relationship between economic growth and the quality of life is conditioned by the complexity of the processes. The COVID-19 pandemic, changing consumption patterns, supporting economies in individual countries, and the challenges of energy and self-sufficiency in energy production show us today how difficult it is to face the challenges of the 2030 Agenda, with V4 countries reaching around 75 % of the EU average. The development of society has increasingly brought to the fore the issue of the protection of human health and, therefore, the need to create better opportunities. Defining quality of life is very difficult, as is its quantification. Many economists focus on the development of socio-economic indicators, which usually only include one aspect of the quality of human life. From this aspect, finding one measurable indicator that includes a measurable result is complicated. Using measurable aggregated indices and examining their interconnectedness, it is possible to demonstrate the interdependence and relationships between the environment, society and the economy.

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