

RESEARCH ARTICLE

Implementation of sustainable development goal 8 in European Union countries—A measurement concept and a multivariate comparative analysis

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Abstract

The study attempts to determine a synthetic measure of the level of implementation of Sustainable Development Goal 8 related to promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all and conducts a multivariate comparative analysis of EU countries in terms of its implementation. The statistical database contained all 9 variables characterising this goal, collected for 27 EU countries in the period from 2015 to 2020. The research method used was the method of unitarisation zeroed in the dynamic version. The results of the conducted research confirm that there have been positive changes in the implementation of SDG 8 sustainable development in most EU countries in the examined years. This is indicated by the increasing values of the calculated synthetic measure for individual EU27 countries in the examined years. However, in the last examined year, i.e. 2020, the impact of the crisis caused by the COVID 19 pandemic on the achievement of the examined Sustainable Development Goal was observed. In 2020, compared to 2015, 12 EU countries advanced their positions in the EU27 ranking, 3 countries did not change their positions, while 12 countries dropped down in the ranking. The study also assesses two selected EU countries, namely the Czech Republic and Poland (The Czech Republic and Poland are the countries of origin of the authors of this article, with a similar history, located in Central and Eastern Europe and with similar problems of socio-economic development. These countries also joined the European Union in the same year, 2004) in terms of achieving Sustainable Development Goal 8.

KEYWORDS

comparative analysis, European Union, SDG 8: Decent work and economic growth, sustainable development goals

1 | INTRODUCTION

Sustainable development is one of the most important challenges of the modern world and has been arousing fairly keen interest.

Sustainable development seems to be an attractive alternative to traditional concepts of development as it takes into consideration the social, economic and environmental aspect of activities as well as the

needs of the present and the future generations alike, it integrates activities of various individuals and entities and provides for equal chances to satisfy the needs of various communities (Pondel, 2021).

The objectives of sustainable development have been deemed fundamental in the development process of all European Union (EU) member state countries (Grzebyk & Stec, 2015) and have been reflected in the concept of Industry 4.0 (Hejdukova et al., 2020). The

concept of sustainable development offers the EU a positive long-term vision of society in which economic development supports social progress and respects the need to protect the environment. The discussion on sustainable development includes increasingly new aspects of poverty (Cermakova & Hromada, 2022, Hromada & Cermakova, 2021, Borgersen, 2022 or Luczak et al., 2022) contentious labour market issues (Jasova & Kaderabkova, 2021; Jasova & Kadeřábková, 2019; Kaderabkova & Jasova, 2019), changing macroeconomic behaviour of young generation (Rotschedl & Mitwallyova, 2021) having impacts in long term economic stability in multiple areas (Dimitrov & Hadad, 2022 or Sabra, 2022).

The European Union is a group of countries advanced in implementing the paradigm of sustainable development. Therefore, a necessity to monitor the changes in these countries with a help of specially chosen indicators has a great meaning. Their task is to show clearly the progress in achieving goals of sustainable development (Fura & Wang, 2017; Momete, 2016; Stec et al., 2014).

Sustainable development is a complex phenomenon due to the wide range of factors involved. As the authors (Kiselakova et al., 2020) note due to a complexity of the concept of sustainable development, the comparison of level and evaluation of each European Union's country in implementing its goals is quite a difficult task, and due to the growing number of goals, it is also very time-consuming. The results of studies by individual authors may also differ depending on the assumptions of the analysis, the method used, the indicators used or the way the study was carried out.

The literature contains studies that compare the level of sustainable development taking into account its goals by means of a single synthetic measure using available statistical data and different research methods (Georgescu & Herman, 2019; Grzebyk & Stec, 2015; Kovačič, 2017; Martin & Carnero, 2019; Cermakova, et al., 2022).

In recent years, several thousand articles have been written on this topic, and the growing trend reflects the demand for knowledge in this area. The scope of research is wide and the scientific output enriches the knowledge on the implementation of sustainable development goals. However, there are no (or few) studies showing the level of sustainable development of EU countries in relation to the individual SDGs using a dynamic approach.

One of the most important sustainable development goals, according to the authors of this article, is the implementation of Goal 8 of Agenda 2030, i.e. Decent work and economic growth. Due to the lack of a universally accepted and used measure, the authors attempted to determine a synthetic measure of Sustainable Development Goal 8 on their own, taking as a basis 9 variables proposed in Agenda 2030 that describe this goal. By joining the discussion on the measurement of progress towards this goal in EU countries, we hope that our findings will contribute to further analyses in this field and serve as an example of research on the issue.

The currently binding document the 2030 Agenda for Sustainable Development (Agenda 2030) contains 17 Sustainable Development Goals (SDGs) that are integrated and linked together. These goals divided into 169 targets, interconnected, indivisible and potentially

applicable everywhere—globally, nationally and locally in order that no one will be left behind (United Nations, 2015).

The aim of the article is to determine the value of the synthetic measure and to compare the countries of the European Union in the implementation of the selected sustainable development goal related to 'Decent work and economic growth' (SDG 8). The research period is 2015–2020 and the research method used is the zeroed unitarisation method using a dynamic approach.

The implementation of the goal of the study included the following stages:

- literature studies on the studied issue,
- collection of statistical data for EU countries and their verification,
- determining the value of the synthetic measure and constructing rankings of EU countries in terms of achieving the selected sustainable development goal in 2015–2020,
- making a classification of EU countries into groups with a similar level of realisation of the examined phenomenon,
- determining the place of the Czech Republic and Poland in the prepared rankings of EU countries.

The study poses the following research questions:

- which of the EU countries are the leaders and which take the last places in the rankings of the EU countries in terms of the synthetic measure determining SDG8 in 2015–2020?
- were there any changes in the rankings of the EU countries between 2015 and 2020 in terms of achieving the examined goal?
- did the Czech Republic and Poland achieve a similar level of SDG 8 between 2015 and 2020?

In order to obtain answers to the research questions posed, the article is divided into several parts. In the first part of the article the literature on the subject is reviewed, taking into account published research after 2016, i.e. after the approval of the new Sustainable Development Goals. In the second part we present the major indicators, which were employed in the analysis, and which show the realisation of SDG 8. They are divided into stimulants and destimulants on which basis we tried to determine the values of the synthetic measure. In the following part we present the statistical appraisal of diagnostic variables and discuss its outcomes. In the next part of the paper we determined the value of the synthetic measure of the achievement of Goal 8 for all EU countries in the period 2015–2020 with particular emphasis on the Czech Republic and Poland, to then group them into those with a high, average-high, average-low and low level of implementation of the phenomenon under study. The last section of the paper recapitulates the results and discusses their practical implementation.

2 | LITERATURE REVIEW

The world has changed dramatically in the last two decades due to human intervention at regional and global levels. The fates of

humanity and our planet are in our hands. Governments, international agencies, the corporate sector, and individuals must work together to shift away from unsustainable practices (Baskaran, 2022).

Sustainable development is a concept that is difficult to define, it includes many elements at once, and depends on the context of its use. It is an interdisciplinary issue that can be viewed from the point of view of various disciplines.

The sustainable development goals, also called global goals, urge the entire universe to take the necessary sustainable action to protect the planet and end poverty by 2030. Worldwide, the implementation of the SDGs is still at an early stage. The challenge is to maintain the right relationship between achieving short-term and long-term goals (matching the concept of sustainable development). The decision to implement the SDGs affects the allocation of resources, and therefore must also be included in budgets (Young, 2017).

The Statistical Commission of the United Nations is currently establishing an indicator framework for worldwide monitoring and reporting on the SDGs implementation process, admitting that different indicators may be helpful in different situations. Due to the COVID-19 pandemic, all countries have shown a reversal in progress towards reaching SDG for the first time since 2015 (The Sustainable Development Goals Report, 2021).

It is stressed that it will be difficult to fully realise all the goals of Agenda 2030, especially in terms of the universal eradication of hunger and poverty. This may not be possible due, in part, to the lack of unanimity among all countries of the world, including some important 'actors' in the economic, political, but also military sphere. The desire of some countries and transnational corporations to pursue their own development strategies may prevail, regardless of the adverse economic, social and environmental impacts in some parts of the globe. Other barriers to the full realisation of the goals of the 2030 Agenda are also important, such as the internal problems of some countries and groups of countries (e.g. excessive migration to Europe, ethnic and political conflicts, military threats and conflicts such as the one currently taking place in Ukraine and thus the need to rearm, the economic crisis, or the very high debt of a given country). However, the most important thing is the fact of implementing the extremely valuable and necessary concept of sustainable development, which gives development opportunities to individuals, social groups, or individual countries, including the least developed ones (Gruchelski & Niemczyk, 2016).

United Nations has called all countries irrespective of economic status to take action on SDG and work together to increase prosperity while safeguarding the environment. The 8th goal belongs to the first group of goals and it promotes an inclusive and sustainable economic growth, full and productive employment and decent work for everyone. Productive employment depends on the quality of the human capital, access to technology and innovations, regulative framework and macroeconomic stability. It refers to all employment (for salaries or as self-employed) that provides sufficient income to enable the worker and his/her family/family members to obtain a material standard of living above the poverty line" (The International Labour Organization, 2012).

It is worth noting that in the literature, one can find only a dozen or so article evaluating or monitoring the implementation of Goal 8 and those that propose various solutions for its implementation. However, there are no studies taking into account all the indicators suggested by the United Nations to assess the level of implementation of this goal internationally, at the national level.

For example, some studies have focused on a nowcasting approach for assigned to SDG 8 in Austria for the year 2020 (Bilek-Steindl et al., 2022).

In article (Frey, 2017) the author assessed the institutional capacity to implement the goal 8 from two perspectives, the business approach advocated by the International Organisation of Employers and the human right to full employment and decent work advocated by the International Trade Union Confederation and human rights NGOs.

The environmental constraints in implementing this goal were highlighted by Goiria and Herrera (2021). They consider that economic growth, including high consumption of many resources and waste generation are incompatible with the other goals of Agenda 2030.

In turn Kreinin and Aigner (2022) proposed a novel framework for SDG8 in line with strong sustainability. The key novel contributions of the paper include new indicators to measure societies' dependence on economic growth, to ensure the provisioning of welfare independent of economic growth.

The impact of the COVID-19 pandemic on Goal 8 and the effects on the economy in Brazilian scenario is presented by Anholon et al. (2021).

In another study, authors have revisited the technology policies of 11 countries, tried to address the problem of environmental degradation, while addressing the issues of sustained economic growth, clean and affordable energy, and quality education. The empirical analysis has been done by using SDG 4, SDG 7, SDG 9, SDG 10, SDG 13 and SDG 8 (Sinha et al., 2020).

Research by Dhakal and Burgess (2020) showed that the implementation of the social aspect of sustainable development (eg. Goal 8) in ensuring decent working conditions for employees is determined by the level of development of the country. In countries where most employees are in the informal sector (e.g., Nepal), the effectiveness of social policy in this area implemented at the national level is limited.

Khalique et al. (2020) point out that it is the responsibility of governments around the world to work towards achieving Goal 8 in particular by leveraging their companies and corporations as a whole. The goal of decent work for all includes equal opportunity and equal pay for all, which leads to economic development. The research focused on the role of Multi-National corporations operating out of India in incorporating workforce diversity, equal opportunity and inclusive growth of its employees by providing a decent work environment.

Other authors (Rai et al., 2019) focused on gender rights in their research, arguing that productive employment and decent work for all men and women by 2030 needs to take into account the value and costs of social reproduction.

Subsequent research aimed to identify the challenges and difficulties faced by some countries, for example Mexico (Herreros, 2021) or developing countries (Roy et al., 2021) in achieving SDG 8, which aims to promote decent work and economic growth. Furthermore, (Đokić & Jovanović, 2019) have shown how working conditions are of huge importance in order to maintain higher levels of economic productivity.

High employment must not be achieved at the expense of them, jeopardising the human and labour rights of employees. Decent work should be attainable and available to all.

The only studies that showed the degree of commitment of European (EU) countries to Goal 8 were those by Carlsen (2021). However, the author used only the five main indicators reported by Eurostat and not all nine describing this goal, which are: Real GDP, Investment share of GDP by institutional sectors, Young people neither in employment nor in education and training, Employment rate and Long-term unemployment rate.

To sum up the literature review, it should be noted that none of the presented studies took into account all the indicators developed by the UN to assess the implementation of SDG 8. This inspired the Authors to carry out their own research.

3 | RESEARCH METHOD

3.1 | Statistical database

The basis for comparative research of EU countries in terms of the implementation of the sustainable development concept related to ‘Decent work and economic growth’ (SDG 8.) were based on all variables proposed by the UN in the Agenda 2030 (The 2030 agenda for sustainable development, 2015), namely:

- X1- Real GDP per capita (euro per capita) (S),
- X2- Investment share of GDP by institutional sectors (% of GDP) (S),
- X3- Young people neither in employment nor in education and training (% of population aged 15 to 29) (D),
- X4- Employment rate (% of population aged 20 to 64) (S),
- X5- Long-term unemployment rate (% of active population) (D),
- X6- People killed in accidents at work (number per 100 000 employees) (D),
- X7- In work at-risk-of-poverty rate (% of employed persons aged 18 or over) (D),
- X8- Inactive population due to caring responsibilities (% of inactive population aged 20 to 64) (D),
- X9- Resource productivity and domestic material consumption (DMC) (Euro per kilogram, chain linked volumes 2010) (S).

Values of variables were taken from Eurostat database (<https://ec.europa.eu/eurostat/web/sdi/main-tables>). The symbols S and D

denote stimulants and destimulants. These terms were introduced to the literature by Hellwig (1968) defining stimulants as features with high values which are desirable from the adopted point of view (e.g. level of sustainable development, while low values are undesirable), while destimulants are features with low values which are desirable from the point of view of the examined phenomenon, while high values are undesirable.

It should be noted that the use in research of one of the methods of multivariate comparative analysis requires that the set of initial variables meets certain statistical criteria related to the appropriate level of differentiation and correlation.

Thus, in assessing the level of variation, the classical coefficient of variation defined by the following formula (Nowak, 1990) was adopted:

$$v_j = \frac{s_j}{\bar{x}_j} \quad (j = 1, 2, \dots, m) \tag{1}$$

where:

- v_j - coefficient of variation.
- s_j - standard deviation of the X_j feature,
- \bar{x}_j - arithmetic mean of the X_j feature,
- Variables that fulfilled the following condition are eliminated:

$$|v_j| \leq v^* \tag{2}$$

where:

v^* - the critical value of the coefficient of variation (usually taken at the level of 0.10).

In the evaluation of correlation between variables the method of inverse correlation matrix of Malina and Zeliaś (1998) was applied.

It consists in:

- determination of the R matrix of linear correlation coefficients of the form:

$$R = \begin{bmatrix} 1 & r_{12} & \dots & r_{1m} \\ r_{21} & 1 & \dots & r_{2m} \\ \vdots & \vdots & \ddots & \vdots \\ r_{n1} & r_{n2} & \dots & 1 \end{bmatrix} \tag{3}$$

where:

r_{jk} - Pearson's linear correlation coefficient between the variables X_j and X_k .

- determination of the inverse matrix to the R matrix,

$$R^{-1} = [r^{(ij)}] \tag{4}$$

where: $r^{(ij)}$ ($i, j = 1, 2, \dots, m$) are the elements of the inverse matrix R^{-1} .

TABLE 1 Assessment of the level of variation of variables in 2020 (EU27 countries)

Statistical measure	X1	X2	X3	X4	X5	X6	X7	X8	X9
Mean	26546.67	22.31	12.70	73.42	2.26	1.97	7.95	21.76	1.89
Standard deviation	17195.27	5.05	3.91	5.55	1.96	0.86	2.80	9.60	1.19
Coefficient of variation	0.65	0.23	0.31	0.08	0.87	0.44	0.35	0.44	0.63

Note: Own calculations.

TABLE 2 Correlation matrix between variables

	X1	X2	X3	X5	X6	X7	X8	X9
X1	1	0.236	-0.449	-0.218	-0.167	-0.090	-0.425	0.743
X2	0.236	1	-0.204	-0.522	0.067	-0.299	0.147	-0.020
X3	-0.449	-0.204	1	0.635	0.335	0.371	0.467	-0.230
X5	-0.218	-0.522	0.635	1	-0.062	0.293	0.023	0.042
X6	-0.167	0.067	0.335	-0.062	1	0.292	0.197	-0.261
X7	-0.090	-0.299	0.371	0.293	0.292	1	0.154	-0.010
X8	-0.425	0.147	0.467	0.023	0.197	0.154	1	-0.371
X9	0.743	-0.020	-0.230	0.042	-0.261	-0.010	-0.371	1

Note: Own calculations.

TABLE 3 Inverse correlation matrix.

	X1	X2	X3	X5	X6	X7	X8	X9
X1	3.267	-0.818	0.903	-0.153	-0.280	-0.241	0.382	-2.164
X2	-0.818	1.756	-0.559	0.963	0.026	0.419	-0.298	0.374
X3	0.903	-0.559	3.605	-2.314	-0.969	-0.300	-1.080	-0.412
X5	-0.153	0.963	-2.314	2.990	0.736	-0.057	0.632	-0.099
X6	-0.280	0.026	-0.969	0.736	1.486	-0.338	0.229	0.424
X7	-0.241	0.419	-0.300	-0.057	-0.338	1.357	-0.172	-0.017
X8	0.382	-0.298	-1.080	0.632	0.229	-0.172	1.727	0.133
X9	-2.164	0.374	-0.412	-0.099	0.424	-0.017	0.133	2.685

Note: Own calculations.

When a variable is excessively correlated with the other variables, then the diagonal elements of the inverse matrix \mathbf{R}^{-1} are much larger than unity, which is a symptom of poor numerical conditioning of the \mathbf{R} matrix.

- removing from the set of variables those for which the condition is met:

$$|r^{(jj)}| > r^* \quad (5)$$

where:

$r^{(jj)}$ - diagonal element of the matrix \mathbf{R}^{-1} ,

r^* - critical value of diagonal elements of the matrix \mathbf{R}^{-1} , most often set at the level of 10.

This method is quite often used in the evaluation of complex phenomena not only by individual authors but also by international institutions. It was used, for example, as part of the Human Development Index calculation methodology and in determining the Summary Innovation Index of the EU countries.

3.2 | Statistical methods

In the analysis of complex phenomena, i.e. phenomena described by a set of variables, multivariate comparative analysis methods are often used. One of them is the method of zeroed unitarisation. It includes the following steps (Kukuła, 2000):

- Presenting of diagnostic variable values X_j ($j = 1, 2, \dots, m$) describing the studied objects (EU countries) O_i ($i = 1, 2, \dots, n$) in each of the studied periods in the form of a two-dimensional matrix:

$$\mathbf{X} = \begin{bmatrix} X_{11} & X_{12} & \dots & X_{1m} \\ X_{21} & X_{22} & \dots & X_{2m} \\ \vdots & \vdots & \vdots & \vdots \\ X_{n1} & X_{n2} & \dots & X_{nm} \end{bmatrix} \quad (6)$$

- Normalisation of the variables to maintain comparability of statistical data, according to the following formulas:

TABLE 4 Descriptive statistics of diagnostic variables in 2020.

Indicator	Maximum value		Minimum value		Mean	Coefficient of variation (CV)	Coefficient of Asymmetry (CA)
X1	82,250	Luxembourg	6380	Bulgaria	26,547	0.65	1.60
X2	39.68	Ireland	11.66	Greece	22.31	0.23	1.29
X3	23.3	Italy	5.70	Netherlands	12.70	0.31	0.60
X5	10.50	Greece	0.60	Czech Republic	2.26	0.87	3.06
X6	3.53	France	0.48	Netherlands	1.97	0.44	0.10
X7	14.90	Romania	3.10	Finland	7.95	0.35	0.39
X8	43.80	Cyprus	4.90	Denmark	21.76	0.44	0.21
X9	4.91	Netherlands	0.33	Romania	1.89	0.63	0.95

Note: Own calculations.

$$\text{for stimulants: } z_{ij} = \frac{x_{ij} - \min_i \{x_{ij}\}}{R_j} \quad (7)$$

$$\text{for destimulants: } z_{ij} = \frac{\max_i \{x_{ij}\} - x_{ij}}{R_j} \quad (8)$$

$$\text{Group 4: } MS_i < \overline{MS}_i - S_i \text{ low level} \quad (13)$$

where:

\overline{MS}_i – the mean value of the synthetic measure,
 S_i – standard deviation of the synthetic measure.

where: z_{ij} – the normalised value of a j th variable for the i th object, x_{ij} – the value of a j th variable for the i th object, R_j – range for the j th variable. Normalisation was carried out for “object-periods”, i.e. $\min_i \{x_{ij}\}$, $\max_i \{x_{ij}\}$, and R_j values were identified for all six studied years.

3. Calculating the synthetic measure values for all European Union countries, using the formula

$$MS_i = \frac{1}{m} \sum_{j=1}^m z_{ij} \quad (9)$$

where:

MS_i – synthetic measure,

z_{ij} – the normalised value of the j th variable for the i th object.

The synthetic measure takes values from the [0,1] range. The higher the general synthetic measure value, the higher the level of development in implementation of Sustainable Development Goal 8 - decent work and economic growth.

4. Classifying the EU-27 countries with similar levels, according to the following formulas (Nowak, 1990):

$$\text{Group 1: } MS_i \geq \overline{MS}_i + S_i \text{ high level} \quad (10)$$

$$\text{Group 2: } \overline{MS}_i + S_i > MS_i \geq \overline{MS}_i \text{ medium – high level} \quad (11)$$

$$\text{Group 3: } \overline{MS}_i > MS_i \geq \overline{MS}_i - S_i \text{ medium – low level} \quad (12)$$

4 | RESEARCH RESULTS

4.1 | Statistical verification of the initial set of variables

Applying the procedure described in Section 3.1, the level of variation of particular variables, within the framework of SDG 8 for data from 2020, was assessed for 27 EU countries. The results are presented in Table 1.

The values of calculated statistical measures (Table 1) indicate that out of 9 variables defining ‘Decent work and economic growth’, only the variable X4 did not meet the criterion of an adequate level of variation (coefficient of variation was 0.08) and is subject to elimination from the initial set of variables.

In the next stage of the research, the correlation between the variables was assessed for the 2020 data (Table 2). No very strong correlation was observed between the variables. The highest values of Pearson's linear correlation coefficient were found between variables X1 and X9 (correlation coefficient 0.743) and between X3 and X5 (correlation coefficient 0.635).

However, when analysing the diagonal elements of the inverse matrix R^{-1} , no values above 10 were found in them, which means that the variables under study did not show excessive correlation among themselves (Table 3).

The diagnostic variables for the 2020 data were therefore all variables from the initial set of variables, with the exception of variable X4. In order to keep the results comparable, the same set of diagnostic variables was adopted for the earlier years i.e. 2015–2019.

TABLE 5 Values of the overall synthetic measure defining SDG8 for EU countries from 2015 to 2020

Country	2015	2016	2017	2018	2019	2020
Austria	0.582	0.579	0.603	0.602	0.622	0.612
Belgium	0.617	0.619	0.629	0.634	0.674	0.661
Bulgaria	0.348	0.327	0.350	0.363	0.374	0.359
Croatia	0.408	0.428	0.458	0.479	0.489	0.488
Cyprus	0.391	0.407	0.440	0.439	0.447	0.433
Czech Republic	0.532	0.557	0.573	0.565	0.573	0.556
Denmark	0.704	0.710	0.708	0.701	0.698	0.694
Estonia	0.453	0.405	0.507	0.486	0.489	0.491
Finland	0.613	0.628	0.652	0.660	0.670	0.664
France	0.589	0.590	0.600	0.610	0.599	0.592
Germany	0.616	0.622	0.631	0.645	0.660	0.632
Greece	0.291	0.307	0.337	0.377	0.408	0.415
Hungary	0.470	0.471	0.484	0.505	0.510	0.496
Ireland	0.519	0.575	0.608	0.629	0.712	0.675
Italy	0.420	0.437	0.436	0.431	0.443	0.444
Latvia	0.430	0.423	0.473	0.484	0.499	0.497
Lithuania	0.451	0.480	0.498	0.509	0.501	0.477
Luxembourg	0.666	0.623	0.700	0.669	0.694	0.703
Malta	0.506	0.510	0.590	0.544	0.566	0.535
Netherlands	0.737	0.748	0.764	0.769	0.792	0.790
Poland	0.430	0.439	0.443	0.464	0.479	0.468
Portugal	0.419	0.442	0.474	0.521	0.517	0.522
Romania	0.265	0.287	0.321	0.340	0.366	0.368
Slovakia	0.432	0.454	0.459	0.481	0.515	0.498
Slovenia	0.531	0.563	0.577	0.597	0.617	0.606
Spain	0.365	0.401	0.429	0.452	0.473	0.475
Sweden	0.699	0.713	0.713	0.710	0.712	0.705

Note: Own calculations.

4.2 | Descriptive statistics of diagnostic variables

The general characterisation of the diagnostic variables defining SDG 8 was carried out by determining the basic descriptive parameters of these variables for the EU countries for 2020 (Table 4).

In 2020, the value of variable X1 ranged from EUR 6,380 to EUR 82,250 per capita. Thus, the highest economic growth was achieved by Luxembourg and the lowest by Bulgaria. The average value of variable X1 in the EU-27 was EUR 26,547 per capita. It can also be observed that EU countries are quite differentiated in terms of Real GDP per capita ($CV = 0.65$) and the determined asymmetry coefficient indicates that in most EU countries the value of variable X1 was below the EU average level.

The highest X2 was observed for Ireland (39.68% of GDP), while the lowest for Greece (11.66%). For the EU as a whole, the average value of the X2 variable was 22.32% of GDP. Individual EU countries are poorly differentiated in terms of the value of the examined variable.

Among EU countries, the most favourable situation of young people (X3) was in the Netherlands, for which the value of variable X3 amounted to 5.7%, while the worst situation was in Italy with the indicator at the level of 23.3%. The EU average was 12.7%. There was little variation among EU countries in terms of the value of the variable examined.

In 2020, the situation of EU countries in terms of long-term unemployment improved. X5 ranged from 0.6% for the Czech Republic to 10.5% for Greece. The average value of the X5 variable for the EU was 2.26%. However, EU countries are highly heterogeneous with regard to this variable and in most EU countries it is below the average level.

The lowest value of variable X6 in 2020 was reached by the Netherlands (0.48), while the highest value was reached by France (3.53). The EU27 average is not high, at around 2 people per 100,000 employees. This indicates good working conditions in EU countries and compliance with health and safety rules.

TABLE 6 Positions of EU countries in terms of the value of the overall synthetic measure defining SDG8 for the period 2015–2020

Country	2015	2016	2017	2018	2019	2020	Changing the position in 2020 compared to 2015
Austria	9	9	9	10	9	9	0
Belgium	5	7	7	7	6	7	–2
Bulgaria	25	25	25	26	26	27	–2
Croatia	22	20	20	20	19	19	3
Cyprus	23	22	22	23	23	24	–1
Czech Republic	10	12	13	12	12	12	–2
Denmark	2	3	3	3	4	4	–2
Estonia	15	23	14	17	20	18	–3
Finland	7	4	5	5	7	6	1
France	8	8	10	9	11	11	–3
Germany	6	6	6	6	8	8	–2
Greece	26	26	26	25	25	25	1
Hungary	14	15	16	16	16	17	–3
Ireland	12	10	8	8	3	5	7
Italy	20	19	23	24	24	23	–3
Latvia	18	21	18	18	18	16	2
Lithuania	16	14	15	15	17	20	–4
Luxembourg	4	5	4	4	5	3	1
Malta	13	13	11	13	13	13	0
Netherlands	1	1	1	1	1	1	0
Poland	19	18	21	21	21	22	–3
Portugal	21	17	17	14	14	14	7
Romania	27	27	27	27	27	26	1
Slovakia	17	16	19	19	15	15	2
Slovenia	11	11	12	11	10	10	1
Spain	24	24	24	22	22	21	3
Sweden	3	2	2	2	2	2	1

Note: Own calculations.

Another variable is related to the X7. It ranged from 3.10% for Finland to 14.9% for Romania. In EU countries the average reached 7.95%. The calculated coefficient of variation ($CV = 0.35$) indicates a weak differentiation among countries in terms of the value of variable X7.

Variable X8 was the lowest in Denmark (4.9%) and the highest in Cyprus (43.8%). The EU27 average was 21.76%. EU countries have a moderate variation in the value of variable X8.

The last variable is X9. Its value ranged from 0.33 Euro per kilogramme for Romania to 4.91 for Netherlands. It should be noted that EU countries are quite strongly differentiated in the value of this variable ($CV = 0.63$).

5 | RANKING OF EU COUNTRIES

To build a ranking of EU countries in terms of the value of the synthetic measure determining the level of implementation of SDG8 in

2015–2020, one of the methods of linear ordering of objects - the method of zeroed unitarisation in the dynamic version - was applied.

The calculated values of the synthetic measure for individual EU countries are presented in Table 5.

Based on the data in Table 5, it can be seen that in the period 2015–2019 there have been positive developments in most EU countries in terms of achieving the selected sustainable development goal of ‘Decent work and economic growth’. This is indicated by the increasing values of the calculated synthetic measure for the EU27 countries in the years under study.

On the other hand, in 2020, slight decreases in the value of the synthetic measure were observed for most of the studied countries compared to the previous year. This was probably related to the crisis caused by the COVID 19 pandemic.

Comparing the values of the Czech Republic and Poland synthetic measures, one can notice higher values for the Czech Republic. In this country, in 2015–2019, the values of the synthetic measure grew with some fluctuations from 0.532 to 0.573. In Poland, on the other

hand, there was a systematic progress in the implementation of SDG8, which was reflected in the increase in the value of the synthetic measure from 0.430 to 0.479. In both countries, as in other EU

TABLE 7 Classification of EU countries in terms of the achievement of SDG 8 in 2015 and 2020

Group	2015	2020
Group 1: high level	Denmark, Luxembourg, Netherlands, Sweden	Belgium, Denmark, Finland, Ireland, Luxembourg, Netherlands, Sweden
Group 2: medium-high level	Austria, Belgium, Czech Republic, Finland, France, Germany, Ireland, Malta, Slovenia	Austria, Czech Republic, France, Germany, Slovenia
Group 3: medium-low level	Croatia, Cyprus, Estonia, Hungary, Italy, Latvia, Lithuania, Poland, Portugal, Slovakia	Croatia, Estonia, Hungary, Italy, Latvia, Lithuania, Malta, Poland, Portugal, Slovakia, Spain
Group 4: low level	Bulgaria, Greece, Romania, Spain	Cyprus, Greece, Romania, Bulgaria

Note: Own calculations.

countries, the impact of the COVID 19 pandemic on the implementation of the examined goal was noted.

It is also worth assessing the positions of individual EU countries in the overall ranking of countries for the achievement of Goal 8 (Table 6).

The leaders in terms of achieving the Goal 8 from 2015 to 2020 were: the Netherlands (first position in the ranking), Sweden, Denmark and Luxembourg. The following countries are in the worst situation: Romania, Bulgaria, Greece and Spain.

In 2020, compared to 2015, 12 EU countries improved their positions in the EU27 ranking, most notably Ireland and Portugal (by 7 places). Three countries did not change their position, while 12 countries placed lower in the European ranking.

The values of the synthetic measures obtained by the Czech Republic in 2015–2020 allowed the country to be ranked between 10 and 13, while Poland was ranked lower between 19 and 22. The slight decrease in the positions of the examined countries in the EU ranking may indicate that despite the progress achieved in the implementation of SDG8 by the Czech Republic and Poland, some other countries are achieving this goal at a faster pace.

Using the scheme for dividing countries into similar groups (formulae no 10–13), the EU27 countries were classified into 4 groups (Table 7 and Figure 1).

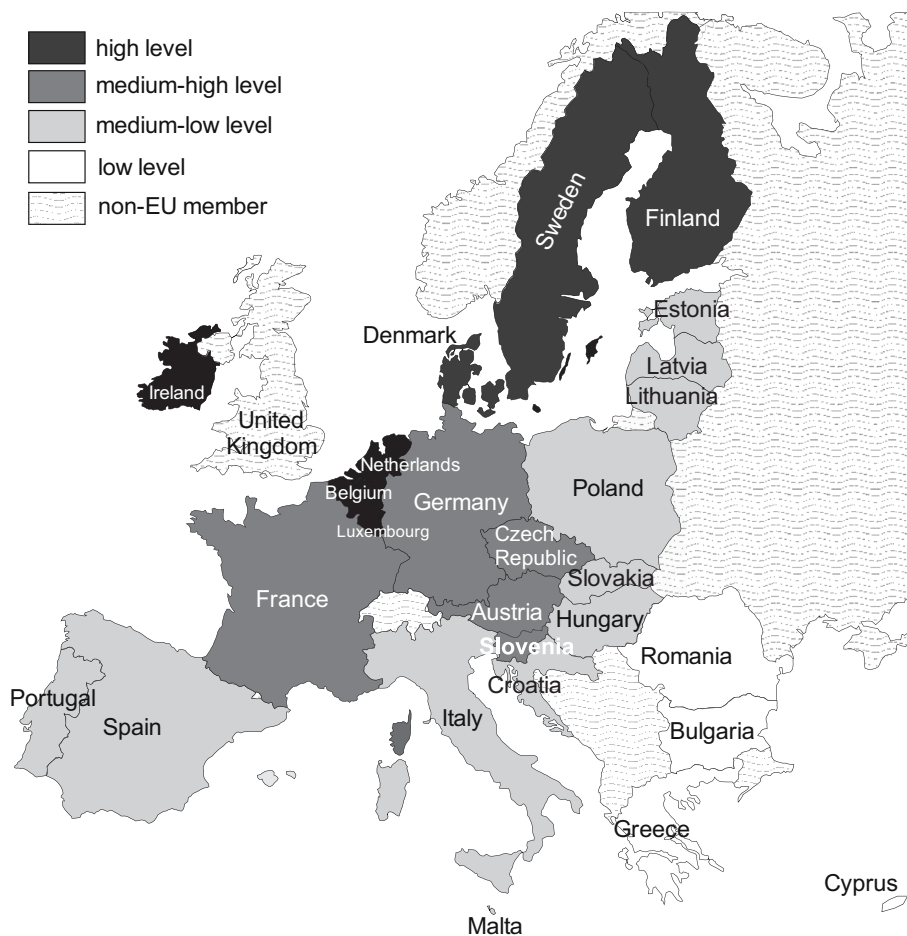


FIGURE 1 Classification of EU countries in terms of the achievement of SDG 8 in 2020. (Source: own elaborations)

It can be noted that in 2020 compared to 2015 there were some changes in the composition of the different groups of EU countries formed in terms of the level of SDG 8 achievement:

- the number of countries with a high level of SDG 8 implementation increased by 3 countries (Ireland, Finland, Belgium),
- group 2 (medium-high level) decreased by 4 countries (3 of them were promoted to group 1, while Malta was moved to a lower group),
- in both years, the most numerous group of countries is still group 3 (medium-low level), containing in 2015–10 countries and in 2020–11 EU countries,
- 4 countries were at the low level of SDG 8 implementation: in 2015 the group included Spain, Bulgaria, Greece and Romania. In 2020 the composition of this group was very similar. Only Spain was replaced by Cyprus.
- in both examined years, the Czech Republic was placed in the group of medium-high level (group 2), and Poland in the lower group (group 3).

6 | CONCLUSIONS

The European Union has decided to implement an ambitious development plan by 2030 based on three main priorities: economic, social and environmental included in 17 Sustainable Development Goals.

In the article, the authors attempted to develop a synthetic measure and statistical evaluation of the progress of individual EU countries in achieving one of these goals, namely SDG 8. The assessment was based on indicators proposed by the UN in Agenda 2030 and published by Eurostat, on the basis of which an overall synthetic measure was determined in a dynamic manner. It made it possible to compare EU countries by simultaneously taking into account all indicators (variables) characterising SDG 8 and to group them according to the degree of implementation of the strategic objectives of this goal.

The results obtained show that the European Union includes countries with different levels of SDG 8 development.

The results of the conducted research confirm that between 2015 and 2019, most of the EU countries have experienced positive changes in the implementation of SDG8. This is indicated by the increasing values of the calculated synthetic measure for the EU27 countries in the years under study. In contrast, in 2020 the impact of the crisis caused by the COVID 19 pandemic on the achievement of the examined Sustainable Development Goal was observed. In 2020, compared to 2015, 12 EU countries advanced their positions in the EU27 ranking, 3 countries did not change their positions, while 12 countries dropped down in the ranking. In 2015, as well as in 2020, the leaders in the implementation of SDG 8 sustainable development were Denmark, Luxembourg, Netherlands and Sweden. On the other hand, Greece, Romania, Bulgaria are the countries having difficulties in achieving this goal (the position of these countries did not change between 2015 and 2020). Delays in the implementation of SDG 8 assumptions within the set timeframe may cause that the

development gap in the scope of this and other sustainable development goals will not decrease. Monitoring the implementation of the 17 Sustainable Development Goals is therefore very important in order to take the right decisions at the right time, which will guarantee the development success of individual countries and the European Union as a whole, as envisaged in Agenda 2030.

The conducted analysis of 9 variables representing SDG 8 showed a weak position of Poland and Czech Republic with regard to the implementation of this goal. Poland belonged to the group of countries with medium-low level both in 2015 and 2020. Croatia, Estonia, Hungary, Italy, Latvia, Lithuania, Poland, Portugal and Slovakia also maintained their positions.

The Czech Republic, on the other hand, belonged to the group of countries with medium-high level, as did Austria, France, Germany and Slovenia. These countries also did not change their position during the years under review.

From the point of view of achieving all the goals included in the Agenda 2030, including SDG 8 Sustainable Development, it becomes very important to monitor changes in the level of development of individual countries and to set common directions for development. Sustainable development should be assessed as part of the EU's long-term development plan on the way to increasing its international competitiveness. Using opinions, analyses and even some calculations carried out by researchers of the problem, it is possible to visualise in more or less detail the state of progress to date in the implementation of individual goals of Agenda 2030.

The conducted research is a preliminary statistical assessment of the implementation of SDG 8 by the EU countries. The article describes research method proven in empirical studies of complex phenomena, used e.g. to determine the Human Development Index (Hollanders, 2019) and Summary Innovation Index of the EU. In subsequent studies of the EU countries diversity in the implementation of SDG 8, it is worth using other methodological proposals, thus enriching the research methodology and comparing the obtained results. The obtained results can be the basis for expanding knowledge in this field, preparing and subsequently applying more advanced research assumptions or expanding research conclusions.

The research constitutes a great practical importance, as it gives a general picture of the situation in terms of the examined problem, and countries with a lower level of implementation of the assumptions of this goal may, for example, apply for assistance funds under the EU cohesion policy or benefit from the experience of countries with a higher level of development. On their basis it is also possible to draw initial conclusions from the implementation of SDG 8, to prepare possible directions of changes needed for further effective and efficient actions. The results of the research will enable the authorities or other decision-makers to indicate which areas need to be improved in order for individual EU countries to fully achieve SDG 8 by 2030.

It should be stressed, however, that the effects of the implementation of SDG 8 can only be observed in the long term, and therefore, in the opinion of the authors, it is advisable to conduct further research in a few years, and the existing disparities between the EU countries may provide a basis for specialisation and implementation

of a specific policy by the authorities of a given country and the European Union as a whole. Effective implementation of this goal requires building a common future and partnership cooperation of particular EU countries.

AUTHOR CONTRIBUTIONS

Mariola Grzebyk: Economy, Local and Regional Development; Public Management, Public Administration. **Małgorzata Stec:** Economy, Socio-Economic Development and Regional Development, Statistics, Econometrics. **Pavlina Hejdukova:** Public administration, Public management, Public Finance, Socio-Economic Development.

DECLARATIONS OF INTEREST

None.

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