MULTIVARIATE SUSTAINABLE DEVELOPMENT GOALS ANALYSIS – COMPETITIVE POSITION OF EUROPEAN COUNTRIES IN 2022

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Purpose: The aim of this paper was to evaluate competitive position of European countries based on the achievement levels of the Sustainable Development Goals in 2022. The tool to achieve the goal was multidimensional comparative analysis.

Design/methodology/approach: The paper presents multivariate analysis based on euclidean distance from the Positive Development Pattern (PDP) to create ranking and to identify those European countries, which were characterized by the highest levels of individual SDG. The research was based on data selected from Europe Sustainable Development Report (2022). From 37 European countries there were selected 32 countries to analysis. The criterion for selecting countries (objects) was the completeness of available data. In the next step of the research was performed the analysis of indicators (SDG – Sustainable Development Goals) completeness.

Findings: The results of the multivariate competitiveness analysis of 32 European countries based on their performance on the Sustainable Development Goals identified which countries performed best and which performed worst in this context. In addition, it was identified which countries performed best and which worst in achieving each of the 16 Sustainable Development Goals considered (for one of the SDGs, data was not complete).

Research limitations/implications: For a proper interpretation of the assessment for each country under study, an in-depth knowledge of its specificities, both in the economic, social and environmental dimensions, is also necessary. It may then turn out that the achievements in the field of individual goals result, for example, from the baseline level in a given area or the real possibility of taking specific actions.

Practical implications: Whereas the challenges faced by countries today, an assessment of the multivariate position of countries, taking into account their achievements in relation to the Sustainable Development Goals, seems to be entirely appropriate, as it provides a picture of the

potential of individual countries in relation to their ability to cope with the problems that the international community has defined as key, and has included in the form of the SDGs.

Social implications: The reference to sustainable development in the context of evaluate countries and their competitiveness fits in with the need to raise public awareness of the challenges of making this a reality and the role of countries in this process.

Originality/value: The research results can contribute to a broader understanding of what a country's competitiveness is in the modern world and what sustainable factors shape it. The approach presented can complement and make more realistic the traditional one-dimensional competitiveness rankings, especially in light of multivariate analysis and the challenges faced by modern states.

Keywords: Sustainable, Multivariate, SDG, Development Goals.

Category of the paper: Research paper.

1. Introduction

In recent years, sustainable development has become a popular concept, both in public debate and academic discourse. The most well-known definition of sustainable development is the one proposed in the report published by the World Commission on Environment and Development (WCED) - "Our Common Future", where it is stated that sustainable development is "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987). Sustainable development encompasses not only environmental aspects but also economic and social dimensions (Brundtland, 2012). It also combines economic growth, social justice, and environmental protection (Sachs, 2015). An integral part of this concept are three indicated areas: economic, social, and ecological (e.g., Giddings et al., 2002; Rogall, 2010; Schaefer, Crane, 2005).

While some authors point to various moments in the creation of the sustainable development concept, the most important seems to be reaching back to the beginnings of the formation of social life (Barrow, 1995; Du Pisani, 2006). Undoubtedly a turning point in the process of its development can be considered the United Nations Conference on the Human Environment in Stockholm in 1972, where the problem of ecological limitations of world development was widely discussed (UN, 1973). In the following decades, a number of initiatives were undertaken related to refining and popularising this concept. In the context of the aim of this article, an important issue is the matter of reporting the sustainable development. The concept had also an impact on the reporting information from countries perspective and financial reporting of companies. J. Elkington, based on the concept of sustainable development, introduced the concept of "triple bottom line", which expanded the traditional framework of corporate reporting to include environmental and social aspects beyond the previously only considered financial aspects (Elkington, 1997). Considering the development of the concept of sustainable development, an important issue was the subsequent attempts to operationalise it by presenting the concept in the form of goals that stand before the modern world, and therefore also before

each organisation and country. The first such attempt was made during the Millennium Summit in New York in 2000, where 8 Millennium Development Goals were formulated. These included: eradicating extreme poverty and hunger; achieving universal primary education; promoting gender equality and empowering women; reducing child mortality; improving maternal health; combating HIV/AIDS, malaria, and other diseases; ensuring environmental sustainability; and developing a global partnership for development (UN, 2000). In 2015, during the United Nations Summit on Sustainable Development held in New York, a summary of the achievements to date in the field of sustainable development was made, and 17 Sustainable Development Goals were defined and adopted (UN, 2015). Their compilation is presented in figure 1.

Figure 1. Sustainable Development Goals (SDG).

Source: https://www.gov.pl/web/polishaid/sustainable-development-goals, 10.11.2023.

The structure of the defined goals is often described as the 5Ps. Thus, goals 1-5 relate to social issues (people), goals 7-11 fit into the economic dimension (prosperity), goal 6 and goals 12-15 address ecological challenges (planet), goal 16 focuses on ensuring broadly understood peace (peace), and goal 17 – indicates the necessity of cooperation for sustainable development (partnership). The realization of the last two goals is essential for creating conditions to achieve social, economic, and environmental goals (UNDP, 2015). These goals are further divided into 169 targets, through which the extent to which an organization meets the requirements of sustainable development can be assessed. In the traditional approach, individual countries are evaluated using the above goals, but the proposed goals can be used to assess sustainable development in the case of enterprises as well (Adams et al., 2020; Camilleri, 2017). Fulfilling the requirements of sustainable development by individual enterprises consequently affects the position in terms of sustainable development occupied by individual countries. Undoubtedly, the realization of sustainable development goals by a large group of enterprises raises the implementation of sustainable development within a given country. In the case of enterprises,

it should be noted that the realization of sustainable development goals affects the perception of a given enterprise by its various stakeholders and consequently influences the purchasing decisions of customers (Frank-Martin et al., 2009; Qorri et al., 2018). The use of the concept of sustainable development is not only an ethical or regulatory obligation but also a key factor in creating value and building competitive advantage of county. Implementing sustainable development in country also affects more efficient cooperation with stakeholders i.a.: citizens, non-governmental organizations, and other entities. Such partnerships can lead to increased innovation and efficiency of the state. The realization of the concept of sustainable development helps countries better manage risk and compliance with regulations. Countries that proactively address environmental and social issues can avoid costs associated with regulatory violations and negative impacts on their reputation.

The aim of this paper was to evaluate competitive position of European countries based on the achievements of the Sustainable Development Goals in 2022. The tool to achieve the goal was multidimensional comparative analysis.

2. Competitive position concept

Competitive position is a concept that can be used to present various areas of activity of both a single organisation and a group of organisations. The concept of competitive position can be applied not only to the entire company but also to its individual products. The competitive position of a product refers to how the product is perceived in the market compared to competitive products (Keller et al., 2008; Aaker, 2012; Grant, 2021; Tidd et al., 2020). The concept of competitive positioning can also be applied to individual departments within a company or projects undertaken by companies (Dziadkiewicz, 2021). In this context, the competitive position refers to the efficiency, productivity, innovativeness, and overall effectiveness of the department compared to similar departments in other enterprises operating in the industry (Ulrich, 1996; George et al., 2004; Christiansen, 1997). It seems that in the literature, the concept of competitiveness is most often related to enterprises. The competitive position of an entity is usually defined as its ability to maintain and increase market share, achieve high profitability, and company value compared to competitors operating in the market. According to Porter, competitiveness is the ability of an entity to defend against five competitive forces that shape the structure of the industry in which the enterprise operates. The competitive position of an entity is related to the choice of strategy that allows the enterprise to gain an advantage over its competitors (Porter, 1980). Meanwhile, according to Kotler, the competitive position of an enterprise is related to the place it occupies in the minds of consumers in relation to the place occupied by competitors (Kotler et al., 2012). The concept of competitive position can also be used to present several entities, such as an industry,

a selected region, or the economy of an entire country. The competitive position of an industry refers to the overall ability of the industry to generate value and profits in a market context, taking into account factors such as the intensity of competition, barriers to entry, growth potential, profitability, and innovativeness (Porter, 1980). Meanwhile, the competitive position of a country refers to the ability of a given state to create and maintain an environment conducive to economic growth, which translates into a high standard of living for its inhabitants (Porter, 1990). Perfect example of implementing country competitive position concept are annually reports of the World Economic Forum. Those reports evaluates the competitiveness of countries based on a wide range of indicators, including: infrastructure, macroeconomic stability, health, education, labour market, financial development, market size, business dynamics, and innovativeness.

It can be considered that the competitive position always relies on the comparison of different entities. If a given entity (product, department, enterprise, industry) has a better competitive position, it ensures benefits over other entities. In the literature, we can find a range of tools used to measure the competitive position of the analysed area. The most commonly used tools for measuring competitive position include: market share (Kotler, 2012); profitability (Brigham, 2013); brand value (Aaker, 1991); innovativeness (Tidd, 2020) or customer satisfaction (Reichheld, 2003).

These are just selected measures of the competitive position of enterprises. In the case of analysing the competitive position of a group of enterprises, a region, or a country, there is also a whole set of tools used to measure competitive position. It seems that to assess the competitive position of a country, the concept of sustainable development can be used, utilising measures indicating the achievement of each of the 17 goals indicated by the UN. Such an assessment of a country indicates its position in terms of all aspects related to the sustainable development of that country.

3. Methodology

The research was based on data selected from Europe Sustainable Development Report (2022). From 37 European countries there were selected 32 countries to analysis. The criterion for selecting countries (objects) was the completeness of available data. In the next step of the research was performed the analysis of indicators (SDG – Sustainable Development Goals) completeness. It turned out that indicator number 14 (SDG 14 – Life Below Water) had to be removed from the list of indicators due to lack of data availability for every country. Therefore the list of indicators was: SDG1 – No Poverty, SDG2 – Zero Hunger, SDG3 – Good Health and Well-Being, SDG4 – Quality Education, SDG5 – Gender Equality, SDG6 – Clean Water and Sanitation, SDG7 – Affordable and Clean Energy, SDG8 – Decent Work and Economic

Growth, SDG9 – Industry, Innovation and Infrastructure, SDG10 – Reduced Inequalities, SDG11 – Sustainable Cities and Communities, SDG12 – Responsible Consumption and Production, SDG13 – Climate Action, SDG15 – Life on Land, SDG16 – Peace, Justice and Strong Institutions, SDG17 – Partnerships for the Goals. Whereas the group of objects was 32 countries: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Türkiye, United Kingdom. The countries that were included in the analysis due to not available data were: Bosnia and Herzegovina, Liechtenstein, Montenegro, North Macedonia and Serbia. As a result, In the study there were 512 observations (indicators).

Depending on the complexity of the problem, the pattern of proceeding in this analysis may vary (Śledzik, 2014; Śledzik, Barembruch, 2015; Śledzik et al., 2023). Based on the views presented in the literature, the verification of the level of correlation between variables was abandoned (Kukuła, 2000; Balicki, 2014).

The paper presents the possibility of using multivariate analysis based on euclidean distance from the Positive Development Pattern (PDP) to identify those European countries, which were characterized by the highest levels of individual SDG. The procedure consisted of the following stages of the calculation:

1. First step of the study was to transform transformation of non-numeric ratings and trends from Europe Sustainable Development Report 2022 into numerical data (grades). Therefore rate "SDG achieved" received a numerical value 4, "Challenges remain" received a numerical value 3, "Significant challenges remain" marked as 2 and "Major challenges remain" as 1. Next trend changes assigned to the non-numeric ratings were marked accordingly: "On track" as 1,25, "Moderately Increasing" as 1,125, "Stagnating" as 1 and "Decreasing" as 0,75. Finally, indicators for analysis were constructed as a multiplier of the rating and trend in numerical form. The result is a matrix od European countries (objects) and 512 numeric indicators:

$$X = [x_{ij}] \; (i = 1, \ldots, \text{n}; j = 1, \ldots, \text{m}) \tag{1}$$

    where: x_{ij}- value of j-th indicator on the i-th object.

2. Due to the fact that the features can be stimulants, destimulants or nominants before next step there should be (if necessary) used procedure to bring uniformity of characteristics (features). In the study every indicator (SDG) was stimulant therefore, there was no need to transform the variables. The second step of the calculation was to bring the different variables comparable titers with standardization. As a result of diagnostic standardization of each variable will have a mean value of 0 and standard deviation equal to 1. Standardization is made according to the following formula:

$$z_{ij} = \frac{x_{ij} - \bar{x}_j}{S_j} \quad (i = 1,...,n, \; j = 1,...,m) \tag{2}$$

where:

$\bar{x}_j$ - the arithmetic mean of the j-th features,

S_j - standard deviation of the j-th features,

z_{ij} - standardized value of j-th features of the i-th object.

3. The third step was to estimate the z_pj - Positive Development Pattern (PDP) by setting the maximum value in each column of standardized features.

4. Calculating the distance of each object from the PDP using Euclidean distance determined by the formula:

$$d_i = \sqrt{\sum_{j=1}^{m} \left(z_{ij} - z_{pj}\right)^2} \quad (i = 1,...,n) \tag{3}$$

where: $z_{pj} = \max \{ z_{ij} \}$ – Positive Development Pattern (PDP).

5. Due to the fact that the synthetic variable determined according to formula (3) is not normalized, the postulate of normativity (Tarczyński, 2006) was used and the preference of the variable was changed, where higher values will indicate a higher level of the examined phenomenon. The proposed SMD (Synthetic Measure of Development) indicator will therefore take values from 0 to 1. The following formula was used for this purpose:

$$SMD_i = 1 - \frac{d_i}{\bar{d}_i + aS_d} \; (i = 1, ..., n) \tag{4}$$

where:

SMD - Synthetic Measure of Development for *i*-th object,

d_i - Euclidean distance from PDP,

$\bar{d}_i$ - arithmetic mean of d_i,

S_d - standard deviation of d_i,

a – parameter satisfying the inequality $a \geq \dfrac{\max d_i - \bar{d}_i}{S_d}$ \hfill (5)

As a result there were created multivariate Synthetic Measure of Development - SMD ratio with range from 0 to 1 for each of 32 objects (European countries). Sorted from highest to lowest value of SMD ratio became a ranking of competitive position of the best countries from SDG point of view in 2022. The main advantage of multidimensional analysis is the fact that this indicator makes it possible to rank selected countries taking into account all 16 SDGs at the same time.

4. Results

Within Europe, there are major differences in SDG performance. The highest grades form SDG1 (no poverty) point of view in 2022 was observed for Belgium, Czechia, Iceland, Ireland, Poland and Slovenia (see Table 1). It means that in those countries has i.a. the lowest estimated percentage of each country's population that is living under the poverty threshold of US$5.50 a day in purchasing power parity (PPP) at constant 2011 prices. In those countries is the lowest number of people who experience at least 4 out of 9 following deprivations items: cannot afford:

1. to pay rent or utility bills,
2. keep home adequately warm,
3. face unexpected expenses,
4. eat meat, fish or a protein equivalent every second day,
5. a week holiday away from home,
6. a car,
7. a washing machine,
8. a colour TV, or
9. a telephone.

The lowest grades in this development goal was observed for Romania and Türkiye.

The highest grades form SDG2 (zero hunger) was observed for Bulgaria, Czechia and Ireland. It means that in those countries is i.a.:

1. the smallest percentage of the adult population that has a body mass index (BMI) of $30 kg/m^2$ or higher, based on self-reported height and weight,
2. percentage of its potential yield in the three annual crops using the most land area, weighted for the relative importance of each crop in terms of surface area.

The lowest grade in this development goal was observed for 10 countries: Cyprus, Finland, France, Iceland, Italy, Latvia, Lithuania, Netherlands, Spain and United Kingdom.

From SDG3 (Good health and well-being) perspective best countries is Switzerland. Romania turned out to be the country with the lowest grade in this aspect. In this evaluation it was taken into account i.a.:

1. life expectancy at birth,
2. gap in life expectancy at birth among regions,
3. population with good or very good perceived health,
4. gap in self-reported health, by income,
5. new cases of tuberculosis infection per 100,000 population,
6. standardised preventable and treatable mortality,
7. suicide rate,
8. people killed in road accidents,
9. population engaging in heavy, episodic drinking at least once a week,

10. smoking prevalence,

11. people covered by health insurance for a core set of services.

Table 1.
Grades of SDG for chosen European countries in 2022

	SDG1	SDG2	SDG3	SDG4	SDG5	SDG6	SDG7	SDG8	SDG9	SDG10	SDG11	SDG12	SDG13	SDG15	SDG16	SDG17
Austria	4,5	2	3,375	3,375	3,375	3	5	3,375	4,5	5	3,375	1	1	1	3	2
Belgium	5	0,75	3,375	2,25	3,375	2,25	3,75	3,375	3,375	5	3,375	1	1	2	3,375	1
Bulgaria	2,25	2,25	2,25	1	2	2,25	2,25	2	1	1,5	2,25	1	2	2,25	2	2,25
Croatia	3,375	2	2,25	2,25	2,25	2	3,75	2,25	2,5	3,75	2,5	2	1	2	2	3
Cyprus	3,75	1	2,25	2,25	1	1,125	2,5	2,25	2,25	3,75	1	1	1	2,5	3	1
Czechia	5	2,25	2,25	2,25	2,25	3,75	2,25	3,375	3,375	5	3,75	2	1	2,5	3	2
Denmark	4,5	1,5	3,375	3	3,375	3,375	5	3,375	4,5	4,5	2,25	1	1	3	3,375	4
Estonia	3,375	0,75	3,375	5	2	2,25	2,25	3	3,375	3,75	3,375	1,125	1,125	3,375	3,375	2
Finland	4	1	3,375	4	3,375	3,75	5	3,375	5	4,5	4,5	2	1	2	3,375	3,375
France	4	1	3,375	2,25	3,375	2	3,375	2,25	4,5	3	3,375	1	1	1,125	1	2,25
Germany	3	1,125	3,375	2	3,375	3,75	3,375	3,375	3,375	2,25	3,375	1	1	2	3,375	4,5
Greece	2,25	2	2,25	2,25	2	2,25	2,25	1,125	2,5	3,75	2,25	2	1,125	2	2,25	2
Hungary	3,75	0,75	3,375	2	0,75	3,375	2	3,375	2,25	3,375	3,375	2	0,75	2	2	1,125
Iceland	5	1	3,75	2	3,375	1,25	5	2	4	4	1,25	1	1	0,75	3,375	2,25
Ireland	5	2,25	3,375	3,375	2,25	2	3,75	2,25	3,375	3,75	3	0,75	1	2	3	0,75
Italy	2,25	1	3,375	2	2,25	2	3,75	2	2,25	2	3,75	2	1	1	2,25	2
Latvia	2,25	1	2,25	3,375	1,5	2,5	3,75	2,25	2,25	1,5	3,75	0,75	1,5	3,375	3,375	1
Lithuania	3,375	1	2,25	3,375	2,25	2,5	1	2,25	2,25	2,25	3,375	1	0,75	3,375	3,375	2,25
Luxembourg	3	2	3,375	2	2,25	2,25	2	3	3	3	3,375	1	1,125	1	2	1,125
Malta	3,375	0,75	2,25	2,25	1,125	1,125	2,25	3,375	2	2,25	2	2	2,5	1	2	1
Netherlands	4	1	3,375	3	3,375	3,375	2,5	3,375	4,5	3	3,375	1	1	1	2	0,75
Norway	4	2	3,375	3	3,375	2,25	4	2	4,5	5	3,375	0,75	1	1	3,375	4
Poland	5	2	2,25	3,375	2	3,375	2,25	3,375	2,25	5	2,5	2	1	2	2	2
Portugal	3,375	2	3,375	3,375	3,375	2,25	3,375	3,375	2,25	3,75	2,25	1	2	0,75	2	2
Romania	1,25	2	2	1	2	2,25	2	1,125	1,125	2,25	2,25	0,75	2	1	2	2
Slovak Republic	3,75	0,75	3,375	2,25	2,25	3,375	3,375	2,25	1,125	5	2,5	1,5	1	2,25	3	2
Slovenia	5	2	3,375	3,375	2	2,5	3,375	3,375	3	5	2,5	2	1	2	3,375	2
Spain	2	1	3,375	3,375	3,375	3	2,25	2,25	2,25	3,75	3,375	2	1	1	3	2
Sweden	3	2	3,375	3,375	3,375	3,75	4	3,375	4,5	5	3,375	2	2	1	2	3
Switzerland	3,375	2	4,5	2	3,375	2,25	5	2,25	4,5	2,25	3,375	1	2,25	1	2	1
Türkiye	1	1,5	2,25	1,125	1,125	3,375	1,5	1	2,25	0,75	1,125	3	2,25	0,75	1	3,375
United Kingdom	3	1	2,25	3,375	2,25	3,375	2,25	3	3,375	2	2	2	1,25	2,25	2	1

Source: Own preparation based on Europe Sustainable Development Report 2022.

SDG4 grade evaluates quality of education. The best European country in this area was Switzerland. The worst occurred Romania. Aspects taken into account to evaluate this goal was i.a.:

1. Participation in early childhood education.

2. Early leavers from education and training.

3. National scores in the Programme for International Student Assessment (PISA).

4. Underachievers in science.

5. Variation in science performance explained by students' socioeconomic status.

6. Tertiary educational attainment.

7. Adult participation in learning.

The highest grades form SDG5 (Gender equality) point of view in 2022 was observed for: Austria, Belgium, Denmark, Finland, France, Germany, Iceland, Netherlands, Norway, Portugal, Spain, Sweden and Switzerland. The lowest grade of SD5 was observed for Cyprus. To evaluate SD5 it was taken into account i.a.:

1. Unadjusted gender pay gap,

2. Gender employment gap,

3. Population inactive due to caring responsibilities,

4. Seats held by women in national parliaments,

5. Positions held by women in senior management positions,

6. Proportion of ICT specialists that are women.

SDG6 describes Clean water and sanitation. The countries that performed best in this aspect were: Czechia, Finland, Germany, Sweden. Cyprus and Malta was on the opposite side. Clean water and sanitation was evaluated by such ratios as i.a.:

1. Population having neither a bath, nor a shower, nor indoor flushing toilet in their household.
2. Population connected to at least secondary wastewater treatment.
3. Freshwater abstraction.
4. Scarce water consumption embodied in imports.
5. Population using safely managed water services.
6. Population using safely managed sanitation services.

The highest grades from SDG7 (Affordable and clean energy) perspective was observed for: Austria, Denmark, Finland, Iceland and Switzerland. The lowest grade has only Lithuania. Affordable and clean energy was evaluated by such ratios as i.a.:

1. Population unable to keep home adequately warm.
2. Share of renewable energy in gross final energy consumption.
3. CO_2 emissions from fuel combustion per electricity output.

SDG8 was titled as a "Decent work and economic growth". Austria, Belgium, Czechia, Denmark, Finland, Germany, Hungary, Malta, Netherlands, Poland, Portugal, Slovenia and Sweden that is list of 13 countries with highest grades. The worst score was observed for Türkiye. This goal was described by such ratios as i.a.:

1. Protection of fundamental labour rights.
2. Gross disposable income.
3. Youth not in employment, education or training (NEET).
4. Unemployment Rate.
5. People killed in accidents at work.
6. In work at-risk-of-poverty rate.
7. Fatal work-related accidents embodied in imports.
8. Victims of modern slavery embodied in imports.

From SDG9 (Industry, innovation and infrastructure) perspective the highest grade was observed for Finland. The lowest grade was observed for Bulgaria. Evaluation was based on such ration as i.a.:

1. Gross domestic expenditure on R&D.
2. R&D personnel.
3. Patent applications to the European Patent Office.
4. Households with broadband access.
5. Gap in internet access, urban vs rural areas.
6. Population with at least basic digital skills.
7. Logistics performance index: Quality of trade and transport-related infrastructure.
8. The Times Higher Education Universities Ranking: Average score of top 3 universities.
9. Articles published in academic journals.

The highest grades from SDG10 (Reduced inequalities) perspective was observed for Austria, Belgium, Czechia, Norway, Poland, Slovak Republic, Slovenia and Sweden. The lowest grade was observed for Türkiye. Evaluation was based on Gini Coefficient and Palma ratio.

Best country from "Sustainable cities and communities" (SDG 11) point of view is Finland. Cyprus had the lowest SDG11 grade. Ratios used to evaluate Sustainable cities and communities was:

1. Urban population without access to green urban areas in their neighbourhood.
2. Overcrowding rate among people living with below 60% of median equivalized income.
3. Recycling rate of municipal waste.
4. Population living in a dwelling with a leaking roof, damp walls, floors or foundation or rot in window frames or floor.
5. Housing cost overburden rate.
6. Exposure to air pollution: PM2.5 in urban areas.

From "Responsible consumption and production" (SDG 12) point of view Türkiye had highest grade (but only 3). The lowest grade (1) was observed for 13 countries: Austria, Belgium, Bulgaria, Cyprus, Denmark, France, Germany, Iceland, Lithuania, Luxemburg, Netherlands, Portugal and Switzerland. This goal was based on ratios like:

1. Circular material use rate.
2. Gross value added in environmental goods and services sector.
3. Production-based SO_2 emissions.
4. Imported SO_2 emissions.
5. Production-based emissions of reactive nitrogen.
6. Imported emissions of reactive nitrogen.
7. Exports of plastic waste.

Best country form "Climate action" (SDG 13) perspective was Malta. The lowest grade was observed for Hungary and Lithuania. Climate issues in SDG13 was evaluated on the basis of:

1. CO_2 emissions from fossil fuel combustion and cement production.
2. CO_2 emissions embodied in imports.
3. CO_2 emissions embodied in fossil fuel exports.

Life below water (SDG 14) was omitted from the study due to missing data for some countries. Taking into account "Life on land" (SDG 15) best countries in 2022 were: Estonia, Latvia, Lithuania. The worst was Iceland, Portugal and Türkiye. This goal evaluation was based on:

1. Mean area that is protected in terrestrial sites important to biodiversity.
2. Mean area that is protected in freshwater sites important to biodiversity.
3. Biochemical oxygen demand in rivers.
4. Nitrate in groundwater.
5. Red List Index of species survival.
6. Terrestrial and freshwater biodiversity threats embodied in imports.

SDG16 describes "Peace, justice, and strong institutions". The highest grade in this issue was observed for: Belgium, Denmark, Estonia, Finland, Germany, Iceland, Latvia, Lithuania, Norway, Slovenia. The lowest score was observed for France and Türkiye. This goal was described by such ratios as:

1. Death rate due to homicide.
2. Population reporting crime in their area.
3. Gap in population reporting crime in their area, by income.
4. Access to justice.
5. Timeliness of administrative proceedings.
6. Constraints on government power.
7. Corruption Perceptions Index.
8. Unsentenced detainees.
9. Exports of major conventional weapons.
10. Press Freedom Index.

"Partnerships for the goals" (SDG 17) was the last goal in this study. The best country in this matter was Germany. The worst was Ireland and Netherlands. Ratios used to evaluate this goal was:

1. Official development assistance.
2. Shifted profits of multinationals.
3. Corporate Tax Haven Score.
4. Statistical Performance Index.

Above conclusions was concerned one-dimensional approach. It was not possible to chose which country is the best taken into account all 16 goals at the same time. The SMD variable presented as a result of the study made it possible to rank individual countries from the best to the worst country from the point of view of all SDGs included in the study.

Therefore the highest value of SMD was observed for Finland (0,55) (see Figure 2). Second place in SDG ranking in 2022 took Sweden (0,50). Third place was observed for Denmark (0,45). Those three Scandinavian countries are characterized by a relatively better competitive position than other countries.
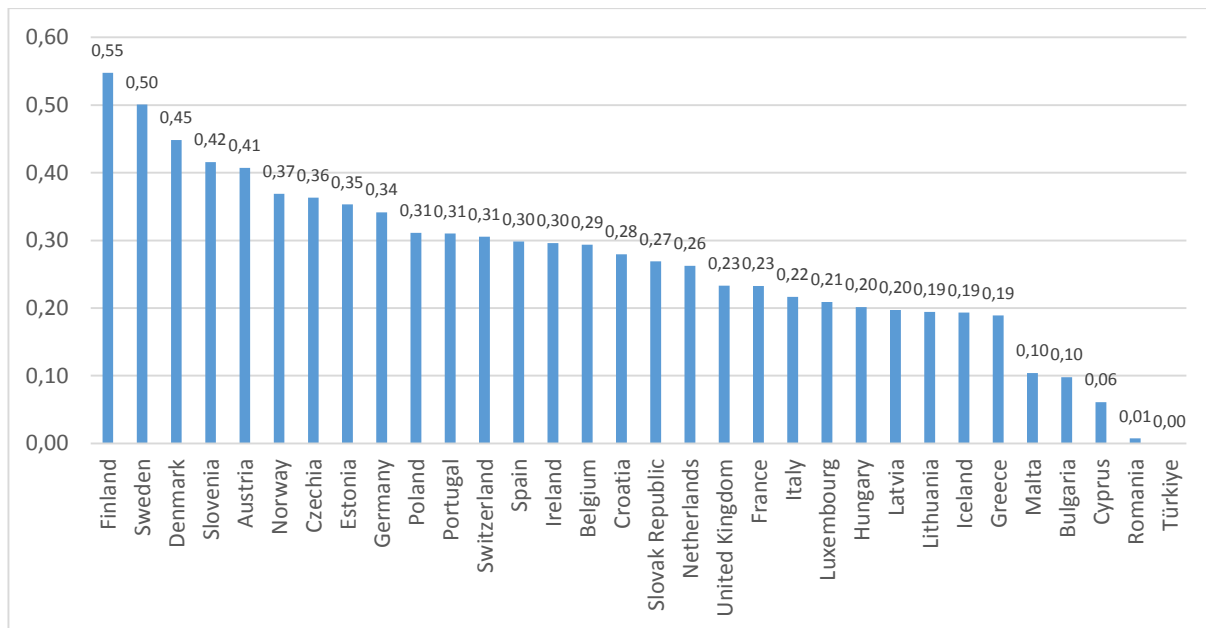
Figure 2. SMD values for chosen European countries in 2022.

Source: Own preparation based on Europe Sustainable Development Report 2022.

A very similar level of relative competitive position was recorded for Slovenia (0,42) and Austria (0,41). Next in the ranking are four countries with a similar score: Norway (0,37), Czechia (0,36), Estonia (0,35) and Germany (0,34). Another group with similar SMD results creates a cluster composed of countries such as: Poland (0,31), Portugal (0,31), Switzerland (0,31), Spain (0,30), Ireland (0,30) and Belgium (0,29). Croatia, Slovak Republic and Netherlands can be considered as another cluster (with SMD form 0,28 to 0,26). United Kingdom and France they matched the result ex aequo with the result at the 0,23 level. A similar situation occurred in the case of Italy (0,22) and Luxemburg (0,21). Subsequently, another cluster with similar SDM values became noticeable. This concerned countries such as: Hungary and Latvia with SMD core 0,20 and Lithuania, Iceland and Greece with score 0,19. Malta and Bulgaria had SMD 0,10. Romania and Türkiye may be considered as countries on the last place in ranking what means that relatively taking into account all 16 SDG those countries were furthest from the positive development pattern consisting of the maximum values of individual SDGs.

5. Conclusions

The aim of the article was to evaluate the competitive position of 32 European countries, based on their performance in achieving the Sustainable Development Goals. Due to data constraints, 16 of the 17 SDGs were eventually included. The conclusions of the analysis turned out to be compelling. On the one hand, the leading multivariate positions were mainly occupied

by the Scandinavian countries, not only relatively wealthy but also traditionally associated with a commitment to sustainable development. But on the other hand, it can be seen that some countries perceived as wealthy do not look so well when confronted with sustainability criteria. One example is Switzerland, ranked 12th, which is 2 positions behind Poland. Even more interesting is the position of Luxembourg, which in the sustainability scorecard is ranked only 22nd. An interesting point, which requires further research, is that the first 8 places are occupied by countries with a relatively small population, while the first larger country in terms of population is Germany in 9th place, followed closely by Poland.

Given the challenges faced by countries today, an assessment of the multivariate position of countries, taking into account their achievements in relation to the Sustainable Development Goals, seems to be entirely appropriate, as it provides a picture of the potential of individual countries in relation to their ability to cope with the problems that the international community has defined as key, and has included in the form of the SDGs.

However, it cannot be ruled out that an assessment of the competitiveness of countries or regions based on an analysis of their performance against the SDGs also entails certain limitations and challenges. It is not only that complete and up-to-date data are needed, in the form of a wide range of indicators. For a proper interpretation of the assessment for each country under study, an in-depth knowledge of its specificities, both in the economic, social and environmental dimensions, is also necessary. It may then turn out that the achievements in the field of individual goals result, for example, from the baseline level in a given area or the real possibility of taking specific actions. It may also turn out that, because of a certain specificity, in different countries different problems may be prioritised and it is these that are addressed first.

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