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Sustainable Energy Development and Sustainable Social Development in EU Countries

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Abstract: Sustainable development has been the focus of many analyses in economics. Nevertheless, only a few attempts have so far been made to identify the underlying relationship between sustainable energy development and sustainable social development. This article fills this research gap and enables a better understanding of the essence of sustainable development to help draw applicable conclusions. The aim is to assess sustainable energy and social development in EU countries and to examine their shared relationship in this area. To this end, this study uses a taxonomic method and correlation analysis. The analysis period covers the years 2014–2020. The research builds directly on the assumptions of the concept of sustainable development, with particular emphasis on energy and social aspects. The article is composed of two parts. The first, based on a literature review, discusses the essence of sustainable energy development and social sustainability. The second outlines the research methodology, including the underpinnings of synthetic measures and the results of the conducted empirical research.

Keywords: sustainable development (sustainability); sustainable energy development (energy sustainability); sustainable social development (social sustainability); multidimensional comparative analysis; EU economy

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1. Introduction

In recent years, the concept of sustainable development, or sustainability, has become an integral component of the development of EU member states [1–3]. The EU's main objective in the area of sustainability is to meet the needs of the present generation without compromising the ability of future generations to meet theirs [4–6]. Sustainable development is a global, interdisciplinary concept based on balanced economic, social, and ecological development. The concept itself is fluid as it does not contain a strictly defined scope of activities but rather evolves over time with the emergence of new developmental challenges [7–9]. The concept of sustainable development refers to three perspectives: holistic (broad and comprehensive approach to problem areas), global (in a broader perspective, sustainable development must refer to the entire world), and secular (one that spans many generations). In addition, sustainable development should take into account ethical principles, i.e., intergenerational and intragenerational justice as well as taking responsibility for one's own actions. These principles lead to revaluation in all spheres of the economy, including the energy sector, due to depletion of limited energy resources and degradation of the natural environment [10]. Behind this concept lie the intensive global development of civilization, rapid population growth, excessive consumption, and the never-waning demand for depleting natural resources, especially energy. Thus, the energy sector has grown to play a particularly important role in meeting the EU's sustainability targets [10–15]. This role stems from the sector's significance for economic competitiveness, environmental protection, and energy security. Rational production, supply, and consumption of energy are among the key components of this policy, leading to tangible economic and social improvements [16]. Currently, the global demand for depleting energy resources is on the rise and the global economy is being threatened by a growing energy deficit, prompting significant degradation of the natural environment and worsening climate change. The EU has for a long time been adopting measures to respond to these emerging challenges. The EU's long-term goal (for the year 2050) is to transform the EU economy into a low-emission economy using modern, "clean" energy technologies. However, sustainable development of the energy sector (the terms "sustainable energy development" and "energy sustainable development" are used interchangeably) has proven to be an exceptionally daunting task for the EU, despite constituting a step in the right direction at an industry level. One such EU-launched undertaking is the European Green Deal (EGD), a new growth strategy envisaging the EU reaching climate neutrality by the year 2050 [17]. The EGD is thus an action plan for a sustainable EU economy, the successful implementation of which will transform the EU into a fair and prosperous society embedded in a modern, resource-efficient, and globally competitive economic setting [18]. According to the EGD strategy, in 2050, the EU will have reached zero net greenhouse gas emissions, and economic growth will have by then been decoupled from resource consumption. This in turn requires a more comprehensive readjustment that will be both cost-effective and fair but also socially sustainable. The goal is therefore to protect, conserve, and enhance the EU's natural capital all the while protecting the health and well-being of citizens from environmental risks and impacts [19]. The EGD, like the Lisbon Strategy and the Europe 2020 Strategy before it, points to the social effects of the planned changes, defined as increasing social inclusion [20].

Having said that, only a few attempts have so far been made to identify the underlying relationship between sustainable energy development and social sustainability. The insufficiency of empirical findings invites supplementation of the existing state of knowledge in this field. As such, the aim of this article is to assess sustainable energy development and social sustainability in EU member states as well as to examine their shared relationship. In addition, the aim is to present a ranking of EU countries that will enable an analysis of the spatial diversity in terms of the development of the energy and social sectors in individual EU countries. Meeting this challenge seems promising as it may add a certain cognitive value as well as potential knowledge-related benefits concerning what sustainable energy and social sustainability are and how they are measured. To this end, this study uses a taxonomic method and correlation analysis. The analysis period covers the years 2014–2020, which coincides with the implementation period of the already mentioned Europe 2020 Strategy. The article is composed of two parts. The first, based on a literature review, discusses the essence of sustainable energy development and social sustainability. The second outlines the research methodology, including the underpinnings of synthetic measures and the results of the conducted empirical research.

The issues raised throughout this article are currently important given that a properly designed energy policy can channel the development of EU countries in a way that is both sustainable and accountable. One of the major threats to human development is the scarcity of resources and the degradation of the natural environment propelled, among other factors, by carbon emissions. In the era of climate change and growing energy demand, mitigating these threats calls for an energy policy whose instruments and principles will have a positive impact on the sustainable development of the energy sector, which in turn will reflect on the same type of development in the social context.

2. The Concept of Sustainable Energy Development—Literature Review

A sustainable energy sector is a necessary direction of development because the global economy is plagued by energy deficits, excessive cash flows to resource-rich countries, environmental devastation, climate change, and biodiversity loss [21,22]. Ensuring a sustainable, harmoniously expanding energy market is one of the key goals of the sustainable policies adopted by different international organizations [23]. The EU first took such steps at the European Council meeting in Gothenburg in June 2001. It was then that the bloc's first

Strategy for Sustainable Development came to life, which highlighted the need to address a small number of threats to the well-being of current and future generations as only then could those be effectively remedied. The main threats at the time were climate change, poverty, the growing resistance of bacteria to antibiotics, the content of chemical agents in food, population aging, biodiversity loss, and regional development disparities across the EU. It was emphasized that sustainable development must be the overarching goal for each and every sector of the economy [10]. The EU Strategy for Sustainable Development was the bloc's contribution to global policy and it laid the groundwork for the 2002 World Summit (Rio+10) in Johannesburg. In September 2015, the United Nations Summit was held in New York, during which a document entitled Transforming our world: The 2030 Agenda for Sustainable Development was unveiled [24]. It sets out 17 sustainable development goals (SDGs) for the years 2015–2030, replacing the previous Millennium Development Goals, which were not fully achieved and for which progress was frequently uneven. With regard to the energy sector specifically, goal seven (SDG 7) is of utmost importance: "to ensure access to affordable, reliable, sustainable and modern energy for all". This objective calls for ensuring universal access to modern energy services, improving energy efficiency, and increasing the share of energy from renewable sources. To accelerate the transition towards an affordable, reliable, and sustainable energy system, countries need to facilitate access to clean energy research as well as to promote investment in energy infrastructure and clean energy technologies. Monitoring of SDG 7 in the EU context focuses on progress in reducing energy consumption, ensuring sustainable energy supply, and improving access to affordable energy [25]. Sustainable development of the entire energy sector plays a vital role in the implementation of the concept of sustainability. Several authors [26–28] point out that in order for that to happen, a holistic readjustment of the global economy, and most importantly energy economics, would have to occur. The concept of sustainable energy development should factor in the following [10]: sustainability (managing energy in such a way that its appropriate amount is allocated for both present and future generations), economic benefit (a socially desirable energy management method that will not entail harm to the environment), harmonious development (maintaining a balance between the three key goals of energy security, economic competitiveness, and efficiency), and environmental protection.

The current energy crisis has markedly influenced the direction of EU energy policy development. It revealed the importance of a common and conscious energy policy focused on specific goals, both short- and long-term. Only a sustainable development policy will help mitigate new developmental challenges as they emerge, protect the EU's economy from energy crises, and enable future generations to use energy and natural resources as freely as we do nowadays. In summary, the three main objectives of sustainable energy policy in the EU have been [10] (1) boosting energy security, (2) boosting energy competitiveness and efficiency, and (3) protecting the environment. Only achieving all three goals under the implemented energy policy can result in sustainable development for the EU energy sector.

3. The Concept of Social Sustainability—Literature Review

The concept of sustainable development is most often defined as the need to maintain a constant income for humanity generated from the ever-decreasing capital resources [29]. The concept assumes the management of natural resources that does not remain indifferent to their depletion and promotes their use relative to social and economic needs. All this is based on a comprehensive approach combining economic, social, and environmental matters in a way that ensures their mutual reinforcement [30,31].

The social dimension of sustainable development primarily concerns activities aimed at improving the quality of life of the population all the while meeting its basic social needs related, among others, to access to education, health care, or decent housing [32,33]. In the broadest sense, the social aspects of sustainable development include curbing poverty and inequality, tackling demographic problems, ensuring intergenerational justice, social inclusion, and the creation of new jobs called green jobs [34–36]. Social goals within sustainable development are, on one hand, measures aimed at updating social attitudes so that environmental goals can be implemented to a greater extent and, on the other hand, measures that reduce the quality-of-life inequalities across or within individual societies [37]. Thus, social sustainability covers equality (where all inhabitants, regardless of gender, should have equal opportunities to survive and seize their potential), sustainability awareness (manifested by more frequent implementation of an increasing number of sustainable consumption patterns), participation (most social groups should be involved in the decision-making process), and social cohesion (which is a society's ability to ensure long-term well-being for all its members) [38]. In UN documents and publications, social development is defined as the expansion of freedoms and opportunities for people to lead a life they value, while sustainable social development is expanding the freedoms of people living today so as not to infringe upon such freedoms for future generations [39].

Poverty and inequality are major problems plaguing modern societies even to this day. The Europe 2020 Strategy for smart, sustainable, and inclusive growth puts forward a common target to fight poverty and social exclusion, namely, a 25% reduction in the number of Europeans living below the poverty line and a reduction in the number of poor population by 20 million. This target was missed, prompting a new target to be set in March 2021 to reduce the number of people living in poverty by at least 15 million by 2030. The importance of poverty as a social problem was confirmed by the adoption of Transforming Our World: The 2030 Agenda for Sustainable Development [25], a pledge to reduce poverty in all its forms worldwide, as the first of the 17 Sustainable Development Goals. Raczkowska et al. [30] indicate that the fight against poverty and inequality, not only in developing countries, should include issues such as access to energy, education, good governance, and socioeconomic policy of the state.

The Sustainable Development Goals (SDGs) set out in the 2030 Agenda also largely extend to the issue of economic and social inequalities. The rationale behind this approach is that as globalization accelerates, so does income inequality and that too rapidly. As a result of global processes such as the progressive liberalization of markets, the growing role of international capital, the expansion of multinational corporations, and the reinforcement of ties across national economies, the gap between the rich and the poor has widened [40]. The problem of inequality was highlighted by T. Piketty [41,42], who saw their main source in the inequality of capital distribution in society and in the fact that the average rate of return on capital exceeds the rate of economic growth. As a remedy for this, the author points to taxing the highest incomes (exceeding USD 0.5 million or 1 million annually) with an 80% tax rate, which will not only not interfere with economic growth but will also allow a larger population to reap the benefits of this growth. T. Piketty's hypotheses were empirically verified in subsequent independent research. C. Góes [43] did so for the relationship between the rate of return on capital and the rate of economic growth in relation to the level of inequality, demonstrating that the correlations hinted at by T. Piketty are not met and the reasons for inequality should instead be sought in institutional, sociological, technological, and structural conditions. Undoubtedly, however, T. Piketty's input has made the problem of inequality an important one in economic and political debate [44].

The assessment of sustainable social development primarily consists of measuring the level of prosperity and analyzing its redistribution. The biggest challenge lies in determining its durability and degree of sustainability. Analysis of these values can be pursued through research on the participation of citizens in economic growth. Simultaneous improvement of development indicators and economic progress poses the greatest scientific challenge of sustainable social development [45].

4. Materials and Methods

Energy and social development are complex phenomena that are conditioned by several different factors [46–49]. Measuring and evaluating complex phenomena therefore requires a multidimensional approach that can reflect that variety. For this, multidimensional comparative analysis methods, classified as taxonomic, are used. Multidimensional comparative analysis is a scientific discipline that enables the analysis of complex objects and phenomena such as those whose state and behavior are simultaneously influenced by many features (variables) and factors. The basic purpose of multidimensional comparative analysis is the construction of a synthetic measure enabling comparison of objects described by many variables.

This taxonomic study was carried out in accordance with the following stages [50–54]:

1. Outline the subject and purpose of the study;
2. Design a database containing diagnostic features collected in the form of intensity indicators describing the subject of the study;
3. Select relevant diagnostic features;
4. Normalize diagnostic features;
5. Determine a synthetic taxonomic measure;
6. Sort the tested objects by the achieved level of the synthetic measure.

The subject and purpose of the research was to construct synthetic measures of sustainable energy development and sustainable social development for the 27 EU member states in the years 2014–2020 and to perform a correlation analysis of these measures.

The basis for the empirical research was a database developed by Eurostat. This database contains statistical data describing the sustainable development of the EU in spatial terms (in relation to individual EU countries) as well as in dynamic terms (2014–2020).

Sustainable development indicators in the Eurostat database are assigned to the 17 objectives of the 2030 Agenda. Guided by the principle of sustainable development, when selecting indicators for the study, the set of features was divided into subsets of similar features, and two groups representing social and energy development were selected [15,55]. A selection was made of those features that are, in light of specific formal and substantive criteria, pivotal from the standpoint of the conducted research analyses. As for the substantive criterion, the principle was adopted that the final set will contain features representing all the distinguished goals of the 2030 Agenda in the area of social and energy development. Ultimately, two lists of potential diagnostic variables were prepared:

7. Concerning energy development, that is, the ability to compete sustainably in the energy dimension—10 variables in total;
8. Concerning human development, which is used to describe the ability of EU countries to compete sustainably in the social dimension—14 variables in total.

A detailed list of indicators classified into two groups describing the research area, together with an indication of the relevant Agenda 2030 goal, is shown in Table 1.

Subsequently, from the set of potential diagnostic features, those for which the value of the coefficient of variation in the classic version (Vj) was lower than 0.2 (20%) were excluded. Those features were considered quasi-permanent, meaning they did not provide significant insight into the studied phenomenon and did not have the ability to discriminate. In total, out of 10 indicators describing energy development and 14 indicators describing social development, 2 in each group (E2, E4 and S8, S13, respectively) were excluded from subsequent analyses. The remaining ones effectively discriminated against the examined objects (EU countries).

In addition to variability, an important criterion for the selection of variables is their correlation. It was assumed that two highly correlated variables convey similar information (in this case, correlation is equivalent to conveying the same information about the tested objects). As such, it is recommended to have one of them removed. For this, an analysis of the matrix of correlation coefficients was carried out. Assuming a critical value of the correlation coefficient at the level of 0.7, the list of potential diagnostic variables describing sustainable energy development was reduced by excluding variables E1, E5, and E6, while variable S1 was dropped from the set of variables describing sustainable social development.

Table 1. Potential diagnostic variables (source: own study based on Eurostat data).

Symbol	Indicator Name	Agenda 2030 Goal and Number
	Sustainable energy development indicators	
E1	Primary energy consumption (tonnes of oil equivalent per capita)	SDG 07.10
E2	Primary energy consumption (index, 2005 = 100)	SDG 07.10
E3	Final energy consumption (tonnes of oil equivalent per capita)	SDG 07.11
E4	Final energy consumption (index, 2005 = 100)	SDG 07.11
E5	Final energy consumption in households per capita (kilogram of oil equivalent)	SDG 07.20
E6	Energy productivity (euro per kilogram of oil equivalent)	SDG 07.30
E7	Energy productivity (purchasing power standard per kilogram of oil equivalent)	SDG 07.30
E8	Share of renewable energy in gross final energy consumption (%)	SDG 07.40
E9	Energy import dependency (% of imports in total energy consumption)	SDG 07.50
E10	Population unable to keep home adequately warm by poverty status (%)	SDG 07.60
	Sustainable social development indicators	
S1	People at risk of income poverty after social transfers (%)	SDG 01.20
S2	In work at risk of poverty rate (% of employed persons aged 18 or over)	SDG 01.41
S3	Housing cost overburden rate by poverty status (%)	SDG 01.50
S4	Agricultural factor income per annual work unit (index, 2010 = 100)	SDG 02.20
S5	Government support to agricultural research and development (euro per inhabitant)	SDG 02.30
S6	Area under organic farming (% of total utilised agricultural area)	SDG 02.40
S7	Ammonia emissions from agriculture (kilograms per hectare)	SDG 02.60
S8	Healthy life years at birth (year)	SDG 03.11
S9	Fatal accidents at work (number per 100,000 workers)	SDG 08.60
S10	Road traffic deaths (number per 100,000 people)	SDG 11.40
S11	Early leavers from education and training (%, from 18 to 24 years)	SDG 04.10
S12	Tertiary educational attainment (%)	SDG 04.20
S13	Participation in early childhood education (%, children aged 3 and over)	SDG 04.31
S14	Adult participation in learning (%, from 25 to 64 years)	SDG 04.60

As part of the next stage, the variables qualified for further analysis were divided into stimulants and destimulants (inhibitors). Variables E7, E8, S4, S5, S6, S12, and S14 were classified as stimulants, while variables E3, E9, E10, S2, S3, S7, S9, S10, and S11 were classified as destimulants (inhibitors).

The literature presents two approaches to the construction of synthetic indicators using the so-called model and nonmodel methods. In this study, synthetic measures were constructed based on benchmarking—the TOPSIS method, in which the point of reference for objects (EU countries) in multidimensional space were two points—the model (pattern) and the antimodel (antipattern). The construction of the synthetic measure proceeded in line with the following stages:

1. Normalization of variables ('zero unitarization'):

$$z_{ij} = \frac{x_{ij} - x_{ij}}{x_{ij} - x_{ij}}, \quad (1)$$

where

z_{ij}—normalized value of the j-th variable for country i
x_{ij}—observation of the j-th variable for country i
x_{ij}—minimum of the j-th variable
x_{ij}—maximum of the j-th variable

2. Determination of model (pattern) coordinates:

$$z_{0j}^{+} = \{max_i\{z_{ij}\} \text{ when variable is a stimulant } min_i\{z_{ij}\} \text{ when variable is an inhibitor}, \quad (2)$$

3. Determination of antimodel (antipattern) coordinates:

$$z_{0j}^{-} = \{min_i\{z_{ij}\} \text{ when variable is a stimulant } max_i\{z_{ij}\} \text{ when variable is an inhibitor}, \quad (3)$$

4. Calculation of the distance of countries from the model (pattern):

$$d_{i0}^{+} = \sqrt{\sum_{j=1}^{m}\left(z_{ij} - z_{0j}^{+}\right)^2}, \quad (4)$$

5. Calculation of the distance of countries from the antimodel (antipattern):

$$d_{i0}^{-} = \sqrt{\sum_{j=1}^{m}\left(z_{ij} - z_{0j}^{-}\right)^2}, \quad (5)$$

6. Calculation of the value of the synthetic variable:

$$s_i = \frac{d_{i0}^{-}}{d_{i0}^{+} + d_{i0}^{-}}, \quad (6)$$

The synthetic variable s_i usually takes values from 0 to 1. The closer the values of the synthetic variable are to 1, the higher the level of sustainable development is for a given object (EU country); if they are closer to 0, the object (EU country) is characterized by a lower level of sustainable development.

Using the criterion of the decreasing value of synthetic indicators, two rankings of EU countries were developed:

- A ranking of EU countries according to the level of sustainable energy development;
- A ranking of EU countries according to the level of sustainable social development.

Subsequently, a correlation analysis was carried out to examine the relationship between energy and social sustainability in the EU. The nonparametric Spearman's rank correlation coefficient was used to level out possible outliers on the results of the correlation analysis.

5. Research Results and Discussion

The research shows that there is a significant difference in the level of sustainable energy development across the EU (Table 2). In the analyzed period (2014–2020), the average value of the synthetic indicator was 0.5207. The highest level of this measure was achieved by countries such as Denmark (0.7104), Sweden (0.6501), and Romania (0.6479), while the lowest was achieved by Cyprus (0.3688), Luxembourg (0.3830), and Malta (0.4150). Thus, the value of the maximum measures was about twice as high as the minimum measures, although a slight decrease in these disproportions could be observed in the analyzed period. In 2014–2020, most countries recorded a decrease in the value of the synthetic indicator, which means unfavorable changes in the area of their sustainable energy development (e.g., Denmark, Germany, Spain, Croatia, Lithuania, the Netherlands, and Romania). Meanwhile, an increase in the value of the indicator was recorded only in two countries—Ireland and Malta. Such unfavorable changes in the values of synthetic measures may prove that the EU policy in the field of sustainable energy development is failing (Table 2).

Table 2. Synthetic measure of sustainable energy development of EU countries in 2014–2020 (source: authors' computation).

EU Countries	2014	2015	2016	2017	2018	2019	2020	2014–2020
Belgium	0.4325	0.4127	0.4353	0.4305	0.4138	0.4300	0.4196	0.4249
Bulgaria	0.4435	0.4319	0.4350	0.4275	0.4287	0.4323	0.4284	0.4325
Czechia	0.5486	0.5356	0.5472	0.5343	0.5283	0.5303	0.5228	0.5353
Denmark	0.7643	0.7138	0.7320	0.7341	0.7069	0.6889	0.6331	0.7104
Germany	0.5447	0.5170	0.5297	0.5252	0.5218	0.5198	0.4836	0.5203
Estonia	0.5949	0.6061	0.6003	0.6020	0.6053	0.6258	0.5996	0.6049
Ireland	0.5391	0.5318	0.5775	0.5885	0.5750	0.5773	0.5796	0.5670
Greece	0.4510	0.4208	0.4272	0.4330	0.4317	0.4428	0.4220	0.4326
Spain	0.5335	0.5018	0.5235	0.5151	0.4917	0.4997	0.4811	0.5066
France	0.5552	0.5315	0.5458	0.5370	0.5294	0.5297	0.5250	0.5362
Croatia	0.6409	0.5912	0.6066	0.5849	0.5750	0.5720	0.5627	0.5905
Italy	0.5313	0.4846	0.5082	0.4976	0.4814	0.4896	0.4922	0.4978
Cyprus	0.3828	0.3530	0.3762	0.3726	0.3728	0.3667	0.3578	0.3688
Latvia	0.6209	0.5788	0.6139	0.6140	0.6107	0.6046	0.5959	0.6055
Lithuania	0.4846	0.4364	0.4497	0.4383	0.4107	0.4048	0.3916	0.4309
Luxembourg	0.4075	0.3832	0.3973	0.3871	0.3745	0.3679	0.3632	0.3830
Hungary	0.5277	0.5132	0.5190	0.5028	0.4980	0.4855	0.4939	0.5057
Malta	0.3759	0.3993	0.4349	0.4319	0.4224	0.4197	0.4209	0.4150
Netherlands	0.5317	0.4844	0.4974	0.4872	0.4712	0.4687	0.4642	0.4864
Austria	0.6159	0.5860	0.5962	0.5784	0.5755	0.5533	0.5655	0.5815
Poland	0.5720	0.5558	0.5554	0.5333	0.5250	0.5347	0.5279	0.5434
Portugal	0.5283	0.4962	0.5260	0.5032	0.4920	0.4855	0.4944	0.5037
Romania	0.6914	0.6484	0.6626	0.6496	0.6389	0.6387	0.6059	0.6479
Slovenia	0.5774	0.5475	0.5552	0.5459	0.5363	0.5471	0.5503	0.5514
Slovakia	0.5187	0.5050	0.5082	0.4897	0.4793	0.4675	0.4841	0.4932
Finland	0.5313	0.5304	0.5355	0.5402	0.5301	0.5391	0.5293	0.5337
Sweden	0.6640	0.6536	0.6511	0.6521	0.6431	0.6486	0.6384	0.6501
MIN	0.3759	0.3530	0.3762	0.3726	0.3728	0.3667	0.3578	0.3688
MAX	0.7643	0.7138	0.7320	0.7341	0.7069	0.6889	0.6384	0.7104
Average	0.5411	0.5167	0.5314	0.5236	0.5137	0.5137	0.5049	0.5207
Standard deviation	0.0918	0.0867	0.0848	0.0856	0.0850	0.0846	0.0793	0.0844

Another area of research was the sustainable social development of EU countries. The research demonstrates that the level of sustainable social development varies across the EU. In the analyzed period (2014–2020), the average value of the synthetic indicator was 0.5284. The highest level of this measure was achieved by countries such as Sweden (0.6771), Finland (0.6486), and Ireland (0.6426), while the lowest was achieved by Romania (0.3222), Malta (0.4288), Bulgaria (0.4297). While there were no significant differences in the level of the indicator between the countries with the highest value, there was a significant difference between Romania and the other countries with the lowest value. The value of the measure for the countries with the highest values was twice as high as the measure for Romania (Table 3). Significant differences between the maximum and minimum values of the calculated measures indicate that there are also significant differences in the level of sustainable social development between EU countries. However, in the analyzed period (2014–2020), there were no significant changes in the value of indicators. Some countries recorded a slight increase in the value of the indicator (among them, Belgium, Ireland, Greece, Italy, Cyprus, and Latvia), while some recorded a decrease (Bulgaria, the Czech Republic, Denmark, and Sweden). However, no significant changes were reported for most countries. It can therefore be concluded that the sustainable social development policy implemented by the EU since 2014 has not yielded any significant changes in this area (Table 3).

Table 3. Synthetic measure of sustainable social development of EU countries in 2014–2020 (source: authors' computation).

EU Countries	2014	2015	2016	2017	2018	2019	2020	2014–2020
Belgium	0.5082	0.5102	0.5099	0.5097	0.5112	0.5114	0.5274	0.5126
Bulgaria	0.4484	0.4495	0.4318	0.4227	0.4272	0.4079	0.4205	0.4297
Czechia	0.5919	0.5677	0.5891	0.5819	0.5548	0.5494	0.5501	0.5693
Denmark	0.6678	0.6440	0.6449	0.6544	0.6097	0.6213	0.6449	0.6410
Germany	0.5298	0.5091	0.5145	0.5248	0.5038	0.5178	0.5333	0.5190
Estonia	0.5817	0.5548	0.5294	0.6110	0.5566	0.5489	0.5875	0.5671
Ireland	0.6286	0.6407	0.6355	0.6557	0.6614	0.6355	0.6411	0.6426
Greece	0.4383	0.4421	0.4335	0.4439	0.4657	0.4749	0.4798	0.4540
Spain	0.5196	0.5264	0.5209	0.4978	0.4937	0.4866	0.5067	0.5074
France	0.5656	0.5820	0.5662	0.5610	0.5649	0.5139	0.5490	0.5575
Croatia	0.4893	0.4978	0.5165	0.4882	0.4905	0.4845	0.5100	0.4967
Italy	0.4957	0.4890	0.4907	0.4644	0.4575	0.4440	0.4470	0.4698
Cyprus	0.5555	0.5602	0.5646	0.5545	0.5347	0.4987	0.4633	0.5331
Latvia	0.4799	0.5153	0.5206	0.5407	0.5012	0.5287	0.5408	0.5182
Lithuania	0.5108	0.5408	0.5478	0.5483	0.5307	0.5234	0.5462	0.5354
Luxembourg	0.5184	0.4994	0.4836	0.5196	0.4712	0.4813	0.5067	0.4972
Hungary	0.5086	0.5040	0.4934	0.4639	0.4705	0.4740	0.4994	0.4877
Malta	0.4337	0.4381	0.3931	0.4439	0.4395	0.4395	0.4138	0.4288
Netherlands	0.5943	0.5899	0.5851	0.5826	0.5696	0.5672	0.6017	0.5843
Austria	0.5798	0.5685	0.5914	0.5887	0.5657	0.5439	0.5590	0.5710
Poland	0.4993	0.5015	0.5026	0.5035	0.5045	0.4987	0.5049	0.5021
Portugal	0.4415	0.4707	0.4826	0.4600	0.4663	0.4605	0.4893	0.4673
Romania	0.3245	0.3167	0.3193	0.3139	0.3197	0.3290	0.3326	0.3222
Slovenia	0.5506	0.5651	0.5689	0.5670	0.5923	0.5686	0.5847	0.5710
Slovakia	0.5542	0.5437	0.5576	0.5486	0.5667	0.5579	0.5668	0.5565
Finland	0.6636	0.6465	0.6558	0.6524	0.6358	0.6365	0.6496	0.6486
Sweden	0.6921	0.7058	0.6916	0.6859	0.6532	0.6580	0.6531	0.6771
MIN	0.3245	0.3167	0.3193	0.3139	0.3197	0.3290	0.3326	0.3222
MAX	0.6921	0.7058	0.6916	0.6859	0.6614	0.6580	0.6531	0.6771
Average	0.5323	0.5326	0.5311	0.5329	0.5229	0.5171	0.5300	0.5284
Standard deviation	0.0811	0.0784	0.0815	0.0832	0.0755	0.0729	0.0767	0.0770

Based on the values of synthetic measures, rankings of EU countries were developed using the level of sustainable energy development and the level of sustainable social development as benchmarks. Countries were then arranged in descending order of energy sustainability and social sustainability, respectively. The results of the ordering are shown in Tables 4 and 5, respectively.

The last stage of the research was to examine the relationship between sustainable energy development and sustainable social development in the EU. Therefore, a correlation analysis was carried out, and the values of the Spearman's rank correlation coefficients between synthetic measures of sustainable energy development and measures of sustainable social development were determined (Table 6).

The critical value of Spearman's rank correlation at the significance level $\alpha = 0.05$ and for 27 observations was 0.3827. In 2014–2015, the correlation coefficients were lower than the critical value, meaning that the analyzed variables were not significantly correlated in those years. However, in the following years (2016–2020) and in the entire analyzed period (2014–2020), the correlation coefficients were already significantly correlated, which prompts a conclusion that there is a positive correlation between sustainable energy development and sustainable social development. In the years 2016–2020, the correlation coefficients were within the range 0.3853 and 0.4857, while the coefficient stood at 0.3981 for the entire analyzed period, pointing to a moderate correlation between sustainable energy development and sustainable social development.

Table 4. Ranking of EU countries by level of sustainable energy development in 2014–2020 (source: authors' computation).

EU Countries	2014	2015	2016	2017	2018	2019	2020	2014–2020
Belgium	24	24	22	24	24	23	24	24
Bulgaria	23	22	23	25	22	22	21	22
Czechia	11	10	11	12	12	12	13	12
Denmark	1	1	1	1	1	1	2	1
Germany	12	14	14	14	14	14	18	14
Estonia	7	4	6	5	5	4	4	5
Ireland	13	11	8	6	8	6	6	8
Greece	22	23	25	22	21	21	22	21
Spain	14	17	16	15	17	15	19	15
France	10	12	12	11	11	13	12	11
Croatia	4	5	5	7	7	7	8	6
Italy	17	19	18	18	18	16	16	18
Cyprus	26	27	27	27	27	27	27	27
Latvia	5	7	4	4	4	5	5	4
Lithuania	21	21	21	21	25	25	25	23
Luxembourg	25	26	26	26	26	26	26	26
Hungary	19	15	17	17	15	18	15	16
Malta	27	25	24	23	23	24	23	25
Netherlands	15	20	20	20	20	19	20	20
Austria	6	6	7	8	6	8	7	7
Poland	9	8	9	13	13	11	11	10
Portugal	18	18	15	16	16	17	14	17
Romania	2	3	2	3	3	3	3	3
Slovenia	8	9	10	9	9	9	9	9
Slovakia	20	16	19	19	19	20	17	19
Finland	16	13	13	10	10	10	10	13
Sweden	3	2	3	2	2	2	1	2

Table 5. Ranking of EU countries by level of sustainable social development in 2014–2020 (source: authors' computation).

EU Countries	2014	2015	2016	2017	2018	2019	2020	2014–2020
Belgium	18	16	18	17	14	15	15	16
Bulgaria	23	24	25	26	26	26	25	25
Czechia	6	8	6	8	11	8	10	8
Denmark	2	3	3	3	4	4	3	4
Germany	13	17	17	15	16	13	14	14
Estonia	7	11	13	5	10	9	6	9
Ireland	4	4	4	2	1	3	4	3
Greece	25	25	24	25	23	21	22	24
Spain	14	14	14	19	18	18	17	17
France	9	6	9	10	9	14	11	10
Croatia	21	21	16	20	19	19	16	20
Italy	20	22	21	21	24	24	24	22
Cyprus	10	10	10	11	12	17	23	13
Latvia	22	15	15	14	17	11	13	15
Lithuania	16	13	12	13	13	12	12	12
Luxembourg	15	20	22	16	20	20	18	19
Hungary	17	18	20	22	21	22	20	21
Malta	26	26	26	24	25	25	26	26
Netherlands	5	5	7	7	6	6	5	5
Austria	8	7	5	6	8	10	9	7
Poland	19	19	19	18	15	16	19	18
Portugal	24	23	23	23	22	23	21	23
Romania	27	27	27	27	27	27	27	27
Slovenia	12	9	8	9	5	5	7	6
Slovakia	11	12	11	12	7	7	8	11
Finland	3	2	2	4	3	2	2	2
Sweden	1	1	1	1	2	1	15	1

Table 6. Spearman's rank correlation between synthetic measures of energy sustainability and measures of social sustainability ($p < 0.05$) (source: authors' computation).

	2014 *)	2015 *)	2016	2017	2018	2019	2020	2014–2020
R Spearman	0.3044	0.3755	0.4103	0.4674	0.3853	0.4534	0.4857	0.3981
T (N-2)	1.5977	2.0255	2.2497	2.6436	2.0876	2.5437	2.7784	2.1699
p	0.1227	0.0536	0.0335	0.0140	0.0472	0.0175	0.0102	0.0397

R Spearman—Spearman's R value. T (N-2)—the value of the t-statistic checks the significance of Spearman's R. p—probability value p for the above t-statistic. The critical value of Spearman's rank correlation at the significance level $\alpha = 0.05$ and for 27 observations is 0.383 [https://mathcracker.com/spearmans-critical-correlation-calculator#results]. *) Correlation insignificant.

The EU's energy and social policy should therefore remain mutually linked, creating a feedback system forming the basis for the sustainable development of EU countries. Policymakers and decision-makers in the energy sector should play a particular role in shaping this relationship by basing their actions on two general assumptions: preventing excessive social cost and ensuring that their undertakings remain "socially responsible".

6. Conclusions

The conducted analyses provide insight into macroeconomic variables that are important for assessing sustainable development in the area of energy and social transformation in EU countries. Monitoring the changes taking place in the area of energy and social development in individual EU countries is an important factor that determines the assessment and verification of the effectiveness of measures undertaken as part of the common EU policy.

The research shows that in the EU, there is a significant difference in both the level of sustainable energy development and the level of sustainable social development. The value of the maximum measures was about twice as high as the minimum measures. In the case of sustainable energy development, the highest value of the synthetic measure was achieved by countries such as Denmark, Sweden, and Romania and the lowest by Cyprus, Luxembourg, and Malta. The average value of the measure (calculated for 2014–2020) for Denmark (0.7104) was almost twice as high as for Cyprus (0.3688). Meanwhile, for sustainable social development, the highest value of the synthetic measure was achieved by countries such as Sweden, Finland, and Sweden and the lowest by Romania, Malta, and Bulgaria. Concerning this indicator, there was also a significant difference between EU countries, which is indicated, for example, by the fact that the average value of the measure for Sweden (0.6771) was more than twice as high as for Romania (0.3222). In addition, in the analyzed period, most EU countries recorded unfavorable changes in the values of synthetic measures of sustainable energy development (decrease in the value of measures), which may indicate incorrect calibration of EU policy in this respect. Although some countries rank very differently depending on the focus of the ranking (e.g., Romania or Finland), the correlation analysis demonstrates that there is indeed a (moderate) positive correlation between sustainable energy development and sustainable social development.

EU policy should be aimed at reducing disproportions between EU countries in sustainable development of the energy and social sectors. It should also factor the existence of a link between sustainable energy development and sustainable social development. Energy policy and social policy are linked by a relationship of interdependence, which means that both these areas influence one another, either in a supporting or limiting fashion. The two policies have both common and conflicting interests, which often lead to clashes between them. Too much focus on energy development leads to underestimating social problems, which, if ignored for a long time, become a barrier to sustainable development. Hence, it is important to search for a common ground and cooperate in the quest to find the most effective solutions. The conducted research demonstrates that the most effective model of relationship assumes that energy and social processes are shaped with the systemic and sustainable participation of both these policy fields. This in turn warrants the possibility of current and strategic shaping of the preconditions for sustainable development that must integrate both these areas.

However, it should be noted that this research has limitations. Only complete (for the adopted research period) indicators of sustainable development published by Eurostat were used in the study. In addition, the authors are aware that not all problems related to sustainable energy and social development occurring in EU countries have been included in this article or discussed extensively enough. Bearing all this in mind, let us note that the selection of variables in an international cross-section is difficult to implement and was dictated primarily by the availability and completeness of statistical data in the Eurostat database. Having said that, the article can be a valuable point of reference for new thoughts, polemics, analyses, and critical scientific discussion. Future research directions include an attempt to answer the following questions: In which EU countries is the link between sustainable social development and sustainable energy development the strongest, and in which countries is it the weakest? Are there links between social and energy policies in individual EU countries?

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References

1. Trane, M.; Marelli, L.; Siragusa, A.; Pollo, R.; Lombardi, P. Progress by Research to Achieve the Sustainable Development Goals in the EU: A Systematic Literature Review. *Sustainability* **2023**, *15*, 7055. [CrossRef]
2. Lafortune, G.; Fuller, G.; Schmidt-Traub, G.; Kroll, C. How Is Progress towards the Sustainable Development Goals Measured? Comparing Four Approaches for the EU. *Sustainability* **2020**, *12*, 7675. [CrossRef]
3. Popović, B.; Janković Šoja, S.; Paunović, T.; Maletić, R. Evaluation of Sustainable Development Management in EU Countries. *Sustainability* **2019**, *11*, 7140. [CrossRef]
4. Çağlar, M.; Gürler, C. Sustainable Development Goals: A cluster analysis of worldwide countries. *Environ. Dev. Sustain.* **2022**, *24*, 8593–8624. [CrossRef]
5. Bali Swain, R.; Yang-Wallentin, F. Achieving sustainable development goals: Predicaments and strategies. *Int. J. Sustain. Dev. World Ecol.* **2020**, *27*, 96–106. [CrossRef]
6. Halisçelik, E.; Soytas, M.A. Sustainable development from millennium 2015 to Sustainable Development Goals 2030. *Sustain. Dev.* **2019**, *27*, 545–572. [CrossRef]
7. Ruggerio, C.A. Sustainability and sustainable development: A review of principles and definitions. *Sci. Total Environ.* **2021**, *786*, 147481. [CrossRef]
8. Barton, J.R.; Gutiérrez-Antinopai, F. Towards a Visual Typology of Sustainability and Sustainable Development. *Sustainability* **2020**, *12*, 7935. [CrossRef]
9. Leal Filho, W.; Tripathi, S.K.; Andrade Guerra, J.B.S.O.D.; Giné-Garriga, R.; Orlovic Lovren, V.; Willats, J. Using the sustainable development goals towards a better understanding of sustainability challenges. *Int. J. Sustain. Dev. World Ecol.* **2019**, *26*, 179–190. [CrossRef]
10. Wójtowicz, A. *Polityka Energetyczna Jako Narzędzie Realizacji Koncepcji Zrównoważonego Rozwoju Energetyki Polski Po 2004 Roku*; Oficyna Wydawnicza Szkoły Głównej Handlowej: Warszawa, Poland, 2021.
11. Chen, J.; Sun, C.; Wang, Y.; Liu, J.; Zhou, P. Carbon emission reduction policy with privatization in an oligopoly model. *Environ. Sci. Pollut. Res.* **2023**, *30*, 45209–45230. [CrossRef]
12. Pan, X.; Shao, T.; Zheng, X.; Zhang, Y.; Ma, X.; Zhang, Q. Energy and sustainable development nexus: A review. *Energy Strategy Rev.* **2023**, *47*, 101078. [CrossRef]
13. Bąk, I.; Tarczyńska-Łuniewska, M.; Barwińska-Małajowicz, A.; Hydzik, P.; Kusz, D. Is Energy Use in the EU Countries Moving toward Sustainable Development? *Energies* **2022**, *15*, 6009. [CrossRef]
14. Zakari, A.; Khan, I.; Tan, D.; Alvarado, R.; Dagar, V. Energy efficiency and sustainable development goals (SDGs). *Energy* **2022**, *239 Pt E*, 122365. [CrossRef]
15. Kozar, Ł. Sektor energetyczny, a wyzwania zrównoważonego rozwoju—Analiza przestrzennego zróżnicowania sytuacji w UE w oparciu o wybrane wskaźniki. *Zesz. Nauk. SGGW W Warszawie. Probl. Rol. Swiat.* **2018**, *18*, 173–186. [CrossRef]

16. Łukasiewicz, K.; Pietrzak, P.; Kraciuk, J.; Kacperska, E.; Cieciora, M. Sustainable Energy Development—A Systematic Literature Review. *Energies* **2022**, *15*, 8284. [CrossRef]
17. Kiełczewski, D. *Koncepcja Zintegrowanej Teorii Ekonomicznej Zrównoważonego Rozwoju. Miedzy Mainstreamem a Heterodoksją Ekonomiczną*; Wydawnictwo Uniwersytetu w Białymstoku: Białystok, Poland, 2021.
18. Communication From the Commission. The European Green Deal. 2019. Available online: https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1596443911913&uri=CELEX%3A52019DC0640#document2 (accessed on 10 April 2023).
19. Green Deal: Key to a Climate-Neutral and Sustainable EU. 2022. Available online: https://www.europarl.europa.eu/news/en/headlines/society/20200618STO81513/green-deal-key-to-a-climate-neutral-and-sustainable-eu?&at_campaign=20234-Green&at_medium=Google_Ads&at_platform=Search&at_creation=RSA&at_goal=TR_G&at_audience=european%20green%20deal&at_topic=Green_Deal&at_location=PO&gclid=CjwKCAjw8ZKmBhArEiwAspcJ7jxBhXIKnVV4xYG9dIo64SMZef1GH_oRNBcNdA63lpBDo4EsxrqBoBoCZcsQAvD_BwE (accessed on 12 April 2023).
20. Kruszyński, K. Jak wygląda społeczny wymiar Europejskiego Zielonego Ładu? In *W Poszukiwaniu Zielonego Ładu*; Burchard-Dziubińska, M., Ed.; Wydawnictwo Uniwersytetu Łódzkiego: Łódź, Poland, 2022; pp. 333–343. [CrossRef]
21. Gunnarsdottir, I.; Davidsdottir, B.; Worrell, E.; Sigurgeirsdottir, S. Sustainable energy development: History of the concept and emerging themes. *Renew. Sustain. Energy Rev.* **2021**, *141*, 110770. [CrossRef]
22. Wilgos, A.; Wróblewska, M. Polityka Unii Europejskiej w zakresie energii a bezpieczeństwo energetyczne na przykładzie wybranych krajów członkowskich. In *Ekonomia Zrównoważonego Rozwoju. Gospodarka—Środowisko—Inwestycje*; Szewczyk, M., Okraszewska, E., Dziuba, R., Eds.; Wydawnictwo Uniwersytetu Łódzkiego: Łódź, Poland, 2018; pp. 69–80.
23. Wysokińska, Z.; Witkowska, J. *Zrównoważony Rozwój. Wybrane Aspekty Makro-I Mikroekonomiczne*; Wydawnictwo Uniwersytetu Łódzkiego: Łódź, Poland, 2016.
24. United Nations. Transforming Our World: The 2030 Agenda for Sustainable Development. 2015. Available online: https://documents-dds-ny.un.org/doc/UNDOC/GEN/N15/291/89/PDF/N1529189.pdf?OpenElement (accessed on 10 May 2023).
25. Hadryjańska, B. *Droga Do Zrównoważonego Rozwoju W Polsce W Świetle Założeń Agendy 2030*; Difin: Warszawa, Poland, 2021.
26. Nyga-Łukaszewska, H. Zapotrzebowanie w energię a konkurencyjność zrównoważona. In *Polska. Raport O Konkurencyjności 2022. W Kierunku Zrównoważonej Gospodarki W Dobie Pandemii*; Kowalski, A.M., Weresa, M.A., Eds.; Oficyna Wydawnicza Szkoły Głównej Handlowej: Warszawa, Poland, 2022; pp. 185–207.
27. Sokół, H. Zrównoważona energetyka w ramach koncepcji zrównoważonego rozwoju. In *Ekonomiczne Dylematy Zrównoważonego Rozwoju. Działalność—Restrukturyzacja—Finansowanie—Upadłość*; Dec, P., Ed.; Oficyna Wydawnicza Szkoły Głównej Handlowej: Warszawa, Poland, 2020; pp. 133–156.
28. Prandecki, K. Teoretyczne podstawy zrównoważonej energetyki. *Stud. Ekon./Uniw. Ekon. W Katowicach* **2014**, *166*, 238–248.
29. Wiśniewska, J. Economic Sustainability of Agriculture—Conceptions and Indicators. *Acta Sci. Polonorum. Oeconomia* **2011**, *10*, 119–137.
30. Raczkowska, M.; Mikuła, A.; Utzig, M. *Zrównoważony Rozwój W Obszarze Społecznym W Unii Europejskiej*; Wydawnictwo Szkoły Głównej Gospodarstwa Wiejskiego w Warszawie: Warszawa, Poland, 2021; Available online: https://www.ieif.sggw.pl/wp-content/uploads/2021/12/Zr%C3%B3wnowa%C5%BCony-rozw%C3%B3j-w-obszarze....pdf (accessed on 30 May 2023).
31. Wołowicz, K. Realizacja celów zrównoważonego rozwoju przez UE—Wizja czy konkret? *Anal. BAS* **2021**, *2*, 1–10.
32. Dymek, D.; Jóźwik, J. Zrównoważony rozwój w ujęciu lokalnym—Analiza wymiarów. *Pr. Geogr./Inst. Geogr. I Gospod. Przestrz. Uniw. Jagiellońskiego* **2022**, *167*, 29–48. [CrossRef]
33. Kryk, B. Cele społeczne zrównoważonego rozwoju. Polska na tle UE. *Pr. Nauk. Uniw. Ekon. We Wrocławiu* **2017**, *465*, 87–95.
34. Bożek, J.; Szewczyk, J. Ocena poziomu rozwoju społecznego powiatów województwa małopolskiego z zastosowaniem dynamicznego miernika syntetycznego. *Wiadomości Stat.* **2021**, *4*, 45–63. [CrossRef]
35. Kozar, Ł.J. *Zielone Miejsca Pracy. Uwarunkowania—Identyfikacja—Oddziaływanie Na Lokalny Rynek Pracy*; Wydawnictwo Uniwersytetu Łódzkiego: Łódź, Poland, 2019; Available online: https://wydawnictwo.uni.lodz.pl/wp-content/uploads/2020/05/Kozar_Zielone_miejsca-pracy-.pdf (accessed on 15 April 2023).
36. Pawlonka, C. Społeczne aspekty zrównoważonego rozwoju. *Rynek-Społeczeństwo-Kult.* **2018**, *4*, 28–31.
37. Matuszczak, A. Koncepcja zrównoważonego rozwoju w obszarze ekonomicznym, środowiskowym i społecznym. *Rocz. Ekon. Kuj.-Pomor. Szkoły Wyższej W Bydg.* **2009**, *2*, 125–141.
38. Murphy, K. The social pillar of sustainable development: A literature review and framework for policy analysis. *Sustain. Sci. Pract. Policy* **2012**, *8*, 15–29. [CrossRef]
39. Siuta-Tokarska, B.; Thier, A.; Żmija, K. *Procesy I Problemy W Realizacji Zrównoważonego I Trwałego Rozwoju W Polsce. Kontekst Mikroekonomiczny*; Wydawnictwo Naukowe PWN: Warszawa, Poland, 2020.
40. Rokicka, E.; Woźniak, W. *W Kierunku Zrównoważonego Rozwoju. Koncepcje, Interpretacje, Konteksty*; Wydawnictwo Uniwersytetu Łódzkiego: Łódź, Poland, 2016.
41. Piketty, T. *Kapitał W XXI Wieku*; Wydawnictwo Krytyki Politycznej: Warszawa, Poland, 2015.
42. Piketty, T. *Capital in the Twenty-First Century*; Harvard University Press: Cambridge, MA, USA; London, UK, 2017.
43. Góes, C. Testing Piketty's Hypothesis on the Drivers of Income Inequality: Evidence from Panel VARs with Heterogeneous Dynamics International Monetary Fund Working Paper, 16/160. 2016. Available online: https://www.imf.org/en/Publications/WP/Issues/2016/12/31/Testing-Pikettys-Hypothesis-on-the-Drivers-of-Income-Inequality-Evidence-from-Panel-VARs-44165 (accessed on 25 April 2023).
44. Atkinson, A.B. After Piketty? *Br. J. Sociol.* **2014**, *65*, 619–638. [CrossRef]

45. Biczyńska, E. Measuring the Social Component of Sustainable Development in the Cities: The Case of Medellín, Colombia. *Barom. Reg.* **2015**, *13*, 119–126. [CrossRef]
46. Fura, B.; Wang, Q. The level of socioeconomic development of EU countries and the state of ISO 14001 certification. *Qual. Quant.* **2017**, *51*, 103–119. [CrossRef]
47. Grzebyk, M.; Stec, M. Sustainable Development in EU Countries: Concept and Rating of Levels of Development. *Sustain. Dev.* **2015**, *23*, 110–123. [CrossRef]
48. Miłek, D. Spatial Differentiation in the Social and Economic Development Level in Poland. *Equilibrium* **2018**, *13*, 487–507. [CrossRef]
49. Stec, M. *Taksonomiczna Analiza Rozwoju Społeczno-Gospodarczego Województw Polski. Studium Przypadku—Województwo Podkarpackie*; Wydawnictwo Uniwersytetu Rzeszowskiego: Rzeszów, Poland, 2017.
50. Cheba, K. *Zrównoważona Międzynarodowa Konkurencyjność Krajów Unii Europejskiej. Studium Teoretyczno-Empiryczne*; CeDeWu: Warszawa, Poland, 2019.
51. Walesiak, M. *Uogólniona Miara Odległości GDM W Statystycznej Analizie Wielowymiarowej Z Wykorzystaniem Programu R*; Wydawnictwo Uniwersytetu Ekonomicznego we Wrocławiu: Wrocław, Poland, 2016.
52. Zwierzchowski, J.; Panek, T. *Statystyczne Metody Wielowymiarowej Analizy Porównawczej. Teoria I Zastosowania*; Oficyna Wydawnicza Szkoły Głównej Handlowej: Warszawa, Poland, 2013.
53. Panek, T. *Statystyczne Metody Wielowymiarowej Analizy Porównawczej*; Oficyna Wydawnicza SGH: Warszawa, Poland, 2009.
54. Młodak, A. *Analiza Taksonomiczna W Statystyce Regionalnej*; Difin: Warszaw, Poland, 2006.
55. Gunnarsdottir, I.; Davidsdottir, B.; Worrell, E.; Sigurgeirsdottir, S. Review of indicators for sustainable energy development. *Renew. Sustain. Energy Rev.* **2020**, *133*, 110294. [CrossRef]