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Promotion of Sustainable Development in the EU: Social and Economic Drivers

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Abstract: The transition to sustainability is a complex process that requires a clear understanding of its drivers and barriers. The paper explores the impact of different social and economic factors on sustainable development as a holistic process. The research involved data from 27 EU member states during 2012–2020. Hausman specification and Breusch and Pagan Lagrangian multiplier test were used to select the proper econometric model, which led to the use of generalized least squares regression with random effects to estimate the sustainable development drivers in the EU. The results suggested that corruption has no statistically significant impact on sustainability, whereas economic freedom increases Sustainable Development Goals (SDG) Index. Our empirical results demonstrated that GDP per capita inhibits sustainability transition, which could be a case of the environmental Kuznets curve hypothesis. Unemployment has a negative impact on sustainable development; however, employment in science and research is its driver. It was unfolded that median income per capita and life expectancy have a statistically significant positive impact on the SDG Index. Following these findings, a wide range of policy recommendations was suggested. They include but are not limited to: ensuring economic freedom, human capital development, digitalization of public services, and lifelong education promotion.

Keywords: sustainable development; sustainability drivers; corruption; economic freedom; GDP per capita; unemployment

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1. Introduction

The transition to sustainability is crucial for the development of the modern global economy. The traditional economic paradigm needs significant transformations because it often neglects this and future generations' social and environmental needs. Unsustainable practices, such as overconsumption of natural resources, pollution, and environmental degradation, threaten the health and security of ecosystems, communities, and individuals. The era of economic crises, political instability, and challenges associated with the Fourth Industrial Revolution make the issue of sustainable development even more urgent and relevant [1].

Sustainable development is a complex concept that is interpreted differently by scientists (Table 1). However, most definitions emphasize the long-term direction of such development. They also focus on the combination of three sustainability pillars: economic, social, and environmental. Their harmonious combination is an indicator of a successful transition to sustainable development.

Table 1. Different approaches to define the concept of «sustainable development» (developed by authors, using [2–5]).

№	Definition
1	The development that meets the needs of the present without compromising the ability of future generations to meet their own needs [2]
2	The stable relationship between human activities and the natural world does not diminish the prospects for future generations to enjoy a quality of life at least as good as our own [3]
3	The capacity to generate an entropic throughput from and back to nature [4]
4	The inherent interdependence between the long-term stability of the environment and the economy [5]

Measuring sustainable development requires considering progress across multiple dimensions and using a range of indicators and frameworks. There are many indices for sustainable development performance measurement. They have different methodologies and are calculated by different organizations. Each of them has its advantages and drawbacks, which scientists and policymakers need to take into account. The most popular indices include Sustainable Development Index, Human Sustainable Development Index, City Sustainable Development Index, and Sustainable Development Goals (SDG) Index. The objective of the SDG index is to estimate how successfully various countries implement Sustainable Development Goals, which were adopted by the UN General Assembly in 2015. This index has a variety of advantages (e.g., advanced methodological approach, the equal role of economic, social, and environmental goals in results estimation, and evaluation of data collected even before official SDG approval) [6]. They make the SDG index suitable for this research.

One of the primary goals of the European Union is the transition to sustainable development. The EU is devoted to carrying out the SDGs both internally and via developing partnerships with different nations. Table 2 demonstrates the progress of the EU in achieving SDG (the year 2020 to the year 2012). As it is clear from Table 2, the EU has significantly succeeded in it. The major advances are observed in SDG 5, SDG 8, and SDG 9. The only SDG where there is a rollback is SDG 12 (Responsible consumption and production).

Table 2. SDG progress in the EU (the year 2020 compared to the year 2012, developed by authors, using [6]).

SDG	Year 2012	Year 2020	Progress	SDG	Year 2012	Year 2020	Progress
SDG1	63.07	69.13	+6.06	SDG10	88.39	89.39	+1.00
SDG2	60.97	61.74	+0.77	SDG11	60.85	70.67	+9.82
SDG3	77.78	82.20	+4.42	SDG12	59.31	58.99	−0.32
SDG4	67.35	68.99	+1.64	SDG13	68.48	70.01	+1.53
SDG5	53.25	62.41	+9.16	SDG14	63.66	67.60	+3.94
SDG6	83.79	85.65	+1.86	SDG15	74.51	75.72	+1.21
SDG7	58.33	64.62	+6.29	SDG16	72.99	74.51	+1.52
SDG8	62.38	70.96	+8.58	SDG17	64.80	67.71	+2.91
SDG9	62.68	75.36	+12.68				

For the successful promotion of sustainable development, it is necessary not only to separately formulate the drivers of economic growth, social and environmental well-being, but also to find such factors that will positively affect all three pillars of sustainability. As discussed in Section 2, there are many factors possibly affecting sustainable development.

In this study we will concentrate on social and economic ones. Therefore, the aim of this research is to investigate the impact of social and economic factors on sustainable development as a holistic process.

The remainder of this study is set out in the following way. Section 2 analyzes the appropriate scientific works. Section 3 shows the data and methods utilized. Section 4 provides the empirical results and their discussion. Section 5 includes the conclusions, policy recommendations, and plans for future research.

2. Literature Review

The literature review will be carried out in two stages:

- bibliometric analysis using computer software—in order to identify the keywords clusters and select the study area.
- analysis of scientific publications based on selected possible sustainability drivers—in order to find out the gaps in existing knowledge.

Scopus Toolkit was utilized to search for the proper publications concerning the issues of sustainability. For this purpose, we used such keywords: «sustainable development», «drivers», «factors». The time frame of analysis covered 2014–October 2022. Using VOSViewer software, an in-depth analysis of scientific publications (indexed by Scopus) was carried out to visualize the linkages between keywords and their network clustering (Figure 1).

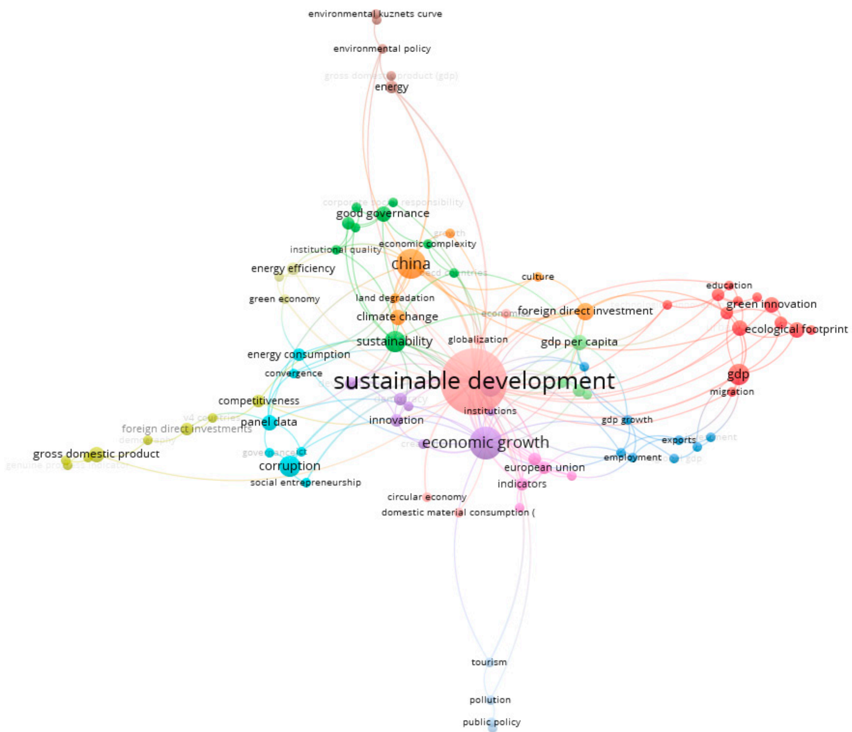

Figure 1. The network map (in clusters) of keywords on the topic (developed by authors, using Scopus Toolkit and VOSViewer).

The analysis identified certain keywords (Figure 1), which are supposed to be drivers (or barriers) of sustainable development. They include economic growth, corruption, good governance, unemployment, innovation, and institutional quality. The number of publications on the topic is not so large; however, it is growing from year to year (in 2014—234 published papers, in 2021—348 papers). When analyzing retrospectively, certain trends can be noticed. In 2014–2015 the most popular keywords were GDP, unemployment, and other classical socio-economic factors. In 2016–2019 scientists did more research on the links between corruption, institutional quality, and sustainable development. In recent years

(2019–October 2022), the most widespread keywords include green finance, digitalization, Industry 4.0 and 5.0. In our research, we will concentrate on the social and economic factors of sustainability promotion. In spite of the high relevance of sustainable development issues in the world, there is a lack of a unified understanding of the sustainability drivers and barriers. This limits the abilities to develop effective policies that address all dimensions of sustainable development.

Some scientists described the role of corruption in national sustainable development. Most researches consider corruption to be a negative social phenomenon that hinders country's development. S. Saha and K. Sen found out the negative impact of corruption on social and economic development without considering the environmental component [7]. A. Sinha and colleagues noted that a high level of corruption increases the ecological footprint and contributes to the decrease in renewable energy development [8]. Likewise, corruption de-stimulates CO_2 emissions reduction by hindering the green transition and making it more expensive. Other scientists, after analyzing a large sample of countries with different incomes, came to the conclusion that corruption inhibits sustainable development in all its components (including environmental) [9]. Another approach lies in the partially positive role of corruption in promoting sustainable development. T. Jiang and H. Nie stated that bribes are a way to speed up obtaining special permits and licenses for doing business, especially in countries with a high level of corruption, but such economic patterns may become an obstacle to long-term national development [10]. Overall, the literature suggests that corruption is a significant barrier to sustainable development.

Hypothesis 1. *Corruption complicates the transition to sustainability, as it has a negative impact on the functioning of socioeconomic systems and inhibits ecological development.*

There is little research on the impact of economic freedom on sustainability. A liberal legislative framework, a strong financial system, freedom to conduct foreign trade, and effective regulation were revealed to support sustainable development in G-20 countries based on [11]. Another research also found a nexus between the level of economic liberty and sustainability performance [12]. It can be marked out with an inverted U-shaped graph. More economic freedom encourages sustainability, according to scientists, but only up until the liberty optimum is reached. The performance of sustainability starts to decline after a certain point. Otherwise, Graafland emphasized the importance of governmental control and regulation for environmental efficiency [13]. Moreover, the author, using econometric approaches, proved: more governmental interventions—less ecological footprint. However, governmental interventions may be ineffective, according to [14]. In our opinion, in countries with poor institutional quality, this can result in corruption and bureaucracy. Economic freedom may also lead to increased industrialization and use of natural resources. This, in turn, can cause environmental degradation, such as deforestation, pollution, and climate change. This may have long-term negative effects on sustainable development. Nevertheless, most scientists emphasized that economic freedom is a feature of the resilient society, which is able to overcome environmental problems.

Hypothesis 2. *Economic freedom promotes sustainable development since it is the basis of inclusive political and economic institutions, which in turn contributes to the harmonious comprehensive development of states.*

The role of GDP per capita in sustainability promotion is ambiguous. A group of authors analyzed 16 selected European economies to estimate the relationship between GDP per capita growth and different sustainable development indicators [15]. The results revealed a strong positive nexus between GDP per capita and the majority of economic, social, and environmental indicators. The authors also noticed that countries facing socio-economic crises can even speed up their GDP with the help of sustainable development. However, most studies estimate the influence of economic growth only on environmental quality. S. Lyeonov and colleagues, using the methods of panel cointegration, revealed the positive linkages between GDP per capita and CO_2 emissions [16]. Similar results were obtained by N. Leitão, who emphasized that GDP per capita growth inhibits environmental improvements and together with corruption may be a major threat to sustainability [17]. From our perspective, this could be a case of Environmental Kuznets Curve, the existence of which, however, is still debatable among scientific community. Otherwise, another study revealed that economic growth has a positive impact on environmental sustainability through renewable energy promotion [18]. Though GDP is considered to be a key economic indicator, it has many alternatives which are supposed to take into account sustainability issues. For example, scientists developed a concept of green GDP. It can be calculated by taking away natural consumption from traditional GDP [19]. Though it also has certain limitations, it is clear that traditional GDP needs transformations to reflect on social and environmental components. Other scientists suggest measuring sustainable economic growth by World Happiness Index (WHI), Human Development Index (HDI), and Genuine Progress Indicator (GPI).

Hypothesis 3. *A higher GDP per capita has an ambiguous impact on sustainable development. Though its impact on the economic component of sustainability is more predictable (in most cases—positive), GDP per capita may have a controversial effect on social and environmental components.*

There is a consensus among scientists that a high level of unemployment is a negative social process, and the task of any government is to reduce it. Using the ARDL method to analyze the Chinese economy, Y. Xin and S. Yang proved that the unemployment rate contributes to the significant rise in greenhouse emissions in the long run, whereas in the short run—this impact is not so strong [20]. Similar results were obtained by Q. Wang [21]. Using the tools of experimental economics, A. Meyer has analyzed the behavioral patterns of society with a high level of unemployment [22]. The author concluded that unemployment slowdowns positive environmental transformations and makes society less eco-oriented. Scientific development and innovations promote sustainable development, according to [23]. M. Kardos considers innovative business as a powerful driver of sustainable development in the example of EU countries [24]. Based on [25], R&D contributes to SDGs implementation in the enterprise. Higher levels of green innovation give businesses competitive benefits, including improved operational procedures, more innovative goods and services, and fewer operating expenses. L. Melnyk and colleagues, utilizing random-effects GLS regression for the panel data of a group of developed economies, proved that advanced R&D has a strong positive impact on GDP per capita, whereas investments in science reduce CO_2 emissions [26]. The results of another study demonstrated that scientific development stimulates greenhouse gas emissions in a group of middle-income countries with a weak financial system [27]. Based on a spatial model, research by Y. Chen and C. Lee found no statistically significant links between innovations and CO_2 emissions [28]. On the contrary, S. Adebayo and D. Kirikkaleli on the example of Japan proved that digital innovations and disruptive technologies stimulate production and result in higher CO_2 emissions [29]. Digital technologies promote good governance through tackling bureaucracy, according to [30]. Authors stated that digitalization improves the speed and, in many cases, the quality of public services and, therefore, contributing to sustainability. Different studies describe the importance of social and ecological innovations for sustainable development promotion. For example, M. Piccarozzi explained their importance for small companies in Italy [31].

Hypothesis 4. *Unemployment discourages sustainable development due to its negative socio-economic consequences, whereas a high level of employment in science and research stimulates sustainable development transition.*

There are some important social factors, which have a significant impact on the life satisfaction and quality. Among others they include median income per capita and life expectancy. GDP per capita is based on the national accounts, and median income is calculated with the help household surveys. Due to this reason, some scientists explained that median income per capita is better for poverty measurement than GDP per capita. A common metric for assessing the community's general health is life expectancy. Following the researches, life expectancy depends on many factors, some of them are rather personal (genetics, lifestyle, hygiene), others are more aggregate (healthcare and education quality, crime rates, GDP, etc.). According to some studies, the relationship between life expectancy and sustainable development is bidirectional [26]. More sustainable economy increases life expectancy due to less ecological footprint and better social conditions, whereas people who live longer themselves contribute to higher economic productivity.

Hypothesis 5. *Median income per capita and life expectancy positively affect sustainable development since they are important indicators of socio-economic well-being.*

Measuring corruption and economic freedom can be challenging as they are complex concepts with multiple dimensions. Literature analysis demonstrated that one of the possible ways is to use the indexes with advanced methodology. For example, the Corruption Perceptions Index is a perception-based measure of corruption developed by Transparency International [32]. This Index aggregates data from various sources, including surveys and assessments conducted by independent organizations, to create a composite score for each country. Similarly, there is the Economic Freedom Index, created by the Heritage Foundation [33]. It takes into account different indicators of monetary and fiscal policy to evaluate the economic policy of the governments.

To conclude, there is an abundance of studies concerning the impact of different factors on separately economic, social, and environmental pillars of sustainability. However, there is not enough research on the relationship between sustainable development (including all its components) and the different drivers affecting it. Most of the existing ones are theory-based and have no or little econometric approach.

Therefore, the added value of our research is that it considers sustainable development as a holistic process. Besides, our research investigates the impact of socio-political factors, which are often underestimated in the scientific literature. To the best of our knowledge, the literature analysis demonstrated that there is no research on the impact of median income per capita on sustainable development in general (including all its dimensions), and our study will address this linkage. The future results of the study can be utilized for developing global and national sustainability strategies and specific roadmaps as well as for their successful implementation.

3. Methods and Data

This study involved datasets from the Sustainable Development Solutions Network [6], Transparency International [32], the Heritage Foundation [33], the World Bank [34,35], and Eurostat [36–38]. The period of analysis was 2012–2020 due to the availability of data used.

Countries for analysis were chosen due to their membership in the European Union (on 1 October 2022). EU countries have common targets for achieving the goals of sustainable development, although the ways of their implementation may differ somewhat. The European Green Deal is considered to be a fundamental framework for sustainability promotion in the EU [39]. It is a range of solutions for the successful transition of the European continent to climate neutrality by 2050 and the development of a fair and prosperous society. The EU has features of both convergence and divergence with respect to many aspects, which make this organization suitable for our research. For example, EU members share a customs union; a single market in which capital, goods, services, and people move freely; a common trade policy. However, each country has a right to adopt itself laws on education, public health, culture, some aspects of industrial development. Therefore, there is a difference in the level of economic, political and social development among the EU countries.

As it was mentioned, the main goal of this study is to identify the key factors that affect sustainable development and how they change over time, using panel data regression models. The reason for choosing panel data analysis is because it is more effective than using cross-sectional or time-series data in applying all obtainable observations for successive periods of time. Formalization and data preprocessing were done using Microsoft Excel, whereas the econometric analysis was performed using STATA 16.0. In the research, Sustainable Development Goals (SDG) index is considered as a dependent variable. This index was chosen among others due to its advanced methodology. It investigates the complex progress of all countries in achieving 17 SDGs by analyzing a set of 99 economic, social, and environmental indicators. A variety of regressors were used (some of them are indexes, others are not). Due to the fact that some independent variables may be subcomponents of the SDG index (from our perspective, it is not highly likely, because the SDG Index is very complex and takes into account many indicators), the correlation analysis must be performed.

Based on the discussion above, the following model can be specified:

$$SDGI_t = \mathrm{f}\ (cor_t, ef_t, gdp_t,\ un_t,\ hr_t, inc_t,\ life_t) \tag{1}$$

where:

dependent variable:

$\mathrm{SDGI_t}$—Sustainable Development Goals Index (0—no progress in sustainable development, 100—advanced progress in sustainable development)

independent variables:

$\mathrm{cor_t}$—Corruption Perception Index (0—totally corrupt, 100—least corrupt)

$\mathrm{ef_t}$—Economic Freedom Index (0—not free, 100—absolutely free).

$\mathrm{gdp_t}$—GDP per capita (USD, in constant prices)

$\mathrm{un_t}$—Unemployment rate (%)

$\mathrm{hr_t}$—Employment rate in science and research (%)

$\mathrm{inc_t}$—Median income per capita (in US dollars)

$\mathrm{life_t}$—Life expectancy (at birth, in years)

It is worth mentioning the possible limitations of the methods and data used. There are some variables-indexes (SDG Index, Corruption Perception Index and Economic Freedom Index) that are more subjective than classical economic indicators (GDP per capita, unemployment rate, median income per capita, etc.). Additionally, in this research, due to the data availability, a rather large number of countries and a rather small number of time periods were analyzed.

4. Results and Discussion

Before modeling, all variables were tested on stationarity by means of the unit root test by the methods of Levin, Lin and Chu (LLC). Empirical results of the panel stationary tests are available in Table 3. Therefore, we could conclude that the series has no unit root and it is stationary.

As the next step of the analysis, correlation analysis was performed. When modelling panel data, such analysis serves to spot potential multicollinearity problems that could bias estimated results. Such multicollinearity issues become problematic when correlation coefficients exceed the 0.8 threshold. The correlation matrix is presented in Table 4. To conclude, the multicollinearity is not a problem for this model.

To select from the fixed- and random-effects regression, the Hausman specification test was utilized. Additionally, Breusch and Pagan Lagrangian multiplier test for random effects was employed to select from the random-effects regression and simple OLS regression. The results of both tests were in favor of random-effects GLS regression (Appendix A). Using STATA 16.0 for the above-mentioned model, we got the following results (Table 5).

Table 3. The results of the LLC unit root test for stationarity.

Variables	Statistic	*p*-Value	Decision
SDG	−3.1533	0.0008	Stationary
COR	9.3381	0.0000	Stationary
EF	−6.7776	0.0000	Stationary
GDP	−7.7581	0.0000	Stationary
UN	−15.0635	0.0000	Stationary
HR	4.2410	0.0005	Stationary
INC	12.0318	0.0000	Stationary
LIFE	−3.9741	0.0007	Stationary

Table 4. The correlation matrix.

	SDG	COR	EF	GDP	UN	HR	INC	LIFE
SDG	1							
COR	0.5492	1						
EF	0.5547	0.4727	1					
GDP	0.4600	0.5471	0.4889	1				
UN	−0.3641	−0.3296	−0.5429	−0.2196	1			
HR	0.5045	0.3494	0.4549	0.3675	−0.2992	1		
INC	0.5503	0.5729	0.5324	0.5879	−0.3009	0.1401	1	
LIFE	0.3867	0.5147	0.0155	0.4289	0.1244	0.3089	0.5008	1

Table 5. The results of the random-effects GLS regression for the model.

SDGI	Coefficient	Stand.Err.	z(st)	P > |z|	95% Confidence Interval	
cor_t	0.0263431	0.0224115	1.18	0.240	−0.0175826	0.0702688
ef_t	0.1190948	0.0426815	2.79	0.005	0.0354405	0.202749
gdp_t	−0.0001141	0.0000354	−3.22	0.001	−0.0001834	−0.0000447
un_t	−0.2948082	0.0316021	−9.33	0.000	−0.3567471	−0.2328693
hr_t	0.1879058	0.0374367	5.02	0.000	0.1145312	0.2612805
inc_t	0.0002722	0.0000731	3.73	0.000	0.000129	0.0004154
$life_t$	0.5285915	0.1426041	3.71	0.000	0.2490926	0.8080904
const	13.62626	11.41505	0.86	0.388	−12.39098	31.89249
Observ.	243 observ. (27 groups)					
R-sq.	0.7813 (within), 0.4915 (between), 0.5087 (overall)					
Probab.	0.000					

The economic interpretation of the obtained results is as follows. Corruption was revealed to have no statistically significant impact on sustainable development. J. Forson and colleagues emphasized that corruption is the indicator of extractive institutions, which inhibit sustainable development transition [40]. Corruption undermines governance and the rule of law, so it is completely incompatible with SDG 16 «Peace, justice and strong institutions». Corruption can divert resources away from essential public services and infrastructure projects, resulting in inadequate or ineffective social and environmental policies. Additionally, corruption can contribute to unsustainable practices, such as illegal logging or fishing, that harm the environment and undermine efforts to promote sustainability [41]. While it is possible that corrupt practices may provide some short-term benefits to specific individuals or groups, these benefits are typically outweighed by the negative impacts on society as a whole. In the long run, corruption erodes public trust in government and hinders efforts to promote sustainable development.

The hypothesis that economic freedom promotes sustainable development confirmed. When Economic Freedom Index rises by 1 point, the SDG index grows on average by 0.12 points. This result is similar to K. Biely and S. van Passel, who stated that free market-driven economies promote sustainability, whereas a market failure discourages such development [42]. Likewise, economic freedom stimulates sustainable growth in the middle-income group of countries, according to [43]. When individuals and businesses have the freedom to make their own economic decisions, they are more likely to invest in sustainable development initiatives, such as renewable energy and conservation efforts. Additionally, economic freedom fosters innovation by promoting competition, which can lead to the development of new technologies and practices that benefit both the environment and social sphere. However, exaggerated economic freedom can be a reason for markets overheating and result in severe crises.

When GDP per capita rises by 1000 US dollars, the SDG index falls on average by 0.11 points. It means that environmental damage caused by goods and services production prevails over possible socio-economic benefits of GDP per capita growth. This is in line with [44]. Additionally, another research has similar results: GDP has a negative impact on sustainability, both in the short- and long-run [45]. Our result may trigger the discussion about the decoupling of economic growth from environmental impact, which has traditionally been seen as an unavoidable trade-off. Even now the eco-economic decoupling is one of the most controversial topics in environmental economics. Some large-scale studies have confirmed its existence (or at least a high probability of its existence in the future) [46,47], while others—have not [48,49]. Anyway, the consensus point is that it is crucial to provide such a sustainable model of socio-economic development, which will meet current and future environmental needs.

The hypothesis that unemployment discourages sustainable development due to its negative socio-economic consequences was proved. When the unemployment rate grows by 1 percentage point, the SDG index declines by 0.29 points. Employment in science and research positively affects sustainable development. When it grows by 1 percentage point, the SDG index increases on average by 0.19 points. This result is consistent with [50–52]. Unemployment leads to poverty, so it is directly incompatible with SDG 1, and SDG 8. It is also inconsistent with SDG 10 (Reduced inequalities) because unemployment leads to increased inequality, according to most scientists. On the contrary, a low level of unemployment contributes to eco-friendlier production and consumption behavioral patterns and leads to increased efficiency of resources used, according to [22].

It was proved that median income per capita and life expectancy have a statistically significant positive impact on sustainable development. When median income increases by 1000 US dollars, the SDG index grows on average by 0.27 points. There are several possible explanations to this result. Firstly, households with higher incomes have the financial means to invest in green technologies, such as solar panels or electric vehicles, which can reduce their carbon footprint and promote energy efficiency. Secondly, higher-income households are often better educated and more informed about environmental issues, which can lead to more sustainable consumption and waste reduction practices. Our empirical results also justified that when life expectancy increases by 1 year, the SDG index rises on average by 0.53 points. Longer life expectancy allows individuals to contribute more to society, both economically and socially. People who live longer can work longer, acquire new skills, and participate in a range of activities that contribute to the development of their communities [53]. There may be another a cause-and-effect relationship, when sustainable development contributes to an increase in median income per capita and the life expectancy of the population. Anyway, they are one of the most important indicators of social well-being. These results emphasized that sustainable development should be socially oriented and proved that the social pillar of sustainability is more than just the indirect effects of economic or environmental components.

To get more robust results, cluster-robust standard errors for the RE estimator were applied (Table A3, Appendix B). According to J. Wooldridge, such an approach allows us to obtain more robust results with respect to heteroscedasticity and/or autocorrelation [54]. They confirmed the previous results, obtained using non-robust standard errors. To compare to the random effects estimates and assess the actual gain in goodness-of-fit, we presented the results of the fixed-effects estimates (Table A4, Appendix B). The results of this estimation is similar to the random-effects, but have lower overall R-squared value. To conclude, the post-estimation analysis confirmed our above mentioned results.

5. Conclusions

The research has investigated the impact of social and economic factors on sustainable development as a holistic process and confirmed the majority of hypotheses tested.

Following the results, corruption has no statistically significant impact on sustainability. It does not mean that countries should refrain from tackling corruption or tolerate it. On the contrary, based on our theory analysis, it is necessary to intensify combating corruption. Corruption minimization requires a multi-faceted approach that involves a combination of legal, political, social, and economic measures. Promoting transparency in government operations, including budget allocation and procurement processes, is essential to reduce opportunities for corruption. In addition, raising public awareness about the negative effects of corruption and the importance of integrity can help create a culture of accountability and discourage corrupt behavior. Economic freedom was unfolded to be a driver of sustainable development. In this context, the government should promote a free market economy by minimizing interference in business, effectively protecting the rights of producers and consumers, and ensuring macroeconomic stability. Specifically, the effective tool to implement these steps is digitalization. Digital public services can eliminate bureaucracy, reduce the time of interaction between government and businesses, and increase the level of general trust. Therefore, digitalization also contributes to the dematerialization of socioeconomic systems and, as a result, promotes sustainability.

A higher level of GDP per capita was revealed to affect sustainable development negatively. It does not mean that governments should discourage economic growth—this growth should be sustainable and inclusive. Ultimately, by pursuing sustainable development, nations can achieve long-term economic prosperity while preserving the natural resources and social fabric on which future generations depend. It is recommended for policymakers to invest in clean production, support energy-efficient technologies, develop green financial markets, and attract investments in promising sustainable projects. For example, governments can invest in green infrastructure projects, such as public transportation systems, bike lanes, and green spaces, which can reduce carbon emissions and provide other benefits to the community, such as improved air quality and public health.

Our empirical results proved that unemployment has a negative impact on sustainability, so the main recommendation for decision-makers is to minimize it. According to economic theory, it is possible to reduce unemployment with the instruments of monetary and/or fiscal policy to stimulate aggregate demand (especially, demand for green products). In the long-run, more fundamental decisions are needed, including increasing social labor standards, lifelong education promotion, and incentives for entrepreneurs to start new businesses. Policy-makers should also pay attention to the regional disparities, which are often a reason for high unemployment rates in some areas. Governments can promote regional development by investing in infrastructure and other public goods, attracting private investment to less developed areas, and promoting local entrepreneurship.

The hypothesis that a high level of employment in science and research stimulates sustainable development transition was confirmed. Therefore, governments should perfect the educational system by enhancing learning standards and providing equal access to education for everyone. Fostering talents for science and research requires a long-term educational vision and strategy with an emphasis on the importance of science for sustainable national development. Existing public grant funds should be transparent and fully accountable. Additionally, it is crucial to support businesses with advanced R&D and create a suitable environment for innovation-based companies of any size.

Median income per capita and life expectancy have a statistically significant positive impact on sustainable development. It is important for governments to invest and stimulate investments in human capital. High-quality healthcare is the basis of a person's physical and mental state and, as a result, social well-being. It is possible to promote it by increasing social standards (including a rise in minimum wages and improving healthcare services) and, therefore, by building a more resilient society. In addition, a healthy lifestyle should be promoted by educators, socially responsible businesses, and non-governmental organizations. Besides, the government should control harmful emissions to reduce their negative impact on human health.

The key finding of the study is that transition to sustainability is a complex process with a variety of factors affecting it. The major contribution of the research is that it provides recommendations for policymakers and practitioners to address sustainability challenges in a comprehensive and integrated manner, considering the interdependence of various factors that contribute to sustainable development. Policymakers should use the drivers of sustainable development, revealed in our study, to promote this transition successfully. However, this research has its limitations: the results were estimated only for a certain group of high-income economies within a relatively short time period. Therefore, in further studies, the existing model should be diversified by adding new groups of countries and using an extended time frame. For example, it is also important to analyze SDG performance across totally different areas (high- and low-income economies, democratic and autocratic states, countries with different life expectancy). Additionally, it is expedient to analyze these and new factors (e.g., foreign direct investments, oil prices, etc.), using different econometric methods. For example, it is possible to take into account spatial spillovers between EU countries, using advanced spatial econometric techniques. Future research should also cover the issues of the local context of sustainability. Sustainable development is often implemented at the local level, but there is still a lack of understanding of the specific contexts in which it is being implemented. This can lead to ineffective policies that do not take into account local cultures, practices, and values. Addressing these gaps in knowledge will be essential for achieving sustainable development and ensuring a more equitable and prosperous future for all.

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Appendix A

Table A1. Hausman specification test for the model.

	—- Coefficients —-			
	(b)	**(B)**	**(b-B)**	**sqrt(diag(V_b-V_B))**
	fe	re	Difference	S.E.
cor_t	0.0125346	0.0285910	−0.0160564	0.005754
ef_t	0.1457164	0.1321854	0.013531	
gdp_t	−0.000121	−0.000095	0.000829	0.0000248
un_t	−0.316427	−0.311289	−0.005138	0.0081328
hr_t	0.147956	0.154176	−0.00622	0.0071485
inc_t	0.0002432	0.0009403	−0.0006971	$9.12*10^{-6}$
$life_t$	0.5708793	0.5462341	0.0246452	0.0384932

b = consistent under Ho and Ha; obtained from xtreg; B = inconsistent under Ha, efficient under Ho; obtained from xtreg; Test: Ho: difference in coefficients not systematic; chi2(7) = (b-B)′[(V_b-V_B)^(−1)](b-B)= 6.48; Prob > chi2 = 0.6894; (V_b-V_B is not positive definite).

Table A2. Breusch and Pagan Lagrangian multiplier test for random effect for the model.

Breusch and Pagan Lagrangian Multiplier Test for Random Effects re[id,t] = Xb + u[id] + e[id,t] Estimated Results:		
	Var	sd = sqrt(Var)
re	43.17406	6.570697
e	0.647888	0.8049149
u	16.0581	4.007255

Test: Var(u) = 0; chibar2(01) = 639.53; Prob > chibar2 = 0.0000.

Appendix B

Table A3. The results of the random-effects GLS regression with cluster-robust standard errors.

SDG	Coefic.	Stand.Err.	z(st)	P > |z|	95% Confidence Interval	
cor_t	0.0263431	0.0467624	0.56	0.573	−0.0653096	0.1179958
ef_t	0.1190948	0.0622197	1.91	0.056	−0.0028535	0.2410431
gdp_t	−0.0001141	0.0000489	−2.33	0.020	−0.0002098	−0.0000183
un_t	−0.2948082	0.055526	−5.31	0.000	−0.4036373	−0.1859792
hr_t	0.1879058	0.0507969	3.70	0.000	0.0883458	0.2874659
inc_t	0.0002722	0.0001227	2.22	0.027	0.0000317	0.0005128
$life_t$	0.5285915	0.1337528	3.95	0.000	0.2664409	0.7907421
const	9.750755	12.09178	0.81	0.420	−13.9487	33.45021
Observ.	243 observ. (27 groups)					
R-sq.	0.7813 (within), 0.4915 (between), 0.5087 (overall)					
Probab.	0.000					

Table A4. The results of the fixed-effects GLS regression for the model.

SDG	Coefic.	Stand.Err.	z(st)	P > |z|	95% Confidence Interval	
cor_t	0.012216	0.0236855	0.52	0.607	−0.0344771	0.0589092
ef_t	0.1296337	0.0431036	3.01	0.003	0.0446601	0.2146074
gdp_t	−0.0001149	0.0000394	−2.92	0.004	−0.0001926	−0.0000373
un_t	−0.2988986	0.0332619	−8.99	0.000	−0.3644705	−0.2333267
hr_t	0.1860487	0.0383916	4.85	0.000	0.1103642	0.2617331
inc_t	0.0002565	0.0000745	3.44	0.001	0.00001097	0.0004033
$life_t$	0.5457458	0.1519296	3.59	0.000	0.2462349	0.8452567
const	8.875823	11.82698	0.75	0.454	−14.43965	32.1913
Observ.	243 observ. (27 groups)					
R-sq.	0.7808 (within), 0.4795 (between), 0.4968 (overall)					
Probab.	0.000					

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