

**SUSTAINABILITY DEVELOPMENT
THROUGH GREEN ECONOMICS**

CONTEMPORARY STUDIES IN ECONOMIC AND FINANCIAL ANALYSIS

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CONTEMPORARY STUDIES IN ECONOMIC AND
FINANCIAL ANALYSIS VOLUME 114

SUSTAINABILITY DEVELOPMENT THROUGH GREEN ECONOMICS

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Emerald Publishing Limited
Emerald Publishing, Floor 5, Northspring, 21-23 Wellington Street, Leeds LS1 4DL.

First edition 2024

Editorial matter and selection © 2024 Sanjay Taneja, Pawan Kumar, Reepu,
Balamurugan Balusamy, Kiran Sood and Simon Grima.
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British Library Cataloguing in Publication Data

A catalogue record for this book is available from the British Library

ISBN: 978-1-83797-425-2 (Print)

ISBN: 978-1-83797-424-5 (Online)

ISBN: 978-1-83797-426-9 (Epub)

ISSN: 1569-3759 (Series)



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FOREWORD



In an era defined by pressing global challenges, the pursuit of sustainable and equitable economic development stands as a shared commitment for nations worldwide. The book *Sustainability Development Through Green Economics*, by Emerald Publishing, serves as a comprehensive exploration of critical topics ranging from the diverse landscape of the European Union's green transition to the details of green HRM, sustainable organisations, and the impact of green banking practices.

In the contemporary landscape, the importance of a green economy cannot be overstated, represents a transformative approach that integrates environmental considerations into economic decision-making, fostering a harmonious coexistence between human activities and the planet. However, the lack of accessible information and resources regarding green economy practices remains a significant impediment to its widespread adoption. The book emerges as a beacon, illuminating the path towards green growth and sustainability, addressing the information gap and catalysing a collective understanding of the imperatives of environmental responsibility. It not only serves as a repository of knowledge but also as a clarion call to raise awareness and disseminate scientific information about green growth and green economy practices. Through the collective expertise and insights shared by esteemed authors, this compilation strives to bridge the informational divide, empowering readers with the tools to navigate the complexities of integrating sustainability into economic frameworks.

The transition to a green economy requires not just commitment but unified responsibility, a collective effort that unfolds gradually. It is a journey that necessitates consistent awareness and understanding and this book is a significant step towards that collective awakening. The authors, through their insightful contributions, have introduced the importance of these sensitive issues, shedding light on the complexities and challenges that lie ahead. Their efforts are commendable

and their works guide us towards a more sustainable future. In extending our gratitude to the authors, I acknowledge the significance of their contributions to the *Sustainability Development through Green Economics* book. I do hope that this book becomes a basis for individuals across various spheres, providing them with the knowledge and stimulus needed to contribute to the ongoing dialogue on sustainable development through green economics.

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PREFACE

The book titled *Sustainability Development Through Green Economics* provides findings of research in the field of *sustainability development in economics*, finance, and computer science. This book commits to providing approaches, theories, risks, tools, and techniques in finance using technology along with SDE goals.

Sustainable development satisfies existing demands without jeopardising the capacity of subsequent descendants to fulfil their respective needs. Economies at their core, are made up of a set of laws and standards that encourage certain conduct and penalise others. Our economies currently encourage excessive consumerism, weaken social ties, and deplete natural resources. But this is just the way our economies have developed to work; it is neither inevitable nor necessary. It takes a fresh economic vision to address these issues which is green economy. The concept of a 'green economy' does not supplant sustainable development but instead places a fresh emphasis on the region's economy, investments in infrastructure, job and skill needs, and favourable social and environmental consequences.

The book describes first about green economy and how it contributes towards sustainable development. This book would elucidate sustainable development. The book traverses the power of economic as well as financial policy, green investment, green insurance as well as green infrastructural development to ensure sustainable development.

This book provides a link between technology, finance, economics, and sustainability and thus, is relevant for undergraduate, graduate, and executive students, and researchers in the field of business, finance, economics, and computer science. The book is also relevant for practitioners, industry people, policymakers, investors, corporate executives, etc. This can be offered as an elective course for undergraduate and postgraduate students to impart knowledge on the newest technology for sustainable living with harnessed usage.

Unique sales points:

1. Offers a thorough exploration of sustainability through the lens of green economics.
2. Provides actionable strategies and real-life examples for practical implementation.
3. Incorporates insights from various disciplines to appeal to diverse audiences.

4. Presents up-to-date research and trends in the field.
5. Inspires readers to make meaningful contributions towards sustainable development.

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CHAPTER 1

SOCIAL AND ECONOMIC DIVERSITY IN THE EUROPEAN UNION ON THE ROAD TO GREEN ECONOMY*

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ABSTRACT

Purpose: The chapter analyses the diversity of the European Union (EU) member states in terms of the transition to a sustainable, green, and just economy.

Need for the study: Sustainable development is an important concern that the EU approaches by aiming to transition to a greener economy, fairly and inclusively. Moreover, the actual context, post-pandemic period and ongoing war at the EU border, makes the social and economic development of the EU countries matter even more in the light of this just transition.

*Part of this work was supported by the NUCLEU Programme funded by the Romanian Ministry of Research, Innovation and Digitalization (Project PN 22100201).

Sustainability Development through Green Economics

Contemporary Studies in Economic and Financial Analysis, Volume 114, 1–19

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ISSN: 1569-3759/doi:10.1108/S1569-375920240000114001

Methodology: The authors relied on a multidimensional approach, using principal component analysis (PCA) to reduce the dimensionality of the dataset. The cluster analysis allowed us to group the countries in such a way that made it possible to identify the best and worst performers, as well as certain patterns that can be the basis for the formulation of good practices and transferable to the states that need more support in the transition to a green economy.

Findings: The results indicated that EU member states can be grouped into five clusters, each needing specific policies to ensure sustainable and inclusive development. Denmark, Finland, and Sweden turned out the best performers, while Estonia, Lithuania, Bulgaria, and Romania proved to have the most unfavourable situation.

Practical implications: The findings provide relevant policy implication insights for policy decision-makers in the field of green economy, economic development, and social policies, with directions for future research.

Keywords: Sustainable development; green economy; inequalities; just transition; cluster analysis; principal component analysis; European Union;

JEL Codes: C38; O44; O52; Q01; Q56; Q58

1. INTRODUCTION

Economic sustainability is a permanent concern in Europe and around the world. The financial crisis from 2008 had put the economic development on hold for several years; there was a relatively calm period after 2012–2014 until the COVID-19 pandemic started. The war in Ukraine came in a period of a slight recovery from the pandemic, the two recent events putting a lot of pressure on all EU Member States' economies and individuals' welfare: the pandemic had put pressure on health systems all over the world, the labour markets, public budgets; the war at the edge of EU affected the energy prices, the food chains (Lee, 2022).

On top of all these events, the climate crisis comes with its specificities: it differs pretty much from other crises, in that the cause and effect are distant from one another: the cause is now and here and the effect might be distant in the future and another place on the planet. This type of causal relationship makes it difficult for some individuals to realise that cause A produces the effect B and therefore they are not interested in changing their behaviour. In other words, the fact that future generations will suffer from our actions, and maybe the vulnerable individuals will suffer the most, does not make some of us today act more wisely and consciously. When talking about air, water, and soil pollution, only the local accidents make individuals aware of the danger. Thus, it is widely considered that only coordinated efforts and actions could make a difference in the future.

Buch-Hansen and Nesterova (2022) argue that we need a deep societal transformation, a change in 'our inner being' to become more empathetic, less egocentric

and possessive, more capable of seeing ourselves as a part of a community and aware of our actions' consequences.

Under such context, it becomes essential to properly investigate the post-pandemic social and economic diversity of the EU countries in the context of green economies and sustainable development. To serve this scope, we relied on a multidimensional approach to cluster and find patterns between the EU countries in terms of income inequalities, unemployment, green economy, and economic development. The novelty of the chapter consists of the holistic methodological approach designed for such investigation, in which a generous dataset was initially considered with indicators reflecting the social, demographic, education and employment, green economy, and economic development dimensions. It was followed by a PCA to reduce the dimensionality of the dataset with a minimum information loss and then a cluster analysis based on the extracted factors. In this manner, we ensure a rather holistic approach when clustering the EU countries and investigating the patterns between them. On the one hand, our findings provide relevant policy implication insights for policy decision-makers in the fields of green economy, economic development, and social policies. On the other hand, our methodological approach could be useful for researchers and academicians by providing directions for future studies.

The chapter is structured in the following manner. Section 2 covers the literature review in the field, followed by the data and methodology in Section 3, in which the steps of our investigation are thoroughly explained. The chapter's main findings are discussed and analysed in Section 4, while the conclusions and limitations of our investigation are tackled in the last section.

2. LITERATURE REVIEW

One definition of the 'green economy' concept is that of the United Nations, which states that for a green economy, we should aim for a low level of carbon, efficient use of resources, and an inclusive society (Lee, 2022). Therefore, the political discourse around the just transition to a net-zero carbon economy should always consider not only the practical aspects of the transition, but also the social dimension of it: inevitable, despite all the adaptation measures, at least in the first phase some will lose and a straightforward result will be the exacerbation of the social inequalities. Because of that, a crucial debate should be on what measures should be adopted to minimise the negative effects, protect the most vulnerable individuals and/or communities, and take the action needed to move forward sustainably.

It is expected that millions of jobs to be created during this transition, but a significant number of other jobs will disappear. Rather more often than less often, the sectors/regions/areas where jobs are created and lost are not the same, meaning that workers must be relocated. Many of them will need training, reskilling, and upskilling (Akgüç et al., 2022). Not only between regions and economic activities will appear unequal effects, but also among men and women, among young and elders, among natives and migrants, among highly educated and less educated. In other words, all those who already are in some form of vulnerability,

who already must face a form or another of discrimination, inequality, or poverty, will most likely suffer significant challenges (Galgóczi & Akgüç, 2021).

In Europe, the European Green Deal is meant to manage the transition to a greener economy. It aims to 'leave no one behind' and to ensure a 'just, fair and inclusive' transition, as Frans Timmermans pointed out at the launch of the programme in December 2019 (European Commission, 2019a). This ambitious political initiative aims to transform Europe into the first climate-neutral continent by 2050, in an attempt to tackle environmental changes (European Commission, 2019b). Despite the official declaration, it is to be expected that the entire process will not be just, fair, and inclusive for all. Some will benefit from this transition, while some will lose. Unfortunately, great chances are that the 'losers' will be the vulnerable and disadvantaged members of today's society.

Who are the vulnerable? To whom should the policies be addressed? One definition that might be useful is that vulnerable individuals are those who suffer from any kind of discrimination, lack of jobs, education, development opportunities, and unequal access to health and other public services. Unfortunately, all too often the vulnerabilities are multiple and cumulative. As a result of the exposure to this kind of systematic barriers, these individuals face poverty, health problems, and a higher risk of social exclusion, they do not take part in any way in the political decision-making and they feel that they do not matter for the rest of the society. In consequence, the political decision-makers need to correctly identify the vulnerable communities at all levels; they also need to understand what makes them so vulnerable, what needs they have, and how those needs can be optimally addressed so that the phrase 'no one is left behind' to turn true at the end of the day.

In a recent study, Eurofound and EEA (2023) investigated the convergence of the quality of life of the Member States, by analysing a set of important variables (at the macro-, meso- and micro-levels). They reached important conclusions, one of them being that the macro-indicators pointed towards progress on reaching the targets, but the convergence was not that straightforward. The evidence showed that there is a reduction in disparities between Member States regarding greenhouse gas emissions, but not regarding the share of renewable energy in energy consumption, for example. They also examined the correlation between socioeconomic and environmental indicators, concluding that high performance on socioeconomic indicators is positively correlated with progress in environmental factors (the higher the income, the better the performance of environmental factors; the better performance of social indicators, the greater improvement observed of environmental performance). The interdependences between social, economic, and environmental development are not a surprise anymore (Daniek, 2020), one country cannot have steady and healthy economic growth without taking care of the social aspects and the well-being of the citizens.

Another hindrance that can prevent sustainable development is corruption. Maybe the connection between corruption and a greener economy is not as straightforward sometimes, but studies are showing that where corruption dominates a country's government, that country is less likely to be able to improve its environmental development (Biswas et al., 2012; Tawiah et al., 2023).

Tawiah et al. (2023) obtained a negative and significant relationship between corruption and green growth, using a panel of 123 countries for the period 2000–2017. They argue that corrupt countries inefficiently exploit their natural resources. Corruption also prevents the increase of renewable energy use and may contribute to the continued use of fossil fuels, as pointed out by Sinha et al. (2019).

Several studies used cluster analysis to obtain homogenous groups of countries when analysing aspects of sustainable development, economic growth, social indicators, and climate change. Some of them looked at worldwide evolutions (Çağlar & Gürler, 2022) and classified 110 countries in terms of sustainable development goals (SDGs); Li et al. (2019) investigated 67 countries to highlight the relationship between economic growth and CO₂ emissions.

Others, such as Petrov et al. (2018), Drastichová and Filzmoser (2019), Onuferová et al. (2020), Drastichová (2020), Rybak et al. (2022) and Jančovič (2022), investigated the dynamics and evolutions inside the EU. Drastichová (2020) used several SDG indicators to classify the EU-28 plus Norway, looking at the performance in sustainability in these countries. She employed data from 2007 to 2016, made use of Ward's method for clustering, and obtained a total of four clusters. She concluded that the Northern countries represent the most sustainable group, while the cluster composed of the countries in the Baltic, Southeast, and South areas is the worst-performing group of countries.

Onuferová et al. (2020) analysed the EU28 countries from the perspective of social and economic development, using a set of indices for 2011 and 2018. Their result indicated that several countries improved their performances and moved from one cluster in 2011 to another in 2018 (UK, Germany, Latvia, Estonia, Lithuania, and the Czech Republic), but most of them remained in the same clusters.

Jančovič (2022) investigated the progress made by EU countries regarding the SDG indicators, performing a cluster analysis for data from 2015 and 2020. He obtained for each of the two years a set of five clusters, with the best performers being Belgium, France, Luxembourg, Denmark, Germany, and the Netherlands. Similar results, with good results towards achieving the SDGs, were identified in Austria, Sweden, Slovenia, and Finland. At the opposite pole, Jančovič (2022) obtained that Bulgaria and Romania were the worst performers.

Petrov et al. (2018) investigated the sustainability of the southern European countries. They investigated 15 indicators for a group of 10 countries, performing a cluster analysis. They obtained three clusters: Serbia Albania, Macedonia, Bosnia and Herzegovina, Montenegro (being the group of the candidate or potential candidate countries for accession in the EU), Bulgaria, Romania, Croatia (the group of countries with moderate performance), and Slovenia and Greece (the best performers in the area).

Rybak et al. (2022) performed a cluster analysis for the EU27 countries, aiming at identifying the groups of countries that are performing like each other when considering a set of indicators regarding Climate Change, Environment, and Energy (as provided by Eurostat database, 2024). They obtained 10 clusters, leading to the conclusion that each country has different energy systems in place. It emerged that each member state was following, in 2019, its specific path to achieve climate and energy policy objectives.

3. DATA AND METHODOLOGY

The chapter intends to study the post-pandemic social and economic diversity of the EU countries in the context of green economies. To serve this scope, we proposed a multidimensional approach to cluster and find relevant patterns between the EU countries in terms of income inequalities, unemployment, green economy, and economic development.

The methodological approach of our investigation consisted of the following main steps.

Step 1. Data Collection: First, we gathered an initial set of potential indicators at the EU level for the year 2022 which were considered relevant for our investigation. The following main five categories of indicators were considered:

- (1) *Social indicators:* Gini coefficient, gender employment gap, at-risk-of-poverty rate (AROP), and the impact of social transfers on poverty reduction.
- (2) *Demographic indicators:* old-age dependency ratio and life expectancy.
- (3) *Education and employment indicators:* unemployment rate, the share of women in top management positions, high-tech employment, adult participation in learning, and the share of the population with low or high education level.
- (4) *Green economy indicators:* carbon dioxide emissions, renewable energy, material footprint, and resource productivity.
- (5) *Economic development indicators:* GDP per capita, trade openness and the corruption perception index (CPI).

The set of indicators is summarised and described in [Table 1.1](#). The main source of our data was the Eurostat online database, only for the variable *trade openness* we used as a source the UNCTAD database (2024).

Table 1.1. Main Indicators.

Data Dimensions	Indicator	Definition
Social indicators	Gini	The Gini coefficient is used to represent the distribution of the population's income and is considered a measure of inequality. The indicator is used to assess the income distribution of equalised disposable income
	AROP	The at-risk-of-poverty rate indicates the percentage of people who have an adult-equivalent disposable income with values below the poverty risk threshold (60% of the median income)
	Employment_gap	The gender employment gap measures the difference between the employment rates of men and women of working age (20–64 years)
	Social_transfers	The effect of social transfers, without taking pensions into account, on poverty reduction

Table 1.1. (Continued)

Data Dimensions	Indicator	Definition
Demographic indicators	Life_expectancy	Life expectancy indicates the average number of years a new born can expect to live under current mortality conditions
	Old_age_dependency	Old-age dependency ratio represents the ratio between the elderly (people aged 65 and over) and people of working age (15–64 years)
Education and employment indicators	Unemployment	Unemployment rate is the number of unemployed persons as a percentage of the labour force
	Hightech_employment	Share of people employed in knowledge-intensive activities: science, engineering, and ICT (% of total employment)
	Women_manag	Share of women occupying senior managerial positions (%)
	Adult_learning	Quantifies the lifelong learning of adults, based on the share of people who participated in learning activities in the last month (%)
	ISCED02	The share of people with a low level of education, less than primary, primary, or lower secondary education: International Standard Classification of Education (ISCED) levels 0–2 (%)
Green economy indicators	ISCED58	The share of people with a high level of education, (tertiary education, ISCED levels 5–8) (%)
	Carbon_dioxide_emissions	Total air emissions (greenhouse gases in CO ₂ equivalent), originating both from productive activities and from domestic consumers (tons per capita)
	Renewable_energy	Share of energy obtained from renewable sources (%)
	Material_footprint	Represents the total amount of raw materials extracted to satisfy the need for final consumption and to support economic growth (tons per capita)
Economic development	Resource_productivity	Resource productivity represents the ratio between the total amount of materials used and the gross domestic product (GDP) and measures whether economic growth is correlated with the use of natural resources in a country (PPS/kilogram)
	GDP_per_capita_pps	The ratio between GDP and population, expressed in purchasing power standards (PPS)
	Trade_openness	Represents the sum of exports and imports, divided by GDP
	CPI	CPI, calculated by Transparency International, with values between 0 (very high corruption) and 100 (very low corruption)

Source: Authors' selection of data.

Step 2. Data Preparation and Standardisation: Before performing a PCA or a cluster analysis on the EU countries based on the selected data, we checked and prepared the data for the investigation. Thus, the dataset was initially checked for missing values to make sure that the investigation was not compromised.

Next, a correlation matrix was computed to check the strength of the relationship between the considered indicators and the results were below the 0.8 cut-point. Finally, since the indicators were expressed in different measurement units, we decided to standardise the dataset using the min–max method (Davidescu et al., 2015; Popescu et al., 2018).

Step 3. Performing a PCA: Since a generous dataset consisting of 19 relevant indicators was gathered for this study, we first had to reduce the dimensionality of the initial dataset with a minimum information loss to be able to perform a cluster analysis on the EU countries. Therefore, a PCA was applied. PCA is a statistical procedure that allows a dimensionality reduction of the initial dataset to fewer uncorrelated factors (called principal components) that keep a maximum of the variance of the initial dataset. These principal components are computed as a weighted linear combination of the initial dataset and are ranked decreasingly according to the variation of the initial indicators. Thus, the first principal component keeps the largest variation, followed by the second factor with the highest variation uncontained in the previous factor, and so on. The choice of the total number of selected principal components was based in this chapter on the number of principal components with eigenvalues higher than one.

Before conducting a cluster analysis based on the resulting principal components, we checked the robustness of the PCA by conducting a sensitivity analysis. Several statistical tests were therefore used to check the quality of the PCA results using the SPSS 21 software. On the one hand, we conducted the Kaiser–Meyer–Olkin (KMO) test to evaluate the adequacy of the sampling by comparing the magnitudes of the observed correlation coefficients to those of the partial correlation coefficients. On the other hand, we applied Bartlett’s test of sphericity to check for redundancies between indicators to make sure that all indicators from the correlation matrix are uncorrelated.

The results are summarised in Table 1.2.

Since the KMO test registered a value higher than 0.5, we can conclude that the PCA is indeed appropriate to be applied and that the sampling is adequate (Davidescu et al., 2015; Popescu et al., 2018), although values higher than 0.8 are optimal to indicate the most reliable results possible for a PCA. Moreover, since the p -value of Bartlett’s test of sphericity is lower than 0.05 for an approximate Chi-square of 198.46, we confirm that the test is statistically significant and that the indicators considered in the PCA are related and suitable for structure detection.

Step 4. Performing the Cluster Analysis: The cluster analysis was next performed using the previously computed principal components and a hierarchical cluster algorithm to find patterns between the EU countries in terms of income inequalities, unemployment, green economy, and economic development.

Table 1.2. Sensitivity Analysis to Test the Robustness of the PCA.

KMO measure of sampling adequacy	0.57
Bartlett’s test of sphericity (approx. Chi-square)	198.46 (0.00)

Source: Authors’ calculations in SPSS.