GREEN TRANSFORMATION OF THE EUROPEAN UNION: IMPLICATIONS ON THE ECONOMIC DEVELOPMENT OF THE WESTERN BALKANS

Ognjen Erić[1]
Dragan Gligorić[2]
Branka Topić-Pavković[3]

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Abstract

Regardless of the geopolitical and economic challenges the world as well as the European Union (EU) face, it appears that these issues have not, in the slightest, affected the EU's commitment to the green transition. The European Commission continues to provide strong support to member countries in implementing reforms that encourage the green transition. In conditions of sluggish economic growth, the investments in the green transition are characterized as a significant driver of economic growth. This paper analyzes and evaluates the implications of the EU's green transformation on the economic development of the Western Balkans (WB), with a special focus on the Green Deal and climate neutrality. The Green Deal represents the EU's key strategy for achieving climate goals and transitioning to a sustainable, green economy. Through an analytical approach, the impacts of the green transformation and related policies on the economic, social, and environmental aspects of the region are explored, considering the global Green Economy Index. The research methodology includes cluster analysis and analysis of the green economy index to assess the correlation between factors of the green economy and economic development, considering financial, institutional, and legal aspects of the Green Deal. Additionally, a comparison of development according to the Green Economy Index is applied to identify the position, potential, but also limitations of the Western Balkans in this context. Key indicators of the green economy, such as investments in renewable energy sources, energy efficiency, and sustainable infrastructure, are analyzed in terms of their impact on macroeconomic indicators such as gross domestic product per capita, unemployment, etc., in the Western Balkans. The paper identifies a range of opportunities for economic development, including increasing investments in renewable energy sources and developing sustainable infrastructure projects, but at the same time recognizes limitations, such as a lack of capacity, financial resources and public sector support to implement sustainable policies. Furthermore, there is a risk of increasing economic and social inequalities in the process of green transformation, as well as potential negative environmental consequences if appropriate measures are not taken.

Keywords: Green Deal, Economic Development, Climate Neutrality, European Union, Western Balkan

INTRODUCTION

The Earth is warming and the climate is changing mainly due to human activities, which made the countries of the world in urgent need to change the environment of the economy (Hadouga, 2023; Kaczmarczyk, 2021). Faced with the global challenge of climate change, the EU has set the ambitious goal of achieving climate neutrality by 2050, presenting the Green Deal as its main action plan (European Commission, 2019 a). This initiative is not solely focused on reducing greenhouse gas emissions but also on promoting sustainable economic growth, resource independence, and the protection of the natural environment (European Parliament,

[1] University of Banja Luka, Faculty of Economics
[2] University of Banja Luka, Faculty of Economics
[3] University of Banja Luka, Faculty of Economics

2018). In the context of these efforts, understanding the implications of the green transformation on the economic prospects of the Western Balkans is particularly significant. The Western Balkans is a term used by the European Union to refer to Balkan countries aspiring to join this integration. These countries include Albania, Bosnia and Herzegovina, Montenegro, North Macedonia, and Serbia (Erić, 2017). In this sense, they are at a crossroads where their economic development and European integration processes can be deeply influenced by the Union's environmental policies and practices (Erić et al, 2023; Mosāne, 2022).

The EU Green Deal encompasses a wide range of objectives aimed at environmental protection and sustainable development. Key elements include a drastic reduction in greenhouse gas emissions by 2030, increasing the share of energy obtained from renewable sources, and promoting the energy efficiency of the entire economy (European Commission, 2019 a; 2019 b). Additionally, the strategy aims to preserve biodiversity, promote sustainable agriculture and food systems, and develop sustainable infrastructure and mobility. The Green Deal represents a fundamental change in the way the EU approaches economic development, creating a growth model that allows for long-term sustainability and competitiveness (Erić et al, 2023). Regardless of the geopolitical and economic challenges the European Union (EU) face, as well as harsh austerity measures (Жарковић, Крајишник & Глигорић, 2014) and fiscal consolidationt taken by the EU countries (Krajišnik, Gligorić, & Gojković, 2019), it appears that these issues have not, in the slightest, affected the EU's commitment to the green transition and green investment.

As part of this long-term strategy, the EU has set a goal to reduce greenhouse gas emissions by at least 55% by 2030 compared to 1990 levels. Achieving this requires strengthening existing climate change policies, introducing new regulations, and encouraging investments, both public and private, in green technologies. One of the aims is also the energy transition, which entails redirecting the EU's energy system from fossil fuels towards cleaner energy sources, such as renewable energy and nuclear power. This includes significant investments in solar and wind energy projects, as well as improving the energy efficiency of buildings and industries (European Commission, 2024).

Regarding sustainable food consumption, the EU has defined the "Farm to Fork" Strategy with the aim of securing a sustainable food system that supports local production and reduces the impact of agriculture on the environment. The goal is also to promote organic farming and reduce the use of pesticides. Furthermore, as part of its strategy, the EU aims to restore damaged ecosystems and address issues such as habitat loss and the decline in the number of animal and plant species. Key activities include the restoration of forests, protection of marine areas, and combating invasive alien species (Popović and Erić, 2021; European Commission, 2019 a).

Through the Green Mobility action, the EU promotes cleaner, cheaper, and healthier modes of transport. The EU encourages the use of electric vehicles, the development of public transport and bicycle infrastructure, and the transition to cleaner fuels for airplanes and ships.

For the effective realization of strategies, a key factor is the financing of the green transition, and the EU has developed sustainable finance taxonomy to guide investments towards sustainable projects (European Commission, 2024). Additionally, European funds targeted at sustainable development support green projects and technologies (Sikora, 2021). The EU's strategy for green transformation lays the foundations for long-term sustainability, while also promoting economic opportunities and competitiveness (Ignjatović et al, 2024; Szpilko, and Ejdys, 2022).

The specific outcomes of initiatives and strategies stemming from the European Union's Global Green Deal are multiple and cover a wide range of sectors. These outcomes are not only a demonstration of commitment to sustainable development and the fight against climate change

but also a roadmap for economic growth that is in line with sustainability principles (European Commission, 2024).

The EU has made significant progress towards reducing greenhouse gas emissions. Achievements include increasing the share of renewable energy in total energy consumption, improvements in energy efficiency, and reductions in emissions from the industry and transport sectors. Furthermore, the share of renewable energy in the EU continues to grow, reducing dependency on fossil fuels and CO2 emissions (The Intergovernmental Panel on Climate Change-IPCC, 2024; European Environment Agency, 2024). Significant financial resources are directed towards renewable energy projects, including wind farms, solar farms, and hydroelectric infrastructure (European Environment Agency, 2024). Areas under organic agriculture in the EU are increasing, aiming to support biodiversity sustainability and reduce the negative impact of agricultural activities on the environment. The "Farm to Fork" Strategy encourages the production and consumption of sustainable, healthy, and fairly produced food products (European Commission, 2019 a). The expansion of the Natura 2000 network, covering protected habitats and species across the EU, plays a key role in biodiversity protection (Rosamond and Dupont, 2021; European Environment Agency, 2024). The EU has introduced various incentives and infrastructure for electric charging, contributing to a significant increase in the number of electric vehicles on EU roads. Improvements in public transport and support for cycling infrastructure encourage citizens to use sustainable forms of mobility (European Commission, 2021). The EU's sustainable activities taxonomy and Green Bond Standard guide investments towards sustainable projects, promoting ecological transition (European Commission, 2023) . The Union continues to play a leading role in global efforts to combat climate change, encouraging other countries to undertake similar actions.

The Western Balkans face specific challenges but also opportunities in the context of the EU's green transformation (European Commission, 2022). On one hand, the EU's ambitious policies provide a model for environmentally sustainable development, while on the other hand, they set requirements for adapting their own economic and regulatory frameworks. The integration of the Western Balkans into the EU and alignment with environmental standards and policies can be key to attracting investments, fostering innovation, and improving energy security and sustainability (European Commission, 2022). This dynamic offers an opportunity for the Western Balkans to evaluate their economic models and identify ways to achieve a green and inclusive economy. Thus, the green transformation imposes the need for the Western Balkans region to invest in renewable energy sources, modernize infrastructure, and develop new skills and capacities. At the same time, the green transition offers opportunities for creating new jobs, reducing energy dependence, improving air quality and health, and stimulating economic growth through innovation and technological development (European Commission, 2022).

The paper is structured in several key chapters that explore in detail the different aspects of the green transformation and its impact on the Western Balkans. The methodological section describes the theoretical approach to the Green Economy Index, provides insight into the percentiles of each analyzed country in the sample, and presents the quantitative tools used in the analysis, while the results and discussion consider the key findings of the research. The conclusion summarizes the main insights of the paper and suggests guidelines for future policy and research.

DATA AND METHODOLOGY

Data

The research methodology is based on an analytical approach that includes cluster analysis and the use of the Global Green Economy Index (GGEI) to assess the impact of the green transformation on economic development. Thus, the GGEI index, published by the consulting firm Dual Citizen, represents an approximation of the success of the transformation into a green economy, and it is calculated for 160 countries. Through selected methods, the paper aims to quantify the connection between EU environmental policies and economic outcomes in the Western Balkans countries, enabling a deeper understanding of how the green transition can impact various aspects of economic development, including investments, employment, and competitiveness.

The GGEI is a key global indicator that measures the performance of countries in the green economy sector, focusing on leadership and climate change, the green economy, resource efficiency, and ecological capital. The Union stands out in this context thanks to the European Green Deal, aiming to make the EU the first climate-neutral continent by 2050. On the other hand, the Western Balkans countries, in their accession process, strive towards a green economy, facing specific challenges.The position of countries according to the GGEI percentile provides important insight into their performance within the green economy. The percentile reflects the country's relative position on a global ranking based on its environmental performances, resource efficiency, sustainable development, and leadership in climate change. Data for individual countries are given in Table 1.

Table 1. Values of GDPpc (USD) and GGEI (percentile), 2022

Country	GDPpc	GGEI	Country	GDPpc	GGEI
Sweden	54,589	0.799	Croatia	15,040	0.667
France	41,558	0.744	Estonia	23,166	0.666
Denmark	61,592	0.742	Slovenia	26,124	0.639
Austria	51,467	0.711	Romania	12,494	0.623
Ireland	79,447	0.703	Greece	19,757	0.617
Portugal	23,563	0.701	Cyprus	29,335	0.613
Latvia	17,865	0.697	Slovakia	19,382	0.606
Luxembourg	116,787	0.696	Bulgaria	9,448	0.604
Belgium	47,545	0.693	Czechia	23,424	0.59
Spain	30,380	0.689	*Albania*	*5,288*	*0.566*
Finland	49,988	0.688	Poland	15,505	0.559
Netherlands	53,045	0.685	Hungary	16,425	0.557
Germany	47,939	0.674	*Montenegro*	*8,850*	*0.531*
Malta	31,786	0.672	*Serbia*	*7,252*	*0.495*
Italy	34,622	0.669	*N. Macedonia*	*6,070*	*0.476*
Lithuania	19,186	0.668	*BIH*	*6,024*	*0.426*

Source: Dual Citizens 2024; World Bank, 2024

The table of percentile values according to the GGEI forms the basis for K-means cluster analysis, which is utilized to test the hypotheses of the paper, draw corresponding conclusions, and determine further research directions.

Methodology

Cluster analysis (K-means method or algorithm) is one of the most well-known methods for clustering or grouping data. It is used to divide a dataset into 'k' distinct subsets (clusters), minimizing the variance within clusters (Arthur, and Vassilvitskii, 2007; Ester et al, 1996).

The steps of K-means analysis are (Likas et al, 2003):

- Initialization: Random selection of 'k' points from the dataset as the initial cluster centers.
- Assignment: Assigning each data point to the cluster whose center is the nearest. Distance is usually measured by Euclidean distance.
- Update: Calculating new cluster centers by taking the mean value of all points assigned to each cluster.
- Repetition: Steps 2 and 3 are repeated until the cluster centers stabilize or the maximum number of iterations is reached.

The goal of the K-means algorithm is to minimize the objective function (J), which is defined as the sum of squared distances between data points and the cluster centers assigned to them:

$$J = \sum_{i=1}^{k} \sum_{x \in S_i} \|x - \mu_i\|^2 \quad (1)$$

where 'Si' is the set of points assigned to the 'i'-th cluster, 'μi' is the centroid of cluster 'i', and ||x - μi|| is the Euclidean distance between point 'x' and the cluster center 'μi'.

K-means is widely used across many fields due to its simplicity and efficiency, although it has some limitations, such as sensitivity to the choice of initial cluster centers.

Euclidean distance: It is used to calculate the distance between two points 'x' and 'y' in a space with 'p' dimensions (attributes) as follows:

$$d(x, y) = \sqrt{\sum_{i=1}^{p} (x_i - y_i)^2} \quad (2)$$

where 'xi' and 'yi' are the values of the 'i'-th dimension of points 'x' and 'y', respectively.

Updating cluster centers: New cluster centers are calculated at the end of each iteration as the arithmetic mean of all points assigned to that cluster. If 'Si' is the set of points in the 'i'-th cluster, the new cluster center 'μi' is:

$$\mu_i = \frac{1}{|S_i|} \sum_{x \in S_i} x \quad (3)$$

where '|Si|' denotes the number of points in the cluster 'Si'.

Convergence: The algorithm is considered to have converged when the positions of the cluster centers no longer change significantly between iterations, implying that the assignment of points to clusters has stabilized. Selection of 'k': The choice of the number of clusters 'k' is crucial for the success of the K-means algorithm. The elbow method is a popular approach for determining 'k', which involves plotting the variance within clusters against the number of clusters and looking for the 'elbow' on the graph, i.e., the point after which adding additional clusters only provides a marginal reduction in variance.

RESULTS

Descriptive Analysis

Above mentioned table 1 displays the position of EU countries and Western Balkan countries within the GGEI, highlighting their specific characteristics and challenges in the context of the green economy. EU countries generally have high GGEI percentile values, indicating their success in implementing policies and practices of the green economy. The EU countries are ranker better, compared to Western Balkans, which is expected. The exception is Albania. The high rank of EU countries is a result of comprehensive strategies, such as the European Green Deal, which aim to reduce emissions, promote renewable energy, and preserve biodiversity. The best-positioned countries within the GGEI are Sweden, France, Denmark, Austria, and Ireland. Sweden is a leader in the green economy, supported by high GDP and strong sustainability policies. It is followed by France, which shows a high level of commitment to the green economy, with a strong focus on the index components specifically related to environmental policies. Denmark, the next best positioned in the ranking, also stands out with advanced policies in the field of renewable energy sources, particularly wind energy. Within the GGEI, Austria leads in the component of conserving natural resources and promoting green energy, while Ireland is particularly noted for improving the green economy through components of renewable energy sources and reducing carbon footprint, giving it a high position on the ranking of this index.

Western Balkan countries have room for improvement, as they have significantly lower GGEI percentiles compared to most EU countries. Their development towards a greener economy involves challenges such as raise awareness about the importance of green transition, the greater investments in green technologies, strengthening the regulatory framework, and aligning with EU standards and practices. Thus, the countries with the poorest position in the analyzed sample are mainly Western Balkan countries: Bosnia and Herzegovina, Serbia, North Macedonia, Montenegro, and Hungary as an EU member state. Bosnia and Herzegovina faces challenges in promoting the green economy, particularly with room for improvement in energy efficiency. North Macedonia has space for greater efforts in implementing environmental policies and technologies, while Serbia is working on improving policies and practices for environmental conservation and sustainable development. Montenegro seeks to improve its performance in the green economy, focusing on the protection of natural resources, with a special emphasis on clean air and sea. Hungary is seen as having space for improvement in energy efficiency and the use of renewable sources.

Cluster Analysis

Cluster analysis using K-means methodology on GGEI percentile data for 2022 proves the obvious significant differences in countries' performances in terms of their green economies. This analysis enables a better understanding of the global distribution of efforts in sustainability and environmental responsibility. The cluster analysis was performed using K-means methodology on a dataset of 32 countries (Table 1), focusing on the GGEI percentile for 2022. The analysis resulted in the formation of three clusters based on the GGEI percentiles of countries.

Initial GGEI percentile values for each cluster (1st cluster: 0.606; 2nd cluster: 0.799; 3rd cluster: 0.426) serve as the basis for the start of the clustering process. These values determine the initial groups of countries to be analyzed. Differences in these initial values suggest the assumption that there are distinct groups of countries with significantly different performances in terms of the green economy.

Table 2. Initial cluster centers

	Cluster		
	1	2	3
GGEI percentile	0.606	0.799	0.426

Source: Author's own calculation in the SPSS software package, version 26

The history of iterations shows how the cluster centers change over time, with convergence achieved after 10 iterations. The reduction in the change of cluster centers over iterations indicates the stabilization of clusters, meaning that further iterations would not significantly change the grouping.

Table 3. History of Iterations[a]

	Change in Cluster Centers		
Iteration	1	2	3
1	0.035	0.059	0.040
2	0.006	0.019	0.016
3	0.005	0.008	0.015
4	0.002	0.006	0.010
5	0.002	0.005	0.008
6	0.012	0.004	0.000
7	0.006	0.000	0.008
8	0.005	0.000	0.010
9	0.004	0.000	0.015
10	0.000	0.000	0.000

a. Convergence achieved due to no or small change in cluster centers. The maximum absolute coordinate change for any center is .000. The current iteration is 10. The minimum distance between initial centers is .180.

Source: Author's own calculation in the SPSS software package, version 26

The elbow method is commonly utilized to ascertain the optimal number of clusters by graphically representing the variance in the dataset relative to the number of clusters. The objective is to identify the "elbow" point, at which the addition of further clusters does not significantly enhance the sum of squares within clusters (WSS), indicating a diminishing return on the benefit of adding more clusters. This methodological approach underscores the inherent compromise in cluster analysis between achieving a granular understanding through detailed segmentation (potentially leading to excessive fragmentation with too many clusters, each containing a small number of countries) and maintaining practical usability and interpretability (which may result in overgeneralization if too few clusters are chosen, thereby potentially overlooking significant variances among countries).

Although specifics regarding the elbow analysis are not delineated within the dataset provided, the election of three clusters is presumably informed by such an analysis. This decision implies a reasoned equilibrium, mitigating the risk of both undue fragmentation and overgeneralization. The resultant convergence and the allocation of countries across the delineated clusters further affirm the appropriateness of selecting three clusters for this dataset. This allocation facilitates a nuanced yet coherent analysis of the disparate performances of countries within the context of the green economy. Subsequently, the distribution of analyzed countries into clusters, according to their GGEI percentile values, is presented as an outcome of this methodological consideration.

Table 4. Distribution of Countries into Clusters

Country	Cluster	Distance	Country	Cluster	Distance
Albania	1	0.032	France	2	0.046
Bulgaria	1	0.006	Germany	2	0.024
Cyprus	1	0.015	Ireland	2	0.005
Czechia	1	0.007	Italy	2	0.029
Greece	1	0.020	Latvia	2	0.001
Hungary	1	0.040	Lithuania	2	0.030
Poland	1	0.038	Luxembourg	2	0.002
Romania	1	0.026	Malta	2	0.026
Slovenia	1	0.042	Netherlands	2	0.013
Slovakia	1	0.008	Portugal	2	0.003
Austria	2	0.013	Spain	2	0.009
Belgium	2	0.005	Sweden	2	0.101
Croatia	2	0.031	*BIH*	*3*	*0.056*
Denmark	2	0.044	*Montenegro*	*3*	*0.049*
Estonia	2	0.032	*N. Macedonia*	*3*	*0.006*
Finland	2	0.010	*Serbia*	*3*	*0.013*

Source: Author's own calculation in the SPSS software package, version 26

Assigning countries to clusters based on their proximity to cluster centers provides tangible insights into how countries are grouped according to their GGEI percentiles. This membership allows for an understanding of which countries share similar characteristics in terms of the green economy and facilitates comparison within and across clusters. The following is an analysis of the outcome for each group of countries by clusters from the previous table.

- Cluster 1: This cluster is characterized by a lower GGEI percentile, indicating that countries within this cluster may not be investing sufficiently in the green economy or lack fully developed policies and practices for sustainability. This presents an opportunity for governments and organizations to target these countries with awareness-raising programs and initiatives to enhance sustainability.
- Cluster 2: Comprising countries with medium to high GGEI percentiles, this cluster indicates a higher commitment to sustainable practices and the green economy. These countries can serve as exemplars of good practices in sustainability and can be sources of knowledge and inspiration for other countries.
- Cluster 3: Positioned between the first two clusters, this cluster contains countries that demonstrate moderate progress towards the green economy. Existing efforts could be enhanced through targeted strategies and investments in green technologies and sustainability.

The results of the analysis of variance (ANOVA) in the following table confirm that there are statistically significant differences between the clusters, with an F-value of 78.552 and a p-value of 0.000. This indicates that the clusters are well-defined and significantly vary in their GGEI percentiles, justifying their existence as separate groups.

Table 5. Analysis of Variance (ANOVA)

ANOVA						
	Cluster		Error			
	Mean Square	df	Mean Square	df	F	Sig.
GGEI percentile	.089	2	.001	29	78.552	.000

The F tests should be used only for descriptive purposes because the clusters have been chosen to maximize the differences among cases in different clusters. The observed significance levels are not corrected for this and thus cannot be interpreted as tests of the hypothesis that the cluster means are equal.

Source: Author's own calculation in the SPSS software package, version 26

The final GGEI percentile values from the previous table (Cluster 1: 0.597; Cluster 2: 0.698; Cluster 3: 0.482) represent the center of each cluster after the iterative adjustment process of the K-means algorithm. The change in values relative to the initial centers indicates an optimization process during which the algorithm more precisely defines each cluster by grouping similar countries.

Table 6. Final Cluster Centers

	Cluster		
	1	2	3
GGEI percentile	0.597	0.698	.482

Source: Author's own calculation in the SPSS software package, version 26

The final values provide a clear insight into the average characteristics of each cluster, followed by a brief commentary.

The existence of a distinct cluster for Western Balkan countries (In the Cluster 3 only Western Balkans countries are classified) may indicate regional differences in the approach to the green economy, which could also be of interest for regional policy analyses and sustainable development strategies.

Countries in Cluster 2, which are leaders in sustainability, can be sources of valuable policies and initiatives that could be studied and potentially adapted by countries in other clusters. Analyzing their strategies could reveal key success factors in the implementation of sustainable practices. Clusters may also suggest the potential for international cooperation between countries within the same cluster, or even between clusters, where countries with higher GGEI percentiles can share their knowledge and resources with countries striving to improve their performances.

Countries within Cluster 3, showing moderate progress, may need to develop tailored strategies that take into account their specific economic, social, and political circumstances. Adapting successful models from Cluster 2 could be key to their advancement.

Understanding the positioning of countries in the global context of the green economy can help in better comprehending global trends and challenges, as well as in identifying leaders and laggards in this field. This could be useful for international organizations dealing with sustainable development issues.

In conclusion, the results of the cluster analysis not only provide insight into the current positions of countries in the context of the green economy but also highlight potential pathways for improvement and cooperation. Further analyses, including comparisons with previous years and in-depth studies of policies and practices within each cluster, could further enrich these findings.

DISCUSSION

Based on the results of the cluster analysis presented, it is possible to engage in a discussion and draw conclusions concerning the performances, policies, and practices of the countries encompassed by this research.

Cluster 2, with countries boasting higher GGEI percentile values, unequivocally identifies nations leading in global efforts toward a green economy. Conversely, clusters 1 and 3 comprise countries with lower GGEI values, signaling a need for the reinforcement of sustainability policies and practices. Development policies and strategies could be tailored to encourage lagging countries to adopt the successful practices of leaders.

A regional concentration of specific countries within clusters, particularly in Cluster 3 containing Western Balkan nations, points to regional factors that might influence performances in the green economy, including economic conditions, political will, and resource availability. There is room for strengthening regional cooperation and knowledge exchange to improve performances.

Differences in performances among clusters provide a basis for developing specific, targeted programs and initiatives that could assist lower-cluster countries in enhancing their ecological performances. For instance, financial assistance programs, technology transfers, and training could be especially beneficial for countries in Clusters 1 and 3.

The results of the cluster analysis can serve as a foundation for contemplating how the green transition can be aligned with economic development. Countries leading in the green economy (Cluster 2) often demonstrate how investments in sustainable technologies and practices can be drivers of economic innovation and growth.

The performances of countries in the green economy (especially through the GGEI) are increasingly recognized as a key factor in global competitiveness. Countries from Cluster 2 not only set standards for sustainable practices but also enhance their attractiveness as partners in international trade and investments, underscoring the importance of aligning national policies with global sustainability trends.

Therefore, the results align with almost all prior research in this area, as well as with the strategies of the European Union in that context. They provide important guidelines for policymaking and resource allocation to support the transition to a more sustainable economy, crucial for achieving sustainable development goals and reducing negative environmental impacts.

The Western Balkans represent an intriguing case when considering ecological performances and the green economy in a global context and analysis. This region faces specific challenges but also opportunities that could impact the transition to a sustainable future. Thus, this discussion offers a detailed examination of the Western Balkans' position through a SWOT analysis:

Strengths

- *Rich natural resources*: The region possesses significant natural resources, including renewable energy sources such as hydro, wind, and solar, providing a solid foundation for developing a green economy.
- *Increasing sustainability awareness*: There is growing awareness among the populace and governments about the importance of sustainable development, which could facilitate the adoption of green policies and initiatives.
- *Young and educated population*: The Western Balkans have a significant portion of the young and increasingly educated population that is open to innovation and changes, including those in the realm of sustainability and the green economy.
- *Geographic position*: The region's geographical position offers strategic advantages for the development of green energy (such as hydro, solar, and wind energy) and ecotourism, providing additional economic and ecological benefits.

Weaknesses

- *Dependence on fossil fuels*: The energy structure of the Western Balkan countries heavily relies on fossil fuels, presenting a significant barrier to the transition toward a green economy.

- *Limited financial and institutional capacities*: A lack of financing and institutional capacities hampers the implementation and management of ecological projects and policies.
- *Infrastructure challenges*: Outdated infrastructure, particularly in the energy sector and waste management, poses a major barrier to the efficient implementation of sustainable practices.
- *Low public awareness of ecological issues*: Despite growing awareness, there is still a considerable portion of the population insufficiently informed about the importance of sustainable practices and ecological issues, slowing change at individual and collective levels.

Opportunities

- *EU integration and funds:* The EU integration process opens access to funds and programs that can support ecological projects and the green transition in the region.
- *Technological advancement and knowledge transfer*: Collaboration with international partners and access to new technologies can accelerate the implementation of sustainable solutions.
- *Development and expansion of regional markets*: Market integration and the development of regional initiatives can provide new opportunities for trade and investments in sustainable technologies and products, stimulating economic activities and sustainable development.

Threats

- *Climate change:* The region is susceptible to the adverse effects of climate change, including extreme weather conditions and natural disasters, which could further strain ecological and economic resources.
- *Political and economic instability:* Political and economic instability can impact the continuity and efficacy of ecological initiatives. Furthermore, political instability and the lack of coherent policy can hinder progress towards sustainable goals, especially in areas requiring long-term and stable political decisions.
- *Competition in the global market:* Western Balkan countries face the challenge of being competitive in the global market, especially in sectors key to sustainable development, such as renewable energy sources and green technologies.

The current analysis applies a single-dimensional cluster analysis to group countries by specific aspects of the green economy. However, future research could expand this analysis to multiple dimensions, including energy efficiency, greenhouse gas emissions, and socio-economic factors. This broader approach would provide deeper insights into the interplay of these factors, offering a more comprehensive view of countries' green transition performance and positioning. Such an expansion would contribute to a clearer understanding of complex patterns and provide researchers with a stronger foundation for developing tailored sustainable development strategies.

CONCLUSION

The analysis clearly shows significant heterogeneity among countries regarding their ecological performances, opening avenues for intensifying efforts toward sustainable development. The research provides insights into how countries are grouped based on their performances in the green economy, highlighting the need for customized approaches in improving ecological performances. Further research could focus on a deeper understanding of the public policies,

innovations, and practices that have enabled countries in Cluster 2 to achieve high performances, as well as identifying specific barriers faced by countries in Clusters 1 and 3.

Beyond economic benefits, the green economy also has the potential to improve social justice and reduce ecological injustices. Cluster analysis in this manner can provide solutions for adopting inclusive and equitable green policies. Encouraging international cooperation and the exchange of best practices between countries can be key to accelerating the global transition to a green economy.

The Western Balkans stand at a crossroads between traditional economic models and the need for sustainable development. While challenges exist, there is also a clear path forward that includes EU integration, regional cooperation, and a focus on renewable energy sources. A key success factor may be the region's ability to align economic and ecological goals, achieving all the prerequisites for sustainable development. This analysis offers significant insight into the current position of Western Balkan countries in the global context of the green economy and highlights the need for coordinated actions on the path to sustainability.

Strengths such as rich natural resources and growing awareness of sustainability provide a solid basis for positive change. However, weaknesses like dependence on fossil fuels and a lack of financial resources, along with institutional and economic challenges, represent significant obstacles. Nonetheless, opportunities provided by European integration, as well as global trends in the development of green technologies, can enable the Western Balkans to overcome these challenges and become a regional leader in sustainable development.

To achieve this, a coordinated approach involving all levels of government, the private sector, non-governmental organizations, and international partners is necessary. A priority in realizing the green transformation includes investments in renewable energy sources, energy efficiency, biodiversity conservation, and green infrastructure. Moreover, strengthening institutional capacities and regulatory frameworks are key factors in the sustainability of ecological policies.

Education and raising awareness about the importance of sustainable development among citizens can contribute to creating a societal consensus on the need for ecological changes. Developing green skills and occupations can also help reduce unemployment and stimulate economic growth. International cooperation and access to international funds and technologies will allow for a faster transition to sustainable energy systems and industries. Partnerships with the EU and other international organizations should be leveraged for the exchange of knowledge, experiences, and best practices in sustainable development.

Further research should focus on longitudinal studies that track the progress of countries in the green economy over time, as well as detailed analysis of the impact of specific policies and initiatives on ecological and economic performances. Additionally, it's important to explore how global challenges, such as climate change, affect countries' ability to make progress in sustainability.

Through understanding these dimensions, it's possible not just to better comprehend the current performances of countries in the green economy, but also to inform the creation of policies and strategies that will support global efforts towards a more sustainable and equitable world.

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