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Towards European Union's Green Deal: The Importance of Sustainable Competitiveness and Eco-Innovation for Achieving Prosperity in the EU-27 Member States

Araştırma Makalesi /Research Article

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ABSTRACT: *Nowadays, the European Union's Green Deal, sustainable competitiveness, and eco-innovation have become important topics in the new theory of economics. The primary purpose of this article is to examine the significance of sustainable competitiveness and eco-innovation in achieving prosperity in the EU-27 Member States by applying various methodological measurement instruments. This research contributes by enlightening the new approach to sustainable competitiveness and different dimensions of EU innovation, by exploring the relationships among indicators of global sustainable competitiveness, the global-digital-competitive SMEs' performance, EU innovation, and eco-innovation for achieving prosperity in the EU-27 Member States. Research results can assure valuable information to policymakers. The variety in ranking positions among essential indicators and the recognizing of priorities are the foundation for the upcoming acceptance of economic actions and policies for the progress of the EU-27 Member States towards the EU's Green Deal.*

Keywords: *EU Green Deal, Sustainable Competitiveness, Eco-Innovation, Prosperity, EU-27.*

JEL Codes: *C8, E0, O30, O57*

Avrupa Birliği'nin Yeşil Anlaşmasına Doğru: AB-27 Üye Ülkelerinde Refahın Sağlanmasında Sürdürülebilir Rekabet Edebilirliğin ve Eko-Yeniliğin Önemi

ÖZ: *Günümüzde Avrupa Birliği'nin Yeşil Anlaşması, sürdürülebilir rekabet gücü ve eko-inovasyon, yeni ekonomi teorisinde önemli konular haline geldi. Bu makalenin temel amacı, çeşitli metodolojik ölçüm araçları uygulayarak, AB-27 Üye Devletlerinde refahın sağlanmasında sürdürülebilir rekabet edebilirliğin ve eko-yeniliğin önemini incelemektir. Bu araştırma, AB-27 Üye Devletlerinde, küresel sürdürülebilir rekabet gücü, küresel-dijital-rekabetçi KOBİ'lerin performansı, AB yeniliği ve eko-inovasyon göstergeleri arasındaki ilişkileri keşfederek sürdürülebilir rekabet edebilirliğe yeni yaklaşımı ve AB inovasyonunun farklı boyutlarını aydınlatarak katkıda bulunur. Araştırma sonuçları, politika yapıcılara değerli bilgiler sağlayabilir. Temel göstergeler arasındaki sıralama konumlarındaki çeşitlilik ve economik önceliklerin tanınması, AB-27 Üye Devletlerinin AB'nin Yeşil Anlaşmasını uygulamaya yönelik ekonomik eylemlerin ve politikaların yaklaşan kabulünün temelidir.*

Anahtar Kelimeler: *AB Yeşil Anlaşması, Sürdürülebilir Rekabet Gücü, Eko-Inovasyon, Refah, AB-27*

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1. Introduction

In today's globalized world, the European Union's Green Deal, sustainable competitiveness, and eco-innovation have been involved in important topics in the new theory of economics. Although the worldwide academic society has already raised interest in sustainable competitiveness and eco-innovation, appropriate understanding of these topics has not been assigned in the recent academic literature because of the variety of their dimensions and evaluations. This research contributes to enlightening the new approach to sustainable competitiveness and different dimensions of EU innovation (including eco-innovation) by exploring the relationships among the global sustainable competitiveness index, the global-digital-competitive small and medium-sized enterprises (SME) index, the EU innovation index, and the eco-innovation index for achieving prosperity in the EU-27 countries. In recent years, a significant number of scholars have focused on the study of sustainable competitiveness and innovation (Chesbrough, 2006; Porter, 2008; Carrillo-Hermosilla, del Río González and Könnölä, 2009; Ambec et al. 2013; Atkinson and Ezell 2012; Fankhauser et al. 2013; Edquist, 2014b; Grossman and Helpman 2015; Terzić, 2017; Terzić, 2021; Lewandowska, Golebiowski and Roszkiewicz, 2022).

In their studies, various dimensions and variables affecting sustainable competitiveness and innovation performance were derived. Besides these surveys, numerous scholars have revealed different dimensions and factors influencing the national prosperity (Jackson, 2009; Stiglitz, Sen, and Fitoussi, 2009; Fleurbaey and Blanchet, 2013; Fritz and Koch, 2016). Recent investigations have shown a strong and positive relationships between sustainability, innovation, and an enterprise's competitiveness (Hermundsdottir and Aspelund, 2021). It has been determined that countries are having a growing tendency toward sustainability, and it is debated that this is proceeding because sustainability is connected with higher levels of profitability, efficiency, and competitiveness (Lewandowska, Golebiowski, and Roszkiewicz, 2022). Those incomplete and sometimes inconsistent findings propose that interrelations are a very complex issue and that more research is required to establish under which circumstances interrelations endure. Additionally, incorporating sustainability into economic performance will apparently be unfavorable to maintaining future business activities (European Commission, 2021). In this context, further expertise and scientific facts in this field are essential for future economic policy-making at the state level. A few empirical surveys have suggested that rigorous sustainability regulations could have a positive impact on an enterprise’s competitiveness and economic performance by stimulating innovation in firms (Porter, 2008; Godin et al., 2021). There are several measurements that are focused on the assessment of global sustainable competitiveness, eco-innovation, and prosperity, but there are evident varieties in the methodological approaches and research results among them.

However, it is possible to debate that these surveys fail to appropriately analyze

the significance of sustainable competitiveness and eco-innovation in achieving prosperity in the different EU Member States' country groups. Existing studies focus on particular indicators and intend to explore the causes of differences between countries' economic performance regarding, for example, sustainability, competitiveness, innovation, carbon dioxide (CO2) emissions or wellbeing. This study contributes to a comparative analysis of how sustainable competitiveness, green-digital-competitive SMEs, EU innovation, eco-innovation, and prosperity indicators are correlated, while the differences in ranking positions among crucial indicators and the determining of the priorities are the basis for the future acceptance of economic actions and policies for the prosperity of the EU-27 Member States towards the EU's Green Deal.

This paper aims to analyze the significance of sustainable competitiveness and eco-innovation in achieving prosperity in the different EU Member States by applying various methodological measurement instruments. To evaluate the relationship between selected indicators, correlation analysis with Spearman's statistician is performed, which is used on ordinal variables with the absence of normality. It also uses the rho-p hypothesis test to estimate the statistical significance of Spearman's correlations. The Spearman's rank-order correlations were run to examine the relationships between the Global Sustainable Competitiveness Index, Green-Digital-Competitive SME Index, European Union Innovation Index, Eco-Innovation Index, Gross Domestic Product per capita, and Legatum Prosperity Index. Research results will provide valuable information to policymakers. The variety in ranking positions between essential indicators and recognizing of priorities is the foundation for the upcoming acceptance of economic actions and policies for the progress of the analyzed countries towards the EU's Green Deal. This article is branched into four sections. The first section of the article explains the theoretical background of the current literature connected to the new EU Green Deal's approach regarding global sustainable competitiveness, eco-innovation, and prosperity. The second section presents methodological measurement tools related to the analyzed variables and crucial indicators. The third section of the article deals with the collected data and the research methodological approach. The fourth section demonstrates the research findings.

2. Theoretical overview of literature: The European Union's Green Deal, Sustainable Competitiveness, Eco-Innovation, and Prosperity

In the last decade, many scientists have increasingly focused their research interests on investigating sustainable competitiveness and innovation. They explored various dimensions and variables influencing the sustainable competitiveness of economies and eco-innovation performance. Porter (2008), and Atkinson and Ezell (2012) consider innovation as the central driver of national prosperity and competitiveness, while Chesbrough (2006) considers the open innovation as a key approach for innovative enterprises. Terzić (2017)

revealed the significance of different dimensions of innovation in fostering competitiveness and economic growth. Carrillo-Hermosilla, del Río González and Könnölä (2009) consider eco-innovation as a main determinant of sustainability and competitiveness. Fankhauser et al. (2013) indicates green growth as a key element in achieving sustainable development. Edquist (2014b) considers innovation as a major driver of long-term economic growth and shows that most EU member countries are trying to develop a holistic innovation policy. Grossman and Helpman (2015) discussed mechanisms that link international integration to the incentives for knowledge accumulation, innovation-driven economic growth, and the effectiveness of these processes. Terzić (2021) revealed the effect of competitiveness and innovation on economic growth, while Lewandowska, Golebiowski and Roszkiewicz (2022) showed a positive link between international competitiveness and enterprises' economic performance.

As can be seen, there is an impressive literature about the different dimensions and variables of sustainable competitiveness and eco-innovation. However, the significance of sustainable competitiveness and eco-innovation in achieving prosperity under the EU's Green Deal has been neglected. The fundamental goal of the EU's Green Deal is to establish the EU-27 Member States on a road toward zero emissions and sustainable growth, including sustainable competitiveness and eco-innovation, decoupled from the usage of resources (European Commission, 2021; European Commission, 2019; European Commission, 2018). The EU's Green Deal records a perceptive withdrawal from conventional ecological methods that have usually been used for consumption reduction and, consequently, degrowth (European Commission, 2019: The European Green Deal COM (2019) 640 final). Despite numerous warnings from researchers about the dangers of climate change, concern for degrowth is why EU authorities and the entire business community have long rejected environmental issues (Jackson, 2009). The theoretical basis for replying to the query, why are specific economies more competitive, sustainable, eco-innovative and prosperous than other economies, was created by Porter (2008) and Nordhaus (2021), leaving several essential dimensions undefined. However, Porter (2008) indicated that innovation is the key element in economic prosperity. The Nobel prize-winning economist, William Nordhaus (2021), in his book *The Spirit of Green,* indicates the significance of the new innovative approach in solving the most important world problems, from environmental to COVID-19 pandemic issues. In an interesting debate, his book offers the history of the environmental questions to the Green New Deal, and thus, Nordhaus explains how the "*spirit of green thinking*" assures a compelling and beneficial new dimension to modern life.

Therefore, if countries wish to go towards a "green economy", it is essential to stimulate specific types of innovation. This kind of innovation is defined as eco-innovation or so-called green innovation. Generally, the phrases "environmental, green, sustainable innovation" or "eco-innovation" are explained similarly in the empirical literature (Ben Arfi et al., 2018; Bossle et al., 2016; Fankhauser et al.,

2013).The green innovation should allow for new approaches to addressing actual and future environmental issues and diminishing energy or resource consumption while encouraging sustainable competitiveness. According to Corrigan et al. (2014), sustainable competitiveness can be explained as the set of institutions, appropriate policies, and determinants that create a nation's long-term productivity, including both social and environmental sustainability. To encourage a positive dimension that highlights prosperity and helps the EU Member States' move forward towards EU Green Deal goals, the Lisbon Council created the Green, Digital and Competitive SME Index as an aggregated index – established on weighting and re-weighting of available data, derived from Eurostat database (2021), European Commission (2021), and European Innovation Scoreboard (2021). SME have been tasked with achieving critical social and environmental goals, some of which are aimed at assisting them in improving their economic performance and creating new job opportunities, while others are aimed at assisting the EU in meeting its ambitious goals of total employment (as a social goal) and zero carbon emissions (as an environmental goal). Bowen and Frankhauser (2012:1157-1158) propose that different policies could help to achieve "*green growth*" by applying the four different policy approaches derived from the theory of economics:

- The Keynesian approach aims to diminish temporary macroeconomic deviations, e.g., unemployment, sustainability of the fiscal system, and global inequalities;
- The Pigouvian approach entails implementing market-oriented methods and other regulations with environmental externalities incorporated;
- The Schumpterian approach emphasizes innovation and research and development (R & D) to boost new "green" industries, technological alternation, and "green" development;
- The Georgian approach is the link between resource scarcity and the awareness that drifting away from the scarcity of resources like fossil fuels may remove a barrier to long-term growth and sustainability.

The economic phrase "sustainability" is diverse in its conceptual formulations. Initially, it was defined as development that assures the requirements of the present time beyond intermediating the capability of future generations to accommodate their own demands (WCED, 1987:44-45). Afterwards, an accepted implementation became the triple-dimensioned central factor, constituted of the economic, environmental, and social elements (Henriqiues, 2007). To comprehend relationships among different sustainability elements, it is necessary to understand how it is approached in the existing literature. From a broader perspective, there are different views of how sustainable innovation, competitiveness, and prosperity are interconnected (Hojnik and Ruzzier, 2016a).

Recently, the EU-27 Member States have faced the challenge of sustaining their

economies by expanding raw material demands, natural resource deficiency, and income inequalities. Making sustainability an essential function as a global, as well as the EU's Green Deal strategy, could be based on economic prosperity and ecological equilibrium. Besides this, it is important to mention that the phenomenon of globalization in business activities has involved a very complex dimension that has increased market competition, access to new markets, and the enhancement of new technologies. Therefore, it has led businesses to direct their efforts toward creating an identity that would strengthen their capabilities. According to Porter (2008), these capabilities represent strengths that are based on competitive advantages, which dominate when there is a similarity between the distinctive competencies of an enterprise and the customer's individual needs, thus aggregating a competitive advantage. An additional element that makes economic activities more complex is the enterprise owners' interest in maximizing their profits in the shortest feasible period while overlooking future prosperity, global society, and the natural environment. The usage of resources as a result of population growth has established an obstacle to the natural environment (European Commission, 2018). Increasing scientific proof of the destructive influences and the unacceptable environmental and social aftereffects of this tendency has raised the external constraints on enterprises to respond to these new challenges and to handle questions affiliated with climate change, communal and environmental degradation (Lundvall, 2002; European Commission, 2019).

In response to these new challenges for enterprises, the European Union (EU), its organizations, and member countries played a crucial role through the adoption of the 2030 EU Agenda (United Nations, Millennium Development Goals (MDGs); http://www.un.org/millenniumgoals). The EU member countries were signalizing for an integrated agenda that would follow the direction of the MDGs on extreme poverty in all its forms, including important issues regarding future environmental sustainability, governance efficiency, inclusion, research and innovation (European Commission, 2015). Besides this, countries are facing increased external constraints in achieving sustainability and competitiveness as a result of globalization and the expansion of new technologies. These external constraints have raised the spotlight on "green" and sustainable value conceptions in economic performance. Carrillo-Hermosilla, del Río González and Könnölä (2009) focused on the issue of whether sustainability in innovation could face these external constraints and synchronously enhance sustainability and competitiveness. In this context, they explained what happens when eco-innovation, sustainability, and competitiveness "shake hands". The interrelations between enterprise sustainability and competitiveness have attracted increased interest of many scientists, international institutions, and policymakers. Recent research results have been disintegrated and puzzling. Many enterprises observe sustainability and innovation essentially as cost drivers (Godin et al., 2021). They were viewed as innovations that required high financial investments and produced only limited environmental advantages (Horbach, 2016).

However, a number of recent studies suggest a strong and positive link between sustainable innovation and an enterprise's competitiveness (Hermundsdottir and Aspelund, 2021). Countries are seen to be demonstrating an increasing trend toward sustainability, and it is argued that this is happening because sustainability is associated with improved levels of profitability, efficiency, and competitiveness (Lewandowska, Golebiowski, and Roszkiewicz, 2022). These insufficient and occasionally contradictory data suggest that interrelations are a very complex issue and that additional research is needed to determine the conditions under which the interrelations are sustained positively. The investigation of the interrelations between sustainable competitiveness and innovation is not only essential to accomplish scientific requirements for new insight but also to identify priorities regarding upcoming economic actions and policies. Additionally, incorporating sustainability into economic performance will apparently be unfavorable to maintaining future business activities (European Commission, 2021). Likewise, additional proficiency and scientific facts in this field are crucial for future economic policy-making at the state level. Several surveys have proposed that rigorous sustainability regulations could have a positive influence on an enterprise's competitiveness and economic performance by driving innovation in enterprises (Porter, 2008; Godin et al., 2021).

Accordingly, this comprehension could create a concept of how regulations could encourage sustainability and innovation in enterprises (Hojnik and Ruzzier, 2016a) and contribution of the private sector in answering sustainability challenges. The empirical literature brings into focus the approach to sustainable competitiveness beyond sustainable development and its goals. The approach to sustainable competitiveness is based on revealing the methods that could put in place a balance of national prosperity and environmental and social sustainability. In regard to that, reshaping the global sustainability-adjusted competitiveness index takes into account two new constitutive dimensions: the environmental and social dimension. Nonetheless, the approach to sustainable competitiveness could be transferred from the microeconomic stage to the macroeconomic stage. Many EU institutions, in order to increase prosperity through sustainable competitiveness and eco-innovation capability, aggregate crucial data from worldwide institutions, scientists, and research centers. Respected international institutions emphasize the importance of sustainable competitiveness (SolAbility, 2021) and eco-innovation (European Commission, 2021) in achieving economic prosperity (Legatum Institute, 2021).

3. Data and Research Methodology

The Global Sustainable Competitiveness Index (GSCI) was developed by the think-thank organization SolAbility (established in Switzerland and South Korea) and is the most comprehensive ranking system that classifies countries based on 131 indicators. The GSCI indicators are categorized into five sub-indices (SolAbility, 2021): 1. Natural Capital, 2. Social Capital, 3. Resource Efficiency

and Intensity, 4. Intellectual Capital and Innovation, and 5. Governance Efficiency. The basis for empirical models that are usually used in investigating the sustainable growth and prosperity of countries was given by economists Dasgupta and Heal (1974), Stiglitz (1974b) and Peretto (2015). They considered poor substitution among labor and exhaustible natural resources in Romer's model of endogenous growth (Romer, 1990), which demonstrates powerful scale influence. The theoretical background for this model was derived from an integrated approach to endogenous growth and innovation-driven growth (Peretto, 2015). The literature uses these theories to emphasize the importance of countries' rankings according to sustainable competitiveness and eco-innovation performance. Sustainable and competitive SMEs should produce final products that can be consumed, applied to create intermediate products, and invest in their quality or create new products. Therefore, production technology can be represented by the following equation:

$$Y = \int_0^n X_j^{\phi} (Z_j^{\beta} Z^{1-\beta} \frac{L^{\delta} R^{1-\delta}}{n^{1-\varphi}})^{1-\phi} d_j, \; 0<\phi, \beta,\delta,\varphi<1. \quad (1)$$

where:

n - is the indicator of the intermediate products;

L- demonstrates labor, and

R- represents exhaustible natural resources.

Resource efficiency can be presented as the ability of the resources to increase the level of national productivity and other crucial dimensions, such as the contribution of a resource (j) with its efficiency dimension (*Zj*), and an average measure of Z, presented as:

$$Z = \int_0^n (Z_j / n) * d_j \quad (2)$$

The new "green" technology characteristics have social advantages to diversity of level (φ) and social gains to quality stage level of 1. The basis for this empirical model, which is commonly used in studying countries' sustainable growth, was provided by economists Stiglitz (1974a), Dasgupta and Heal (1979), who specified the impact of high-tech knowledge on national prosperity. That model could be conducted by dividing countries into three groups. It can also be used to reveal the influence of eco-innovation as a variable of sustainable competitiveness and national prosperity. The model could be demonstrated by classifying the EU-27 Member States into three groups: 1. eco-innovation leaders; 2. average eco-innovation performers; and 3. eco-innovation catching-up countries. The first group of countries, the eco-innovation leaders, are focused on the production of eco-innovative outputs, whereas the average eco-innovation performers and eco-innovation catching-up countries are focused on developing eco-innovation

capability that can lead to higher levels of sustainable competitiveness and prosperity. The following formula could be applied to the EU-27 Member States:

$$Y = ECII\ C_y^{\alpha} L_y^{\beta} HR_y^{1-\alpha-\beta} \quad 0<\alpha<1;0<\beta<1. \tag{3}$$

$$ECII = ECII^{\varphi} C_{ECII}{}^{\varphi} L_N^{\varphi} HR_{ECII}^{1-\varphi-\mu} \quad 0<\varphi<1;0\,\mu<1. \tag{4}$$

where:

- variable Y represents the quantity of indicators used for production performance,
- C demonstrates capital,
- L is labor,
- HR represents human resources, and
- ECII (Eco-Innovation Index) represents the quantity of gauges related to the EU eco-innovation performance developed in the Research & Development sector.

Regarding affirmation of the indicators' aggregation including different dimensions, each observed indicator of the GSCI has been transferred into the "scores of improvement" ranking countries from 0 to 100 by using the equation (with the highest possible and the lowest tolerable values). Generally, every variable is scaled again by the following formula:

$$S_{c,j} = \left(\frac{V_{c,j} - LV_j}{HV_j - LV_j} \right) * 100 \tag{5}$$

where:

- $V_{c,j}$ is new value of the EU-27 Member States for variable (j);
- LV_j - is the lowest tolerable performance value of the EU-27 Member States for variable (j); and
- HV_j - is the highest possible output of the EU-27 Member States.

Taking into observation the calculated scores for the EU-27 Member States, the margin could be the EU Green Deal's policy goal, the highest acceptable score, or a specific number extracted from the distribution's survey. If a value is under the lowest tolerable EU indicators value, its score equals zero; if a value is above the highest value, their scores are over 100. In the case of variables that are derived from the GSCI, the values - $V_{c,j}$ and the lowest possible score - LV_j are frequently seven (7) and one (1), respectively. The values are equivalent to the two conclusive answers to each question in the GSCI Report.

$$GSCI_{cj} = W_j 1 * B_j + W_j 2 * E_j + (1 - W_j 1 - W_j 2) * ECII_j \tag{6}$$

- for EU country *j* and the stage of its sustainable growth *j*; where: - B_j, E_j and $ECII_j$ are sub-indices, and - *W (j)1* and *W (j)2* represent sub-indicators' weights.

Bj and Ej present coefficients for measuring relationships between relatedness and eco-innovation variables (for instance, relatedness × level of eco-innovation). Thus, Bj and Ej could be explained as coefficients modifying the effects of Wj 1 and Wj2 in the presence of location-specific indicators (e.g., the stage of eco-innovation in the EU country). This method has been used very often to identify indicators that diminish the effects of relatedness in enhancing path-breaking economic growth and prosperity.

The GSCI aggregates essential indicators and sub-indicators to discover the ranks of different economies, based on the stage at which the activities of the government achieve sustainable growth. Secondary data derived from the global sustainable competitiveness indicators were employed. Standardized indicators have been applied to create various variables correlated to different dimensions of sustainable competitiveness and eco-innovation performance. The five constitutive pillars create the sustainable competitiveness of an economy and its GSCI. The sustainable competitiveness model is established on a pyramid, where every stage is required to support the next higher stage. For the purpose of the GSCI, the primary data were analyzed and ranked for each indicator, particularly over the calculation of the average standard deviation, where the best performers 5% obtained the highest possible score equaling (100), and the worst performers 5% obtained the lowest possible score equaling zero (0). Values among the highest score and the lowest 5% score are linearly distributed relative to the best 5% and the worst 5%. In the next step, the relevance (weight) of the indicator is assessed against other indicators to estimate scores for the 5 sub-indices.

The GSCI is estimated based on its sub-indices (pillars) that are equally weighted. According to the 2030 Agenda for Sustainable Development, it represents a unique global strategy that incorporates prosperity for all nations through implementing SDGs, where eco-innovation is exemplified as one of the useful instruments on the path toward the implementation of various SDGs. In order to follow the EU member states' progress, the Lisbon Council has created an impressive three-pillar indicator: The Green, Digital and Competitive SME Index, which includes (Lisbon Council, 2021):

- Pillar: Follows the digital capability of the EU country's SMEs;
- Pillar: Follows the green dimension of EU countries' SMEs. The EU will not reach its ambitious climate goals without "greening" the SME sector that constitutes an impressive part of the economy;
- Pillar: How competitive are EU countries' SMEs? The Lisbon Council measures this pillar by looking at SMEs' growth and their success in the new markets within and/or outside of the EU Member States.

Thus, SMEs' eco-innovation demonstrates the introduction of new ideas and solutions with an emphasis on the sustainable development of the EU's Green Deal economy. The ranking of the EU-27 countries according to their position in innovation or eco-innovation performance is based on two aggregated indicators: the European Innovation Index and the Eco-innovation Index. The Eco-innovation Index was created by the Eco-Innovation Observatory (EIO) and collects measures classified into five groups: eco-innovation inputs, eco-innovation activities, eco-innovation outputs, resource efficiency outcomes, and socioeconomic outcomes. Strengthening the EU's sustainable competitiveness and providing that countries achieve "competitive sustainability" requires investments in innovation towards EU prosperity. Many economists have investigated different variables as dimensions of national prosperity (Jackson, 2009; Stiglitz, Sen, and Fitoussi, 2009; Fleurbaey and Blanchet, 2013; Fritz and Koch, 2016). Jackson (2009) investigated national prosperity in terms of the following dimensions: ecological sustainability, social inclusion, wellbeing, and the quality of life.

Fleurbaey and Blanchet (2013) investigated the basis of indicators of social welfare and critically examined the four basic alternatives to GDP that have been suggested: composite indicators, subjective well-being indices, capabilities, and equivalent incomes. Fritz and Koch (2016) examined relations between prosperity indicators, evaluating the ecological, social, and individual dimensions of prosperity as well as economic development. The problem of measuring economic prosperity was originally developed by Stiglitz, Sen, and Fitoussi (2009). The most popular indicator for measuring national well-being is the Legatum Prosperity Index (LPI), created by the Legatum Institute. Revealing advantages is the fundamental idea of the LPI. The LPI provides solutions to a growing concern for national well-being and is an indicator of economic prosperity that follows economic diversification. The effects of new variables in measuring prosperity in various economies have not received appropriate attention.

Therefore, the LPI tries to inaugurate an approach that incorporates these new variables of national wellbeing with essential indicators to investigate which countries are accomplishing the best results in enhancing their prosperity. The LPI was not developed to recognize the happiest or richest economies. The LPI classifies economies by how good they are at performing the necessary tasks to enhance GDP (i.e., boosting national competitiveness) and to increase quality of life (i.e., raising comparative liveability). Data sources are derived from different and globally respected international databases (Legatum Prosperity Index Report, 2021). The pillars of the LPI designed by the Legatum Institute Foundation aggregate three dimensions (Legatum Insitute 2021):

- The Social Dimension incorporates the following group of variables: health, safety and security, social capital, education, and the environment;

- The Economic Dimension includes: economic quality and the business environment;
- The Institutional Dimension is derived from indicators that demonstrate personal freedom, infrastructure, and governance.

The national well-being indicator could be transferred into an empirical model by predicting that an increase in a particular pillar gives enhancement to the stage of well-being at the same time. Well-being can be demonstrated as a function of social, economic, and institutional dimensions. The elements that establish the GSCI, the Eco-Innovation index, and the LPI were determined and measured via Statistical Package for the Social Sciences (SPSS) 25 analysis, using available secondary data in the EU-27 countries as well as other primary data. The LPI incorporates essential measures in order to rank analyzed countries based on the stage on which the performances of their citizens and official governments create or decline the rise of economic prosperity. The LPI employs an impressive ranking equation; i.e., the importance of capital, trade openness, or particular economic performance can alternate as countries rank higher on the scope of economic prosperity.

Fn presents the vector of measures required for creating an index LPI*it* demonstrating the j-th dimension of prosperity in an observed period:

$$LPI_{it} = \left[\frac{(\sum_{n=1}^{j} \alpha \overline{F}_n)}{j} \right]_{it} \text{ for vector } \overline{F} = \frac{A_t}{A_0} \tag{7}$$

where:

A - value of an essential indicator,

j - sum of variables included in the index (n= 1, 2,...j), and

α - weight related to particular variables that constitute an index of economic prosperity.

In the LPI, the variables that are included in the index represent the z-scores (Legatum Institute, 2021), which transform primary indicators into scores with a mean of zero and a standard deviation of one by applying the following equation:

$$PI_{yc} = \frac{Z_c - \overline{Z}}{\sigma(y)} \tag{8}$$

where:

PI_{yc} - is the c element of the variable y,

Z_c - is the current score of the primary indicator,

$\overline{Z}$ - represents the average of the primary indicators; and

$\sigma(y)$ - standard deviation, an indicator of variability of the variable (y).

The LPI thus develops a primary evaluation of the significance of the various indicators in comparison to one another. Specifically, the LPI tries to suggest critical fields where governments and policy-creators could make an enormous change in achieving economic prosperity. The configuration of the fixed prosperity gauges is out of the range of the papers encompass. The accessible secondary data on the LPI substructure were derived from the global sustainable competitiveness measures. Uniform indicators have been applied to create essential measures interrelated with the different dimensions of economic prosperity. Generally, observed dimensions aggregate social, economic, and institutional indicators together with the intention of comprehending each possible indicator and eliminating the total number of common indicators. In spite of that, the theoretical background applied to collect crucial accessible data linked to the chosen indicators by the international institutions demands that the data be classified into heterogeneous fields and, thus, use each interrelated indicator to create an aggregated index of the observed group of variables (OECD, 2018; Legatum Institute, 2020).

The attempt has been made to aggregate the selected variables in each index conforming to the distribution of the indicators titled in the global sustainability classification of gauges regardless of their presence in the aggregated secondary data but not influenced in this study thanks to the calculated extraction of variables. The indicators in different sections were created to incorporate each potential dimension of a citizen's wellbeing over including essential accountable measures to the circumstances of the adequate data group. The principal predisposition is the model's bias concerning economic overview by reason of previously employed variables, categorization, and data collection. The possible sub-indicators presented as aggregated indexes allow one to develop an empirical model determining the variables that influence economic prosperity in the EU-27 countries.

The prosperity of countries can be influenced by various factors that usually apply to distinctive stages of measurement. As a result of the diversified indicators that have been incorporated into the prosperity indices, establishing adequate patterns for achieving prosperity requires a restricted group of significant and representative indicators. Each feasible indicator is used to develop an appropriate prosperity index, assuming that every variable is an authentic example of its particular dimensions (OECD, 2008).

The 256 indicators are categorized into twelve pillars that are averaged using similar weights. The LPI includes twelve sub-indices classified into three particular groups (Legatum Institute, 2021):

- Inclusive countries: Safety and Security, Personal Freedom, Governance,

Social Capital;
- Open Economies: Investment Environment, Enterprise Conditions, Infrastructure and Market Access, Economic Quality;
- Empowered People: Living Conditions, Health, Education, and the Natural Environment.

Correlation analysis using Spearman's method, which is applied to ordinal variables with non-normal distribution, is carried out to assess the link between the chosen indicators. It also calculates the statistical significance of Spearman's correlations using the rho-p hypothesis test. Applying Spearman's rank correlation coefficient, the correlations between the global sustainable competitiveness, EU-innovation, eco-innovation, and prosperity indicators were examined. Because Spearman's correlation is a non-parametric test and some of the variables in this analysis are not normally distributed, it is a suitable estimation approach for these relationships.

4. Research Results

The research was conducted in the EU-27 countries as follows: Sweden, Finland, Denmark, Ireland, France, Austria, Germany, Estonia, Croatia, Portugal, Slovenia, Luxembourg, Netherlands, Latvia, Slovakia, Belgium, Lithuania, Czech Republic, Spain, Romania, Malta, Italy, Poland, Hungary, Bulgaria, Cyprus, and Greece. The aggregated data for every country covers the period 2020-2021. Table 1. demonstrates scores in the EU-27 Member States according to the GSCI, green-digital-competitive SME index, EU innovation index, eco-innovation index, and the LPI.

Table 1: Scores of the EU-27 Member States by indicators of global sustainable competitiveness, green-digital-competitive SMEs' performance, EU innovation, eco-innovation, GDP per capita, and prosperity in 2020-2021.

EU-27	GSCI (0-100)	GDCI (0-100)	EUII EU=100	ECII EU=100	LPI (0-100)
Sweden	61,2	70,38	139,0	142	83,11
Finland	60,7	74,33	134,5	157	82,96
Denmark	60,2	75,23	131,1	150	83,86
Ireland	57,6	70,29	107,8	109	79,63
France	56,8	51,74	108,7	127	76,34
Austria	56,6	54,60	118,7	150	79,74
Germany	56,6	54,28	122,6	133	80,57
Estonia	56,1	50,93	114,0	97	78,13
Croatia	55,1	46,33	69,5	86	67,96
Portugal	54,8	56,45	80,2	115	74,21
Slovenia	54,3	51,80	89,3	113	74,76
Luxembourg	53,9	60,66	121,3	171	81,10
Netherlands	53,9	68,06	123,1	124	82,18
Latvia	53,5	48,32	49,6	90	72,13
Slovakia	53,1	40,63	63,1	82	70,56
Belgium	53,0	62,76	127,5	107	76,33
Lithuania	53,0	46,87	81,8	88	71,77
Czech Republic	52,9	46,63	83,9	111	74,56

EU-27	GSCI (0-100)	GDCI (0-100)	EUII EU=100	ECII EU=100	LPI (0-100)
Spain	52,7	54,45	85,3	125	75,44
Romania	52,3	29,21	31,2	71	66,09
Malta	51,7	61,82	90,4	67	74,95
Italy	51,7	38,42	96,0	124	72,0
Poland	51,2	42,63	58,5	63	70,32
Hungary	50,8	43,00	67,9	69	66,92
Bulgaria	49,6	33,45	44,5	50	65,38
Cyprus	47,5	36,97	94,6	79	70,82
Greece	49,6	37,34	78,6	102	66,97

Note: *The Global Sustainable Competitiveness Index (GSCI), the Green Digital Competitive SME Index (GDCI), the EU Innovation Index (EUII), the Eco-Innovation Index (ECII) and the Legatum Prosperity Index (LPI).*

Source: SolAbility, the Global Sustainable Competitiveness Report 2021, the European Observatory Scoreboard, the Eco-Innovation Index Report 2021, the Lisbon Council Report 2021, the Legatum Prosperity Index Report 2021, and the Eurostat countries database (2021).

The EU-27 leading countries by the scores of global sustainable competitiveness are: Sweden (61,2), Finland (60,7), Denmark (60,2), Ireland (57,6), France (56,8), Austria (56,6), Germany (56,6), Estonia (56,1), Croatia (55,1), and Portugal (54,8). According to the EU Innovation Observatory Scoreboard (2021), EU-27 Member States can be divided into three groups by their total Eco-innovation (ECII) scores: 1. eco-innovation leaders, 2. average eco-innovation performers, and 3. eco-innovation catching-up countries. Therefore, the Eco-Innovation EU-27 Member States' leaders for the 2021 include the ten highest scored EU countries: 1. Luxembourg (171), 2. Finland (157), 3. Austria (150), 4. Denmark (150), 5. Sweden (142), 6. Germany (133), 7. France (127), 8. Spain (125), 9. Netherlands (124), and 10. Italy (124) as presented in Table 1. Average Eco-Innovation EU-27 performers incorporate: Portugal (115), Slovenia (113), Czech Republic (111), Ireland (109), Belgium (107), Greece (102), Estonia (97), and Latvia (90). Countries in the category of Catching-up with eco-innovation include – in descending classification of Eco-innovation scores: Lithuania (88), Croatia (86), Slovakia (82), Cyprus (79), Romania (71), Hungary (69), Malta (67), Poland (63), and Bulgaria (50).

According to the GDCI scores, the leading countries are: Denmark (75,23), Finland (74,33), Sweden (70,38), Ireland (70,29), Netherlands (68,06), Belgium (62,76), Malta (61,82), Luxembourg (60,66), Portugal (56,45), Austria (54,60), and Germany (54,28). The scores of the GDCI indicators revealed greater disparities between EU countries. The GDCI score in Denmark, as the leader in the analyzed period, was almost three times higher than in Romania (the indicator score was 29.21), which ranked last among the EU-27 countries. The accomplished results regarding green, digital and competitive SME performance in the EU-27 leading countries are the direct implication of the EU's Green Deal environmental actions and policies, investments in equipment and systems for the reduction of gas emissions and pollution.

In the analyzed period, the scores of the examined EUII indicators have also indicated larger differences between the EU countries. The EUII score in Sweden (the indicator score was 139.0), as the leader in the analyzed period, was more than three times higher than in Bulgaria, which ranked as the last among the EU countries in terms of innovation (the indicator value of Bulgaria was 44.5). Almost the same situation could be noticed in the case of the ECII in Luxembourg versus Bulgaria. In the observed period, the EUII value in Luxembourg, as the leading EU country, was more than three times higher than in Bulgaria regarding eco-innovation. In comparison to other analyzed EU-27 countries, Sweden achieved the highest GSCI score (61, 2), while the lowest GSCI score was recorded in Cyprus (47,5). Based on the scores of the LPI across the EU-27 countries, it can be seen that the highest value was indicated in Denmark (83, 86), while the lowest LPI score was noticed in Bulgaria (65,38).

Active environmental policies and actions in Sweden have been developed to address environmental issues, and eco-innovations have been integrated into these policies and actions. The Swedish government established numerous institutions to achieve environmental improvements in a variety of fields, such as consulting support for SMEs focused on green economy, digital transformation, and long-term competitiveness. Adjustments to economic policies and environmental regulations provide flexible foundations for developing new technologies and implementing eco-innovation in Sweden.

In a wider outlook, it is very important that operating surveys focus on the identification of reasons for balanced or unbalanced levels of EU innovation and eco-innovation in the EU-27 countries, with special emphasis on the determinants that increase and strengthen the national economies towards creating and applying eco-innovation and innovations. It should also be considered necessary to categorize and examine the countries that are positioned as leaders in eco-innovation and innovation, alongside recognizing determinants of their prosperity.

Table 2 presents the EU-27 countries' rankings by the GSCI, GDCI, EUII, ECII, GDP per capita (Purchasing Power Parity) and the LPI. The first EU country to the GSCI and the EUII is Sweden. According to the GDCI and the LPI, Denmark is the first-ranked EU Member State.

Luxembourg has achieved the highest-ranking position in eco-innovation capability by the ECII and GDP per capita (PPP), in comparison with the other observed EU economies. Romania has scoped the lowest rank (27th) related to green, digital, and competitive SME capability. Cyprus is the lowest-ranked EU country by the sustainable competitiveness index, while Bulgaria is the lowest-ranked EU-27 country according to the ECII, GDP per capita (PPP) and the LPI.

Table 2: Ranks of the EU-27 Member States by indicators of global sustainable competitiveness, green-digital-competitive SMEs' performance, EU innovation, eco-innovation, GDP per capita, and prosperity in 2020-2021.

EU-27	GSCI	GDCI	EUII	ECII	GDP pc	LPI
Sweden	1	3	1	5	7	2
Finland	2	2	3	2	9	3
Denmark	3	1	4	4	3	1
Ireland	4	4	8	14	2	8
France	5	14	6	7	10	10
Austria	6	10	7	3	5	7
Germany	7	12	5	6	6	6
Estonia	8	15	9	17	18	9
Croatia	9	19	25	20	26	23
Portugal	10	9	17	11	21	16
Slovenia	11	13	18	12	14	14
Luxembourg	12	8	12	1	1	5
Netherlands	13	5	2	9	4	4
Latvia	14	16	22	18	23	17
Slovakia	15	22	21	21	22	21
Belgium	16	6	10	15	8	11
Lithuania	17	17	23	19	16	19
Czech Republic	18	18	11	13	13	15
Spain	19	11	16	8	17	12
Romania	20	27	27	23	24	26
Malta	21	7	13	25	11	13
Italy	22	23	15	10	12	18
Poland	23	21	24	26	19	22
Hungary	24	20	19	24	20	25
Bulgaria	25	26	20	27	27	27
Cyprus	27	25	14	22	15	20
Greece	*26*	*24*	*26*	*16*	*25*	*24*

Source: Estimation was based on data published by SolAbility, the Global Sustainable Competitiveness Report 2021, Lisbon Council –Green Digital-Competitive SMEs Index 2020, the European Observatory Scoreboard – Eco- Innovation Index Report 2021, the Legatum Institute, the Legatum Prosperity Index Report 2021, and Eurostat countries database (2021). http://ec.europa.eu/eurostat/data/database

The research results have also shown that certain EU countries are in the initial stages of green economy development and exhibit low scores in sustainable competitiveness. In this regard, observed from the aspect of the stated criteria, Cyprus, Greece, and Bulgaria show the poorest performance, mainly due to ineffective green policies or the lack of adequate infrastructure or financial institution support. The greatest exception is noticeable in the case of Luxembourg, which achieved the first ranking positions in the eco-innovation domain and GDP per capita (PPP), and the 12th ranking positions according to GSCI and EUII.

Table 3 represents the relationships among indicators of sustainable

competitiveness, green-digital-competitive SME capability, eco-innovation, GDP per capita (PPP), and economic prosperity in the observed EU-27 Member States. Spearman's correlation coefficients have revealed correlations between the GSCI, the GDCI, EUII, ECII, GDP per capita (PPP), and the LPI. The data for the conducted research were gathered from both primary and auxiliary sources. The empirical research was carried out using SPSS 25.

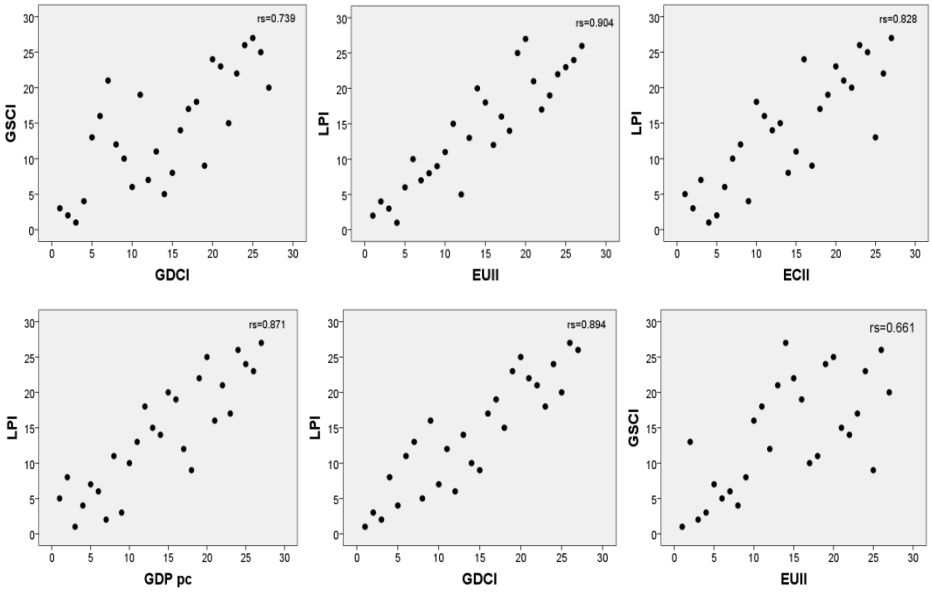
Table 3: Correlations among indicators of global sustainable competitiveness, green-digital competitive SMEs' performance, EU innovation, eco-innovation, GDP per capita, and prosperity in 2020-2021.

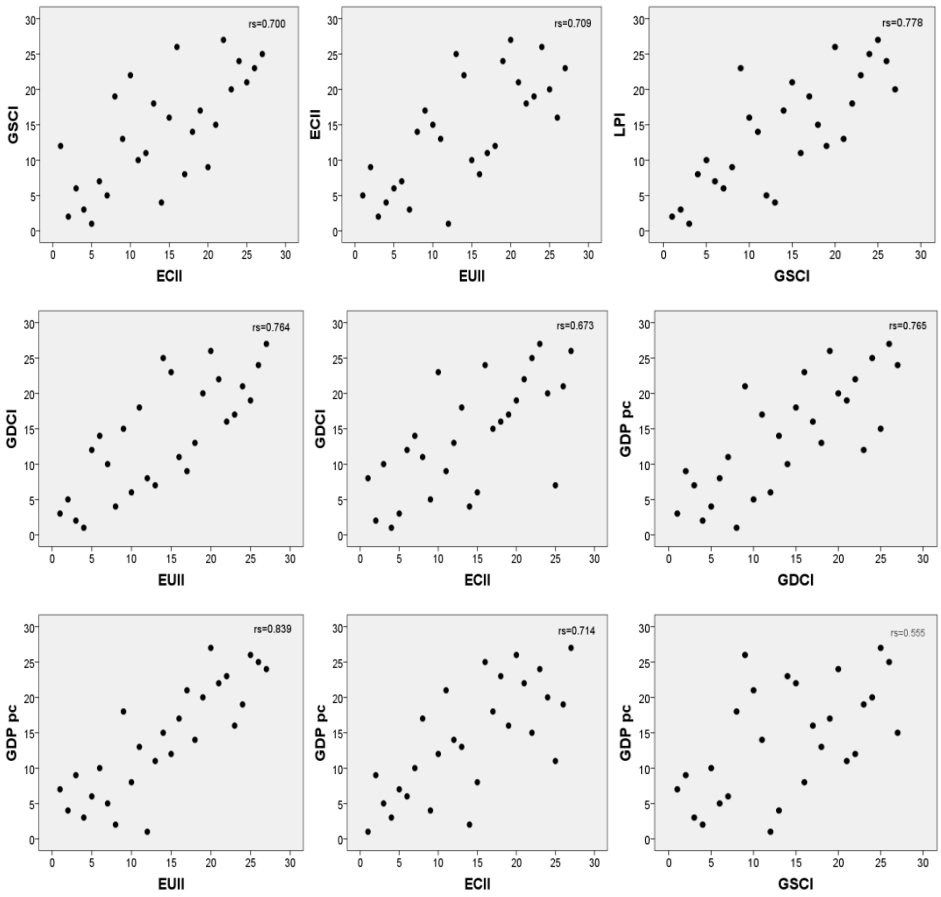
	GSCI	GDCI	EUII	ECII	GDP pc	LPI
GSCI	1,000	,739**	,661**	,700**	,555**	,778**
GDCI	,739**	1,000	,764**	,673**	,765**	,894**
EUII	,661**	,764**	1,000	,709**	,839**	,904**
ECII	,700**	,673**	,709**	1,000	,714**	,828**
GDP pc	,555**	,765**	,839**	,714**	1,000	,871**
LPI	,778**	,894**	,904**	,828**	,871**	1,000

***Note**: ** p<0.001.* **Source:** Author's own calculation.

The correlation results based on Spearman's coefficient are shown by the following scatter dots.

Figure 1: The relationships between indicators of global sustainable competitiveness, green-digital competitive SMEs' performance, EU innovation, eco-innovation, GDP per capita, and prosperity in 2020-2021.





Source: Author's own creation using SPSS 25.

The Spearman's rank-order correlations were run to examine the relationship between GSCI, GDCI, EUII, ECII, GDP pc, and LPI. There are positive and significant correlation between GSCI and GDCI, rs=.739 n=27 p<0.001, EUII and LPI, rs=.904 n=27 p<0.001, ECII and LPI, rs=.828 n=27 p<0.001, GDP pc and LPI, rs=.871 n=27 p<0.001, GDCI and LPI, rs=.894 n=27 p<0.001, GSCI and EUII, rs=.661 n=27 p<0.001, GSCI and ECII, rs=.700 n=27 p<0.001, EUII and ECII, rs=.709 n=27 p<0.001, GSCI and LPI, rs=.778 n=27 p<0.001, GDCI and EUII, rs=.764 n=27 p<0.001, GDCI and ECII, rs=.673 n=27 p<0.001, GDP pc and GDCI, rs=.765 n=27 p<0.001, GDP pc and EUII, rs=.839 n=27 p<0.001, GDP pc and ECII, rs=.714 n=27 p<0.001, GDP pc and GSCI, rs=.555 n=27 p<0.001.

5. Conclusions

The fundamental goal of this paper was to investigate the influence of sustainable competitiveness and eco-innovation on growth per capita and future prosperity in the EU-27 Member States: Sweden, Finland, Denmark, Ireland, France, Austria, Germany, Estonia, Croatia, Portugal, Slovenia, Luxembourg, Netherlands, Latvia, Slovakia, Belgium, Lithuania, Czech Republic, Spain, Romania, Malta, Italy, Poland, Hungary, Bulgaria, Cyprus, and Greece. Regarding the defined objective

of examining interrelations among the indicators of sustainable competitiveness, the green-digital-competitive SMEs' capability, EU innovation, eco-innovation performance, GDP per capita (PPP), and prosperity, different research methodologies have been applied. The research results have revealed very strong positive and significant correlations between the GSCI, GDCI, EUII, ECII, and LPI. Designating to the determined significant correlations, it could be concluded that EU-27 Member States' prosperity is influenced by sustainable competitiveness and eco-innovation that rely upon the SDCI pillars as follows: 1. Natural Capital, 2. Social Capital, 3. Resource Efficiency and Intensity, 4. Intellectual Capital and Innovation, and 5. Governance Efficiency.

The sustainable competitiveness and eco-innovation rankings presented by the appropriate indicators could be essential in comparative analysis among countries and contribute valuable recommendations for economic policy-creators in achieving future prosperity and the EU's Green Deal goals. The EU-27 countries, except the national macroeconomic and microeconomic indicators, follow the complete population's sustainable well-being via the GSCI, GDCI, EUII, ECII, and LPI. The EU-27 economies and their industries are in the appropriate position to develop the required sustainable solutions that maintain development in Europe and far beyond. The conducted research suggests that to achieve a more sustainable, competitive, greener, eco-innovative, and prosperous economy, the spotlight needs to be guided to appropriate the EU Green Deal's policies that can enhance future prosperity and growth in the observed EU-27 Member States. This survey presents additional theoretical synopsis and empirical examination associated with the influence of sustainable competitiveness and eco-innovation indicators on economic prosperity in the EU-27 countries. The foregoing may assist to assure an essential foundation for acknowledging the significance of sustainability and eco-innovation variables, as well as to enhance the expected theoretical groundwork for an adequate new EU Green Deal policy or individual investigations by the EU-27 member countries'. Prioritizing various initiatives and policies will help the EU-27 Member States achieve climate neutrality, reduce pollution, support the EU business community in becoming a global leader in green technology, and identify the equitable and inclusive parts of the green and digital transition.

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