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ECO-INNOVATION AS A KEY DRIVER FOR SUSTAINABLE GROWTH AND DEVELOPMENT: THE CASE OF EUROPEAN UNION COUNTRIES

Abstract: Globalization, technological advancement, and environmental degradation are the main forces behind the growth of eco-innovation. Along with minimizing adverse effects on the environment and making efficient utilization of natural resources, eco-innovation is also closely tied to the goals regarding sustainable growth and development. Eco-innovation needs to be systematically measured to track advancements made towards a more sustainable future. The creation of metrics and techniques for measuring eco-innovation is a significant theoretical and practical problem. The current state of eco-innovation measurement methods is such that a cross-national comparative analysis is challenging. The objective of this paper is to perform a comparative examination of the eco-innovation performance in European Union countries as a key driver of sustainable growth and development. The research employs a comparative assessment and synthesis approach founded on the Eco-Innovation Index in addition to a critical assessment of scholarly literature. Creating and implementing eco-innovation performances in EU countries should be given top priority to promote future sustainable growth and development.

Keywords: eco-innovation; key driver; sustainable growth and development; Eco-Innovation Index; European Union countries.

Introduction

A key strategy for increasing countries' competitiveness and guaranteeing more sustainable growth and development is eco-innovation, which is one of the top areas of the innovation framework (Ekins, 2010; Urbaniec, 2015; Horbach, 2016; Terzić, 2023b). The opportunities for eco-innovation need to be explored on a global, regional, national, and local scale. It is also essential for the policies of the European Union to appropriately formulate a policy in this domain and to assess the degree of innovation while considering its diversified factors. The paper reveals a comprehension of the significant eco-innovation tendencies by employing the Eco-Innovation Index (EII) methodology to assess many aspects of the EU countries' eco-innovation performance. As one of the three components of environmental sustainability (along with infrastructure and the manufacturing sector) that are specifically referred to in SDG 9, eco-innovation, in particular, and innovation in general both contribute to the accomplishment of the 2030 Agenda for Sustainable Development Objectives. Furthermore, they perform accordingly by offering scientific and technological alternatives to the obstacles presented by the other Sustainable Development Goals (Becker et al., 2021; United Nations, 2022).

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Eco-innovation is especially vital to achieving sustainable growth and development, which is recognized as a fundamental component of renewable energy policies and initiatives and as a driver of such adjustments (Díaz-García et al., 2015; Cai and Li, 2018; Columbo et al., 2019). Minimizing adverse environmental effects and developing new markets for goods, services, or procedures aimed at enhancing the environment's sustainability (e.g., conserving energy as well as other assets and cutting down on pollution) are the main goals of eco-innovation (OECD, 2012). Sustainable innovation is a kind of invention that can have a major positive effect on the environment while simultaneously helping both companies and consumers. Eco-innovation is either a newly developed or greatly enhanced method, item, organizational modification, or marketing strategy that lowers the release of dangerous materials along the course of their entire life cycle (Kemp & Foxon, 2007; OECD, 2012; Donis et al., 2021).

Eco-innovation is consequently a crucial component of corporate competitiveness and has a direct impact on economic benefits; nevertheless, its application and size are dependent on a variety of factors, including the industry, rules and regulations, customer sensitivity, and environmental consciousness. The deployment of these measures seeks to enhance competitiveness by lowering energy and material costs while simultaneously mitigating adverse environmental effects (Porter & Van der Linde, 1995; EPI, 2012; Horbach et al., 2012; Nordhaus, 2021; Terzić, 2023b). While scholarly literature offers numerous interpretations, a single definition of eco-innovation is an innovation that improves the quality of the environment and is applied to enhance a company's ecological sustainability (Díaz-García et al., 2015; Park et al., 2017). Even with increased attention, there is still not much research conducted in the field of eco-innovation. Primarily, it is devoid of a generally acknowledged definition and of a logical theoretical framework (Türkeli and Kemp, 2018; Urbaniec et al., 2021; Terzić, 2022a; Terzić, 2023b).

Additionally, quantifying the impact of eco-innovation lacks a standardized methodology. Conversely, regional and national differences exist in the quantity and caliber of data regarding the environment. When discussing eco-innovation at the macroeconomic level, it is important to note that several theoretical frameworks, such as those specific to European nations, are used in the real world and in the literature to measure and analyze eco-innovation. This is associated with nations' endeavors to attain sustainable growth, in addition to mitigating adverse environmental effects and optimizing the utilization of natural resources. Eco-innovation must be systematically measured to track advancements towards a more sustainable future (Park et al., 2017; Terzić, 2023b); thus, creating techniques and metrics to assess and evaluate eco-innovation at the macro and micro stages.

The purpose of this article is to provide an analytical comparison of the evolution of eco-innovation in European Union countries. Which eco-innovation advancements or challenges are present in a subset of European nations is the primary study issue. The methods employed are a critical examination of the literature and an examination of the comparison and synthesis procedures founded on the Eco-Innovation Index. Implementing a comparable methodology, the study offers a comprehensive summary of the advancements in eco-innovation progress. By examining the factors that influence eco-innovation in various nations, the investigation adds to the repository of knowledge on assessing eco-innovation achievement. The structure of the paper is as follows: the introduction is covered in the first section; a theoretical overview of the scholarly literature is provided in the second section; Section 3 presents the research methodology and data, including the conceptual structure for gauging eco-innovation. The findings of the study examination are given in the fourth section, with an emphasis on how far EU economies have come in terms of eco-innovation; the findings are presented in the fifth section.

Theoretical Overview of the Literature

There are numerous theoretical perspectives on eco-innovation. Scientific research contains a single, broadly agreed term for eco-innovation, and the theories that are currently in use have different purviews for research (Díaz-García et al., 2015; Ghisetti, 2015; Türkeli and Kemp, 2018, Terzić, 2023a). Compared to conventional innovation, eco-innovation is characterized by a significantly higher degree of variance because its outcomes are typically indecisive and it frequently depends on scientific procedures (sustainability solutions). The extent and level of information in the various explanations for eco-innovation found

in academic research and economic implementation differ. All in all, they are focused on inventions that improve sustainability.

Researchers began examining eco-innovation as early as the end of the 1970s (Urbaniec, 2015). In the 1990s, a more comprehensive definition of eco-innovation was developed, encompassing "all of the gauges involving appropriate performers (companies, legislators, organizations, groups, religious organizations, and private households) that create novel concepts, actions, goods, or procedures, utilize or present themselves, and that help achieve the minimization of worldwide environmental demands or environmentally friendly defined sustainability goals" (Rennings, 2000; United Nations, 2022). Eco-innovation encompasses improvements in institutional and social frameworks in addition to advances in goods, procedures, and advertising approaches. Thus, eco-innovation need not always be a world first or the outcome of a purposeful commercial endeavour or plan.

Accordingly, it could be claimed that every invention that outperforms important possibilities in terms of environmental advantages is an eco-innovation (e.g., sustainability technologies, organizational innovations, goods and services, innovations, and green framework technological advances) (Arundel & Kemp, 2009; Ghisetti, 2018; OECD, 2012; Nordhaus, 2021). A comparable approach has been applied to the Eco-Innovation Scoreboard (Eco-IS). Designed to minimize negative environmental effects or achieve greater effectiveness and environmentally conscious utilization of resources, eco-innovation has been defined by the EIO as every type of invention that makes a tangible advancement regarding the ultimate objective of sustainable growth. This includes the planned and unplanned environmental effects of new ideas in addition to green technology systems, procedures, and solutions. The eco-innovation achievements of the EU countries are summarized by the Eco-Innovation Scoreboard (Eco-IS). Utilizing sixteen variables categorized into five dimensions – eco-innovation inputs, eco-innovation activities, eco-innovation outputs, resource effectiveness results, and socioeconomic performance, – it seeks to quantify various elements of eco-innovation (Colombo et al., 2019; Bernard et al., 2020; Terzić, 2022b). The positive and negative aspects of eco-innovation across every EU nation can be determined according to the Eco-Innovation Scoreboard rating. The Eco-IS enhances other methods of gauging national innovation, including the International Innovation Index (Bernard et al., 2020; European Commission, 2022), by advocating for a comprehensive understanding of economic, ecological, and social achievements.

As a result, the Eco-Innovation Index is the basis for the parameters that this research analyzes for European nations (EIO, 2013; Jo et al., 2015; Park et al., 2017; Bernard et al., 2020). This index allows for the examination of a country's shortcomings and opportunities by displaying how well that nation is doing across a range of eco-innovation aspects (Park et al., 2017). Its goal is to advance an integrated perspective on economic, social, and environmental sustainability. Numerous academics have focused on creating a study approach to quantify eco-innovation (Horbach et al., 2012; Horbach, 2016; Terzić, 2022b). This adds to the attempt to discover novel approaches to assessment in the field of economics. Though most research has been done in industrialized nations (i.e., European nations), very few studies have looked at eco-innovation at the national level (Jo et al., 2015).

Simultaneously, numerous scholars highlight the connection between innovation and countries' competitiveness, contending that innovations boost competitiveness by allowing businesses to quickly adjust to the rate of technological advancement and changing market conditions (Baumol, 2002; Constantini, V. & Mazzanti, 2012; Peretto, 2015; Bugnar et al., 2016; Terzić, 2022a, Terzić, 2023a). This allows businesses to obtain a competitive edge and boost economic competitiveness (Atkinson & Ezell, 2012; Ciocanel & Pavelescu, 2015; Dutta et al., 2019; Terzić, 2022b). Figure 1 presents opportunities for eco-innovation through a summary of risk factors, regulatory pressures, and changing market conditions.

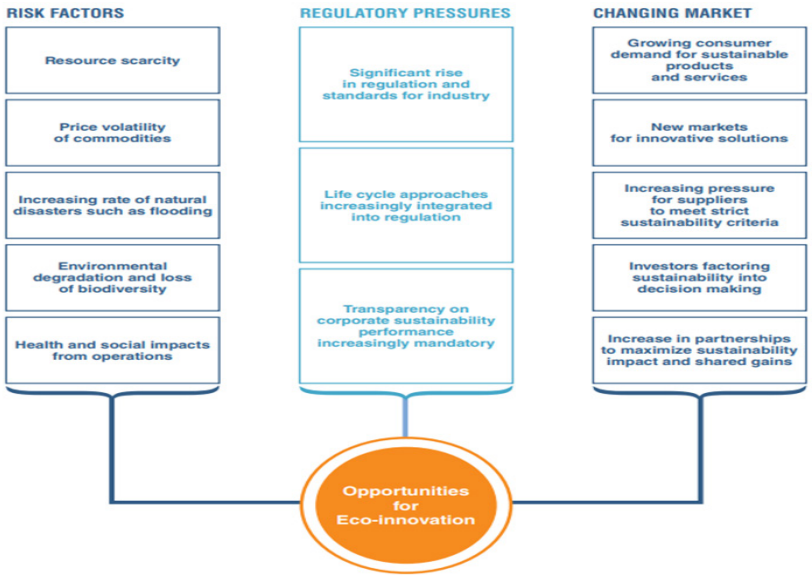


Figure 1. *Opportunities for Eco-Innovation: A Summary of Risk Factors, Regulatory Pressures, and Changing Market Conditions*

Given this discrepancy in research, comparing the degree of eco-innovation in Europe may be possible by concentrating on eco-innovation and by employing the methods used in the Eco-Innovation Ranking. It is evident from the literature assessment on theoretical methods to determine and evaluate the consequences of eco-innovation that, currently, there is no standard gauge or approach to evaluation. Due to the approaches' complexity and amount of information, the specific instance must be appropriately adapted. On the other hand, it needs to guarantee that the outcomes of eco-innovation initiatives are comparable. Another factor contributing to the challenge of quantifying eco-innovation outcomes is their association with unpredictability. Policies regarding the environment can be promoted and worldwide comparisons can be established by assessing eco-innovation at the national level. Eco-innovation opportunities are especially crucial for developing and putting into practice tools to promote environmental sustainability (Donis et al., 2021; Terzić, 2023b).

Assessing eco-innovation also helps to increase awareness among people of responsibility for the environment and improves our comprehension of broader sustainable issues. As previously stated, there are obstacles to the adoption of eco-innovations, mostly because organizational changes are required, ranging from leadership styles to manufacturing processes. Additionally, it is an enormous chance but comes with risks and expenses (Porter & Van der Linde, 1995; EC, 2023), which limits the potential of implementing "extreme" eco-innovations (Hazarika & Zhang, 2019; Bugnar et al., 2016). It needs labour and financial resources without an assurance of profit. Internally, organizational environment obstacles, including technical knowledge, governance of the environment, and accessible funding, have been identified in the literature. Furthermore, the company faces external obstacles related to the ecosystem it performs in, such as the accessibility of suppliers and funding from governments (Kiefer et al., 2019; European Commission, 2022; EEA, 2023).

The Sustainable Development Goals (SDGs) are related to the Eco-Innovation Scoreboard. "Eco-industries" are the subject of the socio-economic outcome elements, which include indicators of export of goods from eco-industries, employment in such industries, and turnover in them. SDG 9: Industry and Infrastructure emphasize that eco-industries may support inclusive, environmentally sustainable industrialization, innovation, and the development of resilient infrastructure. They support productive employment and growth that is sustainable (SDG 8: Good Jobs and Economic Growth). The resource-use component of eco-innovation is the main emphasis of the Eco-IS. One of the main components of eco-innovation is resource efficiency. Decreasing resource consumption, as demonstrated by indicators of lowering material input

and lowering energy input, is how eco-innovation activities are quantified. It makes sustainable production processes and industrialization (SDG 9: Industry and Infrastructure) easier.

Data and Research Methodology

The data sources utilized for generating the parameters include the European Eco-Innovation Observatory Scoreboard, the European Commission countries database, and many international and scientific communities. The research investigation uses a critical evaluation of scholarly literature along with the comparative analysis and synthesis methods based on the Eco-Innovation Index. Table 1 presents a synopsis of eco-innovation components linked to SDGs.

Table 1. *Synopsis of Eco-Innovation Components Linked to Sustainable Development Goals*

Eco-Innovation Component	Parameter	SDGs
Eco-Innovation Inputs	Governments' environmental and energy R&D appropriations and outlays; Total R&D personnel and researchers; Total value of green early-stage investments	SDG 9: Industry and infrastructure; SDG 12: Sustainable consumption and production
Eco-Innovation Activities	Firms having implemented innovation activities aiming at a reduction of material input per unit output; Firms having implemented innovation activities aiming at a reduction of energy input per unit output; ISO 14001 registered organizations	SDG 12: Sustainable consumption and production; SDG 8: Good jobs and economic growth; SDG 9: Industry and infrastructure
Eco-innovation Outputs	Eco-innovation-related patents; Eco-innovation-related academic publications; Eco-innovation-related media coverage	SDG 9: Industry and infrastructure; SDG 12: Sustainable consumption and production; SDG 8: Good jobs and economic growth
Resource Efficiency Outcomes	Material productivity; Water productivity; Energy Productivity; GHG emissions intensity	SDG 3: Good health; SDG 12: Sustainable consumption and production; SDG 6: Clean water; SDG 7: Clean energy; SDG 13: Climate action
Socio-Economic Outcomes	Exports of products from eco-industries; Employment in eco-industries; Turnover in eco-industries	SDG 9: Industry and infrastructure; SDG 12: Sustainable consumption and production; SDG 8: Good jobs and economic growth

Source: Summarization by the author based on the European Eco-Innovation Scoreboard 2021–2022 and United Nations (2022). *The Sustainable Development Goals Report 2022*

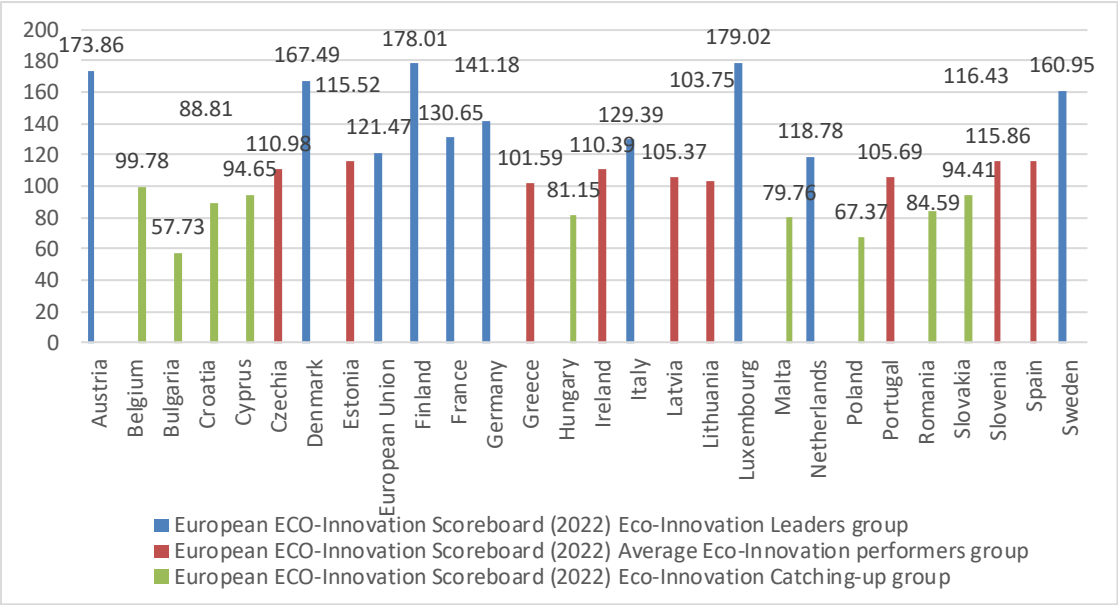
The research employed data collected from 2021 to 2022 to summarize the Eco-Innovation Index, as well as the evolution of the eco-innovation indices from the period 2013–2022. The environment, economy, and social dimensions are all included in the Index. As a result, a thorough instrument was created to gauge eco-innovation in nations that are EU members. Furthermore, according to the European Commission, the Eco-Innovation Index comprises output-oriented variables that evaluate the outcomes of inventive operations, as well as input-based variables that measure the expenditures of creative operations. According to Park et al. (2017), it is also essential to incorporate the influence of eco-innovation into the Eco-Innovation Index. There are distinct parameters in the indices that are arranged into five categories (European Commission, 2022).

The goal of the European Green Deal is to move towards an environmentally conscious and zero-carbon economy, and eco-innovation is essential to accomplishing this goal. According to the European Commission's eco-innovation index, the EU had a rise in eco-innovation between 2013 and 2022. The key reason why this happened was the increased efficiency of resources. It is anticipated that this gradual rise will continue because the European Green Deal has set high goals about sustainability and environmental conditions, and the activities that go along with it will probably foster an environment that is conducive to greater eco-innovation.

Research Results

The research examination was performed in the European Union member states: Sweden, Spain, Slovenia, Slovakia, Romania, Portugal, Poland, the Netherlands, Malta, Luxembourg, Lithuania, Latvia, Italy, Ireland, Hungary, Greece, Germany, France, Finland, Estonia, Denmark, Czechia, Cyprus, Croatia, Bulgaria, Belgium, and Austria. The data collected for every member state covers the period 2021–2022, and the evolution of the eco-innovation period between 2013 and 2022. The following Figure 2 presents the position and accomplishments of EU countries for the base year of 2021 using various parameters in the Eco-Innovation Index 2022.

There are common obstacles to eco-innovation faced by all EU members, and decision-makers must carefully consider these constraints to employ appropriate and successful strategies and tools for eco-innovation policy. The eco-innovation leaders in Europe in the period 2021–2022 in descending order of eco-innovation scores are as follows: Luxembourg (179.02), Finland (178.01), Austria (173.86), Denmark (167.49), Sweden (160.95), Germany (141.18), France (130.65), Italy (129.39), and the Netherlands (118.78), as shown in Figure 2. Average eco-innovation performers are, again in descending order are: Spain (116.43), Slovenia (115.86), Estonia (115.52), the Czech Republic (110.98), Ireland (110.39), Portugal (105.69), Latvia (105.37), Lithuania (103.75), and Greece (101.59).

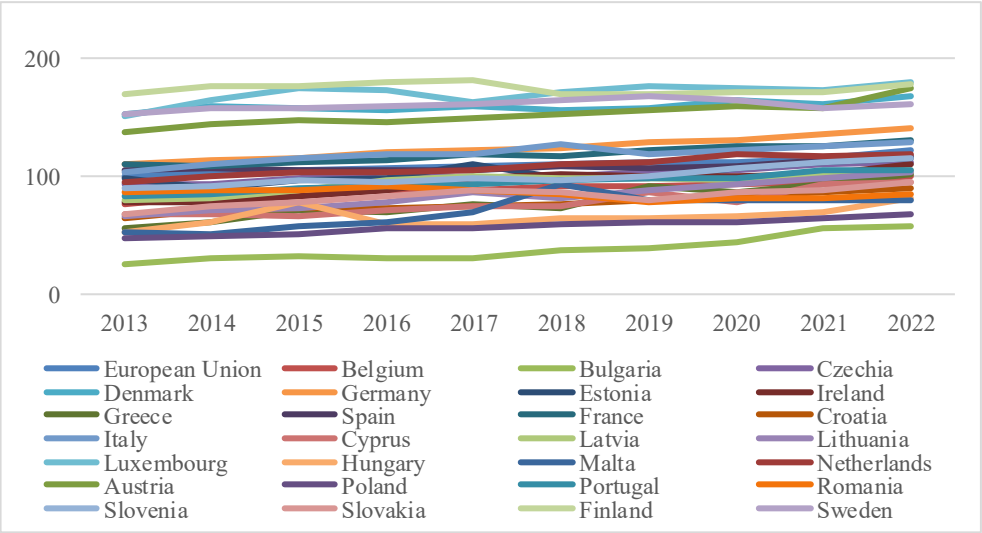


Source: Derived by the author based on the European Eco-Innovation Scoreboard 2021–2022

Figure 2. *Eco-Innovation Index in the EU Countries for the Period 2021–2022*

The eco-innovation performance of the top eco-innovation leaders group is under the EU-27 average score, as shown in Figure 2. Member states in the category of catching up with eco-innovation include, on a decreasing scale, Belgium (99.78), Cyprus (94.65), Slovakia (94.41), Croatia (88.81), Ro-

mania (84.59), Hungary (81.15), Malta (79.76), Poland (67.37), and Bulgaria (57.73). Examining how the Eco-Innovation Index has changed over the past decade within the framework of EU member states is crucial to improving our comprehension of Europe's development. Showing how the eco-innovation indicators have changed over time is also essential for determining which sectors still need work and funding. The graph below shows the evolution of the combined Eco-Innovation Index and other indices for every country that has been part of the Union throughout the previous ten years, from 2013 to 2022.



Source: Derived by the author based on the European Eco-Innovation Scoreboard 2013–2022

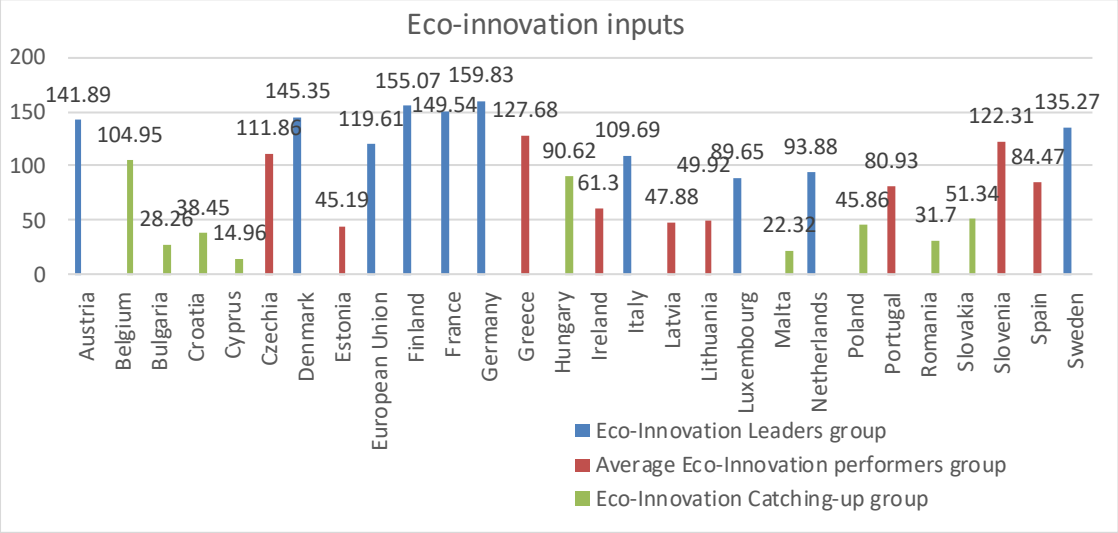
Figure 3. *Evolution of the Eco-Innovation Index in the EU Countries for the Period 2013–2022*

Greece, Lithuania, Austria, Ireland, Bulgaria, and Germany are the member states that show the most increase in their eco-innovation scores between 2013 and 2022, in descending order. For EU nations in this category, eco-innovation performance in comparison to 2021 has increased for Ireland and Greece. As shown in Figure 3, the change in each of these nations' Eco-Innovation Index is equivalent to at least 30 points. Austria has improved the most compared to 2021, followed by France Sweden, Finland, and Spain, which had the lowest changes in the Eco-Innovation Index between 2013 and 2022. Despite this slight improvement, Sweden and Finland continue to be among the top nations in terms of eco-innovation. The ten-year trend in the scores of member states that are catching up with eco-innovation is always changing. Bulgaria, Malta, and Hungary show the most improvements between 2013 and 2022, as seen in Figure 3. Starting in 2016, Romania's performance has continued to decrease. The European Innovation Index (EIS) is an annual assessment that contrasts the accomplishments of research and innovation ecosystems in EU nations and select third-country settings, along with the respective benefits and drawbacks of each nation.

The following approach, which consists of the Eco-Innovation Scoreboard in addition to the Index, measures 16 distinct parameters that are divided into five main categories to quantify the various facets of the eco-innovations made by each of the member states: eco-innovation inputs (government expenditures and investments related to renewable energy, the overall number of R&D employees, etc.); eco-innovation initiatives (such as the quantity of ISO 14001 licenses held by small and medium-sized businesses, the adoption of sustainable goods, etc.); eco-innovation outputs (such as media coverage, scholarly articles, and patents about sustainable development); resource efficiency (which includes productivity of materials, water, and energy, as well as intensity and socio-economic outcomes (e.g., percentage of employment in environmental protection, export of goods from sustainable industries, etc.). The Eco-Innovation Score-

board (Eco-IS) compares the total achievements of EU countries to a European mean of 100, showing their advantages (index > 100), vulnerabilities (index < 100), and overall accomplishments.

The starting point for evaluating the impacts of eco-innovation initiatives and eco-policies, with necessary lags, is provided by the environmental indices. Eco-policy measurements are necessary to ascertain how policies impact sustainability through eco-innovation and to pinpoint policy shortcomings where further action is required. The fourth class of indicators is socio-economic well-being variables. These gauges do not address the innovation-outcome cycle, but they can be very helpful in preventing unfavourable consequences like increased inequality from emerging from the transition to sustainable economic growth. The eco-innovation input scores of EU nations are shown in Figure 4. According to these values, the leading EU countries are Germany (159.83), Finland (155.07), France (149.54), Denmark (145.35), Austria (141.89), Sweden (135.27), Italy (109.69), the Netherlands (93.88), and Luxembourg (89.65). The scores revealed enormous gaps between EU countries. The eco-innovation input score in Germany, as the leader in the period observed, was almost eleven times higher than in Cyprus (the indicator score was 14.96), which ranked last among the member states.

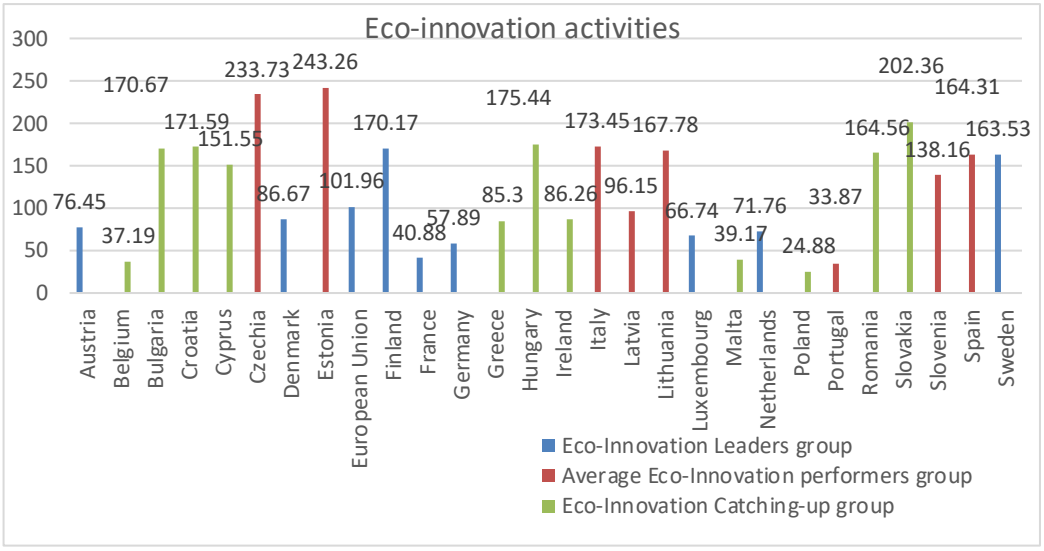


Source: Derived by the author based on the European Eco-Innovation Scoreboard 2021–2022

Figure 4. *Eco-Innovation Inputs in the EU Countries*

Figure 4 shows the eco-innovation input values of EU member states for 2021–2022 across three groups of countries: leaders, performers, and catching-up countries. In terms of eco-innovation inputs, all eco-innovation leaders perform admirably. Germany (159.83), Finland (155.07), France (149.54), and Denmark (145.35) have achieved especially good eco-innovation input scores. In the category of average EU performers, Greece, Slovenia and the Czech Republic have achieved the highest scores according to the eco-innovation inputs. Cyprus (14.96) had the lowest score according to the same criterion.

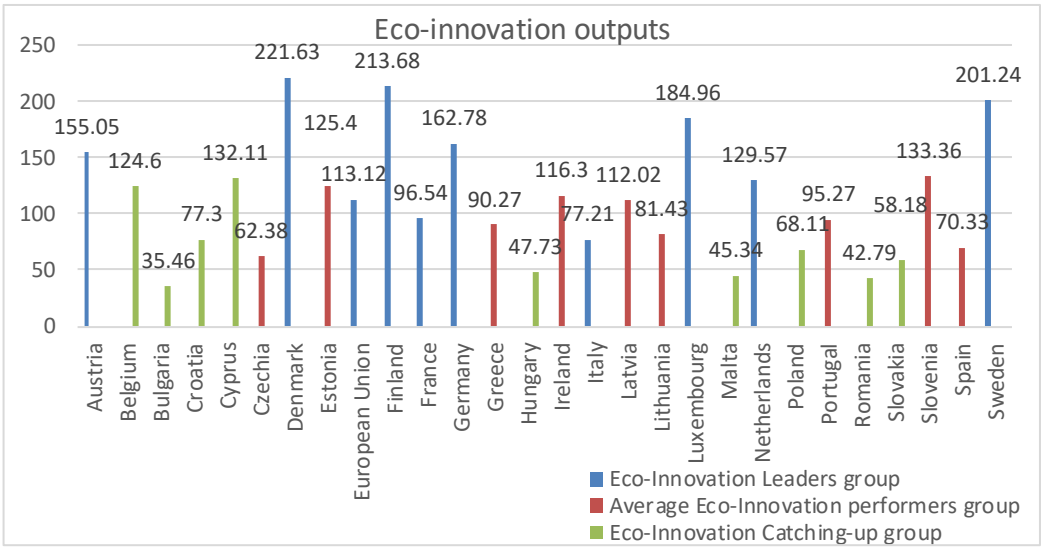
The eco-innovation activity scores of EU nations are presented in Figure 5. Estonia (243.26) and the Czech Republic (233.73) have achieved very impressive scores in the category of average EU performers (red line). In the category of eco-innovation leaders (blue line), Finland (170.17) and Sweden (163.53) have achieved the highest scores according to eco-innovation activities. When it comes to eco-innovation activity scores, Poland, Malta, and Belgium have the lowest relative scores among the nations catching up with eco-innovation, while the other nations in the group score reasonably well.



Source: Derived by the author based on t
he European Eco-Innovation Scoreboard 2021–2022

Figure 5. *Eco-Innovation Activities in the EU Countries*

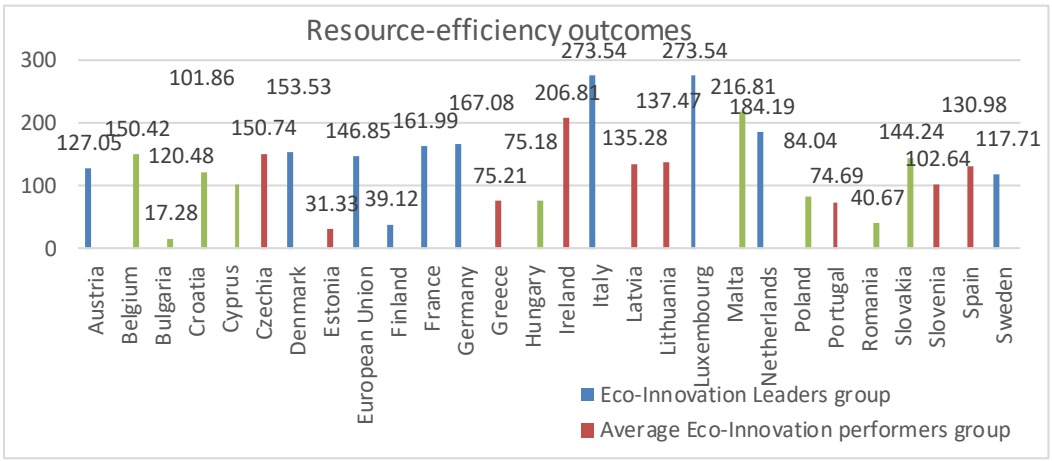
Interestingly, most of the EU countries that belong to the average eco-innovation performer's group and to the eco-innovation catch-up group achieved higher scores than the leader group countries. Slovakia has achieved the best eco-innovation activity score in the category of eco-innovation catch-up group (green line). The eco-innovation activities score in Estonia (243.26), the best-scored EU country, was almost ten times higher than in Poland (the indicator score was 24.88), which scored the worst among the observed EU countries. The eco-innovation output scores of EU countries are shown in Figure 6.



Source: Derived by the author based on
the European Eco-Innovation Scoreboard 2021–2022

Figure 6. *Eco-Innovation Outputs in the EU Countries*

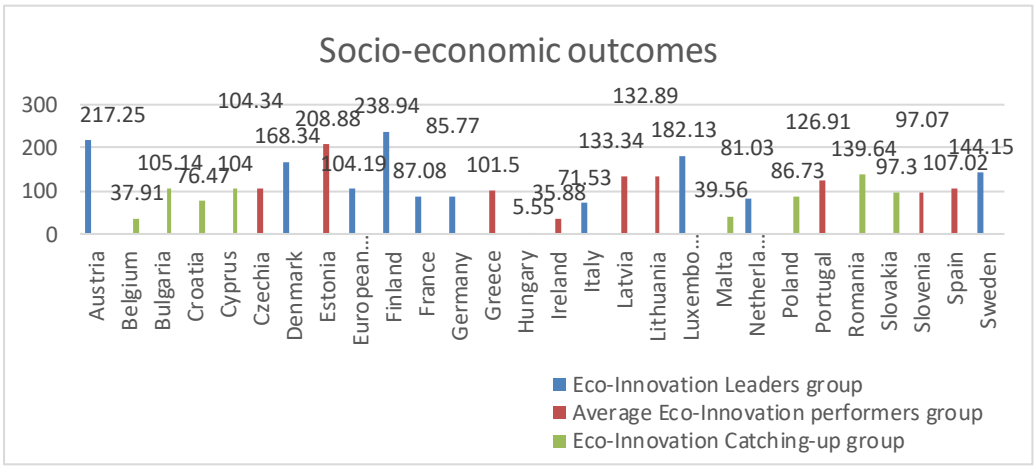
As can be seen in Figure 6, Denmark (221.63) and Finland (213.68) have achieved the highest eco-innovation output scores in the category of eco-innovation leaders (blue line). Slovenia (133.36) has achieved the best eco-innovation output score in the category of average eco-innovation performers (red line). In the category of the eco-innovation catch-up group, Cyprus (132.11) scored the most in eco-innovation outputs, and Bulgaria (35.46) had the lowest score. It is necessary to mention that the eco-innovation output score in Denmark, which was the best-scored EU country, was six times higher than in Bulgaria. Figure 7 presents resource efficiency outcomes in the EU countries.



Source: Derived by the author based on the European Eco-Innovation Scoreboard 2021–2022

Figure 7. *Resource Efficiency Outcomes in the EU Countries*

In the category of eco-innovation leaders (blue line), Italy (273.54) and Luxembourg (273.54) have both achieved identical scores, which are the highest in terms of resource efficiency outcomes. In the category of average eco-innovation performers (red line), Ireland (206.81) achieved the best result in terms of resource efficiency, and Estonia (31.33) ranked last. When it comes to resource efficiency outcomes, Bulgaria (17.28) had the lowest score among all EU member states observed. Figure 8 presents socio-economic outcomes in these countries.

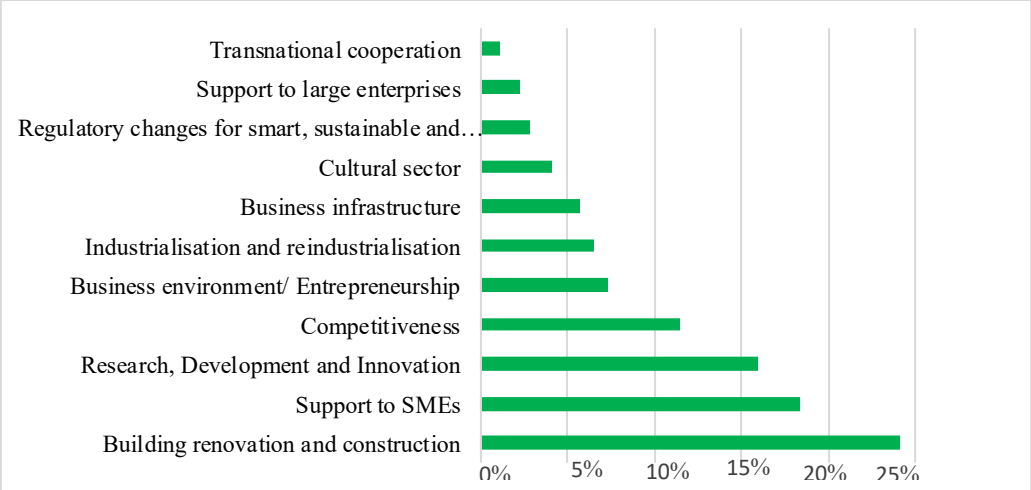


Source: Derived by the author based on the European Eco-Innovation Scoreboard 2021–2022

Figure 8. *Socio-Economic Outcomes in the EU Countries*

Finland (238.94) has achieved the highest socio-economic outcome scores in the category of eco-innovation leaders (blue line). Estonia (208.88) has achieved the best eco-socio-economic outputs score in the category of average eco-innovation performers (red line). In the category of the eco-innovation catch-up group, Romania (139.64) ranked first in socio-economic outcomes, and Hungary (5.55) had the lowest score of all EU countries. It can be noticed that the eco-innovation output score in Finland, which was the EU country with the best score, was forty-three times higher than in Hungary.

Eco-innovations have been incorporated into the effective sustainability initiatives and programmes that Finland has developed. The Finnish government established several institutions to support environmental reforms in a variety of fields, such as consulting assistance for SMEs concentrating on the environmentally friendly economy, technological innovation, and sustainability. Environmental laws and adaptable economic policies in Finland encourage the use of eco-innovation and creative technology. In any scenario, it is imperative that the survey responses centre on determining the reasons behind unequal or unfavourable levels of EU innovation in the member states, with an emphasis on the elements that propel and strengthen national economies towards the creation and application of eco-innovations. Figure 9 breaks down the expected distribution of each policy component based on an overview of policy fields released by the European Commission. The percentage denotes the overall share of the plan marked for each EU policy component.



Source: Derived by the author from the data published by the European Commission in 2022

Figure 9. *Summary of Expenditures Linked to Smart, Sustainable, and Inclusive Growth by Policy Field in the EU Countries*

The substantial adjustments and expenditures that EU member states will carry out with EU funds will increase the competitiveness and resilience of their national economies and pave the way for a sustained recovery. The Union backs policies that encourage entrepreneurial activity, competitiveness, smart, sustainable, and inclusive growth, industrialization and reindustrialization, infrastructure, better business environments, research, development, and innovation, and that support small and medium-sized enterprises (SMEs). Determining the obstacles and facilitators of eco-innovation are crucial for any nation. The various categories of variables that fall under the categories of external, internal, and international, influence how eco-innovation is implemented. The main obstacles to eco-innovation have been determied to be the following ones: insufficient funding to support large enterprises, absence of adequate transnational cooperation, high regulatory charges for smart, sustainable, and inclusive growth, unclear market demand, unpredictable expenditures; inadequate business environment, ineffective legislation; and the absence of expertise and experience in the research and development sector.

Conclusions

Eco-innovations are creative ways to accomplish sustainable growth and development and to obtain a competitive edge through environmentally friendly companies that maximize the use of currently available natural resources without endangering the well-being of the planet. The European Union has established high standards for mitigating the effects of environmental change. The Union wants to become carbon neutral by 2050 and to cut its emissions of greenhouse gases by 55% percent by 2030. Policymakers, businesses, and stakeholders must all be committed to achieving these aims and be open to making adjustments. Europe needs to use eco-innovative practices to maintain its competitive edge in clean technology and to ensure that it is carbon neutral by 2050. Eco-innovative practices are defined as any invention that advances towards the objective of sustainable growth and development. As a result, eco-innovation is essential to creating a circular economy, in which the foundation of production and consumption is the maximization of the product life cycle through material recycling and waste minimization. In addition to the factors that promote the development of eco-innovations, there are numerous obstacles associated with them that discourage EU economies from using these novel approaches.

The research results highlight the importance of improving eco-innovation in EU countries towards environmental responsibility and sustainability. It is crucial to compare national innovation accomplishments by using the eco-innovation index, which is constructed from suitable and objective indicators. This may serve as a fundamental resource that provides numerical numbers to comprehend the state of national eco-innovation in the EU countries. Sorting the index by subsections can provide helpful ramifications for decision-makers regarding the most effective way to support eco-innovation towards achieving sustainable growth and development. The eco-innovation indices are attractive because they provide EU member countries with country-specific values that indicate how competitive each nation is at the national level on newly raised environmental challenges.

Governments that are currently putting green measures into place may find that the performance of the analyzed economies can also provide helpful guidance for achieving sustainable development. With the right measure of the eco-innovation, the economies of the EU can also evaluate the overall welfare of the nations. The study suggests that sustainable policy implementation should be prioritized to boost prospective sustainable growth and development. It is expected that the creation and implementation of suitable, environmentally friendly policies will improve environmental conditions and contribute to the sustainable future of each European Union country.

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