

EU Eco-Innovation Index 2021

Policy brief

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Executive Summary

1- Over the last 10 years, 2012-2021, the European average of the Eco-Innovation Index has continued to increase. The most noticeable improvements over these years are in the resource efficiency outcomes, and eco-innovation outputs.

- Reductions in the GHG emission intensity and improvements in the energy productivity has driven a steady increase in the resource efficiency outcomes. Improvements in resource efficiency outcomes are also observed in Member States whose performance improved the most between 2012 and 2020: Slovenia, Italy, Germany, Luxembourg, and Ireland. This group of countries have witnessed an enhancement in their material productivity, energy productivity and/or GHG emission productivity.
- The continuous increase in the media coverage of related topics has led to a continuous increase in the eco-innovation outputs. This growth in media coverage has particularly driven the increase in eco-innovation outputs between 2012 and 2021 for Greece, Slovenia, Italy, Germany, the Netherlands, and Ireland.

Overall, eco-innovation has continuously improved for most of the European countries.

2- Investment in R&D also appears to have driven the biggest improvements witnessed across certain Member States over the ten-year period. Greece, the Netherlands, and Ireland all portray improvements in at least one of the indicators of eco-innovation inputs: governments environmental and energy R&D appropriations and outlays, total R&D personnel and researchers, and total value of green early-stage investments.

We find that eco-innovation leaders often benefit from a strong governmental support. Therefore, a stronger commitment from national governments to eco-innovation, including via their National Recovery and Resilience Plans, and especially from those Member States in the “catching up” category, is key to ensure that this positive trend in the index is witnessed for the years to come.

3- With eco-innovation performance gaining in importance, it has also become **more integrated within the European Innovation Scoreboard (EIS)**. Given that the EIS' Summary Innovation Index and the Eco-Innovation index are highly correlated, eco-innovation should be central to the strategic planning of national economies.

1.0 Introduction

The inherent link between a better natural environment, sustainable growth, and well-being¹ has pushed eco-innovation to the top of the European agenda. Therefore, it is crucial to monitor the European progress with regard to eco-innovation to ensure that Europe is moving towards its carbon neutrality, holistic sustainable development, and a green, innovative and competitive economy.

The European Eco-Innovation Index is key to help track the progress of Member States. The 2021 index follows the same methodology as the 2019 index with the exception of minor changes in data sources for four indicators as indicated in the annexes and the Technical Note provided on the website². The Eco-Innovation Index is based on five thematic areas:

1. Eco-innovation inputs, which includes financial and human capital investment in eco-innovative activities;
2. Eco-innovation activities, which defines the extent to which companies in a given country are active in eco-innovation;
3. Eco-innovation outputs, which measures the output of eco-innovation activities concerning the number of patents, academic literature and media coverage;
4. Resource efficiency outcomes, which pinpoint a country's efficiency of resources and GHG emission intensity;
5. Socio-economic outcomes, which aims to measure the positive societal as well as economic outcomes of eco-innovation.

This policy brief outlines:

- the performance and ranking of Member States under the “Eco-Innovation Index 2021”, measuring performance for the reference year 2020³;
- the trend of this index and its indicators over the last ten years (2012-2021).

To better understand the coherence between European initiatives, the policy brief provides a comparison between the European-Innovation Scoreboard and the Eco-Innovation Index. Lastly, we identify European policies and initiatives that are expected to be a driving force in enhancing eco-innovation in the EU.

2.0 The Eco-Innovation Index 2021: comparing the latest performance of Member States

The performance of EU Member States on environmental innovations is measured by the summary Eco-Innovation Index, which is a composite indicator obtained by taking an unweighted average of the 16 indicators included in the measurement framework (see Technical Note). Figure 1 shows the scores of this summary index relative to the performance of the EU in 2012 for all EU Member States in 2021. The 27 EU Member States are divided in three equally sized performance groups, where the top-9 countries belong to the Eco-Innovation Leaders, the 10th to 18th ranked countries belong to the Average Eco-Innovation

¹ Honkaniemi, L., Lehtonen, M. H., & Hasu, M. (2015). Well-being and innovativeness: motivational trigger points for mutual enhancement. *European journal of training and development*.

Pereira, Á., & Vence, X. (2012). Key business factors for eco-innovation: an overview of recent firm-level empirical studies. https://ec.europa.eu/environment/ecoap/indicators/index_en.

³ For each indicator, a reference year is identified based on data availability. For most indicators, this reference year will be lagging one or two years behind the year to which the Eco-index refers, in those cases the most recent data is used for the reference year 2020.

performers and the 19th to 27th ranked countries belong to the group of countries Catching-up with Eco-Innovation.

2.1 Three-tier classification of EU Member States

The Eco-Innovation Leaders in Europe for the year 2021 are – from highest to the lowest score – Luxembourg, Finland, Austria, Denmark, Sweden, Germany, France, Spain and the Netherlands, as shown in Figure 1. This ranking remains unchanged from the previous year. Compared to 2012, all these countries have witnessed an increase in their eco-innovation performance, although a higher increase could be witnessed for some countries. Section 3 identifies Member States that have witnessed the highest increase.

Average Eco-Innovation performers are, in descending order, Italy, Portugal, Slovenia, Czech Republic, Ireland, Belgium, Greece, Estonia, and Latvia. Only Italy's performance is slightly above the European average as illustrated in Figure 1. This ranking matches with the 2020 index, except for Estonia and Latvia which have switched their ranks. Similarly to the eco-innovation leaders, this group of countries collectively experienced an increase in eco-innovation since 2012.

Countries in the category of Catching-up with eco-innovation include – in descending order of scores - Lithuania, Croatia, Slovakia, Cyprus, Romania, Hungary, Malta, Poland, and Bulgaria. Figure 1 also shows that this performance difference is witnessed in the previous year. Relative to the year 2012, Romania is the only country in this group – but also at the EU level - for which a decrease in eco-innovation performance was identified.

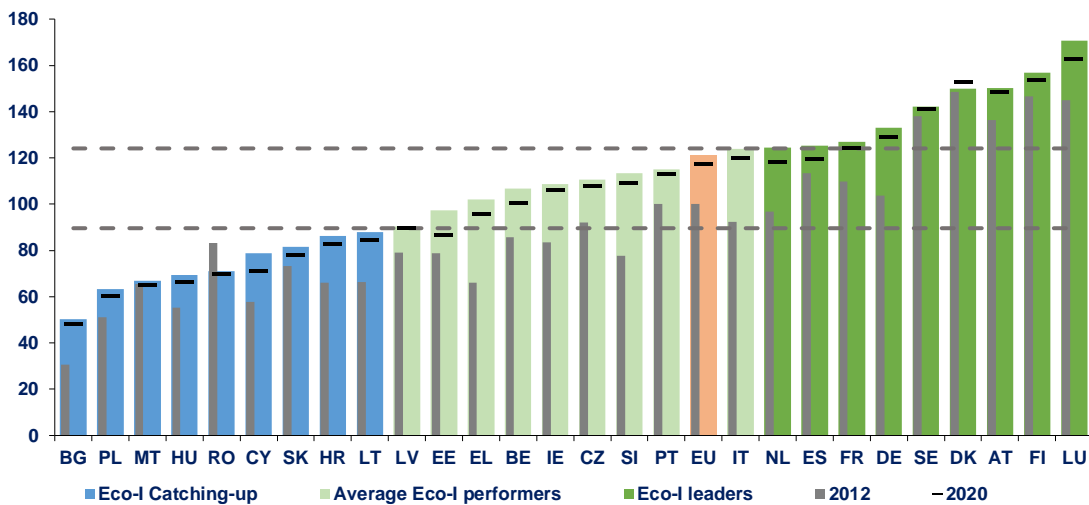


Figure 1 Performance of Eco-Innovation in 2021, 2020 and 2012

Note: Coloured columns show countries' performance in 2021, using the most recent data for 16 indicators, relative to that of the EU in 2012. The horizontal hyphens show performance in 2020, using for all years, the same methodology has been used. The dashed lines show the threshold values between the performance groups, where the threshold values of top 33.3% percentile and 66.7% percentile have been adjusted upward to reflect the performance increase of the EU between 2012 and 2021.

2.2 Performance by eco-innovation dimension of EU Member States

A further breakdown of the performance of Member States per each dimension of eco-innovation for the year 2021 is provided in Figure 2. The top four leaders, Luxembourg, Finland, Austria, and Denmark perform relatively well in the themes of eco-innovation outputs and socio-economic outcomes. In the group of average performers, we observe that Italy, Ireland, and Belgium score best in the resource efficiency outcomes. As for the group of countries that are catching-up with eco-innovation, no pattern is observed with respect to performance in each of the eco-innovation themes.

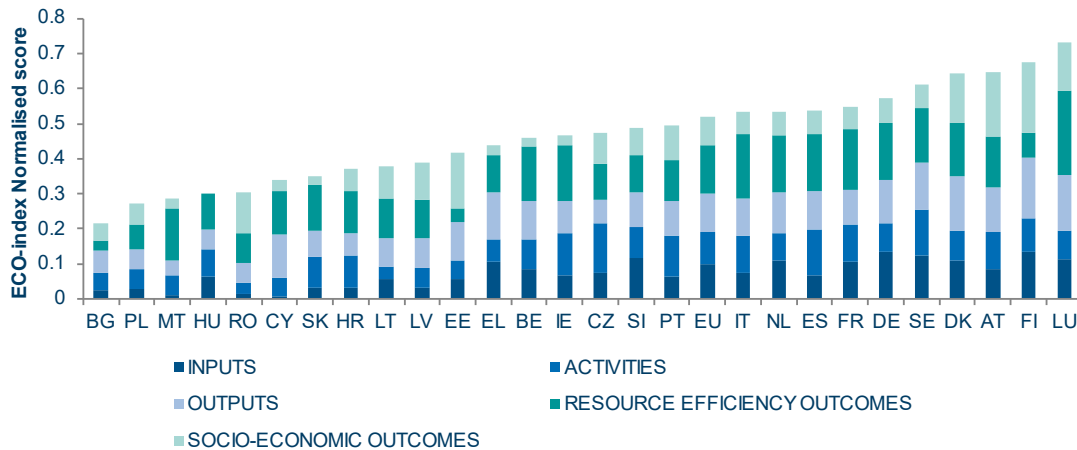


Figure 2 Eco-Innovation 2021 performance breakdown by theme
 Note: countries are presented in descending order of the normalized Eco-Innovation Index.

3.0 Trends in Eco-Innovation: tracking performance over a decade

Examining how the Eco-Innovation Index has evolved over the last 10 years on the European level as well as Member States level is crucial to understand how Europe is progressing. Moreover, understanding the evolution of the eco-innovation indicators is important to highlight areas that remain in need of further change and investment. In this section, we also focus on national trajectories to identify countries that witnessed the biggest improvement or regress over the last decade.

3.1 Evolution of the EU average over 2012-2021: A continuous increase

When examining the trends in the Eco-Innovation Index between 2012 and 2021 on the European level, we observe a continuous increase as illustrated in Figure 3. Over the 10-year period, we also observe that the dimension resource efficiency outcomes portray a continuous increase, where the indicators GHG emission productivity and energy productivity show the biggest improvements. Eco-innovation outputs are also consistently increasing; this increase is driven by a large surge in the media coverage of related topics specially from 2017 onwards.

Eco-innovation inputs and socio-economic outcomes depict a steady, minor growth over the years, as provided in Figure 3. Since 2017 eco-innovation activities fluctuate the most and the only indicator depicting an improvement after 2017 under this theme is the implementation of sustainable products among SMEs.

Relative to 2016, eco-innovation activities continue to decrease for the next five years, and socio-economic outcomes and eco-innovation inputs depict a slight increase. On the other hand, compared to 2016, eco-innovation outputs and resource efficiency outcomes continue to increase, as illustrated in Figure 4.

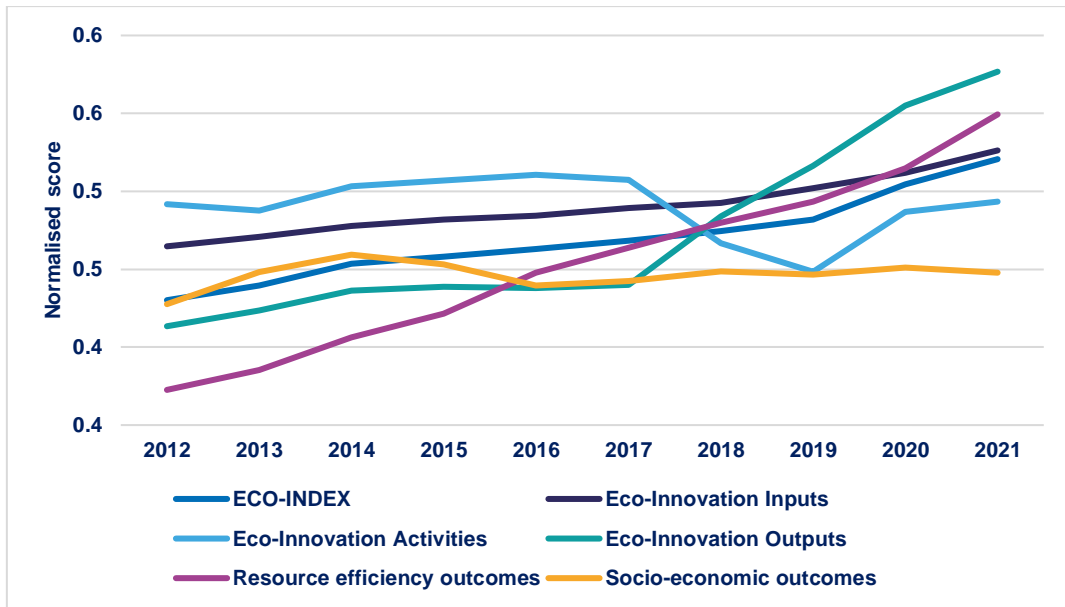


Figure 3 Trends in the Eco-Innovation Index and its indicators for the EU-27 average

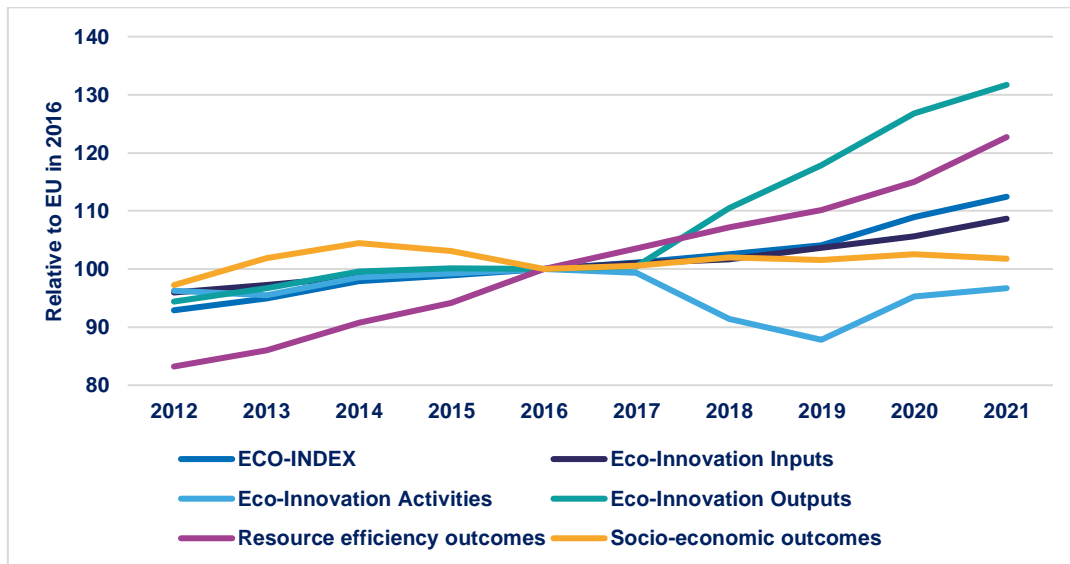


Figure 4 Trends in the Eco-Innovation Index and its indicators for the EU-27 average (relative to EU 2016)

3.2 Evolution of the Eco-Innovation indicators

The relative change in Eco-innovation indicators on the EU level between 2012 and 2021 is summarized in Figure 5. The data reference for the Eco-Innovation index are the years 2011 to 2020 when data is available for the full 10-year period, otherwise the most recent data is used for the reference year 2020.

The biggest noticeable difference is with respect to two indicators: media coverage of related topics and GHG emission productivity. GHG emission productivity, calculated as GDP in million euros (PPS) divided by Greenhouse gases in thousand tonnes, improved from 3.29 in 2011 to 4.58 in 2019 (most recent data availability); this indicator illustrates the GDP generated by GHG emissions. Improvements in the latter indicator has also driven eco-innovation performance in leading countries such as Germany (from 3.23 to 4.65) and Luxembourg (4.70 to 5.87), average performers such as Italy (4.12 to 5.62) and particularly catching-up performer Romania improving from 2.34 in 2011 to 4.39 in 2019.

Green investments in early-stage eco-industries in the EU increased considerably from \$17,500 per capita in 2018 to \$ 21,500 per capita in 2019. R&D personnel showed a steady increase over time in the EU from 2011 to 2019 from 1.23% of employment in 2011 to 1.51% in 2019.

A noticeable increase is also observed in the material productivity, water productivity, and energy productivity. With regard to regress in indicators, a slight decrease is witnessed in the implementation of resource efficiency actions among SMEs, eco-innovation patents, exports of products from eco-industries, and ISO 14001 certifications. Overall, across most of the eco-innovation indicators, there is no significant change between 2011 and 2020.

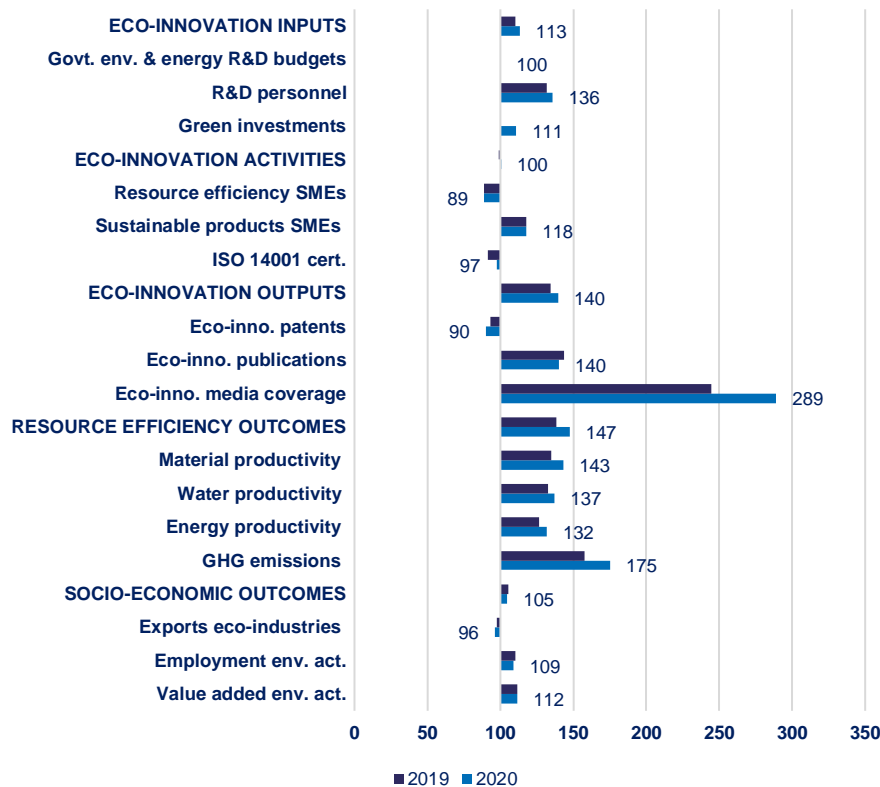


Figure 5 EU performance change between 2012 and 2020 by dimension and indicator
 Note: Normalised scores in 2021 (light blue coloured bars), and 2020 (dark blue coloured bars) relative to those in 2012 (=100).

3.3 National trajectories over a decade

The countries that experienced the biggest positive change in their eco-innovation performance between 2012 and 2021 are – from the country that experienced highest change to the one with the smallest change - Greece, Slovenia, Italy, Germany, the Netherlands, Luxembourg, and Ireland. For all these countries, the change in their Eco-Innovation Index is equal to at least 20 points, as illustrated in Figure 6. An overview of the indicators that demonstrated the biggest change in this group of countries is shown in Figure 7. The progress in this group of countries has been ensured by advancing in indicators of at least two thematic areas. It is worth noting that the media coverage of relevant eco-innovation topics has commonly increased for these countries. While, a wider media coverage certainly helps with creating awareness of eco-innovation and its importance, it does not necessarily translate into a more eco-innovative society.

The smallest change in the Eco-Innovation Index between 2012 and 2021 is observed in Denmark, Malta and Sweden, respectively. Regardless of this small progress, Sweden and Denmark consistently rank as leaders in eco-innovation.

The only country that depicts a negative change in eco-innovation performance in the last 10 years is Romania. In comparison to 2012, the Romanian Eco-Innovation Index has decreased by 12 points. The biggest decreased is observed in eco-innovation inputs (governments environmental and energy R&D appropriations and outlays, total R&D personnel and researchers, and total value of green early-stage investments), and eco-innovation activities (implementation of resource efficiency actions among SMEs, implementation of sustainable products among SMEs, and ISO 14001 certifications). Unfortunately, these remediate the noticeable improvement in GHG emissions productivity relevant to resource-efficiency outcomes.

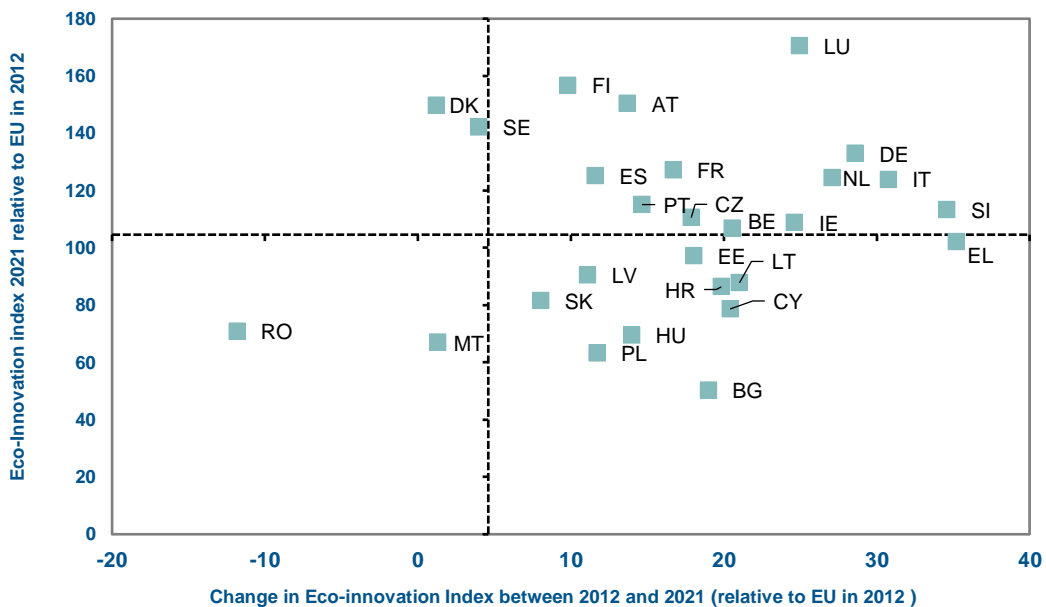


Figure 6 Performance and performance change of EU Member States' eco- innovation

Note: The vertical axis shows Member States' performance in 2021 relative to that of the EU in 2012. The horizontal axis shows the change in performance between 2012 and 2021 relative to that of the EU in 2012. The dashed lines show the respective scores for the EU.



Figure 7 Overview of eco-innovation indicators in Member States that demonstrated biggest positive change between 2012 and 2021

3.4 A closer look on the “catching up” group of Member States

Countries that are catching-up with eco-innovation continuously display fluctuations in their scores over the last ten years, as illustrated in Figure 8. Lithuania, Cyprus, Hungary, and Bulgaria display the biggest improvement between 2012 and 2020, respectively. Since 2017, Romania’s performance continues to decrease.

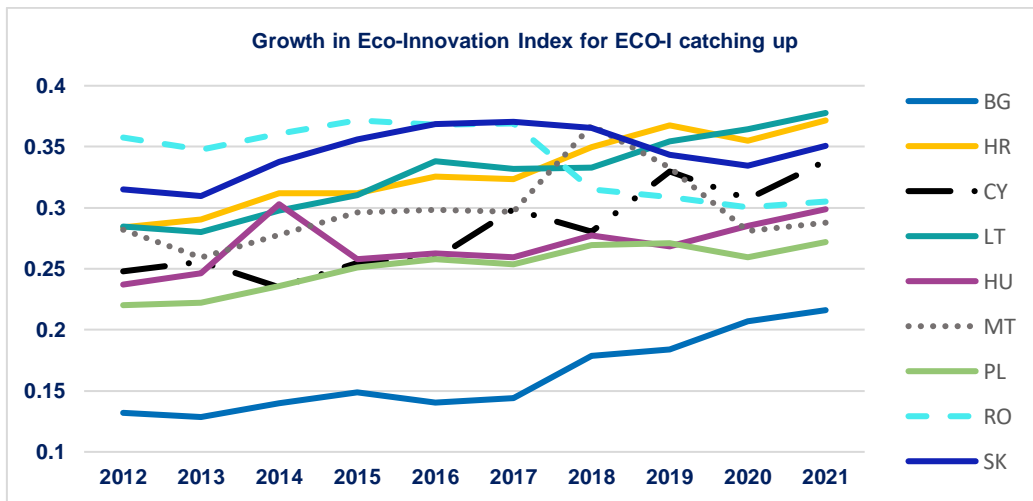


Figure 8 Growth in the normalised Eco-Innovation Index between 2011 and 2020

4.0 Eco-innovation in the wider European innovation framework

Advancing eco-innovation is an objective that is shared among numerous European initiatives and policies. Establishing the link between the Eco-Innovation Index and relevant indices is vital to understand how Member States’ performance might differ based on the underlying index. Moreover, to better understand the

evolution of the eco-innovation index, it is crucial to highlight relevant policy instruments and initiatives that may contribute to the advancement of eco-innovation.

4.1 The link between the Eco-Innovation Index and the European Innovation Scoreboard

The European Innovation Scoreboard (EIS) and the Eco-Innovation Index share a common goal of measuring innovation. The EIS is an annual index that provides a comparative assessment of the research and innovation performance of EU Member States and selected third countries, and the relative strengths and weaknesses of their research and innovation systems.

The two indices also have one common thematic area that they measure: environmental sustainability. The EIS uses three indicators to measure environmental sustainability: 1) resource productivity, 2) development of environment-related technologies, and 3) air emissions by fine particulates (PM2.5); the first and the second indicators are also included in the Eco-Innovation measurement framework.

Moreover, the Eco-Innovation Index score for 2019 is included in the EIS 2021 as a contextual indicator for all of the EU Member States in the country profile section of the EIS⁴. The contextual indicators also include the Greenhouse Gas Emission intensity indicator which is also part of the Eco-Innovation Index.

Given the commonality in indicators as well as thematic focus, it is not surprising that the Summary Innovation Index (i.e. the composite index of the EIS) and the Eco-Innovation index correspond very well with a positive correlation of 0.79. Mapping the normalised scores for the 2021 Summary Innovation Index and Eco-Innovation index in Figure 9 shows a strong positive relationship between the two indexes. In light of this strong correlation between the two indices, a more integrated view is needed for the performance of a national economy, with factors related to eco-innovation playing a major role.

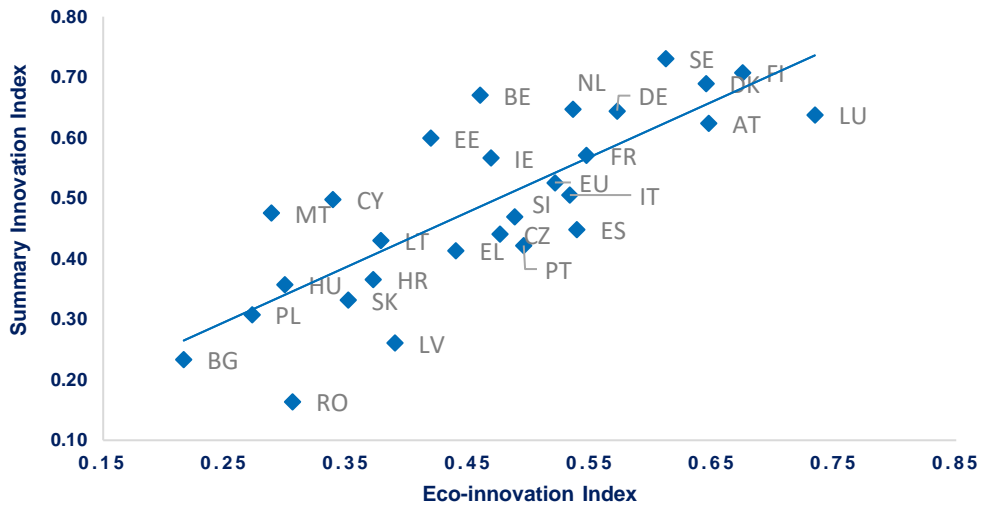


Figure 9 Comparison of the Eco-Innovation Index 2021 and the European Innovation Scoreboard 2021 (normalised scores)

⁴ The data compilation deadline for the EIS is end of April 2021. The Eco-Innovation Index 2021 was published in June 2021

4.2 Next Drivers of eco-innovation at the EU level, 2021-2027

For the upcoming period, the relative change in Member States' performance in eco-innovation will be to some extent ascribed to changes in national policies as well as European policies instigated by the Covid-19 pandemic and global efforts to achieve climate neutrality (NB: as documented in the European review of the Member States' performance, regional and national policies have already given a first impetus to eco-innovative practices -see 2019 country profiles⁵.)

The **European Green Deal**⁶ endorsed in 2019 is the flagship ambition steering all European efforts to reach long-term sustainability and climate neutrality. This deal is accompanied by multiple strategies, policy instruments and targets that are linked to eco-innovative, sustainable and digital technologies like the New Circular Economy Action Plan⁷ and the 2030 Biodiversity Strategy⁸. Moreover, the Zero Pollution Action Plan⁹ adopted in May 2021 points to innovation as a key stimulus to achieve cleaner air, water and soil. The Fit for 55 Package, set to be launched in mid-July 2021, is another catalyst to eco-innovation as it will be the main vehicle for the EU and its Member States to cut emissions by at least 55% by 2030.

The Green Deal is streamlined across various EU policy instruments as evident in **Horizon Europe** programme which is giving a further push towards sustainable innovation. Within its 2021-2022 work programme¹⁰ (worth €14.7 billion), four in ten Euros (almost €6 billion) will be invested into research and innovation that supports the European Green Deal and its climate neutrality targets. The LIFE programme (around €5.4 billion for the 2021-2027 period) and the Innovation Fund (financed from revenues from the EU Emissions Trading System, around €10 billion for the period up to 2030) will also be pivotal to finance "close-to-market" breakthrough and demonstration projects.

The on-going Covid-19 pandemic has highlighted the necessity of eco-innovative societies, further urging countries to advance their eco-innovation in order to increase their resilience.

- Although empirical research is still limited, first studies¹¹ show that sustainable innovations have increased during the pandemic. The pandemic has urged both public and private stakeholders to rapidly develop and implement innovative solutions for work, education, travel, communication and almost any other aspect of life. Teleworking, a type of social eco-innovation, has brought forward a range of environmental benefits due to reduced daily travels and traffic, resulting in a drop in CO₂ emissions and energy consumption as well as in less pollution.
- Many countries – and the European Union through its NextGenerationEU fund– have pledged to build back better and greener from the global crisis. For most developed economies, the pandemic

⁵ https://ec.europa.eu/environment/ecoop/country_profiles_en

⁶ European Commission. (2019). The European Green Deal. https://ec.europa.eu/info/sites/info/files/european-green-deal-communication_en.pdf

⁷ European Commission. (2020c). A new Circular Economy Action Plan - For a cleaner and more competitive Europe (Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions COM(2020) 98 final). European Commission.

⁸ European Commission. (2020g). EU Biodiversity Strategy for 2030 - Bringing nature back into our lives (Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions COM(2020)380). European Commission.

⁹ European Commission. (2011). Zero Pollution Action Plan. https://eur-lex.europa.eu/resource.html?uri=cellar:a1c34a56-b314-11eb-8aca-01aa75ed71a1.0001.02/DOC_1&format=PDF

¹⁰ Commission Implementing Decision (2021). Adopting a financing decision for 2021-2022 as regards the horizontal support expenditure in the framework of the Specific Programme implementing Horizon Europe – the Framework Programme for Research and Innovation (2021-2027). URL: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/common/wp-call/2021-2022/wp-horizontal-expenditure_horizon-ec-euratom-2021-2022_en.pdf

¹¹ Loia, F.; Adinolfi, P. Teleworking as an Eco-Innovation for Sustainable Development: Assessing Collective Perceptions during COVID-19. *Sustainability* 2021, 13, 4823. <https://doi.org/10.3390/su13094823>;

Gregurec, I.; Tomičić Furjan, M.; Tomičić-Pupek, K. The Impact of COVID-19 on Sustainable Business Models in SMEs. *Sustainability* 2021, 13, 1098. <https://doi.org/10.3390/su13031098>

Sprus, C. M. 2020. Taking advantage of COVID-19 to strengthen sustainable mobility with digital solutions: https://www.ey.com/en_ch/decarbonization/advantage-covid19-strengthen-sustainable-mobility; Background study: EY and Wuppertal Institute (2020). Zwischen- bilanz COVID-19: Umweltpolitik und Digitalisierung: https://www.bmu.de/fileadmin/Daten_BMU/Download_PDF/Digitalisierung/zwischenbilanz_covid19_bf.pdf

has provided a chance for reflection on the different areas in which innovative ideas could create durable gains in sustainability.

5.0 Concluding remarks

The Eco-Innovation Index helps tracking progress over time and supports our understanding of the evolution of Member States. Yet it is crucial to consistently examine the change in the underlying indicators to truly understand the existing state of affairs.

Over the last ten years, the classification of countries in terms of eco-innovation remains unchanged. This suggests that **more effort is needed to help countries move from catching up eco-innovators to average** and, eventually, leading eco-innovators. As can be seen from an example of countries with the biggest positive change in their eco-innovation performance, advancements have been driven by changes in a couple or more thematic areas of the index as well as a strong governmental assistance.

Moreover, governments' support for R&D and green investment appear to be an important driver of eco-innovation. As witnessed among leading eco-innovators, strong governmental support is crucial for progress and should continuously increase over the years. Programmes such as Horizon Europe and European initiatives such as the Policy Support Facility will give an extra boost to Member States needing to reform their national post-Covid R&D systems to create more innovative, sustainable and resilient societies.