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RESOURCE EFFICIENCY INDICATORS IN MEASURING ECO-INNOVATION IN EU COUNTRIES

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ABSTRACT: The aim of the article is to analyse the diversity of the level of eco-innovation in the EU Member States in the field of resource efficiency. For this purpose, the resource efficiency outcomes indicator and its sub-indicators were used. The study was prepared on the basis of data from the General Directorate for the Environment. Using positional statistical measures, an analysis of the diversification of the eco-innovation level of the European Union Member States in 2012-2021 was carried out, and the trends of changes in this differentiation were identified. The analysis showed that the difference between the level of eco-innovation in the indicators studied in the EU Member States does not decrease, and there is still a very large difference between the most and the least innovative countries. To date, we have not found this kind of research, so the research carried out fills the research gap in this area.

KEYWORDS: Eco-innovation, Eco-innovation Scoreboard - Eco-IS, productivity, Resource Efficiency Outcomes index

Introduction

The article discussed the problem of eco-innovation scoreboard in the European Union member states. Innovation is one of the most important factors determining the development possibilities of any country, and eco-innovation is a special type of innovation. Eco-innovations are innovations that lead to significant and visible progress in environmental protection. Innovation plays an important role in economic growth. Moreover, its role is now more significant than traditional development factors such as land, capital and labour. Although innovation does not play a decisive role in national and international economic policies, it is a very important element of sustainable development strategies (Rennings, 2000). Innovation is, therefore, crucial to enable economic development on the one hand and to create new business value on the other. In recent years, pollution prevention and the pursuit of a circular economy have become increasingly important. Thus, eco-innovation aims to enable environmental improvement. Furthermore, the current economic crisis and climate change present an excellent opportunity to move towards a green economy by accelerating eco-innovation, which will benefit both people and the planet.

The article undertakes an analysis of one of the elements of the eco-innovation index developed by the European Commission, namely resource efficiency. The main area of interest was the diversity of indicators in this area between EU countries. To this end, the construction of the Eco-innovation Index and the Resource efficiency outcomes and its components were first discussed. Then, using statistical methods, an analysis of the diversity of EU countries in the area of resource efficiency is presented. The literature lacks this type of analysis, so the research carried out fills the research gap in this area. The analysis shows a large variation in the level of eco-innovation of EU Member States in this area.

Literature Review

At present, academic research into the issue of eco-innovation and indicators to measure it continues to deepen. In general, many definitions of the concept can be distinguished. The creator of the concept and theory of economic development based on innovation, Schumpeter (2011) defined innovation as the introduction of new or improved products into production, the introduction of a new or improved method of production, the opening of new markets, the application of a new method of selling or purchasing, the use of new raw materials or semi-finished products, or the introduction of a new organisation of production. The concept of eco-innovation is fairly new (Díaz-García et al., 2015). Fussler and James (1996) are considered the forerunners of the term eco-innovation. Furthermore, James (1997) defined eco-innovation as "new products and processes that provide value to the customer and business, but significantly reduce environmental impacts".

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They are new or significantly improved products, processes, organisational or marketing methods that are more beneficial to the environment than alternatives and also benefit the enterprise that implements them (Rozkrut, 2014; Ziółkowski, 2008; Kemp & Pearson, 2008; Ottman, 2011). The primary objective of eco-innovation is to benefit the environment and to reduce the negative impact of economic activity on the natural environment by reducing energy consumption, the consumption of natural resources or the emission of harmful substances (Ottman et al., 2006). Among the many definitions of this concept, it is important to draw attention to the definition given by UNEP. As defined by UNEP, eco-innovation is a new approach to business that promotes sustainability throughout the life cycle of a product while increasing the productivity and competitiveness of the company (Eco-Innovation). Klaus Rennings, on the other hand, uses the term eco-innovation to describe three types of sustainability-related changes: technological, social and institutional innovations (Rennings, 2000). One of the most relevant definitions of eco-innovation is the one given by the MEI project. According to this project, eco-innovation is understood as "production, assimilation or use of a product, production process, service or management or business methods that are new to the undertaking and which result, throughout their life cycle, in reduced environmental risks, pollution and other negative impacts the use of resources (including energy consumption) as compared to relevant alternatives (MEI project definition)" (Kemp, 2009).

Eco-Innovation Scoreboard and resource efficiency outcomes

Measuring the eco-innovation of national economies is a more difficult task than measuring their overall innovation. This is a result of the need to take into account the effects of implementing innovative environmental solutions and the difficulties associated with defining the scope of research, as well as the method of measuring the effects of introducing new environmental solutions. The European Commission has launched the Eco-innovation Observatory – EIO. The EIO, established in 2009, is an initiative funded by the European Commission under the auspices of the European Commission's Directorate-General for Environment to observe the types, degrees and impacts of eco-innovation in Europe.

The EIO developed in 2010 the first tool to assess and illustrate the level of eco-innovation, namely the Eco-Innovation Scoreboard – Eco-IS. The Eco-IS shows how the level of eco-innovation in the Member States differs from the EU average, highlighting the strengths and weaknesses of each country (Pakulska, 2018). The Eco-Innovation Scoreboard consists of 16 indices divided into five thematic areas in two groups:

- Indices directly related to eco-innovation, such as:
  - Expenditures (government expenditure on environmental and energy R&D, total number of researchers, green investments of PE/VC funds),

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  - Activities (companies introducing eco-innovations improving material and energy efficiency and having ISO 14001 certificate),
  - Results (patents, publications, media coverage of eco-innovation).
- Indices relating to the effects of eco-innovation and these are:
  - Environmental (efficiency of use of energy, raw materials, water and carbon emissivity). Resource efficiency outcomes (see Table 1) refer to achievements in eco-innovation aimed at saving resources such as materials, energy and water and reducing greenhouse gas emissions.
  - Socio-economic (development of "eco-industries" of the economy).

Table 1. Resource efficiency outcomes indices

Eco-innovation Resource efficiency outcomes	Source of data
Material productivity (GDP/Domestic Material Consumption)	EUROSTAT
Water productivity (GDP/Water Footprint)	EUROSTAT
Energy productivity (GDP/gross inland energy consumption)	EUROSTAT
GHG emissions intensity (CO2e/GDP)	EEA

Source: authors' work based on https://ec.europa.eu/environment/ecoap/indicators/index_e [10-01-2022]; Spaini et al., 2018, p. 3.

Productivity is a commonly used term and applies to all types of activities. In the most general terms, it is "the ratio of the quantity of output produced and sold during a specified and considered period to the quantity of input resources used or consumed". The input resources in question are nothing other than the various system inputs and system resources used to produce the final product. System inputs can be, e.g. materials, energy and information, and system resources can be, e.g. people and capital (Encyklopedia Zarządzania, 2021). In economic and social terms, productivity is understood as "a progress-oriented way of thinking expressed in the organisation and support of all kinds of undertakings aimed at continuously improving the efficiency of an organisation's operations, improving its market position and increasing employees' satisfaction with working conditions and living standards" (Lis, 1999). Indices of green economy include water and energy productivity. Water productivity illustrates the GDP generated by household water consumption, and energy productivity illustrates the GDP generated by domestic energy consumption (Spaini et al., 2018). Emission intensity is the volume of emissions per unit of GDP. GHG emissions intensity is an index of greenhouse gas emissions in relation to the intensity of a specific activity or industrial production process. This index is used to estimate air pollution or greenhouse gas emissions based on the amount of fuel burned, number of animals in animal husbandry, industrial production levels, distances travelled or similar business data (Climat Council, 2015).

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Discussion

According to many authors, e.g. European Environment Agency „Eco-innovation is crucial for achieving the European Green Deal objective of transitioning to a carbon-neutral and sustainable economy. The European Commission's eco-innovation index shows that from 2013 to 2022, eco-innovation increased in the EU" (European Environment Agency, 2023). Furthermore, it is envisaged that through the Green Deal, where environmental and climate-related targets are set, the number of eco-innovations will increase.

Between 2013 and 2022, there has been an improvement in various indicators related to resource efficiency (Komisja Europejska, 2022).

It should, therefore, be concluded that an upward trend in the eco-innovation indicator was observed between 2013 and 2021. To a large extent, this increase was also due to improvements in the resource efficiency output dimension, in particular in the productivity of greenhouse gas emissions, i.e. a decrease in greenhouse gas emissions generated per unit of gross domestic product (GDP). However, the greatest improvement was observed in the number of publications on eco-innovation, which are included in the eco-innovation output dimension (Komisja Europejska, 2022). Eco-innovation is a complex process, and the significant differences that exist between EU countries in terms of GDP or production structure obscure the possible overall convergence on this common pathway. As noted by Colombo et al. (2019), eco-innovation is, to some extent, a fashionable buzzword, and there is still room to improve the discourse in order to stimulate economic growth and sustainable development. So far, Eco-innovation has been primarily framed in terms of eco-efficiency, but the emergence of circular economy thinking will provide an opportunity to reformulate eco-innovation as a systemic change (Colombo et al., 2019).

The differential involvement of EU countries (2013-2020) in eco-innovation and innovation activities is confirmed in their study by Sobczak and Głuszczak (2022). They indicated that in 2013, an average of 1.81% of European SMEs implemented resource efficiency measures (saving water energy, using mainly renewable energy, recycling), but in 2020 this share had decreased to 1.64%. The same was also true for eco-innovation activities involving the implementation of sustainable products, where the average involvement of SMEs in EU countries was slightly higher in 2013 – 0.22% and declined to 0.21% in 2020 (Sobczak & Głuszczak, 2022).

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Research methods

Both the resource efficiency outcomes index and its sub-indices are characterised by relatively high variability (European Commission, 2022); the smallest differences are recorded for the GHG emission intensity index. In order to assess the degree of this variation, as well as to analyse the trends of changes over the years, statistical calculations were carried out, which, to a certain extent, allow us to answer the question of what the variation in the level of these indices in the European Union countries, and whether this variation is decreasing or increasing.

To represent the degree of variation, positional statistical measures were used for the determination of which we take into account not all but selected values. Positional measures are not sensitive to outliers (extreme values). The choice of such measures is based on the very high value of the interval, which indicates the existence of observations significantly different from the mean. Since the classic measures are exact measures that do not omit any of the objects under study, the classic measures may pose interpretation problems when the values of the indices are shaped in this way (Pułaska-Turyna, 2011).

Results of the research

The sample range is a measure showing the difference between the smallest and the largest value of the index under study. The larger the indicator, the less evenly distributed the level of eco-innovation is and the greater the dispersion of individual country indicator values around the average level of eco-innovation. The smallest difference is recorded when the spread is 0, which does not occur in practice. The widest range (see Figure 1) is recorded for the water productivity indicator, with slight changes in individual years. For all indicators, the range remains at a similar high level throughout the study period, most often even with an upward trend. For all indicators, a slight increase was recorded in 2018 compared to the previous year. Only for the indicator GHG Emissions Intensity and Water Productivity in 2021, the indicator is slightly lower than in 2012. This shaping of the indicator means that throughout the research period, the range between the level of eco-innovation in the indicators examined in the EU countries is not decreasing, and there is still a very large difference between the most and least innovative countries.

`Due to the high level of the range, which indicates that there are significant outliers from the average, the median will be used for further analysis. It is called the median value and divides the group into two equal parts. Data from 27 countries that are currently members of the EU were used for the analysis. Therefore, the median is equal to the value of the indicators for the middle country, with half of the countries presenting indicators below the median and the other half below

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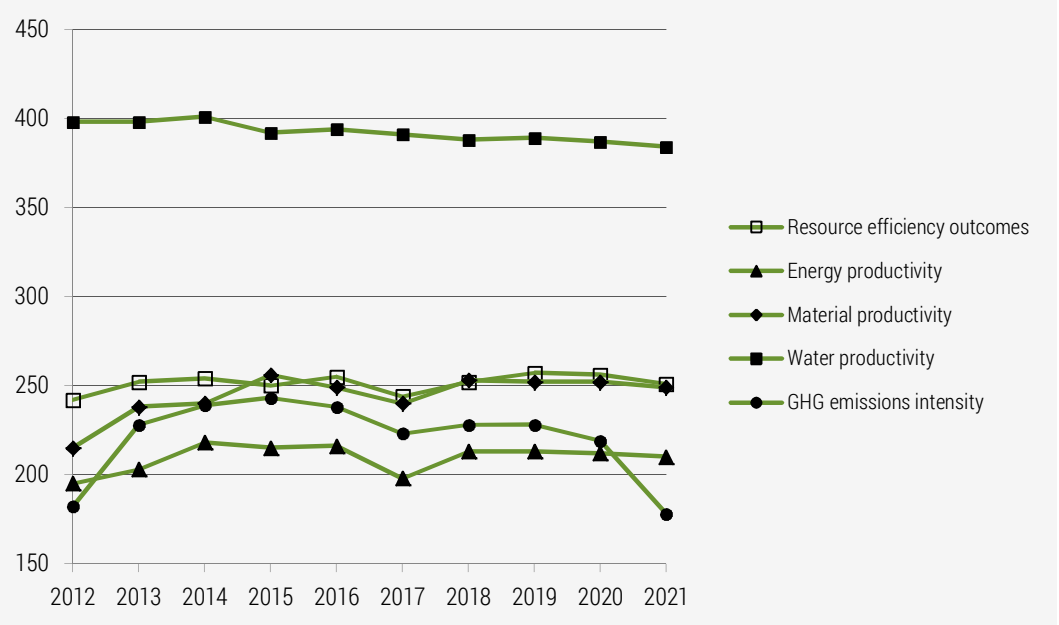

Figure 1. Range illustrating resource efficiency outcomes and its indices in EU countries

Source: authors' work based on https://ec.europa.eu/environment/ecoap/indicators/index_e [10-12-2021].

the median. Only for the Energy Productivity indicator is Belgium, the 'middle' country for most of the period. Different countries occupy the position of the 'middle' country for the Resource Efficiency Outcomes indicator in different years, although most often, the countries are in the middle zone throughout the period. For all indicators analysed, the median increases to a greater or lesser extent throughout the research period. Slight decreases are recorded for various indicators from 2014 to 2016 and 2018. The only indicator for which the median increased steadily without periodic decreases was GHG Emissions Intensity. The smallest increase was recorded for the Energy Productivity indicator, which has the highest variability throughout the period, but the year-to-year changes are small. This indicator is also higher in 2021 than in 2012, although it has increased relatively little compared to the other indicators. The increase in the median means that the level of the surveyed eco-innovation indicators is steadily increasing. This is a positive development, as it signifies an increase in the innovation of the Member States over the period under study in terms of the characteristics examined.

For all analysed indicators, the median increases to a greater or lesser extent throughout the study period (see Figure 2). Slight decreases were recorded for various indicators between 2014, 2016, and 2018. The only index in which the

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median increased consistently without periodic decreases was GHG Emissions Intensity. The smallest increase was recorded for the Energy Productivity index, which is characterised by the highest volatility throughout the period, but the changes from year to year are small. This index in 2021 is also higher than in 2012, although compared to other indicators, it increased relatively little. The increase in the median means that the level of eco-innovation indices studied is systematically increasing. This is a positive phenomenon, as it means an increase in innovation of Member States in the period under review in terms of the examined characteristics.

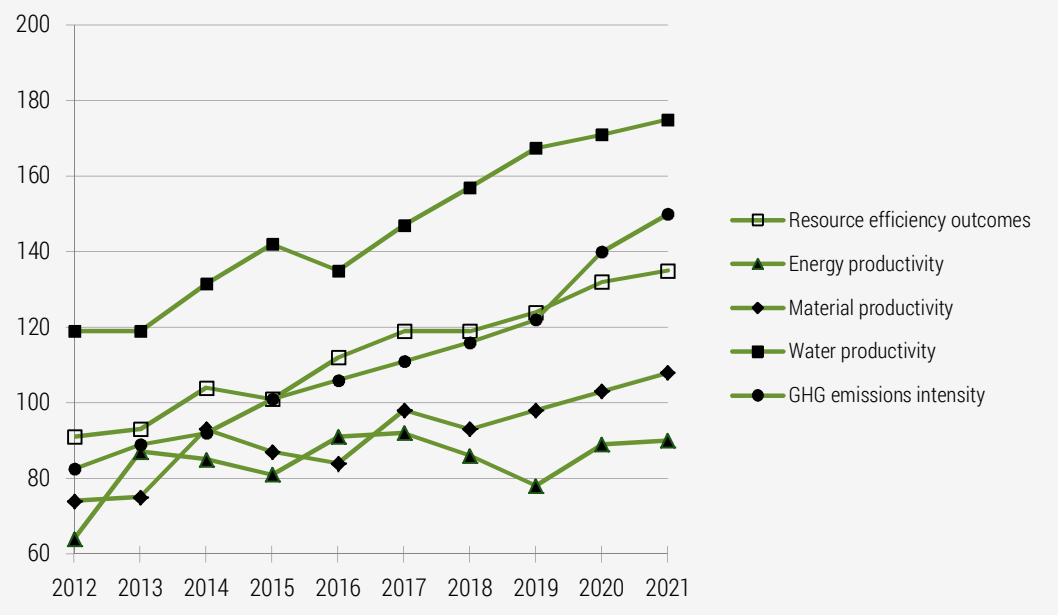

Figure 2. Median illustrating resource efficiency outcomes and its indices in EU countries

Source: authors' work based on https://ec.europa.eu/environment/ecoap/indicators/index_e [10-12-2021].

A measure showing how different the countries under study are in terms of the characteristics analysed is the positional coefficient of variation, which shows the typical percentage deviation from the median value. When analysing the level of this index, it can be concluded that the variation in the level of eco-innovation of the EU countries over the period in question for all the indices examined is very strong and, in most cases, significantly exceeds 30% (see Figure 3). It should be stressed that high values for this measure appear very rarely. Volatility declines steadily only for the GHG Emissions Intensity index, reaching 37% in 2021, just above the boundaries between very strong and strong variation. A downward trend throughout the period is also visible for the aggregate index

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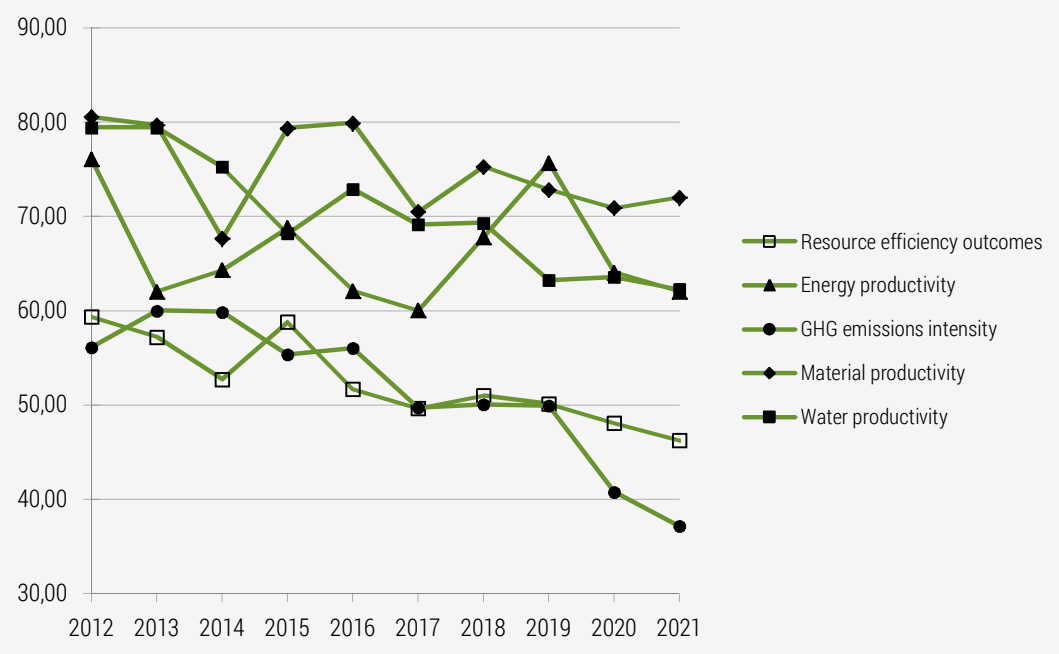

Figure 3. Positional coefficient of variation illustrating resource efficiency outcomes and its indices in EU countries

Source: authors' work based on https://ec.europa.eu/environment/ecoap/indicators/index_e [10-12-2021].

and resource Efficiency Outcomes. No trend can be seen for the other indices, as the values change significantly from year to year (increasing or decreasing).

The analyses carried out so far have made it possible to determine the existence of great diversity in the analysed indices of the level of eco-innovation in the EU countries. Further analysis will answer the question of how the distribution of index values develops. For this purpose, the skewness and kurtosis index was used. The skewness index shows whether the distribution is normal or asymmetric (left- or right-handed). Left asymmetry means that most numbers are smaller than the average, while right-handed asymmetry means that more numbers are larger than the average. For all indices, right-handed asymmetry of the distribution was found, but of varying intensity, meaning that the dominant of the results is smaller than the median, which is smaller than the average. For the Resource Efficiency Outcomes summary index, the coefficient of skewness indicates a strong rightward asymmetry, with the asymmetry decreasing significantly over the years (see Figure 4). A particularly large decrease in right-handed asymmetry was recorded for the Water Productivity index (but from 2020 onwards, the asymmetry shifts again towards the right-hand side) and GHG Emissions Intensity.

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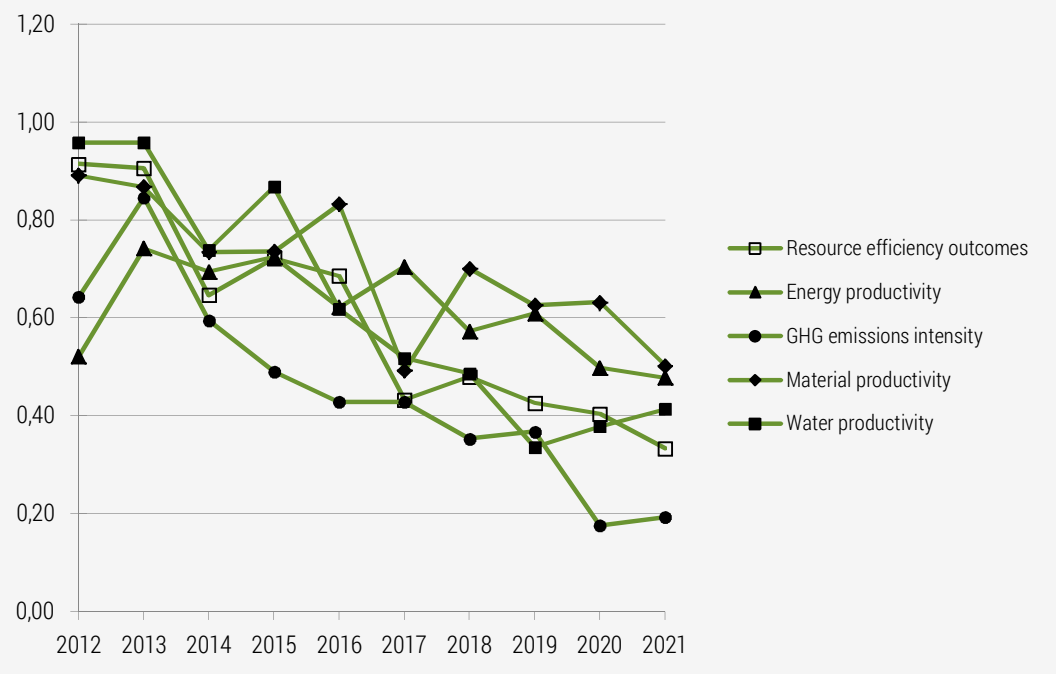

Figure 4. Skewness illustrating resource efficiency outcomes and its indices in EU countries

Source: authors' work based on https://ec.europa.eu/environment/ecoap/indicators/index_e [10-12-2021].

The kurtosis index shows the concentration of the distribution, i.e. the density of the results around the average value. It answers the question of whether the distribution is normal, meaning that most values are evenly distributed on both sides around the average. In the initial period, the kurtosis value for most of the eco-innovation indices examined was increasing, i.e. the level of eco-innovation was concentrated around the EU average, and there were very few countries with extreme index values. However, in later periods (despite periodic increases), the kurtosis values decreased, which means that the variation of the indicators increased. For most of the analysed eco-innovations indices, almost throughout the research period, the distribution was characterised by a flattening greater than normal. It is not possible to notice the trend of the kurtosis index (see Figure 5). Statistical analysis does not, therefore, allow us to characterise the distribution of the studied eco-innovation indices for the EU countries. It is only possible to state how it evolved in the individual analysed years.

Statistical analysis of the Resource Efficiency Index shows that there are significant differences between EU Member States. Moreover, most of the statistical measures used indicate that this disparity is not decreasing and that there is still a very large gap between the most and least ecologically innovative countries.

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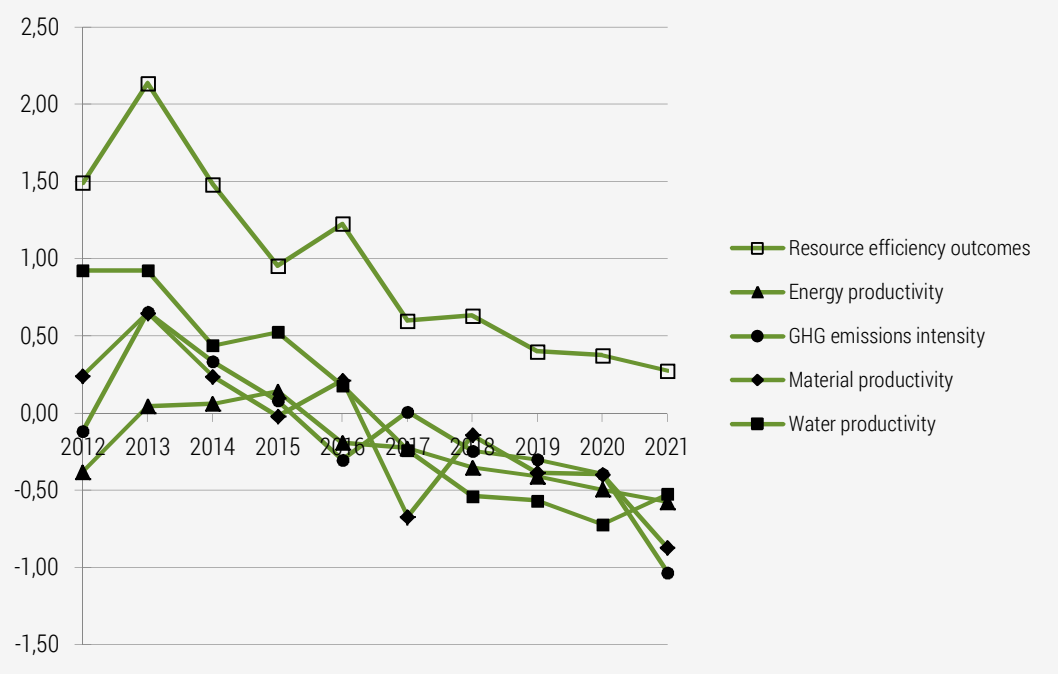

Figure 5. Kurtosis illustrating resource efficiency outcomes and its indices in EU countries

Source: authors' work based on https://ec.europa.eu/environment/ecoap/indicators/index_e [10-12-2021].

Conclusions

Taking the above into account, it is concluded that the objective to analyse the variation in the level of eco-innovation across EU Member States in terms of resource efficiency has been achieved using the indicator (and its sub-indicators) of resource efficiency effects. Based on the analysis of the variation in the level of eco-innovation of EU Member States from 2012 to 2021, it was concluded that the variation in the level of eco-innovation in the indicators studied across EU Member States is not decreasing, and thus, there is still a very large gap between the most and least innovative countries. Moreover, the authors indicate that eco-innovations can have a twofold positive impact on resource efficiency. Namely, they can, on the one hand, increase the economic value generated and, on the other hand, reduce the pressure on the environment. Moreover, Poland ranks far behind not only the leaders in eco-innovation but also the countries that, like Poland, are counted among the catching-up countries in terms of eco-innovation. Furthermore, improving resource efficiency in Europe will contribute to achieving economic, social and environmental policy objectives.

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The contribution of the authors

Conception, J.P. and M.R.; literature review, M.R.; acquisition of data and analysis and interpretation of data, J.P.; draft of article preparation, J.P. and M.R.; critical revision of the article, J.P. and M.R.

References

Berkhout, F. (2011). Eco-innovation: reflections on an evolving research agenda. International Journal of Technology, Policy and Management, 11(3/4), 191-197.

Climat Council. (2015). *What's The Difference Between Absolute Emissions And Emissions Intensity?* https://www.climatecouncil.org.au/what-is-the-difference-between-absolute-emissions-and-emissions-intensity/

Colombo, L. A., Pansera, M., & Owen, R. (2019). The discourse of eco-innovation in the European Union: An analysis of the Eco-Innovation Action Plan and Horizon 2020. Journal of Cleaner Production, 214, 653-665. https://doi.org/10.1016/j.jclepro.2018.12.150

Díaz-García, C., González-Moreno, Á., & Sáez-Martínez, F. J. (2015). Eco-innovation: insights from a literature review. Innovation: Management, Policy & Practice, 17(1), 6-23. https://doi.org/10.1080/14479338.2015.1011060

Encyklopedia Zarządzania. (2021, December 8). *Produktywność.* https://mfiles.pl/pl/index.php/Produktywność (in Polish).

European Commission. (2022). *Eco-Innovation at the heart of European policies.* https://ec.europa.eu/environment/ecoap/indicators/index_e

European Environment Agency. (2023, April 27). *Eco-innovation index.* https://www.eea.europa.eu/en/analysis/indicators/eco-innovation-index-8th-eap

Fussler, C., & James, P. (1996). *Driving Eco-Innovation: A Breakthrough Discipline for Innovation and Sustainability*. London: Pitman Publishing.

James, P. (1997). The Sustainability Circle: a new tool for product development and design. Journal of Sustainable Product Design, 2, 52-57.

Kemp, R. (2009). Measuring Eco-innovation Results from the MEI project. *Proceedings of the Global Forum on Environment on eco-innovation,* Netherlands, Maastricht, University UNU-MERIT.

Kemp, R., Andersen, M. M., & Butter, M. (2004). *Background Report about Strategies for Eco-innovation. Report for VROM*. Maastricht: Maastricht Economic Research Institute on Innovation and Technology.

Kemp, R., & Pearson, P. (2008). Final report MEI project about measuring eco-innovation. Final report. Netherlands. http://www.merit.unu.edu/MEI/index.php

Kobryń, A., & Prystrom, J. (2017). Multi-criteria Evaluation of the Eco-innovation Level in the European Union Countries. Problemy Ekorozwoju – Problems of Sustainable Development, 12(2), 15-26.

Komisja Europejska. (2022). Komunikat Komisji Do Parlamentu Europejskiego, Rady, Europejskiego Komitetu Ekonomiczno-Społecznego I Komitetu Regionów w sprawie ram monitorowania 8. programu działań w zakresie środowiska: pomiar postępów na drodze do osiągnięcia celów priorytetowych programu na 2030 r. i 2050 r., Pub. L. No. 52022DC0357. https://op.europa.eu/pl/publication-detail/-/publication/81c3af2f-0cc1-11ed-b11c-01aa75ed71a1/language-pl (in Polish).

DOI: 10.34659/eis.2023.87.4.446

Lis, S. (Ed.). (1999). *Vademecum produktywności*. Warszawa: Placet. (in Polish).

OECD. (2022, April 18). *Green growth and eco-innovation.* https://www.oecd.org/sti/ind/greengrowthandeco-innovation.htm

Ottman, J. (2011). *The New Rules of Green Marketing: Strategies, Tools, and Inspiration for Sustainable Branding.* Sheffiled: Greenleaf Publishing.

Ottman, J. A., Strafford, E. R., & Hartman, C. L. (2006). Avoiding green marketing myopia: Ways to improve consumer appeal for environmentally preferable products. Science and Policy for Sustainable Development, 48(5), 22-36. https://doi.org/10.3200/ENVT.48.5.22-36

Pakulska, J. (2018). Diversification of eco-innovation in the EU Member States. *Proceedings of the International Conference on European Integration,* Czech Republic, Ostrava, 1131-1138. https://is.muni.cz/publication/1418268/ICEI-2018_Proceedings.pdf

Park, M. S., Bleischwitz, R., Han, K. J., Jang, E. K., & Joo, J. K. (2017). Eco-Innovation Indices as Tools for Measuring Eco-Innovation. Sustainability, 9(12), 2206. https://doi.org/10.3390/su9122206

Pułaska-Turyna, B. (1960). *Statystyka dla ekonomistów*. Warszawa: Difin. (in Polish).

Rennings, K. (2000). Redefining innovation – eco-innovation research and the contribution from ecological economics. Ecological Economics, 32(2), 319-332. https://doi.org/10.1016/S0921-8009(99)00112-3

Rozkrut, D. (2014). Measuring eco-innovation: Towards better policies to support green growth. Folia Oeconomica Stetinensia, 14(1), 137-148. https://doi.org/10.2478/foli-2014-0110

Schumpeter, J. A. (2011). *Teoria rozwoju gospodarczego*. Warszawa: PWN. (in Polish).

Smol, M., Avdiushchenko, A., & Kulczycka, J. (2017). Circular economy indicators in relation to eco-innovation in European regions. Clean Technologies and Environmental Policy, 19, 669-678. https://doi.org/10.1007/s10098-016-1323-8

Sobczak, E., & Głuszczak, D. (2022). Diversification of Eco-Innovation and Innovation Activity of Small and Medium-Sized Enterprises in the European Union Countries. Sustainability, 14(4), 1970. https://doi.org/10.3390/su14041970

Spaini, C., Markianidou, C., & Doranova, A. (2018). *EU Eco-Innovation Index: 2018 version. Technical note.* https://ec.europa.eu/environment/ecoap/sites/ecoap_stayconnected/files/ecoi_index_eu_2018_technical_note.pdf

UNEP. (2022, April 22). *Eco-Innovation.* https://www.unep.org/explore-topics/resource-efficiency/what-we-do/responsible-industry/eco-innovation

Ziółkowski, B. (2008). Znaczenie ekoinnowacji dla rozwoju przedsiębiorstw. In A. Graczyk (Ed.), *Zrównoważony rozwój w teorii ekonomii i praktyce* (pp. 526-534). Wrocław: Wydawnictwo AE we Wrocławiu. (in Polish).

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WSKAŹNIKI EFEKTYWNEGO GOSPODAROWANIA ZASOBAMI W POMIARZE EKOINNOWACJI W KRAJACH CZŁONKOWSKICH UE

STRESZCZENIE: Celem artykułu jest analiza zróżnicowania poziomu ekoinnowacji w państwach członkowskich UE w zakresie efektywnego gospodarowania zasobami. W tym celu wykorzystano wskaźnik wyników w zakresie efektywnego gospodarowania zasobami i jego wskaźniki cząstkowe. Badanie zostało przygotowane na podstawie danych Generalnej Dyrekcji ds. Środowiska. Za pomocą pozycyjnych miar statystycznych przeprowadzono analizę dywersyfikacji poziomu ekoinnowacji państw członkowskich Unii Europejskiej w latach 2012-2021 oraz zidentyfikowano tendencje zmian w tym zróżnicowaniu. Analiza wykazała, że różnica między poziomem ekoinnowacji we wskaźnikach badanych w państwach członkowskich UE nie zmniejsza się i nadal istnieje bardzo duża różnica między krajami najbardziej i najmniej innowacyjnymi. W literaturze brakuje tego typu analiz, więc przeprowadzone badania wypełniają lukę badawczą w tym obszarze.

SŁOWA KLUCZOWE: innowacje ekologiczne, tablica wyników eko-innowacji – Eco-IS, produktywność, indeks wyników efektywnego gospodarowania zasobami

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