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HISTORICAL ANALYSIS (2000 TO 2023) OF THE CORRELATION BETWEEN THE PERFORMANCE OF THE SUSTAINABLE DEVELOPMENT GOALS (SDGs) OF THE COUNTRIES OF THE ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT (OECD)

ANÁLISE HISTÓRICA (2000 A 2023) DA CORRELAÇÃO ENTRE OS DESEMPENHOS DOS OBJETIVOS DE DESENVOLVIMENTO SUSTENTÁVEL (ODS) DOS PAÍSES DA ORGANIZAÇÃO PARA A COOPERAÇÃO E DESENVOLVIMENTO ECONÔMICO (OCDE)

ANÁLISIS HISTÓRICO (2000 A 2023) DE LA CORRELACIÓN ENTRE EL DESEMPEÑO DE LOS OBJETIVOS DE DESARROLLO SOSTENIBLE (ODS) DE LOS PAÍSES DE LA ORGANIZACIÓN PARA LA COOPERACIÓN Y EL DESARROLLO ECONÓMICOS (OCDE)

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ABSTRACT

This study analyzed the correlation between the performance of the Sustainable Development Goals (SDGs) of the member, partner and candidate countries of the Organisation for Economic Co-operation and Development (OECD) from 2000 to 2023. Based on the premise that the SDGs are interdependent and must advance in an integrated manner, the article sought to identify patterns of positive or negative association between the goals and assess the coherence of national public policies with the 2030 Agenda. Methodologically, we used data from the Sustainable Development Goals Transformation Center (2024), processed in the R software (version 4.4.0), applying the Shapiro-Wilk tests for normality, Spearman correlations and K-means cluster analysis. The individual correlations between the SDGs were calculated for 49 countries and summarized using a cumulative correlation matrix, making it possible to identify SDGs with negative trends. The results indicated that no country showed exclusively positive correlations between the SDGs, revealing that progress on certain goals often occurs to the detriment of others. SDGs 2 (zero hunger), 8 (decent work and economic growth) and 16 (peace, justice and strong institutions) were more prone to negative correlations, while SDGs 3 (good health and well-being), 5 (gender equality) and 9 (industry, innovation and infrastructure) were more stable. The cluster analysis did not produce consistent groupings, suggesting strong heterogeneity between the countries. It concludes that progress towards sustainability is highly dependent on local contexts and that achieving the 2030 Agenda requires effective integration between national

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policies and international cooperation, with an emphasis on strengthening SDG 17 (partnerships for the goals).

Keywords: 2030 Agenda. Indicators. Sustainability.

RESUMO
Este estudo analisou a correlação entre os desempenhos dos Objetivos de Desenvolvimento Sustentável (ODS) dos países membros, parceiros e candidatos à Organização para a Cooperação e Desenvolvimento Econômico (OCDE) no período de 2000 a 2023. Foram utilizados dados do Sustainable Development Goals Transformation Center (2024), processados no software R (versão 4.4.0), com aplicação dos testes de Shapiro-Wilk para normalidade, correlações de Spearman e análise de agrupamentos por K-means. As correlações individuais entre os ODS foram calculadas para 49 países e sintetizadas por meio de uma matriz de correlação acumulada, permitindo identificar ODS com tendências negativas. A principal contribuição deste artigo é apresentar os desempenhos das correlações dos ODS para cada país, de forma individual, diferentemente dos artigos que apresentam resultados em termos de medidas de tendência central e análise de variabilidade para um conjunto de países. Os resultados indicaram que nenhum país apresentou correlações exclusivamente positivas entre os ODS, revelando que os avanços em determinados objetivos frequentemente ocorrem em detrimento de outros. Os ODS 2 (fome zero), 8 (trabalho e emprego) e 16 (paz e justiça) mostraram-se mais propensos a correlações negativas, enquanto os ODS 3 (saúde e bem-estar), 5 (igualdade de gênero) e 9 (inovação) demonstraram maior estabilidade. A análise de clusters não produziu agrupamentos consistentes, sugerindo forte heterogeneidade entre os países. Conclui-se que o progresso rumo à sustentabilidade é altamente dependente de contextos locais e que a consecução da Agenda 2030 requer integração efetiva entre políticas nacionais e cooperação internacional, com ênfase no fortalecimento do ODS 17 (parcerias).

Palavras-chave: Agenda 2030. Indicadores. Sustentabilidade.

RESUMEN
Este estudio analizó la correlación entre el desempeño de los Objetivos de Desarrollo Sostenible (ODS) de los países miembros, socios y candidatos de la Organización para la Cooperación y el Desarrollo Económicos (OCDE) entre 2000 y 2023. Se utilizaron datos del Centro de Transformación de los Objetivos de Desarrollo Sostenible (2024), procesados con el software R (versión 4.4.0), aplicando la prueba de Shapiro-Wilk para la normalidad, correlaciones de Spearman y análisis de conglomerados mediante K-medias. Se calcularon las correlaciones individuales entre los ODS para 49 países y se sintetizaron mediante una matriz de correlación acumulativa, lo que permitió identificar los ODS con tendencias negativas. La principal contribución de este artículo es presentar el desempeño de las correlaciones de los ODS para cada país individualmente, a diferencia de otros artículos que presentan resultados en términos de medidas de tendencia central y análisis de variabilidad para un conjunto de países. Los resultados indicaron que ningún país mostró correlaciones exclusivamente positivas entre los ODS, lo que revela que el progreso en ciertos objetivos a menudo se produce a expensas de otros. Los ODS 2 (hambre cero), 8 (trabajo y empleo) y 16 (paz y justicia) mostraron mayor tendencia a correlaciones negativas, mientras que los ODS 3 (salud y bienestar), 5 (igualdad de género) y 9 (innovación) presentaron mayor estabilidad. El análisis de conglomerados no generó agrupaciones consistentes, lo que sugiere una marcada heterogeneidad entre los países. Se concluye que el progreso hacia la

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sostenibilidad depende en gran medida de los contextos locales y que el logro de la Agenda 2030 requiere una integración efectiva entre las políticas nacionales y la cooperación internacional, con especial énfasis en el fortalecimiento del ODS 17 (alianzas).

Palabras clave: Agenda 2030. Indicadores. Sostenibilidad.

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1 INTRODUCTION

We live in a complex world, deeply marked by sensitive social, environmental, economic, political, cultural and ethical issues. Since the middle of the 20th century, theoretical discussions and international action plans have been part of government agendas 4 in the search for solutions to minimize anthropogenic impacts on the planet (United Nations, 2024).

The understanding of the intimate interconnection of everything that exists on Earth began to become clearer to non-traditional populations from studies conducted in the 1960s (Carson, 1962), culminating in terms such as sustainable development (World Commission on Environment and Development, 1987) and sustainability (Elkington, 1998). In this context, in 2000, as part of planning for a more hopeful future, 8 Millennium Development Goals were published (United Nations, 2000), which were expanded in 2015 to 17 Sustainable Development Goals (SDGs) and 169 targets (United Nations, 2015). Folke et al. (2016) consider socio-ecological systems to be complex adaptive systems and use the socio-ecological resilience approach to understand their dynamics. As shown in Figure 1, these authors present the icons of the SDGs in which the biosphere serves as the foundation on which society, the economy, prosperity and development are based.

Figure 1

Representation of the interconnection of the SDGs based on the biosphere

Source: Folke et al. (2016, p. 6).

[4] Countries that participate in the United Nations (UN).

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From the perspective of sustainable development based on the SDGs and their importance to the preservation of the planet, there has been a growth in lines of research that focus on understanding whether the goals are being achieved by countries and how this has been achieved (Yumnam; Gyanendra; Singh, 2024). In this regard, the SDG Transformation Center[5] has been producing annual sustainable development reports at global, regional and sub-national levels since 2015 (e.g: Kroll, 2015; Sachs; Lafortune; Fuller, 2024) that assess, through indicators, the performance of UN member states in relation to the SDGs.[6].

The methodology for calculating the indicators contained in the report was audited by the Joint Research Commission of the European Union in July 2019 (Papadimitriou; Neves; Becker, 2019). One third of the data used in the SDG indicators comes from external official statistics, non-governmental organizations (NGOs) and space technologies, and the rest comes from official data sets, often provided by UN custodial agencies (Sachs; Lafortune; Fuller, 2024).

Several other researchers have used the data generated for applied research and various methods such as: i) the progress of SDGs worldwide (Çağlar and Gürler, 2021); ii) statistical analyses in European Union countries (Hametner and Kostetckaia, 2020); iii) multi-criteria decision analysis (Anselmi et al., 2023); iv) correlation analysis in theoretical studies on SDGs (Fonseca; Domingues; Dima, 2020; Pradhan et al., 2017; Pakkan et al., 2023); v) influence matrix to understand the interactions between SDGs (Scharlemann et al., 2020); vi) multi-objective optimization to accelerate SDG progress (Fu et al., 2024); vii) interaction between SDGs by analyzing the impact of the COVID-19 pandemic (Elavarasan et al., 2022) and viii) clustering analyses for SDG progress in 45 Asian countries (Mathrani et al., 2023).

In view of this context, the general objective of this study was to analyze the correlation between the performance of the SDGs in the countries of the Organisation for Economic Co-operation and Development (OECD[7]) from 2000 to 2023. The main contribution of this paper is to present the correlation performances of the SDGs for each country individually, unlike the papers cited in the previous paragraph which present results in terms of measures of central tendency and analysis of variability for a group of countries. The SDG correlation

[5] Check https://sdgtransformationcenter.org/.
[6] Initially, in 2015, indicators from 34 rich countries were evaluated (Kroll, 2015, p. 17). In 2024, with the evolution of methodologies and databases, Sachs, Lafortune and Fuller (2024, p. 20-21) presented indicators from 167 countries.
[7] The OECD was created in 1961 from the Organisation for European Economic Co-operation (OEEC) through a convention signed in December 1960 in Paris. The OEEC had been formed to administer American and Canadian aid under the Marshall Plan for the reconstruction of Europe after World War II (OECD, 2009).

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performance technique for each country is more interesting because it reflects locally the real challenges and possibilities of each State to achieve the goals.

The OECD was chosen for this study because: i) is an international organization that encompasses countries representing five continents, considering member countries, key partners and candidates for membership and ii) seeks to strengthen societies to face social, economic and environmental challenges (OCDE, 2021).

In addition to this introductory section, this paper contains three more sections: i) methodology; ii) results and discussions and iii) final considerations.

2 METHODOLOGY

This section presents the methodological steps for constructing the correlation of SDG performance. Annual historical data from 2000 to 2023 was analyzed for the 17 SDGs of 49 OECD countries (38 members, 8 candidates and 3 key partners), shown in Appendix 1.

The data was taken from a spreadsheet[8] in the Sustainable Development Report 2024 (SDG TC, 2024), which analyzes the annual performance of the SDG indicators since they were adopted by the 193 member states of the United Nations in 2015, including figures back to 2000.

The data was recorded separately by country. The next step was to carry out the Shapiro-Wilk (SW) normality test (1965) for each SDG by country, resulting in a matrix of SW test results, M_{17x49} (check Appendix 2[9]). With normality as the null hypothesis, the test, at the calculated p-value and significance level of 5%, generally showed that the SDG sets do not have a normal distribution, with a few exceptions. Similar results were found in studies by Fonseca, Domingues and Dima (2020), Hametner and Kostetckaia (2020) and Pakkan et al. (2023). The next step was to calculate the Spearman correlation (Spearman, 1904), which is suitable for non-parametric data, between all 17 SDGs, generating matrices and graphs for each country.

In practice, for data processing, we used the R language and the RStudio environment, version 4.4.0[10] (R Core Team, 2024), with the following packages: i) <corrplot>, which represents the visualization of the correlation matrix, version 0.92 (Wi; Simko, 2021), ii)

[8] Available at: https://dashboards.sdgindex.org/explorer , in the left menu click on Download database and then DOWNLOAD IN EXCEL.
[9] Available at: https://docs.google.com/spreadsheets/d/1FaOw8OsXFU49-o0aGMwWkBng6v8huZmt/edit?gid=1028598285#gid=1028598285
[10] Available at: https://www.r-project.org/

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<xlsx>, which reads, writes, and formats the correlation matrix in Excel 2007 spreadsheets, version 0.6.5 (Dragulescu; Arendt, 2020), and iii) <ggplot2>, which plots graphs of the data analysis from the correlation matrix (Wickham, 2016).

The results are presented in a triangular matrix between each variable. Each element on the main diagonal is the correlation of a random variable with itself, which is always equal to 1. By the Cauchy-Schwarz corollary, each element outside the main diagonal can be between 1 and -1, inclusive. The correlation is: +1 in the case of a perfect direct (increasing) linear relationship (correlation); -1 in the case of a perfect decreasing (inverse) linear relationship (anti-correlation); and some value between -1 and 1, and as it approaches zero, there is less relationship (closer to not linearly associated) (Bathia; Davis, 1995). In the SDG construction theory, there is a positive integration between all the SDGs, in such a way that improvement in one or more goals should help the positive performance of others, as shown by Folke et al. (2016).

The next step was to analyze the SDG correlation spreadsheets for all the countries. To help with the evaluation, in an innovative way, the sum of the correlations in each row of the spreadsheet was applied, here called the *cumulative correlation*, in order to find out which SDGs had mathematically negative results when correlated with the others. The Eq. 1 was development for this calculation, where *i* took on values from 1 to 17, equivalent to each SDG; and *ij* represents the correlation of SDG_i with SDG_j, with *j* also ranging from 1 to 17. As the correlation is 1 when i=j, the equation takes into account the subtraction of the unit so that only the values of i≠j are added up. The SDG_i was considered mostly negative when the result of Eq. 1 was less than -1.0.

$$Cumulative\ correlation\ of\ SDG_i = \sum_{i/j=1}^{17} SDG_{ij} - 1 \qquad (1)$$

Next, the countries' correlation spreadsheets were compared with each other using the K-means clustering method, which is an efficient non-hierarchical analysis technique for analyzing large data sets, as Çağlar and Gürler (2021) did. The K-means method was applied with the number of clusters varying from 4 to 7 to determine the most appropriate grouping structure.

To verify the quality of the clusters generated by the K-means method, the silhouette coefficient and the Within-Cluster Sum of Squares (WCSS) were calculated. The silhouette

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coefficient ranges from -1 to 1, where values close to 1 indicate that the points are well grouped in their clusters, values close to 0 indicate overlapping or poorly defined clusters, and negative values indicate that the points may be poorly grouped. WCSS measures the compactness of clusters, with lower values indicating more compact and therefore better clusters.

In addition, with 7 years to go until the 2030 Agenda is finalized, an analysis was made of the individual performance of each SDG for each country, subtracting the value of the 2023 SDG from the 2000 value. The data was organized in a single spreadsheet where the greatest progress and setbacks in meeting the targets during the period studied could be analyzed.

3 RESULTS AND DISCUSSIONS

In order to present the results and discussions, the data analysis was separated into sections: i) correlation analysis between the SDG performance of OECD countries; ii) cluster analysis; and iii) analysis of the individual performance of each SDG for OECD countries.

3.1 CORRELATION ANALYSES BETWEEN SDG PERFORMANCE OF OECD COUNTRIES

As the SDGs were created with the philosophy of being interconnected, it was theoretically expected that the correlations of all the SDG performances would be positive. However, the study found that no country showed exclusively positive correlations. This result suggests that countries are failing to develop policies that can ensure the connection between all the SDGs and that by 2030 there needs to be more effort on the part of governments and partners.

According to the study by Fonseca, Domingues and Dima (2020), the correlations between the SDG averages of all 110 countries studied together indicated that SDG 12 (sustainable consumption) is, in general, negatively related to the other SDGs, especially SDG 3 (health), SDG 4 (education) and SDG 9 (industrialization). This means that while these SDGs showed progress, SDG 12 showed a decline in indicators. This trend was also confirmed in the study by Pakkan et al. (2023).

However, in this study, when the correlations were calculated separately for each country, it was found that each state has a different correlation dynamic between the SDG performances. There are some countries that have confirmed the results of Fonseca, Domingues and Dima (2020) and Pakkan et al. (2023), but there are countries where there is a negative correlation with other SDGs. As an example, we can cite the correlation study

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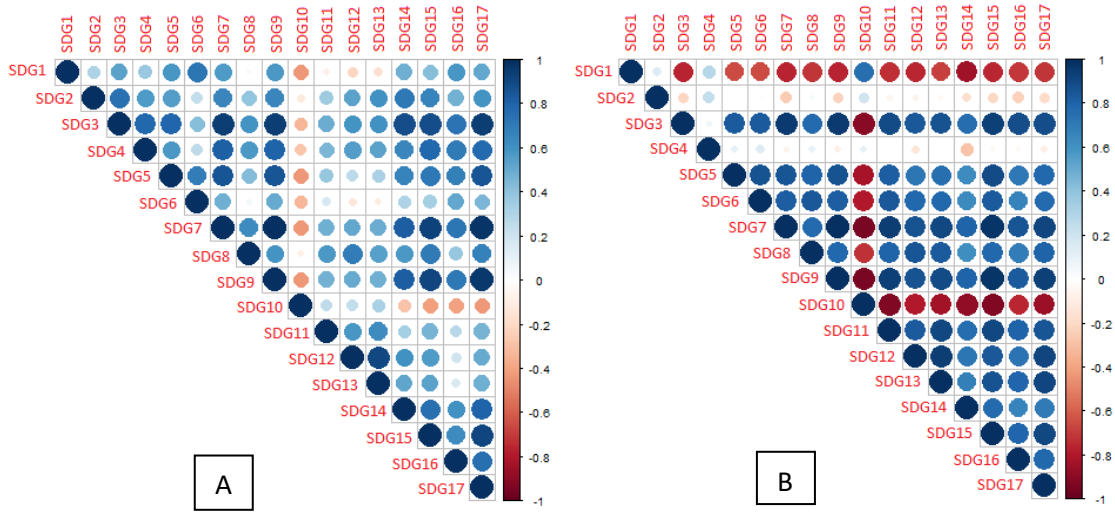
of the performance of the SDGs in South Africa and Germany, as shown in Figure 2, where SDG 10 (reduced inequalities) appeared with negative correlations in South Africa (1A); in Germany the negative correlations were with SDGs 1 (no poverty) and 10 (1B). The correlation graphs for the other countries can be found in Appendix 3[11].

It should be noted that some countries did not present indicator data for SDG 14 (life below water), as they are countries that do not have a sea coast, such as Austria, Slovakia, Hungary, Luxembourg, Switzerland and Czechia.

Figure 2

Correlation of SDG performance from 2000 to 2023 in South Africa (A) and Germany (B)



Source: the authors.

With regard to the analysis of the correlation spreadsheets, Table 1 shows the cumulative correlation values for South Africa, as an example. The correlation spreadsheets for the other countries can be found in Appendix 4[12].

By observing Table 1, it can be seen that only the correlations with SDG 10 are predominantly negative for South Africa, providing a cumulative correlation of -7.27.

[11] Available at: https://drive.google.com/drive/u/0/folders/1WcqPVdp6y2AV5q2-theRT4P4AG0Kupef
[12] Available at: https://drive.google.com/drive/u/0/folders/1n9aqtS_fr9-bRyyLHP01FxqLj4Vs5hiz

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Table 1

Cumulative correlations for South Africa's Spearman correlation matrix

	SDG1	SDG2	SDG3	SDG4	SDG5	SDG6	SDG7	SDG8	SDG9	SDG10	SDG11	SDG12	SDG13	SDG14	SDG15	SDG16	SDG17	Cumulative correlation
SDG1	1.00	0.22	0.47	0.29	0.53	0.69	0.51	-0.17	0.52	-0.70	-0.22	-0.37	-0.33	0.42	0.34	0.53	0.45	3.17
SDG2	0.22	1.00	0.71	0.50	0.49	0.14	0.61	0.32	0.61	-0.32	0.27	0.47	0.56	0.68	0.62	0.41	0.54	6.84
SDG3	0.47	0.71	1.00	0.75	0.77	0.35	0.94	0.54	0.93	-0.59	0.42	0.54	0.56	0.87	0.87	0.70	0.93	9.78
SDG4	0.29	0.50	0.75	1.00	0.52	0.16	0.79	0.52	0.78	-0.52	0.38	0.50	0.47	0.61	0.76	0.67	0.75	7.95
SDG5	0.53	0.49	0.77	0.52	1.00	0.65	0.84	0.36	0.84	-0.70	0.30	0.16	0.24	0.62	0.67	0.64	0.83	7.77
SDG6	0.69	0.14	0.35	0.16	0.65	1.00	0.42	-0.06	0.44	-0.58	0.06	-0.29	-0.25	0.22	0.25	0.45	0.39	3.04
SDG7	0.51	0.61	0.94	0.79	0.84	0.42	1.00	0.58	0.99	-0.70	0.42	0.45	0.43	0.81	0.92	0.69	0.97	9.66
SDG8	-0.17	0.32	0.54	0.52	0.36	-0.06	0.58	1.00	0.54	-0.28	0.52	0.66	0.48	0.52	0.67	0.30	0.63	6.12
SDG9	0.52	0.61	0.93	0.78	0.84	0.44	0.99	0.54	1.00	-0.70	0.41	0.44	0.42	0.80	0.90	0.68	0.96	9.56
SDG10	-0.70	-0.32	-0.59	-0.52	-0.70	-0.58	-0.70	-0.28	-0.70	1.00	0.11	0.11	0.20	-0.53	-0.68	-0.67	-0.70	-7.27
SDG11	-0.22	0.27	0.42	0.38	0.30	0.06	0.42	0.52	0.41	0.11	1.00	0.53	0.58	0.25	0.40	0.18	0.40	5.01
SDG12	-0.37	0.47	0.54	0.50	0.16	-0.29	0.45	0.66	0.44	0.11	0.53	1.00	0.89	0.55	0.51	0.09	0.44	5.69
SDG13	-0.33	0.56	0.56	0.47	0.24	-0.25	0.43	0.48	0.42	0.20	0.58	0.89	1.00	0.46	0.47	0.06	0.41	5.65
SDG14	0.42	0.68	0.87	0.61	0.62	0.22	0.81	0.52	0.80	-0.53	0.25	0.55	0.46	1.00	0.72	0.55	0.78	8.32
SDG15	0.34	0.62	0.87	0.76	0.67	0.25	0.92	0.67	0.90	-0.68	0.40	0.51	0.47	0.72	1.00	0.57	0.91	8.91
SDG16	0.53	0.41	0.70	0.67	0.64	0.45	0.69	0.30	0.68	-0.67	0.18	0.09	0.06	0.55	0.57	1.00	0.72	6.57
SDG17	0.45	0.54	0.93	0.75	0.83	0.39	0.97	0.63	0.96	-0.70	0.40	0.44	0.41	0.78	0.91	0.72	1.00	9.40

Source: the authors.

For an overview of all the countries analyzed, Table 2 was drawn up from their correlation spreadsheets, showing the SDGs with a mostly negative cumulative correlation of performance in each OECD country. The colors used in Table 2 indicate the SDG category according to the classification adopted by Folke *et al.* (2015) (orange color: Social SDG; green color: Environmental SDG; red color: Economic SDG; blue color: SDG-axis (SDG 17)). Table 2 shows that there is no pattern or trend of negative performance, which means that meeting the SDG targets is very specific to each country and depends on its own interests and public policies.

Overall, SDG 2 (zero hunger), SDG 8 (decent work and economic growth) and SDG 16 (peace, justice and strong institutions), respectively, showed the most negative correlations in performance among the countries studied, i.e. over time, these SDGs have regressed the most. On the other hand, SDGs 3 (good health and well-being), 5 (gender equality) and 9 (industry, innovation and infrastructure) did not show significant regressions in any country.

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Table 2

SDGs with mostly negative correlation of performance in each OECD country

OECD COUNTRY	SDG1	SDG2	SDG3	SDG4	SDG5	SDG6	SDG7	SDG8	SDG9	SDG10	SDG11	SDG12	SDG13	SDG14	SDG15	SDG16	SDG17	# negative correlation
ARGENTINA		x										x	x					3
AUSTRALIA	x	x						x		x						x		5
AUSTRIA	x					x										x		3
BELGIUM								x										1
BRAZIL		x						x				x	x			x		5
BULGARIA		x						x				x	x		x			5
CANADA				x												x		2
CHILE		x					x					x	x			x		5
CHINA								x				x	x	x	x			5
COLOMBIA		x										x	x					3
COSTA RICA		x						x				x						3
CROATIA						x												1
CZECHIA				x														1
DENMARK		x				x		x		x								4
ESTONIA												x						1
FINLAND		x		x		x		x		x						x		6
FRANCE	x									x						x		3
GERMANY	x	x								x								3
GREECE	x	x		x				x										4
HUNGARY		x		x				x		x						x	x	6
ICELAND		x						x								x		3
INDIA											x	x	x		x			4
INDONESIA										x		x	x			x	x	5
IRELAND		x		x		x		x										4
ISRAEL		x									x			x				3
ITALY	x	x		x														3
JAPAN								x						x		x		3
LATVIA				x								x	x					3
LITHUANIA							x			x		x	x					4
LUXEMBOURG	x									x						x		3
MEXICO								x								x		2
NETHERLANDS		x												x				2
NEW ZEALAND		x		x				x						x		x		5
NORWAY	x	x						x						x				4
PERU												x	x					2
POLAND		x										x	x			x		4
PORTUGAL																		0
ROMANIA				x								x	x					3
SLOVAKIA				x		x						x						3
SLOVENIA						x		x								x		3
SOUTH AFRICA										x								1
SOUTH KOREA		x		x				x					x					4
SPAIN	x							x		x								3
SWEDEN								x		x				x		x		4
SWITZERLAND		x						x		x						x		4
THAILAND		x						x				x	x		x			5
TURKEY										x		x	x	x	x	x		6
UNITED KINGDOM		x		x												x		3
UNITED STATES				x		x		x								x		4
# negative correlation countries	9	24	0	14	0	8	2	23	0	14	2	18	16	8	5	21	2	

Color caption: social SDG | environmental SDG | economic SDG | axis SDG

Source: the authors.

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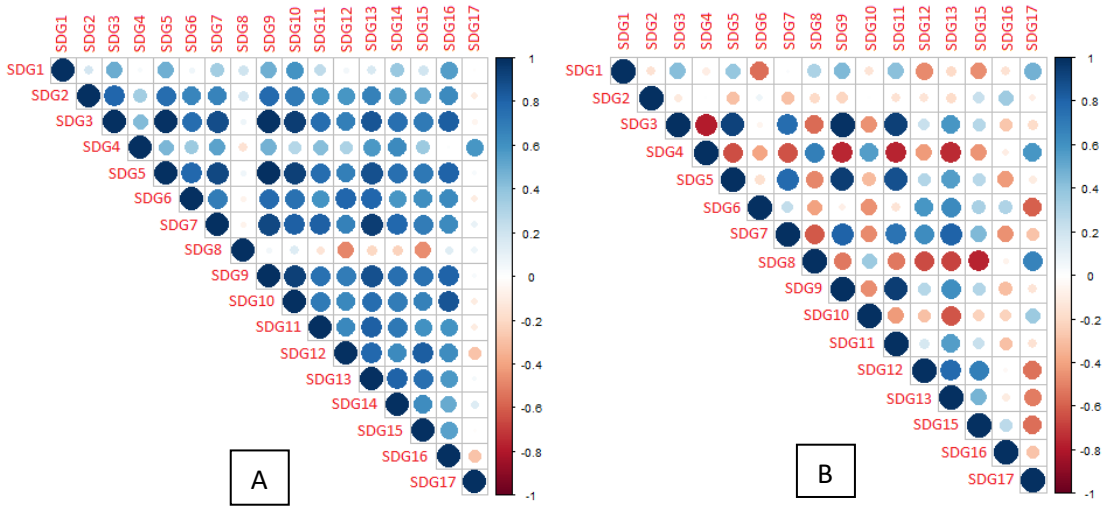
With regard to the analysis by country, it is noteworthy that Portugal did not obtain a mostly negative correlation of performance in any SDG, despite having weak negative correlations for SDG 8 (decent work and economic growth) and 17 (partnerships for the goals). Figure 3 shows the results graph for Portugal (2A). At the other extreme, Hungary (Figure 2B), Finland and Turkey were the countries with the most SDG with a mostly negative correlation, 6 in total.

Figure 3

Correlation of SDG performance from 2000 to 2023 in Portugal (A) and Hungary (B).



Source: the authors.

From Table 3, the countries with 1 SDG with a negative correlation were South Africa (social inequality), Belgium (work), Croatia (sanitation), Estonia (sustainable consumption) and Czechia (education). When we looked at the countries with 2 SDGs with a negative correlation, we came up with Canada (education and justice), Mexico (work and justice), the Netherlands (hunger and life below water) and Peru (sustainable consumption and climate change). The countries with 3, 4 and 5 SDGs with negative correlations are shown in Table 3.

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Table 3

Countries with 3, 4 and 5 SDGs with negative correlations

Countries with 3 SDGs with negative correlations	Countries with 4 SDGs with negative correlations	Countries with 5 SDGs with negative correlations
Germany (poverty, hunger and social inequality)	South Korea (hunger, education, work and climate change)	Australia (poverty, hunger, work, social inequality and justice)
Argentina (hunger, sustainable consumption and climate change)	Denmark (hunger, sanitation, work and social inequality)	Brazil (hunger, work, sustainable consumption, climate change and justice)
Austria (poverty, sanitation and justice)	United States of America (education, sanitation, work and justice)	Bulgaria (hunger, work, sustainable consumption, climate change and life on land)
Colombia (hunger, sustainable consumption and climate change)	Greece (poverty, hunger, education and work)	Chile (hunger, energy, sustainable consumption, climate change and justice)
Costa Rica (hunger, work and sustainable consumption)	India (sustainable cities, sustainable consumption, climate change and life on land)	China (work, sustainable consumption, climate change, life below water and life on land)
Slovakia (education, sanitation and sustainable consumption)	Ireland (hunger, education, sanitation and work)	Indonesia (social inequality, sustainable consumption, climate change, justice and partnerships)
Slovenia (sanitation, work and justice)	Lithuania (energy, social inequality, sustainable consumption and climate change)	New Zealand (hunger, education, work, life below water and justice)
Spain (poverty, work and social inequality)	Norway (poverty, hunger, work and below water)	Thailand (hunger, work, sustainable consumption, climate change and life on land)
France	Poland	

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(poverty, social inequality and justice)	(hunger, sustainable consumption, climate change and justice)
Iceland (hunger, work and justice)	Sweden (work, social inequality, life below water and justice)
Israel (hunger, sustainable cities and life below water)	Switzerland (hunger, work, social inequality and justice)
Italy (poverty, hunger and education)	
Japan (work, life below water and justice)	
Latvia (education, sustainable consumption and climate change)	
Luxembourg (poverty, social inequality and justice)	
United Kingdom (hunger, education and justice)	
Romania (gender equality, sustainable consumption and climate change)	

The countries with 6 SDGs with a negative correlation were Finland (hunger, education, sanitation, work, social inequality and justice), Hungary (hunger, education, employment, social inequality, justice and partnerships) and Turkey (social inequality, sustainable consumption, climate change, life below water, life on land and justice).

It can therefore be seen from the analysis that there is no standard tendency for the SDGs to go backwards in relation to the country's economy, as economically developed countries show declines in indicators in areas such as poverty, hunger and social inequalities.

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Therefore, it is important to analyze negative correlations between pairs of SDGs, because public policies and government programs can serve to achieve these SDGs together. It is considered here that public policies are projects of an ethical-political nature and encompass numerous levels of relations between the State and civil society, while government programs are one-off and, as a rule, suffer discontinuities (Bardach; Patashnik, 2023). In countries with broad-based age pyramids, such as Brazil, for example, public policies for young people can guarantee the simultaneous fulfillment of goals for sustainable consumption, work and hunger (Gonçalves; Fava; 2024).

However, beyond intra-national governance issues, it is assumed that in order to achieve the SDGs, countries depend on international and supra-national actions, as presented by Breuer, Janetschek and Malerba (2019). The authors evoke the concepts of *landscape approach*[13] and *landscape governance*[14] (Görg, 2007; Müller; Janetschek; Weigelt, 2015; IMFN, 2019) to question whether achieving the SDG targets is feasible only through national public policies and government programs, since political-administrative boundaries do not always coincide with biophysical, ecological or sociocultural limits (Reed et al., 2016).

Therefore, horizontal and vertical efforts are needed from all nations towards sustainability and, in this context, SDG 17 (partnerships for the goals) is of paramount importance, as it can set standards for global cooperation. For this to happen, investments are needed in priority areas, i.e. those highlighted in Table 2 in each country. The 2030 Agenda follows the principle of indivisibility and there should be no prioritization of SDGs, but paradoxically, according to the International Council for Science (ICSU, 2017), for budgetary, political and resource availability reasons, countries tend to choose certain areas to act on.

It should be noted, however, that even within countries themselves, government leaders may not be concerned with actions that have a long-term impact due to political party issues, and therefore end up prioritizing short-term programs that have no effect on achieving the SDGs.

[13] "The landscape approach implies adopting both geographical and biophysical variables, as well as socioeconomic variables, to analyze the management and governance of land, water and natural resources necessary to ensure the conservation of ecosystems and sustainable ways of life" (Breuer, Janetschek and Malerba (2019, p. 15, our translation).
[14] "The concept of landscape governance describes the powers, authorities and responsibilities that individual or organizational actors — formal and informal — exercise over a landscape" (Breuer, Janetschek and Malerba (2019, p. 15, our translation).

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3.2 CLUSTER ANALYSIS

For this study, it was not possible to create clusters of countries with similar trends based on SDG performance. The maximum silhouette coefficient was 0.128 and the minimum WCSS was 2996.3, which indicates the low quality of the groupings. Specifically, such a high number of WCSS suggests that the structure of the data is not well represented by the dendrograms generated. In addition, silhouette scores close to zero indicate that the clusters are not clearly defined, with high overlap and low separation between them.

Given that both indicators pointed to an unsatisfactory quality of the groupings, it can be concluded that the use of clustering techniques is not appropriate for this study, unlike the studies by Mathrani et al. (2023) and Çağlar and Gürler (2021). The low quality of the groupings did not allow for a meaningful and reliable interpretation of the results, which would have compromised the validity of the conclusions.

Transposing the numerical results into reality, it is in fact impossible to group countries with cultural, scientific, technological, socio-economic and political-institutional diversities, especially since the 17 SDGs interconnect different spheres that relate to each other in totally different ways, even in countries that are part of consolidated groupings, such as BRICS, G7, G20, central and peripheral countries, emerging countries, Asian tigers, among others.

As the social response to policies is slow and involves numerous national, international and supra-national variables, the 15-year horizon for fulfilling the 2030 Agenda is not enough for developing countries. In these cases, again SDG 17 (partnerships for the goals) would be a possible solution if governments took a global view of the problem of unsustainability.

In general, it is worth analyzing the impact of political actions on the individual performance of each country for each SDG.

3.3 ANALYSIS OF THE INDIVIDUAL PERFORMANCE OF EACH SDG FOR OECD COUNTRIES

The individual country performances from 2000 to 2023 can be seen in the table in Appendix 5[15]. The SDGs with zero performance required a more detailed look, as two situations occurred: i) the SDGs did not vary from 2000 to 2023, which happened with New Zealand for SDG 1 (no poverty), whose indicator was constant at 0[16]; with Slovenia for SDG

[15] Available at: https://docs.google.com/spreadsheets/d/1M6RITXkGdfeq89m9QE3z62F-i8oVVg6v/edit?usp=sharing&ouid=100350641059666420355&rtpof=true&sd=true
[16] There is no information in the databases to explain what might have happened to cause the indicator value to be zero in all the years.

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10 (reduced inequalities), with a constant value of 100; and with Iceland for SDG 11 (sustainable cities and communities), with a constant value of 97.6; and; or ii) the initial and final values of the SDGs were the same, but during the period there were changes in the indicators, as in the case of Norway (for SDG 1 – no poverty), Luxembourg (for SDG 6 – clean water and sanitation), Finland (for SDG 8 – decent work and economic growth), South Korea (for SDG 11 – sustainable cities and communities), and Denmark (for SDG 16 – peace, justice and institutions).

Also shown in Appendix 5 are the results of which SDGs had the highest and lowest performance in each country. The SDG with the greatest progress by countries was SDG 9 (industry, innovation and infrastructure), which appeared in 42 countries, followed by SDG 1 (no poverty) in 4 countries, SDG 10 (reduced inequalities) in 2 countries and SDG 4 (quality education) in 1 country. The SDG with the biggest setbacks was SDG 6 (clean water and sanitation), which occurred in 9 countries, followed by SDGs 2 (zero hunger) and 10 (reduced inequalities) in 7 countries, and SDG 12 (responsible consumption and production) in 6 countries.

The graph in Figure 4 illustrates the positive (progress) and negative (setbacks) performance of each country in relation to each SDG from 2000 to 2023. It can be seen that the vast majority of SDGs have progressed in all countries. The highest level of progress in the period was in China for SDG 1 (no poverty), with 76.8 points, and the highest level of regression was in SDG 10 (reduced inequalities) in Indonesia (-30.8). These values can be seen again in Figure 5.

Figure 4

Positive performance (progress) and negative performance (setbacks) of OECD countries in relation to each SDG from 2000 to 2023

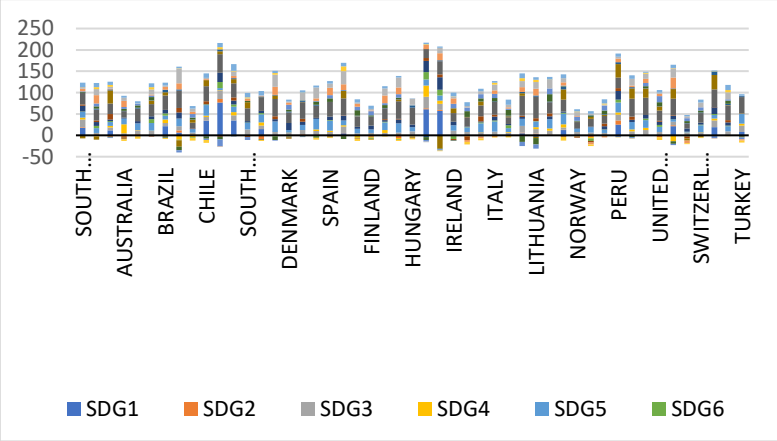

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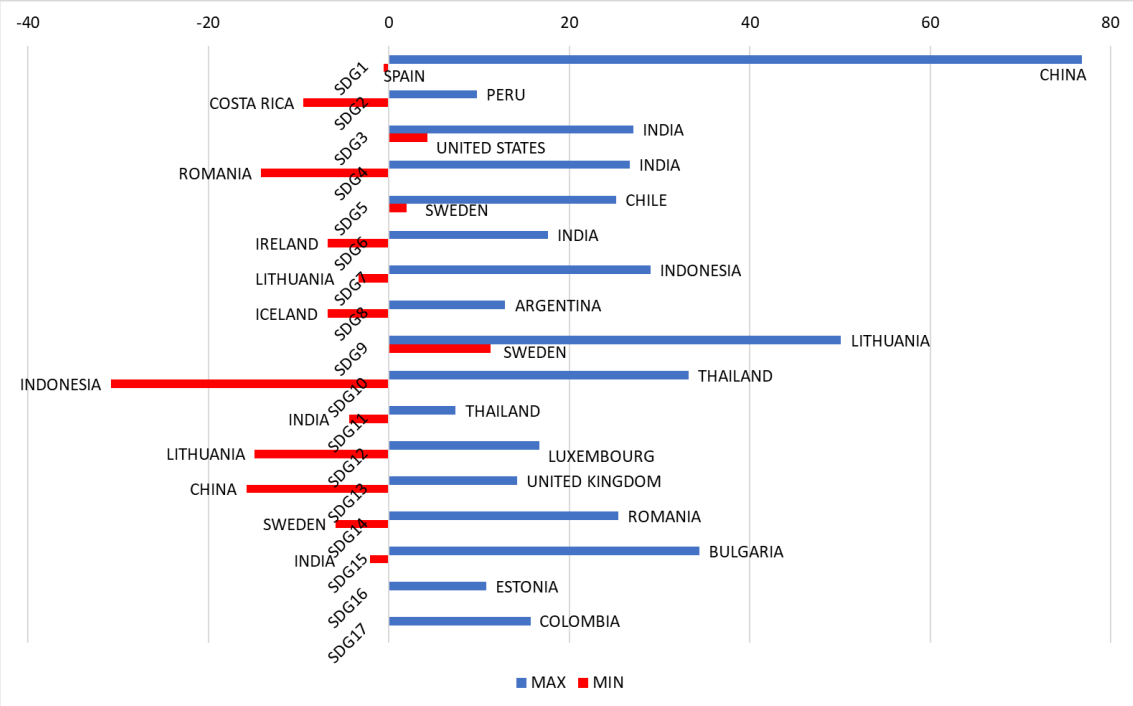
Figure 5 shows the maximum and minimum global performance values for each SDG and the corresponding OECD countries from 2000 to 2023. India appears three times in Figure 5, having achieved the highest overall performance values for SDGs 2, 4 and 6 (zero hunger, quality education and clean water and sanitation). Thailand also stands out for its higher performance in SDGs 10 and 11 (reduced inequalities and sustainable cities and communities). For negative performances, or setbacks, Sweden stands out, with lower performance values in SDGs 5, 9 and 14 (gender equality, industry, innovation and infrastructure and life below water). In contrast to the positive performances, India presented setbacks in SDG 11 and 15 (sustainable cities and communities and life below water), and Lithuania in SDG 7 and 12 (affordable and clean energy and responsible consumption and production).

Figure 5

Maximum and minimum values of global performances for each SDG and their corresponding OECD countries from 2000 to 2023



From the graph in Figure 5, it can be seen that some countries find it difficult to achieve some SDGs while they have the best values for other SDG. This occurs with China, India, Indonesia, Lithuania and Romania. According to Hametner and Kostetckaia (2020), analyzes

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for achieving the SDG must be individual for each country, as relative classifications can be misleading.

4 FINAL CONSIDERATIONS

This study analyzed, in detail, the correlation between the performances of the Sustainable Development Goals (SDGs) of OECD countries in the period from 2000 to 2023, using robust statistical methods such as the Shapiro-Wilk normality test, Spearman correlation and K-means cluster analysis. Unlike previous works, this paper proposed an approach focused on the individual performance of each country, considering its unique trajectory in achieving the SDG, which allowed a more granular and realistic view of advances and setbacks.

The results show that, although the SDG were conceived as interconnected goals, no country presented exclusively positive correlations between the objectives. This reveals the complexity of socioeconomic systems and the difficulty in implementing public policies that promote the simultaneous and harmonious advancement of all SDG. It was observed that some objectives, such as SDG 2 (zero hunger), SDG 8 (decent work and economic growth) and SDG 16 (peace, justice and strong institutions), recurrently presented negative correlations in the countries analyzed; while SDG 3 (good health and well-being), SDG 5 (gender equality) and SDG 9 (industry, innovation and infrastructure) were least affected by setbacks.

Additionally, the attempt to group countries based on similarity of performance via cluster analysis did not produce satisfactory results. The low quality of the clusters, measured by silhouette coefficients and WCSS, reinforces the idea that progress towards the SDG is highly dependent on specific contexts and does not align with traditional classifications such as level of economic development or geopolitical insertion.

The analysis of individual performances also brought to light situations in which certain SDG did not vary over time, which could signal both stability and stagnation of public policies. On the other hand, it was observed that SDG 9 was the one that advanced the most in global terms, while SDG 6 was the one that regressed the most.

As a limitation of this study, the dependence on secondary data stands out, subject to the availability and calculation methodology of the SDG Transformation Center, in addition to the analysis being restricted to the OECD, not covering other regions of the globe where the challenges of the SDG are even more accentuated. Furthermore, the use of statistical

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correlations, although useful for identifying relationships between objectives, does not allow inferring causalities.

Among the suggestions for future studies, it is recommended: (i) deepening the analysis at the subnational level, mainly in countries with high internal heterogeneity; (ii) the development of comparative studies between OECD countries and non-member developing countries; and (iii) the incorporation of qualitative analyzes that explore the role of public policies, historical contexts and institutional capacities in the performance of the SDG.

It is concluded that fully achieving the 2030 Agenda requires integrated action between national policies and international cooperation, with an emphasis on strengthening partnerships (SDG 17) and adapting global strategies to local realities, respecting the sociocultural and structural singularities of each country.

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REFERENCES

Anselmi, D., D'Adamo, I., Gastaldi, M., Virginia, & Lombardi, G. V. (2024). A comparison of economic, environmental and social performance of European countries: A Sustainable Development Goal Index. Environment, Development and Sustainability. Advance online publication. https://doi.org/10.1007/s10668-023-03496-3

Bhatia, R., & Davis, C. (1995). A Cauchy-Schwarz inequality for operators with applications. Linear Algebra and its Applications, 223–224, 119–129.

Bardach, E. S., & Patashnik, E. M. (2023). A practical guide for policy analysis: The eightfold path to more effective problem solving (7th ed.). CQ Press.

Breuer, A., Janetschek, H., & Malerba, D. (2019). Translating Sustainable Development Goal (SDG) interdependencies into policy advice. Sustainability, 11(7), Article 2092. https://doi.org/10.3390/su11072092

Çağlar, M., & Gürler, C. (2021). Sustainable Development Goals: A cluster analysis of worldwide countries. Environment, Development and Sustainability, 24(7), 8593–8624. https://doi.org/10.1007/s10668-021-01801-6

Carson, R. (1962). Silent spring. Fawcett Crest.

Revista ARACÊ
ISSN: 2358-2472

Dragulescu, A., & Arendt, C. (2020). xlsx: Read, write, format Excel 2007 and Excel 97/2000/XP/2003 files (Version 0.6.5) [Computer software]. https://CRAN.R-project.org/package=xlsx

Elavarasan, R. M., Pugazhendhi, R., Shafiullah, G. M., Kumar, N. M., Arif, M. T., Jamal, T., Chopra, S. S., & Dyduch, J. (2022). Impacts of COVID-19 on Sustainable Development Goals and effective approaches to maneuver them in the post-pandemic environment. Environmental Science and Pollution Research, 29, 33957–33987. https://doi.org/10.1007/s11356-021-17793-9

Elkington, J. (1998). Cannibals with forks: The triple bottom line of 21st century business. New Society Publishers.

Folke, C., Biggs, R., Norström, A. V., Reyers, B., & Rockström, J. (2016). Social-ecological resilience and biosphere-based sustainability science. Ecology and Society, 21(3), Article 41. https://doi.org/10.5751/ES-08748-210341

Fonseca, L. M., Domingues, J. P., & Dimas, A. M. (2020). Mapping the Sustainable Development Goals relationships. Sustainability, 12(8), Article 3359. https://doi.org/10.3390/su12083359

Fu, B., Wu, X., Wang, S., & Zhao, W. (2024). Scientific principles for accelerating the Sustainable Development Goals. Geography and Sustainability, 5(2), 157–159. https://doi.org/10.1016/j.geosus.2024.01.005

Gonçalves, R. T., & Fava, A. C. P. (2024). Políticas públicas para a juventude no Brasil – um balanço a partir da implementação do Estatuto da Juventude (2013-2023). Revista Foco, 17(5), 1–28. https://doi.org/10.54751/revistafoco.v17n5-088

Görg, C. (2007). Landscape governance: The “politics of scale” and the “natural” conditions of places. Geoforum, 38, 954–966.

Hametner, M., & Kostetckaia, M. (2020). Frontrunners and laggards: How fast are the EU member states progressing towards the sustainable development goals? Ecological Economics, 177, Article 106775. https://doi.org/10.1016/j.ecolecon.2020.106775

International Council for Science. (2017). A guide to SDG interactions: From science to implementation. https://council.science/cms/2017/05/SDGs-Guide-to-Interactions.pdf

International Model Forest Network. (2019). Governance lessons for the landscape approach. http://imfn.net/governancelessons-landscape-approach

Kroll, C. (2015). Sustainable Development Goals: Are the rich countries ready? Bertelsmann Stiftung. https://www.bertelsmann-stiftung.de/fileadmin/files/BSt/Publikationen/GrauePublikationen/Studie_NW_Sustainable-Development-Goals_Are-the-rich-countries-ready_2015.pdf

Mathrani, A., Wang, J., Li, D., & Zhang, X. (2023). Clustering analysis on Sustainable Development Goal Indicators for forty-five Asian countries. Sci, 5(2), Article 14. https://doi.org/10.3390/sci5020014

Müller, A., Janetschek, H., & Weigelt, J. (2015). Towards a governance heuristic for sustainable development. Current Opinion in Environmental Sustainability, 15, 49–56.

Revista ARACÊ
ISSN: 2358-2472

Organisation for Economic Co-operation and Development. (2009). OECD historical series. OECD Publishing.

OCDE. (2021). Trust in global cooperation: The vision for the OECD for the next decade. OCDE.

OCDE. (2025a). Our history. https://www.oecd.org/en/about/history.html

OCDE. (2025b). Members and partners. https://www.oecd.org/en/about/members-partners.html

Pakkan, S., Sudhakar, C., Tripathi, S., & Rao, M. (2023). A correlation study of sustainable development goal (SDG) interactions. Quality & Quantity, 57, 1937–1956. https://doi.org/10.1007/s11135-022-01443-4

Papadimitriou, E., Neves, A. R., & Becker, W. (2019). JRC statistical audit of the Sustainable Development Goals Index and dashboards. European Commission, Joint Research Centre. https://doi.org/10.2760/723763

Pradhan, P., Costa, L., Rybski, D., Lucht, W., & Kropp, J. P. (2017). A systematic study of Sustainable Development Goal (SDG) interactions. Earth's Future, 5(11), 1169–1179. https://doi.org/10.1002/2017EF000632

Pongiglione, F. (2015). The need for a priority structure for the sustainable development goals. Journal of Global Ethics, 11(1), 37–42.

R Core Team. (2024). R: A language and environment for statistical computing. R Foundation for Statistical Computing. https://www.R-project.org/

Reed, J., Van Vianen, J., Deakin, E. L., Barlow, J., & Sunderland, T. (2016). Integrated landscape approaches to managing social and environmental issues in the tropics: Learning from the past to guide the future. Global Change Biology, 22(7), 2540–2554.

Sachs, J. D., Lafortune, G., & Fuller, G. (2024). The SDGs and the UN Summit of the Future: Sustainable Development Report 2024. Dublin University Press. https://doi.org/10.25546/108572

Scharlemann, J. P. W., Brock, R. C., Balfour, N., Brown, C., Burgess, N. D., Guth, M. K., Ingram,, Ingram, D. J., Lane, R., Martin, J. G. C., Wicander, S., & Kapos, V. (2020). Towards understanding interactions between Sustainable Development Goals: The role of environment–human linkages. Sustainability Science, 15, 1573–1584. https://doi.org/10.1007/s11625-020-00799-6

SDG Transformation Center. (2024a). Sustainable Development Report. https://dashboards.sdgindex.org/explorer

SDG Transformation Center. (2024b). Download the Sustainable Development Report 2024 and supplementary materials. https://dashboards.sdgindex.org/downloads

Shapiro, S. S., & Wilk, M. B. (1965). An analysis of variance test for normality (complete samples). Biometrika, 52(3–4), 591–611.

Spearman, C. (1904). The proof and measurement of association between two things. American Journal of Psychology, 15(1), 72–101.

Revista ARACÊ
ISSN: 2358-2472

Taiyun, W., & Simko, V. (2021). R package 'corrplot': Visualization of a correlation matrix (Version 0.92) [Computer software]. https://github.com/taiyun/corrplot

United Nations. (2000). Resolution adopted by the General Assembly 55/2: United Nations Millennium Declaration. https://documents.un.org/doc/undoc/gen/n00/559/51/pdf/n0055951.pdf

United Nations. (2015). Resolution adopted by the General Assembly on 25 September 2015: 70/1. Transforming our world: The 2030 Agenda for Sustainable Development. https://documents.un.org/doc/undoc/gen/n00/559/51/pdf/n0055951.pdf

United Nations. (2024). Conferences: Environment and sustainable development. https://www.un.org/en/conferences/environment

Wickham, H. (2016). ggplot2: Elegant graphics for data analysis. Springer-Verlag.

World Commission on Environment and Development. (1987). Nosso futuro comum. Oxford University Press.

Yumnam, G., Gyanendra, Y., & Singh, C. I. (2024). A systematic bibliometric review of the global research dynamics of United Nations Sustainable Development Goals 2030. Sustainable Futures, 7, Article 100192. https://doi.org/10.1016/j.sftr.2024.100192

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APPENDIX 1

OECD MEMBER COUNTRIES, MEMBERSHIP CANDIDATES AND PARTNERS IN APRIL 2025

<table>
<tr><th></th><th>AMERICA</th><th colspan="3">EUROPE</th><th>ASIA</th><th>AFRICA</th><th>OCEANIA</th></tr>
<tr><td rowspan="12">MEMBER COUNTRIES</td><td>Canada</td><td>Germany</td><td>France</td><td>Norway</td><td>South Korea</td><td rowspan="12"></td><td>Australia</td></tr>
<tr><td>Chile</td><td>Austria</td><td>Greece</td><td>Netherlands</td><td>Israel</td><td rowspan="11">New Zealand</td></tr>
<tr><td>Colombia</td><td>Belgium</td><td>Hungary</td><td>Poland</td><td rowspan="9">Japan</td></tr>
<tr><td>Costa Rica</td><td>Denmark</td><td>Ireland</td><td>Portugal</td></tr>
<tr><td>United States</td><td>Slovakia</td><td>Iceland</td><td>United Kingdom</td></tr>
<tr><td rowspan="6">Mexico</td><td>Slovenia</td><td>Italy</td><td>Czechia</td></tr>
<tr><td>Spain</td><td>Latvia</td><td>Sweden</td></tr>
<tr><td>Estonia</td><td>Lithuania</td><td rowspan="2">Switzerland</td></tr>
<tr><td>Finland</td><td>Luxembourg</td></tr>
<tr><td colspan="3">Turkey</td></tr>
<tr><td rowspan="3">KEY PARTNER COUNTRIES</td><td rowspan="3">Brazil</td><td colspan="3" rowspan="3"></td><td>China</td><td rowspan="3">South Africa</td><td rowspan="3"></td></tr>
<tr><td>India</td></tr>
<tr><td>Indonesia</td></tr>
<tr><td rowspan="3">MEMBERSHIP CANDIDATE COUNTRIES</td><td>Argentina</td><td colspan="3">Bulgaria</td><td>Indonesia</td><td rowspan="2"></td><td rowspan="2"></td></tr>
<tr><td>Brazil</td><td colspan="3">Croatia</td><td>Thailand</td></tr>
<tr><td>Peru</td><td colspan="3">Romania</td><td></td><td></td><td></td></tr>
</table>

Source: Adapted from OECD (2024b).