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Disparities in sustainable development goals compliance and their association with country risk

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Abstract

The sustainable development goals are aimed at making humankind aware of the importance of establishing common guidelines relating to three fundamental purposes: eradicating poverty, protecting the planet, and improving people's lives. Sustainable development is linked to financial and business risk, financing is necessary to achieve the SDGs. In this context, the aim of this paper is to analyze the homogeneity in SDG achievement, based on *People*, *Planet*, *Prosperity*, *Peace*, and *Partnership* for year 2021. To that end, a cluster analysis is applied, distinguishing between two samples of countries defined by their level of wealth. Furthermore, a synthetic indicator is used to produce a ranking of countries according to their achievement of the SDGs; contingency tables are then created and the χ^2 test is used to identify which country risk factors are associated with SDG achievement. The results indicate that the major powers perform similarly in successfully achieving the 5Ps. Also, the χ^2 test confirms that a good economic and financial position which allows access to international financial markets at a reasonable cost is linked to optimal SDG achievement in high-income areas. However, *Economic assessment*, *Access to international capital markets* and *Debt indicators* are not associated with better SDG achievement in the poorest countries.

KEYWORDS
cluster analysis, contingency tables, country risk, SDG

1 | INTRODUCTION

The Sustainable Development Goals (SDGs) are considered the most comprehensive course of action for nations to achieve sustainable development (Çağlar & Gürler, 2022). These goals are a universal call to action to eradicate poverty, protect our planet and guarantee peace through close partnerships (Stefanescu, 2022; United Nations, 2015). They can all be framed within one of the five dimensions of the 2030 Agenda: *People*, *Planet*, *Prosperity*, *Peace* and *Partnership*, also referred to as the 5Ps (Hepp et al., 2019). Various studies in the literature use different classifications of the SDGs encompassed in the 5Ps (Alamoush et al., 2021; Tremblay et al., 2020); indeed, they are values that help inform public policymaking at all levels of government, scientific research, and the responsible use and application of data, among other aspects (Leichtweis & Soares, 2022).

Sustainable development is linked to financial and business risk (Cervelló-Royo et al., 2020). According to Ziolo et al. (2021) financing is necessary to achieve the SDGs. In recent years, the importance of the country risk score (CRS) has grown: the higher the score, the more solvent a country is, and vice versa, with greater solvency reducing its probability of default (Cervelló-Royo et al., 2014). From the point of view of an international investor, the CRS is a good indicator for

classifying a country's current situation in terms of political, economic and financial risk. Over the past two decades, country risk indicators have become a topic of great interest to the global financial community (Peiró-Signes et al., 2022).

Against this backdrop, the aim of the research is twofold. First, for the year 2021, it seeks to analyze the degree of homogeneity in SDG achievement based on the 5Ps, distinguishing between two samples of countries according to the World Bank's classification[1]: one sample contains a total of 65 Low Income Countries (LICs) and Low-Middle Income Countries (LMICs), while the other contains 39 Upper-Middle Income Countries (UMICs) and High Income Countries (HICs). The classification of the SDGs into 5Ps is based on several studies in the literature (Leal Filho et al., 2018; Lo-Iacono-Ferreira et al., 2022; OECD, 2017; Puertas & Marti, 2023). Complementarily, the second aim is to establish a ranking of countries according to their achievement of the SDGs, to which end a synthetic indicator (SI) is produced, and then to identify which country risk factors are associated with SDG achievement. To fulfill these objectives, two research questions are posed.

> Q1. Are high-income and low-income countries uniform in their achievement of the 5Ps?

The cluster analysis will detect if the 5Ps are differentiating factors between the samples analyzed. By so doing, we can identify countries' strengths and weaknesses in their achievement of the SDGs.

> Q2. Are the components of country risk associated with the achievement of sustainable development?

Using the Technique for Order Preference by Similarity to the Ideal Solution (TOPSIS) multicriteria decision-making technique, a ranking of countries will be established, revealing their level of achievement of the SDGs. Then, contingency tables will be used to examine the association between the components of the CRS and countries' positions in the ranking.

The novel contribution of the paper is the analysis of SDG achievement based on the 5Ps and the relation with country risk, differentiating countries by their level of income. Çağlar and Gürler (2022) conduct a cluster analysis with the 17 SDGs for a total sample of 110 countries, which represent a heterogeneous set of observations. However, there are no studies in the literature on the association between all the SDGs and country risk. Cervelló-Royo et al. (2022) examine the relationship between the two concepts, but for only three SDGs and a sample of 64 countries. The results obtained in the research will be of great use to financial market decision-makers. Those countries with better SDG compliance will be a reference to know the financial factors that can be of most help to the lagging areas.

The rest of the paper is structured as follows. Section 2 reviews the literature on SDG achievement and access to financial markets. Section 3 presents the methods and variables used. The results of the research are analyzed in Section 4. Lastly, the conclusions, the contribution of the study and the limitations are set out in Section 5.

2 | LITERATURE REVIEW

The adoption of UN 2030 Agenda for Sustainable Development assumed that the global economy would continue its steady progress. The Agenda was crystallized into 17 SDGs and 169 targets, requiring an overarching vision of the issues to be addressed, in order to establish joint actions that foster universal sustainable development (Antoniades & Grifth-Jones, 2018; Haas et al., 2021). However, results reported by Elavarasan et al. (2022) confirm that SDG1 (Ending poverty) and SDG8 (Decent work and economic growth) have been the hardest hit by the COVID-19 pandemic Regarding SDG 8, developing and least developed countries were supposed to reach economic growth rates of 5%–7% per year during the last decade; however, according to the World Bank databank (World Bank, 2019), neither group has done so. In fact, according to Antoniades et al. (2020), over the last decade, global debt has been rising in all sectors. In this regard, there is abundant literature calling for "sustainable globalization" in economic, financial and social spheres (Gill & Germann, 2022; Okafor-Yarwood, 2019; Schroeder et al., 2018; Xie et al., 2021). In fact, differences between countries are becoming ever more noticeable; along this line of argument, Reverte (2022) demonstrated that Scandinavian countries (Denmark, Sweden, and Finland) have the highest SDG index values, which reflects their ingrained culture in sustainability and defense of the environment and social rights. Moreover, the countries that are best placed to achieve the SDGs are those with higher levels of governance where there is greater government effectiveness and political stability, greater freedom of expression and association, stronger rule of law and greater control of corruption.

Debt is not necessarily a negative issue; in fact, access to capital is a positive component of country risk (Euromoney Agency, 2020) which fosters economic growth (Antoniades et al., 2020; Antoniades & Grifth-Jones, 2018) and development (Cecchetti et al., 2011). However, a certain magnitude of debt could exacerbate the distress currently experienced by Low-income developing countries (LIDCs), thus threatening the successful implementation of the SDGs. According to the International Monetary Fund, debt levels have risen dramatically in most LIDCs (IMF, 2018).

Many authors and international organizations have recently shifted their attention to the effects of existing debt dynamics on the implementation of the SDGs (Chandy et al., 2013; Schmidt-Traub, 2015; Manuel et al., 2018; UN, 2013, 2018; UNCTAD, 2018), highlighting the importance of the magnitude of the debt and the interest burden, as servicing debt and interest payments could make it harder for some LIDCs to achieve the SDGs. Thus, several analyses have been carried out to quantify the implications of this issue for the different SDGs and evaluate the knock-on effects. Globally, the United Nations encourages countries to not forget the lessons learnt, claiming that this learning will make it easier to face future challenges. The 17 SDGs and the Paris Agreement on climate change are both

supposed to be accomplished in less than a decade from now, with some authors identifying interdependencies between certain indicators for these two objectives (Laumann et al., 2022).

In this respect, the European Union (EU) has undergone remarkable advances in each and every goal (Eurostat, 2022), facilitated by an ambitious strategy regarding the Social Rights Action Plan, digitalization and the European Green Deal. Furthermore, all this has been supported by financial resources to help member states to overcome the consequences of COVID-19 and prevent any delay to the fulfillment of the SDGs. However, the attempted monetary normalizations in the EU and the USA have significantly exacerbated the negative debt dynamics in LIDCs (BIS, 2018). Increases in the Euro and US dollar exchange rates and interest rates have been accompanied by disinvestment from developing countries, leading to a devaluation of their currency. As a result, treasuries, corporations, banks and households in developing countries have to pay higher interest rates in local currency, the value of which has collapsed in many cases. Historically these conditions lead to currency and/or bank crises followed by sovereign debt crises and defaults.

Thus, the scientific community has shown great interest in analyzing the possible contradictions between the need to achieve continuous socioeconomic development and the need to protect the environment, which come into even greater conflict in the LIDCs (Chandy et al., 2013; Coscieme et al., 2020; Hickel, 2019; Manuel et al., 2018). Sachs et al. (2019, 2020) suggest operationalizing and organizing SDGs into six sets of transformation: (1) education, gender, and inequality; (2) health, wellbeing, and demography; (3) energy decarbonization and sustainable industry; (4) sustainable food, land, water, oceans; (5) sustainable cities and communities; and (6) digital revolution for sustainable development. Along the same lines, Shahbaz et al. (2021) study how the economic growth model in India negatively affects climate quality due to heavy dependence on fossil fuels. For a sample of 116 developing economies, Madni et al. (2021) show that GDP growth, the financial sector, and energy consumption generate increases in carbon dioxide emissions, while social interconnectedness, quality institutions, and inclusive financial development favor environmental cleanliness.

On the other hand, Manuel et al. (2018) predict that if growth continues at previous rates, the number of people in extreme poverty will be halved compared to 2015 levels, which means that 400 million people will still be living in poverty. Adewuyi and Awodumi (2021) claim that sustainable growth is not feasible in South Africa and Nigeria, even in a hypothetical scenario in which a structural change is accomplished. Antoniades et al. (2020) use a large dataset of more than 400 financial crisis episodes from around the world during the period 1980–2015. Their data are not limited to episodes of sovereign debt default, but also include monetary crises, as well as banking crises that require significant intervention by the State and the government; the main aim is to capture most of the parameters that define the global debt context surrounding the implementation of the SDGs.

In summary, the characteristics of different countries generate barriers to achieving a unified advance; hence the importance of SDG17 (Alliances to achieve the objectives) throughout this process. Universal sustainable development is only achievable with global partnerships and global cooperation by all countries. Thus, to achieve the 169 targets defined under the 17 SDGs, the synergies between them must be harnessed to solve possible conflicts and reinforce positive interactions (Boar et al., 2021; Kostetckaia & Hametner, 2022; Zhao et al., 2021). Efforts to create such synergies have resulted in the grouping of the SDGs around five central axes (5Ps), facilitating the allocation of resources and thus optimizing the results achieved. It can be said that the evaluation of countries' achievement of the SDGs has aroused the interest of the scientific community, as reflected in recent research (Table 1).

Most analyses have identified connections between the SDGs and the economic, financial and political context. To contribute to this literature, we conduct a country-level analysis aimed at providing evidence on the issues that are key to achieving unified sustainability and the national economic, financial and political circumstances that influence this process.

3 | MATERIALS AND METHODS

3.1 | Materials

The analysis has been conducted using the database from the *Sustainable Development Solutions Network*, for year 2021 which describes the level of achievement of the 2030 Agenda in 163 countries at three levels of aggregation (Sachs et al., 2022). The first level refers to the aggregated SDG Index; the second level refers to each of the 17 SDGs included in the 2030 Agenda; and the third level refers to 85 specific key performance indicators. The statistics in this database ensure the homogeneous treatment of all countries, offering an overview of the path taken to guarantee national sustainability. To be able to compare the indicators used to measure the 17 SDGs, they are rescaled to range between 0 and 100, where 0 denotes the worst possible performance and 100 the best.

Achieving the SDGs has interrelated ecological, social and economic consequences (Singh et al., 2018). In this paper, the SDGs are grouped according to the 5P classification proposed by the OECD (2017) to identify countries' progress toward sustainable development. Each one includes a set of goals and is calculated as the arithmetic mean of the SDGs that comprise it (Figure 1).

The first group, *People*, is made up of the first five SDGs, which relate to people and human rights and are aimed at ending all forms of poverty and hunger and guaranteeing dignity and equality for all. Next, *Peace* is about striving to eliminate violence in order to create peaceful societies. This group is composed of SDG16, which seeks to promote human dignity. The goal of *Partnership* is to implement the Agenda through a solid global alliance that allows progress toward achieving the SDGs, not only through new management mechanisms, but also instruments for communicating initiatives and accomplishments. In fourth place, the mission of *Planet* is protecting the Earth's natural resources and tackling climate issues to guarantee the well-being of current and future generations; SDGs 6, 12, 13, 14 and

TABLE 1 Literature review on SDGs and their implementation.

Author	Sample	Objective	Methodology	Results
Allen et al. (2019)	Arab region	Assess and prioritize SDG targets based on their level of urgency, systemic impact, and policy gap.	Multicriteria analysis	The integration of systems thinking and analysis with more traditional approaches is a key component of the assessment.
Antoniades et al. (2020)	150 countries	New estimates of the impact of financial crises on the multiple social, economic and environmental aspects of poverty and linkages between these aspects.	Econometric model	The results indicate that the current financial difficulties experienced by many LICs may reverse the progress that has been made in reducing poverty. Financial crises are associated with an increase in the extreme poor in LICs.
Jabbari et al. (2020)	150 countries	This study introduces a composite index called DEVI which simple consists of the "development goals indicators." It is based on the SDG index and is aimed at better monitoring and assessment of countries' levels of sustainable development.	A combined statistics-based algorithm.	Based on the similarities in their DEVI scores, countries are classified into developed and developing countries. Applying this algorithm, 43 and 40 countries are classified as developed countries in 2017 and 2018, respectively.
Tremblay et al. (2020)	30 surveys	Present a classification of the SDGs and their targets based on the 5Ps.	Quantification system	The more similar the targets in terms of classification, the more positive the interactions.
González del Campo et al. (2020)	Published academic literature	Review current engagement of strategic environmental assessment with the SDGs both in the academic literature and in practice.	Systematic literature review	Shift towards the adoption of a new paradigm in plan-making, particularly supported by governments' increasingly proactive embrace of SDGs.
Cling et al. (2020)	28 EU member states	Measure interlinkages between the 100 indicators developed by the EU, bearing in mind that the United Nations considers accounting for these interlinkages and the integrated nature of the SDGs a prerequisite for SDG achievement.	Principal component analysis (PCA) and Hierarchical Cluster Analysis (HCA)	Two groups of countries can be identified within the EU. On the one hand, the countries of Western and Northern Europe, and on the other, the countries of Eastern and Southern Europe. Segmentation between EU countries is directly related to their economic development level.
Boar et al. (2021)	408 papers	Study models of SDGs to identify synergies and trade-offs, as well as solutions to enhance these synergies and minimize the trade-offs.	Systematic literature review	The issue of the SDGs should be reviewed by the United Nations. Rich and developing countries must apply multiple strategies to improve the quality of life of their citizens. Developing countries should focus on ending poverty, while rich countries should implement new economic models that are more likely to be environmentally friendly.
Gusheva and de Gooyert (2021)	105 documents	Create an inventory of documents representative of as many diverse opinions as possible. Therefore, they model causal arguments with respect to key concepts comprising green recovery and identify	Systems thinking	Their findings indicate that green recovery is promising for curbing greenhouse gas emissions and addressing growing socioeconomic inequalities. However, the position of what green recovery means for economic

TABLE 1 (Continued)

Author	Sample	Objective	Methodology	Results
		issues of consensus and dissensus.		growth, including the development of gross domestic product and employment, is still largely unclear and sometimes contradictory.
Carlsen and Bruggemann (2022)	102 countries	Analysis of the status and development of the SDGs.	Partial ordering methodology	Based on the 5Ps, they determine the impact of the SDGs on countries grouped according to their economic and regional affiliation.
Verdejo et al. (2022)	Jaén (Spain)	The analysis and implementation of the SDGs in Smart Labs.	Literature review and a case study	The evaluation of SDGs in Smart Labs helps to provide comfort, health, and sustainability in society.
Liu et al. (2022)	144 studies	They discuss the pros and cons of the different types of models and identify seven representative models. They also identify synergies and trade-offs between poverty and other SDGs.	Systematic review	The review shows that poverty scenario analysis was carried out mainly from a single perspective, such as economic, ecological, or agricultural, whereas few studies used effective models to analyze poverty in an integrated analysis of interactions among multiple sectors.
Kostetckaia and Hametner (2022)	EU	Analysis of synergies and trade-offs between the SDGs in the EU Member States.	Regression analysis	There is a negative relationship between countries' progress and the shares of trade-offs between SDG indicators, and a moderate positive relationship between progress and synergies.

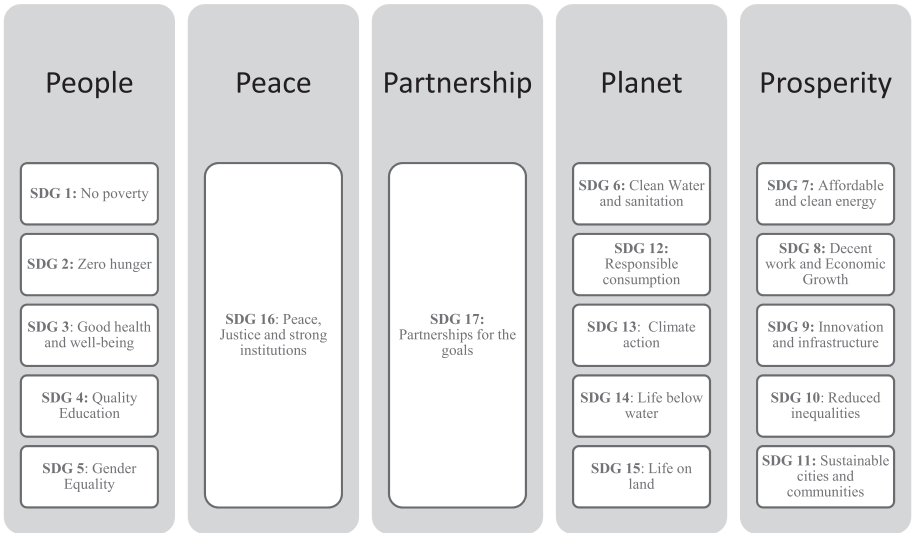


FIGURE 1 Grouping of the SDGs that define the 5Ps.

15 make up this group. In short, the goal is to care for water, the climate, marine life and terrestrial ecosystems, and to promote responsible production and consumption. Lastly, SDGs 7, 8, 9, 10 and 11 comprise the *Prosperity* group, and are aimed at encouraging economic, social, and technological progress compatible with due respect for nature. The goals in this group seek to ensure prosperous and satisfying lives in harmony with the environment.

On the other hand, we use the definition of the CRS provided by the Euromoney Agency (Euromoney Agency, 2020). According to this definition, the CRS combines different categories related to debt,

TABLE 2 Descriptive statistics of 5Ps and CRS.

	Max	Min	Mean	SD
UMICs and HICs				
People	90.50	52.74	80.27	8.94
Peace	94.47	33.14	74.49	12.34
Partnership	94.64	29.56	63.74	12.65
Planet	82.77	50.59	71.85	6.88
Prosperity	93.38	41.46	72.94	11.94
Economic assessment	30.18	6.13	18.73	4.84
Political assessment	31.72	6.62	20.50	6.27
Structural assessment	8.51	3.02	5.87	1.35
Access to international capital markets	9.60	0.88	6.40	2.29
Debt Indicators	9.10	2.12	6.01	1.78
LICs and LIMCs				
People	81.49	34.84	56.00	14.03
Peace	76.35	41.40	57.63	9.51
Partnership	73.42	35.15	53.68	9.86
Planet	81.31	68.10	75.77	2.77
Prosperity	72.97	35.61	51.52	10.57
Economic assessment	19.08	5.60	13.08	3.38
Political assessment	18.87	3.80	12.75	3.40
Structural assessment	5.89	0.63	3.62	1.26
Access to international capital markets	5.77	0.00	3.23	1.75
Debt indicators	6.49	1.76	4.52	1.08

access to credit, political, economic, and structural assessment (Cervelló-Royo et al., 2013). Overall, it evaluates the investment risk of a country, including risk of default on a bond, risk of losing direct investment, risk to global business relations etc. To do so, it takes a qualitative model, based on an expert opinion on risk variables within a country, and combines it with a basic quantitative value. The consensus expert scores, combined with scores on sovereign borrowers' access to international capital markets, together with data from the IMF/World Bank on debt indicators, create the Euromoney CRS for 186 individual countries. The global CRS is presented on a 100-point scale, with 100 indicating virtually devoid of any risk, and 0 completely exposed to every risk. The components *Economic assessment* and *Political assessment* are scored between 0 and 35, and the rest between 0 and 10.

The total sample used in this paper includes 104 countries[2]; specifically, those for which there is available information on the SDGs and the CRS components. In order to conduct more homogeneous analyses, two samples have been established according to the countries' level of wealth: one comprises LICs and LMICs, and the other UMICs and HICs. The different performance of the two sets of countries in terms of SDG achievement justifies the splitting of the sample for a better analysis. Table 2 shows the main descriptive statistics of the SDGs, grouped into the 5Ps, and those of the CRS components.

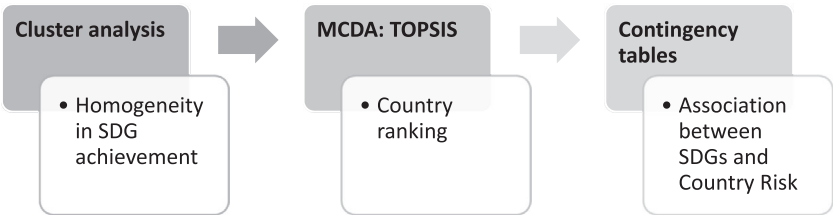
In the sample containing UMICs and HICs, the best SDG achievement is found for the dimension *People*, with a mean value of over 80%, compared to *Partnership*, which only reaches 63%. The focus of SDG 17 (*Partnership*) is promoting collaboration between high-income and low- and middle-income nations for sustainable and equitable global development (Addo-Atuah et al., 2020), and this is where the most developed economies should redirect their efforts. Rich countries must make a huge effort to accelerate progress toward climate change mitigation and biodiversity protection. Low-income nations tend to record lower scores due to the nature of the SDGs, which largely focus on ending extreme poverty, access to basic services and infrastructure (Sachs et al., 2022). In the sample of UMICs and HICs, the mean values corresponding to the pillars of the CRS are all above the mean value for the range of the score, but in the set of the poorest countries, the values are below the mean score.

3.2 | Methods

The research objective requires the use of different methods applied in various stages (Figure 2), which together enable the analysis of the samples of countries established.

The first research question has been answered by applying a cluster analysis to identify patterns of performance in the analyzed samples, based on the available information on the level of SDG achievement, with all the goals grouped under the 5Ps. This method has been widely used in the field of sustainable development for the classification of bioclimatic regions (Roshan et al., 2022), environmental and technological innovations (Tsenina et al., 2022), sustainable

FIGURE 2 Research design.



energy development (Marti & Puertas, 2022), and interrelationships among SDG indicators (Cling & Delecourt, 2022; Çağla and Gürler, 2022). In this paper, the use of a hierarchical cluster analysis is proposed, based on Ward's method and squared Euclidean distance. This method enables a measurement of countries' proximity to one another using the standardized values of the 5Ps. In addition, the number of clusters has been determined by creating a dendrogram, applying the nonparametric Kruskal–Wallis test to check that each variable differs significantly between the clusters established.

In the next stage of the paper, to answer the second research question, two methods are applied: the multicriteria decision-making technique called TOPSIS and contingency tables. The use of a multicriteria decision analysis (MCDA) is appropriate for the construction of the SI (Modibbo et al., 2021); specifically, the technique used here is TOPSIS, which has been commonly applied in the sustainable development literature (Ardestani et al., 2020; Benítez & Liern, 2021; Fathipour & Saidi-Mehrabad, 2018; Mateusz et al., 2018; Stecyk, 2019). This method was originally proposed by Hwang and Yoon (1981) to tackle the problem of establishing an order of alternatives based on the idea of distance to the positive ideal and the negative ideal solution. The two main advantages of TOPSIS are its mathematical simplicity and flexibility in the definition of the choice set. It consists of six consecutive stages (Karabiyik & Kutlu, 2018).

a. The decision matrix must be created $(X_{ij})_{mxn}$, with m alternatives and n criteria. In this study, the criteria are each of the 5Ps, while the alternatives are the countries under study.
b. The normalized decision matrix $(r_{ij})_{mxn}$ is generated, which represents the relative performance of the alternatives.
c. The weighted normalized decision matrix is obtained $(V_{ij} = w_j\ r_{ij})_{mxn}$. In this study, the same weights are used for each criterion to avoid subjectivity in the analysis.
d. Positive and negative ideal solutions are detected. In this paper, the ideal solution is identified by maximizing each criterion, because the highest value indicates a higher level of SDG achievement, while the negative ideal solution is calculated by minimizing the criteria.
e. The distance to the positive ideal solution (A^+) and to the negative ideal solution (A^-) is evaluated. The final ranking for decision-making will be obtained by comparing distances. The Euclidean distance separating each competing alternative from the positive ideal solution (S^+_i) and the negative ideal solution (S^-_i) is measured.
f. The relative closeness to the ideal solution for each competing alternative is computed using the expression (1).

$$CC_i = \frac{S_i^-}{S_i^* + S_i^-}, (0 < CCi < 1, i = 1,2,\ldots m) \quad (1)$$

The preference order of the alternatives is established, according to their relative closeness to the ideal solution. Higher values of relative closeness indicate a higher preference order among alternatives (Lin et al., 2008; Lourenzutti & Krohling, 2016).

Finally, based on the ranking produced, contingency tables are created to analyze the possible connection between countries' position in the ranking and the CRS components that could a priori be considered determinants of the position held. There has recently been growing interest in contingency tables as they have proven useful for studying associations between factors in very diverse areas, such as the circular economy (Virlanuta et al., 2020), sustainable finance (Ziolo et al., 2021), the SDGs at the city level (Puertas & Marti, 2023), and climate change (Martí et al., 2022) among others.

The main objective of this method is to analyze the degree of association of a set of elements with different characteristics, which are represented by categories of the descriptive variables under study. In this paper, a contingency table has been constructed for each of the CRS indicators. The columns represent the number of countries that are in the same quartile of the ranking established according to SDG achievement, and the rows the observations with similar results in the CRS indicators. The expected frequencies are calculated using expression (2).

$$Eij = \frac{n_i\, n_i}{N} \quad (2)$$

where N is the total number of observations, n_i is the number of observations in row i, and n_j is the number of observations in column j.

Both the observed and expected frequencies are needed to perform the χ^2 test showing whether or not the variables considered in the study are independent of one another. The result of the χ^2 test confirms whether the levels of a qualitative variable influence those of another variable. Thus, the result of the χ^2 test used in this study indicates whether SDG achievement is associated with the country risk components. The χ^2 test is defined by expression (3).

$$\chi^2 = \frac{\sum_{i=1}^{h}\sum_{j=1}^{k}\left(n_{ij} - E_{ij}\right)^2}{E_{ij}} \quad (3)$$

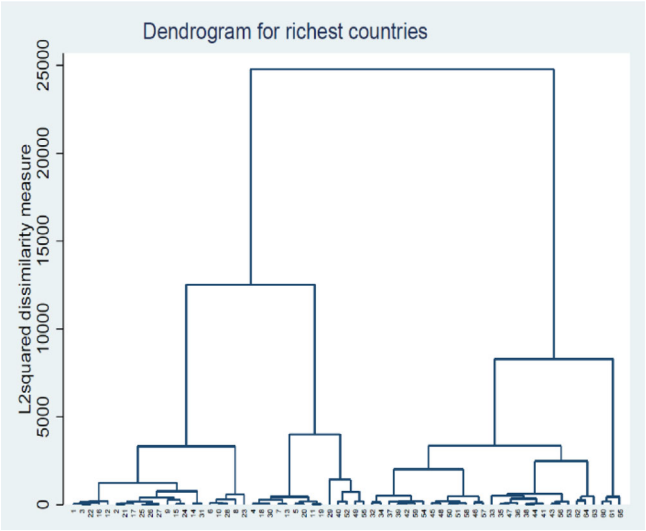


FIGURE 3 Dendrogram for richest countries. [Colour figure can be viewed at wileyonlinelibrary.com]

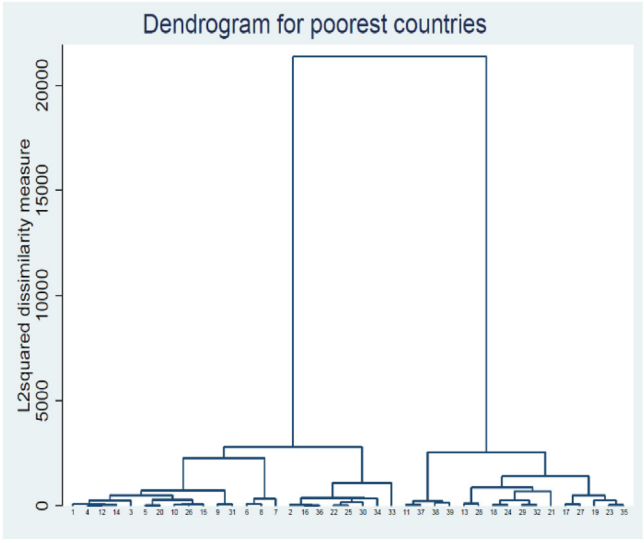


FIGURE 4 Dendrogram for poorest countries. [Colour figure can be viewed at wileyonlinelibrary.com]

where, n_{ij} is the observed frequency, and E_{ij} is the expected frequency. The null hypothesis is that of independence between factors. The alternative hypothesis is that of dependence between factors. In addition, the Gamma coefficient, which indicates the strength of the link between the two analyzed variables, is used as a measure of association. Its value ranges between −1 and 1, with the sign indicating either a direct or inverse relationship between the pillars studied.

4 | RESULTS AND DISCUSSION

Access to financial services on favorable terms fosters progress toward achieving the SDGs, allowing improvements in consumption patterns, optimal planning of expenses, health-related risk management, and investments not only in productive ventures, but also longer-term investments in areas such as education (Klapper et al., 2016). In this context, the two research questions can be answered.

> Q1. Are high-income and low-income countries uniform in their achievement of the 5Ps?

The cluster analysis identifies four groups in the sample of the richest countries (Figure 3) and two in the sample of the poorest (Figure 4), revealing some specific features that mean this research question cannot be answered in the affirmative (Table 3, Table A1). As confirmed by the Kruskall–Wallis test (p-value > 0.05), we find a homogeneous pattern among the LICs and LMICs in the protection of natural resources and concern about climate change for the sake of a better future (the *Planet* dimension); however, the same cannot be said of the other dimensions.

The result regarding the achievements in the dimensions of the 5Ps reveals the strengths and weaknesses of each set of countries, but none of them excels in all dimensions. In the sample of UMICs and HICs, cluster 1 shows a greater level of achievement than the other clusters in 4 of the 5Ps (*Planet* is the exception), with values over 70% in all four cases. This cluster is composed of 21 nations, with a predominance of major European powers, as well as powerful American, Asian and Oceanic countries. These are very responsible countries that have made notable progress toward achieving the SDGs; however, they primarily need to work on the *Planet* dimension related to climate change prevention, the circular economy and renewable energies.

At the other extreme is cluster 4, where levels of achievement do not exceed 60%, except in the *Planet* dimension. The cluster is composed of countries that demonstrate the tension between growth and ecological sustainability, in line with Hickel's (2019) conclusion that the call in SDG8 for sustained global economic growth of 3% per annum contradicts the sustainability goals in the *Planet* dimension. Furthermore, cluster 4 presents its lowest value in *Peace*, showing these countries lack the means to guarantee peace and justice through solid institutions that foster a climate of harmony. Cluster 2 is primarily composed of Eastern and Southern European countries, along with the United Kingdom, the United Arab Emirates, China, and the African countries Lebanon and Mauritius. Together they have a good level of achievement in all dimensions (over 70%) except in *Partnership*, with a value below 50%. This means that these countries need to strengthen their global partnerships for sustainable development, mobilizing and exchanging knowledge, technical capacity, technology and financial resources to achieve the goals of the Agenda. Cluster 3 brings together Latin American countries along with Asian and African nations, whose weak point is in the *Prosperity* dimension; therefore, these countries should target their efforts at incentivizing economic and social progress that remains respectful of the environment.

In the LICs and LMICs sample, we identify two groups that show homogeneous performance in terms of SDG achievement. For cluster

TABLE 3 Results of the cluster analysis and Kruskal–Wallis test.

	People	Peace	Partnership	Planet	Prosperity
UMICs and HICs					
Total mean	80.27	74.49	63.74	71.85	72.94
C1 mean	87.6	84.7	70.7	67.2	85.5
C2 mean	83.2	77.1	47.7	71.0	74.4
C3 mean	75.5	68.8	68.6	75.3	64.3
C4 mean	58.3	42.9	46.3	76.7	56.0
Kruskal–Wallis test					
Chi-sq	36.40	36.461	36.64	19.12	45.60
p-Value	0.000	0.000	0.000	0.000	0.000
LICs and LIMCs					
Total mean	56.00	57.63	53.68	75.77	51.52
C1 mean	45.5	52.9	50.5	76.0	44.6
C2 mean	71.1	64.4	58.2	75.5	61.5
Kruskal–Wallis test					
Chi-sq	27.60	14.638	5.616	0.758	24.258
p-Value	0.000	0.000	0.017	0.383	0.000

TABLE 4 Statistics of the contingency tables.

Variable X–variable Y	Chi-sq	*p*-Value	Gamma	*p*-Value
UMICs and HICs				
Ranking-economic assessment	23.904	0.004	0.427	0.000
Ranking-political assessment	39.357	0.000	0.607	0.000
Ranking-structural assessment	27.870	0.001	0.546	0.000
Ranking-access to international capital markets	33.218	0.000	0.596	0.000
Ranking–debt indicators	31.901	0.000	0.598	0.000
LICs and LMICs				
Ranking-economic assessment	8.927	0.444		
Ranking-political assessment	17.743	0.038	0.394	0.008
Ranking-structural assessment	25.904	0.002	0.576	0.000
Ranking-access to international capital markets	16.120	0.064		
Ranking–debt indicators	6.476	0.692		

1, the strong point is the *Planet* dimension, with a level of achievement of 76%, while the rest of the dimension show values around 50%. These are African and Asian countries (Table A1 in the appendix) that are very concerned about protecting natural resources—which they have in abundance—and that are developing forward-looking climate change strategies to guarantee a better future for forthcoming generations; however, they have a long way to go when it comes to achieving the objectives of the 2030 Agenda. Cluster 2 presents better results than cluster 1, with values above 60% in almost all the dimensions.

In short, based on the analysis carried out, we can conclude that the two samples of countries need greater coordination and cooperation to ensure uniform achievement of all the SDGs. The results confirm the existence of major territorial inequalities in the achievement of the SDGs (*Q1*). There is a need for harmony between governments, public institutions, social entities, the private sector and civil society in order to enhance the universality of the goals set.

Q2. Are the components of country risk associated with the achievement of sustainable development?

The TOPSIS method has been applied to construct the SI, which in turn has been used to establish a ranking of countries for each sample analyzed, based on their level of achievement of the SDGs. Table A2 (second column) sets out the result of the SI TOPSIS whose values are between 0 and 1; they are ordered from highest to lowest preference of the country ranking. Among the UMICs and HICs, Sweden and Denmark stand out in the top positions. These results coincide with those from the TOPSIS applied by Mateusz et al. (2018), indicating that the most developed economies of the EU have made

significant advances in the application of sustainable development. At the same time, Ukraine and Algeria top the ranking in the sample of LICs and LMICs, with high values in most of the SDGs.

The country ranking has been divided into quartiles to analyze the link between the position held and the pillars of the CRS (*Economic assessment*, *Political assessment*, *Structural assessment*, *Access to international capital markets* and *Debt indicators*). The quartiles have been constructed from the results obtained for the SI TOPSIS, considering that the countries in the first quartile are those with the highest value of the indicator and therefore those with the best position in the ranking. Table 4 shows the statistics for the contingency tables, indicating relationships of dependency between variables (Chi-sq, p-value < 0.05) and the positive direction of the relationships (Gamma/ contingency coefficient, p-value < 0.05). The latter indicates that the better the position in the ranking, the better the achieved country risk indicators.

The association between country risk and sustainability outcomes has been demonstrated in other studies in the literature (Asadullah & Savoia, 2018; Barbier & Burgess, 2021). However, in this paper, we identify which types of country risk indicators are associated with SDG achievement, according to countries' income. In this study, the χ^2 test confirms that a good economic and financial position which allows access to international financial markets at a reasonable cost is linked to optimal SDG achievement in high-income areas. However, *Economic assessment*, *Access to international capital markets* and *Debt indicators* are not associated with better SDG achievement in the poorest countries. At the same time, *Political Assessment* and *Structural assessment* are found to be linked to an improvement in the level of achievement of sustainable development. These results coincide with those of Wang et al. (2023), who reported that in the ASEAN area, a decrease in financial and political risks reduces the ecological footprint and promotes sustainable growth. For their part, Martí et al. (2022) confirm that access to financing is a necessary condition for the implementation of sustainable development. Without economic resources, it will be hard for the least developed countries to curb industrial actions that damage the environment. Nevertheless, Shetty (2020) indicates that external financing for the SDGs has stalled, private capital flows to low-income countries are negligible, and although more of them have been able to access capital markets, a large proportion of these countries are struggling with debt or are at high risk of falling into such difficulties. In short, if the poorest countries were able to improve their CRS indicators, they would have an easier path to improving their SDG achievement.

5 | CONCLUSIONS

When it comes to the implementation of the SDGs, countries have different characteristics and needs, and face specific challenges. Monitoring their progress is a crucial process to identify the accomplishments, needs, strengths and weaknesses of each country. Recent troubles stemming from the pandemic or the war in Ukraine have led to poor and declining SDG outcomes for several years, thwarting years of progress toward the eradication of extreme poverty. This study contributes to the research on the role played by country risk in the achievement of the SDGs.

The major world powers, such as the USA, Germany, Australia, or Canada, have been grouped in the same cluster, standing out as clear leaders in 4 of the 5Ps, with their weak point being the *Planet* dimension. However, the sample of the poorest countries has been divided into two clusters, with the *Planet* dimension again being the one showing different patterns of performance. These are African and Asian nations that make great efforts to protect natural resources, which they have in abundance, and develop strategies focused on tackling climate change in order to guarantee a better future for the next generations; however, they have a long way to go in achieving the goals of the 2030 Agenda. One of the ways they can do so is by improving their CRS. This study has shown that in rich countries all the CRS components foster the achievement of the SDGs, while poorer nations need to improve those related to financial access, economic assessment and debt indicators. By so doing, the most disadvantaged countries will be able to improve their sustainable development performance.

This study has some limitations that could open avenues for exploration in future research. It is not possible to know which SDGs the country risk indicators are related to, only the SI TOPSIS result will, by including all of them. Also, the analysis is based on SDG scores, which have gaps in the data collected for some of the detailed country-level indicators, and which are unable to capture transboundary impacts related to the region the country is located in. Furthermore, the SDGs and the CRS have been calculated for an extensive period; therefore, analyzing their evolution over time would be a worthwhile direction for future research. Moreover, ongoing updates of the indices used will make it possible to add to the information extracted and corroborate possible changes in countries' performance, which is sometimes linked to the political leanings of the leaders in question.

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ENDNOTES

[1] The World Bank assigns the world's economies to four income groups—low (GNI per capita < 1085), lower-middle (1086-4255), upper-middle (4256-13,205), and high income (>13,205). The classifications are updated each year on July the 1st and are based on the GNI per capita of the previous year.

[2] Table A2, included in the annex, shows, and lists the analyzed countries grouped by income level.

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APPENDIX A

TABLE A1 Countries belonging to each cluster.

UMICs and HICs	
Cluster 1	Australia, Belgium, Canada, Denmark, Finland, France, Germany, Iceland, Israel, Italy, Japan, Korea South, Netherlands, New Zealand, Norway, Poland, Portugal, Slovenia, Spain, Sweden, United States.
Cluster 2	Croatia, Cyprus, Estonia, Greece, Ireland, Latvia, Lithuania, Malta, United Arab Emirates, United Kingdom, China, Lebanon, Mauritius, Panama.
Cluster 3	Uruguay, Russia, Chile, Albania, Argentina, Bosnia-Herzegovina, Brazil, Bulgaria, Colombia, Costa Rica, Dominican Republic, Ecuador, Fiji, Georgia, Jamaica, Jordan, Malaysia, Maldives, Mexico, Montenegro, Peru, Romania, Thailand, Turkey, Iraq, Namibia, South Africa.
Cluster 4	Gabon, Guatemala, Venezuela
LICs and LIMICs	
Cluster 1	Congo, Gambia, Guinea, Liberia, Madagascar, Mozambique, Niger, Sierra Leone, Sudan, Togo, Angola, Benin, Cameroon, Côte d'Ivoire, Haiti, India, Kenya, Mauritania, Pakistan, Papua New Guinea, Sao Tome & Principe, Senegal, Tanzania.
Cluster 2	Algeria, Bangladesh, Egypt, El Salvador, Ghana, Honduras, Indonesia, Iran, Morocco, Myanmar, Nicaragua, Philippines, Sri Lanka, Tunisia, Ukraine, Vietnam.

TABLE A2 Ranking of countries.

UMICs and HICs						LICs and LIMICs		
Rank	Country	SI TOPSIS	Rank	Country	SI TOPSIS	Rank	Country	SI TOPSIS
1	Sweden	0.8749	33	Brazil	0.5957	1	Ukraine	0.8779
2	Denmark	0.8622	34	United States	0.5953	2	Algeria	0.8421
3	Norway	0.8301	35	Fiji	0.5907	3	Vietnam	0.8195
4	Germany	0.812	36	Latvia	0.58	4	Tunisia	0.8145
5	Finland	0.8037	37	Malta	0.5796	5	Morocco	0.7434
6	Japan	0.7493	38	Israel	0.5794	6	Egypt	0.7228
7	Iceland	0.7231	39	Russia	0.5765	7	El Salvador	0.7148
8	France	0.722	40	Croatia	0.5716	8	Iran	0.6908
9	Chile	0.7219	41	Lithuania	0.5659	9	Indonesia	0.672
10	New Zealand	0.7209	42	Ecuador	0.5639	10	Sri Lanka	0.669
11	Uruguay	0.7192	43	Albania	0.5632	11	Philippines	0.604
12	Canada	0.7136	44	Thailand	0.5584	12	Nicaragua	0.5979
13	Belgium	0.6968	45	Jordan	0.5425	13	Ghana	0.5449
14	Slovenia	0.6839	46	Argentina	0.5409	14	Myanmar	0.5285
15	Portugal	0.6767	47	Maldives	0.5374	15	Sao Tome & Principe	0.4993
16	Australia	0.6744	48	Jamaica	0.537	16	Honduras	0.4876
17	Poland	0.6727	49	Cyprus	0.532	17	Bangladesh	0.4663
18	Netherlands	0.6696	50	Colombia	0.5295	18	Kenya	0.4569
19	Spain	0.6671	51	Malaysia	0.5192	19	India	0.4517
20	Italy	0.6584	52	Namibia	0.5173	20	Senegal	0.4506
21	Romania	0.65	53	South Africa	0.5005	21	Pakistan	0.4319
22	Korea South	0.6467	54	Peru	0.4984	22	Sierra Leone	0.4118
23	Bulgaria	0.6449	55	Iraq	0.4976	23	Gambia	0.3776
24	Bosnia-Herzegovina	0.6407	56	Mexico	0.4875	24	Niger	0.3768
25	Costa Rica	0.6386	57	Mauritius	0.4669	25	Mozambique	0.3665
26	Estonia	0.6332	58	China	0.4664	26	Côte d'Ivoire	0.3509
27	Georgia	0.6301	59	Dominican Rep	0.451	27	Tanzania	0.3247
28	Montenegro	0.6251	60	U A. Emirates	0.4292	28	Mauritania	0.3118
29	Ireland	0.6165	61	Panama	0.3655	29	Togo	0.3014
30	United Kingdom	0.6098	62	Lebanon	0.3401	30	Congo	0.2666
31	Greece	0.599	63	Guatemala	0.3133	31	Cameroon	0.2577
32	Turkey	0.5976	64	Venezuela	0.3027	32	Benin	0.2537
33	Brazil	0.5957	65	Gabon	0.2935	33	Papua New Guinea	0.2483
						34	Guinea	0.2254
						35	Angola	0.2061
						36	Liberia	0.1909
						37	Haiti	0.1902
						38	Sudan	0.1813
						39	Madagascar	0.1492