

Sustainable development in higher education: An in-depth analysis of Times Higher Education Impact Rankings

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ABSTRACT

The Times Higher Education Impact Rankings (THE-IR), introduced in 2019, are a global initiative aimed at assessing Higher Education Institutions' (HEIs) contributions to the 17 Sustainable Development Goals (SDGs). Since their introduction, THE-IR have sparked considerable interest and debate within the research community due to their potential to improve HEIs' accountability but also the existence of some inconsistencies in the selected measurements. To address this issue, the paper analyses whether and to what extent THE-IR reflect HEIs' sustainability level and commitment and examines the factors influencing HEIs' decisions to participate in the ranking providing information on their sustainability performance across all the SDGs.

Using data from the 2022 and 2023 THE-IR, this study confirms that they offer a robust overview of HEIs' sustainability performances, though significant disparities exist in the behavior of HEIs in terms of participation. Finally, the study identifies overall SDG performance and geographical location as key factors influencing outperformer HEIs' willingness to provide information on the full set of SDGs.

1. Introduction

Sustainable Development Goals (SDGs), introduced by the United Nations in 2015, were designed to provide guidance to a wide array of stakeholders, including governments, corporations, and civil society, aiming at pursuing sustainable development and enhancing global well-being. Among these stakeholders, Higher Education Institutions (HEIs) play a crucial role in advancing SDGs, as they bear the responsibility of fostering knowledge creation, promoting innovation, and contributing to human progress (Chankseliani and McCowan, 2021). As key contributors to societal progress, HEIs are tasked with not only incorporating sustainability into their research and educational pursuits but also setting examples through sustainable practices in operations, governance, and community engagement (Leal Filho et al., 2019).

Given the pivotal role HEIs play in advancing sustainable development, there is an increasing interest in assessing their performance in terms of their contribution to the SDGs. To this end, it is fundamental to define suitable metrics (Chankseliani and McCowan, 2021). This challenge has spurred the development of various tools and frameworks intended to assess the sustainability performance of HEIs, including global ranking systems such as GreenMetric and Times Higher Education Impact Rankings (THE-IR) (Suwartha and Sari, 2013; Bautista-Puig et al., 2022). These assessment tools offer valuable insights into the contribution of HEIs to advance sustainable development, but they also face criticism for their methodological limitations, potential biases, and

the absence of contextualization (Rafols et al., 2021; Siegel and Lima, 2020).

Among these tools, the THE-IR have stirred considerable interest within the higher education community. The THE-IR were launched in 2019 as the first global ranking at the institution level designed to assess the contributions of HEIs to each of the 17 SDGs. The THE-IR employs a methodology that involves calculating individual scores for each Sustainable Development Goal (SDG) and then aggregating them to determine an overall sustainability performance indicator (Times Higher Education, 2023). The computation of the overall score considers only four SDGs. SDG 17, applicable to all HEIs, contributes 22% of the total score. The remaining three SDGs included in the overall score are those for which each HEI achieves its highest individual scores from the SDGs information provided by the HEIs. Therefore, for eligibility in the ranking, HEIs must submit data for at least SDG 17 and any three other SDGs. These ranking mechanisms have raised concerns among authors who have highlighted some methodological inconsistencies, such as the limited coverage of SDGs, potential redundancy and the arbitrary weighting system within THE-IR which violates established ranking principles (Torabian, 2019; Bautista-Puig et al., 2022; Gadd, 2020).

The criticisms that emerged in previous studies have underscored the need to assess the validity of the THE-IR by empirically verifying

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List of Notations

SD	Sustainable Development
SDG	Sustainable Development Goals
HEI	Higher Education Institutions
THE-IR	Times Higher Education Impact Rankings
AMAS	Adaptive Model of Sustainability Assessment
STAUNCH	Sustainability Tool for Auditing for University Curricula Holistically
UIGM	UI GreenMetric World University Ranking
STARS	Sustainability Tracking, Assessment and Rating Systems
ISTAT	Istituto nazionale di statistica
THE WUR	Times Higher Education World University Rankings

methodological inconsistencies. Although some authors have provided valuable insights into the participation behavior of HEIs in the THE-IR within specific geographical areas (Cardozo et al., 2021; Iskandaryan, 2020) or by comparing the ranking with other HEIs' rankings (De la Poza et al., 2021; Bautista-Puig et al., 2022; Sierra-García et al., 2024), these studies do not offer a comprehensive examination of the relationship between HEIs' participation in the THE-IR and their sustainability performance. Aiming to address this gap, this study investigates the extent to which THE-IR reflects the sustainability level and commitment of HEIs and explores the factors influencing HEIs' decisions to participate in the ranking providing information on their sustainability performance across all the SDGs.

The study addresses three specific Research Questions (RQs). The first RQ aims to assess the extent to which the ranking provides a thorough assessment of HEIs' sustainability performance, specifically addressing concerns regarding the selection of only four out of the 17 SDGs for calculating the overall score and the weighting systems. This RQ focuses on a subset of HEIs that participate in the overall ranking and that provide information on the full set of SDGs. Firstly, while an institution can participate in the ranking by opting to submit fewer than three SDGs, it will not be eligible for the overall ranking and therefore not included in this analysis. Secondly, to quantitatively address this question, the paper specifically explores HEIs providing information on the full set of SDGs, labeled, as follows, "outperformers". Hence, the first RQ is:

RQ1: Considering outperformer HEIs, to what extent the THE-IR offer an accurate assessment of overall HEIs' sustainability performance?

Then, in light of the flexibility afforded to HEIs to provide information on a subset of four out of the 17 SDGs only, questions arise regarding the true commitment of HEIs to advancing sustainable development across all facets represented by the entire set of SDGs. Therefore, considering all the HEIs that participate in the overall rankings, the second RQ investigates the differences and similarities in terms of overall sustainability performances between outperformer HEIs that provide information on the full set of SDGs and HEIs that provide information on a subset of them. Overall sustainability performances are measured using the overall score given by THE-IR. More specifically, the study addresses the following RQ:

RQ2: Do HEIs that provide information on a subset of the 17 SDGs have similar overall sustainability performance of the outperformer HEIs?

Finally, the heterogeneity in the number of SDG information on performances provided by HEIs, identified by De la Poza et al. (2021), raises questions about the factors influencing HEIs' choices to provide information about the entire set of SDGs. Given the significance of SDGs assessment as a driver for fostering the achievement and integration of SDGs into organizations' strategies and operations (Lozano et al., 2015; Rosati and Faria, 2019), a first exploratory analysis on determinants of

providing information on the full set of SDGs may shed light on barriers and motivating factors that impact the behavior of HEIs. This leads to our third RQ:

RQ3: What factors can explain outperformer HEIs' choices to provide information in connection to all the SDGs?

The paper is structured as follows. The Section 2 introduces the theoretical background by emphasizing the significance of sustainable development in HEIs, sustainability performance assessment for HEIs, THE-IR and the factors influencing HEIs' decisions to provide information on sustainability performances. In Section 3, we present the data and methodology employed to explore the RQs. Section 4 delves into the presentation and the discussion of the results. The Section 5 summarizes the main conclusions, practical implications, and limitations of the study.

2. Theoretical background

2.1. Sustainable development in higher education institutions

HEIs are commonly considered "change agents" with the potential to significantly contribute to addressing the complex environmental, social, and economic challenges currently facing the world (Hesselbarth and Schaltegger, 2014; Sedlacek, 2013). One way HEIs bring this contribution is by integrating the principles of the 2030 Agenda into their policies and activities considering the overall higher education system (Chaleta et al., 2021; De la Poza et al., 2021; Leal Filho et al., 2023). In 2003, Cortese (2003) identified four interconnected and mutually reinforcing areas where HEIs can act in alignment with Sustainable Development: Education, Research, University operations, and External Community.

First, HEIs significantly contribute to human capital development through their educational initiatives. By integrating sustainability principles and practices into their curriculum, HEIs equip future professionals and leaders with the requisite knowledge, skills, and values to contribute effectively to sustainable development in their respective fields. Additionally, the integration of sustainability into teaching activities can strengthen the role of academic educators (Lazzarini et al., 2018).

Second, as knowledge creators, HEIs contribute to the development of novel research insights, innovative solutions, and strategies addressing the complex issues related to sustainable development, ever-aging various disciplines. The promotion of interdisciplinary research and collaboration by HEIs is crucial, as it enhances understanding of the interconnected nature of the SDGs and aids in establishing more comprehensive and integrated sustainability approaches (Thiam et al., 2021).

Third, HEIs can exemplify sustainability by incorporating environmentally friendly practices into campus operations and governance structures. This not only demonstrates sustainable behavior to students but also sets an example for the broader community (Stewart, 2010).

Finally, HEIs extend their impact on Sustainable Development through community engagement and outreach initiatives. By fostering collaborations with stakeholders across local, regional, national, and international levels, HEIs engage in the co-production and dissemination of knowledge, promote meaningful dialogue, and facilitate the exchange of ideas, thereby supporting the implementation of sustainability policies and initiatives (Zilahy and Huisingsh, 2009). In assuming this role, HEIs emerge as agents of change, pivotal in cultivating the partnerships and collaborations necessary to achieve the ambitious targets delineated in the SDGs (Adams et al., 2018).

Prior research has also highlighted the relevance of a fifth area: assessment and reporting (Lozano-Ros, 2003; Lozano, 2006a). Assessment and reporting are crucial for ensuring transparency and fostering the involvement and commitment of key stakeholders, hence accelerating the incorporation of sustainable development among all HEIs' stakeholders.

Moreover, measuring and assessing HEIs' contributions to sustainability is essential to identify areas that require improvement and ensure accountability (Chankseliani and McCowan, 2021). Through the development of robust and contextually relevant measurement tools, researchers, practitioners, and policymakers can gain a deeper understanding of the intricate and diverse ways in which HEIs contribute to the SDGs. This information, in turn, enables the formulation of more effective and targeted strategies and policies to enhance HEIs' impact on sustainable development. Despite significant progress in implementing sustainable development across the five dimensions of the HEIs' system, in 2015, the implementation of sustainable development in assessment and reporting was the least recognized element by HEIs, according to a survey on commitment to and implementation of sustainable development (Lozano et al., 2015).

2.2. Sustainability assessment tools in higher education institutions

The demand for accountability and transparency regarding sustainability performance, coupled with the limited engagement of HEIs in assessing and reporting their efforts in this field, has led to the development of new methods and frameworks for sustainability assessment (Brusca et al., 2018; Saraite-Sariene et al., 2019). Drawing from previous studies, sustainability assessment methods have been defined by Findler et al. (2018) as the "instruments that provide HEIs with a systematic set of procedures and methods to measure, audit, benchmark, and communicate their sustainability efforts" (Shriberg, 2002). These tools can be designed using different approaches: constructing raw data and converting it to a common unit (accounts assessment), combining text, maps, graphics, and data (narrative assessment), or utilizing synthetic indicators (indicator-based assessment) (Alghamdi et al., 2017).

Developing appropriate indicators and metrics to accurately capture the diverse dimensions of sustainability and the contributions of HEIs represents a significant methodological challenge. To address this, different ranking and assessment frameworks have been introduced, such as the Adaptive Model of Sustainability Assessment (AMAS) (Gómez et al., 2015), the Sustainability Tool for Auditing for University's Curricula Holistically (STAUNCH) (Lozano and Peattie, 2011), UI Green-Metric World University Ranking (UIGM) (Suwartha and Sari, 2013) and Sustainability Tracking, Assessment and Rating Systems (STARS) (Gómez et al., 2015; Saadatian et al., 2011).

A comprehensive review of methods for assessing the sustainability of HEIs was conducted by Gutiérrez-Mijares et al. (2023). They reviewed 23 different sustainability assessment methods used for HEIs and classified them according to several properties. This review confirmed the findings of previous studies on the topic, emphasizing the heterogeneity in assessment approaches used by HEIs globally (Shriberg, 2002; Lozano et al., 2013; Lozano, 2006b; Ceulemans et al., 2015; Disterheft et al., 2015; Berzosa et al., 2017; Caeiro et al., 2020).

In general, no method in the literature is considered comprehensive according to the authors' definition, which includes the pillars of sustainability (economic, social, and environmental), the functions of HEIs (education, research, operation, extension, and governance), and the two levels of assessment (policy or practical level). Nevertheless, the authors emphasize the relevance of the THE-IR approach as one of the most comprehensive. Moreover, although several sustainability assessment frameworks have emerged over the years, no framework explicitly quantified HEIs' fulfillment of the SDGs until 2019.

Launched in 2019, THE-IR stands out as the first global framework at the institutional level specifically designed to measure the contribution of HEIs to the 17 SDGs. This assessment tool employs a comprehensive methodology that takes into account a multitude of indicators, each aligned with one of the 17 SDGs.

2.3. The time higher education impact rankings

THE-IR is a global HEIs ranking specifically crafted to gauge institutions' performance against the SDGs. The primary objective of THE-IR is to spotlight the commitment and accomplishments of HEIs in addressing the global challenges outlined in the SDGs, fostering comparisons, and facilitating knowledge sharing among institutions. This ranking encompasses all HEIs engaged in teaching at both undergraduate and postgraduate levels.

This assessment comprehensively evaluates HEIs' contributions to sustainable development across a broad spectrum of dimensions and at the macro level, culminating in an overarching score. The methodology of THE-IR encompasses 18 scores, corresponding to each of the 17 SDGs, and an additional score gauging overall institutional commitment to sustainability. This score is derived from the SDG 17 score (which contributes up to 22% of the overall score), along with the three highest scores from the other SDGs for which data was provided (each contributing up to 26% of the overall score). Hence, the eligibility for the overall ranking requires supply of data for SDG 17 and any three other SDGs. When a HEI has supplied data for more than three other SDGs the overall score is computed using the three in which the HEI has highest performances (Times Higher Education, 2023). The definition of the SDG provided by the United Nations, as well as its adaptation to HEIs by THE-IR, is outlined in Appendix A. The scores for each SDG are based on a set of metrics, each of which is themed and may include individual indicators. The maximum score for each metric is provided, shown both as a specific percentage within that SDG and as an approximate percentage if that SDG were to be used for the HEI's overall ranking. Since different questions are asked for each SDG, the range of scores can vary. To generate the overall ranking, the scores are normalized so that the range for all SDGs is from 0 to 100. The score for the overall ranking is computed as an average of the last two year's total scores, provided that scores are available for both years (Times Higher Education, 2023). The computation of the overall score for the THE-IR overall ranking is illustrated in a flowchart provided in Fig. 1 (Please note that this flowchart provides a simplified overview of the THE-IR overall ranking score calculation process. A detailed methodology, including the criteria used for calculations to generate the results, is provided for each edition in the "Times Higher Education Impact Rankings Methodology" documentation).

Each SDG score undergoes assessment based on three key dimensions: research, outreach, and stewardship.

The research dimension assesses the volume, citation impact, and proportion of the HEIs' publications related to the specific SDG. The outreach dimension measures the institution's engagement with external stakeholders, including industry, government, and local communities, in addressing the SDG. Under the stewardship component, the internal policies, procedures, and infrastructure of the institution are evaluated for their effectiveness in supporting the attainment of the SDGs.

The calculation of scores for each Sustainable Development Goal (SDG) in the THE-IR involves the integration of data sources, incorporating bibliometric data from Elsevier's Scopus database, information submitted by HEIs through a survey, and publicly available data from international sources like the World Bank and the United Nations. When a metric requires evidence, a series of questions are posed, and points are assigned based on the responses. The methodology for each metric provides detailed information on this process. If evidence is provided, THE evaluates whether it fully, partially, or does not answer the question, assigning one point, half a point, or zero points, respectively. HEIs that are unable to provide data for a specific metric receive a score of zero for that metric.

Since its recent introduction, the THE-IR have generated substantial interest and elicited diverse opinions within the higher education community. Torabian (2019) considers the THE-IR a positive signal of institutions' commitment to Sustainable Development (SD). Other

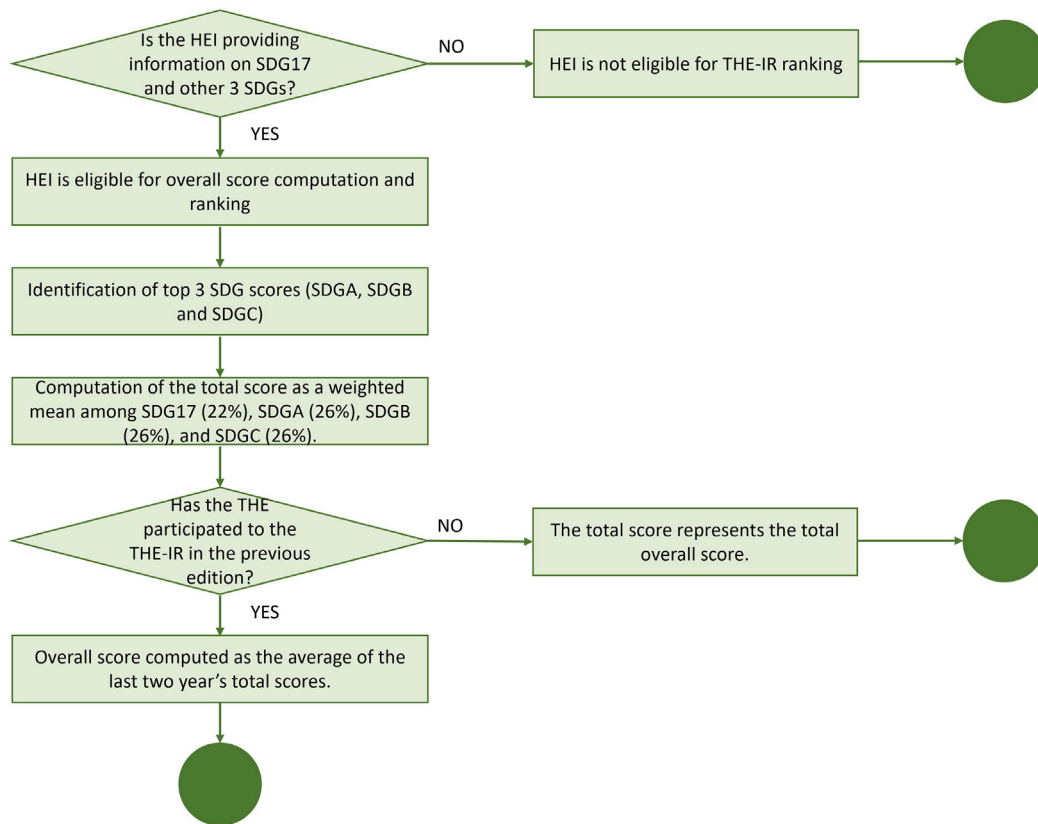


Fig. 1. Computation of the overall score for the THE-IR Ranking.

research has demonstrated a correlation between SDG achievements and an institution's overall standing in THE World University Rankings (THE WUR) (De la Poza et al., 2021; Sierra-García et al., 2024). However, several concerns have been raised regarding the methodology of this ranking. First of all, limitations associated with HEIs rankings that utilize bibliometric data from Elsevier's Scopus database are also applicable to the THE-IR. Notably, Scopus indexes over 23,000 scholarly journals; however, only about 5000 publish in languages other than English. This creates a significant underrepresentation of research published in non-English languages (Tennant, 2020; Vera-Baceta et al., 2019). This bias can negatively impact the rankings of HEIs from non-English speaking countries (Amsler and Bolsmann, 2012; Fauzi et al., 2020), particularly those in developing regions that may lack resources to ensure their research meets high English language standards. Moreover, significant concerns are raised about the specific ranking methodology of THE-IR, particularly regarding the limited coverage of SDGs. Bautista-Puig et al. (2022) emphasized that incorporating only four out of the 17 SDGs, potentially enables HEIs to achieve high rankings while making limited or no contributions to the remaining 13 SDGs. This implies that HEIs are evaluated against different SDGs and grouped into the same classification, posing challenges to a comprehensive assessment of their sustainable development contributions. In addition, THE-IR's methodological structure suffers from limitations in longitudinal comparability. A single HEI's performance and ranking can fluctuate due to variations in the data collected across different editions of the ranking, as highlighted by Bautista-Puig et al. (2022). Moreover, the authors criticize the use of scores with excessively wide ranges, hindering the meaningful interpretation of final ranked positions (Bautista-Puig et al., 2022).

Finally, Gadd (2021) argued that the weighing system in THE-IR is arbitrary, assigning different weights to the four SDGs without providing an explicit explanation for the rationale behind this choice. In the same vein, Bautista-Puig et al. (2022) contend that these arbitrary

weights violate Principle 9, as outlined in the Berlin Principles on Ranking Higher Education Institutions. This principle advocates for making the weights associated with different indicators prominent and limiting changes to them.

2.4. Factors influencing HEIs' decision to provide information on sustainability performance

The decision to provide information (or not) on the full set of SDG performances could be influenced by various factors. Previous studies revealed that the choices universities make regarding providing information on sustainability performances can indeed vary according to their geographic location. This variation can be explained, at least in part, by external pressures, such as coercive forces and mimetic pressures (Larrán Jorge et al., 2019).

Furthermore, the decision to provide information on the full set of SDGs may be influenced by the overall sustainability performance of HEIs. Prior studies have shown that sustainability reporting in HEIs is generally weak, potentially reflecting lower performance (assuming lower disclosure points to weaker performance) on crucial dimensions like education and outreach programs (Sepasi et al., 2019). This suggests that HEIs with strong sustainability efforts may be more inclined to voluntarily showcase their achievements across the entire set of SDGs, enhancing their reputation with external stakeholders (Garde Sánchez et al., 2013). Conversely, institutions with lower performances may hesitate to provide information on the full set of SDGs, adopting a more opportunistic approach.

This reputation rationale may extend to other aspects of HEIs' performance unrelated to sustainability. As noted by de Lange (2013), prestigious universities often adopted robust sustainability practices

Table 1
Initial sample composition by continent, 2023 and 2022.
Source: THE-IR.

Continent	2023		2022	
	Frequency	Percentage	Frequency	Percentage
Africa	104	6.4	82	5.8
Americas	230	14.1	208	14.7
Asia	814	50.1	678	48.1
Europe	443	27.3	407	28.9
Oceania	34	2.1	35	2.5

in response to stakeholder expectations. However, the connection between overall HEIs performance and the extent of sustainability practices in terms of information provided has been contradicted by previous studies examining a sample of Australian universities (Triereksani et al., 2021).

Additional internal characteristics influencing the set of SDGs provided by HEIs may include the size of HEIs. According to recent studies, larger HEIs may show greater attention to providing sustainability information (Larrán Jorge et al., 2019; Aleixo et al., 2016; Sassen et al., 2018). This may be due to two factors: increased resources dedicated to socially responsible activities (Richardson and Kachler, 2017) and the need for legitimacy in their sustainability practices given their higher visibility (Larrán Jorge et al., 2015).

3. Data and methodology

3.1. Sample selection and data collection

The primary data source for this study is the THE University Rankings website. Due to the unavailability of the complete raw dataset by Times Higher Education, we employed web scraping techniques to collect the data from the website.

To address RQ1 and RQ2, data from the 2022 and 2023 THE-IR were collected.¹ This decision was guided by two primary considerations. First, previous studies have analyzed HEIs' participation in the ranking from 2019 to 2021, demonstrating a consistent increase over time (Bautista-Puig et al., 2022). Limiting the scope to 2022 and 2023 allows for a comparative analysis of results and a discussion of any significant differences compared to the findings of these earlier studies. Second, participation in the ranking was lower in previous years (859 HEIs in 2020 and 1240 in 2021). Statistical analyses conducted on a subset of outperformer HEIs (outperformers) may not yield significant results for these earlier years due to the smaller sample size.

The initial sample included 1410 HEIs from 112 countries for the 2022 ranking and 1625 HEIs from 115 countries for the 2023 ranking. Table 1 presents the initial sample distribution by geographical region for two years. As indicated, Asia was the most represented region, accounting for about half of the sample in both years. Africa and Oceania were less represented, together constituting less than 10 percent of the sample in both years.

Pre-processing analysis was crucial to address specific challenges inherent in the raw data. In particular, some scores are expressed as ranges rather than discrete values. These ranges exhibited variations, ranging from narrow to considerably wide intervals. Excluding HEIs employing such score representations would have rendered the entire analysis unfeasible. Therefore, we opted for mean imputation to address the ambiguity associated with these data points. While this technique facilitated the analysis, it may have introduced a certain degree of bias into our findings.

To investigate determinants for RQ3, additional information was collected through web scraping activities from the same website. The

¹ THE-IR 2022 and 2023 are based on data collected from HEIs during the academic years 2020 and 2021, respectively.

Table 2
Final sample composition by continent, 2023 and 2022.
Source: THE-IR.

Continent	2023		2022	
	Frequency	Percentage	Frequency	Percentage
Africa	50	6.7	40	5.6
Americas	111	14.9	112	15.7
Asia	299	40.2	271	37.9
Europe	252	33.9	259	36.2
Oceania	32	4.3	33	4.6

integration of SDG scores with other available data resulted in a sample of 715 HEIs for 2022 and 744 HEIs for 2023, hence restricting the sample size. Table 2 reports the distribution of the final sample by continent. The final composition of the sample remained consistent with the initial composition, particularly when considering African, American, and Oceania HEIs. Asian HEIs accounted for 38 percent and 40 percent of the sample, respectively, for 2023 and 2022. Notably, this marked a slight decrease from the initial representation of about 50% of the sample for both years. There was also a slight increase in the percentage of European HEIs compared to the overall sample, rising from 27.3 percent to 33.9 percent in 2023.

3.2. Variables definition and model

The variables measuring the choice of HEIs to provide information on SDGs and the defined independent variables are detailed in Tables 3 and 4.

To explore to what extent the THE-IR offer a thorough and accurate assessment of HEIs' sustainability performances we performed an exploratory analysis based on descriptive statistics. Pearson correlation was employed to examine the extent to which the THE-IR, based on four SDGs, provides a comprehensive and accurate assessment of HEIs' sustainability performance. We selected a subset of HEIs providing information on the complete set of SDGs and compared the results in terms of scores and rankings using two different approaches: a "same weight" approach that assigns equal importance to all SDGs and the THE-IR approach.

To address the extent of the relationship between HEIs behavior in providing information on SDG performances and overall sustainability performance (RQ2) we conducted descriptive statistics and visualization techniques for missing data patterns. This analysis aimed to identify any polarization or recurrent patterns. Additionally, a t-test analysis was employed to evaluate differences in mean values in the overall levels of SDG performance between outperformer HEIs providing information on the full set of SDGs and those that do not.

To investigate the determinants influencing HEIs decision to provide information or not on their performance in connection to the full set of SDGs (RQ3), we conducted a logistic regression analysis.

The model is presented in Eq. (1):

Equation 1: Logit model equation.

$$\text{Logit}[Pr(SDGs = 1)] = \beta_0 + \beta_{\text{AREA}} \times \text{AREA} + \beta_{\text{SDG_SCORE}} \times \text{SDG_SCORE} + \beta_{\text{SIZE}} \times \text{SIZE} + \beta_{\text{TEACH}} \times \text{TEACH} + \beta_{\text{RES}} \times \text{RES} + \beta_{\text{CIT}} \times \text{CIT} + \beta_{\text{INT_OUT}} \times \text{INT_OUT} + \beta_{\text{IND}} \times \text{IND} + \epsilon \quad (1)$$

Specifically, β_0 represents the constant, β_{AREA} to β_{IND} are the regression coefficients, while ϵ denotes the vector of the stochastic error term.

Table 3
Variable definition, SDGs Information.

Variable name	Variable symbol	Variable description	Source
SDGs Information			
Information on SDG1	SDG1	Boolean variable equals 1 if information on SDG 1 are available and 0 otherwise	THE-IR
Information on SDG2	SDG2	Boolean variable equals 1 if information on SDG 2 are available and 0 otherwise	THE-IR
Information on SDG...	SDG...	Boolean variable equals 1 if information on SDG ... are available and 0 otherwise	THE-IR
Information on SDG16	SDG16	Boolean variable equals 1 if information on SDG 16 are available and 0 otherwise	
Information on SDGs	SDGs	Boolean variable equals 1 if information on the full set of SDGs are available (outperformer HEIs) and 0 otherwise	THE-IR

Table 4
Variable definition, Independent variables.

Variable name	Variable symbol	Variable description	Source
Geographical area	AREA	Boolean variable equals 1 if HEI is located in Europe and 0 otherwise	ISTAT ^a
Overall THE-IR score	SDG_SCORE	Continuous variable equal to the score given by the THE-IR	THE-IR
Size	SIZE	Total number of FTE students	THE WUR ^b
Teaching score	TEACH	Continuous variable equal to the score given by the THE on learning experience and quality at a HEI	THE WUR ^b
Research score	RES	Continuous variable equal to the score given by the THE on the quality and quantity of research output	THE WUR ^b
Citations score	CIT	Continuous variable equal to the score given by the THE on how influential that research is	THE WUR ^b
International outlook score	INT_OUT	Continuous variable equal to the score given by the THE on the environment and attitude for international students, staff, and research	THE WUR ^b
Industry Income score	IND	Continuous variable equal to the score given by the THE on the innovation at a HEI	THE WUR ^b

^a Istituto nazionale di statistica (ISTAT).

^b Times Higher Education World University Rankings (THE WUR).

4. Results and discussion

In this section, we illustrate the results of our study. The section is structured into four subsections. The first subsection provides an evaluation of the accuracy of the THE-IR assessment of overall sustainability performance among outperformer HEIs. The second subsection provides a descriptive overview of the participation choices of HEIs in the THE-IR rankings. The third subsection is dedicated to a comparison of overall THE-IR performance among HEIs providing information on a subset of the SDGs and those that are outperformers. Finally, the fourth subsection focuses on the factors influencing HEIs' decisions to provide information on the full set of SDGs.

4.1. Evaluating the accuracy of the THE-IR assessment of overall sustainability performance among outperformer HEIs

To address the extent to which the THE-IR offers a thorough and accurate assessment of HEIs' sustainability performances (RQ1), a scatter plot is used to visually represent the relationship between THE-IR overall score and "same-weight" score (Fig. 2). Each HEI is represented by a single data point, with its THE-IR overall score on the x-axis and its same-weight score on the y-axis. The correlation analysis demonstrates a strong positive correlation between the two approaches ($R = 0.967$ for 2022; $R = 0.965$ for 2023). Despite criticisms directed at THE-IR for potential distortions caused by weighting systems (Gadd, 2020) and the selection of a limited number of indicators compared to the full set of SDGs (Bautista-Puig et al., 2022), these findings suggest that these ranking mechanisms do not introduce specific biases. The high level of correlation indicates that THE-IR provide a comprehensive and consistent overview of HEIs' sustainability performances, at least when considering those that provide data on the complete set of SDGs. While this study finds no evidence of bias introduced by the weighting system mechanisms within the outperforming HEIs,

criticisms raised by Bautista-Puig et al. (2022) remain relevant. These criticisms focus on the comparability of HEIs across diverse SDGs, the challenges associated with longitudinal analysis in specific cases, and the lack of transparency in calculating the overall score when SDGs have significantly varying ranges.

4.2. Participation choices of HEIs in the THE-IR

The univariate descriptive analysis of HEIs' SDG scores reveals noteworthy patterns and a certain degree of consistency over time, as demonstrated in Figs. 3 and 4 (Tables with descriptive statistics data are provided in Tables B.1 and B.2 in Appendix B). Firstly, it is worth mentioning that the heterogeneity observed in the choices of providing information on SDGs confirms the disparity in information provision, to the detriment of sustainable development objectives (Aleixo et al., 2018; Blasco et al., 2020; Caputo et al., 2021; Leal Filho et al., 2021). In 2022 and in 2023, SDG 17 consistently emerges as one of the top 3 categories with the highest mean scores. Notably, SDG 17 is the only mandatory category for data submission. This consistently high performance in SDG 17 suggests a strategic allocation of HEIs' resources to align with metrics associated with this goal, likely driven by the necessity to fulfill the mandatory submission requirement. The increased investment in meeting this obligation may contribute to elevated performance scores in SDG 17, thereby influencing the higher average scores observed in this category. An interesting insight arises when considering a previous study on HEIs' non-financial reporting based on the GRI database in 2021, which identified SDG 17 as one of the least disclosed SDGs (Caputo et al., 2021). These findings indicate a significant shift in patterns in recent years, suggesting that HEIs have become more proactive in providing information on their performance on SDG 17, potentially motivated by the desire to participate in THE-IR.

When comparing our findings with previous studies, we observe significant variability in the representation of each SDG. Particularly,

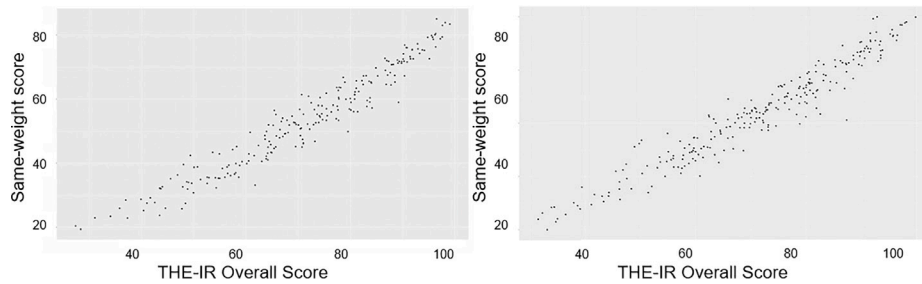


Fig. 2. Same Weight Score vs. THE-IR Overall Score for 2022 (left) and 2023 (right).

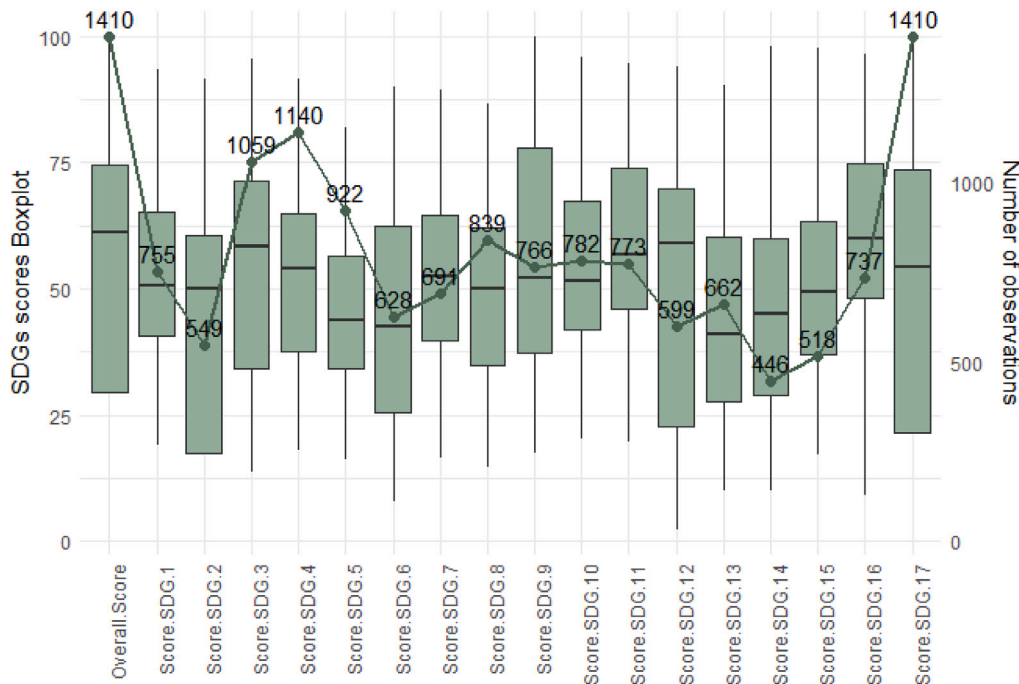


Fig. 3. Descriptive statistics 2022: Boxplots for each SDG score are shown on the left axis, representing the distribution of scores across different categories. The right axis indicates the number of observations available for each SDG, depicted by the line plot.

SDG4 (Quality Education) and SDG3 (Good Health and Well-being) consistently emerge as the goals for which data have been provided more frequently in both 2022 and 2023. The observed patterns align with the sustainability-oriented tendencies of HEIs in terms of the information they provide, as corroborated by prior research on THE-IR participation in Spanish (Blasco et al., 2020) or Portuguese contexts (Monteiro et al., 2024a). Moreover, in their examination, Caputo et al. (2021) analyzed reports from the GRI database, uncovering that SDG4 had the highest participation rate, whereas SDG15 was among the least reported. In line with the insights offered by Beynaghi et al. (2016) and Daú et al. (2023), the significance of the connection between SDGs and HEIs, particularly acknowledged through SDG 4, influenced the decision to provide information on SDGs by a majority of HEIs that voluntarily choose to do so, particularly focusing on this specific SDG. The growing emphasis on SDG3 aligns with previous findings that underscore the increased willingness to provide information on performances using SDG3 due to the COVID-19 pandemic in 2020 and the increasing concern for health issues (Bautista-Puig et al., 2022). In contrast, SDG14 (Life Below Water) and SDG15 (Life on Land), categorized under the Planet Pillar by Nations (2015), exhibit lower prevalence in HEIs' performance declarations for both years. This result underscores the evident challenge associated with providing information on sustainability aspects linked to the Planet Pillar, likely stemming from the inherent difficulties in implementing proactive

strategies associated with these particular themes (Monteiro et al., 2024a). Moreover, the low frequency of SDG13 information could be justified by the fact that while SDG13 may be particularly relevant for certain territories due to geographical reasons, it may hold less significance for others.

In addressing RQ2, we explored patterns related to SDGs information provided to investigate the presence of polarization or recurrent patterns in missing data. Our initial focus involves analyzing the number of HEIs that submitted data for all SDGs and those submitting data for precisely 4 SDGs (the minimum number of categories for ranking consideration). Fig. 5 illustrates the frequency distribution of HEIs within the sample (2022 on the left and 2023 on the right), revealing a bimodal distribution with peaks in the frequency of HEIs submitting either 4 or all 17 SDGs. This polarization is evident in Fig. 5, highlighting a clear distinction between HEIs submitting data for 4 or 17 SDGs compared to those submitting data for a different number of SDGs. This underscores the strategic choice made by HEIs to either participate with the minimum effort required for ranking inclusion or engage comprehensively by submitting data for the entire spectrum of SDGs.

These results partially confirm the trends identified by Bautista-Puig et al. (2022) in their analysis of data from 2020 and 2021 editions. On one hand, we observe the prevalence of “strategic” HEIs submitting

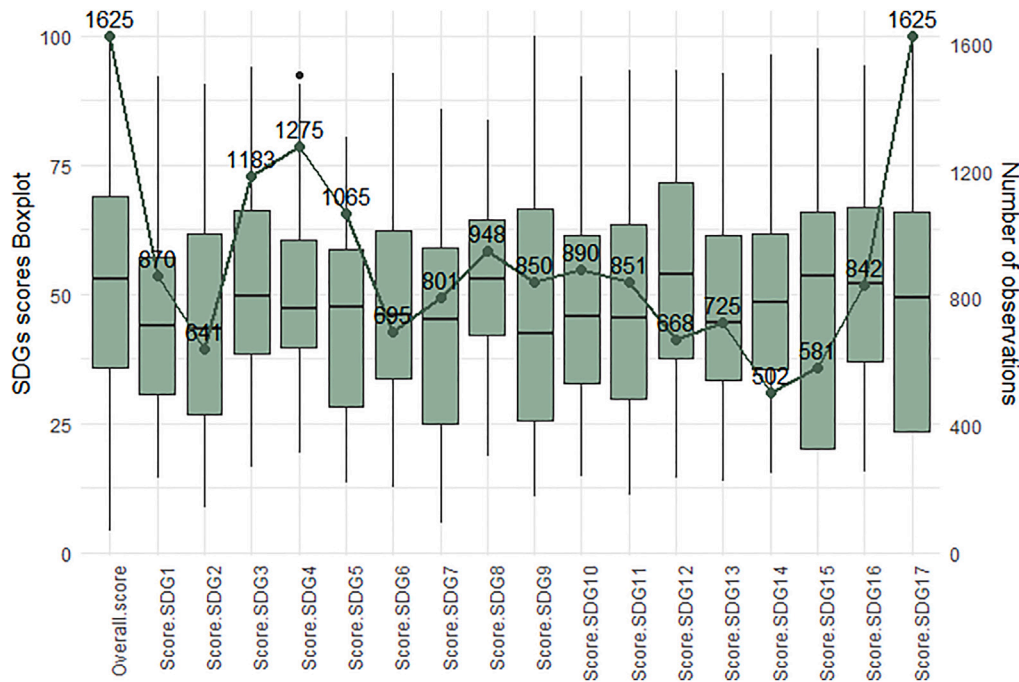


Fig. 4. Descriptive statistics 2023: Boxplots for each SDG score are shown on the left axis, representing the distribution of scores across different categories. The right axis indicates the number of observations available for each SDG, depicted by the line plot.

data for only four SDGs, mirroring a pattern identified by Bautista-Puig et al. (2022).²

On the other hand, an interesting shift emerges regarding high-performing HEIs submitting all 17 SDGs. While (Bautista-Puig et al., 2022) found that only 7.4% of HEIs in the 2021 edition submitted all 17 SDGs, our analysis for 2023 reveals a significant increase to over 19%.

In our exploration of missing patterns, we analyzed the relationship between missing data patterns and SDGs performance. Fig. 6 illustrates the distribution of overall score of SDGs performances for HEIs submitting data on a scale from 4 to 17 SDGs. Examining this figure, it is evident that the average scores of HEIs providing data for 4 and 17 categories respectively show markedly different trends within the ranking. HEIs providing data for 4 SDGs conclude with the lowest average overall score, whereas those submitting data for 17 SDGs conclude with the highest average overall score. This substantial divergence highlights the relationship between the HEIs' choices and the sustainability performance of HEIs within the ranking framework.

4.3. Comparison of overall THE-IR performance among HEIs providing information on a subset of SDGs and outperformers

To further investigate the relationship between the number of SDGs provided and overall sustainability performance, we categorized HEIs into two groups based on the SDGs variable (Table 3). One group included HEIs providing data on all 17 SDGs (Outperformer), while the other group included those providing information on a subset (Others). We then employed a t-test, conducted at a significance level of 0.05, to assess the difference in mean overall SDG scores between these two groups. The analysis revealed a statistically significant difference $p < 0.05$ between the groups, with HEIs providing data on all SDGs demonstrating a higher average overall SDG score compared to those providing data on a subset (Tables 5 and 6).

² The authors distinguish outperformer HEIs that submit data for all available SDGs from those that do not, categorizing them into interested, strategic, and committed groups (Bautista-Puig et al., 2022).

Table 5

T-Test Results for hypothesis: $H_0 : \mu_{Others} - \mu_{Outperformers} \leq 0$. 2022.

Variable	Group	Obs	Mean	Std. Err.	Std. Dev.	p-value
SDGs	Outperformer	301	68.220	1.064	18.475	0.0000
	Others	1109	55.627	0.624	20.789	

Table 6

T-Test results for hypothesis: $H_0 : \mu_{Others} - \mu_{Outperformers} \leq 0$. 2023.

Variable	Group	Obs	Mean	Std. Err.	Std. Dev.	p-value
SDGs	Outperformer	306	64.404	1.063	18.610	0.0000
	Others	1319	48.127	0.640	23.2767	

Furthermore, we extended this analysis to each Sustainable Development Goal (SDG), categorizing HEIs into those providing information on a specific SDG and those not providing information on it. Through a t-test conducted at a 0.05 significance level (Table 7 based on 2022 data and Table 8 based on 2023 data), we identified the null hypothesis ($H_0 : \mu_{Not\ providing\ information} - \mu_{Providing\ information} \leq 0$) is valid between the two groups for each SDGs, except for SDG4 (Quality Education).

Notably, HEIs not providing information on SDG4 exhibit a mean score that is statistically significantly higher in terms of sustainable development compared to outperformer HEIs providing information on the full set of SDGs (p -value of H_1 equal to 0.0002 for 2022 and 0.0031 for 2023). This finding suggests a unique trend for SDG4, indicating that HEIs may be reluctant to provide information on that SDG due to low performances. The ranking mechanism is indeed designed to select the three SDGs with the highest scores; thus, the absence of information on that SDG suggests that, as the score may be lower than the others, HEIs might voluntarily choose not to provide it.

4.4. Factors influencing outperformer heis' decision to provide information on the full set of SDGs

To analyze the determinants influencing HEIs' decision to provide information or not on their performance concerning SDGs (RQ3), we focused on HEIs with available information on THE rankings in various

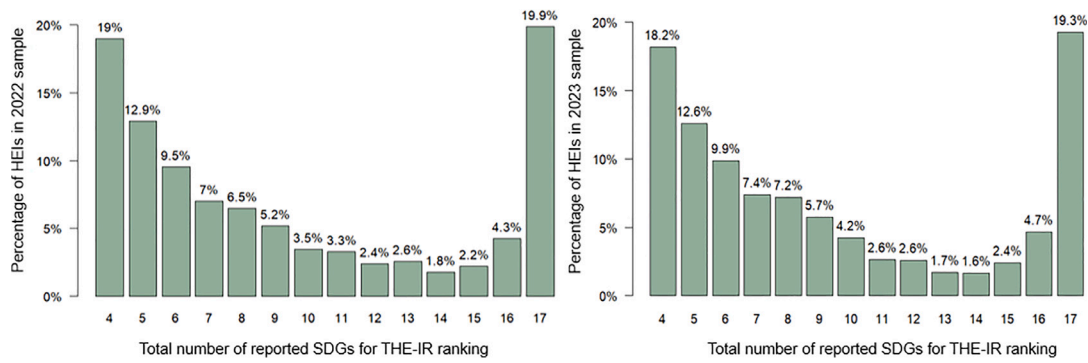


Fig. 5. Percentage of HEIs reporting a specific number of SDGs (from 4 to 17). Percentages are based on the total number of HEIs in the 2022 sample (left) and 2023 sample (right).

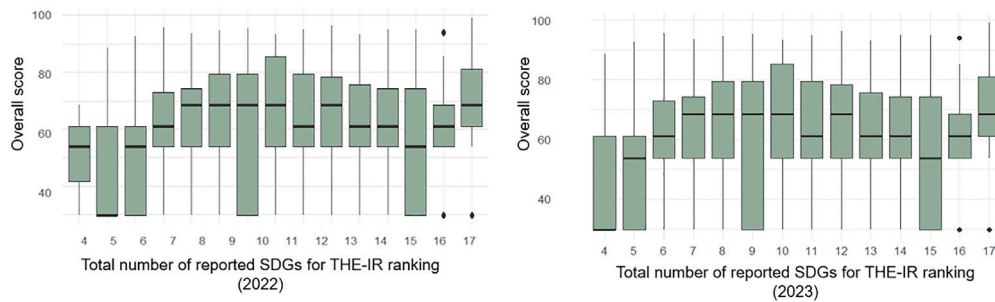


Fig. 6. Distribution of overall scores for HEIs based on the specific number of SDGs reported (from 4 to 17) for 2022 (left) and 2023 (right).

Table 7

T-Test Results for hypothesis: $H_0 : \mu_{\text{Not providing information}} - \mu_{\text{Providing information}} \leq 0$, 2022, for single SDG.

SDG	Not providing information		Providing information		p-value
	Mean	Obs	Mean	Obs	
SDG1	57.082	655	59.385	755	0.020
SDG2	55.203	861	63.198	549	0.000
SDG3	51.362	351	60.620	1059	0.000
SDG4	62.350	270	57.360	1140	1.000
SDG5	55.536	488	59.787	922	0.000
SDG6	54.493	782	63.076	628	0.000
SDG7	52.742	719	64.115	691	0.000
SDG8	53.620	571	61.511	839	0.000
SDG9	53.888	644	62.038	766	0.000
SDG10	53.081	628	62.519	782	0.000
SDG11	51.640	637	63.817	773	0.000
SDG12	52.569	811	66.097	599	0.000
SDG13	52.335	748	65.073	662	0.000
SDG14	54.128	964	67.366	446	0.000
SDG15	54.429	892	65.009	518	0.000
SDG16	52.384	673	63.732	737	0.000

Table 8

T-Test Results for hypothesis: $H_0 : \mu_{\text{Not providing information}} - \mu_{\text{Providing information}} \leq 0$, 2023, for single SDG.

SDG	Not providing information		Providing information		p-value
	Mean	Obs	Mean	Obs	
SDG1	48.281	755	53.718	870	0.000
SDG2	46.810	984	57.919	641	0.000
SDG3	43.200	442	54.178	1183	0.000
SDG4	54.210	350	50.364	1275	0.997
SDG5	46.802	560	53.500	1065	0.000
SDG6	45.997	930	58.144	695	0.000
SDG7	44.123	824	58.465	801	0.000
SDG8	43.584	677	56.625	948	0.000
SDG9	44.447	775	57.343	850	0.000
SDG10	44.137	735	57.019	890	0.000
SDG11	43.141	774	58.515	851	0.000
SDG12	43.668	957	61.972	668	0.000
SDG13	43.802	900	60.366	725	0.000
SDG14	46.218	1123	62.320	502	0.000
SDG15	45.962	1044	60.589	581	0.000
SDG16	43.609	783	58.244	842	0.000

performance dimensions, such as teaching, research, citations, international outlook, and industry income, resulting in a subsample of 744 observations for the year 2023 and 715 observations for the year 2022.

The findings of the logistic regression analysis are presented in Table 9, providing insights into the coefficients and p-values associated with each variable. The results indicate that only two factors – geographical location and the overall sustainability performance of HEIs – emerge as statistically significant drivers influencing HEIs’ behavior. Prior studies yield mixed findings on the relationship between HEIs’ size and the choices to provide information on sustainability performances. While some studies reported no significant association between size and disclosure practices (Siboni et al., 2013; Manes Rossi et al., 2018), others analyzing sustainability reports and websites of HEIs suggested a positive correlation with larger institutions devoting more resources to sustainability reporting (Monteiro et al., 2024b; Aleixo

et al., 2016; Sassen et al., 2018). Interestingly, our analysis of THE-IR data reveals a different pattern when analyzing the choice to submit information for the THE-IR, by showing a non significant association between HEIs’ size and the likelihood of providing information on all 17 SDGs in THE-IR.

The pivotal role of sustainability scores underscores a non-random distribution of missing information, indicating a clear association with overall performance, thereby corroborating the outcomes of RQ2. Our findings align with previous studies highlighting the significant role of sustainability performance in influencing HEIs’ decisions to disclose their performance publicly (Sepasi et al., 2019; Garde Sánchez et al., 2013). Specifically, HEIs with strong sustainability performance may be more likely to provide information across all SDGs, potentially aiming to enhance their reputation with stakeholders. Regarding the role of other performances of HEIs and the connection with the participating

Table 9
Logistic regression results.

	<i>Dependent variable:SDGs</i>	
	(2022)	(2023)
AREA	-0.685*** (0.209)	-0.715*** (0.209)
SDG_SCORE	0.039*** (0.007)	0.044*** (0.007)
SIZE	0.102 (0.083)	0.085 (0.085)
TEACH	0.001 (0.017)	0.005 (0.016)
RES	-0.005 (0.015)	-0.018 (0.014)
CIT	-0.007 (0.005)	-0.005 (0.004)
IND	-0.010 (0.007)	-0.012 (0.008)
INT_OUT	0.002 (0.006)	-0.001 (0.006)
Constant	-2.744*** (0.560)	-2.544*** (0.513)
Observations	715	744
Log Likelihood	-385.377	-405.108
Akaike Inf. Crit.	788.754	828.215

Note: *p < 0.1; **p < 0.05; ***p < 0.01.

behavior to the THE-IR, aligns with the findings of [Trireksani et al. \(2021\)](#), who also reported no significant relationship between HEIs' overall performance and their participation in THE-IR.

The results concerning geographical areas reveal that HEIs situated in Europe tend to refrain from providing information on the entire set of SDGs, confirming the importance of the institutional macro-context on the willingness of outperformer HEIs to provide information on the full set of SDGs, but contradicting the expected higher commitment to the SDGs of UE organizations ([Mulholland, 2017](#)). The study findings resonate with the findings of [Larrán Jorge et al. \(2019\)](#), indicating that Anglo-American institutions tend to provide more sustainability information compared to European HEIs.

5. Conclusions

The growing interest in assessing HEIs' performance concerning the SDGs has led to the development of diverse sustainability assessment tools. Although these ranking systems provide valuable insights, they also face criticism for some methodological limitations and potential biases. Our study aims to address these concerns and enhance the understanding of the THE-IR by exploring three RQs. Firstly, considering outperformer HEIs, we assessed the ability of THE-IR in assessing HEIs' sustainability performance across all 17 SDGs, despite relying on four of them. Secondly, broadening the focus to encompass the entire sample of HEIs, we compared outperformer HEIs with those providing information on a subset of SDGs only. Lastly, we explored factors influencing HEIs' choices to providing information or omit their performance in connection to the overall set of SDG.

To address our first RQ, we examined data from the 2023 and 2022 THE-IR, focusing on a subset of HEIs providing information on the complete set of SDGs. Our analysis, using both the "same weight" approach and THE approach, reveals a positive correlation between the two methods. This finding suggests that the THE-IR offer a comprehensive and consistent overview of HEIs' sustainability performances, particularly among those outperformer institutions.

Turning to the second RQ, our analysis unveils a significant divergence in the choices of HEIs concerning data submission for either four

or all 17 SDGs categories within the ranking. HEIs providing data for only four SDGs exhibit the lowest average ranks and overall scores, while those providing data on all 17 SDGs achieve the highest averages. The analysis of the correlation between missing data and the mean values for each SDG performance reveals that as the number of missing data points decreased, the mean SDG performance tended to increase. Statistical tests for group means shows a significant difference between HEIs outperforming and others, with those providing information on the full set of SDGs performing notably better than the group not providing information on the complete set. These findings remained consistent when HEIs were categorized based on individual SDGs, except for SDG4 (Quality Education).

Finally, our analysis explored the factors influencing the choice of providing information on the full set of SDG performances through logistic regression. The initial results of this analysis indicate that the overall SDG performance and the geographical location of HEIs significantly determine the willingness to provide information on SDG performances. It is important to emphasize the exploratory nature of the analysis regarding the factors influencing HEIs' decisions to participate to the THE-IR by submitting information for the full set of SDGs. While we acknowledge the limitations of our exploratory approach, we believe that these initial findings provide a valuable starting point for future studies. Future research could explore additional potential influencing factors such as the type of organization (e.g. public, private or non-profit universities), the geographical context (whether the institutions is placed in large cities) or stakeholder pressure. Moreover, further research could explore the consistency of participation by analyzing whether HEIs engage in multi-year participation in the ranking or if discontinuity is observed over time. Such an analysis could shed light on the factors that influence sustained commitment by HEIs.

Given the global reach and influence of the THE-IR, this research constitutes a significant contribution to analyzing potential distortions in sustainability practices among HEIs. Firstly, examining weighting and indicator selection mechanisms provides evidence of the ranking's validity. However, the analysis of missing data patterns suggests that HEIs might employ opportunistic behavior.

Furthermore, the preliminary insights derived from this study on the factors influencing HEIs' decisions to provide information on their contributions to the SDGs offer valuable guidance for future strategies. From a practical standpoint, governments and policymakers should consider this evidence to formulate specific guidelines that foster transparency in communication and commitment to sustainable development. Such guidelines may include implementing incentive mechanisms at the European level, such as funding schemes or recognition programs, to encourage HEIs to enhance their sustainability practices and the provision of information on their sustainability performances.

Ultimately, this work contributes to creating a more accurate and inclusive representation of sustainability efforts in HEIs globally, aligning with the overarching goals of the THE-IR and promoting sustainability in higher education worldwide. In practical terms, this work can motivate HEIs to adhere to THE-IR, providing information on the full set of SDGs and showcasing their commitment across all dimensions of sustainable development. It is also noteworthy that the comparison between 2022 and 2023, along with comparisons to other studies analyzing practices of HEIs in 2020 and 2021, offers insights into the evolutionary pathway undertaken by HEIs.

However, it is essential to acknowledge that the information presented on THE-IR websites represents just one facet of HEIs' sustainability performances. Future research could enhance these insights by incorporating data from other sources. For instance, delving into the sustainability reports published by HEIs might reveal more detailed information on the content and extent of their communication choices. Employing more sophisticated indicators to assess the level of information provided on SDG on a broader scale could provide a more comprehensive understanding. Additionally, exploring alternative sources like social media could offer supplementary evidence on the sustainability practices of HEIs.

CRedit authorship contribution statement

Valeria Maria Urbano: Writing – review & editing, Writing – original draft, Visualization, Validation, Software, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Marika Arena:** Writing – review & editing, Validation, Supervision, Methodology, Conceptualization. **Giovanni Azzone:** Writing – review & editing, Validation, Supervision, Methodology, Conceptualization. **Milton Mayeres:** Methodology, Formal analysis, Data curation, Conceptualization.

Declaration of Generative AI and AI-assisted technologies in the writing process

During the preparation of this work the authors used ChatGPT to improve readability and language. After using this tool/service, the authors reviewed and edited the content as needed and took full responsibility for the content of the publication.

Declaration of competing interest

The authors confirm that this work is original and has not been published elsewhere, nor is it currently under consideration for publication elsewhere. The authors have no conflicts of interest to disclose.

Appendix A. Supplementary data

Supplementary material related to this article can be found online at <https://doi.org/10.1016/j.jclepro.2025.145302>.

Data availability

Data are available at <https://www.timeshighereducation.com/impactrankings>.

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