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RESEARCH

University sustainability rankings: a critical literature review on the UI GreenMetric ranking system

Chiara Alberti[1] · Alice Civera[1] · Erik E. Lehmann[2] · Michele Meoli[1] · Jonah Otto[2] · Stefano Paleari[1]

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Abstract
In recent years, societies all over the world have been confronted with new challenges, such as the increasing pace of climate change, stimulating a growing debate about the role of higher education institutions (HEIs) to help tackle these grand challenges. Consequently, this impacts how technology transfer is pursued and what societies want it to produce, making the third mission in the higher education context also a green mission. Thus, excellence in sustainability complements excellence in research and teaching, resulting in a demand for new metrics to rank and position HEIs globally in terms of their sustainability efforts. A widely accepted and prominent ranking has been established by the University of Indonesia, the UI GreenMetric ranking. Since its founding a decade ago, substantial literature has been published about this ranking to examine and evaluate it from multiple perspectives and with various methodologies. This paper summarizes the body of literature on the UI GreenMetric and provides a critical analysis, indicating a tendency towards a self-selection reporting bias of the participating universities and countries, which demonstrates a potential use of the ranking as a means of greenwashing.

Keywords Higher education · Sustainability · Greenwashing · University rankings · Competitiveness · Internationalization

JEL Classification I21 · I23 · I28 · O32

1 Introduction

The needs and pressures of modern society call for higher education institutions (HEIs) to take on a more socially minded orientation in their approaches and goals beyond research and teaching to think about how their activities constitute a service to society (Audretsch et al., 2022b; Civera et al. et al., 2024; Guerrero et al., 2019; Hahn et al., 2019; Lehmann et al., 2024; Otto et al., 2021). In the last decades, a major focus of HEIs in fulfilling this service mission – commonly known as the "third mission" – was to foster economic dynamism and competitiveness via technology transfer (Civera et al., 2020; Lehmann et al., 2020; Otto,

Extended author information available on the last page of the article

2021). HEIs have been seen as the main sources of creating knowledge (i.e. ideas and new technologies), and an interpretation of the third mission was to transfer this knowledge into society via commercial means. This process is referred to as technology transfer and it consists of a multitude of vehicles, like patenting, licensing, and spin-offs among others (Audretsch et al., 2022a, 2023; Audretsch & Link, 2012; Cunningham et al., 2022; Link et al., 2007; Siegel et al., 2003). In recent years, societies the world over have been confronted with new challenges, such as the increasing pace and devastation of climate change, the COVID-19 pandemic and increasing social inequalities, among others (Lehmann et al., 2022). HEIs are called upon to help tackle these challenges, requesting a new conceptualization of the third mission, namely that of the green transition, which is no longer limited to technology transfer, but is connected to a broader mission of public engagement, involving a more intense dialogue with society. This then impacts how HEIs pursue technology transfer, and what societies want it to produce, making the third mission in this context also a green mission (Lehmann et al., 2024; Cohen et al., 2024) at the costs of increasing ambidexterity (Audretsch & Guererro, 2023).

This green mission is a HEI's contribution of a strategic answer to climate change, encompassing new business models by reshaping resources towards the green or sustainability mission (Menter, 2024; Suchitwarasan et al., 2024). Consequently, excellence in sustainability complements the excellence in the research of HEIs, resulting in a demand for new metrics to rank and position global HEIs in terms of their sustainability (Johnes, 2018). Metrics to measure the efforts and success of HEIs in pursuing their new sustainability-driven business models have complemented the traditional measures of excellence, such as the number of graduates, publications, citations, or patents (Galleli et al., 2022; Otto et al., 2021). The traditional rankings of excellence in research such as the Quacquarelli Symonds World University Rankings (QS Rankings), the Academic Ranking of World Universities (ARWU or Shanghai Rankings) and the Times Higher Education World University Rankings (THE-WUR), have been complemented by newer green rankings, particularly the University of Indonesia (UI) GreenMetric, the first green ranking in the market, which was established in 2010 (Galleli et al., 2022; Hazelkorn, 2018). The UI GreenMetric has served as a pioneering ranking worldwide to express the effort and success of HEIs in pursuing their green mission. Since its establishment, a substantial amount of literature has been published about this ranking, examining it and evaluating it from multiple perspectives and with various methodologies. This paper summarizes this body of literature and provides a critical analysis.

Since their nascent stages, HEI ranking systems in general have been intensively discussed in the literature. Researchers have explored if the rankings really express and measure excellence in research, if metrics based on citations and publications are reliable, if these metrics also capture excellence in teaching, or whether such rankings lead to a 'rat race', a competition wasting myriad resources just to climb up the ranking positions instead of focusing more intently on achieving the three missions (Altbach, 2012; Hazelkorn, 2014, 2018, 2023; Johnes, 2018; Lim, 2021; Pusser & Marginson, 2013; Marginson & Van der Wende, 2007, Marginson, 2007, 2009, 2014). Our study differs from this prior literature. We will not enter or open a discussion on the pros and cons of rankings, or whether a new ranking that measures excellence in being green is important and necessary. Our main motivation is the endogeneity of such rankings and, consequently, the bias induced by self-selection – i.e. self-selection by countries participating in these rankings, self-selection by

HEIs participating in these rankings, and, subsequently, also self-selection of authors of the literature on these rankings and a potential bias of their results.

Ranking positions are politically useful, reflecting competitiveness and thus strength, power, and dynamism (Otto, 2023; Pusser & Marginson, 2013). Therefore, such rankings are not free from political power and are in and of themselves a political instrument. Either in sports, in science, or in any other field, rankings are used by political actors to achieve political aims, and the metrics used in these rankings are often more or less influenced (i.e. illegal performance enhancement, artificially augmenting participant selection or metric criteria, unfairly shifting resources, etc.) to improve their ranking positions (Hazelkorn, 2014). Ranking management in HEIs has become as important as technology transfer itself or even accreditation efforts and is often more important than the management of courses and study programs. This even results in central offices and positions within HEIs that are solely dedicated to working on the HEI's performance in the rankings (Lim, 2021). Consequently, countries use the ranking positions of their HEIs to demonstrate their competitiveness over other countries, or the competitiveness of political programs or ideologies over others. The improvement of ranking positions of HEIs not only serves as a measure of their increased performance, but also as a signal of the increasing competitiveness of a country's higher education system in comparison with others (Hazelkorn, 2018). And, like rankings and metrics expressing efforts and success in science and research, green rankings may serve as signals for outstanding success in the green mission, making the planet more sustainable and thus expressing the contribution of countries and states to the health of our shared global environment (Galleli et al., 2022).

Whether or not the academic research around the UI GreenMetric complements this signaling effect, or sheds also a critical light on this ranking, is the main motivation of this systematic literature review (SLR). Our main finding is that the literature is unbalanced in favor of the UI GreenMetric ranking, as it largely comes from the countries and HEIs that are themselves self-selecting as participants in the ranking. This is surprising since most of the worldwide literature on general HEI rankings is rather critical, while for sustainability rankings there has been more favor (Calderon, 2023; Galleli et al., 2022; Hazelkorn, 2023; Marginson, 2009). We also find that the studies investigating the UI GreenMetric are mainly published in new or relatively unknown journals from new or relatively unknown publishers with a large circulation and dissemination in the main countries participating in the UI GreenMetric, producing rather high citation numbers despite not being prominently recognized in most of the countries that have more famous higher education systems (Oviedo-García, 2021). Our SLR, while acknowledging limitations, tries to shed light on the UI GreenMetric literature and, as reflected by the increasing number of HEIs and countries participating in the UI GreenMetric ranking, tries to provide an outlook for policy and practice which accounts for the current and future importance of self-selection and HEI ranking systems. This is a fundamental contribution, as helping HEIs pursue sustainability efforts, and tracking those efforts, is crucial to how HEIs aid in the achievement of the UN SDGs.

The rest of the paper is organized as follows. The second section provides a brief description of the UI GreenMetric ranking and its development over time. Section three presents the selection process of the included studies and the results. Section four presents the discussion of the SLR and section five concludes the study.

2 The founding of the UI GreenMetric

With the aim of assessing HEI sustainability, a few green-focused rankings have been proposed in recent times, including the Times Higher Education Impact Rankings (with a focus on broader sustainable development issues rather than just specifically on the environment) and the Sustainability Tracking, Assessment and Rating System (with a focus on the environment while neglecting social and economic components). Among sustainability ranking systems, the UI GreenMetric appears to have gained substantial popularity in recent years (Atici et al., 2021; Boiocchi et al., 2024). This is reflected by the increasing number of participating HEIs and countries (see Figs. 1 and 2). With the UI GreenMetric having started in 2010, the number of participating HEIs has been constantly increasing with a nearly steady rate of growth, while the growth in the number of participating countries has started to level off in recent years, indicating the increase in participating HEIs is attributed largely to an increase in HEIs from countries that were already represented in the ranking (Atici et al., 2021; UI GreenMetric, 2024). A prior study has identified that a majority of the more recent uptake in the UI GreenMetric comes from countries in the Global South, while participation in Global North countries has either stalled or declined (Matulová, 2023).

Aside from its increasing popularity, statements and declarations of presidents, rectors and high-level administrators of HEIs ranking in the top positions of the UI GreenMetric underline the relevance and validity attributed to this ranking system by many of the HEIs and countries participating in it (Boiocchi et al., 2023, p. 2), increasing its value as a market signal. These HEI leaders' statements provide evidence of multiple motivations for participating in the UI GreenMetric ranking system which are also reflected in documentation regarding the ranking's founding, implementation, and expansion on the UI GreenMetric website (UI GreenMetric, 2024). The website highlights the various explicit missions of the ranking, which include leveraging the ranking to encourage sustainable practices, foster-

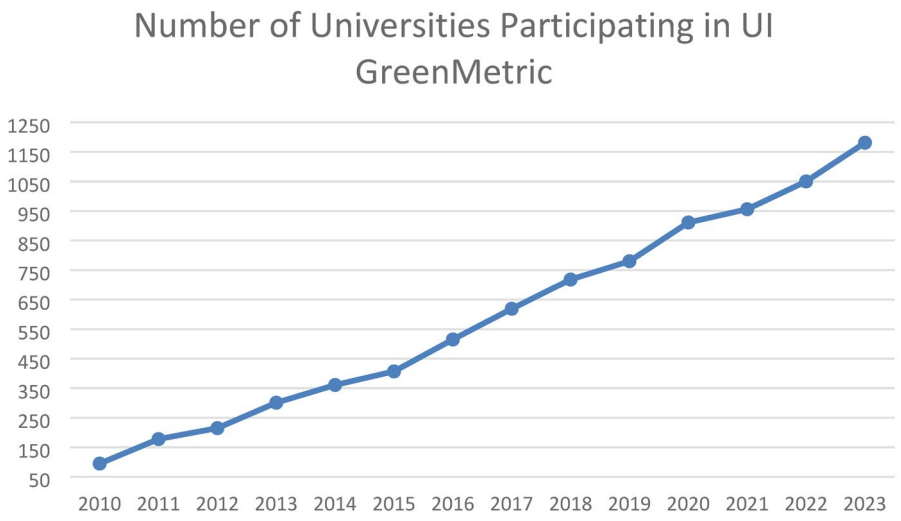

Fig. 1 Yearly trend of the number of HEIs taking part in the UI GreenMetric ranking system *(*UI GreenMetric, 2024*)*

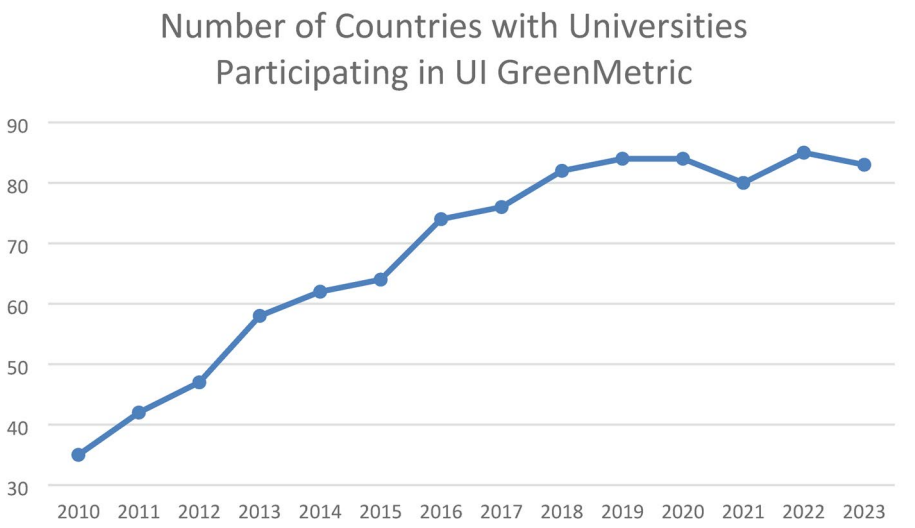

Fig. 2 Yearly trend of the number of countries with HEIs taking part in the UI GreenMetric ranking system *(*UI GreenMetric, 2024*)*

ing sustainability-focused international partnerships, supporting HEIs with sustainability-centered services and filling a gap left by other ranking systems that do not credit a HEI's efforts to reduce their carbon footprint (Puertas & Marti, 2019; UI GreenMetric, 2024). The website also includes multiple statements that directly express the implicit motivations of starting the rankings, writing that the GreenMetric ranking was launched via a UI-hosted conference on world HEI ranking systems, intended as a way of improving UI's international standing and reputation (Calderon, 2023; UI GreenMetric, 2024). In their guideline materials designed to attract new participating HEIs, the UI GreenMetric highlights the usefulness of using the rankings to advertise and promote a HEI's sustainability efforts to gain recognition and visibility on the international stage as the first listed benefit of participation in the ranking – again pointing toward a green mission signaling effect of taking part in the UI GreenMetric (Calderon, 2023; Ragazzi & Ghidini, 2017; UI GreenMetric, 2024).

Therefore, it is important to balance the motivations, purposes, and practicalities behind the UI GreenMetric when evaluating its usefulness as a ranking system for HEI sustainability. While the ranking calls for HEIs to become active in the pursuit and measurement of sustainability practices at their campus (Lauder et al., 2015; Suwartha & Sari, 2013), a very proactive and positive notion, it largely ignores sustainability research or other aspects of sustainability that do not directly deal with the protecting the physical environment (Puertas & Marti, 2019; Ragazzi & Ghidini, 2017). Moreover, the ranking itself has little explanatory power in that an HEI's performance in the ranking is only relative to the rest of the participating institutions. In this manner, measurement provides unclear takeaways, particularly when some world regions are underrepresented and others are overrepresented in the ranking, as is the case with the UI GreenMetric (Matulová, 2023). This insinuates that the sustainability focus and benefit of the ranking may be overstated, leaving the marketability

of participating in a "green ranking" as the primary benefit that the ranking produces for participating HEIs and countries, as previously highlighted (Boiocchi et al., 2023).

Given what we know about the signaling motivations behind the founding of, and participation in, the UI GreenMetric ranking, we address the research question regarding possible biases in what has been written and published about this ranking. We theorize that while many papers may be written which espouse the benefits and efficacy of using the UI GreenMetric ranking to measure and pursue HEI campus sustainability, many authors may be motivated by signaling effects to write favorably about this ranking system due to the participation of their own HEI of affiliation and/or an active participation of other HEIs in their country.

3 Methodology

To address our research question, we identified a proper methodology which would allow us to collect and analyze data on relevant literature which has been written and published regarding the UI GreenMetric, namely, a systematic literature review (SLR). By implementing a SLR we can identify relevant publications, eliminate spurious articles, group the literature into different categories and analyze our findings in order to answer our research question and derive meaning that is useful for policymakers and researchers (Fisch & Block, 2018). We follow the process for a SLR set out by Cunningham et al. (2024a, b), by (1) identifying research questions, (2) identifying an appropriate database, (3) retrieving articles through the definition of inclusion and exclusion criteria and (4) analyzing data by coding, grouping and interpreting results. See Fig. 3 for a visual representation.

For the first step, we established the focal point of the investigation and the research aim. The aim of the SLR is to examine the current state of research on UI GreenMetric rankings, to determine whether these publications suffer from biased results and whether the self-selection mechanism affects the discussion of the ranking within them.

For the second step, we chose Clarivate's Web of Science (WoS) as the database to utilize for our SLR for two key reasons. First, the WoS database is widely used and respected in the scientific community, being utilized commonly in other systematic literature reviews due to its indexing of a multitude of scientific journals across many disciplines (e.g., Atkinson & Cipriani, 2018; Schmitz et al., 2017). Second, as we aim to detect possible biases in article distribution according to authors' country and HEI affiliation, as well as journal characteristics and statistics, WoS serves as the best source of information for our analysis.

For the third step, we first define the inclusion criteria, such as keywords and time frame. We were able to glean from our initial reading that there are multiple name configurations that authors use when referring to the UI GreenMetric, so we knew that we would need to use several different key terms to find as many relevant publications as possible. For this reason, we selected "UI GreenMetric", "UI Green Metric", "GreenMetric" and "Green Metric" as key terms that we searched for in article titles, abstracts and keywords. We wanted to focus our SLR on papers that were principally about the UI GreenMetric or papers where the UI GreenMetric plays a key role in the narrative of the paper, which is why we chose to limit our key term search to only titles, abstracts and keywords. To cast the broadest net possible, we used the search qualifier "or" between each key term – meaning that a paper needed to only have the presence of one of our key terms in either its title, abstract or

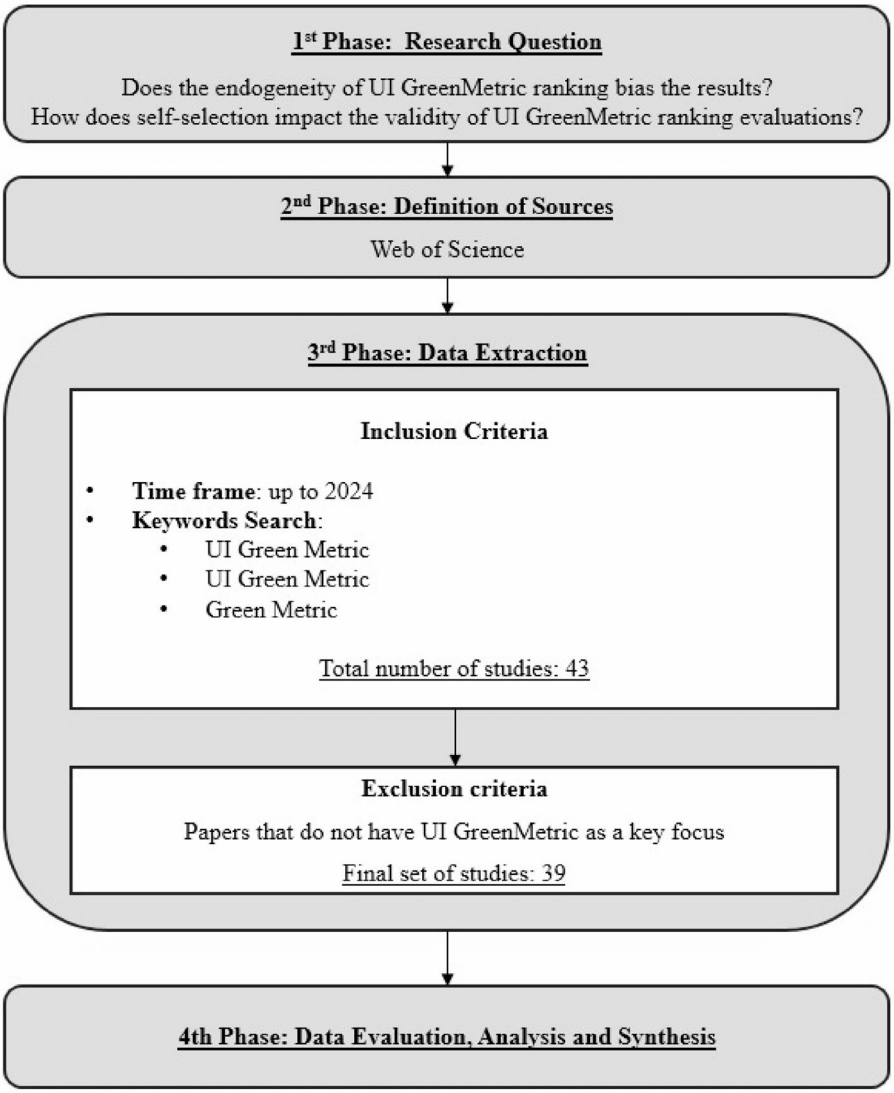

Fig. 3 Identification process for articles included in the systematic literature review

keywords to be identified by our search and included in our initial results. We consider all papers published up to the end of 2024. This initial search yielded 43 papers. Then, we were able to make inclusion versus exclusion decisions about each individual paper by determining if the paper indeed had the UI GreenMetric as a key focus of the paper. This was a relevant criterion for inclusion/exclusion as our research question pertains to the existing literature which bears a focus on the UI GreenMetric or employs the UI GreenMetric in the narrative of the paper. After excluding spurious papers, we arrived at our final sample of 39 scientific papers for our SLR.

For the fourth and final phase we evaluated, analyzed and synthesized the data from these 39 articles. We created a database of information on each paper so that we could accurately code them and group them together. For each paper we ascertained the following information that is relevant for addressing our research question: paper title, language of the paper, geographical context of the study, methodology of the study (quantitative or qualitative), publication year, number of citations in all databases, name of journal of publication, journal of publication JCI (impact factor), open access designations of the paper, authors of the paper, affiliations of the authors, and whether the paper handles its discussion of the UI GreenMetric in a positive, negative, or neutral way (the sentiment of discussion). To determine how each paper handled the discussion of the UI GreenMetric, we performed a close reading of each paper's content regarding the ranking utilizing concepts from content analysis (Krippendorff, 2018). See Table 1 for an overview of the papers in our final sample.

Then, for each affiliation, we retrieved the following information: country locations of the affiliations, whether or not the affiliations are participants in the UI GreenMetric, whether or not the affiliations are located in countries that contain HEIs participating in the UI GreenMetric, whether or not the affiliations participated in the Times Higher Education Impact Rankings (THEI), whether or not the affiliations are located in countries that host HEIs participating in the THE Impact Rankings and whether the country of affiliation has a green party in parliament. See Table 2 for an overview of the affiliations and the related information retrieved. Lastly, to conduct our analysis, we transformed the information contained in the binary variables into dummy variables to test differences among groups of variables in reference to the sentiment of discussion by performing Chi-Square tests. Positive discussions of the ranking, as well as all 'Yes' values, are assigned a value of '1', while negative or neutral discussions, along with all 'No' values, are assigned a value of '0'.

4 Results

This section presents the findings of our analysis. The first part is dedicated to the analysis based on publication characteristics, while the second part highlights the findings related to authors' affiliations. Both sections are organized as follows: first, we present evidence based on the data, followed by statistical tests to identify associations between the variables.

4.1 Publications

As previously stated, our sample consists of 39 papers published between 2013 and 2024. Figure 4 presents a year-by-year breakdown of the data. There is a clear increase in the number of publications from year to year, which highlights the growing importance of this topic in the literature. Concurrently, Fig. 5 shows the journals where the publications have been published and most of them (11) are published in *Sustainability*. It is also noteworthy that most journals (20) published only one article on the UI GreenMetric. One possible explanation is that the topic is relatively new and sustainability in higher education has not been fully addressed yet. Moreover, so far journals tended to accept a positive assessment of the ranking, and a more critical debate on the topic has not been established yet. Another explanation is that being a topic at the intersection of different macro-disciplines, such as

higher education and sustainability, there is no unique target journal where to publish scientific contributions on the topic.

By analyzing the details of the 39 papers, we first report how the publications discuss the UI GreenMetric ranking. Authors can adopt a positive, negative, or neutral perspective towards the ranking. Figure 6 illustrates the distribution of papers according to their sentiment towards the UI GreenMetric. There is a clear preponderance of studies with a positive view of the ranking, suggesting a possible bias in the literature on the topic, which is one of the aspects that this SLR aims to investigate. We have grouped together papers presenting either a negative or neutral assessment of the UI GreenMetric. Our choice is related to methodological needs, as we need enough papers to be able to statistically test the difference between the characteristics of papers with positive and non-positive assessment. Given that studies with a neutral or negative perspective have been published in recent times and are limited in number, we sum them up. This consideration is particularly noteworthy as it shows how UI GreenMetric ranking has been subject to criticism only very recently.

In terms of methodology, the publications analyzed adopt either a qualitative or a quantitative perspective to study the UI GreenMetric. As shown in Fig. 7, the majority of publications make reference to a qualitative methodology. In particular, a year-by-year examination of the data reveals that qualitative methodology is used predominantly during the surge of interest in this topic within the literature. In the latter period there was a notable increase in the number of quantitative studies, which may be attributed to the growing availability of data on the ranking.

Figure 8 illustrates the scope of the analysis, summarizing if the paper considers a single country or multiple countries in their study. The term 'multiple country' encompasses papers that took either a 'worldwide' or a 'European' perspective. In this category, 12 papers adopted a global perspective, while 2 papers consider the European context. Nevertheless, there is a notable prevalence of single-country studies, with 25 papers identified accounting for 64.1% of the total.

Lastly, we analyzed possible relationships between the sentiment of the paper with other characteristics of the paper, with the aim to find eventual biases in these studies. Table 3 shows the Chi-Square tests performed to verify statistically the association between two different variables. Specifically, we tested the sentiment in relation to the context of analysis, the journal of publication and the methodology employed. The analysis reveals a significant difference between single-country and multiple-country contexts. Specifically, the positive outcome is much more prevalent in single-country studies suggesting that the context plays a crucial role in the observed patterns.

4.2 Authors' affiliations

Subsequently, an in-depth examination of the authors and their affiliations can be undertaken as a basis for analysis. First, Fig. 9 shows the number of researchers per country who have published UI GreenMetric-related publications with an affiliation at a HEI located in a country which participates in the ranking. Notably, the countries which are leading this statistic in our analysis are not, at this time, particularly known for their broader sustainability efforts. Furthermore, an examination of the number of HEIs ranked in the UI GreenMetric reveals that the countries with the highest number of researchers also demonstrate the most significant growth in the number of HEIs that participate in the rankings. Indonesia, Thai-

Table 1 Summary of analyzed articles

Nr		Language	Context of Analysis	Methodology	Publication Year	Citations	Journal	Journal Impact Factor	Open Access	Authors	Affiliations	Sentiment Discussion of UI-ranking	DOI
1	Critical review of a global campus sustainability ranking: GreenMetric	English	Worldwide	Qualitative	2015	95	Journal of Cleaner Production	1,52	No	Lauder, A; Sari, RF; Suwartha, N; Tjahjono, G	University of Indonesia	Positive	https://doi.org/10.1016/j.jclepro.2015.02.080
2	Evaluating UI Green Metric as a tool to support green universities development: assessment of the year 2011 ranking	English	Worldwide	Qualitative	2013	85	Journal of Cleaner Production	1,52	No	Suwartha, N; Sari, RF	University of Indonesia	Positive	https://doi.org/10.1016/j.jclepro.2013.02.034

Table 1 (continued)

Nr		Language	Context of Analysis	Methodology	Publication Year	Citations	Journal	Journal Impact Factor	Open Access	Authors	Affiliations	Sentiment Discussion of UI-ranking	DOI
3	Assessment of sustainable development in technical higher education institutes of India	English	India	Qualitative	2019	43	Journal of Cleaner Production	1,52	No	Parvez, N; Agrawal, A	Indian Institute of Technology System	Positive	https://doi.org/10.1016/j.jclepro.2018.12.305
4	Green University and academic performance: An empirical study on UI GreenMetric and World University Rankings	English	Worldwide	Quantitative	2021	42	Journal of Cleaner Production	1,52	Yes	Atici, KB; Yasayacak, G; Yildiz, Y; Ulucan, A	Hacettepe University; University of Huddersfield	Positive	https://doi.org/10.1016/j.jclepro.2020.125289

Table 1 (continued)

Nr		Language	Context of Analysis	Methodology	Publication Year	Citations	Journal	Journal Impact Factor	Open Access	Authors	Affiliations	Sentiment Discussion of UI-ranking	DOI
5	Green Campus initiative and its impacts on quality of life of stakeholders in Green and Non-Green Campus universities	English	Thailand	Quantitative	2016	41	Springerplus	0,00	Yes	Tiyarattanachai, R; Hollmann, NM	King Mongkuts Institute of Technology Ladkrabang	Positive	https://doi.org/10.1186/s40064-016-1697-4
6	Sustainability in Universities: DEA-Green-Metric	English	Worldwide	Quantitative	2019	40	Sustainability	0,68	Yes	Puertas, R; Marti, L	Universitat Politecnica de Valencia	Positive	https://doi.org/10.3390/su11143766

Table 1 (continued)

Nr		Language	Context of Analysis	Methodology	Publication Year	Citations	Journal	Journal Impact Factor	Open Access	Authors	Affiliations	Sentiment Discussion of UI-ranking	DOI
7	A Comparative Analysis between Global University Rankings and Environmental Sustainability of Universities	English	Worldwide	Quantitative	2020	27	Sustainability	0,68	Yes	Muñoz-Suárez, M; Guadalajara, N; Osca, JM	Universitat Politecnica de Valencia; Technical University Machala	Positive	https://doi.org/10.3390/su12145759

Table 1 (continued)

Nr		Language	Context of Analysis	Methodology	Publication Year	Citations	Journal	Journal Impact Factor	Open Access	Authors	Affiliations	Sentiment Discussion of UI-ranking	DOI
8	Education for Sustainable Development in Higher Education Rankings: Challenges and Opportunities for Developing Internationally Comparable Indicators	English	Worldwide	Qualitative	2022	27	Sustainability	0,68	Yes	Veidemane, A	University of Twente	Neutral	https://doi.org/10.3390/su14095102

Table 1 (continued)

Nr		Language	Context of Analysis	Methodology	Publication Year	Citations	Journal	Journal Impact Factor	Open Access	Authors	Affiliations	Sentiment Discussion of UI-ranking	DOI
9	Sustainability university rankings: a comparative analysis of UI green metric and the times higher education world university rankings	English	Worldwide	Qualitative	2022	25	International Journal of Sustainability In Higher Education	1,09	No	Galleli, B; Teles, NEB; dos Santos, JAR; Freitas-Martins, MS; Hourneaux, F	Universidade Federal do Parana; Universidade de Sao Paulo	Neutral	https://doi.org/10.1108/IJSHE-12-2020-0475

Table 1 (continued)

Nr		Language	Context of Analysis	Methodology	Publication Year	Citations	Journal	Journal Impact Factor	Open Access	Authors	Affiliations	Sentiment Discussion of UI-ranking	DOI
10	The role of UI GreenMetric as a global sustainable ranking for higher education institutions	English	Worldwide	Qualitative	2019	14	International Journal of Technology	0,40	Yes	Suwartha, N; Berawi, MA	University of Indonesia	Positive	https://doi.org/10.14716/ijtech.v10i5.3670

Table 1 (continued)

Nr		Language	Context of Analysis	Methodology	Publication Year	Citations	Journal	Journal Impact Factor	Open Access	Authors	Affiliations	Sentiment Discussion of UI-ranking	DOI
11	Decision-making methodology by using multi-expert knowledge for uncertain environments: green metric assessment of universities	English	Worldwide	Quantitative	2023	11	Environment Development and Sustainability	0,80	No	Karasan, A; Gündogdu, FK; Aydin, S	Yildiz Technical University; Turkish Air Force Academy	Positive	https://doi.org/10.1007/s10668-022-02321-7

Table 1 (continued)

Nr		Language	Context of Analysis	Methodology	Publication Year	Citations	Journal	Journal Impact Factor	Open Access	Authors	Affiliations	Sentiment Discussion of UI-ranking	DOI
12	Developing a Novel Index for Assessing and Managing the Contribution of Sustainable Campuses to Achieve UN SDGs	English	Worldwide	Quantitative	2021	8	Sustainability	0,68	Yes	Alawneh, R; Jannoud, I; Rabayah, H; Ali, H	Al-Zaytoonah University of Jordan; Jordan University of Science & Technology	Positive	https://doi.org/10.3390/su132111770

Table 1 (continued)

Nr		Language	Context of Analysis	Methodology	Publication Year	Citations	Journal	Journal Impact Factor	Open Access	Authors	Affiliations	Sentiment Discussion of UI-ranking	DOI
13	Green HRM Practices and Knowledge Sharing Improve Environmental Performance by Raising Employee Commitment to the Environment	English	Pakistan	Qualitative	2023	8	Sustainability	0,68	Yes	Ahmad, F; Hossain, MB; Mustafa, K; Ejaz, F; Khawaja, KF; Dunay, A	Hungarian University of Agriculture & Life Sciences; Minhaj University; International Islamic University, Pakistan; John von Neumann University	Positive	https://doi.org/10.3390/su15065040

Table 1 (continued)

Nr		Language	Context of Analysis	Methodology	Publication Year	Citations	Journal	Journal Impact Factor	Open Access	Authors	Affiliations	Sentiment Discussion of UI-ranking	DOI
14	The role of HEIs to achieve SDG7 goals from Netzero campuses: case studies and possibilities in Brazil	English	Brazil	Qualitative	2023	7	International Journal of Sustainability In Higher Education	1,09	No	Matana, S Jr; Frandoloso, MAL; Briao, VB	Universidade de Passo Fundo	Positive	https://doi.org/10.1108/IJSHE-07-2021-0282
15	Developing a green university framework using statistical techniques: Case study of the University of Tehran	English	Iran	Qualitative	2021	7	Journal Of Building Engineering	1,39	No	Heravi, G; Aryanpour, D; Rostami, M	University of Tehran	Positive	https://doi.org/10.1016/j.jobe.2021.102798

Table 1 (continued)

Nr		Language	Context of Analysis	Methodology	Publication Year	Citations	Journal	Journal Impact Factor	Open Access	Authors	Affiliations	Sentiment Discussion of UI-ranking	DOI
16	Constructing CSR student self-consciousness through university social responsibility implementation: evidence in Indonesia	English	Indonesia	Quantitative	2023	5	Social Responsibility Journal	0,73	No	Agustina, L; Meyliana, M; Hanny, H	Universitas Kristen Maranatha	Positive	https://doi.org/10.1108/SRJ-05-2020-0170

Table 1 (continued)

Nr		Language	Context of Analysis	Methodology	Publication Year	Citations	Journal	Journal Impact Factor	Open Access	Authors	Affiliations	Sentiment Discussion of UI-ranking	DOI
17	Green Campus Design for National Institute of Science and Technology: Implementing UI GreenMetric Criteria to Create Environmentally Friendly and Sustainable Campus	English	Indonesia	Qualitative	2021	4	International Journal of Technology	0,40	Yes	Fatriansyah, JF; Abdillah, FA; Alfarizi, FR	University of Indonesia; Universitas Jenderal Achmad Yani	Positive	https://doi.org/10.14716/ijtech.v12i5.5283

Table 1 (continued)

Nr		Language	Context of Analysis	Methodology	Publication Year	Citations	Journal	Journal Impact Factor	Open Access	Authors	Affiliations	Sentiment Discussion of UI-ranking	DOI
18	The Building Certification System-A Tool of Sustainable Development of University Campuses	English	Romania	Qualitative	2023	3	Journal Of Applied Engineering Sciences	0,16	Yes	Hanga-Farcas, IFP; Bungau, CC; Scurt, AA; Cristea, M; Prada, MF	Technical University of Cluj Napoca; University of Oradea	Positive	https://doi.org/10.2478/jaes-2023-0014
19	Green Campus as a Part of Environmental Management of St. Petersburg State University	English	Russia	Qualitative	2023	3	Sustainability	0,68	Yes	Abakumov, E; Beresten, S	Saint Petersburg State University	Positive	https://doi.org/10.3390/su151612515

Table 1 (continued)

Nr		Language	Context of Analysis	Methodology	Publication Year	Citations	Journal	Journal Impact Factor	Open Access	Authors	Affiliations	Sentiment Discussion of UI-ranking	DOI
20	Sustainable and Green Academic Buildings in Al-Azhar University: Case Study	English	Egypt	Qualitative	2023	2	International Journal of Renewable Energy Research	0,14	No	Soliman, AMA; Mehanna, MA	Egyptian Knowledge Bank (EKB); Al Azhar University	Positive	
21	Ranking Green Universities from MCDM Perspective: MABAC with Gini Coefficient-based Weighting Method	English	Europe	Quantitative	2023	2	Process Integration and Optimization For Sustainability	0,37	No	Öztas, T; Adali, EA; Tus, A; Öztas, GZ	Pamukkale University	Neutral	https://doi.org/10.1007/s41660-022-00281-z

Table 1 (continued)

Nr		Language	Context of Analysis	Methodology	Publication Year	Citations	Journal	Journal Impact Factor	Open Access	Authors	Affiliations	Sentiment Discussion of UI-ranking	DOI
22	Estimation of the Setting and Infrastructure Criterion of the UI GreenMetric Ranking Using Unmanned Aerial Vehicles	English	Colombia	Quantitative	2022	1	Sustainability	0,68	Yes	Fuentes, JE; Garcia, CE; Olaya, RA	Universidad del Valle	Positive	https://doi.org/10.3390/su14010046

Table 1 (continued)

Nr		Language	Context of Analysis	Methodology	Publication Year	Citations	Journal	Journal Impact Factor	Open Access	Authors	Affiliations	Sentiment Discussion of UI-ranking	DOI
23	Education indicator evaluation of UI GreenMetric of campus sustainability of Faculty of Engineering Universitas Negeri Semarang	English	Indonesia	Qualitative	2020	1	International Journal of Innovation And Learning	0,15	No	Wahyuningsih; Sudana, IM; Fardhyanti, DS; Setiawan, MF; Maulana, SS; Nugroho, A; Khoiron, AM	Universitas Negeri Semarang; University of Bristol	Positive	

Table 1 (continued)

Nr		Language	Context of Analysis	Methodology	Publication Year	Citations	Journal	Journal Impact Factor	Open Access	Authors	Affiliations	Sentiment Discussion of UI-ranking	DOI
24	Sustainability Ranking of Turkish Universities with Different Weighting Approaches and the TOPSIS Method	English	Turkey	Quantitative	2023	1	Sustainability	0,68	Yes	Özcan, KA	Bayburt University	Positive	https://doi.org/10.3390/su151612234

Table 1 (continued)

Nr		Language	Context of Analysis	Methodology	Publication Year	Citations	Journal	Journal Impact Factor	Open Access	Authors	Affiliations	Sentiment Discussion of UI-ranking	DOI
25	University social responsibility and sustainability. How they work on the SDGS and how they communicate them on their websites	English	Worldwide	Quantitative	2024	1	Higher Education Quarterly	1,13	Yes	Carrillo-Durán, MV; Sánchez, TB; García, M	Universidad de Extremadura	Positive	https://doi.org/10.1111/hequ.12470

Table 1 (continued)

Nr		Language	Context of Analysis	Methodology	Publication Year	Citations	Journal	Journal Impact Factor	Open Access	Authors	Affiliations	Sentiment Discussion of UI-ranking	DOI
26	Sustainable Green University: Waste Auditing, German Jordanian University as a Case Study	English	Jordan	Qualitative	2022	1	Frontiers In Built Environment	0,44	Yes	Hindiyeh, M; Jaradat, M; Albatayneh, A; Alabdellat, B; Al-Mitwali, Y; Hammad, B	German-Jordanian University	Positive	https://doi.org/10.3389/fbuil.2022.884656
27	Enhancing sustainability performance of universities: A DMAIC approach	English	UAE	Quantitative	2024	1	Systems Research and Behavioral Science	0,82	Yes	Hamdan, A; Hamdan, S; Alsyouf, I; Murad, N; Abdelrazeq, M; Al-Ali, S; Bettayeb, M	University of Sharjah; University of Kent; King Abdulaziz University	Positive	https://doi.org/10.1002/sres.2942

Table 1 (continued)

Nr		Language	Context of Analysis	Methodology	Publication Year	Citations	Journal	Journal Impact Factor	Open Access	Authors	Affiliations	Sentiment Discussion of UI-ranking	DOI
28	Green buildings in Chilean public higher education: a trend or a must-have in university strategic guidelines?	English	Chile	Qualitative	2022	1	International Journal of Sustainable Development And World Ecology	1,50	No	Mac-lean, C; Núñez-Cárdenas, P; Rodríguez, B; Aldea, C	Universidad de Magallanes; Universidad de Chile	Positive	https://doi.org/10.1080/13504509.2022.2095452
29	Enhancing Green University Practices through Effective Waste Management Strategies	English	Thailand	Qualitative	2024	1	Sustainability	0,68	Yes	Phrophayak, J; Techarungruengsakul, R; Khotdee, M; Thuangchon, S; Ngamsert, R; Prasanchum, H; Sivanpheng, O; Kangrang, A	Mahasarakham University; Rajamangala University of Technology Isan	Positive	https://doi.org/10.3390/su16083346

Table 1 (continued)

Nr		Language	Context of Analysis	Methodology	Publication Year	Citations	Journal	Journal Impact Factor	Open Access	Authors	Affiliations	Sentiment Discussion of UI-ranking	DOI
30	Sustainable environmental management in a federal public university from the perspective of the UI GreenMetric	English	Brazil	Qualitative	2024	0	Revista De Gestao Ambiental E Sustentabilidade-Geas	0,05	Yes	dos Santos, AN; Brasil, MVD; Sumiya, LA; de Brelaz, G	Universidade Federal do Cariri; Universidade Federal do Rio Grande do Norte; Universidade Federal de Sao Paulo (UNIFESP)	Positive	https://doi.org/10.5585/2024.23013
31	The Race to Sustainability: Decoding Green University Rankings Through a Comparative Analysis (2018–2022)	English	Worldwide	Quantitative	2024	0	Innovative Higher Education	1,12	No	Abacioglu, S; Ayan, B; Pamucar, D	Ondokuz Mayis University; MEF Universitesi; University of Belgrade	Positive	https://doi.org/10.1007/s10755-024-09734-4

Table 1 (continued)

Nr		Language	Context of Analysis	Methodology	Publication Year	Citations	Journal	Journal Impact Factor	Open Access	Authors	Affiliations	Sentiment Discussion of UI-ranking	DOI
32	A Study of Sustainability Concepts for Developing Green Universities in Thailand	English	Thailand	Quantitative	2024	0	Sustainability	0,68	Yes	Aregarot, P; Kubaha, K; Chiarakorn, S	King Mongkuts University of Technology Thonburi	Positive	https://doi.org/10.3390/su16072892
33	Environmental education policy for pursuing sustainable campus: experience from Taiwan higher education	English	Taiwan	Qualitative	2019	0	Environmental Engineering and Management Journal	0,17	No	Tsai, WT	National Pingtung University Science & Technology	Positive	

Table 1 (continued)

Nr		Language	Context of Analysis	Methodology	Publication Year	Citations	Journal	Journal Impact Factor	Open Access	Authors	Affiliations	Sentiment Discussion of UI-ranking	DOI
34	What do institutional development plans say about sustainability? An analysis of HEIs highlighted in sustainable actions	Portuguese	Brazil	Qualitative	2023	0	Education Policy Analysis Archives	0,31	Yes	Junges, VD; de Campos, SAP; Palma, LC; Laurini, MM	Universidade de Cruz Alta; Universidade Federal de Santa Maria (UFSM); Instituto Federal do Rio Grande do Sul (IFRS)	Positive	https://doi.org/10.14507/epaa.31.7719
35	Ranking of European universities by DEA-based sustainability indicator	English	Europe	Quantitative	2023	0	Journal On Efficiency and Responsibility In Education And Science	0,50	Yes	Matulová, M	Mendel University in Brno	Negative	https://doi.org/10.7160/eriesj.2023.160403

Table 1 (continued)

Nr		Language	Context of Analysis	Methodology	Publication Year	Citations	Journal	Journal Impact Factor	Open Access	Authors	Affiliations	Sentiment Discussion of UI-ranking	DOI
36	University environmental performance in the UI Green Metric Ranking: case of Costa Rican Institute of Technology, central technological campus	Spanish	Costa Rica	Qualitative	2022	0	Tecnologia En Marcha	0,02	Yes	Rodríguez-Rodríguez, A; Mejiás-Elizondo, R; Vindas-Chacón, C	Instituto Tecnologico de Costa Rica	Positive	https://doi.org/10.18845/tm.v35i1.5161

Table 1 (continued)

Nr		Language	Context of Analysis	Methodology	Publication Year	Citations	Journal	Journal Impact Factor	Open Access	Authors	Affiliations	Sentiment Discussion of UI-ranking	DOI
37	Developing students' sustainability consciousness: the role of attitude and practice toward incorporating new uses of old buildings into architectural education	English	Turkey	Qualitative	2024	0	International Journal of Technology And Design Education	0,85	Yes	Kurnaz, A; Aniktar, S	Istanbul Sabahattin Zaim University	Positive	https://doi.org/10.1007/s10798-024-09913-6

Table 1 (continued)

Nr		Language	Context of Analysis	Methodology	Publication Year	Citations	Journal	Journal Impact Factor	Open Access	Authors	Affiliations	Sentiment Discussion of UI-ranking	DOI
38	The Threefold Role of the University in Fostering the Energy Transition: The Case of Bologna and Its Cesena Campus	English	Italy	Qualitative	2024	0	Energies	0,46	Yes	Boeri, A; Turillazzi, B; Sabatini, F; Sassenou, LN; Manella, G	University of Bologna; Universidad Politecnica de Madrid	Positive	https://doi.org/10.3390/en17153751

Table 1 (continued)

Nr		Language	Context of Analysis	Methodology	Publication Year	Citations	Journal	Journal Impact Factor	Open Access	Authors	Affiliations	Sentiment Discussion of UI-ranking	DOI
39	The Sustainable Development Goals for Education and Research in the Ranking of Green Universities of Mahasarakham University	English	Thailand	Qualitative	2024	0	Sustainability	0,68	Yes	Sribanasarn, W; Techarungruengsakul, R; Khotdee, M; Thuangchon, S; Ngamsert, R; Phumiphan, A; Sivanpheng, O; Kangrang, A	Mahasarakham University; University of Phayao	Positive	https://doi.org/10.3390/su16093618

Table 2 Summary of authors' affiliations of analyzed articles

Affiliations	UI-ranking	THEI Ranking	Country	Country with UI-ranked HEIs	Country with THEI-ranked HEIs	Green Party parliament representation
University of Indonesia	Yes	Yes	Indonesia	Yes	Yes	No
Indian Institute of Technology (IIT) - Roorkee	Yes	No	India	Yes	Yes	No
Hacettepe University	No	Yes	Turkey	Yes	Yes	No
University of Huddersfield	No	Yes	United Kingdom	Yes	Yes	Yes
King Mongkuts Institute of Technology Ladkrabang	Yes	Yes	Thailand	Yes	Yes	No
Universitat Politecnica de Valencia	No	Yes	Spain	Yes	Yes	Yes
Technical University Machala	No	No	Ecuador	Yes	Yes	No
University of Twente	No	No	Netherlands	Yes	Yes	Yes
Universidade Federal do Parana	No	No	Brazil	Yes	Yes	Yes
Universidade de Sao Paulo	Yes	Yes	Brazil	Yes	Yes	Yes
Yildiz Technical University	Yes	No	Turkey	Yes	Yes	No
National Defence University Turkish Air Force Academy	No	No	Turkey	Yes	Yes	No
Al-Zaytoonah University of Jordan	Yes	No	Jordan	Yes	Yes	No
Jordan University of Science & Technology	Yes	No	Jordan	Yes	Yes	No
Fatima Jinnah Women University	Yes	No	Pakistan	Yes	Yes	No
Hungarian University of Agriculture & Life Sciences	No	Yes	Hungary	Yes	Yes	Yes
University of Okara	Yes	No	Pakistan	Yes	Yes	No
Minhaj University	Yes	Yes	Pakistan	Yes	Yes	No
International Islamic University, Pakistan	Yes	No	Pakistan	Yes	Yes	No
John von Neumann University	No	Yes	Hungary	Yes	Yes	Yes
Universidade de Passo Fundo	No	No	Brazil	Yes	Yes	Yes
University of Tehran	Yes	Yes	Iran	Yes	Yes	No
Universitas Kristen Maranatha	No	No	Indonesia	Yes	Yes	No
Universitas Jenderal Achmad Yani	No	No	Indonesia	Yes	Yes	No
University Malahayati	No	No	Indonesia	Yes	Yes	No
Technical University of Cluj Napoca	Yes	Yes	Romania	Yes	Yes	No

Table 2 (continued)

Affiliations	UI-ranking	THEI Ranking	Country	Country with UI-ranked HEIs	Country with THEI-ranked HEIs	Green Party parliament representation
University of Oradea	Yes	Yes	Romania	Yes	Yes	No
Saint Petersburg State University	No	No	Russia	Yes	Yes	No
Al Azhar University	Yes	Yes	Egypt	Yes	Yes	No
Pamukkale University	No	No	Turkey	Yes	Yes	No
Universidad del Valle	Yes	No	Colombia	Yes	Yes	Yes
Universitas Negeri Semarang	Yes	No	Indonesia	Yes	Yes	No
University of Bristol	No	No	United Kingdom	Yes	Yes	Yes
Bayburt University	Yes	No	Turkey	Yes	Yes	No
Universidad de Extremadura	No	No	Spain	Yes	Yes	Yes
German-Jordanian University	No	No	Jordan	Yes	Yes	No
University of Sharjah	Yes	No	UAE	No	Yes	No
Universidad de Magallanes	No	No	Chile	Yes	Yes	Yes
Universidad de Chile	No	Yes	Chile	Yes	Yes	Yes
Mahasarakham University	Yes	Yes	Thailand	Yes	Yes	No
Rajamangala University of Technology	Yes	Yes	Thailand	Yes	Yes	No
National university of Laos	No	No	Laos	No	Yes	No
Universidade Federal do Cariri	No	No	Brazil	Yes	Yes	Yes
Universidade Federal do Rio Grande do Norte	Yes	No	Brazil	Yes	Yes	Yes
Universidade Federal de Sao Paulo (UNIFESP)	Yes	Yes	Brazil	Yes	Yes	Yes
Ondokuz Mayis University	Yes	Yes	Turkey	Yes	Yes	No
MEF University	No	No	Turkey	Yes	Yes	No
University of Belgrade	No	No	Serbia	No	Yes	Yes
King Mongkuts University of Technology Thonburi	Yes	Yes	Thailand	Yes	Yes	No
National Pingtung University Science & Technology	Yes	No	Taiwan	Yes	Yes	No
Universidade de Cruz Alta	No	No	Brazil	Yes	Yes	Yes
Universidade Federal de Santa Maria (UFSM)	Yes	Yes	Brazil	Yes	Yes	Yes

Table 2 (continued)

Affiliations	UI-ranking	THEI Ranking	Country	Country with UI-ranked HEIs	Country with THEI-ranked HEIs	Green Party parliament representation
Instituto Federal do Rio Grande do Sul (IFRS)	Yes	No	Brazil	Yes	Yes	Yes
Mendel University in Brno	Yes	No	Czech Republic	Yes	Yes	Yes
Instituto Tecnologico de Costa Rica	Yes	Yes	Costa Rica	Yes	Yes	No
Istanbul Sabahattin Zaim University	Yes	Yes	Turkey	Yes	Yes	No
University of Bologna	Yes	Yes	Italy	Yes	Yes	Yes
Universidad Politecnica de Madrid	No	Yes	Spain	Yes	Yes	Yes
University of Phayao	Yes	Yes	Thailand	Yes	Yes	No

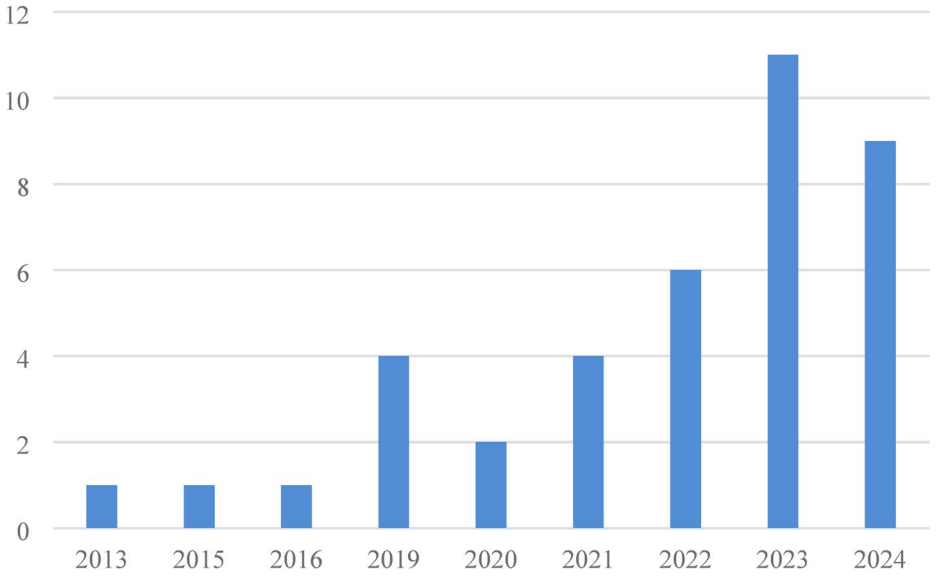

Fig. 4 Annual breakdown of the number of publications about the UI GreenMetric ranking system

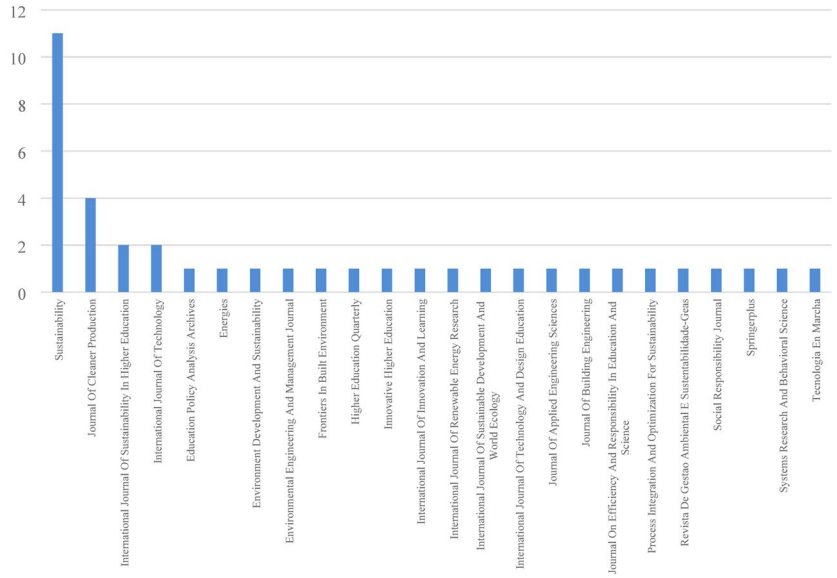

Fig. 5 Journal breakdown of the number of publications on the UI GreenMetric ranking system

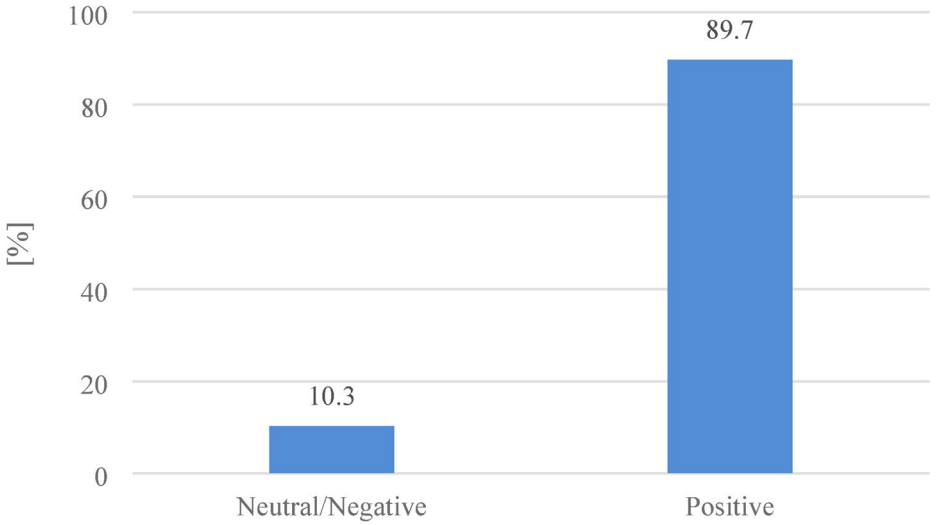

Fig. 6 Sentiment of the Papers on the UI GreenMetric Ranking System, analyzed by percentage

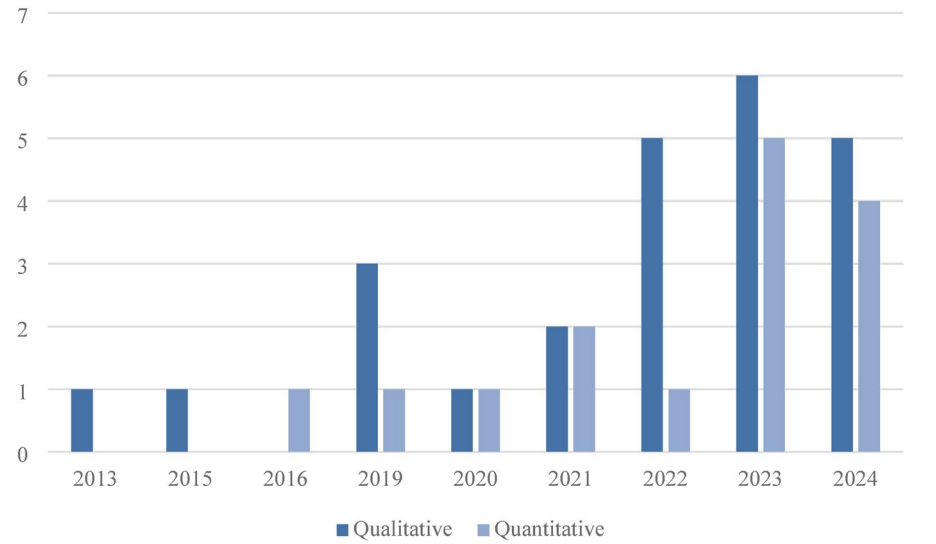

Fig. 7 Breakdown of the methodologies used in papers on the UI GreenMetric ranking system

land, Brazil, and Turkey together account for more than 50% of the total number of country affiliations in our sample – countries that are also heavily represented in the UI GreenMetric rankings.

Second, Fig. 10 illustrates the number of publications that include at least one author affiliated with a HEI participating in the GreenMetric ranking. The figure clearly indicates

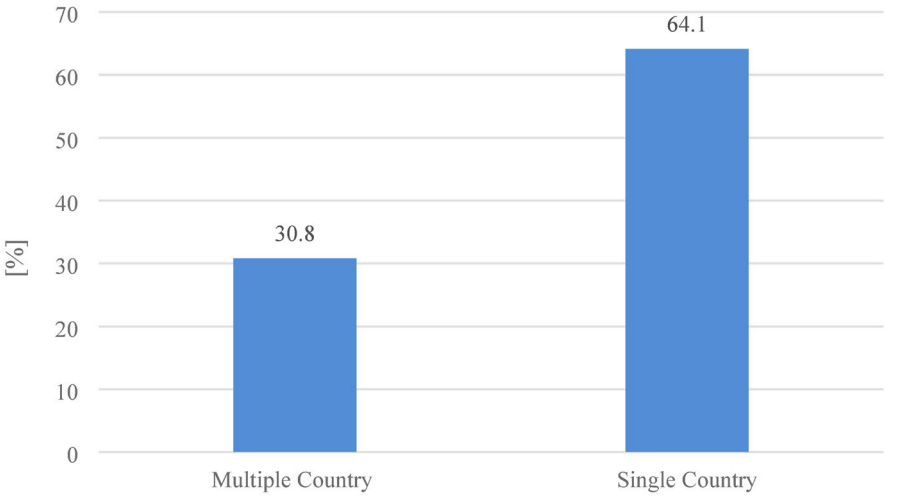

Fig. 8 Breakdown of the context of analysis of the papers on UI GreenMetric ranking system, analyzed by percentage

Table 3 Chi square tests

		Positive Sentiment (*N* = 60.9%)		Negative/Neutral Sentiment (*N* = 39,1%)		
		N	%	N	%	Chi square
Context of analysis	Single country	25	64%	0	0%	7.95***
	Multiple Country	10	26%	4	10%	
Journal	Sustainability – Journal of Cleaner Production	14	36%	1	2%	0.34
	Others	21	54%	3	8%	
Methodology	Qualitative	22	56%	2	5%	0.25
	Quantitative	13	33%	2	5%	

that most of the papers have at least one author affiliated to a HEI in the GreenMetric ranking.

By looking at HEIs in the same countries, we find a concentration of publications in just a few HEIs, as illustrated in Fig. 11. In this figure, each bar represents the total number of authors affiliated with HEIs in each country. The bars are divided into color-coded segments, with each color representing a different HEI. This segmentation illustrates the contribution of individual HEIs in each country. A certain concentration of authors in the same HEIs can be detected. For example, in Indonesia, out of 20 publications, 9 are affiliated at UI and 6 at the University of Negeri Semarang. In a similar vein, in Thailand, 12 out of 19 publications are written with at least one author affiliated to the Mahasarakham University.

It is then noteworthy to investigate the correlation between the sentiment of the publications and the variables pertaining to the country's affiliation. In particular, we examine the positive, negative, or neutral sentiment in association with the following factors: (a) the

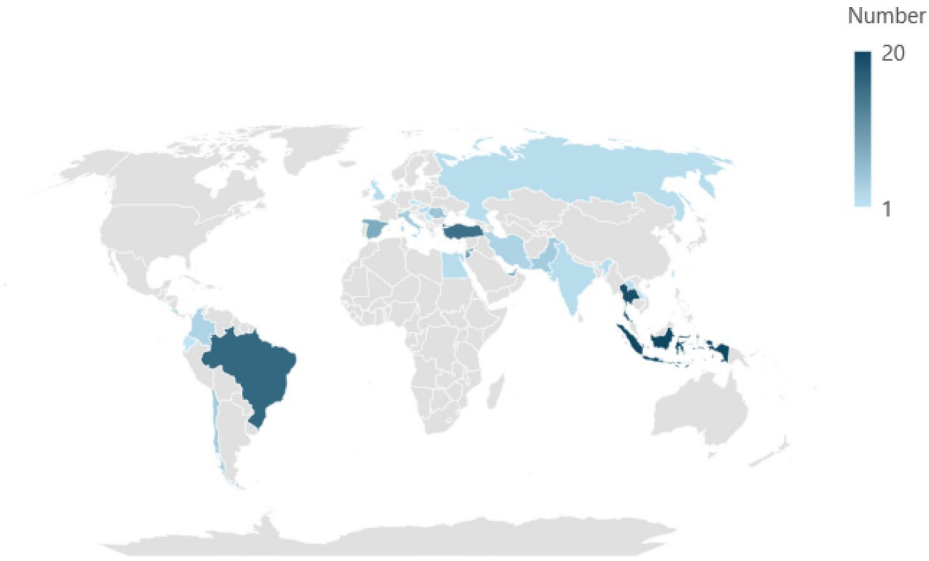

Fig. 9 Country details on the number of authors publishing on UI GreenMetric ranking system with an affiliation in that country

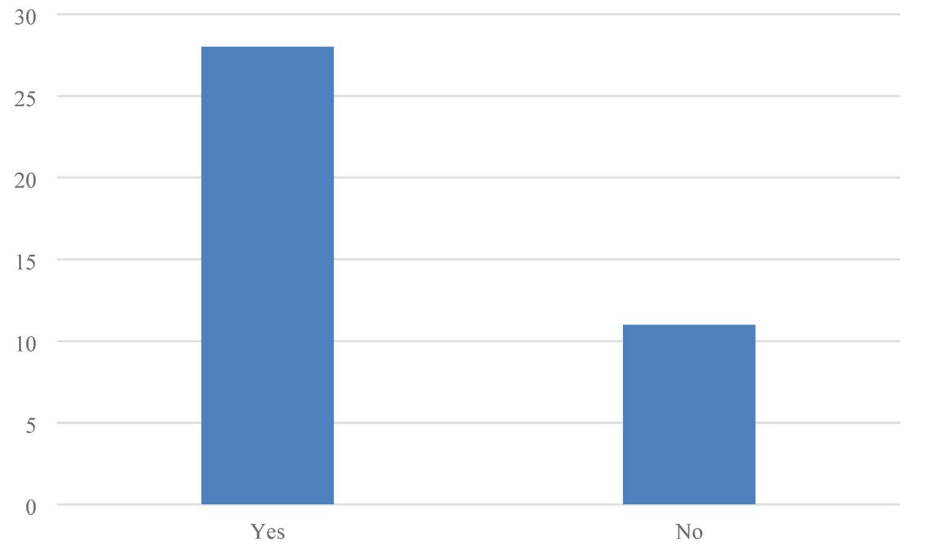

Fig. 10 Number of publications that have at least one author affiliated at a HEI participating in UI GreenMetric ranking

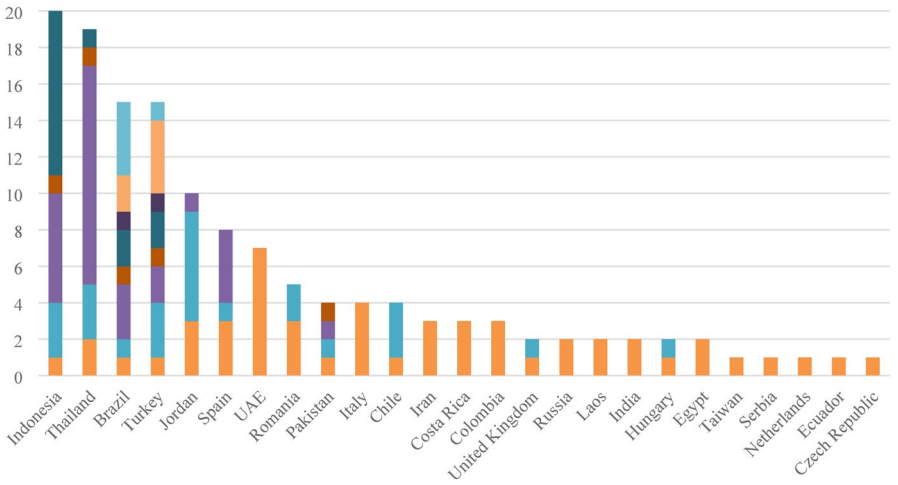

Fig. 11 Number of authors grouped by HEI affiliation per country

Table 4 Chi-square test

		Positive Sentiment ($N = 60.9\%$)		Negative/Neutral Sentiment ($N = 39{,}1\%$)		
		N	%	N	%	Chi square
Match between country of affiliation and country of analysis (if multiple country = Yes)	Yes	121	88%	6	4%	22.90 ***
	No	6	4%	5	4%	
Match between country of affiliation and country of analysis (if multiple country = No)	Yes	91	66%	0	0%	23.14 ***
	No	36	26%	11	8%	
Participation in GM of the HEI of affiliation	Yes	82	60%	2	1%	9.14 ***
	No	45	32%	9	7%	

relationship between the HEI of affiliation and the context of analysis and (b) the participation of the HEI of affiliation in the UI GreenMetric ranking. Table 4 shows that authors which analyze the UI GreenMetric in their country of affiliation are more likely to discuss the ranking in a positive way compared to authors analyzing countries to which they are not affiliated – this difference is statistically significant. Furthermore, the sentiment appears to depend upon the participation of the authors' respective HEIs in the ranking.

5 Discussion and conclusions

The topic of sustainability is gaining attention in academic and policy debates (Lehmann et al., 2024; Cohen et al., 2024). Similar to the traditional rankings, sustainability rankings have the potential to be used as political instruments (Otto, 2023; Pusser & Marginson, 2013). Yet, contrary to the traditional rankings which have been heavily criticized both for the metrics used and for distorting behaviors they attempt to measure (Hazelkorn, 2014,

2018, 2023), sustainability rankings are positively discussed in the literature (Calderon, 2023; Galleli et al., 2022; Hazelkorn, 2023; Marginson, 2009). This lack of the criticism could stem from the fact that these rankings are still under-investigated (where our SRL then arrives at a crucial time to indicate potential areas of future research), or because an attempt to use the UI GreenMetric as a means of greenwashing may be at play.

We lean towards the second argument for different reasons. First, the existing articles are extremely concentrated in just few journals. More precisely, almost 40% of the papers are published in only two journals: *Sustainability* (11 papers) and the *Journal of Cleaner Production* (4 papers). The choice to publish in *Sustainability* may be driven by the fact that it represents the perfect target as it has the subject matter of the rankings (sustainability) as its core topic. At the same time, the fact that these articles have been published in a journal of dubious credibility and impact generates some skepticism. *Sustainability* has been identified as engaging in predatory practices and exhibits a modest journal impact factor (Oviedo-García, 2021). This is also true of the other most targeted journals in our sample, such as the *Journal of Cleaner Production*, the *International Journal of Sustainability in Higher Education*, and the *International Journal of Technology*. Therefore, publishing papers on the UI GreenMetric ranking in these journals might be driven by the rationale of publishing on the topic without seeking for high-quality publication standards, meaning that ease of publication may have been an influence in the choice of journal.

Second, publications are mostly concentrated in just a few countries and come from just a few HEIs (Atici et al., 2021; UI GreenMetric, 2024). This may be interpreted as a genuine scientific interest in sustainability and a consequent specialization in the field, or rather it might also be a signal of interest toward the UI GreenMetric to promote these HEIs and countries that would not normally be associated with sustainability. This second argument may be supported by the fact that those HEIs and countries where publications on the UI GreenMetric concentrate are generally not at the forefront in sustainability concept – see Matulová (2023) for a discussion of the polarization of UI GreenMetric in the Global South. Third, there is a disproportionate number of contributions providing a positive assessment of the topic – which casts doubt on the level of bias surrounding these publications in general (Calderon, 2023; Galleli et al., 2022).

These findings have practical implications, as our study may raise a debate within HEIs that either participate or plan to participate in this ranking around the rationale behind their decision, and the intended and unintended consequences of their decision, in order to assess whether it is worthwhile pursuit. Participating in the UI GreenMetric can be expensive in terms of time, money and human resources devoted to data collection and transmission, which may be better allocated to pursuing further sustainable practices themselves instead of market signalling via a ranking. In addition, our study can inform policymakers around the (lack of) effectiveness of specific incentives devoted to sustainability in HEIs. Encouraging HEIs to participate in a sustainability ranking may be used as a signalling effect without a real commitment to long-term sustainability behaviors in the higher education sector.

However, our study encounters some limitations as well. Although the UI GreenMetric is well established, it is still relatively new compared to traditional rankings. This could influence publication behavior, and, as it gains wider acceptance, the literature may evolve accordingly. From a methodological perspective, we consider the participation of the researchers' affiliated universities in the ranking as a potential source of bias. However, since researchers themselves are usually independent entities, this may not necessarily

impact their work. Nevertheless, we provide evidence on potential misbehaviors in terms of sustainability signalling. We therefore call for more studies on the topic by adopting multiple country perspectives in the research, especially a comparative perspective, in order to critically assess the implementation of sustainable practices as well as the effects of being ranked as a sustainable HEI and/or country. Moreover, based on the shortage of quantitative analyses, we invite scholars to investigate sustainability in the HEI setting by applying statistical as well as survey-based approaches to provide empirical and anecdotical evidence on the subject. In addition, we call for contributions on the HEI sustainability debate from authors whose affiliations are not in the ranking, which can mitigate the risk of self-selection biases and self-promotion behaviors in the literature.

Ultimately, we find that while the aims of the UI GreenMetric are admirable – the pursuit of sustainability in the HEI space is crucial to our future development as a global society – the execution and implantation of the ranking has opened it up to be used for other means that point in the direction of greenwashing. Measuring HEI sustainability performance is a valid initiative, particularly as HEIs are being called upon to be problem solvers in modern society; however, how the measurements are conducted, and who is, and isn't, in, matters. We hope that this study helps policy makers and practitioners improve upon these ranking and measurement efforts, so that HEIs the world over can improve their ability to help our global society work toward sustainability and combat climate change.

Acknowledgements We gratefully acknowledge the supporting and constructive comments by an anonymous referee and the editors of this Journal, Al Link and James Cunningham. All the remaining errors are of course ours. The findings, interpretations, and views expressed in this study are those of the authors, and not necessarily those of the authors' institutions. Further, the authors express their gratitude for their institutions' support in helping to publish this article with Open Access. The authors also wish to express that this study is meant to serve as a critical, yet helpful analysis of HEI sustainability rankings so that they may be improved upon and implemented more effectively. Sustainability and participating actively in the fight against climate change are noble and important causes, and measuring those activities in the HEI space is certainly crucial. The authors hope that this study aids HEIs in more efficiently pursuing the UN SDGs, and sustainability more broadly.

Author contributions All authors wrote the main manuscript text, prepared the tables and descriptive statistics and all authors reviewed the manuscript.

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Data availability No datasets were generated or analysed during the current study.

Declarations

Competing interests The authors declare no competing interests.

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Authors and Affiliations

Chiara Alberti[1] · Alice Civera[1] · Erik E. Lehmann[2] · Michele Meoli[1] · Jonah Otto[2] · Stefano Paleari[1]

✉ Erik E. Lehmann
erik.lehmann@uni-a.de

Chiara Alberti
chiara.alberti@unibg.it

Alice Civera
alice.civera@unibg.it

Michele Meoli
Michele.Meoli@unibg.it

Jonah Otto
Jonah.otto@uni-a.de

Stefano Paleari
Stefano.paleari@unibg.it

[1] University of Bergamo, Bergamo, Italy

[2] University of Augsburg, Augsburg, Germany