

# The influence of sustainability indicators on university performance: an analysis of global university rankings

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## Abstract

**Purpose** – This study aims to investigate how sustainability indicators influence universities' performance by analyzing the configurations of such indicators in relation to global university rankings.

**Design/methodology/approach** – The authors applied a quantitative approach using fuzzy-set Qualitative Comparative Analysis to examine how combinations of sustainability indicators, based on the six dimensions from the UI GreenMetric World University Ranking, relate to institutional performance in the Times Higher Education World University Ranking (THE WUR) and the Quacquarelli Symonds (QS) World University Ranking.

**Findings** – The analysis reveals distinct patterns in how sustainability practices affect performance in different rankings. For the UI GreenMetric and THE WUR intersection, “Waste,” “Water,” “Transport” and “Education and Research” emerged as key elements. In the UI GreenMetric and QS intersection, “Settings and Infrastructure” and “Education and Research” were consistently associated with higher performance levels.

**Practical implications** – Universities should tailor their sustainability strategies according to the logic of each ranking system. The results show that sustainability is a multidimensional concept, with variable effects on institutional performance depending on the ranking's focus. These insights provide guidance for university managers aiming to align their sustainability practices with performance goals.

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**Originality/value** – This study presents a novel analysis using an asymmetric technique and an original interaction analysis between sustainability indicators of a global ranking (UI GreenMetric) and performance indicators of two other global rankings (THE WUR and QS World University Ranking).

**Keywords** Green universities, Sustainability indicators, UI GreenMetric World University Ranking, Times Higher Education World University Ranking, QS World University Ranking, Qualitative comparative analysis

**Paper type** Research paper

## 1. Introduction

Environmental awareness is a current hot topic that has gained increasing relevance, prompting companies across all sectors to align their strategies and operations with sustainable development issues (Meissner *et al.*, 2024; Öztaş *et al.*, 2023). Universities and higher education institutions play a crucial role in promoting and driving sustainable development forward (Galleli *et al.*, 2022). Indeed, the term “green university” has been introduced as a result of efforts toward creating sustainability and protecting the environment (Filho *et al.*, 2019; Wu, 2021). Starting in the 2000s, particularly after 2010, more specified concepts such as “green campus” and even “green curriculum” began to appear in the scientific literature (Atici *et al.*, 2021).

Green universities seek to reduce their negative effects on the environment, raise awareness of ecological issues and cultivate a sustainable culture among their staff, teachers, students and the larger community (Maleki *et al.*, 2025). Initiatives include but are not limited to transforming universities’ missions, changing research programs, reorganizing curricula, implementing new campus lifestyles and behaviors, encouraging outreach and community involvement and evaluating and reporting these initiatives to stakeholders (Atici *et al.*, 2021; Garcia-Lacalle *et al.*, 2025).

Universities have taken on an increasingly vital role in sustainable development, especially since the establishment of the United Nations’ 17 Sustainable Development Goals (SDGs) in 2015. This milestone brought sustainability to the forefront of global discourse, compelling higher education institutions to reassess their commitment to these goals and tackle societal challenges (Calderon, 2023; Leal Filho *et al.*, 2018). The overarching goal of the 17 UN SDGs is to leverage efforts to eradicate all forms of poverty, combat inequalities and address climate change while ensuring inclusive progress (United Nations, 2015). A special SDG (SDG #4, Quality Education) specifically focuses on education for sustainable development, emphasizing its essential role in achieving the other 16 SDGs (Finatto *et al.*, 2024; Ruiz-Mallén and Heras, 2020).

One indicator of universities’ readiness to lead in sustainable development is their involvement in international sustainability rankings (Garcia-Lacalle *et al.*, 2025). Comparing institutions is based on university rankings. In determining the most renowned universities, they influence student choice and influence reputation, promoting competition among institutions (Öztaş *et al.*, 2023) *Asiaweek* published the first international university ranking in 1998. As globalization increased interconnectedness, market expansion and competition for students, financial capital and academic talent, the university’s role was redefined (Calderon, 2023). In 1999, Shanghai Jiao Tong University Institute of Higher Education introduced the Academic Ranking of World Universities (ARWU), followed by the Times Higher Education World University Ranking (THE WUR) and Quacquarelli Symonds (QS) World University Ranking.

Sustainability-related university rankings go beyond classificatory boundaries, being inserted in a context dedicated to achieving sustainable development goals (Galleli *et al.*, 2022).

Published annually since 2010, the UI GreenMetric World University Ranking, created by Universities Indonesia, aims to provide information about the sustainability of universities globally (Lauder *et al.*, 2015). Recognized by the scholarly literature following Suwartha and Sari's (2013) publication, the index is nowadays the most widely adopted framework for constructing a green university. The instrument evaluates the university's policy and performance based on six categories: setting and infrastructure, energy and climate change, waste, water, transportation and education and research. Institutions globally are invited to voluntarily participate in the ranking, being assessed at their institutional level (Veidmane, 2022).

Recently, despite the increasing number of studies on sustainable universities, most research focuses on individual sustainability dimensions or provides descriptive comparisons of ranking methodologies (Boiocchi *et al.*, 2023; Calderon, 2023; Filho *et al.*, 2019; Hernandez-Diaz *et al.*, 2024; Öztaş *et al.*, 2023; Yarritu *et al.*, 2024). Existing studies have found that transforming a conventional university into a green university initially requires significant investment and institutional policies, but in the long term, it can result in cost reduction, increased efficiency and, logically, positive environmental results (Leal Filho *et al.*, 2025). These changes can, indeed, lead the university to a better competitive position and better results, including in international rankings (Hernandez-Diaz *et al.*, 2024). However, few studies have examined how configurations of sustainability indicators influence university performance in widely recognized global rankings using a comparative, causal-oriented approach. Specifically, there is a lack of empirical research integrating sustainability metrics (such as those from UI GreenMetric) with performance indicators from global rankings like THE WUR and QS. This gap limits our understanding of how sustainability efforts contribute to institutional visibility and competitiveness in global academic benchmarks (Atici *et al.*, 2021; Calderon, 2023; Hernandez-Diaz *et al.*, 2024; Öztaş *et al.*, 2023).

This study addresses this gap by analyzing how configurations of sustainability indicators relate to institutional performance in global rankings. By applying fuzzy-set Qualitative Comparative Analysis (fsQCA), we offer a novel approach that captures the causal complexity behind the influence of sustainability practices on university outcomes.

Based on the above, this study aims to analyze the influence of sustainability indicators on universities' performance. More clearly, it is intended to examine how configurations of these indicators are associated with institutional results in major global university rankings. To this end, the sustainable indicators of the UI GreenMetric World University Ranking will be related to the performance indicators of the most recognized global university rankings, THE WUR and QS World University. By adopting a quantitative methodological approach through an asymmetric technique (fsQCA, this study aims to contribute to filling a research gap by relating academic rankings, considering the influence of a specialized sustainable ranking on the total scores of well-recognized rankings, providing valuable insights for promoting green university policies and pointing out the most relevant indicators and how to improve them.

While previous studies have applied fsQCA to sustainability in higher education, this research uniquely investigates the relationship between UI GreenMetric indicators and institutional performance across THE WUR and QS rankings, offering a comparative and configurational perspective that has been largely overlooked.

The remainder of this paper is organized as follows: in Section 2, we present our theoretical background. In Section 3, we set out the research design we applied, and the results are shown in Section 4. Discussion is included in Section 5, followed by implications. Finally, we make our concluding remarks and suggest implications for future research.

## 2. Theoretical background

### 2.1 *The role of universities in fostering sustainable development*

This study is theoretically grounded in two complementary perspectives: Institutional Theory and the Resource-Based View (RBV). These frameworks offer distinct yet interconnected explanations for how sustainability practices are adopted and institutionalized within higher education institutions (HEIs) and how such practices contribute to performance outcomes.

Institutional Theory explains the adoption of sustainability indicators as a response to external pressures for legitimacy. Universities operate in institutional environments where coercive (e.g. government funding), normative (e.g. accreditation requirements) and mimetic (e.g. competition with peer institutions) forces shape strategic behavior (Hope and Zhang, 2024; Bautista-Puig *et al.*, 2022). In this context, participating in sustainability rankings such as UI GreenMetric becomes a way to signal legitimacy and alignment with global norms.

Complementarily, the RBV provides a performance-oriented lens, emphasizing that sustainability initiatives can serve as valuable, rare and inimitable resources that enhance institutional competitiveness (Lee and Yun, 2020; de Villiers *et al.*, 2025). Practices related to green infrastructure, environmental education and responsible operations may contribute to cost-efficiency, innovation and reputation, all valued by global academic rankings.

These two perspectives are not mutually exclusive. While Institutional Theory accounts for the external pressures and legitimacy-seeking behavior of universities, the RBV highlights how sustainability can be internalized into organizational routines and capabilities to generate long-term advantage. Together, they offer a comprehensive understanding of why and how universities engage with sustainability metrics and rankings.

Due to its influential impact on the economy, society and environment, the higher education sector is under pressure to adopt sustainability-advancing knowledge, tools and societal transformations in an era of increased awareness of the myriad contemporary socioenvironmental issues (Caeiro *et al.*, 2020; Fissi *et al.*, 2021).

In the past, educational institutions used to focus only on the triad of teaching, researching and servicing. Over the years, researchers and practitioners have noted the unique ability of universities and other higher education institutions to catalyze social change, including toward sustainability practices. Following the existing literature, since the 1980s, sustainable-related themes have been a part of educational institutions' global agenda. Especially after the 2000s, the "greening" of the university curricula spanned and has not but grown (Atici *et al.*, 2021; Galleli *et al.*, 2022). For Caeiro *et al.* (2020), the SDGs' advent, in particular SDG #4, became an additional driver for the implementation of sustainability at universities and higher education centers after 2015. Thus, in the new millennium, higher education institutions play a vital role in advancing sustainability initiatives.

Universities and higher education institutions are capable of promoting the sustainable development in multiple ways: by minimizing the adverse effects of its operations on the economy, society and environment (Filho *et al.*, 2019; Fissi *et al.*, 2021); by including sustainable values in its governance system (mission, vision and strategic plans); by transforming their campus operation (waste, water and energy) (Bautista-Puig *et al.*, 2022); by incorporating and encouraging sustainable practices into research projects and curriculum (Fissi *et al.*, 2021), by training future professionals and leaders (Galleli *et al.*, 2022); by educating and stimulating public, academic and operational staff awareness of sustainability and habits to adopt (Bautista-Puig *et al.*, 2022; Boiocchi *et al.*, 2023); by discovering novel knowledge about new ways through which sustainability can be achieved or enhanced (Boiocchi *et al.*, 2023); in addition by inventing novel technologies, solutions and

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approaches supporting and promoting sustainability (Anthony Jnr, 2021; Boiocchi *et al.*, 2023).

Based on the above, universities stand out as models of sustainability, assuming a moral obligation as an “agent of change” and “leading by example” (Bautista-Puig *et al.*, 2022; Caeiro *et al.*, 2020). Among the diversity of ways institutions can support sustainability, scholars highlight the teaching dimension. For Ruiz-Mallén and Heras (2020), educational institutions can help students develop useful skills and ideals of human–nature connection while preventing them from becoming overwhelmed by the nihilism and pessimism of the current dire circumstances. By integrating sustainability at the curriculum level, institutions create awareness among their graduates, establishing new mental paradigms related to sustainability (Atici *et al.*, 2021; Fissi *et al.*, 2021; Garcia-Lacalle *et al.*, 2025).

For an institution to be deemed “green” or “sustainability-oriented,” sustainable-related practices need to be ingrained at every level of the campus. It means that disjointed efforts involving discrete acts by particular university departments or organizations are insufficient (Galleli *et al.*, 2022). It is important, however, to consider that there are barriers and challenges faced by universities when attempting to adopt green strategies. The lack of both financial and human resources represents an important obstacle (Filho *et al.*, 2019), also including budgetary constraints (Leal Filho *et al.*, 2025), cultural habits and the lack of mandatory regulations on sustainability disclosure (Fissi *et al.*, 2021).

Despite the obstacles, it is worth mentioning that universities and other kinds of institutional education compete to attract the most talented academics, students and funding (Estrada-Real and Cantu-Ortiz, 2022). Logically, prominent academic institutions are identified by the caliber of their professors and students’ research and technical output (Estrada-Real and Cantu-Ortiz, 2022). Considering that contemporary students are also more concerned about socioenvironmental issues, educational centers need to engage in the “green trend.” In this regard, sustainable initiatives, beyond reducing the institution’s environmental footprint (Leal Filho *et al.*, 2025), also provide a competitive advantage and significant cost reductions in the long term (Atici *et al.*, 2021; Hernandez-Diaz *et al.*, 2024).

In this picture, reporting has become a viable alternative for universities to engage their various stakeholders and share their performance and actions (Fissi *et al.*, 2021; Garcia-Lacalle *et al.*, 2025). Especially those reports linked to sustainability are a tool for universities to disclose and communicate their commitment to socioenvironmental issues and, consequently, the SDGs (Bautista-Puig *et al.*, 2022). Also, reports allow benchmarking practices, comparing university and higher educational institutions’ processes and performance metrics (Caeiro *et al.*, 2020; Maleki *et al.*, 2025). Beyond their practical utility, such reports also reflect broader institutional dynamics and strategic orientations, which can be interpreted through established organizational theories.

In parallel, participation in sustainability rankings not only supports external communication but also reflects underlying institutional dynamics and strategic behavior that can be better understood through established organizational theories. Institutional Theory has been widely used to explain how universities and other organizations adopt practices to align with institutional expectations and gain legitimacy (Bitektine and Song, 2022; Hope and Zhang, 2024; Huisman and Burgoa, 2024). In this framework, the adoption of sustainability practices in higher education can be understood as a response to coercive pressures (e.g. government policies and funding conditions), normative influences (e.g. accreditation standards, academic culture) and mimetic behaviors (e.g. benchmarking with prestigious institutions) (Bautista-Puig and Sanz-Casado, 2021; Menon and Suresh, 2020). Universities often incorporate sustainability reporting, green policies and participation in international rankings as symbolic and strategic actions to conform to societal expectations

and enhance their legitimacy in a competitive and globalized academic field. These external pressures tend to shape organizational behavior, even when internal motivations may be secondary (Hope and Zhang, 2024; Pedro *et al.*, 2024).

From another perspective, the RBV Theory, as by Lee and Yun (2020) and Patnaik *et al.* (2022), highlights how sustainability-related practices and capabilities can serve as strategic resources for universities. When these practices are embedded into the institution's culture, operations and academic processes, they may create value through innovation, cost savings, reputation enhancement and stakeholder engagement (Munaro and John, 2025; de Villiers *et al.*, 2025). In this sense, sustainability becomes more than compliance; it is positioned as a potential source of competitive advantage. Particularly in higher education, where differentiation and reputation are critical, sustainability initiatives that are rare, difficult to imitate and integrated across functions can enhance institutional performance and visibility (Irungu and Liu, 2024; Leal Filho *et al.*, 2025). To translate these advantages into recognized outcomes, institutions increasingly rely on mechanisms that make their sustainability practices visible and comparable. One way to report refers to participating in global university rankings and we will better discuss it in the following topic.

## 2.2 Global university rankings

Over time, global university rankings have gained legitimacy as key indicators for evaluating the quality of higher education systems and comparing institutions. Studies show that participation in global university rankings not only influences stakeholders but also reflects an institution's level of innovation and internalization of practices (Garcia-Lacalle *et al.*, 2025). Participation in sustainability rankings, in particular, supports universities in developing and improving sustainability initiatives aligned with their institutional goals (Galleli *et al.*, 2022; Leal Filho *et al.*, 2025). It also supports "green" decision-making (Anthony Jnr, 2021).

Ranking systems pursue different purposes (Lim and Williams Øerberg, 2017); consequently, they use distinct methodologies. As a result, questions often arise about the robustness of the indicators used to generate these key metrics. Beyond the indicators themselves, the main criticisms focus on the methodologies used, evaluation criteria, transparency and the influence of rankings on university behavior. Nonetheless, despite these concerns, ranking results are increasingly accepted internationally as benchmarks for assessing how effectively universities fulfill their societal missions.

Next, we discuss three global university rankings in more detail: UI GreenMetric (2.2.1), THE WUR (2.2.2) and QS World University Ranking (2.2.3).

**2.2.1 UI GreenMetric World University Ranking.** Considered one of the oldest rankings for assessing sustainability in higher education institutions and currently the most widely adopted by universities, the UI GreenMetric was established by the University of Indonesia in 2010. Its objective is to develop a survey that effectively represents and measures the sustainability policies and programs of universities worldwide (Veidemane, 2022). By providing six criteria for ranking green universities, UI GreenMetric serves as a suitable basis for achieving a sustainable environment (Maleki *et al.*, 2025), considering three dimensions: research, educational and environmental (Suwartha and Sari, 2013). From a university governance perspective, the ranking serves as a self-assessment tool and a support mechanism for the sustainable management of campuses (Leal Filho *et al.*, 2025).

Participation in the ranking is voluntary, its coverage is global and assessment is done at the institutional level annually. Data collection happens through online questionnaires and open-access systems sent to university administrators between May and October. Publication of the classifications occurs in December (Suwartha and Sari, 2013; Veidemane, 2022).

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Over the years, the UI GreenMetric evaluation tool has undergone updates since its first edition, in 2010. Indicators were implemented, in addition to improvements to the questionnaire and collection methods (Lauder *et al.*, 2015).

Scores are determined from numerical data, primarily involving item counts or scaled responses (UI GreenMetric, 2024). Each of the criteria is categorized into a general class of information and when the results are processed, the raw scores are weighted to provide a final calculation (Bautista-Puig *et al.*, 2022). There is an increased growth in the number of universities participating in this ranking annually (Leal Filho *et al.*, 2025). The 15th edition of the rankings, released in 2024, features 1,477 institutions from 95 countries.

**2.2.2 Times Higher Education World University Ranking.** The THE WUR is one of the most well-known and respected academic performance ranking systems globally. It evaluates universities' impacts in alignment with the 17 UN SDGs. Created in 2004, THE WUR was initially developed in partnership with Quacquarelli Symonds until 2009. The rankings have been published independently since 2010 by TES Global and are affiliated with *The Times*, a recognized British newspaper. The ranking system takes into account several indicators, covering both teaching and research performance (THE World University Rankings, 2024). For this reason, THE WUR is considered the first global initiative to document evidence of universities' societal influence beyond traditional teaching and research metrics, according to the World Economic Forum.

Its 13 indicators are organized into five core performance areas. Many scholars worldwide consider that the THE WUR methodology system of evaluation ensures a detailed assessment of university quality on a global scale, providing a holistic view of institutional performance across multiple critical dimensions (Atici *et al.*, 2021; Galleli *et al.*, 2022; Leal Filho *et al.*, 2025).

By comparing the THE WUR with UI GreenMetric, it is possible to identify that while the UI GreenMetric aims to give a measure of sustainable circumstances and sustainability policies in institutions, THE WUR goes beyond by gauging how well university institutions are doing at achieving the SDGs. Compared to the UI GreenMetric, the educational dimension of the THE WUR is more interested in the percentage of first-generation students, the number of graduates who obtained primary school teaching credentials and the chances for lifelong learning offered, reflecting the SDG framework (Galleli *et al.*, 2022). It is worth mentioning that the adherence of participating institutions can also be considered different in these instruments. In the UI GreenMetric, universities are invited and incentivized to participate in the ranking, while in the THE WUR, participation is merely voluntary (Galleli *et al.*, 2022).

It is important to note that even though the THE WUR embraces environmental issues, it addresses a wide range of social indicators (Boiocchi *et al.*, 2023). In its latest edition, published in January 2025, 2,092 universities were ranked, and 472,694 datapoints from 2,860 institutions that submitted data were analyzed.

**2.2.3 Quacquarelli Symonds World University Ranking.** The QS World University Ranking was introduced by Quacquarelli Symonds in 2004 and developed in collaboration with THE until 2009. Its goal is to assess universities worldwide through indicators related to student experience, institutional partnerships, research performance and faculty credentials (QS World University Rankings, 2025). Currently, the ranking system includes eight dimensions, each with a representative weight in the total points.

QS World University Ranking, similar to UI GreenMetric and THE WUR, is one of the most influential global university rankings. Scholars widely adopt QS due to the availability of data (Atici *et al.*, 2021; Estrada-Real and Cantu-Ortiz, 2022). The 2025 edition is the largest to date, featuring more than 1,500 universities across 105 higher education systems.

### 3. Research design

The methodological approach of this research relied on fsQCA to address the influence of sustainability indicators on universities' performance. fsQCA is an asymmetric comparative technique that identifies configurations of causal conditions associated with specific outcomes. It allows for the discovery of multiple pathways leading to the same outcome (Ragin, 2006; Woodside, 2014).

The fsQCA model comprised indicators from the UI GreenMetric World University, WUR and QS World University Ranking. These rankings were chosen because they contain a significant number of universities, offering reliable and recent data (Atici *et al.*, 2021). Indeed, previous studies have already used the UI GreenMetric indicators (Atici *et al.*, 2021; Boiocchi *et al.*, 2023; Lauder *et al.*, 2015; Suwartha and Sari, 2013).

For fsQCA analysis, the six sustainability dimensions of the UI GreenMetric ranking were considered causal variables. As outcome variables, we considered the overall scores from THE WUR and QS World University Ranking. The final sample was composed of all universities that appear in the intersection of the UI GreenMetric with one of the other two rankings (UI GreenMetric World University x THE WUR = 419 universities; UI GreenMetric World University x QS World University = 63 universities). For this reason, two different fsQCA models were delineated, and analysis was based on data collected in 2023.

Figure 1 presents the methodological steps followed in the study.

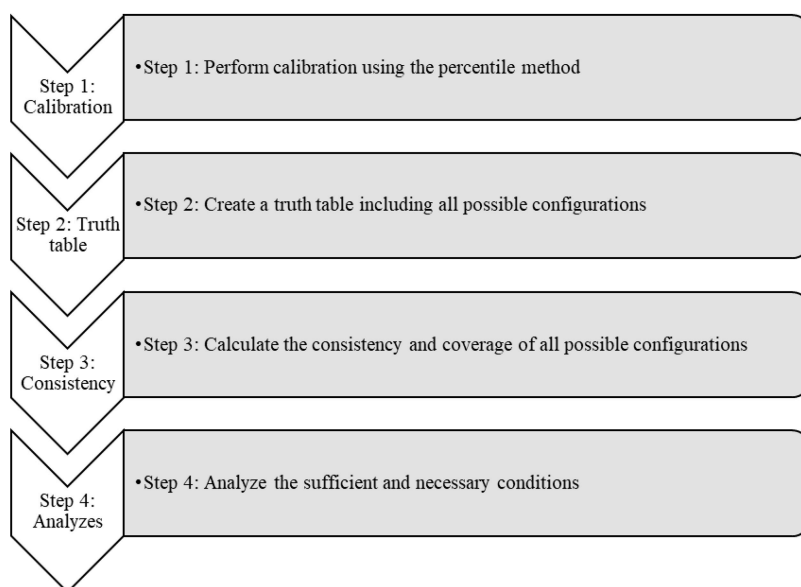
#### 3.1 Research instruments, validity, reliability and sample selection

The research relied on systematically collected secondary data derived from three internationally recognized university rankings: the UI GreenMetric World University Ranking, the THE WUR and the QS World University Ranking. These rankings served as the core research instruments+. Specifically, the six sustainability indicators of the UI GreenMetric (i.e. Setting and Infrastructure, Energy and Climate Change, Waste, Water, Transportation and Education and Research) were used as causal conditions, while the overall scores from THE WUR and QS were used as outcome variables.

The validity and reliability of the research instruments are supported by their widespread use and established methodologies in the academic literature and institutional benchmarking. The UI GreenMetric, for instance, has been applied annually since 2010 and is recognized as a robust tool for assessing sustainability policies and practices across higher education institutions worldwide (Suwartha and Sari, 2013; Lauder *et al.*, 2015). Both THE WUR and QS rankings follow methodologically rigorous and transparent procedures and are widely adopted for evaluating institutional performance.

As the study uses fsQCA, additional measures were taken to ensure methodological robustness. Calibration procedures followed the percentile method (80%, 50% and 20%) to convert raw data into fuzzy membership scores and thresholds for consistency and coverage were applied as per established guidelines (Ragin, 2006; Fiss, 2011). These steps ensure the internal consistency and analytical rigor of the configurational models.

Regarding sample selection, the study targeted universities that appeared in both the UI GreenMetric and at least one of the other two rankings (THE WUR or QS) in the year 2023. As a result, two distinct data sets were analyzed: 419 universities in the UI GreenMetric–THE WUR intersection, and 63 universities in the UI GreenMetric–QS intersection. This approach ensured that all cases included had complete data for both sustainability indicators and performance outcomes, enabling coherent and meaningful comparative analysis.



**Figure 1.** Methodological steps  
Source: Authors' own work

#### 4. Results

This section is divided into two subtopics: results from the intersection between UI GreenMetric and THE WUR (4.1) and results from the intersection between UI GreenMetric and QS rankings (4.2).

##### 4.1 *UI GreenMetric* × *THE WUR*

In fsQCA, the original data encompassing the conditions and outcomes must be transformed to obtain fuzzy membership scores. Thus, in the *first step* (see [Figure 1](#)), to perform the calibration, we used the percentile method. Percentiles allow the calibration of any measure, regardless of its original distribution or scale. As the structure of the data is asymmetric, with data unevenly distributed around the mean, we used values of 80%, 50% and 20% as thresholds for full membership, crossover point and nonmembership, respectively. [Table 1](#) presents the calibration information for the indicators.

In the *second step*, the calibrated fuzzy scores were used in implementing a truth table algorithm to arrange adequate configurations for the outcome and discard the remaining ones. A minimum consistency cut-off point of 0.8 was adhered to, leading to the exclusion of cases that did not satisfy the specified criteria. In this step, we considered all possible configurations for the UI GreenMetric ranking indicators, considering the “total THE WUR variable” as the outcome.

Next, in the *third step*, the necessary conditions for high THE WUR score levels were analyzed. At this stage, no indicator presented consistency and coverage values greater than 0.90, so no condition was considered necessary.

The sufficient conditions were analyzed in the *fourth step*. To this end, the consistency and coverage of the results were analyzed. In fsQCA, the “consistency” and the “coverage”

**Table 1.** fsQCA calibration (UI and THE WUR)

Indicators	Max.	Min.	Fuzzy scores		
			0.80	0.50	0.20
Setting and infrastructure	1,500.00	340.00	1,225.00	1,010.00	760.00
Energy and climate change	1,950.00	425.00	1,650.00	1,350.00	925.00
Waste	1,800.00	0.00	1,575.00	1,275.00	900.00
Water	1,000.00	10.00	900.00	700.00	400.00
Transportation	1,800.00	210.00	1500.00	1,300.00	985.00
Education and research	1,800.00	215.00	1,675.00	1,450.00	1,125.00
Total – THE	70.30	14.35	36.00	27.00	20.00

**Source(s):** Authors' own work

are fundamental metrics for assessing the validity and relevance of the causal combinations identified (Fiss, 2011). While consistency refers to the proportion to which a causal combination is sufficient to lead to the outcome, coverage reflects the proportion of cases of the observed outcome that can be explained by the causal combination (Fiss, 2011). Configurations with consistency above 0.75 and coverage above 0.25 are considered sufficient in fsQCA analyses.

Table 2 displays the intermediate solution, identifying each path's central and contributing causal conditions. The categorization of conditions as central or contributing is determined through a counterfactual analysis enabled by the joint analysis of the three solutions generated, namely, complex, parsimonious and intermediate (Fiss, 2011; Ragin, 2006). Conditions present in the parsimonious solution are designated as core causal conditions, while those appearing exclusively in the intermediate solution are considered contributing causal conditions.

The configurational approach presented four paths with adequate solution consistency and coverage. Path 1 is characterized by the absence of the contributing condition "Energy and Climate Change," the presence of the core conditions "Waste" and "Water," and the absence of the core condition "Transport." Path 2 is defined by the absence of the core

**Table 2.** Configurational paths for a high level of score in the THE WUR

Conditions	Path 1	Path 2	Path 3	Path 4
Setting and infrastructure		○	●	○
Energy and climate change	○	○	○	○
Waste	●	●	●	
Water	●			●
Transportation	○		●	●
Education and research		●	○	●
Gross coverage	0.17	0.19	0.13	0.17
Unique coverage	0.05	0.03	0.05	0.03
Consistency	0.76	0.79	0.78	0.80
Solution coverage	0.34			
Solution consistency	0.76			

**Note(s):** ● = core causal contributing condition (present); ○ = core causal contributing condition (absent); ● = contributing causal conditions (present); ○ = contributing causal conditions (absent)

**Source(s):** Authors' own work

condition “Settings and Infrastructure,” the missing contributing condition “Energy and Climate Change” and the presence of the core conditions “Waste” and “Education and Research.” Path 3 is formed by the presence of the core conditions “Settings and Infrastructure,” “Waste” and “Transport,” along with the absence of the contributing condition “Energy and Climate Change” and the core conditions “Education” and “Research.” Finally, Path 4 contains the missing core condition of “Settings and Infrastructure,” the missing contributing condition of “Energy and Climate Change” and the present core conditions of “Water,” “Transport” and “Education and Research.”

#### 4.2 UI GreenMetric × QS World University Ranking

Similar to the analysis between UI GreenMetric and THE WUR, the analysis of the UI GreenMetric × QS intersection followed the same fsQCA procedure. Table 3 shows the calibration information for the indicators.

Based on calibration procedure results, a truth table was constructed considering all possible configurations for the UI GreenMetric ranking indicators, based on the total QS variable as an outcome. The necessary conditional analyses followed this step. Again, no condition was considered necessary for higher score levels in the QS ranking. Regarding sufficient conditions analysis, results allowed us to build Table 4.

From Table 4, it is possible to identify six paths with adequate solution consistency and coverage. The first path is formed by the present conditions of “Settings and Infrastructure” and “Waste” (as core), “Transportation” and “Education and Research” (as contributing) and the absent contributing condition of “Water.” The second path shows present contributing conditions for all UI GreenMetric elements except the “Settings and Infrastructure.” The third path indicates the absent contributing causal conditions of “Energy and Climate Change,” “Water,” “Transportation” and “Education and Research,” while “Settings and Infrastructure” configures a present core causal condition followed by the contributing condition of “Waste.” Similar to the third path, Path 4 implies the absent contributing causal conditions of “Settings and Infrastructure,” “Water,” “Transportation” and “Education and Research,” only highlighting the present contributing causal conditions of “Energy and Climate Change” and “Waste.” Path 5 is defined by the presence of the contributing conditions “Settings and Infrastructure,” “Energy and Climate Change” and “Water”; the presence of the core condition “Education and Research”; and the absence of the contributing conditions “Waste” and “Transport.” Finally, Path 6 contains the present contributing conditions of “Settings and Infrastructure,” “Waste,” “Water” and “Education

**Table 3.** fsQCA calibration (UI and QS)

Indicators	Max.	Min.	0.80	Fuzzy scores	
				0.50	0.20
Setting and infrastructure	1,450.00	425.00	1,300.00	1,125.00	925.00
Energy and climate change	1,950.00	525.00	1,825.00	1,550.00	1,275.00
Waste	1,800.00	450.00	1,800.00	1,650.00	1,200.00
Water	1,000.00	110.00	950.00	900.00	650.00
Transportation	1,800.00	535.00	1,650.00	1,500.00	1,175.00
Education and research	1,800.00	550.00	1,750.00	1,675.00	1,425.00
Total – QS	77.00	24.40	51.60	38.00	27.50

**Source(s):** Authors’ own work

**Table 4.** Configurational paths for a high level of score in QS ranking

Condition	Path 1	Path 2	Path 3	Path 4	Path 5	Path 6
Setting and infrastructure	●		●	○	●	●
Energy and climate change		●	○	●	●	○
Waste	●	●	●	●	○	●
Water	○	●	○	○	●	●
Transportation	●	●	○	○	○	○
Education and research	●	●	○	○	●	●
Cobertura Bruta	0.18	0.39	0.08	0.08	0.12	0.11
Cobertura Única	0.05	0.22	0.02	0.02	0.01	0.02
Consistência	0.75	0.75	0.81	0.79	0.77	0.85
Cobertura da Solução	0.54					
Consistência da Solução	0.75					

**Note(s):** ● = core causal contributing condition (present); ○ = core causal contributing condition (absent); ● = contributing causal conditions (present); ○ = contributing causal conditions (absent)

**Source(s):** Author's own work

and Research”; the absent contributing condition of “Energy and Climate Change”; and the absent core condition of “Transportation.”

## 5. Discussions

Contemporary society faces numerous economic, social and environmental challenges that demand responses from individuals, organizations and governments at all levels (Öztaş *et al.*, 2023). In such a background, universities and other higher education institutions, while exerting great effort in incorporating and disseminating sustainable values, also benefit institutionally from the visibility and recognition that follow such attainments. This study aimed to examine configurations of sustainability indicators that influence the overall performance of universities. By adopting a technique that identifies configurations of causal conditions associated with various outcomes while allowing for multiple pathways leading to the same result, three global university rankings were analyzed.

To begin with, the first comparison was established between the UI GreenMetric and the THE WUR. In this assessment, 419 universities emerged from the intersection of both databases. Empirical findings reveal four main paths for achieving higher performance on the THE WUR based on UI GreenMetric indicators. In three out of four paths (Paths 1–3), “Waste” appears as a core causal contributing condition, highlighting waste treatment and recycling programs as key factors in creating a sustainable university environment. “Water,” “Transport” and “Education and Research” appear next in importance, appearing in at least half of the identified paths. “Water” dimension includes water conservation programs and the use of tap water. “Transportation” category assesses university policies on limiting the number of motorized vehicles on campus. Finally, “Education and Research” examines the university’s efforts to create and support a new generation’s concern for sustainability issues.

These findings are consistent with previous research. Existing studies have already proved the influence of waste management initiatives like a strategy for greening a campus (Tangwanichagapong *et al.*, 2017). For instance, Tangwanichagapong *et al.* (2017) identified, in a higher education institution in Thailand, that “reduce,” “reuse” and “recycle” (3R) are initiatives with effects on students’ attitudes about waste management, resources and consciousness of the need to avoid waste. It reinforces that activities pursued by universities are influential steps to attain sustainable development, in addition to impacting

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their performance in international rankings (Atici *et al.*, 2021). Conversely, the role developed by universities in promoting consciousness about excessive water usage in curriculum as well as in its operation within the campus appears indispensable (Moghayedi *et al.*, 2024).

In addition to these findings, it is important to mention the influential “Transportation” and “Education and Research” dimensions from our results. University managers often face challenges related to the mobility of students and employees to and around campus. Motor vehicles are very responsible for the emission of pollutants into the environment. In this sense, encouraging public transport at a very reasonable price is an alternative to a great impact, as demonstrated by Fissi *et al.* (2021) and confirmed by our findings. Our results also demonstrate the importance of education and research as simultaneously crucial for sustainability outcomes and the performance of universities. As mentioned above, universities and other higher education institutions, in addition to including “learning for sustainability” in their curricula (Moghayedi *et al.*, 2024), are privileged spaces for discovering and inventing technologies and solutions toward sustainability (Bautista-Puig *et al.*, 2022; Boiocchi *et al.*, 2023).

Despite these positive associations, it is worth noting that, still regarding the association established between the UI GreenMetric and the THE WUR, our empirical findings demonstrate, on the other hand, that “Energy and Climate Change” and “Setting and Infrastructure” are absent core and contribution causal conditions, respectively, on the four paths that lead to high performance in the THE WUR. “Energy and Climate Change” includes electricity consumption and climate change. “Setting and Infrastructure” refers to the university’s size, location, zoning and green space. Results possibly indicate that the highest-ranked universities in THE WUR have prioritized the management of natural resources and waste. Especially the absence of “Energy and Climate Change” across all pathways suggests a lack of focus on these issues in university strategies.

Regarding the second analysis, the comparison between the UI GreenMetric and the QS World University Ranking considered a smaller sample of 63 universities. In this examination, it was possible to identify six pathways that guide universities to higher scores in the QS Ranking based on its classification at the UI GreenMetric. Similar to what appeared in the intersection with THE WUR, “Waste” is a present and influential causal condition. In this same vein, “Education and Research” emerges as a constant and present dimension among the paths, as does “Setting and Infrastructure.” “Energy and Climate Change” is an indicator that appears both present and absent in different paths, suggesting that its influence on university performance in the QS Ranking is more context-dependent. Finally, while “Settings and Infrastructure” is a present (as core or contributing) causal condition in Paths 1, 3, 5 and 6, “Transportation” appears as absent in Paths 3, 4, 5 and 6.

In terms of analytical strength, the intersection between UI GreenMetric and THE WUR, the consistency of the solution was 0.76, which is considered adequate. However, the coverage of the solution was only 0.34, which, while within acceptable standards, is considered low. This suggests a weak relationship between UI sustainability indicators and THE WUR results. In contrast, the intersection between UI GreenMetric and the QS Ranking showed a consistency of 0.75 and a coverage of 0.54, indicating a stronger alignment between UI sustainability indicators and QS results.

When comparing both ranking systems, our findings regarding THE WUR and QS Ranking make it possible to identify similarities and differences between intersections. While THE WUR seems to focus more on specific environmental issues (such as resource and waste management), QS reflects a more holistic nature, including factors related to the quality of education and infrastructure as well as sustainable aspects. These differences have

important implications for universities seeking to improve their position in global rankings, as the strategy to be adopted may vary according to the target ranking.

These findings are also aligned with studies that directly examined sustainability rankings in higher education. For instance, [Calderon \(2023\)](#) and [Garcia-Lacalle et al. \(2025\)](#) pointed out that although the UI GreenMetric is widely adopted, its correlation with traditional performance-based rankings is inconsistent – an aspect confirmed by our comparison between UI GreenMetric and THE WUR and QS. Furthermore, [Irungu and Liu \(2024\)](#) emphasized that methodological differences between global rankings (e.g. scope, weighting and indicators used) often lead to diverging strategic focuses among universities. Our results corroborate this by demonstrating that while certain indicators such as “Waste” and “Education and Research” are recurrent in different paths, others like “Energy and Climate Change” or “Transport” fluctuate depending on the ranking system. These findings reinforce the argument raised by [Lauder et al. \(2015\)](#) that institutions must interpret sustainability rankings carefully and tailor their strategies accordingly, rather than attempting to meet all indicators equally across all systems.

This study contributes methodologically to the field by applying fsQCA, an asymmetric and configurational method rarely used in sustainability and higher education research. This method enabled us to explore causal complexity by identifying multiple combinations of sustainability indicators that lead to high performance in global rankings. This methodological innovation adds analytical depth and reflects the heterogeneous strategic paths universities may follow, especially in diverse national and institutional contexts.

Finally, we also emphasize that the speed of sustainability transformations in universities differs greatly depending on each institution’s specific local context and available resources ([Leal Filho et al., 2025](#); [Veidemane, 2022](#)). Likewise, ranking systems use distinct performance indicators, making it difficult to determine which system most accurately measures a university’s true performance ([Atici et al., 2021](#)). We can affirm, however, that there is no single trajectory or set of sustainable conditions and practices that drives performance, but multiple pathways that may vary depending on the focus of universities. Finally, we agree that while existing rankings offer a partial perspective on universities’ sustainability efforts, there is a need to develop clearer and more actionable and transparent metrics, grounded in clearer definitions ([Calderon, 2023](#)).

### 5.1 Implications and contributions

By analyzing the influence of sustainability indicators on universities’ performance, this study offers influential theoretical and practical contributions. Theoretically, the study, *first*, deepens the understanding of how sustainability practices impact university performance, addressing and filling a research gap pointed out by previous scholars ([Atici et al., 2021](#); [Calderon, 2023](#); [Hernandez-Diaz et al., 2024](#); [Öztaş et al., 2023](#)). *Second*, the study offers a significant theoretical contribution by exploring the connection between sustainability indicators (UI GreenMetric) and university performance in global rankings (THE WUR and QS). We reinforce the thesis that sustainability is not a linear or monolithic factor, but reflects a complex interaction of multiple indicators with differentiated impacts ([Calderon, 2023](#)). *Third*, the employment of an asymmetric methodological technique allowed us to identify multiple pathways to high university-ranking performance. This expands the literature by showing that there is no single path to improving university performance but different possible configurations that can be strategically chosen according to the universities’ focus. For better performance in the THE WUR, for example, elements such as “Waste,” “Water” and “Transport” stood out as crucial, while for higher scores in the QS ranking, factors such as “Settings and Infrastructure” and “Education and Research” proved to be more consistent.

For practitioners, our main contribution lies in demonstrating that sustainability practices strategically enhance university performance. Based on empirical evidence, we affirm that including sustainability actions is not (and should not be) just a compliance, but a strategy of significant returns. We also call attention to university and other higher education institution managers that want to improve their reputation in THE WUR based on their score in UI GreenMetric to focus on actions aimed at waste management and natural resources. In the case of QS ranking, it is crucial to invest in infrastructure, research and education. Furthermore, we highlight that the combination of different strategies allows universities success in global rankings. Thus, managers are allowed flexibility and customization of institutional strategies, aligning sustainability priorities with the specific objectives of each ranking. Finally, our results are aligned with SDG #4, Quality Education. Given the pivotal role universities play in shaping a sustainable future, we underscore the need to educate students who will graduate as leaders and professionals committed to sustainability (Leal Filho *et al.*, 2025). Green institutions can lead by example, not only through energy and resource efficiency, but by embedding sustainability into their educational missions and research agendas, thereby inspiring similar transformations beyond the academic environment.

In addition to institutional and academic implications, the sustainability practices adopted by universities can generate significant social impact beyond campus boundaries. By promoting environmental education, engaging in community-based programs and leading by example in the responsible use of resources, universities contribute to shaping more environmentally conscious behaviors among students, staff and the surrounding community (Munaro and John, 2025; de Villiers *et al.*, 2025). Initiatives to reduce waste, generate clean energy and promote sustainable mobility can take root in society's attitudes and also inspire organizations (Argento *et al.*, 2020; Menon and Suresh, 2020).

Sustainability indicators in rankings can also impact national education agencies, contributing to the way they structure performance assessment models and funding models (Irungu and Liu, 2024). Universities that stand out in sustainability issues become references for government strategies related to the SDGs (Leal Filho *et al.*, 2025). Thus, the sustainability aspect of higher education has an impact beyond institutional performance, but also on the formulation of public policies and collective environmental responsibility.

## 6. Conclusions

By general means, this study analyzed whether the scores of universities in the UI GreenMetric influence their performance in THE WUR and QS Ranking. In other words, it sought to determine whether sustainability practices are associated with improved performance in global academic rankings. The fsQCA technique was adopted to identify different configurations of scoring in UI GreenMetric to impact both THE WUR and QS Rankings. The empirical results indicate that the influence of UI GreenMetric differs in terms of university performance considering THE WUR and QS Ranking. While THE WUR is more focused on resources and waste management, QS addresses a more holistic approach, considering infrastructure and research dimensions. Findings suggest that sustainability, far from being a linear concept, involves multiple elements that influence performance and rankings in different ways.

Despite offering contributions that highlight the complexity and diversity of sustainable practices in university performance, this study has some limitations. *First*, the analysis was based on a sample restricted to universities with simultaneously available data in UI GreenMetric, THE WUR and QS Ranking. Consequently, the need for intersection data in these databases reduced the number of universities analyzed. *Second*, we had to consider two

different samples sizes. While the intersection between UI GreenMetric and THE WUR resulted in 419 universities for analysis, the intersection between UI GreenMetric and QS rankings approached only 63 universities. *Third*, the cross-sectional nature of this research limited analysis only regarding data from 2023. Finally, only three university rankings were used, and we recognize there are other ranking agencies that could be included, like Round University Ranking, Academic Ranking of World Universities Shanghai and U.S. News Global University Rankings, among others.

Based on the above, future research guidelines can be defined. At first, this study can be replicated considering other periods of analysis to compare and examine whether the present results remain the same or differ over time; to this end, longitudinal analysis techniques can be considered. We also suggest that comparing a larger number of rankings can provide more consistent and conclusive analyses. Qualitative research approaches are also welcome, as they can bring more in-depth insights into how sustainability influences university performance.

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