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Identifying the eminent indicators and criteria of Sustainability Assessment Tools in Higher Education: a systematic literature review.

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Abstract. The significance of incorporating sustainability in (tourism) higher education is beyond doubt. This article aims to assess how this integration is best measured. This objective considers two variables: A. the indicators, referring to the questions being asked to investigate the nature of sustainability integration, and B. the criteria, referring to the organisational aspect or level at which the institute integrates sustainability. Hence, the emerging questions are: 1) What is the most appropriate set of questions that best assess sustainability integration in a Higher Education Institution? (indicators) And 2) To what department, operation, or process should this question be addressed? (criteria). The feature of the significance of the most important indicators and criteria becomes evident through the frequency of repetition. A systematic literature review regarding the sustainability assessment tools (SAT) in higher education is conducted, following PRISMA guidelines.

Keywords**:** *sustainability assessment tools, higher education, indicators, criteria, systematic literature review.*

1 Introduction

1.1 Sustainability via Higher Education

Over the past decades, two major thematic areas—sustainability and education—have integrated dynamically. Sustainability aims for holistic development, addressing social, environmental, and economic issues, while education prepares future generations. According to Pizzutilo and Venezia (2021), future generations will play a crucial role in fostering a sustainable and responsible world through their actions and behaviours. Professor Jeffrey Sachs emphasises that sustainable development pathways will emerge from networked problem-solving involving universities, businesses, NGOs, governments, and especially young people (Sachs, 2012). Casarejos et al. (2017) further highlight that higher education institutions can support knowledge generation and dissemination to build a resilient society.

Acknowledgement of the prominent role of education in fostering sustainability via knowledge generation and transfer is also recognised in the early years by the Stockholm Declaration on the Human Environment (1972). Bourdieu (as cited in Pizzutilo, 2021), even back in 1973, named the higher educational institutes as 'transformative organisations', highlighting their contribution to a more responsible, ethical and, among other features, sustainable world. Inevitably, higher education institutions have gained popularity in recent years regarding their role in fostering sustainability via institutional implementation and integration. Maragakis and Dobbelsteen (2015) support that interest has spurred among educational practitioners and has acquired immense popularity over recent years in integrating sustainability in higher education. On the other hand, Deda et al. (2023) describe how higher education institutions (HEIs) cannot avoid the challenge (of fostering sustainability), and they may play a leading role in promoting sustainable development. 'With the growing attention to sustainable development, the role of higher education in this process became the focus of debate', referring to the best way that higher education can become a vehicle of change targeting sustainability (Son-Turnan and Lambrechts, 2019).

Consequently, many higher educational institutions have prioritised sustainability in teaching, research, community life, and campus operations (Leal Filho et al., 2018). This shift has led to the emergence of a new field of research focusing on managing education for a sustainable future (Figueiro and Raufflet, 2015). Sustainability through higher education has become central to the global development agenda, known as Higher Education for Sustainable Development (HEfSD), aiming to address numerous global challenges (Tamrat, 2022).

2 Theoretical background

Due to the growing attention lately, academia has produced a lot of literature covering many aspects of this synergy. This section of this paper selectively introduces the niche parts of literature as reviewed and related to the topic. This includes the notions of heterogeneity of institutions, the challenges and criticism faced in integrating sustainability, and provides an overview of sustainability reporting as a process and a tool.

2.1 The challenges of a sustainable university

As Varouchas et al. (2018) noted, contemporary universities have evolved from tranquil environments of scholarly pursuit to complex entities with diverse characteristics, as highlighted by Ruhmland et al. (2021). Despite this diversity, the drive to integrate sustainability persists, as advocated by University Leaders for a Sustainable Future (2023). As conceptualised by Amaral et al. (2015) and Velazquez et al. (2006), a sustainable university goes beyond mere operations, embodying a commitment to societal responsibility, economic viability and environmental protection. This transformative operation involves mitigating adverse impacts, engaging with communities, and fostering a sustainable future through teaching, research, and community involvement. Kapitulcinova et al. (2018) describe sustainability integration as a comprehensive process, moving from conventional to sustainable practices over time, as highlighted by Mapar et al. (2022). In essence, the concept of a sustainable university calls for well-orchestrated efforts across all institutional dimensions.

The review confirmed that sustainability and higher education are closely linked. Universities can play a crucial role in promoting transformative change in support of the SDGs and are called to step forward as leaders in sustainability (Armstrong, 2021and Ezquerra-Lazaro et al., 2021). The review undertaken in this paper isolated three main concerns that challenge the effectiveness of the implementation of sustainability in higher education. Firstly, there is a degree of ambiguity as to the definition of the term' sustainability integration/implementation' (Velazquez et al. 2006, in Tamrat, 2022), leading to a 'sluggish, technocratic and lacking leadership' process as noted by Rieg et al., (2021). Secondly, higher education institutions should be approached as organisations rather than universities to understand this matter better. Ceulemans et al. (2015) make the correlation between the corporate world and universities and suggest that the latter can learn from corporate sustainability report efforts through a contextualised approach adjusted to their situation and needs. A better understanding of the 'readiness for change' is required (Ezquerra Lazaro et al., 2021). The degree of responsiveness and the university's transformative character are to be improved via the recognition of the importance of the human factor in successful organisational change (Kapitulcinova et al. (2018), Lambrechts (2015). Lastly, it is commonly perceived that sustainability implementation mainly takes place at the heart of a university, being its curricula (Tamrat, 2022; Varouchas et al., 2018). This is challenged by Zen (2017), Kapitulcinova et al. (2018), Pizzutilo and Venezia (2021) and Ezquerrra-Lazaro et al. (2021), who observe that very few institutions are currently using the toolset in an integrated way across all dimensions of institutional practice, an inexpediency that leads to a lack of exploring the advantages of turning the campus into a living laboratory.

2.2 Reporting Sustainability in Higher Education

HEIs can initiate sustainability reporting to assess their current sustainability status across all activities, identifying areas of progress that need improvement (Ruhmland et al., 2021). However, sustainability reporting in higher education is still developing, posing significant challenges and requiring clarification on what, why, and how to report (Aglhamdi, 2020). Sustainability assessment tools (SATs) have been designed to address these questions, aiming to holistically evaluate a university's sustainability achievements without fostering competition (Caeiro et al., 2020). Despite their creation to aid sustainability implementation in HEIs, SATs face criticism, and their development still needs to be improved (Mapar et al., 2022; Maragakis and Dobbelsteen, 2015). Areas of SAT's improvement are detected in the areas of simplifying the process (Caeiro et al., 2020), design characteristics that foster usability and ineligibility (Omazic and Zunk, 2021) and a need for a unified rating system (Maragakis and Dobbelsteen, 2015). Thus, even though the contribution of SAT development is undoubtedly recognised, it is perceived as an unclear, ununified and often puzzling process. Lambrechts (2015) highlights the plethora of available tools, including various approaches, sustainability indicators and conceptual frameworks, that need refining to ensure SAT effectiveness. This emphasises the need for a taxonomy of the core components of a SAT, namely the thematic areas one focuses on and the related indicators.

2.3 Article specifics

This paper addresses the need to categorise the variety of available SATs, aiming for appropriateness and maximising effectiveness in sustainability integration. Recognising the differentiated origins of the SATs available and the unique features of a HEI, this paper undertakes a logical sequence of tasks to satisfy the following evolving research question. Which SAT is most appropriate according to the specifics of an Educational Institute and/or the field of science being taught?

Through specific procedures, as described by PRISMA protocol, to ensure quality assurance, items of interest were reviewed, as described in detail in the following section. The five most frequently mentioned and reviewed SATs comprise this paper's interest selection for the article. The questions forming categories of implementation levels, which formulate the core body of the five SATs, are of crucial interest. A keyword approach enables the thematic mapping of all indicators (referring to questions) and all criteria (referring to categories/implementation levels) of the five SATs under investigation. The similarities and possible variations are distinguished, but more significantly, the indicators and criteria that repeatedly overlap throughout the evaluation of the top-rated SATs are emerging as eminent. This article aims to reveal the eminent indicators and criteria to act as an agent to simplify the reporting procedure of implementing sustainability in higher education institutes.

Thus, the research questions of this paper are:
RQ1: Which five SATs are most commonly used and/or reviewed in this systematic literature review?
RQ2: What questions (indicators) are primarily repeated in the five most popular SATs?
RQ:3 What are the implementation levels (criteria) of the tools assessing the sustainability integration within a Higher Education Institute, as noted in the most popular five SATs?

3 Methodology

This paper comprises three main phases. First, a systematic literature review using the PRISMA protocol identifies literature on Sustainability Assessment Tools (SATs) in Higher Education, including papers of particular review types on SATs. Second, the frequency of SAT mentions in the review is measured to identify the five most popular SATs, which are then analysed for their indicators and criteria. Third, the indicators and criteria of these popular SATs are merged to identify the most frequently repeated, characterised as the eminent indicators and criteria for this article.

3.1 Systematic Literature Review

The method used in this paper to quality assure the findings is according to the guidelines of the PRISMA 2020 statement (Page et al. 2021) and was concerning the assessment methods of sustainability integration in higher education. It consists of the following steps.

Initial search. An electronic search was carried out in Google Scholar and Scopus in June 2023. The keywords added in the search consisted of a filter, aiming to narrow the results.

The eligibility criteria of this review are peer-reviewed articles published from 2000 to 2023 in the English language only. Eligible papers had to meet the screening criteria: 1) include the term sustainability concerning the economic, social, and environmental pillars, based on the Sustainable Remediation Forum for the UK guidance (Bardos et al., 2011), and 2) address issues within the field of higher education.

Identification of publications and screening. After removing two duplicates, 162 articles were identified initially. A reference management tool, Zotero, was used to exclude articles that did not contain 'sustainable' or 'sustainability,' eliminating 46 articles. Further refinement using the terms 'education' and 'higher' excluded 65 and 9 more articles, respectively, leaving 42 articles. Manual screening verified eligibility, excluding 4 duplicates and 2 irrelevant articles, resulting in 36 articles for final review.

Selection of assessment methods and components for this review. Articles were read in-depth to complete the literature analysis. Particular articles focused on one SAT, whereas others were a specific type of review regarding several SATs. The context was organised using a qualitative software analysis, MAXQDA. Codes representing the areas of interest were created within the software. In turn, the parts of the articles falling under each code were categorised, creating the framework of this article's taxonomy.

Analysis of methods. The context revealed by this literature review was coded in thematic areas best serving the needs of this paper. Six thematic areas were identified as relevant and best served the article's purposes. After that, the reviewed information was classified per code relating to a thematic area consisting of the following classification codes.

3.2 Codes Classification criteria

The points of interest that formulated the codes as classification criteria for this literature are focusing on the publishing and methodological aspect of the review items (1), the origin of the sustainability assessment tools (2-3), and the components of SATs (4-6).

1. Bibliometric measures or reviewed items. Most reviewed items were published in academic journals, and several theses were on the topic. The number of papers published in each journal and their publication years were recorded to provide insights into the journals and periods associated with SAT literature. By including the term "review" in the keyword search, numerous papers that already reviewed SATs, as indicated in their titles, were found. This process revealed a variety of review types, which were subsequently documented.

2. Country perspective. This section identifies the countries of origin for the reviewed articles, providing a global perspective. For single-country papers, origin detection is straightforward. If multiple authors from different countries contributed, the country is determined proportionally; for example, a paper by authors from Brazil and Germany gives each country half a point, resulting in some frequency records being expressed as decimals.

3. Field of Science perspective. The notion of sustainability is universal, with no scientific boundaries. It soon became apparent as the papers reviewed derived from and related to various scientific areas. This set of findings summarises the distribution of those sciences that give credit to SAT applications. This type of information is retrieved from the country's perspective, either by a direct correlation in the text of the paper or by the author's details.

4. Frequency of SATs reviewed. This review reveals the existence of a plethora of SATs, yet all aim to measure sustainability implementation in higher education. Through this review, a search is conducted to retrieve the five most frequently mentioned, assessed and reviewed SATs. They, in turn, comprise the basis for the components analysis, being the indicators and criteria.

5. Component of SAT: nature and context of criteria. In every case, the questions composing a SAT are grouped in themed categories named as criteria for this paper, referring to the implementation level. A comparative review of all the criteria seeks to uncover the most frequently used groups/ categories of questions organised in the five most popular SATs under the term criteria. The evolving categories of questions reveal the university's operational level or department that implements sustainability.

6. Component of SAT: nature and context of indicators. The questions included in a SAT are of fundamental interest regarding their nature, as they are expressed in words. What type of information is a question seeking to retrieve, and what is its context? As previously explained, for the SATs selected, the most frequently asked questions are isolated and noted as the most significant.

4 Results

4.1 Overview

This section presents the results of the codes as classification criteria for the assessment of best reporting sustainability in universities. This analysis presents an overview of the country and scientific field from which a SAT might originate. It seeks to determine the popularity of the SATs and further deepens the search for the selected criteria and indicators. Some results were developed manually, whereas the other three were analysed using the quantitative software MAXQDA. As the volume of words to be assessed was large scale, the contribution of technological screening proved advantageous.

4.2 Presentation of results and discussion

Bibliometric measures of reviewed items. Most reviewed documents are articles published in academic journals, complemented by two Master's theses (2014, 2020) and three PhD theses (2017, 2021), indicating recent student interest in SATs. Three documents are unclassified: a book chapter, conference proceedings, and one with insufficient classification details. Three journals are predominantly the primary literature sources, with their Journal Impact Factor scores included to assess scientific quality. Although the review contains publications from 2000 to 2023, most papers are from the last three years, reflecting a recent increase in sustainability reporting interest. Eight papers are reviews of varying methodologies, contributing to a comprehensive overview. Notably, aside from two reviews from 2015, the rest have been published within the last few years, reflecting the specific inclusion criteria of this research.

Country perspective. Son-Turan and Lambrechts (2019) observe that countries adopt varying preferences and approaches regarding sustainability in higher education. Investigating the origin of a SAT by its country of development offers quantitative data (number and identity of countries involved) and qualitative insights (analysis of SAT components). Europe is leading in contributions to SAT literature, followed by the USA and Canada. Brazil represents a medium contribution from South America, Africa shows lower contributions, and Asia is notably absent. The "international" category refers to two review items involving multiple countries, which could not be individually listed, yet the results are not significantly altered.

Field of Science perspective. A significant diaspora is evident in the scientific fields from which SATs have been developed, applied, reviewed, or adjusted, highlighting the universal applicability of sustainability. Collaborations among authors from diversified scientific disciplines have formulated a holistic SAT approach. Business Studies and Economics are the primary fields referencing or using SATs, followed by Sustainability and Environmental Studies. The science of Education also ranks relatively high, while other contributions come from Social Sciences and engineering disciplines. Two documents remain unclassified due to vague descriptions. Notably, the scientific area of Tourism is absent from the reviewed documents, possibly clustered under broader categories like Business or Social Sciences. This diversity reflects the interdisciplinary synergy of the science of sustainability.

Frequency of SATs reviewed. Thirty-six review items were analysed to determine the most popular SATs in this literature review, utilising qualitative data software. Each SAT mentioned or reviewed in the documents was assigned a unique MAXQDA code. SATs with limited references were classified under a "Miscellaneous" code but were still included in the analysis. Thirty-six search items were identified, referring to either SATs, sustainability assessment scorecards, names of organisations developing these tools, or tools considered within a broader process framework.

The highest among the top five SATs is the Sustainability Tracking, Assessment, and Rating System (STARS), developed by the Association for the Advancement of Sustainability in Higher Education (AASHE). Extensively used in Europe and the United States, almost one thousand universities globally have submitted their sustainability reports to STARS as of April 2019 (Alghamdi, 2020). Caeiro et al. (2020) support that STARS is better classified in understanding, comparability, broad

sustainability coverage, and decision-making support. The second most frequent SAT is the Global Reporting Initiative (GRI), the world's most widely used sustainability reporting framework, though not specific to higher education (GRI 2002; Huber and Bassen 2018). GRI focuses on training and education from an employer's perspective, not adequately addressing research, teaching, and operations in HEIs (Moggi, 2023). Therefore, it will be excluded from the remaining phases of this paper. The Assessment Instrument for Sustainability in Higher Education (AISHE) ranks third in this research. Developed by the Dutch Committee on Sustainable Higher Education (CDHO) in 2001, AISHE is widely utilised in Europe and the United States. Initially focused on environmental issues, AISHE 2.0 has since broadened its scope to include social, research, and operational aspects, including quality management and the Deming cycle (Ceulemans et al., 2015; Casarejos et al., 2017). The American College & University Presidents' Climate Commitment (ACUPCC) ranks fourth in frequency and volume of documents reviewed. It focuses on environmental sustainability, explicitly targeting campus greening initiatives within higher education institutions. Singh et al. (2023) explain its role in engaging US universities to commit to carbon neutrality and climate action through various campus-based projects. However, ACUPCC's scope is limited to environmental aspects, lacking assessments on economic and societal dimensions, which excludes it from further consideration in this study. The Principles for Responsible Management Education (PRME), established in 2007 under the United Nations provision, ranks fifth among the reviewed SATs. It is a global initiative for business and management schools, emphasising sustainability that is aligned with the UN Sustainable Development Goals and Global Compact. PRME focuses on six principles—purpose, values, method, research, partnership, and dialogue—to develop leadership skills that balance economic, environmental, and social objectives. Despite its unique approach of guiding universities to prepare Sharing Information Progress reports, PRME will be included in subsequent phases of this study due to global HEI applicability and the inclusion of the three pillars of sustainability.

Component of SAT: nature and context of criteria. Upon reviewing the literature across 36 items, several operational dimensions of sustainability implementation within Higher Education Institutions (HEIs) emerged as eminent through consistent theoretical repetition. These areas include i) education (curriculum), ii) research, iii) campus operations, iv) community outreach, and v) assessment reporting (Aleixo et al., 2018; Armstrong, 2021; Caeiro et al., 2020; Farhina et al., 2020). Additionally, aspects of the vi) institutional organisational framework were also partially discussed. These findings underscore the focus and importance placed on these specific implementation levels in the context of sustainability initiatives within HEIs, referred to as criteria in this paper. This study aims to assess the prominence of criteria by comparing the review findings with three prominent SATs selected based on their popularity: STARS, AISHE, and PRME. The main sub-categories of their implementation levels are analysed to identify common grounds. Criteria that are repeated across STARS, AISHE, PRME and the literature review will be identified as prominent features of these sustainability assessment tools.

Facilitating comparability among the three SATs has been challenging, as has spotting differences and, most importantly, recording similarities. It was concluded that the composition of criteria in the three SATs are similar, and they tend to coincide in the six primary criteria groups as presented in the literature, with minor verbal alterations. *Institutional characteristics, educational, and academic matters* are equally weighted in the three SATs, whereas research has a deducted value in STARS. *Research* in STARS is a sub-criterion of education, whereas AISHE and PRME are stand-alone criteria. *Operational issues* like greening campuses and providing socially responsible and equal employment are recorded to demonstrate a significant diversification approach when reporting them; however, they are equally valued. The criterion that scores the highest is the one that incorporates the institute's activities with the surrounding stakeholders. This could be done through public engagement, communication, *or collaboration activities*. To conclude, STARS incorporates a criterion under the name 'Innovation and Leadership' that is not met in another SAT and PRME on the sixth principle named 'Dialogue'; it incorporates actions with sustainability as the core interest.

Component of SAT: nature and context of indicators. This section conducts a detailed analysis of criteria components across STARS, AISHE, and PRME. The information that a question seeks to reveal is called an indicator at this point. STARS utilises sub-categories to derive its indicators, reflecting its detailed structure. AISHE, in contrast, provides brief descriptions, necessitating deeper manual examination for indicator extraction. PRME categorises criteria directly into questions, facilitating straightforward identification of indicators. Each SAT's indicators are summarised in a table format across six criteria, with a concluding row featuring key summary keywords. This systematic approach filters and emphasises the eminent indicators within each SAT through repetition. The order of discussion is arranged according to repetition weight.

1st Criterion. Public engagement, outreach, collaborations and communication. These questions form the criterion with the highest frequency score, indicating a growing emphasis among HEIs on external engagement. Despite being a recent addition to sustainability literature, public engagement is uniformly addressed in STARS, AISHE, and PRME. They explore how HEIs foster relationships with society to advance sustainability. Primary criterion keywords are public engagement, community involvement, activities with the surrounding community, partnerships, involvement, connecting, and cooperation with external stakeholders.

2nd Criterion. Identity & institutional characteristics. This set of questions focuses on institutional and strategic features and the institute's commitment to sustainability. Only AISHE explicitly addresses the economic viability of the institute, while

STARS touches on economics through sustainable investment in its Planning and Administration Criterion. Operational, institution, leadership, policy, and governance are significant criterion keywords.

3rd Criterion. Education & academic matters. The backbone of a higher educational institute is its academic dimension. This group of questions looks into disciplines, curricula, courses, and degree levels concerning sustainability integration. The process of developing courses, the learning outcomes, and the possibility of students influencing the curriculum structure are also matters of interest. The main criterion keywords are Curriculum development, topic sustainability, thematic integration, and learning outcomes/output.

4th Criterion. Research. For AISHE and PRME, this is a stand-alone criterion that emphasises the importance of such activities. The main concern of this set of questions is to retrieve the connection the research topics possibly have with sustainability. Open access to research, scholarship and student involvement is also assessed. Criterion keywords are Sustainability thematic integration, open access, and recognition of sustainability/SDGs-related topics.

5th Criterion. Campus operational aspects of environmental interest. In general, the content of this question group focuses on how the campuses operate and the footprint they leave on the planet. As stated in the summary keywords, environmental and operational aspects are being assessed and are the most common. As noted in Criterion B in STARS, an interesting point is the campus sustainability green practices organised as a living laboratory. Criterion keywords are climate, water, air, biodiversity, waste, energy, greenhouse gas emissions, and campus.

6th Criterion. Campus operational aspects of societal interest (stakeholders within the institute). Social integration of sustainability in an HEI concerns the internal stakeholders, namely, the students' and the staff's well-being, equal opportunities, treatment, and professional development in good health conditions with safety. The keywords for this criterion are social responsibility, equity, inclusion for students and employees, diversity supported, affordability, development (professional), well-being, internal stakeholders, and health and safety.

5 Conclusions

Various scholars emphasised that investing in higher education for the next generation is wise, particularly within the sustainability framework. Assessing and reporting an institution's sustainability performance is crucial for achieving a sustainable university through multilevel transformations. Hence, Sustainability Assessment Tools (SATs) are pivotal in fostering sustainability implementation.

This study identifies the three most popular SATs, namely the STARS, AISHE, and PRME, and further analyses their components: criteria and indicators. The evolving eminent criteria sum up six prominent categories of questions referring to: i) public engagement, outreach, collaborations and communication; ii) identity & institutional characteristics; iii) education & academic matters; iv) research; v) campus operational aspects of environmental interest; vi) and campus operational aspects of societal interest (stakeholders within institute). The questions referred to as “Indicators” have been presented in detail in the results section.

Future research could look into developing a shortened SAT based on the eminent criteria and indicators as recorded in this paper. The development of a proposed simplified new SAT could feature ease of use, encouraging more HEIs to embrace implementing sustainability principles and practices.

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