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# Sustainability Assessment of Higher Education Institutions: A Systematic Literature Review †

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**Abstract:** Higher education institutions (HEIs) are crucial social organizations that foster innovation, disseminate knowledge, and train future leaders in various fields. Higher education institutions are essential to implementing the Education for Sustainable Development (ESD) plan. This review article addresses HEI's attempts to evaluate sustainability in higher education. This study analyzes the literature available on the sustainability assessment of higher education institutions to provide a review of the practices incorporated by different HEIs around the globe. Using the Scopus Database and Google Scholar, 88 articles were selected for this review. The analyzed literature provided information that helped compile a SATs list (Sustainability Assessment Tools). The SATs identified in these articles are categorized as qualitative, quantitative, and mixed-method techniques. The utilization of these SATs in real-world case studies was also presented, and their results are highlighted. This analysis aids and contributes to current research on using these SATs and other methods for evaluating and implementing the sustainability of HEIs. This study also explains the difficulties and scope of utilizing these SATs in the actual world.

**Keywords:** Sustainability Assessment; Sustainable Practices; Green Practices; Universities; Colleges; Campus; Higher Education Institutes; HEI

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## 1. Introduction

Sustainable development safeguards economic and socially important environmental services and resources. The ideal community safeguards the biological system while providing resources and housing. The 1987 Brundtland Report defined sustainable development as "growth that meets the aspirations of the current generation without jeopardizing the capacity of future generations to satisfy their demands." From economic and social growth to environmental protection and sustainable development [1]. Since then, regional, national, and municipal HEI sustainability announcements have garnered attention [2].

Many research evaluations have examined higher education sustainability assessment methods (SATs). 11 cross-institutional evaluation tools were reviewed to establish their development stage and closeness to the "ideal tool" [3]. Ref. [4] statistically and qualitatively assessed HEI assessment tool issues and methodologies using 16 SATs. Ref. [5] used several techniques to compare a real case study. Ref. [6] evaluate ESD implementation techniques in two case studies. Ref. [7] utilized the GRI-HE, a framework based on the Global Reporting Initiative and Association of University Leaders for a Sustainable Future criteria, to evaluate nine publicly accessible frameworks for HEI

sustainability. Ref. [8] evaluated assessment tools to extrapolate the major elements used to rank sustainability assessment systems and combine them into a full technique to evaluate current systems and pick the best for public use.

According to various writers, these evaluations have substantially increased our knowledge of how HEIs analyze sustainability, but their execution still needs improvement. A sustainable university is still under development [5,9,10]. Assessment tools must be used for practical applications and integrated into Higher Education Institution agents' processes. ESD at HEIs has spawned numerous evaluation and benchmarking methodologies [11]. By comparing indicators, criteria, and introductions of twelve sustainability assessment tools, ref. [10] showed how different industries and subjects dominate and are marginalized. However, how case studies are conducted and how they assess sustainability and advantages are still unknown.

This paper systematically reviews the literature on sustainability evaluation in higher education institutions to present an integrated picture of the assessment approaches used by various universities worldwide. This study instead examines case studies that use these approaches to learn more. This study updates the HEI sustainability evaluation literature and identifies best practices.

## 2. Method of Research

This work reviewed Scopus and Google Scholar publications using research questions as shown in Table 1. English-language, peer-reviewed scientific journals were used for all articles. Since sustainable assessment literature demands clarity, several keywords were searched in article titles and abstracts.

**Table 1.** Method for the article selection for the review.

| Particulars | Details |
|---|---|
| Keywords Used | Sustainability Assessment, Sustainable Practices, Green Practices, University, Colleges, Campus, Higher Education Institutes, HEI. |
| Database Used | Scopus and Google Scholar |
| Initial Search | 652 Articles |
| Inclusion Criteria | "Only Articles, Language: English, Year range 2000-2023" |
| Excluded Subject Areas | "Decision Sciences, Materials Science, Chemical Engineering, Chemistry Nursing, Health Professions, Mathematics, Biochemistry, Genetics, Molecular Biology, Psychology, Immunology, Microbiology, Pharmacology, Toxicology, and Pharmaceutics". |
| Screened Articles | 150 |
| Final Articles set | 88 |

## 3. Results and Discussion

This study reviewed 88 publications and SAT data from institutions worldwide. SATs were quantitative, qualitative, and mixed. This review showed case study tools. Sustainability Assessment Questionnaire is the main qualitative instrument (SAQ). EFA, CSAF, uD-SiM, AISHE, UI Greenmetric World University Rankings (WUR), and Life Cycle Assessment are the key quantitative instruments (LCA). STARS, A&A Framework/UEMS, and SWOT analysis dominate mixed techniques. Real-world SATs were not included in previous study.

As HEIs prioritise sustainability, some institutions are launching sustainable programmes. HEI ESD programmes are essential [12]. University dedication has increased, but by kind [13]. Sustainability issues have forced HEIs to adapt their operations, facilities, and corporate culture [14].

Universities prioritise environmental innovation [15]. HEI programmes, research, and outreach enhance SDG 4 (Quality Education) [16]. Studying increased eco-awareness for most students [17]. Green campus operations, administration, organisation, and leadership; teaching, research, and service; campus-wide actions and activities; institutional monitoring of campus sustainability measures; and proven ways to overcome obstacles contribute to environmental sustainability [18]. Business school research improves organisations, systems, and social and environmental challenges, impacting the economy, law, and education. (2021) Climate, social structure, culture, traditional beliefs, and regulations affect Campus Sustainability approaches [19,20].

SATs identify areas for improvement, make strategies for campus sustainability improvement, and foster a sustainability culture to execute sustainability [21]. Beyond eco-efficiency, the SAT should emphasise important issues, be quantitative, comparable, and unambiguous [3]. Higher education institutions require sustainability guidance and a comparison method [22]. Instruments seldom permitted institution comparisons. These tools may be based on indicators and conceptual models that support sustainability choices and enable rapid and wide communication, understanding how to react to tough processes and research the sustainability transition [11].

HEI Sustainability Assessment literature and aims are summarised below. It comprises educational institutions' tools and practises throughout time and location. Three categories separate these tools: Quantitative, qualitative, mixed techniques (comprising both quantitative and qualitative)

### *3.1. Qualitative Methods*

#### 3.1.1. Graz Model for Integrative Development (GMID):

Sustainability process transformational potential assessment model. Ref. [23] analyzed sustainability practices' transformational potential.

#### 3.1.2. Adaptable Model for Assessing Sustainability (AMAS):

The tool uses metrics and standards for environmental management, social responsibility, and economic sustainability [22].

#### 3.1.3. Sustainability Assessment Questionnaire (SAQ):

The qualitative SAQ covers environmental management, social responsibility, and economic sustainability. The questions assist institutions understand their sustainability performance strengths and shortcomings and create improvement strategies. Ref. [12] investigated sustainable teaching, curriculum, research, campus operations, administration, and financial management. Ref. [1] polled students on university operations, community participation, research, and curriculum.

#### 3.1.4. American College & University Presidents' Climate Commitment (ACUPCC):

US higher education institutions make a qualitative commitment to carbon neutrality and climate change via numerous activities and projects. Ref. [24] compared this technique to STARS and Green Report Card.

#### 3.1.5. Sustainability Tool for Auditing Universities Curricula in Higher Education (STAUNCH):

UK Higher Education Academy created this qualitative sustainability evaluation instrument (HEA). It helps colleges audit and assess their programs to include sustainability ideas. Users evaluate their curricula's sustainability content using the tool's questions and suggestions. It also covers utilizing assessment findings to create and execute sustainability plans. The tool is versatile and adaptable to many fields. Auditing 5800-course descriptions from 19 of 28 Cardiff University schools enabled SD implementation and distribution [25]

*3.2. Quantitative Methods*

3.2.1. Ecological Footprint Analysis (EFA):

It quantifies the life cycle environmental performance of items and systems. Ref. [26] conducted the first institutional-level EFA at Newcastle University (NSW), Australia. Ref. [27] utilizes EFA to address the "How large is Redlands' ecological impact?" His work [28] identifies practical EF and recommends policies to mitigate environmental impacts on college campuses. Ref. [29] examined the consumption-based ecological footprint technique (EFM) and its application to quantify university campus sustainability.

3.2.2. Graphical Assessment of Sustainability in Universities Tool (GASU):

GASU graphs the institution's sustainability performance to assist identify areas for improvement and measure progress. Ref. [30] analysed tools to assess and report academic institutions' sustainability activities, revised the Global Reporting Initiative (GRI) Sustainability Guidelines, and created the GASU, a simplified graphical overview of tool indicators.

3.2.3. Three-Dimensional University Ranking (TUR):

It ranks universities based on research, outreach, and stewardship. It rates each dimension using quantitative indicators and then ranks them. Ref. [31] suggested comparing university research, pedagogical, and environmental performance to fulfil the sustainability concept.

3.2.4. uD-SiM Model

It quantifies urban design and sustainability studies. This fuzzy multi-criteria assessment technique [32,33] may assist higher education institutions evaluate sustainability.

3.2.5. Green Report Card

US institutions use it to quantify sustainability. The Sustainable Endowments Institute scores institutions on energy efficiency, transportation, water consumption, and trash management. STARS and ACUPCC approaches were compared by [24].

*3.3. Mixed Methods (Both Qualitative and Quantitative)*

3.3.1. University Environment Management System (UEMS)

It aids universities in environmental management and sustainability. It advises creating and executing a university-specific environmental management system (EMS). The framework is based on ISO 14001, but it's tailored to institutions' special needs. The UEMS covers environmental reviews, goals, targets, management plans, and performance monitoring and reporting. It stresses stakeholder engagement and university sustainability [34]. It was utilized by [35] to assess an Indian university's sustainability and by [36] at AU, India, to study the EF's main attributes and set campus environmental rules.

3.3.2. SWOT Analysis

Strategic planning may uncover an organization's internal strengths and weaknesses and external opportunities and dangers. It entails analyzing internal and external variables that impact an organization's performance and competitiveness and creating a market-improvement strategy. In their research, ref. [37] proposed an EMS paradigm for Indian institutions. Ref. [38] examined UNDIP's sustainable development and higher education programmes using it (HEIs).

3.3.3. Sustainability Tracking, Assessment & Rating System (STARS)

The Association for the Advancement of Sustainability in Higher Education designed a voluntary sustainability rating system for colleges and universities (AASHE). STARS increases academic, engagement, operational, and planning and administration sustainability. Criteria and performance indicators determine sustainability in each area. Surveys, audits, and other data indicate scores. The institution's sustainability score is bronze to platinum. STARS is a comprehensive sustainability tool for all enterprises. It evaluated Saskatchewan University [39]. It assessed 21 Canadian HEI sustainability policies. Refs. [40–42] used STARS online performance sustainability data from the same institutions to see whether management sustainability culture affects worldwide university rankings. It analyzed Indian HEI sustainability. Refs. [43,44] gave national authorities HEI sustainability measures.

## 4. Conclusions and Future Scope

Outreach, teaching, and research should support sustainability in HEIs [45]. Assessment methodologies increasingly affect HEIs. We provide HEI sustainability assessment evaluation framework case studies. Quantitative, qualitative, and mixed-method research exist. Other methods can support HEIs. To help academics understand frameworks' pros and cons, this study's literature review shows HEI sustainability assessment. This research may help HEI sustainability scholars interpret.

This study examined higher education sustainability evaluation literature for sustainability assessment methods and case studies. This article adds case studies on sustainability evaluation at HEIs to earlier sustainability assessment research. 88 peer-reviewed articles are examined. Sustainability evaluation drives early diagnosis, plan creation, and management modifications in HEI case studies. Qualitative, quantitative, and combination methods reveal the most prevalent SATs. This may assist future academics in adopting a sustainability assessment method for positive HEIs. Real-life case studies on HEI sustainability assessment are included in this review research. This study evaluates HEI sustainability. It examines this field's research methodologies, strengths, shortcomings, and possibilities. This review may inform higher education sustainability assessment research. This research eliminates rare methods. HEI sustainability assessment methods need data. Long-term, using a different database like SCOPUS, Web of Science, etc. will allow for a more thorough analysis.

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## References

1. Abubakar, I.R.; Al-Shihri, F.S.; Ahmed, S.M. Students' assessment of campus sustainability at the University of Dammam, Saudi Arabia. *Sustainability* **2016**, *8*, 59. https://doi.org/10.3390/su8010059.
2. Wright, T.S.A. Deÿnitions and Frameworks for Environmental Sustainability in Higher Education. 2002. Available online: www.elsevier.com/locate/highedpol (accessed on).
3. Shriberg, M. Institutional assessment tools for sustainability in higher education: Strengths, weaknesses, and implications for practice and theory. *Int. J. Sustain. High. Educ.* **2002**, *3*, 254–270. https://doi.org/10.1108/14676370210434714.
4. Yarime, M.; Tanaka, Y. The Issues and Methodologies in Sustainability Assessment Tools for Higher Education Institutions: A Review of Recent Trends and Future Challenges. *J. Educ. Sustain. Dev.* **2012**, *6*, 63–77. https://doi.org/10.1177/097340821100600113.
5. Berzosa, A.; Bernaldo, M.O.; Fernández-Sanchez, G. Sustainability assessment tools for higher education: An empirical comparative analysis. *J. Clean. Prod.* **2017**, *161*, 812–820. https://doi.org/10.1016/j.jclepro.2017.05.194.
6. Caeiro, S.; Hamón, L.A.S.; Martins, R.; Aldaz, C.E.B. Sustainability assessment and benchmarking in higher education institutions-a critical reflection. *Sustainability* **2020**, *12*, 543. https://doi.org/10.3390/su12020543.

7. Bullock, G.; Wilder, N. The comprehensiveness of competing higher education sustainability assessments. *Int. J. Sustain. High. Educ.* **2016**, *17*, 282–304. https://doi.org/10.1108/IJSHE-05-2014-0078.
8. Maragakis, A.; van den Dobbelsteen, A. Sustainability in higher education: Analysis and selection of assessment systems. *J. Sustain. Dev.* **2015**, *8*, 1–9. https://doi.org/10.5539/jsd.v8n3p1.
9. Findler, F.; Schönherr, N.; Lozano, R.; Stacherl, B. Assessing the impacts of higher education institutions on sustainable development-an analysis of tools and indicators. *Sustainability* **2019**, *11*, 59. https://doi.org/10.3390/su11010059.
10. Fischer, D.; Jenssen, S.; Tappeser, V. Getting an empirical hold of the sustainable university: A comparative analysis of evaluation frameworks across 12 contemporary sustainability assessment tools. *Assess. Eval. High. Educ.* **2015**, *40*, 785–800. https://doi.org/10.1080/02602938.2015.1043234.
11. Caeiro, S.; Leal, W.; Charbel, F.; Ulisses, J.; Azeiteiro, M. Editors. *Sustainability Assessment Tools in Higher Education Institutions: Mapping Trends and Good Practices Around the World*; Springer International Publishing: Cham, Switzerland, 2013.
12. Alshuwaikhat, H.M.; Adenle, Y.A.; Saghir, B. Sustainability assessment of higher education institutions in Saudi Arabia. *Sustainability* **2016**, *8*, 750. https://doi.org/10.3390/su8080750.
13. Bautista-Puig, N.; Sanz-Casado, E. Sustainability practices in Spanish higher education institutions: An overview of status and implementation. *J. Clean. Prod.* **2021**, *295*. https://doi.org/10.1016/j.jclepro.2021.126320.
14. Berchin, I.I.; Grando, V.D.S.; Marcon, G.A.; Corseuil, L.; de Andrade Guerra, J.B.S.O. Strategies to promote sustainability in higher education institutions: A case study of a federal institute of higher education in Brazil. *Int. J. Sustain. High. Educ.* **2017**, *18*, 1018–1038. https://doi.org/10.1108/IJSHE-06-2016-0102.
15. Gasperina, L.D.; Mazutti, J.; Brandli, L.L.; Rabello, R.D.S. Smart practices in HEIs and the contribution to the SDGs: Implementation in Brazilian university. *Int. J. Sustain. High. Educ.* **2022**, *23*, 356–378. https://doi.org/10.1108/IJSHE-12-2020-0480.
16. Ferguson, T.; Roofe, C.G. SDG 4 in higher education: Challenges and opportunities. *Int. J. Sustain. High. Educ.* **2020**, *21*, 959–975. https://doi.org/10.1108/IJSHE-12-2019-0353.
17. Turner, L.M.; Hegde, S.; Karunasagar, I.; Turner, R. How university students are taught about sustainability, and how they want to be taught: The importance of the hidden curriculum. *Int. J. Sustain. High. Educ.* **2022**, *23*, 1560–1579. https://doi.org/10.1108/IJSHE-03-2021-0105.
18. James, M.; Card, K. Factors contributing to institutions achieving environmental sustainability. *Int. J. Sustain. High. Educ.* **2012**, *13*, 166–176. https://doi.org/10.1108/14676371211211845.
19. Bantanur, S.; Mukherjee, M.; Shankar, R. Sustainability perceptions in a technological institution of higher education in India. *Curr. Sci.* **2015**, *109*, 2198–2203.
20. Figueiró, P.S.; Neutzling, D.M.; Lessa, B. Education for sustainability in higher education institutions: A multi-perspective proposal with a focus on management education. *J. Clean. Prod.* **2022**, *339*, 130539. https://doi.org/10.1016/j.jclepro.2022.130539.
21. Nixon, A. Improving the Campus Sustainability Assessment Process. 2002. Available online: https://scholarworks.wmich.edu/honors_theseshttps://scholarworks.wmich.edu/honors_theses/1405 (accessed on).
22. Gómez, F.U.; Sáez-Navarrete, C.; Lioi, S.R.; Marzuca, V.I. Adaptable model for assessing sustainability in higher education. *J. Clean. Prod.* **2015**, *107*, 475–485. https://doi.org/10.1016/j.jclepro.2014.07.047.
23. Mader, C. Sustainability process assessment on transformative potentials: The Graz Model for Integrative Development. *J. Clean. Prod.* **2013**, *49*, 54–63. https://doi.org/10.1016/j.jclepro.2012.08.028.
24. Shi, H.; Lai, E. An alternative university sustainability rating framework with a structured criteria tree. *J. Clean. Prod.* **2013**, *61*, 59–69. https://doi.org/10.1016/j.jclepro.2013.09.006.
25. Lozano, R. Diffusion of sustainable development in universities' curricula: An empirical example from Cardiff University. . *J. Clean. Prod.* **2010**, *18*, 637–644. https://doi.org/10.1016/j.jclepro.2009.07.005.
26. Flint, K. *Institutional Ecological Footprint Analysis*; MCB University Press: Bradford, UK, 2001. Available online: http://www.emerald-library.com/ft (accessed on).
27. Venetoulis, J. *IJSHE 2,2*; MCB University Press: Bradford, UK, 2001. Available online: http://www.emerald-library.com/ft (accessed on).
28. Vaisi, S.; Alizadeh, H.; Lotfi, W.; Mohammadi, S. Developing the ecological footprint assessment for a university campus, the component-based method. *Sustainability* **2021**, *13*, 9928. https://doi.org/10.3390/su13179928.
29. Genta, C.; Favaro, S.; Sonetti, G.; Fracastoro, G.V.; Lombardi, P. Quantitative assessment of environmental impacts at the urban scale: The ecological footprint of a university campus. *Environ. Dev. Sustain.* **2022**, *24*, 5826–5845. https://doi.org/10.1007/s10668-021-01686-5.
30. Lozano, R. Incorporation and institutionalization of SD into universities: Breaking through barriers to change. *J. Clean. Prod.* **2006**, *14*, 787–796. https://doi.org/10.1016/j.jclepro.2005.12.010.
31. Lukman, R.; Krajnc, D.; Glavič, P. University ranking using research, educational and environmental indicators. *J. Clean. Prod.* **2010**, *18*, 619–628. https://doi.org/10.1016/j.jclepro.2009.09.015.