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A Quantitative Framework for Green Auditing in Higher Education Institutions: Development and Campus-Level Application

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ABSTRACT

Green auditing in higher education institutions is increasingly required by regulatory and accreditation bodies. However, existing practices are largely qualitative and lack consistency in evaluation. The current approaches often rely on checklists and self-reported information, which do not adequately reflect performance relative to institutional scale or operational demand. This limits comparability and reduces the usefulness of audit outcomes for decision-making. This study addresses this gap by developing a quantitative and normalised green audit framework that converts qualitative sustainability practices into measurable indicators. The framework is structured across twenty sustainability domains, each evaluated using defined sub-criteria and a normalized scoring system. Domain-level scores are aggregated to obtain an overall institutional performance index on a 100-point scale. The framework was applied to a representative university campus, Jawaharlal Nehru Technological University Kakinada (JNTUK), using field observations, institutional records, and physical verification of infrastructure and operations. The results indicate an overall score of 55.5/100, corresponding to a moderate level of sustainability performance. The higher scores were observed in infrastructure-based domains such as rainwater harvesting, while lower scores were noted in areas related to institutional processes, including curriculum integration and internal sustainability governance. The findings show that while several sustainability measures are in place, their effectiveness is limited by partial utilisation and lack of systematic integration. The proposed framework provides a structured basis for performance evaluation and can support institutions in identifying priority areas for improvement and shows consistent benchmarking across campuses.

Keywords: *Higher Educational Institutions (HEIs), Green Audit, Quantitative scoring system, Sustainable measures, bench marking.*

1 Introduction

Green auditing has become an important tool for evaluating environmental performance in academic institutions, particularly in relation to sustainability-focused accreditation and regulatory requirements [3]. Statutory bodies such as the National Assessment and Accreditation Council (NAAC), All India Council for Technical Education (AICTE), and the Indian Green Building Council (IGBC) have incorporated environmental indicators into their assessment frameworks [4, 6]. These include aspects such as energy use, water management, waste handling, and environmental practices. As a result, green auditing is increasingly treated as a necessary component of institutional evaluation rather than an optional activity [7. 8]. In practice, however, green audits are commonly conducted using qualitative approaches. Assessments are often based on checklists, visual inspections, and institutional records that confirm whether certain facilities or practices exist. While such methods are useful for documentation, they do not assess whether these systems are adequate for the size or needs of the institution [22,18]. For example, the presence of a rainwater harvesting system does not indicate whether it is sufficient relative to the campus area or water demand. Similar issues arise in other areas such as waste management and energy use. Because of this, institutions with very different levels of resource consumption may receive similar audit scores. Previous studies have noted that such approaches limit consistency and reduce the usefulness of audits for comparison and decision-making [8, 12, 15, 18].

Another limitation is the lack of a clear and consistent structure for evaluating performance. Existing frameworks, including IGBC, GRIHA, and GreenMetric, provide useful guidelines but often do not translate them into measurable and comparable indicators at the institutional level [13, 16, 19]. Scoring methods are not always standardized, which introduces variation between auditors and institutions. In addition, key factors such as campus size, population, and infrastructure capacity are rarely considered explicitly, even though they strongly influence environmental performance [9, 31,25]. As a result, current audit outcomes tend to describe practices rather than assess their effectiveness. These limitations point to the need for a more structured and quantitative approach [7, 10, 14]. When combined with normalization, such an approach makes it possible to compare institutions of different sizes on a common basis [11, 19]. Recent studies in sustainability assessment have emphasized the importance of measurable and normalized indicators for improving the reliability of institutional evaluations [8, 12, 15, 19, 21, 25]. Green auditing is also relevant beyond accreditation. It can support institutional planning by providing a clearer understanding of how resources are used and where inefficiencies exist [3, 26, 28].

In the absence of structured evaluation methods, decisions related to infrastructure, resource use, and sustainability initiatives are often based on limited information [24, 29]. A quantitative framework allows institutions to link environmental performance with measurable outcomes, making it easier to plan improvements and monitor progress [23, 25]. This is particularly important in the context of increasing expectations for accountability and continuous improvement in environmental performance [27, 32, 12]. In view of these considerations, this study presents a quantitative and normalized green audit framework for academic institutions [16, 14, 11]. The framework is based on measurable sub-criteria, normalization procedures, and a structured scoring system that produces an overall sustainability score. Unlike conventional approaches, it considers performance in relation to institutional demand and capacity, allowing for more meaningful comparison across institutions. The framework is aligned with existing regulatory requirements while providing a more consistent and transparent method for evaluating sustainability performance [32, 12].

2 Literature Review

To examine current green auditing practices in higher education, it is important to review existing approaches to sustainability assessment and institutional evaluation. Several studies have addressed sustainability frameworks, indicator-based assessment methods, and environmental management practices in academic institutions. In many cases, the absence of standardized quantification, normalization, and consistent scoring approaches limits the comparability and reliability of results. The following section presents a review of relevant studies to outline existing methods and identify gaps that inform the development of the present framework as shown in Table 1

The literature indicates that sustainability assessment in higher education has been widely studied, with various frameworks and indicator-based methods proposed in recent years. Many of these studies focus on individual domains such as energy, waste management, or curriculum-related activities, while relatively few provide a comprehensive assessment at the institutional level. In addition, differences in indicator selection and scoring methods lead to inconsistencies across studies. The limited use of normalization further restricts comparison between institutions with varying sizes and operational characteristics.

Table 1: Literature Review (Recent Studies: 2018–2025)

S. No.	Author(s) & Year	Study Focus	Methodology / Approach	Key Findings	Limitation / Research Gap
1	Fissi et al. (2021)	Sustainability practices in universities	Case-based assessment	Increased adoption of sustainability reporting	Lack of quantitative benchmarking methods
2	Stough et al. (2018)	Sustainability assessment in curricula	Indicator evaluation	Identified inconsistencies in assessment practices	Absence of standardized measurable indicators
3	Marrone et al. (2018)	Campus sustainability evaluation	Morphology-based indicators	Spatial planning influences sustainability	Does not include operational performance metrics
4	Basheer et al. (2024)	Sustainability assessment practices	Bibliometric + content analysis	Growing shift toward data-based assessment (MDPI)	Lack of normalization across institutions
5	Sharma & Bandyopadhyay (2023)	Quantitative sustainability framework	Indicator-based numerical model	Quantification improves clarity in assessment	Limited real-world institutional validation
6	Basheer et al. (2025)	Sustainability indicators validation	Mixed-method approach	Identified gaps in stakeholder awareness and indicator use (Springer Link)	Weak integration into institutional decision systems
7	Dankova (2024)	University sustainability frameworks	Review of UniSAF indicators	Frameworks useful for structured evaluation (IDEAS/RePEc)	Lack of comparability and unified scoring
8	Henderson et al. (2024)	Sustainability assessment framework design	Multi-criteria evaluation framework	Systematic assessment improves decision processes (PMC)	Limited application in higher education audits
9	Farahdel et al. (2024)	Sustainability assessment frameworks	Systematic literature review	Use of multi-criteria decision methods (AHP, DEMATEL) (arXiv)	Complexity limits practical institutional application
10	Annarelli et al. (2024)	Social sustainability assessment	Indicator-based framework	Emphasizes importance of social dimension (arXiv)	Environmental metrics still dominate frameworks
11	Ankareddy (2025)	Sustainability integration in HEIs	Analytical review	Large variation in sustainability implementation (ScienceDirect)	Lack of consistent evaluation systems
12	Jha et al. (2024)	Sustainability in Indian HEIs	Review of institutional practices	Identified gaps in stakeholder participation (Sage Journals)	Limited quantitative evaluation mechanisms
13	Pragya et al. (2025)	Sustainability assessment tools (SATs)	Systematic review (PRISMA)	Identified 30+ tools with varied structures (Emerald Publishing)	Lack of unified and comparable framework
14	European University Association (2025)	Sustainability in universities	Survey-based institutional analysis	Increasing institutional engagement in sustainability (European University Association)	Variability in reporting and evaluation methods
15	Recent Review (2026)	Sustainability assessment in HEIs	Systematic review	Identifies qualitative, quantitative, and mixed approaches (ResearchGate)	Challenges in real-world implementation and standardization

3 Methodology

The methodology adopted in this study focuses on developing a structured approach for assessing sustainability performance in academic institutions through a green audit framework. The objective was to translate commonly observed qualitative practices into measurable indicators that allow consistent evaluation across different institutional contexts. In developing the framework, reference was made to established guidelines and standards, including those of the Central Pollution Control Board (CPCB), Bureau of Indian Standards (BIS), National Assessment and Accreditation Council (NAAC), and Indian Green Building Council (IGBC), as well as relevant studies on sustainability assessment in higher education.

The first step involved identifying a set of sustainability domains that reflect the major environmental and operational aspects of an academic campus. A total of twenty domains were selected, covering areas such as water management, energy use, waste handling, biodiversity, and institutional practices. These domains were chosen to ensure that both infrastructure-related and operational dimensions of sustainability are represented. For each domain, a set of sub-criteria was defined to capture specific and measurable aspects of performance. Wherever possible, these sub-criteria were expressed in quantifiable terms, such as percentage coverage, capacity relative to demand, or frequency of implementation, so that the assessment is based on observable and verifiable data rather than general descriptions.

To evaluate performance, a normalized scoring system was adopted using three levels: 0, 0.5, and 1. A score of 0 indicates absence or non-compliance, 0.5 represents partial implementation, and 1 indicates satisfactory performance in line with defined criteria. The thresholds for assigning these scores were derived from regulatory guidelines and practical considerations relevant to institutional settings. This approach allows differences in performance to be captured without introducing unnecessary complexity into the scoring process. Since the number of sub-criteria varies across domains, normalisation was applied to ensure comparability. The score for each domain was obtained by averaging the scores of its sub-criteria and converting the result to a five-point scale. This step ensures that all domains contribute equally to the overall evaluation, regardless of the number of parameters used within each domain. The overall institutional green audit score was then calculated by aggregating the domain-level scores and expressing the result on a 100-point scale. This provides a single value that represents the overall sustainability performance of the institution while retaining the ability to examine domain-specific results.

Data required for the assessment were collected through a combination of field observations and institutional records. The physical verification of facilities, measurement of relevant parameters, and review of documents such as maintenance logs, reports, and compliance records formed the basis of evaluation. Where possible, observations were supported by documentary evidence to maintain consistency in scoring. This approach reduces reliance on subjective judgment and ensures that the assessment reflects actual conditions within the institution. The framework was applied to a representative academic institution to demonstrate its use in practice. All domains and corresponding sub-criteria were evaluated using the defined scoring and normalisation procedures.

The results were compiled to obtain both domain-level scores and the overall institutional score, which were then presented in tabular and graphical forms to support interpretation. In addition, a sensitivity check was carried out by introducing small variations in sub-criteria scores to examine the stability of the framework. The results showed that the overall assessment remained consistent under such variations, indicating that the framework provides a stable basis for evaluating institutional sustainability performance.

4 Case Study

The proposed green audit framework was applied to Jawaharlal Nehru Technological University Kakinada (JNTUK) to evaluate its applicability and to assess sustainability performance across multiple domains. The campus represents a typical residential technical university with academic buildings, hostels, administrative facilities, and supporting infrastructure, providing an appropriate setting for demonstrating the framework. Data for the assessment were collected through a combination of field visits and review of institutional records. The author conducted on-site inspections across different functional units of the campus to verify the presence and condition of infrastructure related to water management, waste handling, energy use, and environmental safety. The observations were supported by information obtained from institutional documents, including maintenance records, log books, operational registers, and relevant compliance reports. This approach ensured that the evaluation was based on verifiable evidence rather than solely on reported information.

The specific observations were made for key sustainability domains. The assessment of water management included verification of the number and distribution of rainwater harvesting structures, along with their maintenance status and operational condition. The Wastewater management systems, including neutralization tanks, were examined through physical inspection to assess their functionality and performance. In the energy and carbon management domains, available records related to energy use, conservation measures, and carbon reduction initiatives were reviewed. Institutional practices such as internal revenue generation through consultancy activities and environmental awareness programs were also considered, based on documented evidence and operational records. All twenty sustainability domains were evaluated using the defined sub-criteria and scoring system. Each parameter was assessed based on measurable indicators and field observations, and the resulting scores were aggregated to obtain category-level performance. The results indicate that the institution performs relatively well in infrastructure-based domains, particularly in water management, where rainwater harvesting systems are present and functional. Moderate performance was observed in areas such as energy efficiency, waste management, and carbon-related initiatives, indicating partial implementation of sustainability measures. Lower scores in domains such as neutralization systems, internal revenue generation, and curriculum integration suggest that these areas require further attention in terms of operation, monitoring, and institutional integration.

A closer examination of individual domains reveals variation in the level of implementation and effectiveness of sustainability practices. While paperless administration and waste management systems are reasonably established and functional, the utilisation of renewable energy infrastructure remains limited, with continued dependence on conventional grid-based electricity.

Fire safety systems are available across the campus; however, periodic calibration, validation, and structured training programs for staff and students are not consistently conducted. Similarly, institutional processes such as the preparation of annual environmental reports are not carried out in a systematic or regular manner. The biodiversity within the campus shows signs of decline, primarily due to ongoing construction and expansion activities, with limited evidence of structured restoration or conservation efforts. In several domains, sustainability initiatives are present but operate at obsolete or passive level, without continuous monitoring, performance evaluation, or integration into institutional practices.

The application of the framework demonstrates its ability to capture both physical infrastructure and operational practices through a structured and measurable approach. The combination of field verification and documented evidence strengthens the reliability of the assessment. The results provide a clear basis for identifying priority areas for improvement and support the use of the framework as a tool for institutional sustainability planning and evaluation.

5 Results and Discussions

The category-wise performance in Figure 1 reflects differential levels of implementation across the twenty sustainability domains. The interpretation below is organised by domain, linking observed conditions to the corresponding scores.

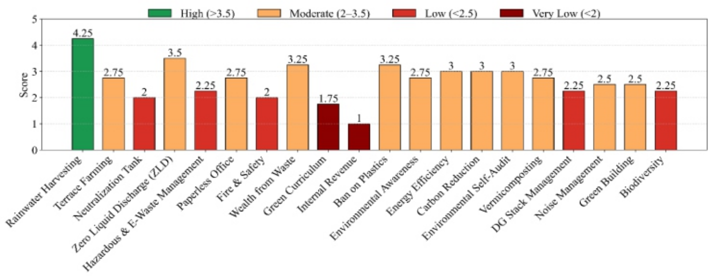

Figure 1: Green Audit Parameter Performance on the Campus Study

Based on the IGBC rating classification Table 2, the institutional score of 55.5 falls under the "Certified" category, indicating that basic sustainability measures are in place, but further improvements are required to achieve higher performance levels.

Table 2: IGBC Rating System

Overall Score (0–100)	IGBC Rating Level	Interpretation
≥ 85	Platinum	Excellent sustainability performance with comprehensive implementation
75 – 84	Gold	High level of sustainability with strong system integration
65 – 74	Silver	Good performance with moderate system effectiveness
50 – 64	Certified	Basic level of sustainability with partial implementation
< 50	Below Certified	Limited sustainability practices and weak system integration

5.1 Water Management

Rainwater harvesting (RWH) attained the highest score (4.25/5), indicating that the number and distribution of recharge structures are broadly adequate relative to campus extent and rooftop catchment. Field verification confirmed the presence of multiple recharge pits and functional conveyance from rooftops.

5.2 Terrace farming (2.75/5) The Terrace Farming is present and encouraged at selected rooftops however, coverage is partial and not uniform across buildings. The expansion is feasible where structural capacity and water availability permit.

5.3 The neutralisation tank systems (2.00/5) It serve a limited number of laboratories. Zero Liquid Discharge (ZLD) scored 3.50/5 based on system presence however, campus-wide utilisation is not consistently observed. This suggests that installed capacity is not fully integrated into routine operations. Physical inspection indicated intermittent operation and inconsistent maintenance.

5.4 Waste and Resource Management

Hazardous and e-waste management (2.25/5) is implemented in parts but not uniformly across departments. Segregation, storage, and authorised disposal records are available, though engagement is inconsistent. Paperless administration (2.75/5) reflects partial transition to electronic workflows. With the adoption of e-office systems mandated by government, communication and file movement are increasingly digital, though legacy practices persist in some units. "Wealth from Waste" (3.25/5) is evident through campus initiatives such as display of obsolete equipment and the conversion of scrap into demonstrative models (e.g., open museum-type exhibits). This indicates functional reuse, though systematic tracking of material diversion is limited.

5.5 Energy and Carbon Energy efficiency (3.00/5) and carbon reduction (3.00/5) indicate moderate implementation. The efficient fixtures and basic conservation measures are present. Renewable energy installations exist but are not utilised to the extent of their rated capacity, resulting in continued reliance on grid supply.

5.6 DG set stack management (2.25/5) It shows compliance in installation however, aspects such as stack height verification, emissions monitoring, and waste diesel disposal require closer oversight. Environmental performance depends on adherence to prescribed stack heights and proper handling of used oil.

5.7 Fire and Safety provisions (2.00/5) The Fire and Safety are physically available across campus. However, periodic calibration of equipment, validation checks, and structured training or mock drills for staff and students are not conducted consistently, limiting operational readiness. An environmental self-audit (3.00/5) is carried out, but the preparation and updating of annual environmental reports are not systematic across all units. This affects continuity in monitoring and follow-up. Internal revenue generation for sustainability (1.00/5) is minimal. Consultancy activities exist but are not formally linked to sustainability initiatives or reinvested through a defined mechanism.

5.8 Materials, Plastics, and Built Environment

Ban on plastics (3.25/5) is supported by institutional policy and partial enforcement. The compliance is visible in certain areas, though monitoring across all campus zones is not uniform. The green building practices (2.50/5) are adopted in selected developments however, comprehensive application across new and existing structures is limited.

5.9 Biodiversity and Land Use
Biodiversity (2.25/5) shows signs of decline in sections of the campus, largely associated with ongoing construction and expansion. The evidence of structured restoration (native planting, habitat creation) is limited.

5.10 Energy and Carbon Energy efficiency (3.00/5) and carbon reduction (3.00/5) indicate moderate implementation. The efficient fixtures and basic conservation measures are present. Renewable energy installations exist but are not utilised to the extent of their rated capacity, resulting in continued reliance on grid supply.

5.11 Green curriculum (1.75/5) It indicates limited integration. While environmental courses are offered in some programmes, inclusion across all Boards of Studies (BoS), and the balance between core, elective, and mandatory environmental subjects, remains uneven. Broader incorporation across disciplines is required. Environmental awareness programmes (2.75/5) are conducted periodically, but their continuity and measurable outcomes (participation rates, follow-up actions) vary.

5.12 DG set stack management (2.25/5) It shows compliance in installation however, aspects such as stack height verification, emissions monitoring, and waste diesel disposal require closer oversight. The environmental performance depends on adherence to prescribed stack heights and proper handling of used oil.

The results indicate that infrastructure-oriented domains (water systems, certain waste practices) perform better than domains dependent on governance, monitoring, and academic integration. Several systems are present but operate below capacity or without regular validation, leading to moderate scores. The framework distinguishes between mere presence and functional adequacy by linking observations to measurable criteria, thereby identifying priority areas for improvement particularly in operational consistency, utilisation of installed systems, and integration into institutional processes.

6 Conclusions
The present study developed and applied a quantitative green audit framework for assessing sustainability performance in academic institutions. Based on the analysis, the following conclusions were drawn:
1. The framework converts qualitative audit observations into measurable indicators using a normalized scoring system (0-1 at sub-criteria level, aggregated to 0-5 per domain and 0-100 overall), enabling consistent evaluation across 20 sustainability domains.
2. The application of the framework yielded an overall institutional score of 55.5/100, indicating a moderate level of sustainability performance, with significant variation across domains.
3. Only 1 out of 20 domains (5%) achieved a high-performance level (>4.0), namely rainwater harvesting (4.25), indicating that strong performance is limited to specific infrastructure-driven areas.
4. Approximately 12 domains (60%) fall within the moderate performance range (2.5–3.5), including energy efficiency (3.0), carbon reduction (3.0), and waste-related practices (3.25), suggesting partial implementation and scope for improvement.
5. A total of 6 domains (30%) fall within the low-performance range (2.0-2.5), including neutralization systems (2.0), DG stack management (2.25), and biodiversity (2.25), indicating gaps in operational effectiveness and monitoring.
6. 2 domains (10%), namely green curriculum (1.75) and internal revenue generation (1.0), fall under very low performance (<2.0), reflecting limited integration of sustainability into academic and financial systems.
7. Infrastructure-related domains exhibit higher scores compared to governance and institutional domains, indicating that sustainability efforts are currently concentrated on physical systems rather than systemic integration.
8. The utilisation ratio of installed renewable energy systems remains below optimal levels, with continued dependence on grid electricity, indicating underutilisation of available capacity.
9. Wastewater management systems, including neutralization tanks, are operational in selected units but do not cover the full volume of generated effluent, resulting in partial treatment efficiency.
10. Fire safety systems are present across campus however, the absence of periodic calibration, validation, and training reduces their operational effectiveness.
11. Biodiversity indicators suggest a declining trend in vegetative cover due to developmental activities, with limited restoration measures observed.

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Conflict of Interest
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References
1. Annarelli, A., Battistella, C., & Nonino, F. (2024). A framework for social sustainability assessment: A systematic review. *Sustainable Futures*, 6, 100120.
2. Basheer, A., et al. (2024). Sustainability assessment in higher education institutions: A bibliometric and content analysis. *Sustainability*, 16(13), 5799.
3. Basheer, A., et al. (2025). Evaluation of sustainability indicators in higher education institutions. *Discover Sustainability*, 6, 45.
4. Bureau of Indian Standards (BIS). (2016). *Guidelines for environmental management systems*. New Delhi, India.
5. Central Pollution Control Board (CPCB). (2020). *Guidelines for environmental compliance and waste management*. Government of India.
6. Ceulemans, K., Molderez, I., & Van Liedekerke, L. (2018). Sustainability reporting in higher education: A review of recent developments. *Journal of Cleaner Production*, 179, 332–341.
7. Dankova, P. (2024). University sustainability frameworks and indicators: A review of UniSAF. *Journal of Environmental Management*, 345, 118765.

8. Farahdel, M., et al. (2024). Multi-criteria decision-making approaches in sustainability assessment: A systematic review. *Environmental Impact Assessment Review*, 96, 106789.
9. Fissi, S., Romolini, A., & Gori, E. (2021). Sustainability reporting in universities: A stakeholder perspective. *Meditari Accountancy Research*, 29(5), 1011–1032.
10. Findler, F., Schönherr, N., Lozano, R., & Reider, D. (2019). The impacts of higher education institutions on sustainable development. *International Journal of Sustainability in Higher Education*, 20(1), 23–38.
11. Henderson, J., et al. (2024). Framework development for sustainability assessment in complex systems. *Journal of Environmental Planning and Management*, 67(4), 789–806.
12. Indian Green Building Council (IGBC). (2021). *IGBC Green Campus Rating System*. Confederation of Indian Industry (CII), India.
13. Jha, A., et al. (2024). Sustainability practices in Indian higher education institutions: A review. *Environment, Development and Sustainability*, 26, 14567–14589.
14. Karatzoglou, B. (2018). The role of universities in sustainability transition: A review. *Journal of Cleaner Production*, 172, 457–465.
15. Lambrechts, W., et al. (2019). Sustainability assessment in higher education institutions: A review of tools and approaches. *Journal of Cleaner Production*, 217, 370–384.
16. Leal Filho, W., et al. (2019). Sustainable development in higher education: Reviewing trends and practices. *Journal of Cleaner Production*, 231, 168–180.
17. Leal Filho, W., et al. (2020). The role of universities in sustainable development: Global perspectives. *Sustainability*, 12(2), 1–18.
18. Lozano, R., et al. (2020). A review of commitment and implementation of sustainable development in higher education. *Journal of Cleaner Production*, 248, 119237.
19. Marrone, P., et al. (2018). Assessing campus sustainability using spatial indicators. *Sustainable Cities and Society*, 37, 33–45.
20. Mohammadalizadehkorde, M., & Weaver, R. (2018). Universities as models of sustainability: A review. *Sustainable Development*, 26(3), 201–215.
21. National Assessment and Accreditation Council (NAAC). (2023). *Manual for Self-Study Report (SSR) for Higher Education Institutions*. Bangalore, India.
22. Nunes, L., et al. (2018). Sustainable university campus: Review of assessment methods. *International Journal of Sustainability in Higher Education*, 19(2), 276–291.
23. Pragya, N., et al. (2025). A critical review of sustainability assessment tools in higher education. *International Journal of Sustainability in Higher Education*.
24. Ramos, T. B., et al. (2019). Sustainability assessment in higher education institutions: An overview. *Journal of Cleaner Production*, 217, 343–356.
25. Recent Review (2026). Sustainability assessment of higher education institutions: A systematic literature review. *Journal of Cleaner Production* (in press).
26. Sassen, R., & Azizi, L. (2018). Assessing sustainability reporting in universities. *Journal of Cleaner Production*, 172, 2823–2833.
27. Sharma, R., & Bandyopadhyay, S. (2023). A quantitative sustainability assessment framework for higher education institutions. *Environmental Development*, 45, 100789.
28. Sonetti, G., et al. (2019). Sustainability indicators in higher education: A review. *Ecological Indicators*, 98, 1–13.
29. Stough, T., et al. (2018). Integration of sustainability into higher education curricula. *International Journal of Sustainability in Higher Education*, 19(7), 1306–1323.
30. Trencher, G., et al. (2019). University contributions to sustainability transitions. *Sustainability Science*, 14(3), 737–751.
31. United Nations (2019). *Sustainable Development Goals Report 2019*. UN Publications.
32. United Nations (2023). *Global Sustainable Development Report 2023*. United Nations.
33. Velazquez, L., et al. (2018). Sustainability practices in universities: Trends and challenges. *International Journal of Sustainability in Higher Education*, 19(5), 858–876.
34. Yarime, M., et al. (2020). Establishing sustainability in universities: A systems perspective. *Sustainability Science*, 15(1), 191–205.