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SUSTAINABILITY ASSESSMENT OF HIGHER EDUCATION INSTITUTIONS: DEVELOPMENT OF WEIGHTED AND PRIORITIZED KEY PERFORMANCE INDICATORS USING THE DELPHI STUDY

Avaliação da sustentabilidade das instituições de ensino superior: desenvolvimento de indicadores-chave de desempenho ponderados e priorizados utilizando o estudo Delphi

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ABSTRACT

Researchers have become increasingly interested in assessing the sustainability performance of higher education institutions (HEIs) over the past decade, driven by environmental challenges, social disparities, and economic instabilities worldwide. HEIs are regarded as mini-cities; hence, having a sustainable university campus will have a resultant effect on the cities and the immediate societies in which they operate. Therefore, developing and prioritizing a set of performance indicators for the sustainability assessment of HEIs becomes imperative. This study aimed to develop weighted indicators and prioritize their relative levels of importance for the sustainability assessment of HEIs in Nigeria using a Delphi study. A mixed-methodology approach was employed, involving desk research and a Delphi study. The desk research involved the utilization of sustainability indicators that were consistently and frequently cited in the extant literature pertinent to HEIs and adapted to the Nigerian context. The results revealed that commercialized research outputs, renewable energy, campus fleet, and sustainability awareness were the four most important indicators, as they were highly prioritized. HEIs in Nigeria are at a nascent phase of sustainability advancement, and the identified contextual key performance indicators (KPIs) are intended to bolster local sustainability initiatives. A comprehension of the existing phases of sustainable development (SD) and the strategic application of KPIs would enable HEIs to optimize their contributions to sustainability practices, especially in the context early adopters like those in Nigeria.
Keywords: Higher education institutions, Sustainability, Sustainable development, Sustainability performance assessment, Performance indicators, Delphy study

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AVALIAÇÃO DA SUSTENTABILIDADE DAS INSTITUIÇÕES DE ENSINO SUPERIOR: DESENVOLVIMENTO DE INDICADORES-CHAVE DE DESEMPENHO PONDERADOS E PRIORIZADOS UTILIZANDO O ESTUDO DELPHI

Assessing the sustainability of higher education institutions: developing weighted and prioritized key performance indicators using the Delphi study

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RESUMO

Nos últimos dez anos, cresceu o interesse dos pesquisadores em avaliar a sustentabilidade das instituições de ensino superior (IES), diante de desafios ambientais, sociais e econômicos globais. As IES são vistas como “mini-cidades”. Assim, um campus sustentável pode impactar positivamente as cidades e comunidades em seu entorno. Torna-se, portanto, essencial definir e priorizar indicadores de desempenho para avaliar a sustentabilidade universitária. Este estudo teve como objetivo desenvolver indicadores ponderados e estabelecer sua ordem de importância para as IES na Nigéria, por meio do método Delphi. Utilizou-se uma metodologia mista, combinando pesquisa documental e estudo Delphi. A pesquisa documental reuniu indicadores de sustentabilidade frequentemente citados na literatura sobre IES e adaptados ao contexto nigeriano. Os resultados apontaram quatro indicadores como mais relevantes: produção de pesquisas comercializadas, uso de energia renovável, frota de veículos do campus e conscientização em sustentabilidade. As IES nigerianas encontram-se em fase inicial de avanço nesse campo. Os indicadores identificados podem fortalecer iniciativas locais e apoiar a transição para práticas mais sustentáveis. A compreensão do estágio atual de desenvolvimento sustentável (DS) e a aplicação estratégica dos indicadores permitem otimizar as contribuições das IES para a sustentabilidade, especialmente no caso de adotantes iniciais, como as instituições nigerianas.

Palavras-chave: Instituições de ensino superior, Sustentabilidade, Desenvolvimento sustentável, Avaliação de desempenho, Indicadores de desempenho, Estudo Delphi

INTRODUCTION

Over the past decade, sustainable development (SD) has drawn increasing scholarly attention, with varied perspectives from conferences and diverse global actions seeking to balance human progress with environmental, societal, and economic realities (Griebeler et al., 2022; Lozano et al., 2013; Slaymark, 2018). Early milestones included the 1972 Stockholm conference and the 1987 Brundtland Report, which emphasized meeting present needs without compromising future generations (Brundtland, 1987). Today, sustainability is widely recognized as essential in sectors such as manufacturing, governance, and education, underscoring the urgent need to align human activities with limited planetary resources.

Higher Education Institutions (HEIs) are viewed as critical actors in advancing sustainability, particularly in addressing global warming and climate change. In January 2023, the United Nations Academic Impact (UNAI) launched a pilot program within the context of the Decade of Action for the Sustainable Development Goals (SDGs), UNAI (2023), offering free online training on the SDGs to academic staff. However, participation remains limited: by January 2024, only 43 institutions and colleges members of UNAI across 25 countries had joined, including just three African universities—one each from Tunisia, Mauritius, and Kenya—with no Nigerian representation. HEIs contribute to sustainability by promoting environmentally responsible campuses, but true impact requires extending initiatives beyond campus boundaries. By collaborating with governments, industries, and civil society, universities can co-design and co-create knowledge and tools that drive societal transformation (Horan and O'Regan, 2021; Trencher et al., 2014). They can also establish sustainability-focused career and recruitment counseling offices to prepare graduates as agents of change.

In Nigeria, HEIs face distinct challenges. Despite rapid expansion, they rank poorly on global scales. Nigeria's large population and growing urbanization have fueled a surge in HEIs, making it one of the fastest-growing systems in Africa. According to the National Universities Commission (NUC), the country hosts 284 HEIs, including 170 universities, while the rest were Polytechnics, Monotechnics, Colleges of Education, Religious Institutions, and Specialized Institutions. Of these, 43 are federally owned, 48 are state-owned, and 79 are privately operated. Total university enrollment reached over 2.15 million students, with overall HEI enrollment slightly higher at 2.23 million. Female students accounted for 43.4% of this figure, highlighting persistent gender imbalances according to the NUC report of 2019 (NUC, 2019).

Nigeria, as the most populous nation in sub-Saharan Africa with an estimated 237.5 million people, according to the United Nations Population Fund (UNFPA, 2025), faces continuous growth in student populations, academic staff, and administrative personnel within its HEIs. This expansion intensifies existing challenges such as inefficient campus transportation, environmental pollution, inadequate infrastructure, poor land use, campus degradation, and unsustainable consumption and production patterns. To address these concerns, the Association of African Universities (AAU) convened the 2009 Abuja Declaration in Nigeria and called on African HEIs to prioritize sustainability by critically evaluating educational frameworks and assessing campus sustainability performance (SP) (AAU, 2009). However, progress since then has been limited.

In Nigeria, despite strategic efforts to enhance sustainability in HEIs, there is a significant lack of indicators, methodologies, and frameworks to assess performance effectively. Official platforms provide little documentation on sustainability performance assessments (SPA) or campus development policies, while empirical research from existing literature and statistical data remains scarce. Consequently, sustainability reporting and practices within Nigerian HEIs are largely overlooked, leaving the overall condition of campus sustainability uncertain. This research objective, therefore, seeks to bridge this gap by developing weighted and prioritized key performance indicators (KPIs) for a holistic SPA of Nigerian HEIs. Using the Delphi study methodology, the investigation represents the first comprehensive attempt to create sustainability indicators tailored to Nigeria's unique socio-cultural context—marked by religious, ethnic, and racial diversity.

Furthermore, this is the first attempt to employ the Delphi study in a study such as this. To date, no similar scholarly contribution has been documented in the academic literature, making this study novel. Unlike earlier studies, which focused mainly on environmental issues, Adenle et al., (2020, 2021), this research incorporates social, economic, and environmental dimensions known as the triple bottom line (TBL) of sustainability. The proposed indicators aim to help practitioners in Nigerian HEIs and potentially in analogous contexts, assess SP from the categorized perspectives (Table 8) and also across multiple dimensions of the TBL. However, while some

indicators can be classified into a single sustainability dimension, others can be categorized into one or more dimensions of sustainability. Notable examples of indicators that have both social and economic dimensions are staff involved in sustainability research, students involved in sustainability research, and publications related to sustainability. This means that some indicators align clearly with a single dimension, whereas others span multiple sustainability domains, offering flexibility for institutions to classify them appropriately.

Beyond assessment, these indicators have practical implications. They can be used to evaluate HEIs' contributions to quality of life (QOL), guide institutional reforms, and support policy recommendations for governing bodies. Although designed specifically for Nigeria, the indicators could be adapted for HEIs in neighboring countries facing similar challenges.

After the Introduction, Section 1 of this article gives a brief literature review. The methodology used is presented in Section 2. The development of weighted and prioritized KPIs is shown in Section 3, while the results and discussion are outlined in Section 4 and the research implications in Section 5. The final section is dedicated to the conclusion.

1 LITERATURE REVIEW

The assessment of SP of HEIs is widely examined through the TBL framework for global or regional evaluations. The differences observed between global and regional sustainability assessment tools (SATs) and indicators underscore the necessity of contextual adaptation to suit the institutional and regional environment. Hence, Kapitulčinová et al. (2018); Veidemane (2022), among others, suggest the use of global SATs for HEIs, while Du et al. (2020, 2023); Gulcimen et al. (2023); Paz et al. (2023); Velasco et al. (2018), among others, have developed regional SATs for HEIs. KPIs are usually embedded in the various SATs for HEIs' performance evaluation.

Global assessment initiatives have emerged to address the limitations of existing international rankings. For example, Veidemane (2022) proposed a global framework for assessing education for sustainable development (ESD), noting the inadequacy of the Universitas Indonesia Green Metric (GM) and the Times Higher Education Impact Ranking (THE-Impact Ranking) in capturing ESD indicators. Likewise, Kapitulčinová et al. (2018) developed the "Accelerator Toolset," designed to integrate sustainability principles systematically across universities by positioning individual actors—students, research, operational staff, or administrators—as central change agents. This perspective, also supported by Stephens et al. (2008), emphasizes the role of diverse actors within HEIs in driving transformative change, rather than relying solely on institutional structures.

Contextualization of assessment methods is particularly evident in regional studies. Paz et al. (2023), for instance, evaluated Brazilian municipalities hosting HEIs by synthesizing four SATs—Assessment Instrument for Sustainability in Higher Education (AISHE), Sustainability Assessment Questionnaire (SAQ), Sustainability Tracking, Assessment and Rating System (STARS), and the Unit-Based Sustainability Assessment Tool (USAT)—and applying a hybrid multi-criteria decision-making (MCDM) method by combining the analytic network process (ANP) with TOPSIS. Working differently, Gulcimen et al. (2023) assessed the Abdullah Gul University Summer Campus, Turkey, but employing a life cycle sustainability assessment (LCSA) framework that integrates environmental life cycle assessment (ELCA), social life cycle assessment (SLCA), and life cycle costing (LCC) to provide a holistic evaluation.

However, the direct transferability of SATs across regions remains problematic. Velasco et al (2018) demonstrated this challenge in their application of the North American STARS framework to assess Universidad San Francisco de Quito (USFQ), Ecuador, in South America. The evaluation proved infeasible due to cultural, geographical, and systemic differences, including the absence of certification mechanisms prevalent in North America. In a similar vein, Du et al. (2020, 2023) addressed the contextual misalignment of global tools with Chinese HEIs by developing a two-hierarchy SAT tailored to the national context. The tool's indicators, selected from existing SATs, were validated by a 34-member research team and tested in 15 case studies. Collectively, these studies illustrate the diversity of SATs and the challenges inherent in their universal application. While global frameworks provide overarching benchmarks, their heterogeneity and contextual limitations necessitate the development of regionally adapted tools and KPIs to ensure fair, meaningful, and context-sensitive SPA of HEIs.

There is limited extant literature on the SPA of HEIs in Nigeria, with none focusing on assessing all TBL dimensions except for the studies by Adenle et al. (2020, 2021), which addressed only the environmental dimension. For instance, Ologun & Wara (2014) evaluated carbon footprints as a climate change mitigation tool in a Nigerian HEI, while Folorunso et al. (2020) explored energy demand mitigation strategies based on carbon footprint in a Nigerian university campus. Similarly, Amakom et al. (2022) estimated annual carbon emissions from electricity generation at the Nigerian Federal University of Technology, and Ogunje et al. (2022) proposed carbon-zero initiatives using rooftop solar photovoltaic installations. These studies, though significant, primarily focused on driving carbon-zero initiatives to foster sustainability in HEIs in Nigeria without necessarily assessing any aspect of the TBL sustainability dimensions. Other contributions, including those of Abenu et al. (2024); Abenu & Abdullahi (2025); Bolaji (2020); Mshelia et al. (2021), similarly discuss the sustainability of HEIs in Nigeria without explicit TBL-based SPA.

The development of relevant and weighted performance indicators is essential for conducting robust sustainability evaluations. However, to date, no study has provided a holistic SPA of Nigerian HEIs that integrates weighted and prioritized indicators or employs the Delphi methodology. Given the scarcity of such research in Nigeria and across sub-Saharan Africa, the formulation of weighted and context-specific KPIs is both necessary and urgent. Existing studies in Nigeria have mainly concentrated on environmental sustainability, neglecting the broader TBL framework.

The study's objective, therefore, is to fill the gap by developing weighted and prioritized KPIs for assessing SP in Nigerian HEIs, which are currently at the early or preliminary stages of sustainability awareness and practices, using the Delphi method. This research objective is, therefore, to address the research question, "What weighted and prioritized KPIs are suitable for assessing HEIs in Nigeria, particularly within their four core activity areas—academic, engagement, operations, and governance, taking cognizance of the TBL, using the Delphi method?"

To achieve the set objective, this study developed a set of applicable KPIs in the Nigerian context by selecting preliminary indicators from the generic global and regional indicators identified in studies by Du et al. (2020); Kapitulčinová et al. (2018); Veidemane (2022), among others, to capture social and economic dimensions, while environmental indicators were extracted from Adenle et al. (2020, 2021). A Delphi study was used to validate the selected indicators and assign relative weights. Preliminary indicators include water consumption, sewage disposal, sustainable landscape management, carbon emissions, academic programs with sustainability specializations, commercialized sustainability research outputs, employees' rights, procurements from sustainable suppliers, total grants and funds for sustainability-related research, and sustainability budget.

2 METHODOLOGIES

This study adopted a mixed-methods approach to develop and prioritize KPIs for Nigerian HEIs. A Delphi study was conducted to validate the preliminary indicators and establish their relative importance for effective SPA. Figure 1 illustrates the research methodology in a stepwise manner. The methodology involved reviewing and analyzing relevant literature to identify key factors and adapting them to the Nigerian context. Indicators were categorized under four core HEI activities as shown in Figure 2, and aligned with the TBL framework (Elkington, 1998, 2004). This approach, supported by recent studies: Dawodu et al. (2023); Góes & Magrini (2016); Gulcimen et al. (2023); Konbr et al. (2023), among others, ensured a holistic evaluation framework.

The Delphi method facilitates consensus among experts from diverse or similar fields through iterative questionnaires. Experts, selected for their relevant knowledge, receive surveys in successive rounds, with each round refined by feedback from the previous one. This structured process enables the gradual refinement of opinions while systematically communicating results back to participants. The approach ensures data quality, accuracy, and validity by combining diverse perspectives into a collective judgment. Typically, the method requires at least two rounds, allowing for the progressive enhancement of expert assessments and the achievement of reliable consensus on the issue (Fefer et al., 2016; von Ruschkowski et al., 2013).

The Delphi technique is a structured method for managing expert input and validating literature findings (Lim & Antony, 2016). Consensus is typically assessed using three approaches: percentage agreement, quartile deviation (QD), and content validity ratio (CVR). Percentage agreement is based on baseline thresholds. Studies such as Donohoe & Needham (2009); Seagle & Iverson (2001), Chang et al. (2011), and Labuschagne & Brent

(2008) used baseline scores of 60%, 75%, and 80%, respectively. QD values determine the level of agreement: ≤ 0.5 indicates consensus, 0.5–1.0 moderate consensus, and >1 no consensus (Ab Latif et al., 2017). The CVR assesses item necessity using the formula CVR = (N_e – (N/2)) / (N/2), where N_e is the number rating an item "essential" and N is the total panelists. For a Likert scale of 1 to 3, which includes "not necessary, useful but not essential, essential" respectively, CVR ranges from (-1 to 1), with a higher score reflecting greater consensus among panel members regarding the necessity of an item within the instrument (Zamanzadeh et al., 2015). Lawshe's Table provides minimum CVR thresholds; for 15 experts, a CVR above 0.49 indicates significance (Ayre & Scally, 2014).

The scholarly discourse posited that a range of 9 to 13 experts is deemed suitable for the prompt and effective conclusion of a Delphi study, particularly in the context of indicator development. For instance, (Vitali et al., 2012) employed a cohort of 9 experts to formulate sustainability indicators about green public procurement, while (Hsu et al., 2017) utilized the same number to identify critical SP indicators. Three rounds of questionnaires were used for the validation process. The first-round questionnaire, including indicators and their assessment units, was developed based on available data from the literature and tested for suitability and user-friendliness by a pilot test involving three experienced academic researchers who reviewed and provided suggestions for improvements. Among the three academic researchers, two are professors while one is a senior lecturer at universities in Nigeria.

Figure 1 - Methodology flow diagram

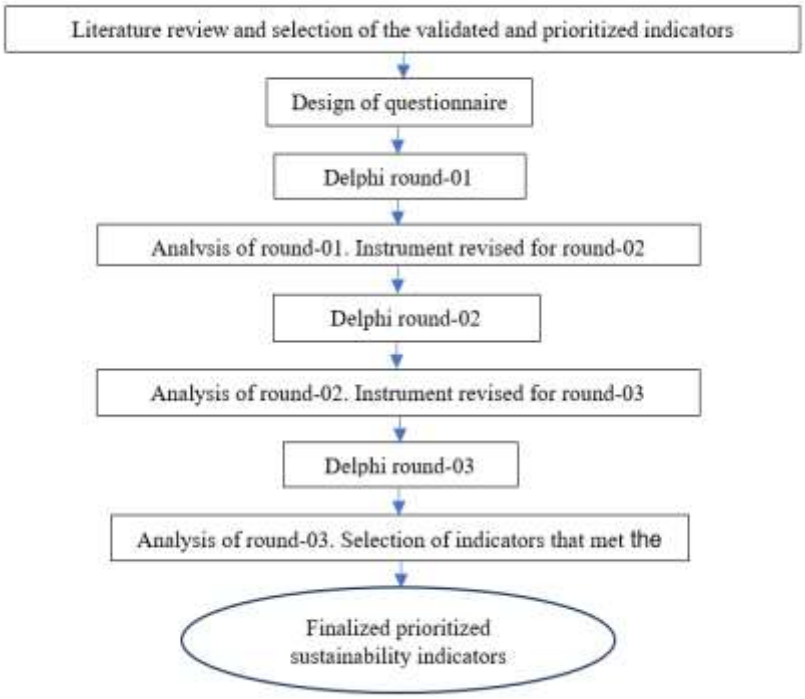
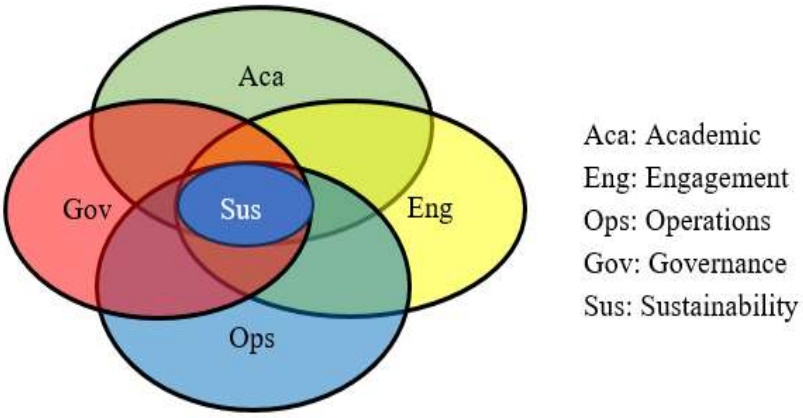


Figure 2 – Core activities of higher education institutions



The Delphi study engaged 14 experts, comprising 8 academics and 6 administrators overseeing sustainability offices or centers that are hubs of sustainability initiatives at HEIs. Other stakeholders were excluded due to limited awareness of sustainability practices. Experts were selected based on publications and recommendations from Nigerian researchers, while the list of 16 experts aligned with typical Delphi panel sizes as already discussed in the previous section. The study sought informed opinions on early sustainability development in Nigeria. A three-round Delphi process was used: round one focused on rating indicator applicability and gathering comments from experts, aiming to enhance the indicators and their assessment units. The rounds two and three followed a similar pattern. The consensus was evaluated using the QD method while reminders ensured timely responses.

3 DEVELOPMENT OF PERFORMANCE INDICATORS

This section presents the findings of the Delphi study, which aimed to establish prioritized sustainability indicators within the four HEIs' core activities or categories, along with their local weights and relative importance.

3.1 Experts' profile

The Delphi study engaged 14 Nigerian experts, including 8 academics and 6 administrators, with 11 males and 3 females (21% female representation). Efforts were made to ensure diversity across gender, institutional type, and academic/administrative roles as presented in Table 1. The proportions of the three educational sectors considered were federal (7, 50%), state (4, 29%), and private (3, 21%). Academic staff had a minimum of 2 publications and at least 3 years of experience in sustainability-related assessments, with 5 having 6 years' experience or above. Administrative staff possessed at least 3 years of work experience in sustainability offices, with half (3 of 6) having at least one publication. Experience was measured from the first sustainability-related publication or appointment to a sustainability role. Experts contributed by reviewing, correcting, and validating indicators and assessment units for applicability in the sustainability assessment of HEIs.

Table 1- Profile of the study experts

Type	Qualification	Job Position	Department	Years of Experience	Type of HEI	Gender	Publications Related to Sustainability
Academic	PhD	Professor	Engineering	10	Federal	Male	6
Academic	PhD	Professor	Engineering	7	Private	Female	3
Academic	PhD	Professor	Architecture	9	State	Male	5
Academic	PhD	Professor	Building	8	Private	Female	4
Academic	PhD	Associate Professor	Geography/ Urbanization	6	Federal	Male	3
Academic	PhD	Lecturer	Engineering	3	State	Male	4
Academic	PhD	Senior Lecturer	Engineering	4	Federal	Male	3
Academic	PhD	Senior Lecturer	Architecture	3	Federal	Male	2
Administration	PhD	Director	Sustainable Development Center	6	Federal	Male	2
Administration	PhD	Director	Sustainable Environment & Social Inclusion Center	4	Federal	Male	0
Administration	PhD	Director	Environmental & Social Development Center	5	State	Male	2

Table 1 - Profile of the study experts contd

Administration	**PhD**	**Director**	**Sustainable Environment & Social Inclusion Center**	**4**	**State**	**Male**	**1**
Administration	PhD	Assistant Director	Sustainable Environment & Social Inclusion Center	3	Federal	Female	0
Administration	PhD	Assistant Director	Community Impact Initiative Center	3	Private	Male	0

3.2 Preliminary indicators and the three Delphi rounds

The preliminary indicator set for Nigerian HEIs was developed from sustainability indicators frequently cited in the literature, as explained in detail in section 2 previously. To ensure relevance, both science-oriented and policy-oriented indicators were incorporated. Science-oriented indicators relate to knowledge generation and sustainability impact evaluation (Aljerf & Choukaife, 2016). Examples of science-oriented indicators are obtainable in environmental indicators and they include electricity consumption, carbon emissions, and solid waste generated. Policy-oriented indicators, in contrast, address social and political standards (Rametsteiner et al., 2011). Examples include employees' rights, occupational health and safety of employees, and diversity and equity coordination. While Table 2 presents only the operations category from round one, to be concise, modifications across subsequent rounds covered all sustainability dimensions.

The indicator set was structured around the TBL framework and the four core activities of HEIs. "Academic" indicators reflect sustainability integration and adoption in education, curriculum, and research. "Engagement" refers to campus and community sustainability initiatives with stakeholder involvement. "Operations" cover management policies, practices, and infrastructure, while "governance" addresses resource planning and institutional oversight.

To refine and validate the indicators, a three-round Delphi study was conducted with 14 Nigerian experts. Applicability was assessed using a five-point Likert scale (with 1 denoting very low applicability and 5 representing very high applicability). At the same time, experts were free to modify, add, or eliminate indicators and assessment units. The second-round questionnaire was adapted from round one feedback, while the primary aim of rounds two and three was to reach consensus and incorporate additional expert comments. Experts were initially given two weeks to respond, though the first round extended to three weeks due to delays. Despite this, all 14 participants completed every round, resulting in a commendable response rate and reliable consensus on the final indicator set.

Table 1 - Preliminary selected operations (O) category indicators

Indicators	Code	Description	Assessment Unit
Electricity consumption	O1	The amount of electricity consumed annually by an HEI.	kWh
Renewable energy generated	O2	The amount of renewable energy generated annually by an HEI	kW
Carbon emissions	O3	The amount of direct and indirect carbon emitted annually by an HEI.	$tC0_2e$
Water consumption	O4	The volume of water consumed annually by an HEI.	L
Solid waste generated	O5	The amount of solid waste generated annually by an HEI	kg
Toxic and hazardous waste management	O6	The extent of safe disposal and treatment of toxic and hazardous wastes in an HEI	Likert scale (1= very low, 2 = low, 3 = average, 4 = high, 5 = very high)
Rainwater used	O7	The annual volume of untreated rainwater used in an HEI	L
Campus fleet	O8	The number of registered eco-friendly transportation (electric vehicles, electric motorcycles, etc.) in an HEI	Number
Pedestrians and cycling	O9	The extent to which pedestrians and cycling are promoted and encouraged in an HEI	Likert scale (1= very low to 5 = very high)
Eco-friendly buildings and facilities	O10	The number of buildings and facilities with eco-friendly design and construction in an HEI	Number
Sustainable landscape management	O11	The extent of the use of organic fertilizers and non-toxic and non-hazardous pesticides for sustainable landscape management in an HEI	Likert scale (1= very low to 5 = very high)
Biodiversity and ecosystem services	O12	The extent of care for the sustainable coexistence of humans and other living things in an HEI	Likert scale (1= very low to 5 = very high)
Water efficiency	O13	The extent to which water minimization and efficiency measures (e.g., active maintenance of facilities, retrofitting, use of pervious paving, etc.) are put in place in an HEI	Likert scale (1= very low to 5 = very high)

Table 2 - Preliminary selected operations (O) category indicators contd.

Public space	**O14**	**The extent to which public space is utilized for recreational and sporting activities in an HEI**	**Likert scale (1= very low to 5 = very high)**
Recycling of solid waste	O15	The amount of solid waste recycled in an HEI	kg
Green space and forest land	O16	The extent to which green space and forest land are provided for and protected in an HEI	Likert scale (1= very low to 5 = very high)
Sewage disposal	O17	The extent to which sewage is efficiently and safely disposed of in an HEI	Likert scale (1= very low to 5 = very high)

3.3 The three Delphi rounds

3.3.1 Delphi round-01

The study employed 44 indicators across four categories: academic (10), engagement (6), operations (17), and governance (11). All indicators scored at least 40% (2/5) in applicability. Expert scores were used to weight indicators and categories, with those having a quartile QD above 1 excluded. Adjustments were also made based on feedback. In the academic category, "sustainability careers and recruitment" was removed due to limited opportunities in Nigeria and sub-Saharan Africa. For engagement, a new indicator on sustainability awareness was introduced, probably due to its importance in campus culture. Operations indicators such as rainwater use, biodiversity, ecosystem services, and solid waste recycling were excluded. The removal of biodiversity and ecosystem services indicators in Nigeria is likely due to a lack of enabling laws and a weak legal framework. Additionally, minimal solid waste recycling is visible in only a few cities, and it is nonexistent on most campuses. In governance, indicators on sustainability targets and strategies, as well as sustainable investment and banking, were removed. At the same time, ethical financial practices as well as welfare and well-being of staff and students, were added. This could be due to the low level of ethical financial practices prevalent in Nigeria and in many HEIs. Overall, six indicators were removed and three added, ensuring stronger contextual relevance for Nigerian HEIs.

3.3.2 Delphi round-02

In the second round, the instrument comprised a total of 41 indicators, categorized into 9 academic, 7 engagement, 13 operations, and 11 governance indicators. Each expert was apprised of the feedback from their peers and provided with a revised questionnaire for the continued assessment of the indicators (Profillidis & Botzoris, 2019). The opportunity to append supplementary information or offer commentary remained available in round two. The consensus regarding the incorporation of indicators was predicated on a QD value of less than or equal to 1 as determined by the experts, which led to the retention of specific indicators. Notably, in the operations category, sewage disposal was retained. This might have been because sewage disposal poses a significant concern in Nigeria and its surrounding regions due to the absence of a centralized sewage disposal system. The sewage indicator, integrated into the operations category of HEIs in Nigeria by experts, aligns with the research conducted by Adenle et al. (2020).

Nevertheless, all indicators that satisfied the QD score criteria were preserved. Ultimately, no new indicators were introduced; however, a change was made based on comments from experts' feedback. For example, the measuring units for water consumption and electricity consumption were Liter (L) and kilowatt-hour (kWh) respectively in the first and second rounds, but it was changed to cubic meter (m^3) and megawatt-hour (MWh) respectively in the third-round questionnaire based on the feedback received from experts during round-02.

3.3.3 Delphi round-03

In round-03, the instrument remained a total of 41 indicators, categorized into 9 academic, 7 engagement, 14 operations, and 11 governance indicators. As in previous rounds, each expert received a new questionnaire for additional assessment of the indicators and was apprised of the input of the other experts. In round-03, there was still the opportunity to provide comments or add further details. All indicators that met the QD score requirements were retained. Overall, the experts' input did not lead to the addition or removal of any new indicators or comments. The indicators and their brief descriptions, concerning HEIs, obtained after the Delphi study, are listed in Table 3, along with their corresponding assessment units.

4 RESULTS AND DISCUSSION

4.1 Results

Based on applicability scores and expert consensus, 41 sustainability indicators were finalized for Nigerian HEIs: 9 academic, 7 engagement, 14 operations, and 11 governance (Table 3). Each indicator includes its impact direction, measurement unit, quartile deviation (QD), and weight (Tables 4–7). Indicators were classified as positive (+) or negative (–), depending on whether higher scores improve or diminish sustainability. Applicability and QD scores were computed in Excel, with applicability scores forming the basis for weighting. The weight of each indicator was calculated as its applicability score divided by the total applicability scores within its category. Similarly, each category's weight was determined by dividing its cumulative applicability score by the overall scores across all four categories.

Table 3 - The finalized applicable 41 key performance indicators

Indicators	Code	Description	Assessment Unit
Sustainability-focused academic courses offered by an HEI	A1	The number of academic courses that focused on sustainability in an HEI	Number
Academic programs with sustainability specializations	A2	The number of academic programs with sustainability specializations in an HEI	Number
Sustainability training for staff development	A3	The number of sustainability trainings for staff development in an HEI	Number
Staff involved in sustainability research	A4	The number of staff involved in sustainability-focused research in an HEI	Number
Students involved in sustainability research.	A5	The number of students involved in sustainability-focused research in an HEI	Number
Intellectual property rights from sustainability-focused research	A6	The number of intellectual property rights from sustainability-focused research in an HEI	Number
Commercialized sustainability research outputs	A7	The number of Commercialized sustainability research outputs in an HEI.	Number
Publications related to sustainability	A8	The number of publications (Books, Book chapters, Journal Articles,	Number

		Conference Papers, Policy Papers, etc.) related to sustainability in an HEI.	
Centers on campus providing sustainability-related research or services	A9	The number of centers on campus providing sustainability-related research or services	Number
Sustainability culture	E1	The extent to which sustainability culture is practiced in an HEI.	Likert scale (1= very low, 2 = low, 3 = average, 4 = high, 5 = very high)
Outreach materials and publications on sustainability	E2	The extent of the availability of sustainability outreach information materials (website, bulletins, newsletters, etc.) in an HEI	Likert scale
Orientation programs on sustainability for staff and students	E3	The extent to which sustainability is incorporated into orientation programs for staff and students in an HEI	Likert scale

Table 3 - The finalized applicable 41 key performance indicators contd

Registered societies, clubs, and associations related to sustainability	**E4**	**The number of registered sustainability-related societies, clubs, and associations for staff and students in an HEI**	**Number**
Inter-campus collaboration	E5	The number of Inter-campus collaborations on sustainability-related functions and projects in an HEI	Number
Community service engagement by staff and students	E6	The number of community service engagements undertaken by staff and students in an HEI	Number
Sustainability awareness	E7	The extent of sustainability awareness in an HEI	Likert scale
Electricity consumption	O1	The amount of electricity consumed annually by an HEI.	MWh
Renewable energy generated	O2	The amount of renewable energy generated annually by an HEI	kWh
Carbon emissions	O3	The amount of direct and indirect carbon emitted annually by an HEI.	$tC0_2e$
Water consumption	O4	The volume of water consumed annually by an HEI.	M^3
Water efficiency	O5	The extent to which water minimization and efficiency measures (e.g., active maintenance of facilities, retrofitting, use of pervious paving, etc.) are put in place in an HEI	Likert scale
Solid waste generated	O6	The amount of solid waste generated annually by an HEI	kg
Sewage disposal	O7	The extent to which sewage is efficiently and safely disposed of in an HEI	Likert scale
Toxic and hazardous waste management	O8	The extent of safe disposal and treatment of toxic and hazardous wastes in an HEI	Likert scale
Campus fleet	O9	The number of registered eco-friendly transportation (electric vehicles, electric motorcycles, etc.) in an HEI	Number
Pedestrians and cycling	O10	The extent to which pedestrians and cycling are promoted and encouraged in an HEI	Likert scale
Eco-friendly buildings and facilities	O11	The number of buildings and facilities with eco-friendly design and construction in an HEI	Number
Sustainable landscape management	O12	The extent of the use of organic fertilizers and non-toxic and non-hazardous pesticides for sustainable landscape management in an HEI	Likert scale

Table 3 - The finalized applicable 41 key performance indicators contd

Public space utilization	**O13**	**The extent to which public space is utilized for recreational and sporting activities in an HEI**	**Likert scale**
Green space and forest land	O14	The extent to which green space and forest land are provided for and protected in an HEI	Likert scale
Sustainability-dedicated employees	G1	The extent to which relevant employees are dedicated to planning and managing initiatives in an HEI.	Likert scale
Procurements from sustainable suppliers	G2	The number of procurements per annum from sustainable suppliers (machines, equipment, materials, furniture, food, etc.) in an HEI.	Number
Sustainability budget	G3	The annual budget allocated to sustainability projects and initiatives in an HEI	Amount in Naira
Non-financial incentives and support for staff	G4	The extent to which non-financial incentives and support are given to employees to enhance sustainability-related teaching, research, and other initiatives in an HEI	Likert scale
Employees' rights	G5	The extent to which the rights of employees (including outsourced contract staff) are protected in line with the applicable laws and regulations.	Likert scale
Occupational health and safety of employees	G6	The extent to which the occupational health and safety of employees are protected in an HEI.	Likert scale
Total grants and funds for sustainability-related research.	G7	The amount of grants and funds received by an HEI for sustainability-related research.	Amount in Naira
Ethical financial practices	G8	The extent to which good and ethical financial practices are adopted in an HEI	Likert scale
Diversity and equity coordination	G19	The extent to which diversity (including ethnicity, religion, gender, societal status, etc.) is encouraged and equity of treatment is given in an HEI.	Likert scale
Welfare and well-being of staff and students	G10	The extent to which the welfare and well-being of staff and students are taken care of in an HEI	Likert scale
Sustainability reporting for stakeholders	G11	The level of sustainability reporting and publishing annually by an HEI for stakeholders	Likert scale (1= very low to 5 = very high)

KEY: **A** (Academic); **E** (Engagement); **O** (Operations), and **G** (Governance).

4.2 Analyses and discussion

The findings shown in Tables 4 to 7 provide the basis for a variety of insightful analyses and discussions. For the sake of simplicity, the analyses were conducted independently at the indicator and category levels, as well as by expert consensus.

4.2.1 Indicator level

The applicability scores highlight the priority of indicators for SP in Nigerian HEIs. In the academic category (Table 4), the highest-ranked indicators were commercialized sustainability research outputs (4.929), intellectual property rights from sustainability-focused research (4.357), and sustainability training for staff development (4.286). The lowest-ranked were student involvement in sustainability research (3.357) and campus centers providing sustainability-related research or services (3.286). The high ranking of research outputs and intellectual property reflects HEIs' emphasis on research as a core mandate, while training scored highly, probably due to its organizational importance. Overall, if a score of 4.0 or higher is considered highly applicable, then there were 44% (4/9) indicators in this category.

Table 4 - Final academic category indicators, quartile deviations, and weights

Indicators	Code	Quartile Deviation	Applicability (mean score)	Indicator's weight	Category's weight
Sustainability-focused academic courses offered by an HEI (+)	A1	0.375	3.643	0.104	0.207
Academic programs with sustainability specializations (+)	A2	0.500	3.571	0.102	
Sustainability training for staff development (+)	A3	0.500	4.286	0.123	
Staff involved in sustainability research (+)	A4	0.500	3.429	0.098	
Students involved in sustainability research (+)	A5	0.500	3.357	0.096	
Intellectual property rights from sustainability-focused research (+)	A6	0.500	4.357	0.125	
Commercialized sustainability research outputs (+)	A7	0.000	4.929	0.141	

Table 4 - Final academic category indicators, quartile deviations, and weights contd

Publications related to sustainability (+)	**A8**	**0.000**	**4.071**	**0.117**	
Centers on campus providing sustainability-related research or services (+)	A9	0.500	3.286	0.094	

Examining the engagement category, Table 5 reveals that sustainability awareness, community service engagement by staff and students, and orientation programs on sustainability for staff and students are the top indicators, with scores of 4.786, 4.571, and 4.000, respectively. Interestingly, community service engagement by staff and students is also one of the core mandates of HEIs, which may have informed the experts' judgment to score the indicator high. According to the existing literature on sustainability, it is widely acknowledged that sustainability awareness should be accorded the priority it deserves, as it drives the sustainability culture and enlightenment required to foster SD. Therefore, the experts scored sustainability awareness and orientation programs on sustainability for staff and students relatively highly. Overall, 43% (3/7) of the indicators were highly relevant in the engagement category, based on the criterion discussed earlier.

Table 5 - Final engagement category indicators, quartile deviations, and weights

	Code	Quartile Deviation	Applicability (mean score)	Indicator's Weight	Category's weight
Sustainability culture (+)	E1	0.000	3.929	O.137	0.169
Outreach materials and publications on sustainability (+)	E2	0.000	3.929	0.137	
Orientation programs on sustainability for staff and students (+)	E3	0.000	4.000	0.140	
Registered societies, clubs, and associations related to sustainability (+)	E4	0.000	3.857	0.135	
Inter-campus collaboration (+)	E5	0.500	3.500	0.123	
Community service engagement by staff and students (+)	E6	0.500	4.571	0.160	
Sustainability awareness (+)	E7	0.000	4.786	0.168	

For the operations category, as presented in Table 6, the topmost applicable indicators were renewable energy, campus fleet, water consumption, and electricity consumption. This result aligns with the findings of Ologun & Wara (2014) study. In the study, the carbon footprint of the Federal University of Agriculture, Abeokuta, Nigeria, was evaluated, and the findings show that the transportation category contributed the most to carbon emissions at the HEI. The high score attributed to the campus fleet by the experts is therefore not surprising. At the same time, the adoption of renewable energy is understandable, as it helps pave the way towards carbon neutrality in HEIs. On the other hand, green space and forest land, sustainable landscape management, and carbon emissions are the three lowest-ranked indicators. Additionally, 71% (10/14) of the indicators in this category were highly applicable.

Table 6 - Final operations category indicators, quartile deviations, and weights

Indicators	Code	Quartile Deviation	Applicability (mean score)	Indicator's Weight	Category's weight
Electricity consumption (-)	O1	0.500	4.571	0.077	0.353
Renewable energy (+)	O2	0.000	4.857	0.082	
Carbon emissions (-)	O3	0.500	3.429	0.058	
Water consumption (-)	O4	0.375	4.714	0.079	
Water efficiency (+)	O5	0.500	4.357	0.073	
Solid waste generated (-)	O6	0.500	4.500	0.076	
Sewage disposal (+)	O7	0.000	4.143	0.071	

Toxic and hazardous waste management (+)	O8	0.500	4.500	0.076
Campus fleet (+)	O9	0.000	4.786	0.080
Pedestrians and cycling (+)	O10	0.500	4.214	0.071
Eco-friendly buildings and facilities (+)	O11	0.500	4.357	0.073
Sustainable landscape management (+)	O12	0.500	3.500	0.059
Public space utilization (+)	O13	0.000	3.786	0.064
Green space and forest land (+)	O14	0.000	3.714	0.062

In the governance category, the most prominent indicators were welfare and well-being of staff and students, diversity and equity coordination, and employees' rights (Table 7). Experts may have assigned higher scores to these due to Nigeria's focus on well-being, labor relations, and inclusivity and equitable treatment. The welfare and well-being of staff and students emerged as the most relevant, reflecting how sensitive health is to the campus community. Notably, 82% (9/11) of governance indicators were highly applicable, the highest across all categories. This finding aligns with the quadruple bottom line (QBL)—economic, social, environmental, and governance—highlighted in the Greening Universities Toolkit V2.0 as central to sustainability in HEIs (Dave et al., 2014).

Table 7 - Final governance category indicators, quartile deviations, and weights

Indicators	Code	Quartile Deviation	Applicability (mean score)	Indicator's weight	Category's weight
Sustainability dedicated employees (+)	G1	0.000	4.071	0.089	0.271
Procurements from sustainable suppliers (+)	G2	0.500	3.571	0.078	
Sustainability budget (+)	G3	0.500	4.286	0.094	
Non-financial incentives and support for staff (+)	G4	0.000	4.071	0.089	
Employees' rights (+)	G5	0.500	4.500	0.098	
Occupational health and safety of employees (+)	G6	0.375	4.286	0.094	
Total grants and funds for sustainability-related research (+)	G7	0.500	4.286	0.094	
Ethical financial practices (+)	G8	0.000	4.143	0.090	
Diversity and equity coordination (+)	G9	0.500	4.643	0.101	
Welfare and well-being of staff and students (+)	G10	0.375	4.714	0.103	
Sustainability reporting for stakeholders (+)	G11	0.375	3.214	0.070	

4.2.2 The category levels

The analysis could also be performed at the category levels. From the operations standpoint, as illustrated in Figure 3, the operations category, comprising essentially environmental dimension indicators such as renewable

energy, campus fleet, water consumption, and electricity consumption, was prioritized over the other categories of academic, engagement, and governance in HEIs in Nigeria. The reason for this could be attributable to their high environmental impact on HEIs' environment. The governance category has the second-highest score, with 0.271, compared to 0.353 for the operations category (Figure 3). The reason for this high score by the experts could be attributed to the high concentration of the social dimension aspect of sustainability within it. These include employees' rights, occupational health and safety, diversity and equity coordination, etc. These factors have a significant social impact on HEIs.

Although the academic category was ranked lower, it has the most applicable indicator (commercialized sustainability research outputs). The experts' reason for the very high score given to this indicator may be due to the tangible benefits that commercialization can bring to the environment, economy, and society. Whilst the engagement category is of prime importance to the sustainability performance of HEIs, it was, however, ranked the lowest, as shown in Figure 3. Despite this, the indicator, sustainability awareness of the engagement category was ranked 3rd in the global priority ranking. This high score by experts underscores the importance of sustainability awareness in promoting a culture of HEIs. The global priority of all the indicators is depicted in Table 8. In addition, although the academic indicator received the highest score, there were more operations indicators (5 out of 10) among the top ten indicators based on global priority. Overall, approximately 63% (26/41) of the indicators were highly applicable. Among these high-relevance indicators, there were 15% (4/26) academic,12% (3/26) engagement, 38% (10/26) operations, and 35% (9/26) governance indicators.

Figure 3 - Category weights

Table 8 - Global priority of categorized sustainability indicators

Indicators	S/N	Sustainability category	Applicability score (out of 5)
Commercialized sustainability research outputs	1	Academic	4.929
Renewable energy	2	Operations	4.857
Campus fleet	3	Operations	4.786
Sustainability awareness	3	Engagement	4.786
Water consumption	5	Operations	4.714
Welfare and well-being of staff and students	5	Governance	4.714
Diversity and equity coordination	7	Governance	4.643
Electricity consumption	8	Operations	4.571
Community service engagement by staff and students	8	Engagement	4.571
Solid waste generated	10	Operations	4.500
Toxic and hazardous waste management	10	Operations	4.500
Employees' rights	10	Governance	4.500
Eco-friendly buildings and facilities	13	Operations	4.357
Water efficiency	13	Operations	4.357

Intellectual property rights from sustainability-focused research	13	Academic	4.357
Sustainability training for staff development	16	Academic	4.286
Total grants and funds for sustainability-related research	16	Governance	4.286
Sustainability budget	16	Governance	4.286
Occupational health and safety of employees	16	Governance	4.286
Pedestrians and cycling	20	Operations	4.214
Sewage disposal	21	Operations	4.143
Ethical financial practices	21	Governance	4.143
Sustainability-dedicated employees	23	Governance	4.071
Non-financial incentives and support for staff	23	Governance	4.071
Publications related to sustainability	23	Academic	4.071
Orientation programs on sustainability for staff and students	26	Engagement	4.000
Sustainability culture	27	Engagement	3.929
Outreach materials and publications on sustainability	27	Engagement	3.929
Registered societies, clubs, and associations related to sustainability	29	Engagement	3.857
Public space utilization	30	Operations	3.786
Green space and forest land	31	Operations	3.714
Sustainability-focused academic courses offered by an HEI	32	Academic	3.643
Academic programs with sustainability specializations	33	Academic	3.571
Procurements from sustainable suppliers.	33	Governance	3.571
Sustainable landscape management	35	Operations	3.500
Inter-campus collaboration	35	Engagement	3.500
Carbon emissions.	37	Operations	3.429
Staff involved in sustainability research,	37	Academic	3.429
Students involved in sustainability research,	39	Academic	3.357
Centers on campus providing sustainability-related research or services	40	Academic	3.286
Sustainability reporting for stakeholders	41	Governance	3.214

4.2.3 The Consensus Level

This section presents the consensus level among experts regarding the indicators. A QD score ≤ 0.5 signifies consensus, and all 41 indicators met this criterion (Table 9). Of these, 37% (15) had a QD of 0.000, 12% (5) scored 0.375, and 51% (21) scored 0.500. No indicators fell into moderate ($0.5 < QD \leq 1.0$). Similarly, there were no indicators with a "no consensus" rating (QD >1.0), as such cases were excluded earlier. Interestingly, although the engagement category had the lowest weight, it contained more indicators with perfect consensus (QD = 0.000) than the academic and governance categories, which were equalled only by operations. Meanwhile, the 21 indicators with QD = 0.500 included 6 academic, 2 engagement, 8 operations, and 5 governance indicators.

Table 9 - Global consensus on categorized sustainability indicators

Indicators	S/N	Sustainability category	Consensus score (QD)
Commercialized sustainability research outputs	1	Academic	0.000
Publications related to sustainability	2	Academic	0.000

Sustainability culture	3	Engagement	0.000
Outreach materials and publications on sustainability	4	Engagement	0.000
Orientation programs on sustainability for staff and students	5	Engagement	0.000
Registered societies, clubs, and associations related to sustainability	6	Engagement	0.000
Sustainability awareness	7	Engagement	0.000
Renewable energy	8	Operations	0.000
Sewage disposal	9	Operations	0.000
Campus fleet	10	Operations	0.000
Public space utilization	11	Operations	0.000
Green space and forest land	12	Operations	0.000
Sustainability-dedicated employees	13	Governance	0.000
Non-financial incentives and support for staff	14	Governance	0.000
Ethical financial practices	15	Governance	0.000
Sustainability-focused academic courses offered by an HEI	16	Academic	0.375
Water consumption	17	Operations	0.375
Occupational health and safety of employees	18	Governance	0.375
Welfare and well-being of staff and students	19	Governance	0.375
Sustainability reporting for stakeholders	20	Governance	0.375
Academic programs with sustainability specializations	21	Academic	0.500
Sustainability training for staff development	22	Academic	0.500
Staff involved in sustainability research,	23	Academic	0.500
Students involved in sustainability research,	24	Academic	0.500

Table 9 - Global consensus on categorized sustainability indicators contd

Intellectual property rights from sustainability-focused research	**25**	**Academic**	**0.500**
Centers on campus providing sustainability-related research or services	26	Academic	0.500
Inter-campus collaboration	27	Engagement	0.500
Community service engagement by staff and students	28	Engagement	0.500
Electricity consumption	29	Operations	0.500
Carbon emissions	30	Operations	0.500
Water efficiency	31	Operations	0.500
Solid waste generated	32	Operations	0.500
Toxic and hazardous waste management	33	Operations	0.500
Pedestrians and cycling	34	Operations	0.500
Eco-friendly buildings and facilities	35	Operations	0.500
Sustainable landscape management	36	Operations	0.500
Procurements from sustainable suppliers.	37	Governance	0.500
Sustainability budget	38	Governance	0.500
Employees' rights	39	Governance	0.500

Total grants and funds for sustainability-related research.	40	Governance	0.500
Diversity and equity coordination	41	Governance	0.500

5 RESEARCH IMPLICATIONS

This study represents the first comprehensive effort to establish a set of sustainability indicators, with assigned weights, tailored explicitly for HEIs in Nigeria. To date, no comparable work has been reported in the literature. Methodologically, it is also the first to employ the Delphi approach for developing weighted and prioritized KPIs for HEIs. The indicators are contextualized within Nigeria's unique cultural setting, characterized by a multi-religious, multi-ethnic, and racially diverse population.

Practically, these indicators provide HEIs in Nigeria—and potentially in similar contexts—with tools to assess sustainability performance across categorized perspectives (Table 8). Such assessments would enable institutions to monitor progress and identify areas for improvement. While some indicators align with a single sustainability dimension, others span multiple dimensions, as explained in section 1 previously. The assigned weights enhance the accuracy and reliability of evaluations.

For researchers, the indicators and weights offer a basis for future studies, facilitating relevant comparisons and supporting the development of frameworks, methods, databases, or other tools for sustainability assessment. Notably, the study underscores the Delphi method's utility in producing credible, consensual indicators, offering guidance for future sustainability assessment research.

CONCLUSIONS

Sustainability has become increasingly important in addressing environmental challenges, social inequalities, and economic instabilities. HEIs, like other sectors including manufacturing and government, must align their operations with the earth's finite resources, making it essential to evaluate SP from a TBL perspective. Nevertheless, research on HEIs in Nigeria has focused mainly on the environmental dimension, often neglecting social and economic aspects. A lack of context-specific, practical indicators also remains a barrier, as most existing studies originate from developed countries, leaving Nigeria and other sub-Saharan nations underrepresented. To address this gap, this study developed and prioritized comprehensive, weighted, and consensus-based key performance indicators (KPIs) for Nigerian HEIs, covering their four core activities: academic, engagement, operations, and governance. The Delphi method was employed, engaging academic experts to validate and assign weights to the indicators.

Findings revealed that the operations category was most highly prioritized, followed closely by governance, highlighting the centrality of effective governance and management in any institution, including HEIs. In total, 41 KPIs were established, comprising 9 academic, 7 engagement, 14 operations, and 11 governance indicators. A global priority analysis identified commercialized sustainability research outputs, renewable energy, campus fleet, and sustainability awareness as the top four indicators. Notably, five of the top ten belonged to operations, though the highest-ranked indicator (commercialized sustainability research outputs) came from the academic category. Overall, 63% (26 of 41) of the indicators scored highly on applicability (≥4.0), including 4 academic, 3 engagement, 10 operations, and 9 governance indicators.

Consensus analysis further showed strong agreement among experts, with all 41 indicators falling within the defined consensus range. Specifically, 37% (15 out of 41) of the indicators recorded a QD score of 0.000, 12% (5 out of 41) indicated a QD of 0.375, while the remaining 21 out of 41 (51%) had a QD of 0.500. The 51% of indicators that attained a QD of 0.500 included 6 academic, 2 engagement, 8 operations, and 5 governance indicators. In addition to the study's practical applicability, implications, and valuable conclusions, the indicator weights, in particular, are unique to Nigerian HEIs. Furthermore, some of the indicators—such as ethical financial practices, sewage disposal, diversity (inclusivity, impartiality, religious tolerance, nationalism, and gender neutrality), and equity coordination—may be more relevant in Nigeria. These context-specific KPIs provide a

practical framework for assessing and improving the SP of Nigerian HEIs, while offering transferable insights for similar settings.

Declaration of competing interest

We authors declare no financial interests, personal relationships, or proprietary interests in any material discussed in this article.

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