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Sustainable Assessment Tool For Higher Education Institutions In Malaysia: The Inclusion Of Education Criteria

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Abstract– *Higher Education Institutions (HEIs) shall play a vital role in advocating sustainability due to their size and population. Given the pressing need for sustainable development and the current shortage of sustainable HEIs in Malaysia, this study aims to incorporate educational criteria into a sustainable assessment tool (SAT) for evaluating sustainable HEIs in Malaysia. This study employs a mixed-methods approach, combining a systematic literature review with the selection of suitable indicators for measuring sustainable HEIs. 30 indicators, focusing on educational criteria, were identified. Subsequently, questionnaires were conducted in ten (10) public HEIs to validate these education indicators. Analysis using SPSS software revealed that all thirty indicators were deemed essential for inclusion in the educational criteria for measuring. The study revealed 30 education indicators from the selected SATs and by employing SPSS software, the top five most significant indicators, were identified as: (1) funding for program development, (2) funding for research and innovation, (3) funding for training, (4) sustainable course and (5) sustainable research. The research mainly contributes to developing a SAT for HEIs in Malaysia which is the main research gap. Initially, it will assist green organisations and the other HEIs in creating an evaluation tool for sustainable HEIs, as the methods already in use are mostly intended for use with residential, commercial, and infrastructure facilities. Second, it will boost the total number of sustainable HEIs. Thirdly, it will allow academics to serve as sustainability assessors.*

Index Terms—*Higher education institutions, Sustainable higher education institutions, Green campus, Sustainable assessment tool, Sustainable development education.*

I. INTRODUCTION

Higher education institutions (HEIs) are one of the essential developments in every country that shall initiate the expansion and implementation of sustainable practices due to their significant contribution to the environmental impact (Bautista-Puig & Sanz-Casado, 2021). HEIs are increasingly crucial in advancing sustainability (Howarth et al., 2023) since they are considered 'small cities' due to the large community and campuses (Santa et al., 2019), high level of social responsibility, and the crucial role in the development of social behaviors (Heravi et al., 2021; Sepasi et al., 2019). Adopting sustainable practices in HEIs has been a longstanding global initiative, since 1990s. The HEIs worldwide are taking on a significant role, not only in teaching and research, but also in advocating for sustainability beyond their institutional confines. Every HEI must prioritize sustainability, as this is no longer optional. This is because HEIs can effectively disseminate influential ideas and concepts to society, they play a crucial role in fostering a shift toward sustainable thinking and raising awareness about the importance of sustainability. This is achieved not only through curricula and academic research but also through

implementing positive environmental practices in educational buildings, aimed at reducing adverse impacts on the environment (Abdalla et al., 2020). "If you cannot measure it, you cannot improve it" concept has frequently been a topic of discussion across numerous fields" (Krskova et al., 2021). Measuring each achievement or goal against a standard is a common practice to ensure its quality. Assessment is one of the methods used to measure something's or someone's abilities towards a certain part while assessment tools refer to the techniques used to do the measurement. Sustainability assessment tools (SATs) have been implemented in various fields and industries to improve decision-making at the level of policy, program, and project (Coteur et al., 2020). SATs are considered one of the initiatives towards the path of sustainability, and SATs have become crucial elements in sustainable development (Du et al., 2020; Filho et al., 2023; Freidenfelds et al., 2018; Husaini et al., 2018; Parvez & Agrawal, 2019). It can be in the form of rubrics, checklist, weightage, etc. as the main purpose is to guide the outcome of the assessment.In Malaysia, the Minister of Higher Education (MOHE) is responsible for the development of a better HEIs ecosystem. HEIs refer to a university, a university college, a university branch, a college or polytechnic, and community colleges and include both public and private institutions. Public universities are the universities, which are funded by the government while private universities are the universities that are established by financially sound corporations. On the other hand, polytechnics and community colleges are established to train technical assistants and technicians in various engineering fields. The number of HEIs in Malaysia also has witnessed tremendous growth in the last two decades. There are more than 595 universities with 3.18 million students by the end of 2021. According to Fuchs et al. (2020), HEIs must transformed into 'green campuses' in order to foster a community that is concerned with environmental issues. However, only 4.7% of HEIs in Malaysia were rated as sustainable HEIs. This number is extremely low due to the absence of sustainable criteria pertaining to the HEIs and lack of indicators and initiatives to measure HEIs sustainability (Adenle et al., 2020; Isa et al., 2021). Even though Malaysia has developed many sustainable assessment tools, none of the tool were designed specifically to measure sustainable HEIs due to the absence of education criteria. Whereby, most sustainable tools do not mainly cover academic indicators in measuring sustainable HEIs (Rosa et al., 2024). It should not have happened since the main role of HEIs is to educate youth and prepare future generations by providing adequate opportunities to learn about recent developments and future needs for sustainable societies (Habib et al., 2021). This research aims to develop education criteria and indicators to measure sustainable HEIs in Malaysia. Education is believed to shape people's thoughts and actions, playing a vital role in raising public awareness about the consequences and impacts of unsustainable practices on society (Menon & Suresh, 2022). Specifically, this study seeks to address two objectives:

1) Identifying and evaluating the important education indicators in developing sustainable HEIs in Malaysia; and
2) Developing the education indicators for measuring sustainable HEIs in Malaysia.

II. LITERATURE REVIEW

A. Higher Education Institutions (HEIs)

Education is an essential discipline in every country, and it is also a powerful driver of development and one of the most potent instruments for reducing poverty, improving health, gender equality, peace, stability, and many more as set by the United Nations (UNs) in the 17 sustainable development Goals (SDGs). For every individual, education promotes employment, earnings, living, health, and poverty reduction, while for society, it drives long-term economic growth, strengthens institutions, and fosters social cohesion. From kindergarten to primary school and secondary school, knowledge is disseminated at a suitable level before people enter HEIs. Therefore, HEIs are well known as places to educate people, as they provide experts, materials, equipment, and facilities. Numerous scholars have recognized HEIs as a prime channel for achieving Sustainable Development Goals (SDGs) through education (Adhikari & Shrestha, 2024). Researchers have also highlighted HEIs as spaces for cultivating future leaders (Ribeiro et al., 2021) while simultaneously functioning as real-time laboratories (Parvez & Agrawal, 2019). Moreover, demonstration projects where future citizens are trained. HEIs also vital place to disseminate knowledge from facilitators and a place where ideas and creative innovation are produced (Zainordin &

Ismail, 2018)). As a result, HEIs cultivate talent for industries and becoming a part of a country property (Wu & Liu, 2021).

B. Sustainable Higher Education Institutions

Green building is known as buildings with designs that can reduce the overall impact of the built environment on human health and the natural environment (Nain et al., 2021). However, the term 'green building' is only specified to a building, or a structure, and their criteria are limited to the buildings or structures only. This differs from green campuses, sustainable campuses, or sustainable Higher Education Institutions (HEIs), whose scope extends beyond building infrastructure to encompass academic accomplishments. Previous researchers have formulated numerous definitions concerning sustainable HEIs (Table 1).

Sustainable HEIs are defined by (Aleixo et al., 2018; Dawodu et al., 2022) as 'An education institution that grants academic degrees that promote, concern and involve, on a regional or university level, the minimize a negative environmental, economic, societal, and health impacts generated in the use of their resources to achieve its functions of teaching, outreach and partnership, and stewardship in ways to help society to make the transition to a sustainable lifestyle'. Atici et al. (2021) described sustainable HEIs are institutions concerned with the environment and research, enhancing their campus setting and infrastructure to create a more environment-friendly environment and ensure their curricula cover environmental and sustainability courses. Biancardi et al. (2023) and Findler et al. (2019) claimed that, sustainable HEIs can be achieved through education and research, building behaviours, and community sharing. Fissi et al. (2021) highlighted that the elements of sustainable HEIs shall consist of (1) curriculum, (2) research, (3) campus operation, (4) community engagement, and (5) teaching. Sustainable HEI is also known as institutions that can minimize negative impacts on the environment, economy, society, and well-being (Krskova et al., 2021; Rinawiyanti et al., 2023). Table 1 presents other interpretations of sustainable HEIs. Sustainable HEIs not only focus on protecting people, the economy, and the environment but also integrate sustainability into their curriculum, research and innovation, campus setting and infrastructure, community engagement, and teaching.

Table 1. Definition of Sustainable HEIs

Definition of Sustainable HEIs	Author/ year
Enhancing campus setting and infrastructure and sustainable curriculum	(Atici et al., 2021)
Sustainable HEIs can be achieved through building behaviors and community sharing	(Biancardi et al., 2023; Findler et al., 2019)
Sustainable HEIs shall consist of 1) Campus operation, 2) teaching, 3) research, 4) community engagement	(Fissi et al., 2021)
Sustainable HEIs can minimize negative impacts on the environment, economy, society, and well-being	(Krskova et al., 2021; Rinawiyanti et al., 2023)
At a regional or global level, institutions are created to promote the minimization of adverse environmental, economic, social, and health effects and fulfill their teaching, research, outreach partnership, and stewardship functions.	(Aleixo et al., 2018; Dawodu et al., 2022)

Having sustainable campus operation, sustainable research, public outreach, cooperation between universities, sustainable curricula, and green reporting	(Freidenfelds et al., 2018)
Sustainable campus aspects are governance, education, research, and engagement.	(Du et al., 2020)
Sustainable campus resources and curricula, sustainable educational experience, sustainable administration and management of material resources, and sustainable governance.	(Gutiérrez-Mijares et al., 2023)
Incorporate curriculum, operations, community outreach programs, and research.	(Menon & Suresh, 2022)

C. Sustainable Assessment Tool (SAT) for Higher Education Institutions (HEIs)

Assessment is one of the methods used to measure something's or someone's abilities towards a specific part, while assessment tools refer to the techniques used to measure them. The tool can be checklists, rubrics, multiple choice questions, reports, etc. Sustainable assessment tool (SAT) is considered one of the initiatives towards the path of sustainability, and SAT has become a crucial element in sustainable development (Du et al., 2023; Findler et al., 2019; Husaini et al., 2018). Malaysia has created numerous green building rating systems (GBRTs) encompassing diverse subcategories, such as assessments for new and existing buildings, residential and non-residential properties, resorts, hotels, restaurants, interior designs, heritage buildings, commercial spaces, and industrial facilities. Approximately 10 such assessment tools have been developed by different organizations. The Green Building Index (GBI) was the earliest established in 2009. Followed by GreenRE, Malaysian Carbon Reduction and Environmental Sustainability Tools (MyCREST), Skim Penilaian Penarafan Hijau JKR (PhJKR), Low Carbon Cities Framework and Assessment System (LCCF), Green Performance Assessment System (Green PASS), (Bespoke Township Sustainability Index) SUSDEX, CASBEE Iskandar, The Malaysia Green Highway Index (MyHGI) and Melaka Green Seal. Only GBI and GreenRE are the most suitable tools to measure sustainable HEIs under the township category. However, the tools are still lacking of education criteria and none of the tools were specifically designed to measure sustainable HEIs, resulting in a lack of sustainable HEIs and slow progress, particularly in developing countries (Aleixo et al., 2018).

SAT is actually a common practice not only in measuring sustainability but also use for products, policy and institutional appraisal. It also can be applied for countries, regions, states, cities, universities or planning and development of documents (Gomez & Yin, 2019). Using SATs for HEIs is not recent, as its implementation and adoption in various countries date back to the 1990s, and the trend is rising (Husaini et al., 2018). This trend is evidenced by the proliferation of SATs developed over the years. Research conducted by Du et al. (2020) identified 40 SATs globally, indicating a growing interest in sustainable HEIs since their inception. Additionally, various studies have examined varying numbers of SATs for HEIs, further underscoring the increasing attention and research dedicated to this area (Dawodu et al., 2022; Parvez & Agrawal, 2019; Ribeiro et al., 2021; Zainordin & Ismail, 2018).

Various SATs have been developed for both global and regional contexts, including SATs for HEIs. Each SAT differs in its assessment methods, indicators, and weightage. Recently, the UI GreenMetric, a popular tool, has significantly increased the number of sustainable HEIs worldwide. This is evident from the rising number of sustainable HEIs since its establishment. However, measuring sustainable HEIs remains complex and challenging due to the diverse practices and cultures in different regions.

III. RESEARCH METHODOLOGY

This research employed a mixed-method approach, and the method employed is similar to the previous study (Du et al., 2020; Griebeler et al., 2022). The primary strategy used was selecting and identifying articles that compare SATs. Ultimately, 10 articles were chosen for analysis, followed by the selection of SATs from the selected articles. Next, the chosen SATs were analyzed to discover crucial educational indicators for developing SATs specifically designed to measure sustainable HEIs. Eventually, questionnaire surveys were distributed to the academicians at ten (10) selected public HEIs in Malaysia to confirm the education indicators. The number of 10 public HEIs was chosen out of 595 HEIs. The chosen number is deemed appropriate, considering that the focus and limitation of the study are only towards public HEIs in Malaysia, where the total number of public HEIs was 20. The remaining 575 institutions, which include colleges, polytechnics, community colleges, and private institutions, fall outside the scope of the researcher's study. Ten (10) public HEIs were selected in this study, following a similar approach by Yaakub and Mohamed (2020) who selected 7 public HEIs.

A. Selection of sustainable assessment tool

Numerous sustainable assessment tools have been established globally to evaluate sustainable HEIs. In a study conducted by (Du et al., 2020), 73 distinct types of sustainable assessment tools for HEIs were recognized. To devise indicators for gauging sustainable HEIs in Malaysia, a thorough review of pertinent literature determined the selection of sustainable assessment tools specific to HEIs. This literature review targeted journals and articles comparing SATs designed for HEIs. A search query was executed on Scopus to locate relevant articles.

TITLE-ABS-KEY (“sustainability” OR “sustainable development”) AND
TITLE-ABS-KEY (“higher education institutions” OR “university” OR “campus”) AND
TITLE-ABS-KEY (“assessment” OR “reporting” OR “benchmarking”)
Document type = article
Language = English
Source type = journal

The search identified 2,956 articles from a single database, and then a screen of the articles was made. The screening was based on the criteria specified in Table A 1 and supported by the PRISMA, which consists of a checklist and a flow diagram to improve the reporting of systematic reviews (Table A 1 and Figure A 1 in Appendix A). The PRISMA statement is a guidance designed to help authors to complete their systematic review transparently reporting the purpose of the review, the methods used, and the findings obtained (Page et al., 2021). As a result, five (5) articles were identified. The selected articles were based on 2018 to present to ensure coverage of a period of less than 10 years, making it relevant to focus on articles from the past 5 years as well (Paul & Criado, 2020). The articles specifically examine HEIs, not buildings, schools, or other institutions. The main focus is on the SATs for HEIs, with a comparison of more than 3 SATs. These are the reasons for the extreme reduction of the identified articles. The extreme reduction of the selection of the articles is also similar to the study of (Dawodu et al., 2022). In addition to the 5 publications included in the study data, an additional 5 articles were found by cross-referencing (Dawodu et al., 2022; Findler et al., 2018; Husaini et al., 2018; Zainordin & Ismail, 2018). The 5 papers also evaluate and contrast assessment techniques for HEIs. Consequently, 10 publications were deemed the most pertinent for the study. These articles centre around a comparative examination of SATs and a proposal for a new framework that evaluates the SATs as a foundation.

In these articles, fifty-one (51) SATs were identified. The SATs were screened, and nine (9) SATs were often compared in the selected articles. In the end, nine (9) SATs were chosen for analysis. A brief description of each SAT is given.

1) The Sustainability Assessment Questionnaire (SAQ) was released by University Leaders for Sustainable Future (ULSF). It is a qualitative survey designed to elevate awareness, stimulate discussion, and offer an overview of sustainability status. It is accessible online for HEIs to utilize.

2) Campus Sustainability Assessment Framework (CSAF) - developed by Lindsay Cole in her master thesis with the help of 15 other researchers in 2000. The framework comprises ten indicators: health and well-being, community, governance, knowledge, economy and wealth, water, materials, air, energy, and land.

It was found that some of the indicators in CSAF overlap; however, the tool is considered a holistic and comprehensive framework (Parvez & Agrawal, 2019).

3) Auditing Instrument for Sustainability in Higher Education (AISHE) – was published by The Dutch Foundation for Sustainable Higher Education. Widely utilized across Europe, AISHE has been implemented in approximately 30 countries.

4) UI Green Metric (UIGM) - developed by Universitas Indonesia in 2010. The assessment is based on the annual survey data collected from all HEIs worldwide; the tool has improved since the initial version. The rankings are published every December via their website based on the data given by the participating HEIs (Atici et al., 2021).

5) Sustainability Tracking, Assessment, and Rating System (STARS)—developed by the Association for the Advancement of Sustainability in Higher Education (AASHE) over several years with the help of many students, staff, faculty, and administrators drawn from a wide range of institutions. STARS is a rating system and not a ranking system. It is a self-assessment tool that helps to provide a clear and thorough system by which HEIs can benchmark where they are today and set goals for the future.

6) Adaptable Model for Assessing Sustainability (AMAS)—This tool evaluates the sustainability of HEIs "across various stages of implementation and under different data availability conditions," tailored to the Chilean context. It has been extensively utilized in five HEIs throughout Chile.

7) Sustainability Tool for Auditing for University Curricula in Higher Education (STAUNCH) – developed by Lozano in 2007 at the Economic and Social Research Council-funded Center for Business Relationship, Accountability, Sustainability, and Society at Cardiff University. STAUNCH aims to quantify curriculum content by assigning scores to sustainability course material. This content was classified as "economic," "environmental," "social," or "cross-cutting" themes. The tool aimed to identify the percentage of courses integrating sustainability content and determine whether the emphasis was on environmental aspects like pollution and climate change or social elements such as poverty and diversity.

8) Graphical Assessment of Sustainability in Universities (GASU) is a benchmarking tool that emerged through adaptations of the Global Reporting Initiative (GRI) Sustainability Guidelines. It underwent updates 2011 to synchronize with GRI G3. 12 universities have utilized Gasu.

9) The Swedish/Africa International Training Programme (ITP) supported the unit-based sustainability assessment tool (USAT), which was formulated using elements from SAQ, AISHE, and GASU. (Singh et al., 2023)Designed for adaptable use at both partial or institutional levels, USAT endeavors to "spotlight potential change projects/areas for future development and growth." The tool has been implemented across approximately 18 universities in African nations.

B. Comparison of sustainable assessment tools

Each of the selected SATs was compared based on the essential characteristics, year, context, and education indicators to draw a general picture of how education criteria are measured in sustainable HEIs (Table 2). Then, the education indicators were studied based on the definition of sustainable HEIs (Aleixo et al., 2018; Biancardi et al., 2023; Dawodu et al., 2022; Du et al., 2020; Fissi et al., 2021; Freidenfelds et al., 2018; Gutiérrez-Mijares et al., 2023; Khovrak, 2020; Menon & Suresh, 2022; Rinawiyanti et al., 2023). At some point, the education indicators shall cover the elements of curriculum, research and innovation, campus setting and infrastructure, community engagement, and teaching. 85 education indicators were identified from all the selected SATs and thirty (30) indicators were then adopted as per Figure 1.

Table 2: Comparison of SATs (Enlarge the Table here)

SATs	Context	Year	No. of Education indicator	Education Indicators
STAUNCH	Regional (United Kingdom)	2007	4	Economic, environmental, social, cross-cutting themes

SAQ	Global	2009	10	Research and scholarship, sustainable research, sustainable research scholarship, percentage of sustainable research, percentage of sustainable teaching, percentage of interested lecturers in teaching sustainable courses, percentage of interested lecturers in doing sustainable research, sustainability center for research, education, and policy
CSAF	Regional (Canada)	2009	8	Orientation training, ongoing training, research collaboration, research funding, research practice, internalization of learning, education, and curriculum development
AISHE	Global	2009	9	Profile of the graduate, educational methodology, role of the

				teacher, student examination, curriculum, integrated program handling, traineeship, graduation, and specialty
USAT	Regional (Africa)	2009	6	Curriculum, teaching approach, research and scholarship activity, community service, assessment of sustainability topics, and staff and expertise and willingness to participate in sustainability teaching and research.
GASU	Global	2011	22	Sustainability courses, number of students enrolled in sustainability-related courses, number of courses with some sustainability content, specific course to educate the educators in sustainability, management procedures, course title and sustainable theme contained,

				course structure, goals, and duration, management structures, administrative support, sustainability research, percentage of graduate doing research sustainability, percentage of faculty doing research in sustainability, institutional support, number of research projects, list of issue addressed, list of knowledge field involved, list of faculty members and departments, type of support provided, list of department and center involved, total revenue from grants, published research on sustainability, number and function of center on campus providing sustainability-related.
AMAS	Regional (Chile)	2014	4	Sustainability-related programs, sustainability-

				related research, sustainability-related presence on the web, and inter-campus collaboration on sustainability
UIGM	Global	2019	11	Sustainable courses, sustainable research, scholarly publications, sustainable events, sustainable activities, sustainable websites, sustainable reports, cultural activities, university sustainable programs, sustainable community service, and sustainable start-ups.
STARS	Global	2019	11	Academic courses, learning outcomes, undergraduate program, graduate program, immersive experience, sustainable assessment, incentives, campus as a living lab, research and

				scholarship, sustainable research support, and open research access.

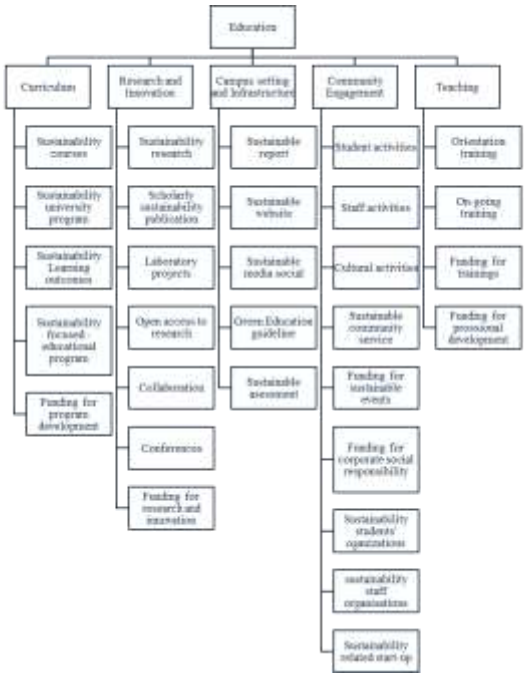

Figure 1: Education Indicators in Measuring Sustainable HEIs (Enlarge the Figure here)

C. Questionnaire survey

Subsequently, a questionnaire survey was conducted to achieve the aim of this study. The questionnaire survey was divided into two sections: (1) Demographic background, and (2) Confirmation of the education indicators. While the indicators are based on existing Sustainable Assessment Tools (SATs) used in other countries, it is important to finalize each one to accommodate cultural differences. Furthermore, sustainable practices in Malaysian HEIs are still in their early stages, and no specific indicators have been highlighted by MOHE for sustainable HEIs. The proposed indicators can be refined and improved during the post-implementation phase, incorporating feedback from the participating HEIs. The survey was conducted at ten (10) of the most sustainable public HEIs ranked by UIGM specifically focused either at the Faculty of Built Environment, Engineering or Architecture. The faculty was selected due to the fact that a majority of the building accessors in Malaysia came from this background. However, academicians from the other faculty also were accepted. The completion of the questionnaire will take around 15 to 20 minutes. Google Form is chosen as the preferred way for delivering the questionnaire to respondents because to its user-friendly interface, simplicity, and comprehensive response data. After conducting a thorough analysis of the websites of each HEI, a total population of 827 individuals was identified within the specific faculty of ten (10) public HEIs in Malaysia. The sample size was determined using the Survey Monkey sample calculation method, with a standard confidence level of 95% and a margin of error of 5%. Hence, a grand total of 262 academic samples is necessary.

IV. RESULT

A. Result of selected assessment tool

The systematic literature review resulted in a list of 85 indicators used to evaluate sustainable HEIs from regional and global perspectives. After connecting these indicators with the definition of sustainable

HEIs, 30 indicators were selected, as per Figure 1. The findings reveal that the first assessment tool, STAUNCH, was developed in 2007. Several tools emerged in 2009, including SAQ, CSAF, AISHE, and USAT. GASU followed in 2011, with AMAS in 2014. The most recent additions to the lineup are UIGM and STARS, introduced in 2019. STAUNCH emerged as the earliest tool, while UIGM and STARS represent the latest additions. All the 9 SATs have been developed between 2007 and 2019.

In terms of context, the investigated SATs are mainly created for global applications and not specifically designed for their country while the other SATs were designed for their country like STAUNCH was designed to evaluate sustainable HEIs in the United Kingdom (UK), CSAF was designed for HEIs in Canada, USAT designed for HEIs in Africa and AMAS was designed for HEIs in Chile.

In terms of the number of education indicators, the highest education indicators come from GASU with 22 indicators, UIGM, and STARS come second with 11 indicators followed by SAQ with 10 indicators, AISHE (9 indicators), CSAF (8 indicators), USAT (6 indicators), while STAUNCH and AMAS had the lowest education indicators with only 4 indicators as illustrated in Table 2.

The first objective of this research has been achieved through the selection and analysis of the selected SATs as presented in Figure 1. Looking at the education indicators, it is found that the frequent indicators are sustainable courses, sustainable content or learning outcomes, sustainable programs, sustainable research, and sustainable websites. While the other indicators are found least listed in the SATs. All of the indicators are then summarized in Figure 1.

B. Result of questionnaire survey

The questionnaire survey started on 12th August 2023 until 12th January 2024 and was distributed via emails, WhatsApp applications, and hard copy distribution. The first stage of the survey was conducted via email beginning on 12th August 2023 as email is the most convenient way to distribute the survey (Stockemer & Stockemer, 2019). Besides, some questionnaires were distributed via WhatsApp application as an alternative but for those who are reachable. Email reminders were sent after a few weeks to increase the percentage of response rate; however, after a few weeks of sending the questionnaire, the response rate was found to be very low (10% response rate). To increase the response rate, the hardcopy questionnaire was sent to the HEIs after two (2) months (starting on 12th October 2024) and two (2) weeks were given for the respondents to complete and return their questionnaire. The face-to-face survey was supported by little incentive to increase the participant rates, which has been very effective in increasing participation as suggested by Stockemer and Stockemer (2019). Due to the different locations of HEIs and travelling requirements, three (3) months were taken to complete the questionnaire survey to collect 262 respondents (See Figure 2). As a result, 181 academicians responded to the survey, as depicted in Table 3. The discrepancy between the sample size and the total respondents is due to the unavailability of the academicians during the face-to-face data collection as most of them were busy with classes, training, workshops and also taking semester breaks. The response rate for this study was 69%. Based on the sample size explained in Section 3.3, the returned questionnaire required 262 responses to represent the total population of the study adequately. However, a similar study from Govindaraju et al. (2018) collected 175 academicians in public HEIs in Malaysia. Therefore, 181 returned respondents were exceeded from previous studies and considered adequate. In addition, the intended participants were professors, associate professors, professional architects, engineers, quantity surveyors, and others who understand sustainability in HEIs and can articulate their perceptions of the subject.

Figure 2: Timeline for Data Collection

Table 3: Response Rate

	Number of questionnaires		
Respondents	Distributed	Returned	Response rate
Academicians	262	181	69%

The analysis of the questionnaire survey has been divided into two parts. The first part presents the demographic background of respondents. The second part is the required indicators to measure sustainable HEIs in Malaysia. The data analysis was conducted using SPSS software. SPSS stands for Statistical Package for Social Science, and it is one of the most popular statistical packages that can analyze highly complex data manipulation and analysis with simple instructions.

C. Demographic profile of respondents

To ensure the reliability of the education indicators, the questionnaire survey was distributed to the academicians at the public HEIs regarding their opinion on the education indicators to measure sustainable HEIs in Malaysia. This was achieved by determining the frequency of occurrences of education indicators from the respective respondents.

Section A asks general questions about the respondent's background. The purpose of this question was to help the researcher identify the academic background, teaching experience, the respondents' institutions, and involvement in campus sustainability of the respondents. The result is depicted in Table 4. The findings indicate that the lowest response rate, at 2.2%, was from building surveyors, while civil engineers exhibited the highest response rate at 7.7% from a particular background. The highest percentage also comes from other backgrounds which is 54.1% from real estate, park and amenity management, environmental management, forestry, social science, and many more. The other percentage of 3.9% of the respondents were Architects, 7.7% were mechanical and electrical engineers, 10.5% were quantity surveyors, 6.1% were construction management, and 3.9% were estate management. This implies that there are two groups of academicians almost half of the respondents have construction backgrounds and another half come from different industries.In regard to their academic background, on average, the respondents have gained more than five years of experience in the academic area. However, only 13.3% of the survey participants have less than five years of working experience. The data analysis revealed that the respondents possessed extensive experience in the academic domain and have contributed their insights over the years to shape the establishment of educational indicators. In summary, the relative experience and competence of the survey participants are sufficient and can be trusted to accurately represent the actual population, thus lending credibility to the collected survey data. Among the respondents, the highest respondents 41.1% were affiliated with UTHM, followed by the second highest respondents 34.3% were from the UiTM Shah Alam campus. While lowest or no respondents were received from UiTM Puncak Alam, UMP, and UNiSZA. The respondents were asked about their involvement in campus sustainability, such as integrating sustainable learning outcomes into teaching and learning, conducting sustainable research, and developing sustainable programs. Findings revealed that 91.2% of respondents were actively involved in campus sustainability initiatives, while 8.8% were disengaged. This outcome indicates that the respondents were aware of and familiar with campus sustainability initiatives.

Table 4: Demographic Profile of Respondents

Area	Frequency (No)	Percentage (%)
Academic Background		
Architect	7	3.9
Civil Engineer	21	11.6
Mechanical and Electrical Engineer	14	7.7
Quantity Surveyor	19	10.5
Building Surveyor	4	2.2
Construction Management	11	6.1
Estate Management	7	3.9
Others	98	54.1
Academic experience		
More than ten years	128	70.7
Five years to 9 years	29	16.0
Less than five years	24	13.3
Higher Education Institutions		

UiTM Shah Alam	62	34.3
UiTM Puncak Alam	0	0
UPM	27	14.9
UTM	13	7.2
UTHM	75	41.4
UM	1	0.6
UMP	0	0
UteM	1	0.6
UNiSZA	0	0
UMS	2	1.1
Involvement in campus sustainability		
Yes	165	91.2
No	16	8.8

D. Indicators in measuring sustainable Higher Education Institutions (HEIs)

A five-point Likert scale was used to determine the 30 indicators in measuring sustainable HEIs with values on the scale as follows: 1 as "strongly disagree," 2 as "disagree," 3 as "neither agree nor disagree," 4 as agree and five as "strongly disagree." Hence, factors with mean scores between 4.00 and 5.00 are considered as having high frequent occurrence indicators. Meanwhile, the factors with mean values from 3.00 to 3.99 are considered to have moderate occurrence. Meanwhile, the factors with mean values less than 3.00 are considered low occurrence.

Based on Table 5, all the adopted 30 indicators under the five areas needed to be included in the education criteria to measure sustainable HEIs in Malaysia. Table 5 shows the rank of the education indicators rated by academicians from the selected public HEIs in Malaysia. The developed education indicator facilitated the accomplishment of objective two in this study. Following the interpretation of the five-point Likert scale, the analysis of the survey data indicated that the mean score for the thirty (30) education indicators ranged from 4.0497 to 4.3778, and the standard deviation ranged from 0.61822 to 0.79223. This resulted in all thirty (30) indicators being agreed to be inserted as education indicators in measuring sustainable HEIs. This is because factors with mean scores between 4.00 and 5.00 are considered as having high frequent occurrence indicators, as mentioned in previous paragraphs.

Table 5: Education Indicators and Ranking in Measuring Sustainable HEIs

Indicators	Mean	Standard deviation (SD)	Ranking
Funding for program development	4.3778	0.64432	1
Funding for research and development	4.3702	0.70000	2
Funding for training	4.3425	0.69427	3
Sustainable course	4.3425	0.64447	4
Sustainable research	4.3260	0.72176	5
Green education guideline	4.3260	0.69828	6
Funding for corporate social responsibility	4.3260	0.65730	7

Sustainable community service	4.3149	0.66270	8
Funding for professional development	4.3094	0.67772	9
On-going training	4.3039	0.66786	10
Scholarly sustainable publication	4.2762	0.72337	11
Sustainable assessment	4.2762	0.67572	12
Student Activities	4.2597	0.61822	13
Laboratory projects	4.2541	0.73903	14
Sustainable media social	4.2541	0.67622	15
Funding for sustainable events	4.2486	0.70637	16
Sustainable report	4.2431	0.73524	17
Sustainable website	4.2431	0.68841	18
Open access to research	4.2376	0.79856	19
Sustainable learning outcome	4.2155	0.73256	20
Sustainability focused - educational program	4.2155	0.72494	21
Sustainable university program	4.2155	0.71723	22
Staff activities	4.2099	0.67504	23
Conference	4.2044	0.65590	24
Sustainability student organizations	4.1823	0.69516	25
Orientation training	4.1713	0.68997	26
Sustainability related start-up	4.1547	0.68988	27
Collaborations	4.1492	0.79223	28
Sustainability staff organizations	4.1436	0.69228	29
Cultural activities	4.0497	0.70140	30

V. CONCLUSION

The need to establish a tool to measure sustainable HEIs is crucial as the percentage of sustainable HEIs in the country is low. Among many types of HEIs public and private HEIs are particularly important for a transition towards sustainable development. This research aims to develop the education criteria and indicators for measuring sustainable HEIs in Malaysia. To complete the aim of the study, a comparative analysis of 9 SATs was made from ten (10) selected articles, and thirty (30) education indicators were identified. The present study found that the thirty (30) indicators cover the elements of curriculum, research, setting and infrastructure, community engagement, and teaching. These indicators were then confirmed through a questionnaire survey at ten selected public HEIs. The top five indicators were

identified as: (1) funding for program development, (2) funding for research and innovation, (3) funding for training, (4) sustainable course, and (5) sustainable research. Funding was identified as the most important indicator to adopt sustainability in HEIs. It is agreed that a specific tool shall be developed to measure sustainable HEIs in Malaysia, and all the thirty (30) indicators for the education criteria shall be included in measuring sustainable HEIs in Malaysia. The top three indicators identified were funding for program development, research and innovation, and training. This validates the viewpoint by Leal Filho et al. (2018), establishing sustainable higher education institutions (HEIs) should start with creating sustainable programs and research and innovation activities, making financial support in these areas essential. Additionally, funding for training was necessary to support sustainable training initiatives. Other significant indicators emerged once funding for program development and sustainable research was initiated. The other required twenty-five (25) indicators can be acknowledged from the development of HEIs sustainable websites and sustainable social media like Facebook, Instagram, TikTok and many more which are also part of the indicators in measuring sustainable HEIs. To support the future development of SATs, it is recommended that education indicators be simplified to encourage all HEIs to adopt sustainable practices. Additionally, a post-assessment is necessary for sustainable HEIs to ensure that sustainability efforts extend beyond the campus.

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APPENDIX

Table A 1 Inclusion and exclusion criteria

	Inclusion criteria	Exclusion criteria
Title and abstract	Relevant area (sustainability assessment in HEIs)	Irrelevant area (sustainability assessment in buildings, schools, institutions, and other than HEIs)
Full-text	Comparison of SATs for HEIs	Comparison of SATs that are less than 3 SATs

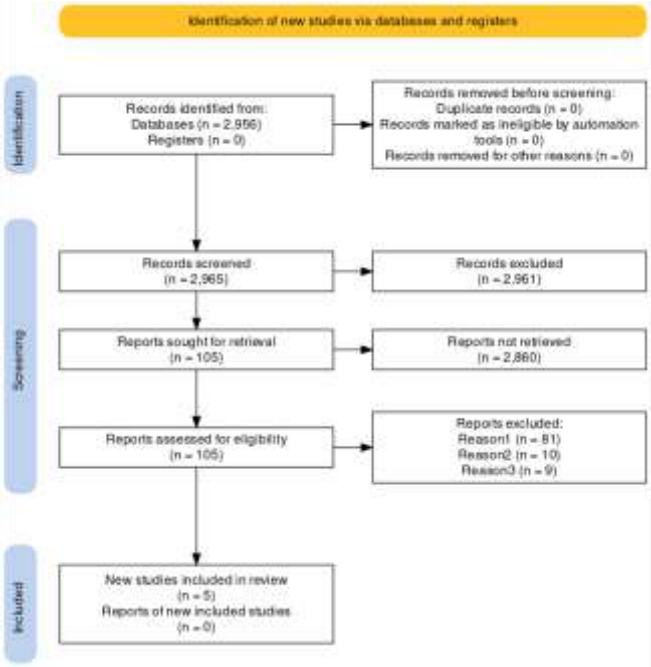

Figure A 1 The screening process of articles