Assessing smart sustainable library practices in higher education: development and validation of instrument

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Article Info

ABSTRACT

A smart sustainable library is a new form of a library that blends sustainability and smart libraries with an emphasis on ethics. This study focuses on the need for thorough tools to assess the evolving concept of a smart sustainable library, especially within Malaysian higher education. This study emphasizes the need for a comprehensive tool that combines smart library, sustainability practices, and ethical values in libraries. Developed and conducted a pilot study to validate a new instrument designed to assess these intertwined aspects thoroughly. By distributing a survey to 30 librarians from different academic institutions in Malaysia, we used statistical measures such as Cronbach's alpha, omega, and corrected item-total correlation to assess the validity and reliability of the instrument. The results showed a high level of reliability with Cronbach's alpha at 0.929 and Omega at 0.918, suggesting that the instrument has strong internal consistency and could be effective for wider use. Our research indicates that the newly developed instrument effectively captures the complex nature of smart sustainable libraries, demonstrating its potential for future research and practical use in the field. This research significantly contributes to the library science field by offering a validated tool to evaluate smart sustainable library development.

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1. INTRODUCTION

Cities are dramatically changing into so-called smart cities in this age of urbanization. The term "smart" is frequently connected with a city's level of automation in both the public and private sectors and the incorporation of information technology into its many activities. Ghosh *et al.* [1] defines smart cities as having a smart economy, smart housing, smart government, smart people, a smart environment, and smart mobility. These qualities emphasize the significance of using technology and data-driven initiatives to improve urban efficiency, sustainability, and quality of life [2]. As cities expand and adapt to modern-day difficulties, the notion of smart cities is predicted to play a critical role in defining the future of urban development [3]. A sequence of that is a need for study to identify and examine the existing requirements of libraries to ensure their continued relevance, meet the current demands of users, and prepare them for the future. In addition to delving into the need for transformations that align with the fourth industrial revolution, this research will also investigate the forthcoming necessities of Industry 5.0, which is a return to humanity

and emphasizes human-centric technologies and processes that prioritize ethical considerations and sustainability [4], [5].

Furthermore, there are discussions on the new revolution called IR5.0. The concept of Industry 5.0 represents a shift towards a more human-centered approach to technology development, with sustainability, ethical considerations, and social responsibility at its core [4]–[6]. This approach has implications for the role and function of libraries in society, as they can play a crucial role in promoting and supporting the development of technologies that put people at the center and benefit society as a whole. Libraries can also contribute to the development of Industry 5.0 by promoting innovation and creativity through their programs and services. In doing so, libraries can help ensure that new technologies are developed in a sustainable, ethical, and socially responsible way. A smart sustainable library study will relate the smart library to sustainability and ethics. Therefore, this pilot study aims to develop and validate a research instrument for assessing the smart sustainable library as perceived by librarians in Malaysian higher education.

One method of gathering data for surveys that is frequently employed is the use of questionnaires. As a result, consistency and accuracy provide a rough idea of whether the questionnaire can be used to continue the actual investigation. This stage of examination is known as the instrument's validity and reliability. While there are other ways to determine validity, content validity is strongly advised since it can measure each item precisely [7]. Subsequently, inter-rater, alternate forms, and test-retest can be employed to evaluate the instrument's reliability. However, the most effective method for determining an instrument's level of internal consistency is to use Cronbach's alpha assessment [8].

Assessing validity and reliability is an important step in a pilot study. The purpose of a pilot study is to identify any weaknesses in the measurement instrument, such as a questionnaire, and to ensure its responsiveness and applicability [9]. Validity refers to the extent to which a test or instrument measures what it is intended to measure, while reliability refers to the consistency of the results produced by the instrument [10], [11]. Face validity, criterion validity, content validity, and construct validity are the four categories. Face validity investigates whether a test appears legitimate on the surface. Criterion validity entails showing validity within the study, which necessitates a thorough understanding of relevant theory as well as measuring the relationship between the instrument and related components. The content validity of the test items determines whether they accurately measure the intended notion. Lastly, construct validity assesses how well an instrument represents the theoretical construct under consideration.

In contrast, reliability is defined as the degree to which test scores are free of measurement error. It measures an instrument's internal consistency or stability in measuring specific concepts [12]. Methods such as test-retest, alternative forms, and inter-rater variability can subsequently be employed to assess the instrument's reliability. However, among all methods, Cronbach's alpha remains the most effective for assessing the extent to which an instrument maintains its internal consistency [13].

Discussing the advancements in contemporary library science, the shift towards smart sustainable libraries is a crucial development that combines smart library, sustainability, and ethical practices to address the changing needs of users and communities. Although this integration is important, there is a noticeable gap in the available measurement and evaluation tools. Existing assessments focus on smart libraries, sustainability, and ethical practices as distinct areas without considering their interconnectedness. Furthermore, the current tools frequently lack thorough validity and reliability testing, which raises doubts about their ability to accurately capture the core of smart sustainable libraries. This gap highlights the importance of a comprehensive tool to assess the concept of smart sustainable libraries, especially in the Malaysian higher education setting. Developing and validating such an instrument is essential for the progression of library science and ensuring libraries can adapt to future challenges, which is the main focus of this study.

The research questions are formulated as follows: i) How is the validity of the construct of the smart sustainable library in Malaysian higher education? and ii) How is the reliability of the smart sustainable library assessment instrument in Malaysian higher education? It is anticipated that the outcome of research into smart sustainable library instruments will make the following significant contributions: i) From an academic standpoint, the outcomes of this study have the potential to expand the body of knowledge and educational library concerning assessment, specifically by developing a dependable and standardized instrument for evaluating smart sustainable library and ii) The findings of this study may serve as empirical data that motivates further research. This paper thoroughly outlines the development, validation, and reliability testing of an instrument designed to evaluate smart sustainable libraries in Malaysian higher education, providing essential insights for academic and practical advancements in library services.

2. LITERATURE REVIEW

2.1. Smart library

Libraries are dynamic entities that have continually evolved to meet the changing needs of their users. Traditionally, libraries served as repositories for collections of newspapers, CDs, books, and other physical media for study, borrowing, and reading. However, the rapid advancement of knowledge and technology has catalyzed a transformation from conventional to electronic, digital, hybrid, virtual, and intelligent libraries. According to Aittola, Ryhanen, and Ojala [14] introduced the phrase "smart library" in 2003; since then, librarians have applied the concept in a variety of methods [15]. Smart libraries consist of three primary elements: smart technology, smart services, and smart people. They represent an innovative and novel approach to providing services, as well as a dynamic strategy for increasing the number of users. Smart libraries are additionally defined by [16] as the implementation of intelligent computer technology to enhance the efficacy, integration, and intelligence of the library's critical infrastructure operations and services.

General literature, on the other hand, implies that a library is considered smart if it employs cutting-edge information technology in an innovative manner and offers smart services delivered by knowledgeable personnel. Figure 1 illustrates the elements in the smart library encompassing smart technology, smart services, and smart people. Overall, a smart library involves a comprehensive strategy combining cutting-edge technology, inventive services, and educated staff and users to establish a dynamic and adaptable information environment. By fully embracing these essential components, libraries can successfully adapt to the demands and possibilities of the digital era, ultimately promoting continuous learning, research, and community growth.

The evolution of libraries is closely linked to the broader shifts heralded by the industrial revolutions. The progression from IR 1.0 to IR 4.0 showcases the library's transformation from a simple book collection to an advanced, technology-driven information center. In the era of IR 1.0, libraries were limited by their size, organization, and the scarcity of technology, with the steam-powered printing press marking a significant advancement. With the advent of IR 2.0, libraries began to improve management and accessibility through the implementation of card catalogues and structured storage systems, significantly enhancing resource discoverability and organization.

The transition into the era of IR 3.0 marked a substantial modernization of libraries, with the adoption of automated processes and digital operations. The use of computers and electronics revolutionized library services, enabling online catalogues and electronic database searches. The current phase, IR 4.0, has seen the emergence of smart libraries at the pinnacle of this evolutionary journey. Equipped with state-of-the-art technologies such as artificial intelligence (AI), the internet of things (IoT), and cloud computing, smart libraries have transcended their traditional roles. They now serve as dynamic knowledge management hubs, fostering digital literacy, enabling remote access to information, and offering personalized user experiences.

The impact of this transformation extends beyond the mere adoption of technology; it signifies a shift towards a more inclusive, accessible, and user-centered model of information services. Smart libraries embody the confluence of technology and human insight, leveraging the potential of digital innovation to enrich the library experience for all users. As libraries continue to evolve in the age of IR 4.0, they are poised to play an increasingly vital role in the dissemination of knowledge, the promotion of digital skills, and the support of lifelong learning in our societies.

Figure 1. Elements of smart library

2.2. Ethical values

Ethical values, or ethics, are fundamental concepts that guide both individual librarians and libraries as institutions. They encompass moral right and wrong, moral good and bad, and ethical conduct. Ethics is a discipline of philosophy concerned with the rightness or wrongness of human behavior or based on reason and logic [17], [18].

Librarian ethics and library ethics are related but distinct concepts. Librarian ethics refers to the ethical principles and responsibilities that individual librarians adhere to in their professional practice, including issues such as privacy, intellectual freedom, and professional conduct. It guides the behavior and

decision-making of librarians in interactions with customers, colleagues, and the wider community. Library ethics, on the other hand, encompasses the ethical principles and values that guide the overall operation and management of libraries as institutions, covering issues such as access to information, intellectual freedom, and social responsibility.

In this study, the focus is on librarian ethics, as the respondents were librarians in a Malaysian academic library. The ethical values of librarians are guided by professional conduct as stated in codes of ethics, which serve as a basis for accepting responsibility as information producers. Professionals need a code of ethics to conduct their practice ethically, earn the respect of the community they serve, and maintain consisted behavior to establish ethical standards.

2.3. Sustainable library

International Federation of Library Associations and Institutions (IFLA) defines a sustainable library as one that operates responsibly in environmental, economic, and social terms to meet present needs without compromising future generations and ability to meet their own needs. This includes resource use, waste reduction, energy efficiency, and promoting sustainable development through education and awareness raising. Sustainable library aims to minimize its environmental impact, reduce its carbon footprint, and promote sustainability in its community while ensuring long-term viability and financial sustainability [19]. Both terms refer to modernized libraries that minimize energy consumption while maximizing renewable energy sources [20]. Fedorowicz-Kruszewska [21] differentiating between a "green library" with a "sustainable library" which focuses on minimizing negative impacts on the environment and maximizing indoor environmental quality through careful site selection, use of natural building materials, conservation of resources, and responsible waste disposal. Sustainable library takes care of all aspects, including environmental, economic, and social aspects. Figure 2 illustrates the dimensions of a sustainable library, highlighting the interconnectedness of environmental, economic, and social sustainability. Figure 2 shows that a sustainable library is one that considers all three dimensions in its operations and services, and that these dimensions are interdependent and reinforce each other.

Figure 2. Dimensions of sustainable library

2.4. Smart sustainable library

Jerkov *et al.* [22] integrated the concepts of sustainable libraries and smart services, specifically emphasizing smart cities. This study defines a smart sustainable library as an establishment that incorporates ethical values and utilizes smart technology, services, and people to improve its services while simultaneously addressing environmental, economic, and social sustainability concerns. Smart sustainable libraries are a modern concept that integrates advanced technologies and sustainable practices to improve library services and operations. The concept of smart libraries is evolving with the integration of cutting-edge technologies such as cloud computing, data mining, artificial intelligence, and the internet of things (IoT) [23]–[26]. These technologies enable smart libraries to offer innovative and creative services and transform the traditional library environment into a more efficient and user-centered space [25], [27]. Furthermore, the role of libraries in promoting global sustainability and environmental literacy is crucial for developing sustainable smart libraries [28], [29] summaries, smart sustainable libraries represent a paradigm shift in how libraries work. They integrate advanced technologies, sustainability initiatives and innovative services to meet the changing needs of users and promote environmental literacy. Developing smart sustainable libraries requires a multifaceted approach combining technological innovation, environmental sustainability, and strategic planning to create a holistic and user-centered library environment emphasizing personnel ethical values.

This study introduces the concept of a "smart sustainable library" as a novel development in the field. Currently, there is a lack of direct research measuring this specific type of library. The unique contribution lies in the combination of components: smart library, ethical values, and sustainable library, forming a distinct entity. Although separate studies exist on smart libraries, ethical values in library practices, and sustainable libraries, they do not directly address the integrated concept.

For instance, study [30] presented measurement items to assess the smartness of libraries, but it did not report the instrument's reliability. Similarly, research on sustainable libraries lacked a reliability test for the instrument used [31]. Consequently, there is a clear need for a validity and reliability test of the instrument to ensure its appropriateness for future studies in the domain of smart sustainable libraries.

Emphasizing the essential requirement for comprehensive testing of the instrument created to evaluate smart sustainable libraries is of utmost importance. Ensuring the accuracy of the tool's measurements is crucial in this rapidly evolving field of study, building a strong foundation for further research and practical implementation. Considering the interdisciplinary nature of smart sustainable libraries, involving library innovation, ethical considerations, and sustainability principles, it is crucial to thoroughly test the instrument to accurately capture the nuances of these integrated concepts. Without this crucial validation process, further research runs the risk of being based on an unstable foundation, which could result in inaccurate conclusions or ineffective suggestions. Thus, guaranteeing the validity and reliability of the instrument is crucial not only as a methodological necessity but also as a fundamental step towards enhancing the discussion on smart sustainable libraries. This sets the stage for generating strong, practical insights that can shape the development of library services in the digital and sustainable era. This process will help establish a standardized method for examining these libraries in various settings, which will contribute to a unified knowledge base to inform future developments in this dynamic field.

3. RESEARCH METHOD

The present study comprised a sample of thirty librarians employed in higher education libraries in Malaysia. The librarians were chosen through the implementation of the simple random method. The ethical values instrument developed by [31], the smart library instrument created by [30], and the sustainable library instrument created by [32] were utilized to determine how librarians (respondents) viewed the development of smart sustainable libraries in their respective libraries. The items under consideration were assessed using a 5-point Likert scale. This scale was adequate for measuring human attitudes, according to [33]. In this study, a five-point and seven-point scale (section B and D) is used because it is simpler and easier for respondents to understand and is used more frequently, which can reduce confusion and increase comparability of results across studies. For section C it is using a five-point Likert scale which is respond range from "Not at all important" to "Very important". The researcher assessed the instrument's validity and reliability to ascertain the likelihood of obtaining statistically significant results via data analysis [18], [34].

3.1. Identify variable

The initial stage involves identifying predictor variables and the potential effect of smart sustainable library development. The researchers employed a structured literature review (SLR) methodology, drawing inspiration from prior studies conducted by [35], [36]. The process of conducting a literature search was carried out in three distinct phases. The literature search commences using prominent databases such as Scopus, Web of Science (WoS), and Google Scholar. Furthermore, an in-depth examination of pertinent literature was undertaken. In addition, a comprehensive literature review was performed to locate recent scholarly publications that reference the earlier research. Consequently, a comprehensive analysis yielded the identification and classification of a total of seven variables, which were subsequently organized into three different dimensions: smart library, ethical values, and sustainable library.

3.2. Instrument development

Next, the items of the variables were developed by adapting and adopting from the previous relevant studies. Table 1 shows the summary of the instrument. The questionnaire was constructed with five domains: Respondents' general information, smart library, ethical values, and sustainable library. The smart library comprises smart technology, smart services, and smart people. Sustainable libraries consist of environmental, social, and economic aspects. For ethical values, on the other hand, no specific construct was used.

Table 1. Measurement of items

Construct	Items	Scale	Sources
Respondents' general information	7	Open Ended	-
Smart library:		5 Likert Scale	(Jadhav and Shenoy, 2020)
Smart technology	3		
Smart services	4		
Smart people	3		
Ethical values	6	5 Likert Scale	(Prasanth and Vasudevan, 2019)
Sustainable library:		7 Likert Scale	(Datta and Chaudhuri, 2019)
Environmental	8		
Social	8		
Economical	4		

The questionnaire consists of 5 sections, as shown in Figure 3. The first section is a cover letter that contains an ethical statement describing the possible impact of the research on the respondent. The second section is to collect respondents' general information. The following sections collected responses on each dimension and constructs as shown in Table 1.
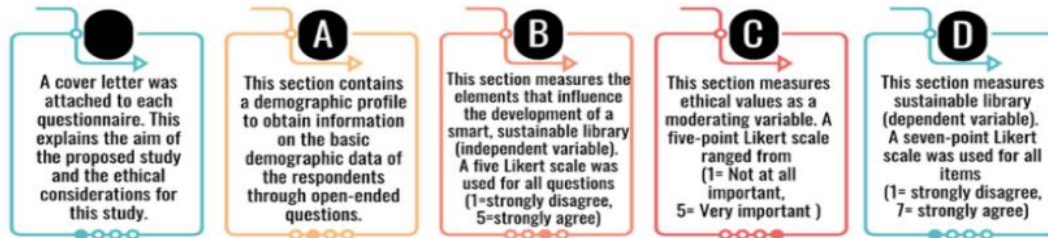

Figure 3. Questionnaire structure

3.3. The validity of the research instrument

Following the development of the items table for measurement purposes, the subsequent phase, known as face validation, can be initiated. To assess the validity of an instrument, three types of validity can be evaluated: content validity, concurrent validity and construct validity [37], [38]. Content validity refers to the extent to which the instrument covers all aspects of the concept being measured, while concurrent validity refers to the extent to which the instrument correlates with other measures of the same concept. Construct validity refers to the extent to which the instrument measures the theoretical construct designed to measure. During this phase, this study conducts face validity or content validity. The researcher responsible for developing the measurement scale should ask for the opinions of experts or specialists (preferably other researchers, a Ph.D. level or possessing experience in the construct domain of the scale) regarding the items and their correlation with the construct being measured [39]. Table 2 contains detailed information on the experts involved in the validation process of the instruments used in this study. These experts were carefully selected based on their extensive experience, different institutional backgrounds, positions, and areas of expertise. They evaluated, reviewed and determined the sufficiency and validity of the document. The researcher noted their feedback and comments and improved the instrument according to the suggestions.

Table 2. List of experts for instrument validation

No	Expert	Experience	Position	Area of Expertise	Validation Status
1	Expert 1	> 15 years	Senior Lecturer	Methodology	Return
2	Expert 2	> 15 years	Former Chief Librarian	Contents	Return
3	Expert 3	> 15 years	Chief Librarian	Contents	Return
4	Expert 4	> 15 years	Senior Lecturer	Contents	Return
5	Expert 5	> 5 years	Lecturer	Methodology	Return
6	Expert 6	> 15 years	SISC+Officers (School Improvement Specialist Coaches)	Language	Return

3.4. Pilot study

The pilot study is used to test the validity and reliability of the instrument before the actual study. A pilot study is an experimental study conducted with the same group of respondents intended for the actual study to test the reliability, consistency and validity of the questionnaire items to be answered by the actual study sample [11]. On the other hand, study [8] notes that questionnaires need to be improved before the final questionnaires are released to ensure the reliability of an instrument in a pilot study. For this reason, a pilot study was conducted with the questionnaire to assess its reliability and validity.

The sample size for a pilot study should be at least twenty-five respondents [11]. To this end, the sample size for this study is thirty respondents, including thirty (30) librarians working in academic libraries who were randomly selected. This is supported by [40], [41], who state that the ideal sample size for a pilot study should be between five and ten to thirty respondents. The respondents in the pilot study are not included in the final sample size.

The pilot study conducted as part of this research played a crucial role in testing the validity and reliability of the questionnaire intended for the larger study. By engaging a carefully selected sample of thirty librarians from academic libraries, the study not only adhered to the recommended sample size guidelines but also ensured a comprehensive evaluation of the instrument's performance. This preliminary assessment

allowed for necessary adjustments and improvements, thereby enhancing the reliability and validity of the questionnaire. The exclusion of pilot study participants from the final sample size underscores the methodological rigor and commitment to maintaining the integrity of the research findings, setting a strong foundation for the subsequent phases of the study.

3.5. Data analysis plan

The statistical software statistical package for the social sciences (SPSS) version 29 (SPSS Inc., Chicago, IL, USA) was used to analyze the data, validate the questionnaire, and ensure its reliability. For categorical data, descriptive statistics were used to analyze the data. Then it is displayed as frequencies and percentages.

3.6. Reliability of research instrument

The data collected were analyzed using IBM software (SPSS) to determine the validity, consistency and reliability values. In this study, Cronbach's alpha and Omega were used for reliability testing. Cronbach's alpha is a commonly used measure of internal consistency that assesses the reliability of a questionnaire or survey by calculating the correlation between the responses of each item and the overall score of the instrument [42]. Internal consistency ranges from 0 to 1, with higher values indicating greater internal consistency [40], [43]. A Cronbach's alpha value of 0.7 or higher is generally accepted for use in research [11]. Likert-type and dichotomous items can be tested for reliability using Cronbach's alpha. Cronbach's alpha is not a measure of validity, i.e., the extent to which an instrument measures what it is supposed to measure. Therefore, recommended to assess reliability and validity when evaluating the quality of an instrument. Table 3 shows the interpretation of Cronbach's alpha values to assess the reliability level of each variable [33], [44]. This categorization aids researchers in evaluating the consistency of their instruments and making necessary adjustments for accurate data collection.

Table 3. Cronbach's alpha value interpretation

Cronbach Alpha Value	Reliability Level
0.8 – 1.0	Very good and effective with a high level of thoroughness
0.7 – 0.8	Good and acceptable
0.6 – 0.7	Acceptable
< 0.6	There are items that need to be repaired
< 0.5	There are items that need to be dropped

Numerous researchers have demonstrated that Omega is a more rational measure of internal consistency, both in comparison to alpha and in contrast to alternative indices [34], [45], [46]. Omega performs at least as well as alpha, according to [47], even when the assumptions of the essentially *tau*-equivalent model are satisfied. However, in situations where *tau*-equivalence is violated, which is likely to occur frequently in the field of psychology, Omega performs better than alpha and is unquestionably the superior option. The primary benefits of Omega in comparison to alpha can be outlined as follows:
a. Omega is more realistic and makes fewer assumptions than alpha.
b. Expenses related to inflation and internal consistency estimation attenuation are considerably less probable.
c. By eliminating a specific scale item, "omega if item deleted" increases the likelihood that the entire population's reliability estimates are reflected in a sample.
d. By incorporating a confidence interval into the Omega calculation, the variability in the estimation process is significantly more closely reflected, resulting in a more precise level of assurance regarding the consistent administration of a scale.

Conducting a reliability analysis of the research instrument using Cronbach's alpha and Omega measures highlights the instrument's strength in evaluating the intended constructs with strong internal consistency. Using both measures, with Cronbach's alpha values exceeding the accepted threshold of 0.7 and incorporating Omega for a detailed reliability evaluation, demonstrates a thorough and meticulous approach to ensuring the questionnaire's reliability. Approaching research with a dual perspective maintains high research standards and effectively deals with the complexities of psychological and educational research instruments. By validating the instrument's reliability through these rigorous statistical methods, the study solidly establishes the foundation for precise and dependable data collection, boosting the credibility and integrity of the research findings through a thorough validation process highlighting the advantages of both Cronbach's alpha and Omega, the research instrument is carefully calibrated for its specific purpose, providing a dependable way to capture detailed insights into the studied phenomena.

4. FINDINGS

The following subsections will explain the findings and output of the pilot study. The findings are divided into an assessment of the expert review process, a reliability analysis, and an interpretation of Cronbach's alpha. The process was designed to confirm the validity and reliability of the instrument developed for the study.

4.1. Expert evaluation

The instrument underwent expert evaluation by six experts based on specific criteria identified by study [48]. These criteria include expertise in the relevant field, demonstrated experience in validating or evaluating instruments, extensive familiarity with the intended use or target population, impartial judgements, a solid reputation, a history of research related to instrument validation, effective communication skills, and the involvement of a diverse group of experts. And hence to these criteria ensures the instrument's validity and reliability. The researchers refined the instrument based on feedback, subjecting it to final testing before being ready for data collection. Based on the feedback received, the researchers made the necessary changes to refine the instrument and ensure its validity and effectiveness in collecting the intended data. The defined instrument is then subjected to final testing and adjustments before it is considered ready for the main phase of data collection.

4.2. Reliability analysis

A pilot instrument was developed to test the reliability of the instrument. An online instrument was developed using a Google form, and the link was sent to 32 librarians at higher education in Malaysia via a WhatsApp application. A total of 30 valid responses were received. The number of responses resulted in a response rate of 94%. The responses were then analyzed using Cronbach's alpha coefficient and Omega to determine whether the instrument was reliable. Table 3 shows the final analysis of Cronbach's alpha and Omega coefficients.

The result shows that all Cronbach's alpha variables exceeded the value of 0.70 recommended by Nunnally (1978) and Kaplan and Saccuzzo (1982) [35]. The lowest value is 0.749, and the highest value is 0.912, indicating that this instrument is reliable for actual data collection. Omega also exceeds the value of 0.7, with the lowest value of 0.801 and the highest value of 0.910. Table 4 shows the values of Cronbach's alpha and Omega for the study. In summary, it can be determined that every item in this instrument can be utilized as a unit of measurement. However, in order to establish its greater reliability, this preliminary investigation utilized corrected item-total correlation and Cronbach's alpha if Item Deleted to interpret the alpha as discussed below.

Table 4. Instrument stability measurement

Dimension	Construct	Cronbach's alpha	Omega
Smart library	Smart technology	0.805	0.812
	Smart services	0.749	0.801
	Smart people	0.878	0.881
Ethical values		0.882	0.873
Smart sustainable library		0.912	0.910
	Overall (36 items)	0.929	0.918

4.3. Interpreting Cronbach's alpha

In order to interpret the reliability analysis using Cronbach's alpha more precisely, it used *corrected item-total correlation* and *Cronbach alpha's if item deleted*, which was produced from the SPSS reliability analysis statistics. The column labelled *Corrected item–total correlation* in the table shows the correlations between each item. For a reliable scale, all items should correlate well in total. If one of these values is below 0.3, it shows the item has a problem because this means that a particular item does not correlate very well with the scale as a whole. Items with low correlations may need to be dropped [10].

The values in the column *Cronbach's alpha if item deleted* are the values of the total alpha when that item is not included in the calculation. Therefore, they reflect the change in Cronbach's alpha, which would result if an item were deleted. *Cronbach's alpha if item deleted* column shows whether removing an item will improve the overall reliability: values greater than the overall reliability indicate that removing that item will improve the overall reliability of the scale. For example, the total a is 0.805, so all values in this column should be close to this value. Therefore, any item that has values of alpha in the Cronbach's alpha if *item deleted* column is greater than the total Cronbach alpha's, it may need to be deleted from the scale to improve reliability [10].

Table 5 shows the value of *Corrected item-total correlation* for the constructs of smart technology is more than 0.3 (ranging 0-577–0.707), which is acceptable and the value of *Cronbach alpha's if item deleted* is between 0.678 to 0.807. For on item (ST3) deleted, *Cronbach's alpha* increased slightly from 0.805 to 0.807. However, these items were retained and modified based on expert and supervisor approval as they are essential for measuring smart technology in the library. This action is the same as the previous study of [49], which made the same decision to keep the item. Based on the total *Cronbach alpha* score (0.805), every item demonstrated a high degree of reliability.

Table 6 shows the value of *Corrected item-total correlation* for the constructs of smart services is more than 0.3 (ranging from 0.344–0.525), and the value of *Cronbach alpha's if item deleted* is between 0.521 to 0.792. For on item (SS4) deleted, *Cronbach's alpha* increased slightly from 0.749 to 0.792. However, these items were retained and modified based on expert and supervisor approval as they are essential for measuring smart services in the library. The reliability of the items was acceptable, as the *Cronbach's alpha* value totaled 0.749.

Table 7 shows the value of *Corrected item-total correlation* for the constructs of smart people is more than 0.3 (ranging from 0.720 – 0.796), and the value of *Cronbach alpha's if item deleted* is between 0.801 to 0.866. Thus, none of the items were removed from the smart people construct. The overall *Cronbach alpha* value was 0.878, which indicates excellent reliability.

Table 8 shows the value of *corrected item-total correlation* for the constructs of ethical values is more than 0.3 (ranging from 0.659 – 0.760), and the value of *Cronbach alpha's if item deleted* is between 0.855 to 0.872, which is acceptable. These items were retained in this section. All items showed excellent reliability, as indicated by the overall *Cronbach's alpha* value is 0.882.

Table 9 shows the value of *corrected item-total correlation* for the constructs of sustainable library is more than 0.3 (ranging from 0.310 – 0.795), and the value of *Cronbach alpha's if item deleted* is between 0.902 to 0.914. For two items (SC4 and EC2) deleted, *Cronbach's alpha* increased slightly from 0.912 to 0.914. However, these items were retained and modified based on experts' approval as they are essential for measuring sustainability activities in the library. While the overall value of *Cronbach Alpha* is 0.912, and its show's excellent reliability.

Table 5. The value of correlation and Cronbach alpha for the smart technology construct

Construct	Item	Label	Corrected Item – Total Correlation	Cronbach Alpha's if Item Deleted	Cronbach Alpha's
Smart Technology	1	ST1	.707	.678	.805
	2	ST2	.680	.705	
	3	ST3	.577	.807	

Table 6. The value of correlation and Cronbach alpha for the smart services construct

Construct	Item	Label	Corrected Item – Total Correlation	Cronbach Alpha's if Item Deleted	Cronbach Alpha's
Smart Services	1	SS1	.525	.701	.749
	2	SS2	.541	.694	
	3	SS3	.801	.521	
	4	SS4	.344	.792	

Table 7. The value of correlation and Cronbach alpha for the smart people construct

Construct	Item	Label	Corrected Item – Total Correlation	Cronbach Alpha's if Item Deleted	Cronbach Alpha's
Smart People	1	SP1	.720	.866	.878
	2	SP2	.783	.813	
	3	SP3	.796	.801	

Table 8. The value of correlation and Cronbach alpha for the ethical values construct

Construct	Item	Label	Corrected Item – Total Correlation	Cronbach Alpha's if Item Deleted	Cronbach Alpha's
Ethical Values	1	EV1	.668	.868	.882
	2	EV2	.704	.860	
	3	EV3	.760	.855	
	4	EV4	.708	.860	
	5	EV5	.738	.855	
	6	EV6	.659	.872	

Table 9. The value of correlation and Cronbach alpha for the smart sustainable library construct

Construct	Item	Label	Corrected Item – Total Correlation	Cronbach Alpha's if Item Deleted	Cronbach Alpha's
Sustainable Library	1	EN1	.698	.904	.912
	2	EN2	.594	.907	
	3	EN3	.764	.904	
	4	EN4	.658	.905	
	5	EN5	.749	.904	
	6	EN6	.524	.909	
	7	EN7	.795	.902	
	8	EN8	.659	.906	
	9	SC1	.432	.911	
	10	SC2	.644	.908	
	11	SC3	.459	.910	
	12	SC4	.310	.914	
	13	SC5	.417	.912	
	14	SC6	.610	.908	
	15	SC7	.680	.907	
	16	SC8	.409	.911	
	17	EC1	.548	.909	
	18	EC2	.330	.913	
	19	EC3	.489	.911	
	20	EC4	.697	.905	

5. DISCUSSION

The main objective of this study was to determine the validity and reliability of the smart sustainable library instrument to measure librarians' views on smart sustainable library development at Malaysia higher education. This study focuses on a pilot study undertaken in Malaysian higher education in 2023. The reliability of the smart sustainable library was in the acceptable range in all constructs. The construct and items are adopted from the previous study. Smart library assessment was taken from the [30] study, ethical values from [31] and sustainable library from [32] study.

Based on the findings obtained, the Cronbach's alpha values for all items in the construct pilot study are within the acceptable range of 0.7-0.9, while the Omega value is also within the acceptable range of 0.8-0.9. According to [36], the correlation value of the corrected item-total correlation is greater than 0.30. From this, it can be concluded that the item has a high-reliability value, as suggested by Abu Bakar (1987), Cohen (1988), Norusis (1977) and Nunally (1987). These results suggest that the instrument constructs have good internal consistency and reliability. Generally, a Cronbach's Alpha value above 0.7 is considered acceptable for most research purposes [42], [46], [47]. However, some fields and industries may have different minimum values, so checking for the specific study area is important. Extremely high values of Cronbach's Alpha can indicate that the questions are redundant, and some analysts/fields of study differ on what constitutes "too high".

In the present study, all items in the constructs had inter-item and item-total correlation values of more than 0.3 (> 0.3), which is in the acceptance range, and these items were retained in this instrument. Cronbach Alpha's if Item Deleted is seen around the Cronbach Alpha's values for all constructs and below total Cronbach Alpha's values except for four items (ST3, SS4, SC4 and EC2). However, these items were retained and modified based on experts' approval as they are essential for measuring smart technology, smart services, and sustainability activities in the library. Overall, the results of Cronbach's Alpha analysis suggest that the instrument constructs have good internal consistency and reliability, and the values obtained are within the acceptable range for most research purposes.

The results of this study have remarkable implications for both theoretical foundations and practical applications in the field of library science. Establishing and validating a comprehensive measurement instrument for evaluating librarians' perspectives on smart sustainable library development represents a significant theoretical advance. This instrument fills a critical gap in the literature by integrating items from smart libraries, ethical values, and sustainable library practices. Furthermore, the study contributes to the theoretical landscape by providing a nuanced understanding of the interlinked relationships between smart technology, smart services, smart people, ethical values and sustainability activities in the library context.

In practice, the validated instrument serves as a valuable guide for libraries, particularly in the context of Malaysian higher education. Its application enables libraries to assess and improve their sustainable practices and provides strategic insights for evidence-based decision-making. The study focuses on reliability and validity, ensures the consistency and accuracy of the instrument and builds confidence among librarians and administrators. This not only contributes to quality assurance in library operations but also provides a reliable means of identifying views on smart sustainable library development, enabling

continuous improvement based on empirical evidence. Overall, these findings have implications that go beyond theoretical enrichment and provide practical guidance for developing and managing smart sustainable libraries in an educational context.

6.   CONCLUSION

Our study substantially contributes to the academic and practical knowledge of smart sustainable libraries in higher education. This research significantly contributes to understanding smart libraries, ethical values, and sustainable library practices. It introduces a new framework for evaluating librarians' attitudes towards developing smart sustainable libraries. This framework enhances the current academic discussion and offers a thorough tool for upcoming research to delve into the various aspects of smart and sustainable library services. For professionals in the education field, especially those working in library management, the study highlights the significance of combining smart library elements with ethical and sustainable practices to improve library services. The instrument developed through this research gives libraries a strong tool to assess and improve their services, helping them move towards more sustainable, efficient, and user-centered operations.

Nevertheless, the study's scope is constrained by its sample size, indicating that future research could be enhanced by more extensive data collection to better generalize the findings. In addition, the research highlights the necessity for continuous improvement of the measurement tool to maintain its relevance and precision in capturing the complexities of smart sustainable library development. Based on these discoveries, we suggest conducting additional research to broaden the utilization of our framework across various library settings and demographics. Furthermore, delving into new variables that could impact the effectiveness of smart sustainable libraries may offer more profound insights into the strategic implementation of such initiatives in various educational settings. This study establishes a strong foundation for academia and library practitioners by providing a structured approach to understanding and implementing smart sustainable library practices. It contributes to academic literature and serves as a practical guide for improving the quality and sustainability of library services in higher education institutions.

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