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DEVELOPING SMART SUSTAINABLE LIBRARIES IN HIGHER EDUCATION: A PRELIMINARY STUDY

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Abstract: *This preliminary study explores the development of smart sustainable libraries in Malaysian public universities, emphasizing the integration a smart and sustainable practices to enhance library services and support the United Nations' Sustainable Development Goals (UNSDGs). The research begins with a qualitative study involving interviews with expert librarians, which is then validated through secondary data gathered from literature reviews. This process identifies critical gaps in awareness, implementation, and the interrelationship of smart and sustainable elements within academic libraries. Ethical values, such as access to information, privacy, and transparency, are essential to smart sustainable libraries' development. The findings suggest that while Malaysian university libraries are familiar with smart and sustainable concepts, there is a need for clearer implementation strategies and a deeper understanding of the synergistic relationship between smart technologies and sustainable practices. This study contributes to the ongoing discourse on library innovation, providing insights into the challenges and opportunities for developing technologically advanced, environmentally conscious, and socially equitable libraries. The research underscores the importance of ethical considerations in ensuring the responsible use of technology and fostering user trust, ultimately promoting sustainable development in higher education.*

Keywords: *Smart Library, Sustainable Library, Academic Library, Preliminary Study*

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Introduction

In the era of urbanization, cities are increasingly evolving into smart cities, characterized by automation and the integration of information technology across various sectors. Key features of a smart city include a smart economy, smart living, governance, people, environment, and mobility, all aimed at enhancing efficiency, sustainability, and quality of life. As urbanization accelerates, with projections indicating that 66% of the global population will reside in urban areas by 2050, the development of smart cities is expected to play a pivotal role in future urban growth (United Nations in Malaysia, 2023).

Simultaneously, climate change has become a critical global issue, driving governments and institutions to pursue sustainable development to mitigate environmental impacts. The United Nations' 2030 Agenda for Sustainable Development, which includes 17 Sustainable Development Goals (SDGs), emphasizes the importance of knowledge and partnerships, with libraries identified as key contributors to these goals.

Integrating smart and sustainable practices in library management is essential for fostering innovation, improving service delivery, and addressing environmental challenges. Libraries that adopt advanced technology and data-driven solutions can enhance operational efficiency, user experiences, and information access. Additionally, sustainable practices like energy efficiency and waste reduction can significantly impact environmental conservation and social equity. Aligning these practices with the broader objectives of smart cities and sustainable development agendas positions libraries as catalysts for positive change and knowledge dissemination in urban environments.

This paper explores the potential of smart sustainable libraries in academic institutions, focusing on librarians' perceptions of integrating smart library elements and sustainable practices. It also examines their views on ethical values in their roles to ensure libraries can meet future user needs and remain relevant in the changing landscape of higher education and urban development.

Literature Review

Smart Library

The concept of a smart library, emerging in the early 21st century, integrates advanced technologies like IoT, AI, and blockchain to enhance user experiences and library management systems (Hu, 2022). As defined by Gul and Bano (2019), a smart library uses electronic and communication technology to offer specialized services, including cloud computing, data mining, and AI (Cao et al., 2018; Fang, 2020). Key elements include Technology, Service, and People (Cao et al., 2018)(Yunus et al., 2023), aiming to improve service quality, promote information literacy, and offer innovative, interactive services (Baryshev et al., 2018). Smart libraries are integral to the knowledge ecosystem of smart cities, employing automation and machine learning to optimize operations and deliver tailored experiences (Cao et al., 2018; Igwe & Sulyman, 2022). Global examples of smart libraries include Tianjin Binhai Library in China, which uses automation and data analytics, Helsinki's Oodi Library, featuring 3D printing and AI recommendations, and Singapore's NLB, leveraging IoT and AI for resource management and personalized services. These libraries integrate technology to enhance user experience and service quality.

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Sustainable Library

The International Federation of Library Associations and Institutions (IFLA) defines a sustainable library as one incorporating environmental, economic, and social sustainability. The terms "green library" and "sustainable library" are often used interchangeably, referring to libraries that minimize energy consumption and maximize the use of renewable energy sources (Ismail et al., 2022). While a green library reduces environmental impact, a sustainable library considers broader aspects, including economic viability and social equity (Fedorowicz-Kruszewska, 2019).

Why Smart Sustainable Library?

The concept of a smart sustainable library, first introduced by Jerkov et al. (2015), merges the ideas of smart and sustainable libraries. These libraries leverage modern technology and user interaction to support sustainability goals, with librarians acting as intermediaries to facilitate knowledge sharing. Sustainable practices in libraries, such as reducing energy consumption and waste, are essential for long-term viability (Fedorowicz-Kruszewska, 2019). Smart libraries, which combine smart technologies, people, and services, can promote sustainability by reducing paper use, conserving energy, and utilizing sustainable energy sources (Mohammed et al., 2019).

A smart sustainable library integrates technology, services, and people, focusing on environmental sustainability, social equity, and economic feasibility. These libraries aim to provide quality services while minimizing environmental impact and being economically viable and socially responsible. They play a crucial role in academic libraries by meeting evolving user needs, enhancing efficiency, reducing energy consumption, and supporting the academic mission of universities.

Methodology

This study employed a qualitative approach, gathering data from interviews with library professionals, validated through secondary data from a literature review, to assess the need for developing smart sustainable libraries in academic institutions.

Primary Sources

Data Collection Method: Data was collected through individual interviews with expert librarians from public universities in Malaysia. A structured interview protocol was developed specifically for this study and based on M. N. Ismail et al. (2010). The interviews, conducted in a private setting, aimed to explore challenges and opportunities for creating smart, sustainable libraries. This approach provided rich, detailed insights from experienced librarians.

Participants

Five senior librarians were interviewed with over ten years of experience in academic libraries. These experts, recognized for their deep understanding of library management and services, were selected based on their experience and expertise. Participants had diverse educational backgrounds, with three holding Master's degrees and the others having diplomas. This diversity helped capture a wide range of perspectives on the development of smart, sustainable libraries in Malaysia.

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Interview Procedures

The interview protocol focused on challenges, opportunities, and strategies related to sustainability, smart technology, smart people, and smart services in libraries. Participation was voluntary, and confidentiality was ensured. The interviews, lasting one to two hours, gathered insights on creating smart, sustainable libraries in Malaysian public universities.

Secondary Sources

A comprehensive literature review served as the secondary data source, providing an understanding of existing knowledge on smart, sustainable libraries in academic institutions. The review involved a systematic search across databases like Google Scholar, Scopus, and Web of Science, using keywords such as 'smart library,' 'sustainable library,' 'academic library,' and 'green library.' The findings from this review were compared with interview data to validate results, identify consistencies, and uncover additional insights.

Findings

These findings are based on expert interviews and a comprehensive literature review, highlighting significant gaps and challenges that need addressing to foster sustainable development in academic libraries. Interviews with experts have highlighted three main issues:

i. Awareness and Implementation: While librarians are familiar with the concepts of smart and sustainable libraries, there is a need for a more focused transition towards smart libraries that emphasize sustainability aligned with the United Nations Sustainable Development Goals (SDGs) and smart city concepts. The lack of smart sustainable libraries in these institutions negatively impacts both the environment and the quality of user-centric services, and it restricts the effective use of innovative technologies. However, librarians lack clarity about the extent to which they have implemented smart library and sustainability practices, which could hinder efforts to promote smart sustainable development.

ii. Interrelationship of Elements: The concept of a smart sustainable library is relatively new, and the interrelationship between smart library elements—such as smart technology, smart services, and smart people—and sustainable practices is poorly understood. This gap in understanding poses challenges for effectively integrating these elements, potentially impeding the development of smart sustainable library models. Assessing this interrelationship is crucial for guiding strategic planning and implementation, enabling Malaysian public universities to fully utilize smart library innovations to create sustainable and innovative library environments.

iii. Ethical Values: The experts unanimously emphasize the importance of incorporating ethical values in library management, especially in the context of smart sustainable libraries. Key ethical principles include access to information, privacy, transparency, neutrality, and professional integrity. Although integrating smart technology, services, and people is essential, the role of ethical values in this integration is underexplored. Neglecting ethical principles could lead to mistrust, compromised privacy, and inefficiencies, ultimately affecting the effectiveness and acceptance of smart sustainable libraries. Therefore, further research on the interrelationship between smart library elements and ethical values is essential for developing smart sustainable libraries in Malaysian public universities.

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This study synthesizes findings from secondary sources through a comprehensive literature review:

i. Necessity of Sustainable Practices: Integrating sustainable practices within library services is essential for environmental, social, and economic sustainability. Previous studies emphasize that sustainable libraries can minimize environmental impacts and promote social justice (Fedorowicz-Kruszewska, 2019). Libraries aligning with sustainable development goals foster community engagement and environmental stewardship (Thorpe & Gunton, 2022). Smart libraries, enhanced by technologies like IoT and AI, offer more efficient services and support sustainability (Bi et al., 2022). However, librarians' readiness and clarity in implementing these technologies are crucial for success (Igwe & Sulyman, 2022). Without a clear understanding, libraries risk inefficient resource allocation, missed innovation, and limited stakeholder engagement (Mohammed et al., 2019).

ii. Impact of Smart Library: Smart libraries, incorporating IoT and AI, can significantly improve user experience and operational efficiency (Bi et al., 2022). Integrating smart technology, smart services, and smart people is vital for developing smart sustainable libraries. Understanding this interrelationship is key to strategic planning and creating sustainable library environments (Fedorowicz-Kruszewska, 2019). The lack of sustainable practices can lead to environmental degradation, social inequality, and economic inefficiencies (Mathiasson & Jochumsen, 2022; Ran, 2022; Shukla et al., 2020).

iii. Role of Ethical Values: Ethical values are fundamental in library operations, ensuring integrity and professionalism. Key principles include access to information, privacy, transparency, and intellectual property (Ejedafiru & Francis, 2020). The responsible use of smart technologies must be balanced with ethical considerations to protect user privacy and data security. Ethical values guide adopting new technologies, ensuring responsible use and maintaining user trust (Jones & Salo, 2018). The absence of these values can compromise user privacy, restrict intellectual freedom, and undermine the library's mission (Prasanth & Vasudevan, 2019). Research into the influence of ethical values on smart sustainable libraries is essential for responsible technology use and sustainable development. Theoretical framework for this study as below (Figure 1).

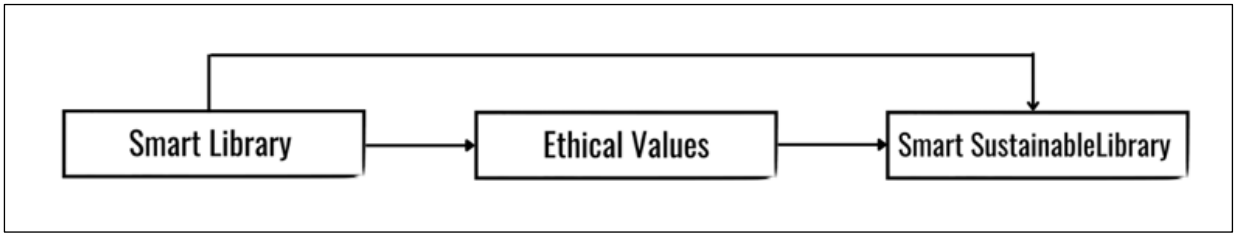

Figure 1: Theoretical for This Study

Discussion & Recommendations

The idea of a smart sustainable library, integrating technology, services, people, and ethical values, has immense potential for development in academic libraries at Malaysian public universities. Given the presence of smart libraries, it is worth exploring the impact of these libraries on the advancement of smart sustainable academic libraries. The findings identified from both primary and secondary sources are summarized in Table 1.1 below.

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Table 1: Summary of Findings in Preleminary Study from Primary and Seconday Sources

There is a need for research on how to prepare future libraries that remain relevant by developing a smart sustainable library that integrates smart and sustainable library, and ethical values.		
Findings	Primary Sources	Secondary Sources
The lack of clarity about the implementation of smart libraries and smart sustainable library practises in academic institutions can hinder their efforts to promote smart sustainable development practises.	Malaysian university libraries must adopt smart and sustainable practices for Sustainable Development Goals (SDGs), and librarians play a crucial role in achieving this.	(Mohammed et al., 2019) (Bi et al., 2022) (Igwe & Sulyman, 2022) (Thorpe & Gunton, 2022) (Fedorowicz-Kruszewska, 2019)
The development of a Smart Sustainable Library is obstructed by a lack of research on the interrelationship between smart library and sustainable practices.	The concept of the smart sustainable library is new, and the relationship between the smart library and smart sustainable library development is underexplored.	(Fedorowicz-Kruszewska, 2019) (Igwe & Sulyman, 2022) (Jakesh & Jochumsen, 2022) (Ran, 2022) (Bi et al., 2022)
Neglecting ethical values may lead to mistrust, compromise user privacy, biased access, inefficiency, inequities, and ultimately hinder the effectiveness and acceptance of a smart sustainable library.	Ethical values play a crucial role in guiding responsible technology use, strengthening user trust, and contributing to sustainable development, with the absence of ethical values in academic libraries risking compromised user privacy, restricted intellectual freedom, and a lack of equal access to information.	(Jones & Salo, 2018) (Prasanth & Vasudevan, 2019) (Yusuf, 2021) (Ejedafiru & Francis, 2020) (Jakesch et al., 2022)

Further research is required to understand librarians' perceptions of smart and sustainable libraries in Malaysian public universities. This study explores librarians' perceptions of smart sustainable library development, focusing on how integrating smart library elements and sustainable practices intersects with the role of ethical values in this process. Gaining insights into these perceptions is essential for academic libraries to develop effective strategies for modernizing library services, promoting environmentally, socially, and economically responsible practices, and staying relevant and adaptable amid evolving technological trends. Ultimately, this research will contribute to sustainable development and address the changing needs of academic communities. In summary, this study seeks to (1) develop and (2) validate a conceptual model that explores the relationships between smart library elements, ethical values, and smart sustainable libraries within the context of Malaysian public universities.

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Conclusion

This study underscores the critical need for Malaysian public university libraries to evolve into smart sustainable libraries by integrating smart technology, sustainable practices, and ethical values. Expert interviews and literature reviews reveal significant gaps, such as a lack of clarity in implementing smart library concepts, the underexplored integration of smart and sustainable practices, and the crucial role of ethical values in library management. While librarians are familiar with smart and sustainable concepts, guidance on implementation aligned with UN SDGs is necessary. Integrating smart technology with sustainable practices is vital for creating innovative library environments. Ethical values, including access to information, privacy, and transparency, are essential to prevent mistrust and ensure the libraries' effectiveness and acceptance. The study highlights the importance of a strategic approach incorporating these elements to modernize library services, promote responsible practices, and adapt to technological trends, contributing to sustainable development and advancing academic library services.

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