

Sustainable Environment Challenges in Malaysian Public Universities: A Systematic Literature Review

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ABSTRACT

This systematic literature review discusses the myriad challenges hindering environmental sustainability in Malaysian public universities. As institutions responsible for educating future leaders and advancing innovation, universities play a pivotal role in addressing the problem of global environmental degradation. This paper synthesizes current literature on the main environmental challenges faced by these institutions, including waste management, energy consumption, water resource management, and loss of biodiversity. Furthermore, it explores policy structures and sustainable practices currently in place, highlights the vital roles of each stakeholder, and demonstrates best practices through relevant case studies, including Universiti Malaya, Universiti Kebangsaan Malaysia, Universiti Putra Malaysia, and Universiti Teknologi MARA. In addition, the review identifies significant barriers to implementing sustainable practices, including budget constraints, lack of awareness, and resistance to change. Based on these findings, the article suggests future directions toward integrating sustainability into academic programs, fostering collaborative research activities, and strengthening community engagement to support environmental stewardship in Malaysian universities.

Keywords: Environmental sustainability, green campus, public universities, Malaysia, sustainable practices.

INTRODUCTION

Modern universities are faced with the great challenge of embracing sustainability initiatives and moving towards green initiatives in line with the dominant sustainability (Habib M. Alshuwaikhat, 2008). Over the years, many scientists have warned that the Earth's ecosystem is severely jeopardized and that its status will continue to decline unless drastic intervention is undertaken by humanity (Najad, Ahmad, & Zen, 2018). The unorganized use of scientific discoveries and technological innovations since the industrial revolution has been a root cause leading to a sharp rise in environmental degradation. As such, in the modern era, the pursuit of green initiatives is timely and essential in maintaining a sustainable environment to ensure the well-being of future generations (Najad, Ahmad, & Zen, 2018). Various communities, including universities, are now rushing to create a green profile, product, or image in order to promote a greener environment for the good of humanity (Habib M. Alshuwaikhat, 2008).

Universities have always been playing a crucial part in generating future leaders who will be responsible for all the developments that occur in the future (Keat, Yaacob, & Hashim, 2016). Universities are the institutions that enable individuals to develop and enhance their self-identity and be visionary regarding the future. Irrefutably, universities across the world are faced with numerous challenges emanating from the increased use of natural resources and energy consumption due to the growing number of students enrolled and the newest equipment that consume electricity in teaching and learning processes (Keat, Yaacob, & Hashim, 2016). Malaysia, being a developing country, is no exception. Public universities in Malaysia are facing the same issues concerning environmental protection and the sustainability of the world (Muhiddin, Isa, Sakip, Nor, & Sedhu, 2023). Owing to the environmental issues facing the world, universities have to take an active role in generating solutions to ensure the environment is safeguarded. The primary purpose of this study is to examine the issues

Malaysian public universities are facing in order to develop solutions for creating a sustainable environment (Muhiddin, Isa, Sakip, Nor, & Sedhu, 2023).

Malaysian Public Universities Overview

The Malaysian higher education system is crucial in the social, economic and cultural growth of the nation (Keat, Yaacob, & Hashim, 2016). Concern with issues of sustainability in Universities and colleges is gaining momentum around the world, particularly among developing nations. In Malaysia, institutions of higher learning have been assigned a central role in assisting the national aspiration of attaining sustainability (Muhiddin, Isa, Sakip, Nor, & Sedhu, 2023). Nonetheless, being an environmentally sustainable organisation is fraught with numerous challenges. Recent studies have established methodologies which Universities and Institutions of Higher Learning may adopt towards becoming organisations that adhere to sustainable development goals (Habib M. Alshuwaikhat, 2008). The aim of this paper is to précis the existing literature on the challenges Malaysian universities and institutions of higher learning are facing in ensuring an environmentally sustainable environment. The paper also discusses and provides sustainable solutions such as environment-friendly policies and activities initiated by Malaysia's public Universities (Muhiddin, Isa, Sakip, Nor, & Sedhu, 2023).

Public universities in Malaysia are publicly owned and fully or partially funded by the Malaysian government. In the 20th century, the significant role of universities and other related learning institutions have positively contributed to the development of the country. Most of these public universities are research universities, which included two premier universities, i.e., University of Malaya, and Universiti Sains Malaysia. As stated in the Malaysian Budget 2024, education is the third largest item of expenditure in the development budget. Higher education sector which inclusive of 20 public universities, 467 polytechnics, 516 community colleges and 543 private higher education institutions receive RM16.3b for comprehensive benefits (Malay Mail, 2023). As such, universities must be responsive to the challenges of the 21st century by creating a holistic paradigm that focuses on the academic value as well as environmental stewardship for future sustainability.

Environmental Issues Confronting Universities

Malaysian universities are now confronted by the challenge of sustainability, particularly on the environmental dimension at the campus level (Muhiddin, Isa, Sakip, Nor, & Sedhu, 2023). Universiti Teknologi Malaysia (UTM), for instance, has experienced a collective effort in starting the indicators of sustainability for the University. The presence of huge numbers of students and staff necessitates high energy and resources demand (Abdul-Azeez & Ho, 2015). The attempts to conserve and safeguard the environment respond to the problems within those institutions and serve as a guide in carrying out campus management, procedures, and activities (Abdul-Azeez & Ho, 2015). Limited land space and compromised air quality during Malaysia's haze period contributes to the environmental problems for the universities and colleges (Abdul-Azeez & Ho, 2015). Monash University already received the official recognition of the Malaysian government for its contributions in the field of green campus (Najad, Ahmad, & Zen, 2018). Universities also embraced the green campus concept in teaching, learning, and research activities due to the infusion of sustainability and environmental ethics in the academic curricula (Muhiddin, Isa, Sakip, Nor, & Sedhu, 2023).

The Faculty of Civil and Environmental Engineering (FCEE) at Universiti Tun Hussein Onn Malaysia houses researchers dedicated to the development of a sustainable environment and has been able to come up with a host of innovations and products (Abdul-Azeez & Ho, 2015). The role of the Faculty in the development of sustainability has received accolades from the government. FCEE's main goal at the moment is to create an Active, Healthy and Green (AHG) campus at its main campus through the adoption of practices that back the "Go Green" campaign, specifically targeting Malaysian Public Universities (Muhiddin, Isa, Sakip, Nor, & Sedhu, 2023).

Waste Management Problems

One of the most critical environmental issues facing Malaysian public universities is waste management (Aleluia & Ferrao, 2016). The high numbers of people in university campuses – students, staff, and faculty –

produce large quantities of wastes every day. These range from general solid waste to food waste from canteens, laboratory waste, and electronic waste. Lack of segregation of waste at the source, few recycling facilities, and limited awareness among campus residents commonly result in landfills overflowing and environmental pollution. The inappropriate disposal of hazardous laboratory waste also presents significant environmental and health risks (Chan & Theam Foo Ng, 2022).

Energy Consumption and Efficiency

Universities are large consumers of energy because of the wide usage of lighting, air conditioning, computers, laboratory equipment, and other electrical appliances in their many buildings, lecture theaters, laboratories, and student residential buildings (Ahmad Sukri Ahmad, 2013). Older university buildings might not be energy-efficient by design, which causes a lot of energy wastage. The use of fossil fuels for energy production results in greenhouse gas emissions and climate change (Ali & M. Hasanuzzaman, 2021). The application of energy-efficient technologies, the adoption of energy conservation behavior, and the use of renewable energy sources are important but are often difficult to achieve because of financial and technological limitations (Ahmad Sukri Ahmad, 2013).

Water Resource Management

Water is an essential commodity, and its effective management is an increasing concern for Malaysian public universities (Chan N. W., 2012). Large numbers of students and sprawling campus facilities translate to significant water usage for multiple purposes, such as sanitation, irrigation of landscaped areas, and laboratory use. Issues range from aging water infrastructure causing leakages, inefficient water fittings, and lack of systematic water consumption monitoring (Al-Mamun & Zainuddin, 2013). Water pollution through improper discharge of wastewater from laboratories and other campus operations can also affect surrounding water bodies (Chan N. W., 2012).

Loss of Biodiversity and Conservation

As campuses grow, they tend to encroach on natural habitats, which contributes to biodiversity loss (Manokaran, 1992). Even in existing campuses, unawareness of the significance of biodiversity can lead to the deterioration of green areas and the loss of local plants and animals. Universities can play a special role as living laboratories for the conservation of biodiversity, but this needs special efforts in campus planning, landscape management, and education (Yang Ling Tan, 2022).

METHODOLOGY

This paper takes a systemic literature review methodology to explore the issues of a sustainable environment in Malaysian public universities. The main aim was to integrate current knowledge, highlight the main issues, and report current practice and future direction pertaining to environmental sustainability in this particular higher education sector.

The methodology encompassed several distinct steps: A systematic investigation was performed across multiple academic databases (e.g., Scopus, Web of Science, Google Scholar) utilizing keywords such as "sustainability," "green campus," "environmental challenges," "Malaysian public universities," "higher education," "waste management," "energy efficiency," "water management," and "biodiversity." A particular emphasis was placed on peer-reviewed journal articles, conference proceedings, and authoritative reports published predominantly within the past ten years; however, seminal older works were incorporated to provide foundational context (Torres-Carrion & Carina Soledad Gonzalez, 2018).

Relevant information pertaining to environmental challenges, policy frameworks, sustainable practices, stakeholder roles, successful case studies, and barriers to implementation was extracted from the curated literature. This information underwent critical analysis and synthesis to uncover recurring themes, emerging trends, and noteworthy findings. The synthesized data was systematically organized into thematic sections, reflecting the structure of this article, to facilitate a coherent and logical progression of discussion. This

organization involved the categorization of environmental challenges, varieties of sustainable practices, and the functions of different stakeholders. Through the review, areas in need of further research or enhanced efforts were identified, culminating in the "Future Directions" section. All references were diligently cited according to APA style to maintain academic rigor and enable readers to access the original works for additional information (American Psychological Association, 2020). This qualitative methodology permitted a comprehensive understanding of the contemporary landscape of environmental sustainability within Malaysian public universities, drawing insights from diverse studies and initiatives to deliver an integrated overview.

DISCUSSION

Policy Framework for Sustainability

National Policies on Environmental Sustainability

Malaysia has formulated various national policies and frameworks to promote environmental sustainability. They include the National Policy on the Environment, the National Green Technology Policy, and several acts on environmental quality, waste management, and biodiversity conservation. These policies give public institutions, including universities, a general mandate to incorporate environmental aspects into their operations and development plans. The focus on green technology and sustainable development goals at the national level offers a conducive background for university-led sustainability efforts (Kementerian Tenaga Teknologi Hijau Dan Air, 2009).

University-Specific Sustainability Policies

Although national policies offer general direction, effective implementation of sustainability at universities needs specific individualized policies. A number of Malaysian public universities have started to develop their own sustainability policies, frequently expressing commitments to minimize environmental footprint, encourage sustainable behavior, and incorporate sustainability into their key activities of teaching, research, and community service (Ahmad Sukri Ahmad, 2013). Policies frequently address issues such as energy saving targets, waste management strategies, green procurement guidelines, and water conservation initiatives. Development and enforcement of such policies, however, differ greatly from one institution to another (Ahmad Sukri Ahmad, 2013).

Sustainable Approaches in Public Universities of Malaysia

Green Building Initiatives

Several Malaysian public universities are embarking on green building initiatives. These include building new facilities or retrofitting existing ones to meet green building specifications, incorporating features that range from energy-efficient lighting and natural ventilation to rainwater harvesting systems and the use of sustainable building materials. The aim of such initiatives is to reduce the environmental footprint of campus facilities and to demonstrate a commitment to sustainable development (Ali & M. Hasanuzzaman, 2021).

Eco-friendly Transport Solutions

In an effort to curb carbon emissions and ease traffic congestion within the campus, there is a move by some universities to adopt and develop sustainable transportation systems. Some of these sustainable transportation options involve encouraging public transport usage, offering bike lanes and bike-sharing schemes, setting up electric vehicle charging stations, and promoting carpooling (Tafida, Alaloul, & Zawawi, 2016). The aim is to shift from private vehicle use dependence towards creating a greener commuting culture.

Campus Greening Programs

Campus greening initiatives entail expanding green areas, planting additional trees, and developing ecological corridors in university campuses. These efforts lead to better air quality, increased biodiversity, and a more comfortable campus atmosphere (Muhiddin, Isa, Sakip, Nor, & Sedhu, 2023). The programs normally

incorporate the aspect of community engagement, where students and staff are engaged in tree-planting exercises and cleaning the campus.

Stakeholders' Role in Encouraging Sustainability

Government Agencies

Government agencies are essential in facilitating sustainability in Malaysian public universities through the provision of policy frameworks, funding, and regulatory supervision. Ministries in charge of environment and higher education have the ability to encourage green initiatives, provide grants for sustainability-related projects, and set key performance indicators for environmental care in universities (Keat, Yaacob, & Hashim, 2016). Their encouragement is paramount in influencing systemic change (Abo-Khalil, 2024).

University Administration

University administration, including top leadership, is instrumental in setting the strategic direction for sustainability. Their commitment to integrating sustainability into the university's vision, mission, and operational plans is essential. This includes allocating resources, establishing dedicated sustainability offices or committees, and ensuring accountability for environmental performance (Muhiddin, Isa, Sakip, Nor, & Sedhu, 2023).

Students and Student Organizations

Students and student groups are powerful agents of change towards enhancing sustainability in the campus community. Their enthusiasm, advocacy, and active involvement in environmental causes can significantly drive changes. Students can initiate recycling programs, organize awareness campaigns, promote sustainable lifestyle habits, and hold the university accountable for its environmental responsibilities (Noor, Mamat, & Mohamad, 2024).

Case Studies of Successful Initiatives

University of Malaya's Sustainability Initiatives

The University of Malaya (UM) is at the forefront of sustainability among Malaysian higher education institutions. The university has established a dedicated EcoCampus Secretariat and has implemented various programs that include energy conservation efforts, comprehensive waste management systems, and water conservation projects. UM's commitment to sustainability is supported by its focus on environmental research and attempts to integrate sustainability into academic curricula (Zakwan, Mahdzir, & Mustafa, 2025).

University Kebangsaan Malaysia Green Campus

Universiti Kebangsaan Malaysia (UKM) has worked assiduously towards applying a "Green Campus" model. The efforts made by UKM include enhancing the use of renewable sources of energy, enriching biodiversity through efficient landscape management, and developing an environmental care culture among its populace. Additionally, the university has engaged in research related to sustainable technologies and practices relevant to its campus activities (Keat, Yaacob, & Hashim, 2016).

Sustainable Practices at Universiti Putra Malaysia

Universiti Putra Malaysia (UPM) has shown significant dedication to environmental sustainability, especially in the faculties of agriculture and environmental sciences. UPM has placed emphasis on sustainable land management, waste-to-resource programs, and building ecological awareness through its curriculum and campus life. The institution also prioritizes research that supports sustainable development (Ahmad Sukri Ahmad, 2013).

Universiti Teknologi MARA's Sustainability Leadership

Universiti Teknologi MARA (UiTM) has become a prominent leader in sustainability in Malaysian higher education, as evidenced by the creation of the UiTM Green Centre (UGC) in 2020 to lead its sustainability agenda (UiTM Green Centre, n.d.-a). UiTM's dedication is embedded in its strategic plan through a "Smart Campus" theme and its firm performance in international sustainability rankings, including ranking 9th among Malaysian universities in the UI Green Metric World University Rankings 2021 (UiTM, n.d.-b). The institution has made considerable efforts in renewable energy, being the unique owner and operator of two large-scale solar photovoltaic (LSSPV) plants and widespread rooftop solar installations on its campuses, showing a palpable commitment to clean energy and carbon footprint reduction (UiTM Energy & Facilities, 2022). In addition, UiTM actively incorporates sustainability into its operations, research, and community service, prioritizing fields such as waste management, water conservation, and sustainable transportation in its Campus Sustainability Strategic Action Plan 2024–2030 (UiTM Green Centre, n.d.-c). Through these multifaceted endeavors, UiTM illustrates a holistic approach to environmental sustainability, aligning its activities with national aspirations and the United Nations Sustainable Development Goals (UiTM, n.d.-d).

Challenges in Adopting Sustainable Practices

Financial Constraints

A primary obstacle to the adoption of sustainable practices within Malaysian public universities is the issue of financial limitations (Keat, Yaacob, & Hashim, 2016). The capital needed for investments in green technologies, the renovation of existing structures to enhance energy efficiency, and the establishment of extensive waste management systems is frequently considerable. Although such investments may result in cost savings over time, obtaining the necessary initial funding proves difficult, particularly for state-funded institutions that face budgetary constraints (Abo-Khalil, 2024).

Lack of Awareness and Educational Programs

Despite the growing global emphasis on sustainability, there still exists a notable gap in comprehensive knowledge and teaching regarding environmental issues and sustainable practices among university students and staff (Sadeq & Ismail, 2025). This state of affairs can lead to a lack of participation in sustainability, improper waste disposal, and inefficient use of resources. Bridging this information gap through effective teaching and awareness programs is crucial (Najad, Ahmad, & Zen, 2018).

Resistance to Change

Sustainable practices typically involve altering ingrained routines, habits, and institutional culture. Resistance to change may be based on a number of factors ranging from comfort with current practices, perceived inconvenience of adopting new approaches, or limited awareness of the gains of sustainability. To overcome such resistance, firm leadership, efficient communication, as well as an inclusive strategy engaging all stakeholders in the transition, is needed (Chan & Theam Foo Ng, 2022).

Future Directions for Sustainability in Higher Education

Incorporating Sustainability into Curriculum

To develop a generation of leaders who are sensitive to environmental concerns, it is essential to introduce sustainability into the core curriculum of a variety of disciplines. This effort goes beyond establishing separate environmental science programs and requires the introduction of sustainability concepts into engineering, business, social sciences, and the humanities (Muhiddin, Isa, Sakip, Nor, & Sedhu, 2023). This approach ensures that all graduates have a fundamental understanding of sustainability problems and solutions regardless of their area of academic concentration.

Joint Research

Possibilities Universities are well placed to undertake interdisciplinary research targeting intricate sustainability problems. Encouraging joint research activities among various faculties, with other universities,

and with industrial partners can generate innovative solutions to energy, waste, water, and biodiversity problems. It is also a way to give students valuable opportunities to be involved in significant research (Habib M. Alshuwaikhat, 2008).

Enhancing community participation in the universities can expand their sustainability initiatives beyond campus boundaries through active interaction with the surrounding communities. This may include transferring knowledge, joint community-level environmental initiatives, and encouraging sustainable lifestyles among neighbouring communities. This interaction reinforces the university's position as a good community citizen and increases its influence on overall sustainability objectives (Abo-Khalil, 2024).

CONCLUSION

Malaysian public universities are confronted with complex challenges in attaining environmental sustainability, from dealing with enormous quantities of waste and high energy use to mitigating water resource depletion and loss of biodiversity (Ahmad Sukri Ahmad, 2013). Although national policies offer a conducive environment, the effective execution of sustainable measures depends on the formulation of specific university-level policies, dynamic administration, and active participation of all stakeholders, especially students (Keat, Yaacob, & Hashim, 2016). Regardless of fiscal limitations, limited awareness, and opposition to change, several universities have shown admirable initiatives through green building, sustainable transportation, and campus greening (Chan & Theam Foo Ng, 2022). In the future, the deeper infusion of sustainability into the curriculum, collaborative research, and community engagement will be imperative for Malaysian public universities to make meaningful contributions towards a sustainable future for the country and beyond (Noor, Mamat, & Mohamad, 2024). By meeting these challenges and opportunities, Malaysian public universities can entrench their position as champions of environmental guardianship and become change catalysts for a more sustainable environment (Muhiddin, Isa, Sakip, Nor, & Sedhu, 2023).

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