Towards Developing a Sustainable Campus: Best Practice Approach

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***Abstract*— Campus Sustainability has become challenging because it requires active participation and coordination of related stakeholders particularly the campus community itself. Previous research has pointed out that for a campus to be sustainable, consideration to the three pillars of sustainable development is essential. This refers to the preservation of the environment, continuous economic growth and social sustainability. Good governance and best practice is the key to achieve a sustainable campus. This could be achieved through active coordination and participation between the management, administrative and operational departments, and the academic department and its local community. Continuous support of the efforts to achieve a sustainable campus will be reflected in the quality of the teaching, learning and other related activities. Hence it is important to frame out the best practice that comprises a holistic approach and strategies to achieve a sustainable campus. This paper provides a review on the status of higher education development in Malaysia that also looks into the issues and challenges of achieving a sustainable campus. Subsequently, the authors propose a conceptual framework of best practice to achieve sustainable campus aimed at improving the current campus sustainability plan.**

***Keywords*—** *Sustainable development; sustainable campus;best practices;Malaysian universities*

1. Introduction

Achieving campus sustainability has become particularly challenging because it requires active participation and coordination of related stakeholders particularly the campus community itself. However, it has been one of the main priorities of university policymakers and planners as a result of the impact of university's activities and operations have upon the environment. The issue is becoming more significant as we are facing problems as a result of the global warming and changes in the climatic condition. A sustainable campus can be defined as "healthy campus environment, with a prosperous economy through energy and resource conservation, waste reduction and an efficient environmental management, and promotes equity and social justice in its affairs and export these values at community, national and global levels"[1]. Previous research has pointed out that for a campus to be sustainable, consideration to the three pillars of sustainable development is essential. This refers to the preservation of the environment, continuous economic growth and sustainability of the community [2]. Through the process to achieve sustainable campus, it is also important to understand the campus ecology. Campus ecology consists of three components that include; (i) campus population/ organisms/ inhabitants; (ii) settings/ environment; and (iii) activities/ behaviors and operations [3]. Drawing from this, a campus can be regarded as a small city because the structure and composition is similar but at a different scale [4]. Hence it is important to frame out the best practice that comprises a holistic approach and strategies to achieve a sustainable campus. In the first section of the paper, the authors provide a review on the status of higher education development in Malaysia that also looks into the issues and challenges of achieving a sustainable campus. Subsequently, the authors propose a conceptual framework of best practice to achieve sustainable campus.

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2. Issues in developing a sustainable campus

The issue of sustainable campus development is becoming a critical issue in Malaysia. The expanding higher education 'industry' is reflected in the numbers of universities established in Malaysia. In 2006, there were only 20 public universities established in Malaysia. More recent statistics from the Department of Education, Malaysia indicates that there are 70 private universities incorporated since 2011, which are in the process of establishing their campus [5].The rapid expansion of the education industry reflects in the increasing number of foreign universities launching local campuses in Malaysia. The rise of campuses is in line with the aim of the Malaysian Ministry of Education to place Malaysia on the map for international higher education [5]. Accordingly, campus development issues should cater the needs of the increasing population of both local and international students. Consequently, sustainability in campus calls the university to promote an integrated approach that incorporated the three pillars of sustainable development; environmental, economic and social aspects. It is apparent that the general awareness of sustainability in campus universities is directed towards the steps to be taken for maintaining the sustainable campus and resolving the challenges. However, a more proactive solution calls for enabling sustainable efforts to be incorporated into the existing campus development, as this is more reflective of the current situation in Malaysia where most universities were developed before the awareness of sustainability in campus development. In addition, for new campus development or building, it shall be a priority to incorporate the sustainability features to ensure that the new development are ready to face the challenges of changing climatic conditions and the increasing population, needs and demand of the campus community. In enabling sustainable campus development, several components must be considered. These elements should reflect the need and unique requirements of that particular university. This is to ensure that all works conducted concerning campus development must comply with the standards set by the users or the persons responsible in managing the campus facilities [6]. Based on the multitude of works as well as the multiparty involvement in developing a sustainable campus calls for a method that encourages knowledge sharing and mutually shared objectives, to ensure the needs of the user (university student and staff) are fulfilled as well as satisfying the requirement in being energy efficient and environmentally friendly yet sustaining if not profitable to the operational costs of the university.

The awareness raised by several declarations such as Tallories, Kyoto and Thessaloniki Declarations on sustainable universities and higher education institutions have paved the way for sustainable efforts in universities worldwide [7]. In the context of this paper which discusses the significant efforts in the sustainable campus development, the definition provided by [8] shall be applied. It also stated that a sustainable campus community acts upon its local and global responsibilities to protect and enhance the health and well-being of humans and ecosystems[8]. It actively engages the knowledge of the university community in addressing the current and future challenges, be it ecological or social in nature. This definition implies that sustainable campus does not only reflect on the existence of green and environmentally structures, but it also encompasses the entire social system in the proximity of the campus. Accordingly, previous studies have also highlighted that a sustainable university campus should be a healthy campus environment[1],[3]. The campus should impart a prosperous economy through energy and resource conservation, waste reduction and an efficient environmental management, as well as promoting equity and social justice in its affairs. The campus then exports these values to the community, national and global levels[1], [9].

In terms of environmental consideration, green buildings that can reduce energy and water consumptions while having a minimal carbon footprint [10]. The target of the energy-efficient green buildings is to have better lighting, temperature control, improved ventilation and indoor air quality which contribute to healthy environments by reducing the dangerous air pollutants that cause respiratory disease in campus buildings [11]. However, to support the existence of green buildings and environmentally friendly structures, comprehensive measures should also be taken to shift the political and managerial mindsets of the government and more specifically campus

administrators to ensure that the systems support the existence of green buildings and will enable the sustainable efforts to be successful.

Previous studies have identified the issues about sustainable campus development [12], [13], [14]. In the matters of developing a sustainable campus, the underlying factors of sustainable development should be highlighted. These basic factors; ecological, social and economic must be present in developing a sustainable campus. Correspondingly, the paper highlights issues in developing a sustainable campus from the design and construction stage up to the operations and maintenance stage. Hence it is important to understand the difference between 'developing' a sustainable campus and 'sustaining' a sustainable campus. When developing a new campus, sustainable strategies can be incorporated starting from the planning and design stage. This refers to the implementation of sustainable strategies such as; zero-carbon footprint, collaborative procurement, climate-friendly purchasing, green construction, green and low energy buildings and use of green materials. However, strategies for existing campus are more challenging as it involves an adaptive approach, which most of the time requires the full commitment of university stakeholders and its users/ community.

3. Sustainable campus development in Malaysia: current status

In Malaysia, most public universities have taken the initiatives to commit in transforming into a sustainable campus. This is the outcome of Malaysia's commitment to the implementation of the sustainable development. Policies to govern the sustainability of the campus lie within the jurisdiction of the university itself. However, the degree of the approach and implementation varies. As an example, Universiti Kebangsaan Malaysia (UKM) has setup a sustainable institute- Institute of Environmental and Development (LESTARI) in 1994 to look into the adaptive strategies towards transforming UKM to become a sustainable campus [9]. However, focus of the institute is to mainly look into the environmental and education component of sustainability. Universiti Teknologi Malaysia (UTM) on the other hand, has developed a UTM Campus Sustainability Policy in 2010 that include the establishment of UTM Campus Sustainability organization (consist of Sustainable Campus Council) [15]. Over the years, the policy has improved. The policy has moved towards becoming more comprehensive with consideration to address the three main sustainable components; resource consumption (incorporates environmental component), economic and socio-cultural. However, it is realized that there still lacks consideration to the campus physical development / improvement that would potentially contribute to the conducive environment for teaching and learning [13]. Another study in a Malaysian university had identified the university community perceptions on the components of these underlying factors and how these factors are fulfilled in their university campus [16]. In general, the results indicate that the staff and students are aware of the importance in having a balanced land distribution for a green area and construction to enhance a healthy and sustainable lifestyle; as well as identifying the lack of renewable energy sources on campus. Furthermore, the campus community called for a better plan in waste management and recycling effort for the campus. This indicate that the campus community is aware of the ecological aspects of the campus operations and requires action to be taken in managing the environmental aspects of sustainable campus development through formulating a campus sustainable master plan and guideline to enhance the campus development according to sustainability underlying factors. In new campus development, an issue in developing a sustainable campus revolves around aspects of planning, designing and construction processes. As the full government-sponsored higher education institutions, the budget for campus development comes from the government. Many of the projects in campus development have difficulty regarding the budget received from the government. Proposing the planning to the government will not get the enough resources for the development, in this situation the project has to be redesign to reduce the cost to ensure the structure can be built according to the specification needed by the client. This has resulted to the objective to achieve a sustainable campus is compromised.

4. The best practice approach in achieving a sustainable campus

Good governance and best practice is the key to achieve a sustainable campus. This is realized through active coordination and participation

between the management, administrative and operational departments, and the academic department and its local community [3], [17]. Generally, priority of the campus sustainability initiatives shall include reduced greenhouse gas emissions; energy, water, fuel and cost savings; improved health; and increased resilience to climate change impacts. Continuous support on the efforts to achieve a sustainable campus will be reflected to the quality of the teaching, learning and other related activities [17]. Previous studies have proven that a sustainable and conducive campus environment able to give positive impact to the students' and staffs' performance, behavior, satisfaction and relationship with the campus [3], [18], [19].

In terms of new campus development, current campus sustainability plan has already emphasized the need for zero-carbon footprint, low energy building and sustainable transport. However, there is still limited research that focuses on the aspects of collaborative procurement/ partnering in the campus project delivery. The consideration in this aspect will contribute to achieving a sustainable campus in the early stage of campus development. Partnering has been recognized as one of the project delivery methods, which allows for early involvement of all players in a construction project [20]. Collaboration and coordination between all players in the construction industry are crucial for sustainable design and development, as highlighted in [21], [22]. Although there are works of literature citing the importance of the partnering method in sustainable development, there seems to be a minimal discussion on applying the partnering method in a model specifically for sustainable campus development[23], [24]. Realizing this gap, the authors proposed to establish the link in which partnering practices assist the adoption of sustainable campus development among Malaysian universities and more specifically, and identify the key factors that are needed for partnering in enabling sustainable campus development for Malaysian universities. On the other hand, the adaptive approach in existing campus is currently a challenge for the university policymakers and managers. The development of most public universities in Malaysia was before the realization of the need to incorporate the idea of sustainability. Since the process to achieve campus sustainability is intricate, it may require longer period. As a start, the process requires the audit of existing performance of the campus. Findings from the audit will be the foundation of the benchmark to assess the sustainability status of the campus. Table 1 provides a comprehensive framework of best practice to achieve sustainable campus is pertinent specifically for the Malaysian context.

4.1. Environmental sustainable

Majority of the public university in Malaysia have taken initiatives to address the environmental sustainability of its campus. However, it is noted that there is still limited effort taken to look into the resilience of the campus towards the changing climatic conditions. Getting the campus ready for the extreme event is crucial because these phenomenons such as heat waves and flooding are occurring more frequent. Therefore, campus managers can address this issue by looking into the multifunctional use of spaces through the concept of water/ climate sensitive campus design within the campus ground. The multifunctional character of the spaces have the potential to adapt to the changing climatic conditions hence have better resilience to the adverse impact of climate change. Other sustainability initiatives include sustainable waste management, integrated water management, sustainable transport and increased energy efficiency. Nevertheless, these initiatives have already been in placed in most university sustainability plan. However, it is worth noting that what really determines the success of such policy or plan is the implementation and monitoring. It is also important to detail out the strategy to be more practical in addressing the implementation issues. Audits and assessments of the performance and implementations of the policy shall be performed from time to time to ensure that the effort is continuous.

4.2. Social Sustainability

A university campus can only be regarded as socially sustainable when the core dimensions of social sustainability is fulfilled; satisfaction of basic needs and the quality of life, social justice and social conference [25]. Community is the main component of the campus ecology [26]. Hence, campus design and development should be integrated with the idea that the community has a place that they can engage with i.e. place-making. In the context of sustainable campus, place-making can be achieved through the physical planning of

landscape elements and structure that can also contribute to increased comfort and safety and further improve the public realm [27]. Furthermore, social sustainability is also closely related to the behavior of people and how people respond to change in their surrounding environment. Hence, it is important that campus sustainability initiatives carefully consider that the there is continuous efforts to achieve social sustainability. With reference to Figure 1, the authors suggested that the initiatives to achieve social sustainability in campus includes; planning for facilities and services, campus design for place-making/public realm, Improve public space/open space, increased accessibility and create conducive environment through physical improvement. Planning for the community in the planning and design stage is more effective in ensuring the campus can contribute to achieving a sustainable community.

4.3. Economic Sustainability

In today's economic situation, to attain economic sustainability shall be a priority. The recent Malaysia Education Blueprint 2015-2025 (Higher Education) has highlighted that Malaysian universities need to transform their management and operation to allow them to become self-autonomy [15]. This refers to the condition where the university's activities and operation will able to generate more income as the federal government reduces the financial support and subsidies in the university cost of operation. In line with this, to become economically sustainable, the university policymakers and stakeholders need to incorporate the sustainability initiatives more effectively and efficiently. Among the initiatives for economic sustainability include; planning for eco-friendly building, promoting climate-friendly purchasing, sustainable water and waste management and increase energy efficiency and to apply adaptive reuse whenever possible. On the other hand, the university policymakers also need to consider options where it can reduce the cost of operations whilst generating income. Apart from research and consultancy, rental of spaces and other main university activities, options for income generation include efficient waste management and energy harvesting. This can be achieved through proper implementation and monitoring of the sustainability initiatives.

Table 1 Framework of Best Practice for Sustainable Campus

	New campus development	**Existing campus (Adaptive)**
Environmental	SUSTAINABLE/ EFFICIENT TRANSPORTATION • Minimize vehicular movement • Designated bicycle routes • Continuous covered walkway • Electric bus • Centralized transportation hub / to integrate with existing public transportation • Mass parking / park and ride	SUSTAINABLE/ EFFICIENT TRANSPORTATION (Improve current situation based on audit result/ benchmark) • Minimize vehicular movement • Propose designated bicycle routes • Propose continuous covered walkway • Electric bus
	GREEN INFRASTRUCTURE/ CONSTRUCTION • Low Energy Building • To adhere to the Green Building Index (GBI)/ LEED/ BREAM throughout the whole process of design, planning and construction. • To use recycled building materials • Local Materials (Less than 100km from source) • Green Method of construction using materials with recycled content and maximizing prefabricated system	ENERGY EFFICIENCY • To audit current energy use and performance for benchmarking purposes • To establish behavior guidelines for energy efficient use i.e. turning light on/off, office machines, etc. • Encourage the use of Energy Star* computers and other office machines • To retrofit low energy light bulbs and inverter split unit air conditioning unit. • To maximize use of natural lighting/ daylight from window

	during construction. • Minimize construction waste.	• To maximize use of facilities during daytime and minimize night time usage or centralize usage during night time.
	SUSTAINABLE WATER MANAGEMENT • Incorporate water-efficient systems that include the opportunities for use of recycled water • To install water-efficient fittings	SUSTAINABLE WASTE MANAGEMENT/ WASTE REDUCTION/ RECYCLING • To reduce waste to landfill by promoting recycling (avoid, reduce, reuse, recycle and disposal). • To ensure the recycle/waste bin are placed at most high use location. • To assess the current distribution and capacity of recycle and waste bin. • To encourage refill
	WATER/ CLIMATE SENSITIVE CAMPUS DESIGN • Increase more tree plantings • Closed-cycle water management (rainwater harvesting and reuse) • Use recycled water for landscape irrigation • Use less technology through natural vegetation and plantings; green roof, green walls, vertical gardens, rain gardens and etc. • Use of porous, permeable pavement materials to permit infiltration	
Economic	SUSTAINABLE / COLLABORATIVE PROCUREMENT • To implement sustainable procurement practices in all contracts • To promote the use of technology to reduce overhead cost	• Sustainable water management • Sustainable waste Management • Increase energy efficiency and management/ energy harvesting • To use recycle materials/ furniture
	To encourage the participation of local suppliers/contractors in projects or procurement agreements.	
	CLIMATE-FRIENDLY PURCHASING • To purchase office materials that minimize the environmental impacts, i.e. paper products, food utensils (recyclable plates, reusable cups and utensils) • To use fuel-efficient/ hybrid/electric vehicles • Purchasing of new equipment that meets the Energy Star rating/ energy efficiency standard	
	GREEN CONSTRUCTION • Low carbon footprint / eco-friendly building • Use of local/ recycle construction materials for cheaper options	ADAPTIVE REUSE • To encourage adaptive reuse of existing buildings/spaces to minimize cost of new development
Social	• Planning for facilities and services Campus design for place-making/public realm	• Improve public space/open spaces • Increased accessibility
	• Community design that encourages social interactions and healthy activities (recreational public spaces)	• Create conducive environment through physical improvement i.e. landscaping

5. CONCLUSION

The strategy for sustainable campus development requires a comprehensive understanding of the factors involved in the development, construction, maintenance and the overall operations of the university. In Malaysia, since most of the public universities were built before the awareness of sustainable development declaration, to achieve a sustainable campus is a challenge. The commitment of all stakeholders, including campus community is vital. A top-down involvement is required to ensure that all functions within the university realize the criticality of the situation if the campus does not attempt to minimize its carbon footprint and energy consumption. Moreover, the faculty and student should become active advocates in promoting the sustainable practices that can be adopted in daily living through research and community engagement activities, rather than just imposing the responsibility for sustainability to the administrators, builders and designers. The move towards sustainability is holistic in nature and requires the total involvement of all parties, as this is our responsibility to future generations. Whether it is adaptive strategies or strategies for new development, sustainability considerations will provide positive impact to the campus environment and inhabitants. In addition, the role of sustainable campus manager is also important to ensure that there is a continuous effort and monitoring. The proposed framework of best practice for sustainable campus in this paper is expected to assist university managers and related stakeholders to further improve the current sustainability plan and policy. Further research in this area may include assessing and evaluating the implementation and performance of the current sustainability policy. The process may include the comparative analysis of the current plan with the best practice framework to further establish detailed strategies and actions for a holistic approach to achieve campus sustainability.

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