An Investigation on Green Building Implementation in Campus Environment: Preliminary Study

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ABSTRACT

Green building well-defined as the building that concentrations on maximise the energy-efficiency and resource used, whereas minimise building impact on human health and the environment during its life cycle. Numerous higher education institutions like universities, polytechnic and colleagues in Malaysia have initiated exploring green campus which includes converting existing building to green building. Since, the students and staff population in campus have significantly grown in number thing, it is putting pressure to the campus management to improve and also looking forward to become a green campus in the future. This research had been carried out with the aim to identify the initiatives, challenges and strategies among campus community toward achieving green building. Data for this study was obtained through questionnaire survey to targeted respondents such as students, academic and supporting staff. The data was analysed using descriptive statistical analysis. The research has established that there is serious need for the establishment of clear initiatives, challenges and strategies for green building concept in campus. A lot of efforts by campus community need to improve the existing infrastructure and facilities if they plan to achieve green building status in the future.

INTRODUCTION

A Green building focuses on increasing the efficiency of resource use – energy, water, and materials – while reducing building impact on human health and the environment during the building's lifecycle, through better sitting, design, construction, operation, maintenance, and removal. Green Buildings should be designed and operated to reduce the overall impact of the built environment on its surroundings. Another element on green building are:

a. Designed to save energy and resources, recycle materials and minimise the emission of toxic substances throughout its life cycle. Preservation water and water efficiency.
b. Harmonise with the local climate, traditions, culture and the surrounding environment.
c. Able to sustain and improve the quality of human life whilst maintaining the capacity of the ecosystem at local and global levels.
d. Make efficient use of resources, have significant operational savings and increases workplace productivity.
e. Sends the right message about a company or organisation – that it is well run, responsible, and committed to the future [1].

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In brief, the environmental impact of buildings is often underestimated, while the perceived costs of green buildings are overestimated. [2] comprehensively examined the costs and benefits of green buildings for the state of California in the United State. In a follow up study, [2] found that the average cost premium over just building to code is less than 2%. The report found that "minimal increases in upfront costs of about 2% to support green design would, on average, result in life cycle savings of 20% of total construction costs more than ten times the initial investment". The majority of savings from green building are in the maintenance part and utility costs [3].

In order to improve the healthy and comfortable of the community on campus, campus planning and designs need to be tailored to strengthen sustainability by facilitating the community to work, learn, enjoy, shop, travel and eat in a more sustainable manner [4]. In the context of planning and design, a sustainable campus is defined by a campus that assimilates green and nature elements to provide a healthy environment and space that supports social integration among society. In Malaysia, universities and higher education institutions with a high focus on green and sustainability concept are lacking [5]. In terms of green university campus, the ranking of Malaysian green university campus is low compared with other countries such as Canada, United Kingdom, and America [6]. Universiti Putra Malaysia (UPM) has the highest ranking amongst the universities in Malaysia based on 2015 ranking. It is ranked 17th based on the participating universities in the UI GreenMetric Ranking [7].

Besides, in a comprehensive study of sustainable campus, [8] suggested, in accordance with competitive spirit and determination to become a sustainable campus, University Technology Malaysia (UTM) needs to monitor the process of sustainable campus and to improve the planning process there is need to identify factors that lead to indicate sustainable campus initiatives. This will help to evaluate and coordinate sustainable development in our commitment towards a greener and more sustainable environment, the entire community of campus is fortified to take environmentally – conscious steps and implement sustainable practices towards a greener environment. The key is going greener is to think greener. If each of us contributes in our own little ways by taking simple steps towards saving energy and preserving the nature, it would be able to have a major effect towards a better future.

Sustainable Higher Education Concept

The idea sustainable higher education concept has distinctive interpretations as per researchers in this specific field. Sustainable campus has been an important concept in the study that related as "a higher educational institution, as a whole or as a part, that addresses, involves, and promotes on a regional or global level, the minimisation of negative environmental, economic, societal and health effects generated in the use of their resources in order to fulfil its functions of teaching, research, outreach and partnership, and stewardship in ways to help society make the transition to sustainable lifestyles [9] . Similarly, [10], sustainable campus is fundamental aspect as "a higher educational institution that practises and promotes the minimization of adverse environment, economic and societal impacts in the use of its resources in order to fulfil its function of teaching and conducting research." Moreover, according to [11];[12] stated sustainable campus as "an institution which actively engages the knowledge of the university community to address the ecological and social challenges that we face now and in the future." Furthermore, local researchers propose that institutions of higher education in Malaysia are already taking on the concept of sustainability in their governing body that is demonstrated through several initiatives which are divided into five basic parts such as (1) sustainability in policy, planning and administrations (2) sustainable courses and curricula (3) research and scholarship (4) university's operations, and (5) outreach and services [13]. To promote the concept of sustainability in the university administration, [14] outlined three basic components that are (1) improving economic efficiency, (2) protecting and conserving the ecological system, and (3) improving human welfare. All of these components must be acknowledged so that the goal of

sustainable campus can be accomplished.

Objectives

The specific objectives of this study are:

i. To investigate initiatives that have been taken by the campus community towards green building.
ii. To identify the challenges towards achieving green building initiatives and,
iii. To propose the strategies for achieving green building campus.

METHODOLOGY

Data Collection

The data collection process involves a survey questionnaire in which the survey questions consist of a set of questions that have been framed and written where the researcher wants to ask the respondents and record their answers. Surveys can be an efficient data collection tool when researchers know precisely the information that is needed and how to measure the variables of interest. Thus, all questions should be understandable, clear, and obtain no ambiguity. Before disseminating the questionnaire survey, a literature review was performed to outline an overview of the research topic. Moreover, the necessary information and additional references needed for research were gained from the literature review. The materials for the literature review include books, articles, magazines, internet, journals, newspaper, and others. Thus, the literature review guides the preparation of the survey questionnaire. Data validation occurs after the questionnaires had been collected. In the process of validation, the answer obtained from questionnaires will be checked for accuracy and suitability for this study purpose.

Sampling Data

The questionnaire survey was distributed to 200 relevant respondents in one higher education institution at Melaka but only 165 questionnaire papers were collected back. The method of distribution and collection of the questionnaire survey encompass the following:

a. By hand distributions for selected respondents.
b. By conforming through telephone calls and dispatching the questionnaire.
c. By mail and returned via mail through a stamped self-addressed envelope. This research uses stratified purposeful sampling strategy, focuses on towards achieving green campus initiatives. Questionnaire survey is designed on the Likert scale which the likert item evaluate according to any kind of subjective or objective criteria on the level of agreement of disagreement. The questionnaire is built on likert's scale of five ordinal actions from one (1) to five (5) according to level of the contribution. Each scale signifies the resulting score: strongly agree (5 point), agree (4 point), not sure (3 point), disagree (2 point) and strongly disagree (1 point). This research has continued to determine the problem, solution and point out of the scope of data collection. This is conducted step by step start from literature review, sample data analysis; data collection, data analysis and finally the conclusion and suggestion were presented as the outcome of this research.

DISCUSSION

The Initiatives That Have Been Taken by Campus Towards Green Building

It has been reported that the top three "major" initiatives related to energy efficient criteria are Energy-efficient fluorescent lamps were install in place of 'conventional' fluorescent lamps, propose nightlights to avoid lights in bathroom from being left on all night and Add controls of lighting like time clocks or photo sensors. The respondents marked a score 3.45 which showed the high level of agreement that propose nightlights to avoid lights in bathroom from being left on all night. By proposing a night light, the saving of energy used can be increased from power a bathroom light during the night time. Therefore, the guest still can feel comfortable in the unfamiliar zone. Besides, second initiative are installation of energy-efficient fluorescent lamps in place of 'conventional' fluorescent lamps marked a score 3.43. This initiative is possible to be applied for transforming to green building. Nowadays, many types of fluorescent lamps that differ in term of lifespan or duration of lamp, energy consumption and quality of transmitted colour, thus, the campus technical teams select the right fluorescent lamps which suit its purpose the most. Then, the third top initiative are Add controls of lighting like time clocks or photo sensors, which is an average index 3.37. The photo sensor is the mechanical device which allows fittings to operate only when required by monitoring the daylight conditions. The light quantity will detect using sensor and the signal send to main controller to regulate the lighting. Photo sensors are a very cost-effective control device which can automatically the lights is on at dusk and off at dawn. Thus, the unnecessary lighting is not left on during daytime hours and then the energy cost will be reduced.

Whilst, the used of LED light bulb as the lighting systems in the campus and Installation of occupancy or motion sensors to turn lights on and off where applicable were also initiatives are taken toward green building. Considering all of these studies, it seems that the lighting can be controlled by occupancy sensors to allow operation whenever someone is within the area being scanned. When motion can no longer be spotted, the lights switch off. Thus, the energy waste has been reduced. Also, Multiple LEDs properly designed, produced equivalent lighting and consumed 95% less electricity. A major benefit is the 20 years life cycle rating of LEDs; it virtually eliminates maintenance. In the water efficiency criteria, the initiatives that can be applied are low flush capacity combination with the sensor operated flushing system in all the toilet. The mean index is 3.34 which agreed for these criteria. Then the fitting of dual-flush toilets which enable users to select to use only partial the water in the cistern which mean is about 3.29. It is the internal devices that can be installed in the existing building in order to maximise water efficiency within building to diminish the load on municipal water supply. So, we can save the consumption of water because the water has been used wisely. Next, in the Indoor Environment Quality criteria, the minor simplest initiatives are used of plastic sheets which emit light for an office block. The mean index is 3.23. This is the new technology where not familiar by respondent. The plastic sheets are used to collect and redistribute sunlight, so it does not require an electrical energy.

The Challenges Towards Achieving Green Building Initiatives

The study has figured out the most and the least important challenges towards achieving green building. This finding will help to identify the challenges towards achieving green building initiatives. According to results shown the top three major challenges are no demand for green building itself, lack of money and limited resources and perceived insignificant of the individuals' roles, while the top three minor challenges are lack of clear priorities for green measures, contractors feel hard to find suppliers for the use of sustainable materials and the benefits of greening building is too small. No demand for green building itself is the most important challenges towards achieving green building with an average index of 3.72. This has shown that the development commitment towards green building is still new, lack of competence person like

engineer, executive or manager, less demand and market in Malaysia. The second top "major" challenges are lack of money and limited resources with an average index of 3.71. [15] pointed out that cost factor is the main constraint to implement of this concept of sustainable construction at Malaysia construction industry. A few respondents stated that sustainable construction is believed by many to be economically non-viable. The practices of sustainable are believed to escalation project cost because they need to have higher capital upfront. Higher cost means higher price. If they pursue sustainability in the projects, they need to know that there is a market for it because technically, the cost will be transferred by the buyers or end users. The top "minor" challenges are the benefits of greening building are too small with an average index of 3.12. Level of understanding and awareness about green building concept is still low, so that is why they do not know about the benefit of greening building. Moreover, according to [16] also found that there is a lack of concern of the climatic aspect in the landscape design and outdoor campuses in Malaysia. Social interaction in outdoor spaces, in hot and humid weather is hardly observed in the campus environment due to the lack of shaded areas in the campus. This is linked with another finding stated that shading is provided by trees is sufficient to increase outdoor thermal comfort [17]. Hence, by creating a comfortable outdoor space are needed in encouraging outdoor activities within the campus.

The Strategies for Achieving Green Building

It has been observed that there are eight strategies considered importance to be adopted by the campus community towards achieving green building. This is because from the analysis, the average index for all criteria exceed to 3.5 which mean they are significant. From the eight questions that have been asked, there are sixth key criteria to be measured and related during assessment in order to obtain the score which are (i) Energy Efficiency (EE), (ii) Indoor Environmental Quality (EQ), (iii) Sustainable Site Planning and Management (SM), (iv) Material and Resources (MR), (v) Water Efficiency (WE) and (vi) Innovation (IN). The results analyses showed that provide recycle bin is the most important strategies with a mean index of 4.3. Provide a recycle bin can be considered under reused and recycled material or waste management and also related with 3R concept. This is also the way to accumulate and analyse data on the quantities and sorts of waste generated by the facility and figure out ways to reduce waste. Provide recycle bin is under item of material and resources. From the results identified the strategies which are less important is Introducing the Green Purchasing Policies with a mean index of 3.89. Introducing the Green Purchasing Policies is under the element of Sustainable Site Planning and Management. In addition, Malaysia country is still lacking in arrears in developments of green building compared with another country such as Singapore, Australia and Japan. [18] Obtained that few "green buildings" in the Malaysia, which have been built based on the concept of energy efficiency, despite it being a relatively new concept in the country. In addition, lack of awareness about this strategy is still low because the communities still not expose to this policy.

CONCLUSION

Based on the research findings good governances are the main factor that help organisations to achieve their objectives and target. Therefore, it is important for the campus community to develop their implementation agent to achieve the 2020 vision to become green building and sustainable campus. [19] suggested the adoptions of energy sustainability management practice in higher education institution's core activities:

a. Education – through curriculum and subject on green building and sustainability teaching in universities, polytechnic colleges and etc.
b. Training – Expose on general assessment and good practices as become qualified and competence person like engineer, manager and executive in green building, for example MYCREST qualified professional training course recommended by CIDB, Malaysia.

c. Research – Research relates sustainability, such as transport efficiency, ecological habitats, other environmental issues, procurement practices, alternative energy resources and building design, energy management and water efficiency
d. Operation – New building repair, design and refurbishment project, building maintenance and operations, landscaping concept, procurement practices, recycling at numerous levels, improvement of energy management, waste management, residential operation and food services.
e. Local community – Involvement the local community in providing various levels of resources to assist the community organisations, business community, green building effort, transport providers, vendors, utility suppliers and local chapters of professional affiliations.

The following recommendations are given for the future research as follows: (a) To study on indicators for sustainable campus initiatives. (b) To improve the benefits, challenges and barriers as highlighted in this research. (c) Technical study on comparison between other universities that implement green building concept. Hopefully the findings of this research will benefit to all anybody involved as well as the researchers, students and professionals in the achieving of green building initiatives for future generations.

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