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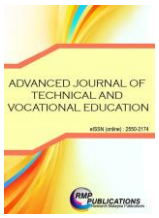

The Challenges of Sustainable Green Building Design in Malaysia

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Abstract: Green Building helps cities to support sustainable development agenda around the world. The interest in sustainable green buildings reflects the growing interest among the urban area in many developed and developing countries to build friendly-environment cities. The aim of this study is to identify the main challenges and issues associated with sustainable green building design as well as explaining the principle of green building in general. To achieve this objective, this study attempts to identify the strategy that enables green building developer to select sustainable technologies and materials in order to overcome the challenges in implementing sustainable green building. The result of this study showed that the obstacles in establishing green buildings have been raising in recent years so that sustainable buildings are not easy to be naturally different from conventional buildings. Thus, this study recommends for developers of green buildings to use special materials in the design of green building to achieve sustainability of environment through energy efficiency and use of efficient resources.

Key words: *Green Building Design, Green Building Strategy, Green Building Materials, Sustainable Green Building.*

INTRODUCTION

Green building development involves an integrated approach where building professionals collaborate closely on achieving sustainable goals and better efficiency in building projects. This new industry is expanding through the support of various organizations as well as public institutions and city governments that are requiring certain green standards in new construction of public facilities [1]. The design of green buildings in a sustainable manner aimed at reducing usurped its effects on the environment through energy efficiency and use of resources. The building is considered one of the biggest causes of the damage on the ground, as a result of excessive use of heating energy and cooling indoor environmental pollution caused by the largest of the exhaust pollution cars [2].

The concept of "sustainable design", "green architecture" and "sustainable buildings", reflect the growing interest among the urban sectors and economic development issues in the context of protecting the environment, reducing energy consumption, optimal utilization of natural resources, and greater reliance on renewable energy sources [3].

Green Building helps to support a broader sustainable development agenda. If sustainable development goals are to be truly reached, it can be argued that buildings should consume no energy, water or materials, and should produce no emissions, noise or waste over their lifespan. While this is an interesting concept, it is likely that working towards more modest goals during the next 20 years has to be done. Even at a more realistic level, there is global interest in improving the performance of buildings. Governments want to reduce the use of scarce resources and airborne emissions, owners want to reduce operating costs, and developers are finding that customers are demanding higher quality and performance [4].

THE PURPOSE OF THIS STUDY

This study discusses the main challenges and issues associated with sustainable green building design as well as explaining the principle of green building in general. It will be the goal of this research to address the challenges of sustainable development in green building technology in general and in Malaysia in particular. The attempt to achieve this objective through answering the following main question:

What is the strategy that enables green building developer to select sustainable technologies and

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materials in order to overcome the challenges in implementing sustainable green building?

SIGNIFICANCE OF THE STUDY

The significance of this study is mainly its critical discussion and analysis to solve the problem of green building in Malaysia, where it is concerned and urges the use of sustainable materials and encourages the architectural engineers in Malaysia to adopt the principles of green building in their design. The outcome of this research will contribute to the environment-friendly urban environment.

METHODOLOGY.

- Quantitative Survey
- Overall we have 162 participants
- 10 Survey Questions in total
- We used continuous scale (e.g. strongly Disagree to Neutral to Agree to Disagree to Strongly Agree).
- Google Forms –Statistical Package for the Social Sciences (SPSS) – Microsoft Word

THE CONCEPT OF GREEN BUILDING

Green building or green homes or sustainable building refers to both structure and the use of the processes that are environmental responsible and resource-efficient throughout a building's life cycle from siting through construction, operation, maintenance, renovation, and demolition [5]. It is the practice of increasing efficiency with which buildings use resources – energy, water and materials – while reducing building impacts on human health and the environment. Green building concept is gaining importance in various countries, including Malaysia [6]. The terms 'sustainable architecture', 'green building' and 'ecological design' have emerged, along with a host of similar permutations, in recent practice as environmentally friendly modes of design, construction and operation geared towards producing healthy enduring communities. However, the terms are still vague and lead to much ambiguity in their implementations. Chatterjee [7] defined the "green building practice" as a process to create buildings and infrastructure in such a way that minimize the use of resources, reduce harmful effects on the ecology, and create better environments for occupants.

Kamana and Escultura [3] defined "sustainable building" or "green building" as an outcome of a design which focuses on increasing the efficiency of resource use - energy, water, and materials – while reducing building impacts on human health and the environment during the building lifecycle, through better location, design, construction, operation, maintenance, and removal. Pan et al. [8] added that a green building is an outcome of a design philosophy which focuses on increasing the efficiency of resource use.

Green buildings exhibit a high level of environmental, economic, and engineering performance. These include energy efficiency and conservation, improved indoor air quality, resource and material efficiency, and occupant's health and productivity [9].

There is a deference between "green building" and "eco-construction", where the concept of eco-construction is a part of the whole concept of green building. The charter of the network for the development and the use of natural resources in local construction of the Mediterranean Cluster on Eco-construction and Sustainable Development defined the "eco-construction" as a holistic and integrated approach that aims to support access to a healthy habitat, primarily in rural areas, while ensuring conservation of natural resources and to build on the cultural and architectural heritage in construction [3]. Table-1 shows a comparison between "green buildings" and "non-green buildings" or "traditional buildings" [10].

Table-1: Comparison between "green buildings" and "non-green buildings"

Building Type	Green Buildings	Non-Green Buildings
Energy Consumption	Low	High
Indoor Environment Quality	Very Good	Good
Emissions	Low	High
Waste Management	Highly Efficient	Efficient
Building Materials	Environmentally Friendly	Not Environmentally Friendly
Project Practices	Sophisticated	Normal
Feasibility	>5% than Threshold	Threshold

GREEN BUILDING MATERIALS

The green building movement emerged to mitigate these effects and to improve the building construction process. This paradigm shift should bring significant environmental, economic, financial, and social benefits. However, to realize such benefits, efforts are required not only in the selection of appropriate technologies but also in the choice of proper materials. Selecting inappropriate materials can be expensive, but more importantly, it may preclude the achievement of the desired environmental goals. In order to help decision-makers with the selection of the right materials, a mixed integer optimization model that incorporates design and

budget constraints while maximizing the number of credits reached under the Leadership in Energy and Environmental Design (LEED) rating system was proposed by Castro-Lacouture et al. [11].

The presence of the organic matter in a given building material and its EMC are more important predictors of fungal susceptibility than the label of "green" or "non-green" [12]. Table-2 presents the characteristics of some green building materials.

Table-II: Characteristics of some green building materials Source: Hoang et al. [12]

Material	Source	Recyclability	Natural Cycle	Reference
Bio cement	Organic	Recyclable	Included	Hosseini et al. [13]
Eco-cement	Organic	Recyclable	Included	Yen et al. [14]
Green Concrete	Organic /Inorganic	Recyclable	Included with limitations	Kevern [15]
Reed Mats	Recyclable	Recyclable	Included	Samer et al. [16]
Straw Mats	Recyclable	Recyclable	Included	Samer et al. [16]
Steel Sections	Inorganic	Recyclable	Not Included	Samer [17]
Glass	Inorganic	Recyclable	Not Included	Hatem [18]

SUSTAINABILITY STRATEGY OF GREEN BUILDING IN MALAYSIA

The government of Malaysia has realized the importance of saving the environment through sustainable building development especially toward reducing carbon emission and resources use [19-21]. Many efforts to realize sustainability in building have been implemented in the country. The commitments are including the implementation of photovoltaic systems in buildings through the 'Malaysia Building Integrated Photovoltaic Program' (MBIPV) and introducing renewable energy program called 'SURIA 1000 for developers' [22].

The concept of sustainability has also been incorporated in the design of several government office buildings such as LEO (Low Energy Office), GEO (Green Energy Office) and Diamond buildings, which provide a platform for proof of the concept in driving forward the sustainability goals of the Malaysian building industry [19]. GBI Malaysia has been developed in 2009 for the reason of evaluating the environmental design and performance of Malaysian buildings [23].

Sustainability in Malaysian building project is also supported by the numerous current spatial planning of the country such as Malaysian National Physical Planning, National Urbanization Policy, Development Plans and the development control activities [23]. A special attention is also given in the Tenth Malaysia Plan (2011-2015) towards improving sustainability in the building sector of the country including to the economy plan to harness its energy savings potential and to reduce carbon emissions and dependence on fossil fuel. Revision of the UBBL (Uniform Building Bylaws) to incorporate MS1525 Code of Practice is highlighted in the plan for the integration of renewable energy and energy efficient systems in buildings. Wider adoption of GBI to benchmark energy consumption in the new and existing buildings is also emphasized [24].

Malaysian construction players are always offered a range of different thoughts that point to misconceptions and uncertainty about sustainable development [25]. They also claimed to be not fully understood the concept and principles of sustainability [21]. Besides, it was revealed that the current frameworks of sustainability in the country are not fully equipped to handle sustainable building project [19]. It is often encouraged environmental measure in most cases, yet the rest of measures are less promoted. Thus, knowledge enhancement and clear comprehensive framework of sustainable building that considered all the aspects of sustainability in building is very crucial to be explored.

CHALLENGES FOR IMPLEMENTING THE GREEN BUILDINGS TECHNOLOGY

There are various challenges in environmental and economic performance of green buildings in the world. For environmental performance, there were a significant amount of criticisms on the actual environmental performance of the buildings that obtained green building certificates for 'new building'. The challenges facing the contractors of green buildings technology are summarized as follows:

The Lack of Awareness:

The request for sustainability is recognized as "always there" but the implementation is very poor because there is a lack of awareness among clients, consultants and contractors [26].

Perception of Higher Cost for Sustainable Options:

It is common that there is always the perception that the cost required for green building alternatives are always higher than the conventional building method. The additional cost can be incurred from many aspects, it can be the higher purchase cost, the learning curve cost, employing skilled labor and a special design work program for the project [27].

Difficulties in Achieving Economic Scale:
Another main problem and obstacle preventing the implementation of green construction is the cost of the construction, it is too high and expensive. In quantifying the cost of green construction, 2 factors need to be considered which are the initial capital outlay for the building and the payback period, the time it takes to pay back the additional sustainability features of the building [28].

Insufficient Supply of Green Product:
In most of the countries whereby the developments of green buildings are still in initial stage, most of the green technologies and green product have yet to form a mature system for the user [29]. Sustainable development in housing is lacked of sustainable materials, methods and technologies [11].

Lack of Technical Understanding:
Due to the green technologies that being introduced are always something innovative, it will cause the lack of understanding of the staff in the constructions regarding the technical specifications and operation of the technologies. Undoubtedly, it would contribute a higher risk that error and delay will occur throughout the construction process due to unfamiliarity of the skill possessed [27].

CHALLENGES OF INDOOR AIR QUALITY AND VENTILATION OF GREEN BUILDINGS

Buildings and their related activities are responsible for a large portion of the consumed energy. It is therefore worthwhile to investigate methods for improving the energy efficiency of buildings. A hybrid ventilation system which employs both natural and mechanical ventilation can be used for the buildings even in severe climates. On the other hand, natural ventilation for the buildings is viable in the mid-seasons. The hybrid ventilation system is a feasible, low energy approach for building design, even in sub-tropical climates [30].
Khaleghi et al. [31] concluded that, in general, mechanical ventilation can provide better indoor air-quality, but the noise is an issue if the system is not properly designed. The results suggest that the acceptability of environmental factors in buildings depends on the degree of compliance of the design and its implementation with standards and design guidelines (i.e. for ventilation, air quality, thermal comfort, etc.), whether the original design concept is 'green' or non-'green'.
Gou et al. [32] stated that green buildings can have a more significant impact on their occupant health and productivity through improving indoor environment quality (IEQ).cHowever, post-occupancy studies invariably pointed out that green buildings were not always more comfortable and productive than non-green buildings. They presented a comparison study between three buildings (two green buildings and one non-green building) aiming to examine the actual performance of green buildings from occupant point of view.

SURVEY ON GREEN BUILDING CHALLENGES

The descriptive analysis (mean, standard deviations) associated with the items of Green Building Challenges in Malaysia in Malaysia is shown below:

Table-III: Descriptive result of Green Building Challenges

#	Description	Mean
1	The cost of the construction is too high and expensive in Malaysia	**3.59**
2	The implementation of green construction is very difficult in Malaysia	**3.48**
3	There is a lack of expertise on green building technology in Malaysia	**3.60**
4	Sustainable practices increases project cost in Malaysia	**3.86**
5	Investors in buildings avoid green building technology	**3.61**
6	The high capital investment is a big challenge to establish green building in Malaysia	**3.65**
7	The available information and studies on how major is high costing hinder the implementing of green construction industry is not well known	**3.45**
8	The lack of knowledge is one of the main obstacles towards the implementation of green building.	**3.71**
9	The government policy on green building need further development	**3.69**
10	A failure in implementation of green building is large scale in Malaysia due to lack of expertise	**3.52**
Average mean of all items		***3.61***

The findings from the descriptive results shows that the maximum level of agreement is found on item 4 (mean = 3.86), which understand that the sustainable practices increases project cost in Malaysia. It is found that items 8 and 9 scored the second highest level of agreement, mean = 3.71 and 3.69 respectively, which shows that the lack of knowledge on green building concept is one of the main obstacles towards the implementation of green building in Malaysia as well as the Malaysian government policy on green building need further development. The minimum level of agreement is found on item 7 (mean = 3.45), according to the participants confirmation that the available information and studies on how major is high costing hinder the implementing of green construction industry is not well known. The average standard deviation of all items is large (1.17). This result indicates that the standard deviation associated with this variable shows that the majority of responses are clustering away from the mean value of each item. The accumulated mean of all items equal (3.61). This value is positive and

indicates a good level of agreement by the participants on the challenges of green building in Malaysia.

RESULTS AN1D DISCUSSIONS

The review of literature shows that green building projects are not an easy plan and there are many challenges facing the developers of these building such as low-energy building; net zero energy building, and passive building.

This study found that three main challenges associated with green building. One of the main challenges is indoor air quality and ventilation of green buildings. It is found that buildings and their related activities are responsible for a large portion of the consumed energy. It is therefore worthwhile to investigate methods for improving the energy efficiency of buildings. A hybrid ventilation system which employs both natural and mechanical ventilation can be used for the buildings even in severe climates. In addition to that, there are some challenges associated with green building performance Green building performance is tied to credits and scores in green building rating systems as architects and design professionals base the of designs of their buildings on the requirements of the rating system for which they will apply. Finally, the challenges of integrated technologies are also one of the issues facing the developers of green buildings.

The empirical result of this study revealed that the cost of the construction is too high and expensive in Malaysia, the implementation of green construction is very difficult in Malaysia, there is a lack of expertise on green building technology in Malaysia and Sustainable practices increases project cost in Malaysia. Moreover, the high capital investment is a big challenge to establish green building in Malaysia. However, the available information and studies on how major is high costing hinder the implementing of green construction industry is not well known.

Furthermore, the survey on site shows a lack of knowledge on green buildings in general which is one of the main obstacles towards the implementation of green building. Thus, the government policy regarding green building requires further development because the failure in implementation of green building is large scale in Malaysia due to lack of expertise.

The test of relationships in previous chapter shows that green building materials and green building technology affects green building challenges in a causal =9relationship. Therefore, much of interest should be provided for green building materials and green building technology to reduce the challenges facing the growth of green building in Malaysia.

CONCLUSION

The implantation of green building projects requires strong support from all parties like the stakeholders, government and the public itself. Priority need to be given to educate the stakeholders, developing strategies for environmentally friendly construction materials, energy efficiency in buildings, construction and demolition waste management. Moreover, there is a need of technologies and tools in achieving sustainable building in Malaysia; for instance, the awareness campaigns need to be intensified to educate and give knowledge about the importance of the green building projects and its benefit to the environment as well as to restore the world for future generations. As Malaysia heads towards a more comprehensive implementation of green building projects, it can be concluded from the obstacles on implementing green buildings have been raising in recent years so that sustainable buildings are not easy to be naturally different from conventional buildings. Thus, these buildings require special materials and building practices as well as management commitment to sustainability.

RECOMMENDATIONS

In order to make the construction of green buildings cost-effective, the agricultural wastes, e.g. plant residues should be used as green building materials and most of these materials should enter the natural cycle i.e. originate from the nature and turn back into the nature where it will break down.

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