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Propelling Green Building Technologies Adoption in Malaysia Construction Industry

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Abstract. The government of Malaysia has taken several pro-active actions in promoting green technology, especially in the construction industry. Many efforts have been taken into the green development and the initiative evolving various kinds of practices and materials enhancement. Construction Industry Transformation Plan (CITP) is Malaysia's national agenda to transform the construction industry from 2016 to 2020, and one of the strategic goals is to institute more environmentally sustainable practices throughout the industry. Therefore, the green building technology now has been imposed as the back bone behind every development agenda for the future sustainability. The purpose of this paper is to identify the strategies within the local construction industry to enhance the adoption of green building technologies towards sustainable development. A questionnaire survey was carried out within green building practitioner. Theoretically, this research contributes to the literature on green building technologies by improving understanding of the key strategies to promote green building technologies adoption. These enable the industry stakeholders to implement proper strategies and to manage the environment, whilst keeping of the quality in Malaysian construction development

1. Introduction

The building and construction industry play a critical role in Malaysia economic and social development. The industry contributes to the continuing economic competitiveness and the quality of life in delivering an excellent built environment for the future growth and development. The bigger attentions from government agencies, private organizations and the public has been working with the industry to promote the wider adoption of green building technology, energy efficient buildings, universal design and barrier-free access in our built environment.

Green Technology (GT) is an initiative evolving various kinds of methodologies and materials enhancement, from techniques for generating energy to non-toxic cleaning products. GT used to conserve the natural environment and resources, which minimize and reduce the negative impact of human activities. GT is cross-sectoral in nature, which presents a solution in balancing the needs for economic development and our responsibility towards the environment. The main goal to achieve in this rapidly growing field includes sustainability of the economic development. According to [7], Green Technology is used synonymously with terms 'environmental technology' or 'clean technology' and can be said to refer to technologies that aim to have little impact on the environment. This technology is an idea and understanding found to be exceptionally beneficial to the environment as it can reduce greenhouses gases release to the atmosphere which in turn causes warming of the earth drastically.

Nowadays, GT plays a very important role to promote a societal move toward sustainability. For the construction industry, the use of green technologies is a crucial issue towards achieving sustainable



construction. According to [15], the government of Malaysia is failing to regulate and enforce due to the lack of a legislative framework specifically for green technology or green growth. [1] stated that the restriction in decision-making, planning and management, green construction could face big challenge to be practiced especially when those in the industry are not exposed with suitable information at their organization level. Henceforth, this paper delves into the actions undertaken by the Malaysian government, non-government organizations and construction players in promoting sustainability in construction. Through extensive literature review, this paper will discuss the commitment of the Malaysian government on sustainability agenda and the progress so far in the construction industry. This paper will also discuss the findings from a survey conducted to identify the strategies within the local construction industry to enhance the adoption of green building technologies towards sustainable development.

2. The Adoption of Green Building Technologies in Malaysia Construction Industry

Construction industry has been recognized as a major contributor to environmental problems. The whole supply chain from the production, procurement, transportation and storage of the construction material, the process of the construction, to the end user unalterably affects the environment. Green construction is commonly associated with the use of green technology especially to reduce the energy consumption, indoor cooling, water saving, green material etc. However, the use of new technology is perceived as expensive due to the need of technical capacity, lacks competition and commonly manufactured abroad [13]. According to [12] construction sector consumes massive portions of natural resources, uses high amount of energy, causes emission and pollution, and generates significant waste. According to [14], many of environmental issues that occur in this country are due to lack of environmental considerations in the exploitation, development and management of resources as well as lack of control of pollution resources. These issues if not tackled strategically will further aggravate and exert challenges towards sustainable construction in the following way.

Taking into action towards the issues, Malaysia government therefore had been introduced the Green Technology as a measure to mitigate the environmental problems. Green technology is expected to mark its footprint on the improvement of environment and human health [3]. Construction Industry Transformation Plan (CITP) is Malaysia's national agenda to transform the construction industry from 2016 to 2020, and one of the strategic goals is to institute more environmentally sustainable practices throughout the industry [5]. This is mainly driven by factors such as to fulfill the market demands, to provide comfort and health for the occupant, save more money and also to act as an environmental responsibility. The recent launched of Green Technology Master Plan (GTMP) 2017 – 2030 provides actionable strategic directions to support the National Green Technology Policy [8]. GTMP is fundamentally an outcome of the Eleventh Malaysia Plan (2016-2020) which has earmarked green growth as one of six game changers altering the trajectory of the nation's growth. The discussion for GT in the building sector will primarily focus on the following areas:

- *Green building design and operation;*
- *Sustainable construction practices;*
- *and green building materials*

The implementation of GT in construction will support dynamic growth of economic development activities, while improving the environment. Hence, it is important to develop a strategic plan to promote the use of GT while the areas are still developing.

The popularity and acceptance gained by the green building practice have in turn caused the development of various Green building technologies (GBTs) for enhancing the sustainability performance during the construction process. As defined by [2], GBTs are technologies that are incorporated into building design and construction to make the end product sustainable. There are various green technologies that have been introduced to achieve sustainability in sustainability development, and can be found in the literature [17] [18] [9] [2]. Though the Green building policies are now being adopted and implemented by governmental agencies from the national to the local level, the adoption of GT amongst the construction industry players is still uncertain [4] [6]. According to

[10], green development industry in Malaysia is still new and researching how these components would contribute towards green development achievement is extremely significant. Understanding these variables and uniting all the key components towards green development is critical. Thus, it is interesting to know whether construction players (including architects, engineers, designers, builders, developers and clients) are all aware of the GT concept because it is believed that if all the construction practitioners are being well-groomed with the importance of implementing green concept, then their projects will also be integrated with GT system [11].

[4] stated that by adopting GBTs provides a wide variety of economic, social, and environmental benefits and, along with the growing awareness of climate change, these benefits play a huge role in pushing for the adoption and development of GBTs. However, previous studies discuss the various barriers affecting the adoption of GBTs in buildings development process, including higher costs of GBTs, a lack of interest and market demand, a lack of knowledge and awareness of GBTs and their benefits, a lack of government incentives, and resistance to change [17]. To effectively and efficiently promote the adoption of GBTs, it is necessary that proper strategies and policies be devised for overcoming the barriers in the industry.

3. The Research

A quantitative study has been conducted and construction experts are chosen the population of the study. In green building research, the method of questionnaire survey, which is a systematic method of gathering data on the basis of a sample [16], has been extensively used to collect professional opinions. A population of the study is from the construction field involved in various sustainable construction development projects in Malaysia. The main focus of this paper is to identify the strategies within the local construction industry to enhance the adoption of green building technologies towards sustainable development. The study has narrow scope and specific area of Klang Valley only. Total of 150 questionnaire samples have been distributed among construction experts, however only 65 questionnaires successfully collected due to the several limitations from the respondents.

4. Result, Analysis & Discussion

In order to examine the eminence of green building adoption in Malaysia construction industry, a questionnaire is designed on the basis of assessment of various strategies summarized from an extensive literature review. There are two sections in questionnaire: Section A is the Respondent's Demographic that will cover the respondent details. In this section, the respondent also asked about the knowledge toward the Green Technology concept. Section B is reviewing the Strategies to Implement Green Technology concept. The reliability value obtained for this part is 0.919 is excellent. Data has been analyzed using 'Statistical Package for the Social Science for Windows' (SPSS for Windows). Descriptive statistics are used to determine frequency, percentage and mean.

4.1 Respondent's Demographic

Table 1 indicated the findings from the demographic questions in questionnaire answered by the respondents. Importantly findings shows (in Figure 1) that most of the respondents claimed their knowledge toward Green Technology concept is "Average", although they are all experienced in construction industry.

Table 1 : Respondent Profile (n = 65)

Characteristic	Frequency	Percentage (%)
1. Professions		
a. Engineer	13	20.00%
b. Architect	10	15.38%
c. Quantity Surveyor	20	30.77%
d. Project Manager	12	18.46%
e. Contract Manager	10	15.38%
f. Others	0	0.00%
2. Company Types		
a. Consultant	25	38.46%
b. Contractor	20	30.77%
c. Developer	15	23.08%
d. Government Agency	5	7.69%
e. Others	0	0.00%
3. Experience in construction industry		
a. 1 - 5 years	12	18.46%
b. 6 - 10 years	18	27.69%
c. 11 - 15 years	20	30.77%
d. >15 years	15	23.08%

Figure 1 shows how respondent respond upon their knowledge toward Green technology concept in the construction industry. Most of the respondent (53.85%) indicated that their knowledge is at the average level. However, only 35.38% of the respondent have an exceptional understanding (good & excellent) about the Green Technology concept. Hence, the knowledge and awareness of the green technology concept shall be improved among the construction industry player.

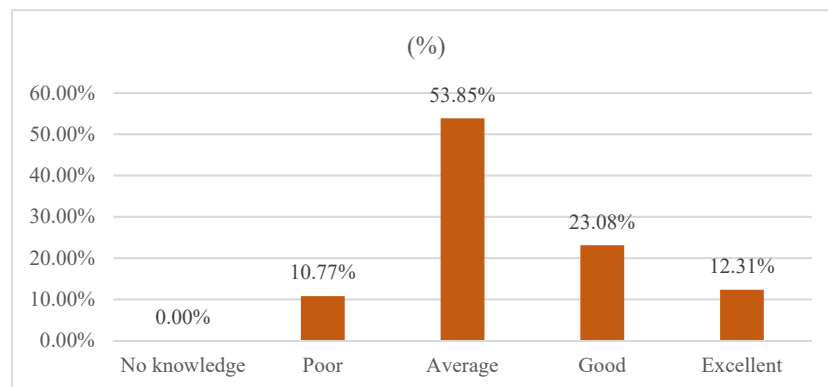


Figure 1 : Knowledge toward Green Technology concept

4.2 Strategies to Implement Green Building Technology Concept

Further research examines the strategies to implement Green Building Technology concept in the organization. In the questionnaire, the Likert Scale from 1 to 5 will be used in which the respondents need to respond by ticking in the box indicating 1 as Strongly Disagree (SD), 2 as Disagree (D), 3 as Neutral (N), 4 as Agree (A) and 5 as Strongly Agree (SA). This part revealed the adopting strategies to enhance green building technology in Malaysia.

Table 2 indicate the ranking of strategies recommended by the respondents. Awareness and education is highly promoted strategies ranked as mean= 4.37. Better information on cost benefit of GBTs are ranked as second highest (mean= 4.35). Meanwhile, the third rank of top strategies are the

increment and availability numbers of supplier for GT products as mean = 4.34. However, out of ten listed strategies, respondent recommend the three least strategies effort shall be given to Publicity upon GBT & Green Building road map (mean = 4.26), also the Green Building Rating system (mean = 4.21). The findings stated that awareness and education is the most prominent action to encourage green building adoption and implementation.

Table 2 : Strategies to Implement Green Building Technology Concept

Strategies	Mean	Rank
1. Monitoring and Enforcement Through Law	4.34	3
2. Financial and further market-based incentives for GBTs adopters	4.28	5
3. Better enforcement of existing green building policies and standards	4.31	4
4. Low-cost loans and subsidy from government (financing scheme)	4.31	4
5. Awareness and educations - through workshops, seminars, and conferences that relate to GBT	4.37	1
6. Extensive publicity to promote GBT	4.26	6
7. Better information on cost and benefits of GBTs	4.35	2
8. Availability of Supplier for GT products and need to be increased	4.34	3
9. Green Building technology road map	4.26	6
10.Green Building technology rating system	4.21	7

5. Conclusion

The adoption of GBTs in the construction industry is one of way in enhancing the sustainability performance of buildings. To promote the adoption of GBTs in buildings development, this study identified the strategies that are important for promoting GBTs in the construction industry. This study has presented 10 various strategies summarized from an extensive literature review for the promotion of GBTs adoption. The identified strategies are to assist and improve the adoption of the GBTs in Malaysia construction industry. Based from the survey, the most prominent action to encourage green building adoption and implementation are the awareness and education through workshops, seminars, and conferences. More research and development should have to conduct and the employee's training and skill development program is highly recommended in the future.

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