INVESTIGATION ON THE BARRIERS OF GREEN BUILDING DEVELOPMENT IN MALAYSIA

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ABSTRACT

Sustainable development provides environmental and human health benefits, but the development faces obstacles to green building implementation in construction projects. Therefore, the objective of this paper is to determine the barriers and strategies in developing green buildings in Malaysia. For this research, the method used was the quantitative method by using a questionnaire survey. The respondents of this research were contractors ranging from G5 to G7 located in Selangor and Kuala Lumpur. The findings showed that the main barriers of green building development could be classified into two main categories, which are internal barriers and external barriers. The result revealed that a lack of public awareness of the benefits of green building, lack of financial help or government incentives for green building projects, and lack of knowledge about green building were crucial factors restricting green building development in Malaysia. Besides, the strategies to improve green development are also being analysed. Further study suggests the study on green building development in more depth, focusing on a specific type of building.

INTRODUCTION

In this age of globalisation, many constructions sectors are undergoing a green transformation (Gou & Lau, 2014). According to World Green Building Council (2016), a 'green' building is a building that reduces or eliminates negative effects on its architecture, construction, or operation and can positively affect our atmosphere and the natural environment. Green building benefits include reduced energy and water consumption, improved indoor air quality and improved health and productivity (Dwaikat & Ali, 2018). Despite that, the green movement in Malaysia still faces some barriers preventing its development. One of the issues to slow progress and the unwillingness to participate in green building is the lack of awareness from the construction professionals, such as consultants, contractors and even the client (Powmya & Abidin, 2014).

With the global recognition of the numerous sustainability benefits of green building implementation, facilitating the effective and widespread adoption of green buildings has recently emerged as a priority topic in the construction industry (Chan, Darko, & Ameyaw, 2017). Furthermore, the challenges to green building adoption, such as higher costs and a lack of knowledge, demonstrate the need for appropriate strategies to be developed to encourage the wider adoption of green building in building construction. Therefore, this study is intended to analyse the barriers and also the strategies in developing the green building in the Malaysian construction industry with two research objectives names:

RO1: To identify the barriers in Malaysian green building development
RO 2: To propose strategies to improve the development of green building in Malaysia

LITERATURE REVIEW

Barriers in Developing Green Building

According to Chan et al. (2017), sustainable development provides environmental and human health benefits, but the development faces

obstacles to green building implementation in construction projects. Based on a study conducted by Samari (2013), the main barriers to the development of green buildings in the country are a lack of green technologies, a lack of credit resources to cover upfront costs, a higher final price and a lack of demand. Moreover, the previous study has found that a lack of professionals and public awareness about green buildings has also negatively impacted sustainable development. Also, based on the findings identified by Khalfan (2015) and Samari et al. (2013), one of the barriers to sustainable construction is high costs throughout the construction process.

Aside from that, the implementation of green building technology would be refused if top management is not concerned about the environment and refuses to implement green measures (Du et al., 2014). According to Halim (2012), previous research has concluded that cost-effectiveness is the main obstacle to green building in the construction industry. The barrier focuses on the green building market, where the project's profitability always drives players such as developers, investors, and tenants. This is because most of them are concerned about profits and do not want to take any risks that could prevent them from earning more profits. Abidin (2010) supports this assertion, who examined how developers are motivated by profit and focus on sustainability only when clients demand.

Several studies have revealed, as part of the knowledge concept, that a lack of knowledge among professionals and contractors is one of the major barriers to implementing a green rating system in the construction industry (Aliagha et al., 2013; Ahn et al., 2013; Ding et al., 2018; Elforgani & Rahmat, 2012; Khalfan, 2015). Meanwhile, Chian (2013) agreed that a lack of benefits exposure to developers could disrupt the implementation of a green rating system. In their study, these barriers were also mentioned and supported by Aliagha et al. (2013). Besides, previous research has discovered that departmental lack of coordination and management, strict requirements for obtaining a green design certification, various evaluation methods, and political issues are some of the barriers in developing green building in the Malaysian construction industry (Ding et al., 2018; Smith et al., 2006).

Strategies to Improve Green Building Development

Various promotion strategies for green building and practices adoption have been addressed in previous studies. Hwang, Zhu and Tan (2017) described the co-funding and government incentives, green development policies and regulations, and collaboration with research institutions to study the benefits of green business parks. These were deemed the three most feasible solutions to encourage the adoption of green business parks in Singapore. Another Singapore-based study by Hwang and Tan (2012) identified the strategies to encourage green building adoption. These strategies identified are broadening the coverage of governmental incentives to include green building technologies adoption educating clients on the benefits of green building. Apart from that, other strategies are developing a green building project management framework, organising construction tours to educate the public on the benefits of green building, and government funding for green building research and development (R & R&D).

Furthermore, mandatory environmental regulations imposed by the government, requirements imposed by the government and non-governmental organisations (e.g., green label scheme), and the establishment of standards (e.g., green specification) have been identified as important factors in facilitating the successful adoption of green procurement in construction projects (Wong, Chan & Wadu, 2016). Next, Li et al. (2017) and Doan et al. (2017) reviewed green building certification systems literature. They concluded that green building certification systems play an important role in the international development of green buildings. Financial and additional market-based incentives and better information on the costs and benefits of green building, green labelling, and information dissemination have all played important roles in promoting green building adoption (Darko et al., 2017).

Häkkinen and Belloni (2015) further claimed that developing clients' awareness about the benefits of green buildings is one of the essential actions to encourage green building. Furthermore, consumers and the public's attitudes and behaviour have significant impacts on the promotion of green building. Increasing public awareness of environmental sustainability and customers' willingness to pay for green buildings has been considered effective means of increasing public awareness of environmental

sustainability and customers' willingness to pay for green buildings (Zhou et al., 2015).

METHODOLOGY

To carry out this study, there are two approaches to collect data which involve two categories of primary and secondary data sources. A survey questionnaire was used to achieve a broader coverage of the research and give the respondent more time to think about a proper answer for primary data. The questionnaires consisted of four sections:

i. Section A

Section A includes respondents' demographic information questions, such as gender, current job position, and work experience. Demographic information questions are intended to determine what factors may influence a respondent's responses, interests, and opinions.

ii. Section B

The second section of the questionnaire focuses on the barriers to green building development. This section aims to examine the key barriers to the development of green buildings in Malaysia to achieve the first objective of this research. It was closed-ended questions, and the respondents were asked to rate the 5-point Likert scale accordingly from 1 (Strongly Disagree), 2 (Disagree), 3 (Neutral), 4 (Agree) and 5 (Strongly Agree) as previous study conducted by Lop et al (2016).

A Systematic Literature Review (SLR) was used to gather relevant literature on the barriers to green building development in Malaysia. The researcher applied the SLR methodology to generate suggested barriers published by other researchers. The suggested barriers will be variables in the questionnaires in Section B.

The SLR method was used in this study, which included a manual search of journals and proceedings papers related to the research title. In this case, the review's goal is to evaluate SLR and the steps involved in the SLR, which include four (4) steps, as documented below.

First, many searches were conducted to identify several related topics

or terms related to green building. The researcher used Google Scholar and journals subscribed to by UiTM, which were justified by the large databases of abstracts and citations of peer-reviewed publications (ScienceDirect, Scopus, Emerald, etc.). Two database search engines were used to look for related published papers. The next step is to review the literature. The identified literature was then screened to ensure relevance to the topic. Out of 55 works of literature reviewed, 37 were relevant to the topic of this paper, which is the barriers, benefits, and strategies for green building development. The screening ruled out any duplicates in the literature and non-English publications.

After that, Step 3 involved the data evaluation. Data evaluation is when reviewers extensively analyse each reference gathered and determine which articles will be included in the SLR list. At this stage, 10 works of literature were used for barriers information, 10 works of literature were used for benefits information, and 10 were also used for strategies information. The information was analysed and abstracted. Barriers, Author(s), Year, and Frequency were tabulated in a systematic review. The last step is interpreting the findings gathered. It was discovered that all of the items on the checklist could be classified into six (6) major categories of barriers: economic barriers, social barriers, technology and training barriers, knowledge barriers, political barriers, and financial barriers.

iii. Section C
Section C focuses on the benefits of green building implementation in Malaysia, as respondents see. Economic, environmental, and social benefits have been identified as the three main categories of benefits identified from extensive literature. The Likert scale of the likelihood of occurrence consists of (1=Strongly Disagree to 5=Strongly Agree). This section aims to analyse the most significant benefits of green building development in the Malaysian construction industry to achieve objective number two (2) of the research. The variables of questionnaires were obtained using a similar method as Section B, which was the SLR method.

iv. Section D
Section D focuses on the strategies to improve green building development in the Malaysian construction industry to achieve objective number three (3) of the research. The Likert scale of the likelihood of

occurrence consists of (1=Strongly Disagree to 5=Strongly Agree). This section aims to analyse the strategies to improve the development of green buildings in Malaysia. This section also used the SLR method in Section B and Section C.

Due to time and cost constraints, the scope of this research is limited to Kuala Lumpur and Selangor, and the respondents targeted for this research are contractors ranging in grade from G5 to G7. These areas were chosen because they are home to most of Malaysia's green buildings.

Based on CIDB (2017) source, the population of registered higher grades contractors in Kuala Lumpur and Selangor are about 7000 contractors. The table below shows the population of registered contractors by grade in Kuala Lumpur and Selangor.

Figure 1. Population of Registered Contractors by Grade in Kuala Lumpur and Selangor

	Registration Grade	Population	Total
Lower grades	G1	5,667	15,606
	G2	3,503	
	G3	4,731	
	G4	1,705	
Higher grades	G5	2,822	7,244
	G6	772	
	G7	3,650	

Source: CIDB (2017)

According to Krejcie and Morgan (1970), the sample size for a population of 7000 is 364. From that, 364 questionnaires were distributed to the respondents, with 218 of them being returned, indicating a 60% response rate. From the data collection, an evaluation was carried out to summarise the research results based on the aim and objectives of this research. The data collected were analysed using the Statistical Package for Social Science Software (SPSS) version 26.0. The "Statistical Package for Social Sciences" (SPSS) is software designed to manipulate, interpret and present data; the package is commonly used in social and behavioural sciences.

The secondary data consists of journals, articles, relevant websites, previous research papers etc., that are relevant to the research. These

secondary sources are mainly used in the preparation of the Literature Review.

The limitation of this study is that this study can only be performed on the survey but not on observation. While observation is important for this form of analysis, the observation cannot be carried out due to the Movement Control Order (MCO) and the Covid-19 outbreak that currently happened all over the country.

FINDINGS AND ANALYSIS

Objective 1: Barriers in Developing Green Building in Malaysia

This research study divided the barriers into two main categories: internal and external barriers. The variables for internal barriers consist of economic barriers, social barriers, technology and training barriers, and knowledge barriers. In contrast, the variables consist of political and financial barriers for the external barrier. The mean score and rank for each factor involved were analysed in the following section.

Table 1. Factors of Economic Barriers (Internal)

Item	Descriptions	Mean	Perception Level	Rank
1.	High cost for green building materials and products	3.94	Agree	1
2.	A limited supply of materials and products for green building.	3.72	Agree	3
3.	Difficulty in getting green resources, e.g., materials, technologies etc.	3.78	Agree	2
4.	Lack of market demand	3.78	Agree	2
5.	Unfamiliarity with sustainable materials and products.	3.71	Agree	4

Source: Author

Table 1 above shows the list of economic barriers to green building development. 'High cost for green building materials and products (mean=3.94) has been found as the main barrier in economic aspect. Meanwhile, 'Difficulty in getting green resources, e.g., materials, technologies etc.' (mean=3.78) . Moreover, 'Lack of market demand' share the same mean score. Next, the mean score for 'Limited supply of materials and products for green building' and 'Unfamiliarity with sustainable materials and products' is intangible.

Table 2. Factors of social barriers (Internal)

Item	Descriptions	Mean	Perception Level	Rank
1.	Lack of understanding and coordination between stakeholders and parties	3.94	Agree	2
2.	Tendency to maintain the current practice.	3.84	Agree	5
3.	Lack of strategy to promote sustainable development.	3.90	Agree	4
4.	Lack of company's commitment to green development.	3.96	Agree	1
5.	Upper management refuses to accept the modern building approach.	3.94	Agree	2
6.	Top management is not highly aware of environmental concerns.	3.92	Agree	3

Source: Author

The factors contributing to the social barrier category are also being analysed. From Table 2 above, 'Lack of company's commitment to green development' (mean=3.96) takes the first rank among the other factors shown above. Two factors share the same mean score (mean=3.94): ' Lack of understanding and coordination between stakeholders and parties' and 'Upper management refuses to accept modern building approach'. Next, the respondents agreed that 'Top management is not highly aware of environmental concerns' (mean=3.92) is one of the factors of the social barrier. After that, the fourth rank is 'Lack of strategy to promote sustainable development (mean=3.90) while 'Tendency to maintain current practice' (mean=3.84) has the lowest mean score for this category.

Table 3. Factors of Technology and Training Barriers (Internal)

Item	Descriptions	Mean	Perception Level	Rank
1.	Lack of technologies for green building.	3.88	Agree	2
2.	Lack of database and information on green technologies.	3.84	Agree	4
3.	Lack of skilled or technical personnel	3.85	Agree	3
4.	Lack of training for the workers to gain the new knowledge and soft skill	3.95	Agree	1

Source: Author

As presented in Table 3 above, some factors influenced green building development's technology and training barriers. The main barrier for this category is 'Lack of training for the workers to gain the new knowledge and soft skill' (mean=3.95). Then, it is followed by the factor 'Lack of technologies for green building' with a mean score of 3.88. Meanwhile, the difference of mean scores for 'Lack of skilled or technical personnel' (3.85) and 'Lack of database and information on green technologies' (mean=3.84) is intangible.

Table 4. Factors of Knowledge Barrier (Internal)

Item	Descriptions	Mean	Perception Level	Rank
1.	Lack of knowledge about green building.	3.97	Agree	2
2.	Lack of public awareness of green building benefits.	4.00	Agree	1
3.	Lack of exposure to benefits of green building.	3.95	Agree	3
4.	Professionals' awareness about green building.	3.85	Agree	4

Source: Author

Table 4 above shows the factors contributing to the knowledge barrier, with the highest response being 'Lack of public awareness of green building benefits' (mean=4.00). The respondents agreed that 'Lack of knowledge about green building' (mean=3.97) also impacts the knowledge barrier, which is the second-highest among the factors. Besides, the respondents also voted 'Lack of exposure to benefits of the green building' (mean=3.95) as one of the factors. Then, the least voted factor is 'Lack of professionals' awareness about green building' with a mean score of 3.85. Overall, the respondents gave positive feedback on the factors contributing to the

financial barrier.

Table 5. Summary of Internal Barrier Categories

Category	Mean	Rank
Economic barriers	3.83	4
Social barriers	3.91	2
Technology and training barriers	3.90	3
Knowledge barriers	3.96	1

Source: Author

By analysing from barriers breakdown for each category respectively, the mean score for the main categories was identified. Based on Table 5 above, the 'Knowledge barrier' (mean=3.96) takes the first rank among all the others. Then, it is followed by the category 'Social barrier' with a mean score of 3.91. The third highest mean score for the internal barriers category is 'Technology and training barrier' (mean=3.90) with a slightly different value of mean score compared to Social barrier. Lastly is the 'Economic barrier' (mean=3.83), taking the fourth rank in this category.

Table 6. Factors of Political Barriers (External)

Item	Descriptions	Mean	Perception Level	Rank
1.	Lack of encouragement and development of green building by the government	3.89	Agree	3
2.	Strict requirements to obtain a green design evaluation label.	3.90	Agree	2
3.	Lack of enforcement and monitoring of law and legislation.	3.91	Agree	1
4.	Lack of building codes and regulations.	3.87	Agree	4
5.	Lack of mimetic pressure for green development policy.	3.80	Agree	5

Source: Author

Table 6 provides the breakdown of political barriers to green building development. 'Lack of enforcement and monitoring of law and legislation' (mean=3.91) has been found as the main barrier in the political aspect and then followed by 'Strict requirements to obtain a green design evaluation label' (mean=3.90). However, there is a slight difference in the mean score for 'Lack of encouragement and development of green building by the

government' (mean=3.89) with 'Lack of building codes and regulations' (mean=3.87). Meanwhile, from the data, respondents also agreed with the question 'Lack of mimetic pressure for green development policy' (mean=3.80) as one of the factors that influenced the political barrier.

Table 7. Factors of Financial Barriers (External)

Item	Descriptions	Mean	Perception Level	Rank
1.	High risk of investment	3.84	Agree	5
2.	Lack of credit resources to cover the upfront cost for green building.	3.90	Agree	3
3.	Lack of financial help or incentives for green building projects.	3.99	Agree	1
4.	Well-built firms potentially go beyond the minimum standards compared to small firms.	3.89	Agree	4
5.	The high final price at the end of construction progress.	3.93	Agree	2

Source: Author

A few factors contributed to the financial barriers to green building development. 'Lack of financial help or incentives for green building projects (mean=3.99) is the major factor contributed to the financial barrier category. Moreover, two factors, ' High final price at the end of construction progress' and 'Lack of credit resources to cover the upfront cost for green building', have a slight difference in their mean score with 3.93 and 3.90 respectively. The next factor is 'Well-built firm potentially to go beyond the minimum standards compared to small firms' (mean=3.89) while 'High risk of investment' (mean=3.84) is the last factor voted for this category.

Table 8. Summary of External Barriers Categories

Descriptions	Mean	Rank
Political barriers	3.90	2
Financial barriers	3.94	1

Source: Author

As shown in Table 8 above, 'Financial barriers' is ranked first with a mean score of 3.94 in the external barrier category. In contrast, 'Political barriers' is ranked second as one of the barriers in this category with a mean score of 3.90.

Table 9. Summary of Overall Barriers Categories

Descriptions	Mean	Rank
Internal barrier	3.90	2
External barrier	3.92	1

Source: Author

Between the two categories, the External barrier takes the first rank with a slightly higher mean score of 3.92. Meanwhile, the Internal barrier is placed in the second rank with a mean score of 3.90.

Objective 2: Strategies to Improve the Green Building Development

The independent variables for this section are government policies and regulations, government incentives and environmental consciousness. The mean score and rank for each factor involved were analysed in the following section.

Table 10. Factors of Government Policies and Regulations

Item	Descriptions	Mean	Perception Level	Rank
1.	Development of certification system for green building	4.15	Agree	2
2.	Development of project management framework	4.07	Agree	4
3.	Government should provide subsidies for research and development of green building products, systems and technologies.	4.16	Agree	1
4.	Green rating systems and labelling programs are instrumental that can further the use of green building and practices.	4.11	Agree	3

Source: Author

Few factors influenced the government policies and regulations as part of strategies to develop green building. 'Government should provide subsidies for research and development of green building products, systems and technologies' (mean=4.16) has been found as the main strategy for this category. The respondents also agreed on the question ' development of certification system for green building' (mean=4.15) as this is the second-highest rank for this category. Next, it is followed by 'Green rating

systems and labelling programs are instrumental that can further the use of green building and practices' (mean=4.11) and 'Development of project management framework' (mean=4.07).

Table 11. Factors of Government Incentives

Item	Descriptions	Mean	Perception Level	Rank
1.	Government has to provide incentives/ subsidies for green building projects.	4.17	Agree	1
2.	Financial institutions have to introduce lending schemes	4.13	Agree	2
3.	Widening the coverage of governmental incentives, including the adoption of green building technologies, government funding for green building research and development (R & R&D), etc.	4.09	Agree	3

Source: Author

Table 11 above illustrates some of the factors contributing to government incentives strategy to develop the green building in Malaysia. The first rank voted is that the government has to provide incentives/ subsidies for green building projects with a mean score of 4.17. Then, it is followed by 'Financial institutions have to introduce lending schemes' (mean=4.13). Moreover, the respondents also showed positive feedback on 'Widening the coverage of governmental incentives, which includes green building technologies adoption, government funding for green building research and development (R & R&D) etc.' (mean=4.09).

Table 12. Factors of Environmental Consciousness

Item	Descriptions	Mean	Perception Level	Rank
1.	Increase the environmental consciousness of stakeholders, improve green technology R&D and communication, and formulate green building policies.	4.06	Agree	4
2.	Develop the awareness of clients about the benefits of green buildings.	4.12	Agree	1
3.	Organising construction tours can educate the public about the benefits of green building.	3.98	Agree	6
4.	Improve the availability of better information on the cost and benefits of green building.	4.10	Agree	3

5.	More skilled and experienced project teams and contractors for green building projects.	4.11	Agree	2
6.	Labelling and information dissemination of the benefits of green building	4.05	Agree	5

Source: Author

The results obtained from the analysis show that 'Develop the awareness of clients about the benefits of green buildings' (mean=4.12) is the main factor that the respondents agreed for this category. Meanwhile, there is only a slight difference in mean score between 'More availability of skilled and experienced project team and contractors of green building projects' (mean=4.11) with 'Improve the availability of better information on cost and benefits of green building' (mean=4.10). Moreover, the respondents also agreed with the questions 'Increase the environmental consciousness of stakeholders, improve green technology R&D and communication, and formulate green building policies' (mean=4.06) and 'Labelling and information dissemination of the benefits of green building' (mean=4.05). Lastly, even though 'Organising construction tours can educate the public about the benefits of green building' (mean=3.98) has the lowest mean score, but overall mean score for this category is quite high, which shows that the respondents are giving positive feedback on this category.

Table 13. Summary of Strategies Categories

Descriptions	Mean	Rank
Government policies and regulations	4.13	2
Government incentives	4.15	1
Environmental consciousness	4.08	3

Source: Author

The mean score for the main categories is identified from the breakdown of the factors for each category. Based on Table 13 above, the 'Government incentives' category takes the first rank among all the others with a mean score of 4.15. This variable has strong findings from respondents who mostly agreed with the questions. Meanwhile, 'Government policies and regulations' (mean=4.13) is in the second rank, and the last mean score for this category is 'Environmental consciousness' (mean=4.08). Overall view of these strategies, all respondents gave positive feedback for this category.

DISCUSSION

Research Objective 1: To identify the barriers in Malaysian green building development

The study has evaluated and discovered that the major barrier voted by the respondents is from the internal barrier, which is the knowledge barrier where lack of public awareness of green building benefits bring down the green building implementation in Malaysia. Several authors supported these findings; Abidin (2010), Yin (2012), Aliagha (2013), Samari et al. (2013), Khalfan et al. (2015) and Elforgani and Rahmat (2012) which they stated that lack of professionals' and public awareness about green buildings has negatively impacted sustainable development.

The financial barrier category ranked second in the listed barriers categories in the external barrier category. Lack of financial help or government incentives for green building projects and high final price at the end of construction progress was rated as the highest agreed by the respondents. This finding is slightly different from Samari et al. (2013), where he found that lack of incentives was ranked in eleventh place among the barriers listed in his research paper. However, these findings were supported by some authors; Aliagha et al. (2013), Samari et al. (2013), Ding et al. (2018) and Khalfan et al. (2015), where financial act as one of the main barriers to sustainable development.

Moreover, the respondents have also chosen social barriers to be among the top-ranked listed barriers. The social barrier has been categorised as related to the company's involvement in implementing green building and understanding between stakeholders. This research has identified that the lack of the company's commitment to green development and lack of understanding and coordination between stakeholders and parties involved in the project would prevent green initiatives from being introduced. These findings were agreed by Ding et al. (2018) and Smith, Baird and Nz (2006). The authors lined out that lack of top management concern and awareness on green development will impact the construction company's intention to implement green practices.

Generally, the overall results of barriers identification in this research had shown positive feedback from the respondents. This research's barriers findings have also been supported from the literature review before.

Research Objective 2: To propose strategies to improve the development of green building in Malaysia

This research analysed and found that the significant green building strategies agreed by respondents are government incentives. 'Government have to provide incentives/subsidies for green building projects has been voted the most important strategy to cope with green building barriers. Lack of incentives for green building projects could bring down the green building development in Malaysia. This result aligns with Hwang and Tan (2012), Darko and Chan (2018) and Bahruddin and Mohd (2019). They have pointed out that providing financial and non-financial incentives is important in promoting green building and practices adoption within the construction market. However, this finding is slightly different from Hakkien and Belloni (2015). The authors argued in their research study that the most essential actions to encourage green building are by developing clients' awareness about the benefits of green.

Next, government policies and regulations took second place in the listed strategies categories identified in this research study. Provision of subsidies for research and development of green building products, systems and technologies and the development of certification system for the green building was rated as the highest agreed by the respondents. Several authors supported these findings; Hwang and Tan (2012), Esa et al. (2017) and Hwang, Zhu and Tan (2017), where government policies and regulations act as one of the main strategies to sustainable development.

The next top strategy that has been analysed in this research study is environmental consciousness. 'Develop the awareness of clients about the benefits of green buildings' was ranked as the most agreed factor by the respondents. This finding was supported by Hwang and Tan (2012) and Hakkien and Belloni (2015). These authors pointed out that creating environmental awareness on the benefits of green building through workshops, seminars, and conferences was a crucial strategy for promoting the rapid adoption of green building guidelines.

Overall, results of green building strategies in this research showed positive feedback from the respondents and have been supported from the literature review before.

This paper aims to give a significant contribution to portray the characteristics of the barriers and the strategies of green building development accurately, considering that green building plays an important role in construction today. It also aims to gain familiarity with green building or achieve new insights about overcoming the barriers in green building development. Green buildings reduce or eliminate negative impacts on the environment, but they can positively impact by generating their energy or increasing biodiversity.

CONCLUSION

Even though green buildings have numerous societal benefits, their development is affected by various barriers in developing countries such as Malaysia. The barriers discovered in Malaysia could restrict the growth of green building construction. However, this study has shown that the adoption of the green movement has a strong environmental impact. Overall, the first objective of this research was achieved where it highlights the main barriers that prevent the development of green buildings in Malaysia. It can be summarised that internal barrier such as financial barrier was the main barrier to the slow progress of green development in the construction industry.

The second objective of this research was achieved by establishing a rank of mean scores for each of the strategies listed. Thus, to improve the development of green building in Malaysia, it was revealed to gain strategies from a few aspects, including government incentives, government policies and regulations, and environmental consciousness. Government incentives take the first rank among the strategies listed where government incentives or co-funding have been identified as the most feasible solutions for overcoming the significant barriers to green building development.

As a whole, the analysed data are supported by the literature review of this research. Every objective in this research was successfully achieved

through the responses from contractors in Kuala Lumpur and Selangor. Thus, hopefully, this study may be used to assist the current and future industry team gain insights on how to advance green development in Malaysia further. It may also give future researchers a guideline or ideas to investigate green building implementation more in-depth, focusing on specific types of buildings such as residential or commercial buildings.

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AUTHOR CONTRIBUTIONS

All authors contributed to the design of the research, the questionnaire, and the write-up. The on-line survey, data cleaning and tabulation was undertaken by researcher. All authors have read and approved the final manuscript.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

REFERENCES

Aliagha, G. U., Hashim, M., Sanni, A. O., & Ali, K. N. (2013). Review of Green Building Demand Factors for Malaysia. *Journal of Energy Technologies and Policy, 3*(11), 471–478. Retrieved from http://www.iiste.org/Journals/index.php/JETP/article/view/8596.

Bahruddin, N. A., & Mohd, T. (2019). Enabling Factors for Green Housing Projects. *Malaysian Journal of Sustainable Environment, 6*(2), 97. https://doi.org/10.24191/myse.v6i2.8687.

Chan, A. P. C., Darko, A., & Ameyaw, E. E. (2017). Strategies for promoting green building technologies adoption in the construction industry-An international study. *Sustainability (Switzerland), 9*(6), 1–18. https://doi.org/10.3390/su9060969.

Darko, A., & Chan, A. P. C. (2018). Strategies to promote green building technologies adoption in developing countries: The case of Ghana. *Building and Environment,* 130, 74–84. https://doi.org/10.1016/j.buildenv.2017.12.022.

Ding, Z., Fan, Z., Tam, V. W. Y., Bian, Y., Li, S., Illankoon, I. M. C. S., & Moon, S. (2018). Green building evaluation system implementation. *Building and Environment,* 133, 32–40. https://doi.org/10.1016/j.buildenv.2018.02.012.

Du, P., Zheng, L. Q., Xie, B. C., & Mahalingam, A. (2014). Barriers to the adoption of energy-saving technologies in the building sector: A survey study of Jing-jin-tang, China. *Energy Policy, 75*(12), 206–216. https://doi.org/10.1016/j.enpol.2014.09.025.

Dwaikat, L. N., & Ali, K. N. (2018). The economic benefits of a green building – Evidence from Malaysia. *Journal of Building Engineering, 18*(2), 448–453. https://doi.org/10.1016/j.jobe.2018.04.017.

Elforgani, M. S., & Rahmat, I. Bin. (2012). The Influence of Design Team Attributes on Green Design Performance of Building Projects. *Environmental Management and Sustainable Development, 1*(1), 10–30. https://doi.org/10.5296/emsd.v1i1.1623.

Esa, M. R., Marhani, M. A., Yaman, R., Rashid, A. A. H. N. H. N., & Adnan, H. (2011). Obstacles in implementing green building projects in Malaysia. *Australian Journal of Basic and Applied Sciences, 5*(12), 1806–1812.

Goh, H. H., Goh, K. C., & Seow, T. W. (2013). *Challenges of implementing Sustainability in the Malaysian Housing Industry.* Http://Eprints.Uthm.

Edu.My/3964/, (2007), 1–8. Retrieved from http://eprints.uthm.edu.my/3964/.

Gou, Z., & Lau, S. S. Y. (2014). Contextualising green building rating systems: A case study of Hong Kong. *Habitat International*, 44, 282–289. https://doi.org/10.1016/j.habitatint.2014.07.008.

Hwang, B. G., Zhu, L., & Tan, J. S. H. (2017). Green business park project management: Barriers and solutions for sustainable development. *Journal of Cleaner Production, 153*(153), 209–219. https://doi.org/10.1016/j.jclepro.2017.03.210.

Khalfan, M. (2015). Perceptions towards Sustainable Construction amongst Construction Contractors in State of Victoria, Australia. *Journal of Economics, Business and Management, 3*(10). https://doi.org/10.7763/joebm.2015.v3.313.

Krejcie, R. V, & Morgan, D. W. (1970). *Determining Sample Size for Research Activities*. In Educational And Psychological Measurement (Vol. 30).

Powmya, A., & Abidin, N. Z. (2014). The Challenges of Green Construction in Oman. *International Journal of Sustainable Construction Engineering & Technology, 5*(1), 2180–3242. https://doi.org/10.5829/idosi.mejsr.2014.21.06.21202.

Samari, M., Godrati, N., Esmaeilifar, R., Olfat, P., & Shafiei, M. W. M. (2013). The investigation of the barriers in developing green buildings in Malaysia. *Modern Applied Science, 7*(2), 1–10. https://doi.org/10.5539/mas.v7n2p1.

Smith, J., Baird, G., & Nz, S. (2006). Implementation of a Building Sustainability Rating Tool: a Survey of the New Zealand Building Industry. Star, (2), 1–11.

Suzila, N. B. L., Asmalia, C. A., & Nik, A. D. B. N. Z. (2016). The Implementation Of Green Building In Malaysian Construction Industry: Determination Of Key Success Factors. Malaysian Journal Of Sustainable Environment, 1(2), 64–79.

What is green building? | World Green Building Council. (n.d.). Retrieved

June 6, 2021, from https://www.worldgbc.org/what-green-building

Zainul Abidin Nazirah, N. (2010). Investigating the awareness and application of sustainable construction concept by Malaysian developers. *Habitat International, 34*(4), 421–426. https://doi.org/10.1016/j.habitatint.2009.11.011