

Review Article

Barriers to green building implementation in Malaysia: A systematic review



Ha Chin Yee¹, Khoo Terh Jing^{*1}, Loh Jia Xuan²

¹ School of Housing, Building, and Planning, Universiti Sains Malaysia, Minden 11800, Pulau Pinang, Malaysia

² Centre for Postgraduate Studies and Research, Tunku Abdul Rahman University of Management and Technology, Setapak 53300, Kuala Lumpur, Malaysia

* Correspondence email: terhjing92@gmail.com

Abstract

In recent years, green building has been a trend in the world. Green building in Malaysia is still lagging in terms of development in green building. The construction industry has contributed the greatest percentage of greenhouse gas emissions. In order to reduce this issue, the increase in implementing green buildings is a concern among different construction stakeholders. The aim of this study is to investigate the barriers to implementing green buildings in Malaysia. A systematic review was used to achieve the research aim. A PRISMA protocol was used to present the systematic review. The systematic literature review was conducted between 2018 and 2022, and a total of 18 articles were analyzed. In the process, Scopus and Google Scholar databases were used to find the pertinent articles. In this study, the barrier the green building implementation in Malaysia were identified and categorized into several barriers related to economic, technology and training, knowledge, financial and political aspects. The highlighted key barriers contributed to both industry and government increasing the implementation of green building in Malaysia.

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1 Introduction

The construction industry is the main contributor to growth the of Malaysia's economy. There are 5.9% of the total gross domestic product (GDP) in 2017 stated by the Department of Statistics Malaysia [1]. An increase of 3.44% in greenhouse gas (GHG) emissions from 2018 to 2019 in Malaysia [2]. The construction industry was responsible for the greatest percentage of greenhouse gas emissions. However, green building is one of the solutions to reduce greenhouse gas emissions. In Malaysia, there are 500 green building projects which have been certified by Green Building Index (GBI) [3].

Green buildings are designed to sustain the construction industry to achieve energy and water efficiency standards, reduce natural resource use, and enhance health and the environment. There are many types of green building rating tools such as Leadership in Energy and Environmental Design (LEED), Building Research Establishment Environmental Assessment Method (BREEAM), and Green Mark which evaluate and identify buildings that fulfil certain green requirements. On the other hand, Malaysia is using GBI as a standard requirement for green buildings. The criteria include Energy Efficiency, Indoor Environmental Quality, Sustainable Site Planning & Management, Water Efficiency, and Innovation [3].

Green building development in Malaysia is stagnated as shown in Table 1. Although there are multiple researchers who had studied the barriers to implementing green buildings, pertinent research are still insufficient in the area [4,5]. For example, Basri and Ismail [6] conducted semi-structured interviews with government agencies, GBI facilitators, local authorities, and property developers to discover the barriers to implementing green building projects. The interviewees in Basri and Ismail [6] concluded the main concerns of implementation of green building projects in Malaysia are lack of laws and policies, lack of incentives, and incremental cost. They are focusing on housing projects that are faced with financial and political barriers. Moreover, a semi-structured interview was conducted and identified five challenges of green office based on a case study in Penang, Malaysia which is lack of budget, lack of awareness, lack of expertise, rented office, and type of building [7].

Table 1 Green Building Development in Malaysia [8].

No.	Property	Location	Type of Building	Green Certification
1	Ponderosa Lake Side Luxury Apartments	Johor	Residential	Green Building Index (GBI), Malaysia
2	Molek Pine 4 Apartments	Johor	Residential	Green Building Index (GBI), Malaysia
3	Ken Rimba	Selangor	Residential	Green Building Index (GBI), Malaysia
4	S11 House	Selangor	Residential	Green Building Index (GBI), Malaysia
5	Setia Greens	Penang	Residential	Green Building Index (GBI), Malaysia
6	Setia Pinnacle	Penang	Residential	Green Building Index (GBI), Malaysia
7	The Light Collection 1	Penang	Residential	Green Building Index (GBI), Malaysia
8	The Light Collection 2	Penang	Residential	Green Building Index (GBI), Malaysia
9	Marinox Sky Villas	Penang	Residential	Green Building Index (GBI), Malaysia
10	Johor Authority Building	Johor	Commercial	Skim Penarafan Hijau JKR (PHJKR), Malaysia
11	Diamond Building	Selangor	Commercial	Green Building Index (GBI), Malaysia
12	Bangkok Bank Tower	Kuala Lumpur	Commercial	Green Mark, Singapore
13	Melawati Mall	Selangor	Commercial	Green Building Index (GBI), Malaysia
14	Setia City Mall	Selangor	Commercial	Green Building Index (GBI), Malaysia
15	I-Park Senai Airport	Johor	Industrial	Green Building Index (GBI), Malaysia
16	Setia Business Park, Laman Setia	Johor	Industrial	Green Building Index (GBI), Malaysia
17	Plot 56–69, I-park phase II Indahpura	Johor	Industrial	Green Building Index (GBI), Malaysia
18	Plot 1–3, District 6 @SILC	Johor	Industrial	Green Building Index (GBI), Malaysia

According to Sharif, Kamaruzzaman and Pitt [9], a green building project which is a government building in Menara Kerja Raya, Malaysia indicated the use of framework might help to ensure the success of green building delivery mainly for government projects in Malaysia. It is helpful to implement green buildings for new government projects. However, green buildings are still less favored by companies in the Malaysian construction industry. Besides, there is still a lack of encouragement for Malaysians to implement green building development. Therefore, this study aims to investigate the barriers to implementing green buildings in Malaysia. Fig. 1 shows the framework for implementing green buildings [9].

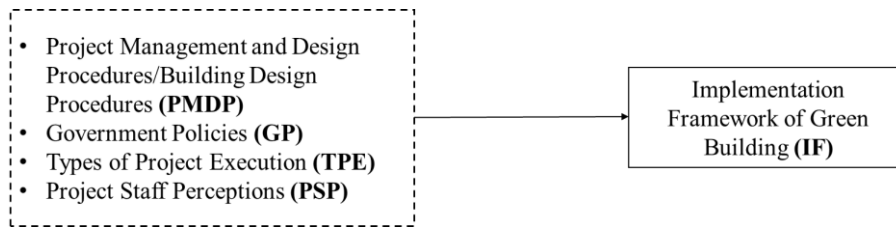


Fig. 1 Framework of Implementing Green Building [9].

2 Methodology

A systematic literature review was used to analyze the problems by identifying, critically reviewing, and integrating the data to fulfil the goal of this paper. A systematic literature review is described as a systematic, explicit, and repeatable approach for recognizing, assessing, and synthesizing the current body of finished and documented work by researchers, academics, and practitioners [10]. This method was also being used to gather and analyze data from the selected and pertinent articles in this review. Moreover, this method was applied to figure out the related literature and research on the barriers to implementing green buildings in Malaysia.

Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) 2020 is used as the research methodology in this study to carry out this systematic literature review. The following stages have been included in PRISMA: specify the source of information, decide on qualifying requirements, establish the search strategy, define the technique of data management, establish the selection procedure, create a data gathering procedure, verify the data items, carried out classification and categorization, determine the possibility of bias in specific research and analyze and debate the results [11].

In this paper, there are three-phase approaches to evaluate the systematic review following the PRISMA. The phases are Identification, Screening, Eligibility, and Exclusion.

2.1 Identification of literature

In this phase, several searches for relevant subjects or topics linked to the implementation of green buildings in Malaysia were conducted. This study is carried out to identify the barriers to green building implementation in Malaysia. The two databases which are Scopus and Google Scholar were used to search the journal article published from 2018 to 2022. Nevertheless, the researchers removed articles that had not been peer-reviewed. Articles edited in English and relevant to the study aim were also included in the inclusion criteria. Table 2 shows the search string of this research.

Table 2 Search String.

Database	Keywords	Results
Scopus	(Barriers AND of AND implementation AND green AND building AND in AND Malaysia) AND (LIMIT-TO (EXACTKEYWORD, "Malaysia") OR LIMIT-TO (EXACTKEYWORD, "Green Buildings"))	112
	(LIMIT-TO (PUBYEAR, 2022) OR LIMIT-TO (PUBYEAR, 2021) OR LIMIT-TO (PUBYEAR, 2020) OR LIMIT-TO (PUBYEAR, 2019) OR LIMIT-TO (PUBYEAR, 2018))	84
	AND (LIMIT-TO (DOCTYPE, "article") OR LIMIT-TO (DOCTYPE, "review") OR LIMIT-TO (DOCTYPE, "conference paper"))	4
Google Scholar	"barriers" OR "green building implementation" OR "green building" OR "Malaysia" "2018-2022"	165
		112
The sum of the papers = 277		
Keyword and limit to the year 2018-2022 = 81		
Remaining = 196		
After document type = 187		
After duplicate and invalid paper = 152		
After titles screening = 95		
After abstract screening = 60		
After full paper screening = 18		
Total = 18		

2.2 Screening of identified literature

Table 3 shows the inclusion criteria and exclusion criteria to filter the journal articles. After identifying the literature, the second phase was to review the articles that suit to the context. There were nine articles removed because these articles are not in the categories of journal articles, conference papers, review articles, and English articles. After that, there were 17 articles found duplicated while 18 invalid articles were found not providing full text online. Hence, the total remaining papers were 152 articles.

Table 3 Inclusion criteria and exclusion criteria.

Inclusion Criteria	Exclusion Criteria
Journal articles, conference articles, and review articles can be accessed using the Scopus and Google Scholar databases.	Non-English Articles.
Relevant to the research aim and objectives.	Duplicate and invalid articles.
Barriers to green building implementation.	Irrelevant research aims and objectives.

Next, the remaining journal articles, conference articles, and review articles were screened based on the inclusion criteria. The duplicated and invalid articles were also screened based on the exclusion criteria. Furthermore, the title of the remaining articles was manually screened to exclude the articles which are not related to the green building implementation. After the titles have been screened, there were 95 articles remained while 57 articles were removed. Additionally, the abstract of the remaining articles was manually reviewed, there were 60 articles remaining while 35 articles were removed in this stage. Now, there were a total of 60 remaining articles.

2.3 Eligibility and exclusion

Finally, the remaining 60 articles were thoroughly reviewed in this stage. Following a thorough full-text review, 42 articles were excluded. Through the full-text review, it can classify and analyze the barriers to green building implementation. Generally, the excluded articles lack information on barriers to green building implementation, and only focused on green building development and green building evaluation systems. Therefore, 18 articles were reviewed and analyzed to be used in this study. Eventually, the result of the analysis was categorized into the economic barriers, technology and training barriers, knowledge barriers, financial barriers, political barriers, and other barriers. The entire paper selection procedure is shown in Fig. 2.

2.4 Bibliometric analysis

A total of 277 publications related to green building implementation in Malaysia were available from 2018 to 2022. The breakdown number of publications were 204 articles (73.65%), 39 conference articles (14.08%), and 34 review articles (12.27%). The co-occurrence network map of the publications is shown in Fig. 3. Fig. 3 shows the nodes linking or lines that represent the relationship of journal co-occurrence. The size of the node is representing the total connection strength of the journals whereas the thickness of the line shows the strength between the journals. In this case, the thicker the lines, the stronger the co-occurrence strength between the journals. It is shown that the journal is categorized into three clusters which are Cluster 1 (red), Cluster 2 (green), and Cluster 3 (blue). Cluster 1 indicates the journals in the sustainability field are the topic that mainly focuses while Cluster 2 and 3 are the wider topics focused on by the researchers in Malaysia.

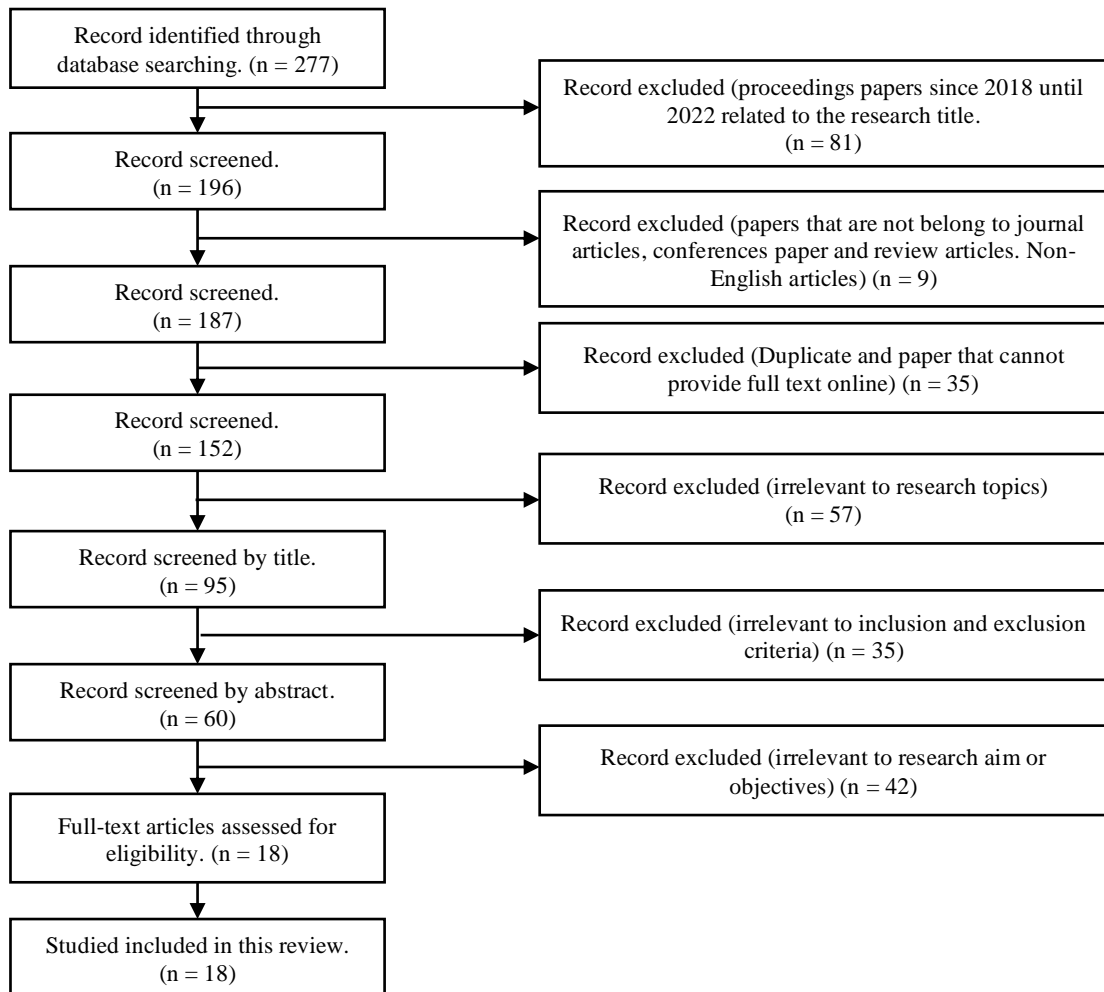


Fig. 2 PRISMA Flowchart.

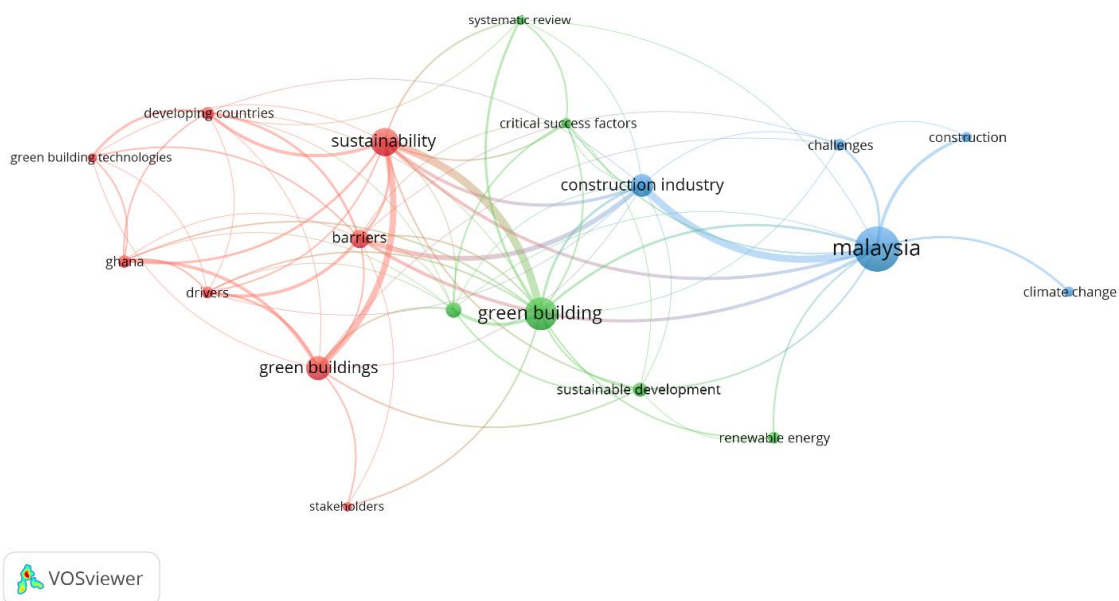


Fig. 3 Co-occurrence relationship among journals for research on green building implementation in Malaysia.

3 Results

Fig. 4 shows the number of articles published. In this section, the selected articles were published from 2018 to 2022. The reason for published years was limited to 2018 until 2022 to identify the latest trend within five years. Based on the histogram, there were two articles published in 2018, three articles published in 2019, five articles published in 2020 and 2021, and three articles published in 2022. This explains the number of published articles is increasing from 2018 to 2021. Moreover, the number of published articles related to the barriers to green building implementation is constant, this can conclude that the barriers to green building implementation has not been resolved.

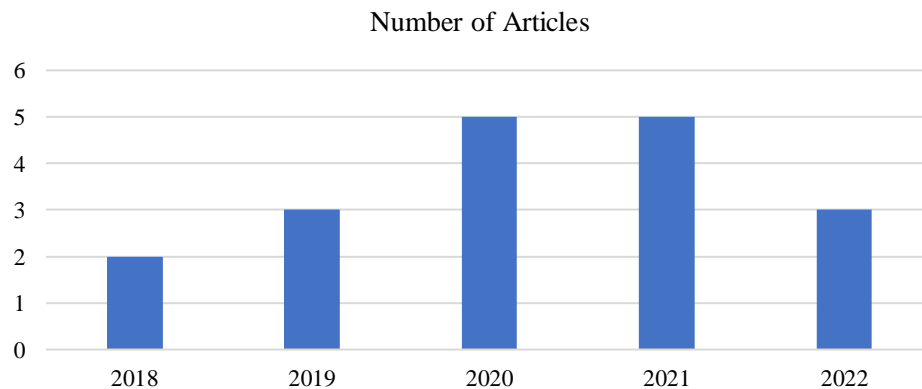


Fig. 2 Number of articles published.

Table 4 contains a list of journals that have contributed one or more relevant articles to this research database. There is a list of 15 different journals listed. IOP Publishing has made the greatest contribution to this topic where it published a total of 4 articles. The remaining journals only contributed one article each.

Table 4 List of journal type.

Journal Types	Number of Paper
International Journal of Energy Economics and Policy	1
Malaysian Construction Research Journal	1
Architecture	1
Science International Journal	1
Universiti Utara Malaysia	1
PM World Journal	1
IOP Publishing	4
Management of Environmental Quality: An International Journal	1
International Journal of Construction Management	1
Progress in Energy and Environment	1
Buildings	1
Journal of Facilities Management	1
Building and Environment	1
International Journal of Special Education	1
Malaysian Journal of Sustainable Environment	1

4 Discussion

Table 5 shows the barriers to implementing green buildings collected from the selected articles. The six barriers obstructing green building development are the economic barriers, technology and training barriers, knowledge barriers, financial barriers, political barriers, and other barriers. These barriers have caused stagnant green building development in Malaysia.

Table 5 Barrier to implementing green building.

No	Factors	Sub-barrier	References
1	Economic Barriers	<ul style="list-style-type: none"> i. High cost of green building ii. Lack of market demand iii. High green materials and product price iv. Limited supply of green materials 	[12],[13],[14],[6],[15],[16],[17],[18],[19] [20],[21],[22],[23],[4],[24],[5]
2	Technology and Training Barriers	<ul style="list-style-type: none"> i. Lack of database and information on green building ii. Lack of expertise iii. Lack of experienced labor iv. Lack of technology v. Lack of professional personnel 	[25],[12],[13],[14],[26],[15],[16],[17],[19], [20],[21],[22],[23],[24],[5]
3	Knowledge Barriers	<ul style="list-style-type: none"> i. Lack of public awareness ii. Lack of knowledge of green building iii. Lack of expert knowledge 	[25],[12],[13],[14],[6],[15],[17],[18],[19], [20],[21],[22],[23],[4],[24],[5]
4	Financial Barriers	<ul style="list-style-type: none"> i. Lack of financial support ii. High risk of investment iii. Lack of incentives 	[25],[26],[16],[17],[18],[19],[21],[22], [23],[24],[5]
5	Political Barriers	<ul style="list-style-type: none"> i. Lack of policies and regulations ii. lack building codes and regulations. iii. lack of enforcement of law 	[12],[13],[14],[26],[6],[15],[16],[18],[20], [21],[23],[4],[24],[5]
6	Other Barriers	<ul style="list-style-type: none"> i. Time-consuming 	[14],[4]

4.1 Economic barriers

In the economic barriers, the higher cost of green building is supported by Ahmad, Omar and Hashim [17], Assylbekov, Nadeem, Hossain, Akhanova and Khalfan [12], Ebekozién, Ayo-Odifiri, Nwaole, Ibeabuchi and Uwadia [21], Kumar and Agarwal [22], Masia, Kajimo-Shakantu and Opawole [19], Mustafa, Isa and Ibrahim [24], Onososen, Osanyin and Adeyemo [18], Roslee, Abdul Tharim and Jaffar [23], Simpeh, Smallwood, Ahadzie and Mensah [20], Wong, Low, Wong and Tai [5] and Yee, Ismail and Jing [4]. This explains that green building has a high initial cost or high maintenance cost which eventually will increase the property selling price. Moreover, low market demand is supported by Ahmad, Omar and Hashim [17], Alshamsi [13], Berawi, Basten, Latief and Crévits [16], Ebekozién, Ayo-Odifiri, Nwaole, Ibeabuchi and Uwadia [21], Isa, Yunos, Ibrahim, Ismail and Marzuki [15], Kumar and Agarwal [22], Lee, Azmi and Lee [14], Masia, Kajimo-Shakantu and Opawole [19], Mustafa, Isa and Ibrahim [24], Onososen, Osanyin and Adeyemo [18], Roslee, Abdul Tharim and Jaffar [23], Simpeh, Smallwood, Ahadzie and Mensah [20], Wong, Low, Wong and Tai [5] and Yee, Ismail and Jing [4]. This explains the clients are not aware of the green building benefits, therefore, the construction stakeholders are not interested in implementing green buildings. For the limited supply of green materials and high green materials and product prices are supported by Berawi, Basten, Latief and Crévits [16], Isa, Yunos, Ibrahim, Ismail and Marzuki [15], Lee, Azmi and Lee [14], Mustafa, Isa and Ibrahim [24], Roslee, Abdul Tharim and Jaffar [23] and Wong, Low, Wong and Tai [5]. There is a lack of suppliers to supply green materials for green buildings. When the demand is high while the supply is low, the price will increase significantly. Furthermore, the cost of green materials is high due to the ingredient of these materials are non-toxic and require special manufacturing skills which will increase the manufacturing cost.

4.2 Technology and training barriers

In the technology and training barriers, the lack of database and information on green buildings is supported by Alshamsi [13], Assylbekov, Nadeem, Hossain, Akhanova and Khalfan [12], Berawi, Basten, Latief and Crévits [16], Ebekozién, Ayo-Odifiri, Nwaole, Ibeabuchi and Uwadia [21], Kumar and Agarwal [22], Masia, Kajimo-Shakantu and Opawole [19], Mustafa, Isa and Ibrahim [24], Roslee, Abdul Tharim and Jaffar [23] and Wong, Low, Wong and Tai [5]. Database and information regarding green building materials are insufficient and difficult to understand. Furthermore, the lack of experienced labour is supported by Alshamsi [13], Berawi, Basten, Latief and Crévits [16], Ebekozién, Ayo-Odifiri, Nwaole, Ibeabuchi and Uwadia [21], Mustafa, Isa and Ibrahim [24], Roslee, Abdul Tharim and Jaffar [23] and Wong, Low, Wong and Tai [5]. Most of the construction workers have more experience in constructing conventional buildings but there is a lack of workers who know the skills to construct green buildings. Then, the lack of technology is supported by Isa, Yunos, Ibrahim, Ismail and Marzuki [15], Lee, Azmi and Lee [14], Mustafa, Isa and Ibrahim [24], Roslee, Abdul Tharim and Jaffar [23] and Wong, Low, Wong and Tai [5]. Most of the construction technologies are imported from other countries which experienced in constructing green buildings. Besides, lack of expertise and lack of professional personnel are supported by Ahmad, Omar and Hashim [17], Alshamsi [13], Assylbekov, Nadeem, Hossain, Akhanova and Khalfan [12], Berawi, Basten, Latief and Crévits [16], Ebekozién, Ayo-Odifiri, Nwaole, Ibeabuchi and Uwadia [21], Mustafa, Isa and Ibrahim [24], Nugradi [26], Roslee, Abdul Tharim and Jaffar [23], Simpeh, Smallwood, Ahadzie and Mensah [20], Wong, Low, Wong and Tai [5] and Zainordin, Petrus and Wahi [25]. Constructing a green building is a complex project as this required very good planning and monitoring throughout the whole process. However, there is a lack of expertise and professional personnel to guide and provide professional suggestions in the green building project.

4.3 Knowledge barriers

In the knowledge barriers, lack of public awareness is supported by Ahmad, Omar and Hashim [17], Assylbekov, Nadeem, Hossain, Akhanova and Khalfan [12], Ebekozién, Ayo-Odifiri, Nwaole, Ibeabuchi and Uwadia [21], Isa, Yunos, Ibrahim, Ismail and Marzuki [15], Kumar and Agarwal [22], Lee, Azmi and Lee [14], Mustafa, Isa and Ibrahim [24], Onososen, Osanyin and Adeyemo [18], Roslee, Abdul Tharim and Jaffar [23], Simpeh, Smallwood, Ahadzie and Mensah [20], Wong, Low, Wong and Tai [5], Yee, Ismail and Jing [4] and Zainordin, Petrus and Wahi [25]. In order to raise the demand for green building development in Malaysia, the public should be educated and informed about the importance of the green building to the environment. Next, the lack of knowledge of green buildings is supported by Ahmad, Omar and Hashim [17], Mustafa, Isa and Ibrahim [24], Simpeh, Smallwood, Ahadzie and Mensah [20] and Yee, Ismail and Jing [4]. The authorities should promote the courses which related to green buildings to construction stakeholders. Besides, the lack of expert knowledge is supported by [12], Kumar and Agarwal [22], Mustafa, Isa and Ibrahim [24] and Onososen, Osanyin and Adeyemo [18]. Most of the industry players lack of knowledge about green building, therefore, these players are required to learn about green knowledge.

4.4 Financial barriers

In financial barriers, lack of incentive and lack of financial support is supported by Ahmad, Omar and Hashim [17], Alshamsi [13], Berawi, Basten, Latief and Crévits [16], Ebekozién, Ayo-Odifiri, Nwaole, Ibeabuchi and Uwadia [21], Isa, Yunos, Ibrahim, Ismail and Marzuki [15], Kumar and Agarwal [22], Lee, Azmi and Lee [14], Masia, Kajimo-Shakantu and Opawole [19], Mustafa, Isa and Ibrahim [24], Nugradi [26], Roslee, Abdul Tharim and Jaffar [23], Onososen, Osanyin and Adeyemo [18], Simpeh, Smallwood, Ahadzie and Mensah [20], Wong, Low, Wong and Tai [5] and Zainordin, Petrus and Wahi [25]. This explains the present government incentives were insufficient to encourage construction stakeholders to include green components in their building development projects. Also, there is a high initial cost to building a green building. Next, the high risk of investment is supported by Isa, Yunos, Ibrahim, Ismail and Marzuki [15], Nugradi [26], Onososen, Osanyin and Adeyemo [18] and Simpeh, Smallwood, Ahadzie and Mensah [20]. Green buildings cost higher compared to conventional buildings,

thus, property developers will have to think about the risk in constructing a green building compared to a conventional building.

4.5 Political barriers

In political barriers, lack of policies and regulations is supported by Alshamsi [13], Assylbekov, Nadeem, Hossain, Akhanova and Khalfan [12], Berawi, Basten, Latief and Crévits [16], Ebekoziem, Ayo-Odifiri, Nwaole, Ibeabuchi and Uwadia [21], Isa, Yunos, Ibrahim, Ismail and Marzuki [15], Mustafa, Isa and Ibrahim [24], Onososen, Osanyin and Adeyemo [18], Roslee, Abdul Tharim and Jaffar [23], Simpeh, Smallwood, Ahadzie and Mensah [20], Wong, Low, Wong and Tai [5] and Yee, Ismail and Jing [4]. Since there is a lack of green building development, there is no specific policies and regulation on green building development. Moreover, the lack of building codes and regulations is supported by Alshamsi [13], Assylbekov, Nadeem, Hossain, Akhanova and Khalfan [12], Berawi, Basten, Latief and Crévits [16], Isa, Yunos, Ibrahim, Ismail and Marzuki [15], Mustafa, Isa and Ibrahim [24], Onososen, Osanyin and Adeyemo [18], Roslee, Abdul Tharim and Jaffar [23], Simpeh, Smallwood, Ahadzie and Mensah [20] and Wong, Low, Wong and Tai [5]. The present regulatory frameworks for green development imposed by authorities are difficult to comply with. There is no standardization of criteria for construction players to follow as the standard guidelines. Moreover, the lack of enforcement of the law is supported by Berawi, Basten, Latief and Crévits [16], Isa, Yunos, Ibrahim, Ismail and Marzuki [15], Mustafa, Isa and Ibrahim [24], Onososen, Osanyin and Adeyemo [18], Roslee, Abdul Tharim and Jaffar [23], Simpeh, Smallwood, Ahadzie and Mensah [20] and Wong, Low, Wong and Tai [5]. Since there is no enforcement from the government stating that it is required to construct green buildings, the intention to implement green buildings will be low.

4.6 Other barriers

Time consumption is supported by Lee, Azmi and Lee [14] and Yee, Ismail and Jing [4]. Construction stakeholders are concerning about green building development as green building projects might consume a lot of time in the beginning stage which is allocated to creating the green concept in the design stage. However, construction stakeholders do not want to spend a long time on a construction project because this will reduce their profits.

5 Conclusion

This paper presented a systematic literature review of green building implementation. There were 18 articles screened to conduct the systematic literature review and analysis. The barriers to green building implementation were evaluated using a systematic literature review. From this study, the results of barriers to implementing green building have been categorized as economic barriers, technology, and training barriers, knowledge barriers, financial barriers, political barriers, and other barriers. The highlighted key barriers are contributing to both industry and government increasing the implementation of green building in Malaysia. There were nine articles identified from Malaysia. Hence, this is useful to know the barriers to implementing green buildings and solve the issue to increase the implementation of green buildings in Malaysia.

Declaration of Conflict of Interest

The authors declared that there is no conflict of interest with any other party on the publication of the current work.

ORCID

Ha Chin Yee  <https://orcid.org/0000-0003-3234-0571>

Loh Jia Xuan  <https://orcid.org/0009-0008-9029-9902>

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