Progress in Energy and Environment

Journal homepage: https://www.akademiabaru.com/submit/index.php/progee
Link to this article: https://doi.org/10.37934/progee.25.1.3343

Volume 25 (2023) 33-43

Original Article

Overview of the Green Building Index and factors affecting the willingness of the public to purchasing green residence

OPEN ACCESS

Ha Chin Yee[*,1], Khoo Terh Jing[1], Teh Soo Chin[2]

[1] School of Housing, Building and Planning, Universiti Sains Malaysia, Pulau Pinang
[2] Centre for Postgraduate Studies and Research, Tunku Abdul Rahman University of Management and Technology, Setapak, 53300, Kuala Lumpur
[*] **Correspondence email:** chinyeeha@yahoo.com

Abstract

Green building has reduced the negative impact on the natural environment caused by construction activities. Commonly, these green buildings are built based on the opinion and knowledge of construction stakeholders such as contractors, developers, and engineers as their most critical point is to earn more return on investment, and the practicability and functionality of buildings. However, the public is the consumer of green buildings, thus, the voice of the public should be heard. To raise public demand for green buildings, this study aimed to identify the factors affecting the willingness of the public in purchasing a green residence. This study adopted a quantitative method where a questionnaire survey was conducted. A total of 53 valid responses were obtained through the convenient sampling method. Apart from that, Cronbach's alpha and mean score analyses were performed in this study. The results revealed that "improve indoor air quality", "enhance occupant comfort and health" and "lower greenhouse gas emission" are the most important factors affecting the public in purchasing a green residence. The results of this study can be used as a guideline to boost the development of green residences in Malaysia.

Article Info

Received 2 December 2022
Received in revised form 4 May 2023
Accepted 23 May 2023
Available online 10 August 2023

Keywords

Green Building Index
Sustainability
Public Willingness
Factors

1 Introduction

Green buildings are gaining significant attention in many countries as buildings are considered as built assets that consume an abundance amount of natural resources and the construction of buildings might harm the environment [1]. Currently, the main environmental issues are mostly related to the construction site, construction materials, occupant demands, and energy and water consumption. Furthermore, every construction activity brings certain damages and environmental impacts such as causing global warming. The extent of the environmental harm caused by unsustainable living has increased the awareness level of public and construction key stakeholders on the need to adopt more environmentally friendly practices [2]. The awareness level among the construction industry's key stakeholders has increased which led to the development of the green building project.

The green building concept emerged in the 1970s. In the 1970s, the construction industry started to design and construct green buildings which indicated the beginning of sustainable development [3]. Furthermore, globally regulated building-rating systems like Leadership in Energy and Environmental Design (LEED), Building Research Establishment Environmental Assessment Method (BREEAM), Building Environmental Assessment Method (BEAM), Green Mark, Green Building Index (GBI) have contributed to the growth of green building development. The number of green buildings has increased gradually over the years. Based on the study conducted by Khan et al. [4], there were 815 registered green building projects by December 2017, the number has increased from 723 registered green building projects that had been registered in January 2017. Even though there were only 380 green-certified buildings in January 2017 and 435 in December 2017, this shows that the number of green buildings in Malaysia is growing. Once the green buildings receive certification, it means these green buildings have fulfilled the relevant criteria of the green building rating system which is GBI used in Malaysia.

Moreover, the demand for energy conservation to reduce emissions and rising public awareness of the important environmental effect in the built environment are boosting the green building adoption trend [3]. Therefore, the public is the most crucial factor in determining the success of green buildings, aside from the effort and role of the relevant construction industry stakeholders. As public demand for green residential development grows, more and more construction companies are willing to implement the green building concept. To reduce the negative effects of buildings on resource consumption, the environment, and human health, green building integrates a wide range of practices and strategies. Green buildings can aid in reducing water and energy consumption, better indoor air quality, lower greenhouse gas emissions, enhancing occupant comfort and health as well as lowering maintenance and operational cost [5]. Thus, based on the benefits of green building, this study is aimed to identify the factors affecting the willingness of the public in purchasing a green residence.

On the other hand, a wide range of topics is covered in recent literature on green building, such as obstacles to green building adoption, developer incentive for green building adoption, stakeholder challenges for green building, green building pricing premium, energy, and water efficiency [6-9]. Most of the studies outlined the responsibilities of industry experts like contractors and engineers as well as relevant governmental bodies in encouraging the growth of green buildings. However, there is still limited and fragmented research on the willingness of the public to purchase a green residence.

This study contributes to identifying the most significant factor that affects the willingness of the public in purchasing green residences by considering the recent state of the literature and the earlier discussion. This study is organised with a literature review on the green building rating system used in Malaysia which is GBI and its six criteria as well as the factor affecting the willingness of the public in purchasing a green residence. A quantitative approach is adopted to collect data from the public. The collected data will be analysed by using Statistical Package for Social Science (SPSS) to form the fundamentals for the discussion of the findings. The final section of the study address conclusion.

2 Literature review

2.1 Green building rating systems

A green building can be defined as a sustainable building that bring beneficial to the environment, social, and economic. The energy demands of the present and future can be significantly reduced via green buildings. In the world today, most construction projects are promoted and encouraged to be built as green buildings. Every country has its rating system to be certified as a green building. Various green building rating systems have been developed by different countries based on their respective culture, climatic conditions, and geographic importance [10]. According to Shan and Hwang [11], The first green building rating system is BREEAM which was introduced by Building Research Establishment Ltd. in the United Kingdom in 1990.

Over time, more and more green building rating systems are being implemented including LEED in the United States, BEAM in Hong Kong, Comprehensive Assessment System for Built Environmental Efficiency (CASBEE) in Japan, Green Star and Green Mark in Singapore, GBI in Malaysia, etc. Kamaruzzaman et al. [12] and Abd Rahman et al. [13] stated that GBI was developed based on Singapore's Green Star and Green Mark ratings since Malaysia and Singapore have very similar climates, with some modifications made to suit the local requirements.

The study by Shan and Hwang [11] did a comparison for the evaluation criterion of various green building rating systems, and seven criteria are used frequently. These criteria are water efficiency, material and resource, energy efficiency, indoor environment quality, sustainable site, land, and outdoor environment as well as innovation in design. Most of the rating systems use a 100-point or higher point scale to evaluate buildings, with the different number of points varying between rating systems [14]. Once the requirement has been achieved, the representative points will be awarded. The total points gained will reflect the building rating followed by a classification of the adopted green building rating tool.

2.1.1 Malaysia Green Building Index

Malaysia is using GBI which is developed by Pertubuhan Arkitek Malaysia (PAM) and the Association of Consulting Engineers Malaysia (ACEM) in 2009 [14]. The GBI assessment is used as a standard measurement to certify green buildings which can reduce damages and impacts on the environment, increase building value and benefit society. It raises awareness of environmental issues among the stakeholders and public as well as their responsibility to future generations.

In GBI, six main sustainability criteria: energy efficiency (EE), indoor environmental quality (EQ), sustainable site planning and management (SM), material and resources (MR), water efficiency (WE), as well as innovation (WE), are used to evaluate the criteria of the building design to be awarded as a green building. Furthermore, buildings can be categorised into seven groups which are residential new construction (RNC), non-residential new construction (NRNC), non-residential existing building (NREB), township, industrial new construction (INC), industrial existing building (IEB), and interiors (ID) [10,14].

Table 1 shows the GBI rating classification. Based on the points obtained from a 100-point scale that consist of those six criteria, green buildings can be classified as platinum, gold, silver, or certified. A building that scored less than 50 points cannot be defined as a green building. Each of the six criteria is further divided into the corresponding sub-sections for obtaining the necessary credit points. It can be a guide for stakeholders while designing a green building [15]. Table 2 shows the GBI assessment criteria for residential buildings.

Table 1 GBI rating classification.

Points	GBI Rating
86 – 100 points	Platinum
76 – 85 points	Gold
66 – 75 points	Silver
50 – 65 points	Certified

Table 2 GBI assessment criteria for residential buildings.

Part	Criteria	Assessment Criteria	Points	Total
1	**EE**	**Energy Efficiency**		
	Design			**23**
	EE1	Minimum EE Performance (Mandatory Compliance)	1	
	EE2	Advanced EE Performance	12	
	EE3	Renewable Energy	5	
	Energy Efficiency			
	EE4	External Lighting and Control	2	
	EE5	Internet Connectivity	1	
	Maintenance			
	EE6	Sustainable Maintenance and Building User Manual (BUM) 2	2	
2	**EQ**	**Indoor Environmental Quality**		
	Air Quality			**12**
	EQ1	Minimum Indoor Air Quality Performance	3	
	EQ2	Volatile Organic Compounds Minimisation	2	
	EQ3	Formaldehyde Minimisation	1	
	Lighting, Visual and Acoustic Comfort			
	EQ4	Daylighting	3	
	EQ5	External Views	1	
	EQ6	Sound Insulation	1	

	Evaluation			
	EQ7	Post Occupancy Evaluation	1	
3	**SM**	**Sustainable Site Planning & Management**		**33**
	Site Planning			
	SM1	Site Selection & Planning	1	
	SM2	Re-habilitation of Brownfield Sites OR Re-development of Existing Buildings	1	
	SM3	Community Connectivity	4	
	Lighting, Visual and Acoustic Comfort			
	SM4	Earthworks – Construction Activity Pollution Control	1	
	SM5	QLASSIC – Quality Assessment System for Building Construction Work	1	
	SM6	Workers' Site Amenities	1	
	SM7	IBS – Industrialised Building System	2	
	Evaluation			
	SM8	Public Transportation Access	8	
	SM9	Dedicated Cycling Network	2	
	Lighting, Visual and Acoustic Comfort			
	SM10	Stormwater Design – Quantity and Quality Control	3	
	SM11	Heat Island Effect – Greenscape and Water Bodies	5	
	SM12	Heat Island Effect – Hardscape	2	
	SM13	Heat Island Effect – Roof	1	
	SM14	Composting	1	
4	**MR**	**Materials & Resources**		**12**
	Reused & Recycled Materials			
	MR1	Materials Reuse and Selection	2	
	MR2	Recycled Content Materials	2	
	Sustainable Resources			
	MR3	Regional Materials	2	
	MR4	Sustainable Timber	2	
	Waste Management			
	MR5	Storage and Collection of Recyclables	2	
	MR6	Construction Waste Management	2	
5	**WE**	**Water Efficiency**		**12**
	Water Harvesting & Recycling			
	WE1	Rainwater Harvesting	4	
	WE2	Wastewater Recycling	2	
	Increased Efficiency			
	WE3	Water Efficient Irrigation and Landscaping	2	
	WE4	Water Efficient Fittings	4	
6	**IN**	**Innovation**		**8**
	IN1	Innovation in Design and Environmental Design Initiatives	7	
	IN2	Green Building Index Facilitator (GIBF)	1	
			Total Points	**100**

2.1.1.1 Energy Efficiency (EE)

There are some considerations to consider in improving energy efficiency including optimizing building orientation to gain more natural daylight but at the same time, lesser solar radiation. The use of heat-insulating building materials and renewable energy such as solar power are also considered as achieving energy efficiency. Marhani and Muksain [16] found that a green building project will save 36% on energy usage in comparison to a conventional project in their study [16]. For example, the utilisation of natural daylight as a source of energy consumption in a green building could reduce the reliance on artificial light which reduce the consumption of electricity.

2.1.1.2 Indoor Environment Quality (EQ)

In the indoor environment quality aspect, a green building must perform excellently in terms of air quality, lighting, visual comfort, and acoustic comfort. According to section 62.1 in The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), a green building should be controlled with minimal ventilation rates with an acceptable indoor environment quality to reduce the impacts on human and occupant health [17]. A good indoor environment quality can also be achieved by employing as least amount of volatile organic compound components as possible. A requirement for proper control of air temperature, movement, and humidity as well as the use of high-quality air filtration to minimise formaldehyde [10]. To make an inhabitant comfortable, the daylighting, exterior views, and sound insulation may be improved.

2.1.1.3 Sustainable Site Planning and Management (SM)

A site planner should consider good sustainable site planning in green buildings to minimize the harmful impact on surrounding areas. According to Nizarudin et al. [18] and Abdulaali et al. [10], each project development must submit a structural plan for the proposed site and must comply with local authority guidelines. Redevelopment of an existing structure or location may lead to reduced exploitation of the natural environment, which is beneficial in situations including green land. Implementing appropriate construction management to control the loss of soil, stormwater sedimentation, and pollution. Furthermore, building cooling and shading effects from heat islands can be reduced by using greenery on rooftops [19].

2.1.1.4 Material and Resources (MR)

A green building project must take waste management, reused and recycled materials, and sustainable materials into account when determining the material and resource criteria. Thus, the 3R principle of “reduce, reuse, and recycle” is crucial to minimising the environmental impact of a building. The reusable materials, such as formwork and scaffolding, can be moved to the appropriate site for further use, additionally, the recycling materials may be shipped back to the manufacturing facility for processing [19]. An area on the site that is appropriate to store recyclable non-hazardous items should be provided to reduce materials wastage. In addition, the utilization of environmentally friendly materials will ensure low building maintenance without affecting the quality of the project.

2.1.1.5 Water Efficiency (WE)

The introduction of rainwater harvesting systems promotes the collection and reuse of rainwater for activities such as flushing toilets and watering plants. All domestic waste should be recycled and used in the irrigation of crops. Ahuja [20] and Algburi et al. [19] stated that recycling is the process of recovering water that was once supposed to be sent to the waste system, cleaning and purifying it, and then reusing it as potable water. It is beneficial when domestic waste could be used in agriculture and conjunction with an automated irrigation system. One environmentally friendly method for increasing water efficiency is water recycling.

2.1.1.6 Innovation (IN)

Each of the green building projects would have a unique innovation criterion [16]. One of the innovative initiatives is the adoption of the Industrialized Building System (IBS), which can reduce the amount of labour required, shorten the building duration, and increase site quality. On the other hand, Building Information Modelling (BIM), also known as the n-dimensional model, may also function in green building projects since it can generate a 3D model, visualise the model, detect clashes, estimate costs and timelines, and even demonstrate sustainability [21].

2.2 Factors Affecting the Willingness of the Public to Purchasing Green Residence

Green building and sustainable development are very significant in saving the world to assure that future generations can enjoy similar benefits as the existing generation can obtain from natural [19]. By adopting green buildings, the consumption of natural resources and carbon emissions can be reduced to slow down the effect of global warming. Besides that, by using green technology in the construction industry, there is a reduction in exploitation of the natural resources. According to Simpeh and

Smallwood [5], improving air and water quality, waste reduction, and protecting biodiversity and ecosystems are the contributions of green building.

Besides, Shabrin and Kashem [22] also mentioned that the green building can reduce heat gain while the building is designed to harvest optimal daylight. It leads to an economic benefit since it saves energy consumption. Rainwater harvesting system is also one of the methods used in green buildings resulting in a reduction of water consumption. There is a reduction in operating costs as green building saves money through the reduction of energy usage, water usage, and lowering of maintenance costs of the building [5]. Since green buildings are energy efficient, a lesser amount of greenhouse gases is emitted to enhance occupants' feel of comfortable. The importance of green buildings is relevant to the criteria of GBI and these will be the factors affecting the willingness of the public in purchasing green residences. Table 3 shows the relevant literatures that discussed the factors affecting the willingness of the public on purchasing green residences.

Table 3 Factors affecting the willingness of the public on purchasing green residences.

	Factors	Reference
1.	Reduce energy consumption	[23], [24]
2.	Reduce operational cost	[25], [26]
3.	Using a rainwater harvesting system	[27]
4.	Low building maintenance	[25]
5.	Reused and recycled material	[28]
6.	Improve indoor air quality	[29]
7.	Improve lighting, visual and acoustic comfort	[30]
8.	Enhance occupant comfort and health	[25], [31]
9.	Enhance and protect eco-system	[25], [26], [31]
10	Lower greenhouse gas emission	[25]
11.	Innovation in design and environmental design initiatives	[32]

3 Research Methodology

A quantitative method had been used in this study. There were three stages in the research methodology of this study. Firstly, information was collected from the literature to identify the factors affecting the willingness of the public in purchasing green residences. Next, the factors were used as the fundamentals to develop the questionnaire. The target population in this study was the potential house buyers in Malaysia. A question to identify whether the respondent is a first house buyer has been asked to filter out those respondents who are not qualified to participate in this study. According to the Department of Statistic Malaysia [33], the population in Malaysia is 33 million. Morgan [34] suggested the sample size should be 384 if the population is over one million people.

According to Bell, Bryman and Harley [35], sampling is one of the important parts that focus on the selection of the correct individuals and objects where the required information is collected from the empirical research. Creswell and Creswell [36] mentioned that it is important to use the sampling method in a study if there is a large population and this exceeds the capability of researchers to cover all the respondents in the population. By using the suitable sampling method, researchers can reduce the spending time, data to be collected and money to be used when collecting the data from the population [37]. The non-probability sampling method was used in this study. Non-probability sampling is a method of selecting units from a population using a subjective (i.e. non-random) method [38]. Since non-probability sampling does not require a complete survey frame, it is a fast, easy, and inexpensive way of obtaining data. The convenience sampling method is the sampling method that relies on data collection from respondents who are convenient and willing to participate in the study. Therefore, the convenience sampling method was used in this study due to it is cheap, efficient, and simple to implement.

Next, a questionnaire was distributed to the public. The questionnaire was made in Google Forms and distributed to respondents through social media and email. There were two sections in this questionnaire survey which were closed-ended questions for section A: the demographic of respondents whereas a 6-Likert scale point was used for section B: factors affecting the willingness of the public in purchasing green residences**.** After three months of the data collecting period, a total of 53 questionnaire feedback were collected from respondents. After feedback from the respondents was collected, this study conducted data analysis. SPSS was used to evaluate the feedback of respondents and undertake data analysis, such as demographic analysis of the questionnaire respondents, Cronbach's alpha, and mean score analysis. In the last stage, a discussion was carried out based on the analysis results and the conclusion and limitations were made.

3.1 Data Analysis

3.1.1 Demographic Analysis of Questionnaire Respondents

The questionnaire only obtains 53 responses which is only 13.80% from 384 targeted responses. The questionnaire survey respondents were categorized based on their gender, age, education qualification, working experience, income, and housing utility fees. Table 4 elaborates on the distribution of respondents.

Table 4 Distribution of respondents.

Item	Description	Number of Participants	Percentage (%)
Gender	Male	27	50.9
	Female	26	49.1
Age	20 - 29	50	94.3
	30 - 39	2	3.8
	40 - 49	1	1.9
Education qualification	SPM	5	9.4
	Diploma / STPM	9	17.0
	Bachelor's degree	39	73.6
	Master's degree	0	0
	PhD	0	0
Working experience	Less than 2 years	39	73.6
	2 - 5 years	9	17.0
	5 - 10 years	4	7.5
	More than 10 years	1	1.9
Income	Less than RM2000	23	43.4
	RM2000 - RM5000	21	39.6
	RM5001 - RM10000	6	11.3
	More than RM10000	3	5.7
Utility fees	Less than RM200	24	45.3
	RM200 - RM400	26	49.1
	RM401 - RM600	1	1.9
	More than RM600	2	3.8

3.1.2 Cronbach's Alpha

The reliability was assessed using the degree of accuracy within the measurement result. This analysis was able to assess the reliability by using SPSS. A Cronbach's alpha coefficient was produced to check the data validity. A number between 0.6 and 0.8 is considered excellent and acceptable, whereas a value below 0.6 indicates that the data is unreliable and unacceptable. Once the value of Cronbach's alpha coefficient is greater than 0.8, the data will be the most reliable [39]. With a Cronbach's alpha coefficient of 0.865 shown in Table , this study proved the collected data are having a high level of data reliability.

Table 5 Reliability statistics.

Cronbach's Alpha	N of Items
0.865	11

3.1.3 Mean Score Analysis

Mean score analysis aims to rank the relative importance of factors in a quantitative analysis. Mean score analysis was also used in previous studies by other authors [39]. Table 6 shows the mean score analysis and the ranking.

Table 6 Mean score analysis of respondents.

Factors Affecting the Willingness of the Public to Purchasing Green Residences	Mean Value	Rank	Std. Deviation
Improve indoor air quality	5.25	1	1.090
Enhance occupant comfort and health	5.19	2	0.761
Lower greenhouse gases emission	5.13	3	0.878
Improve lighting, visual, and acoustic comfort	5.02	4	1.009
Enhance and protect eco-system	4.98	5	0.930
Innovation in design and environmental design initiatives	4.96	6	0.960
Reduce energy consumption	4.94	7	0.949
Reused and recycled material	4.92	8	1.035
Reduce operational cost	4.91	9	0.986
Using a rainwater harvesting system	4.70	10	1.102
Low building maintenance	4.40	11	1.485

The analysis results show that the top three factors affecting the willingness of the public in purchasing green residences are “improve indoor air quality”, “enhance occupant comfort and health” and “lower greenhouse gases emission”. Followed by the “improve lighting, visual and acoustic comfort”, “enhance and protect eco-system” and “innovation in design and environmental design initiatives” ranked fourth, fifth, and sixth respectively. The seventh, eighth, and ninth ranks are “reduce energy consumption”, “reused and recycled material” and “reduce operational cost”. “using rainwater harvesting system” and “low building maintenance” which is ranked tenth and eleventh respectively.

4 Discussion on mean score analysis

According to the findings, most of the respondents think that improvement in indoor air quality is the most important factor which will affect their willingness to purchase green residential. This is due to the public would take this for granted since people can’t live without breathing. However, people nowadays actually have trouble with breathing problems, especially those who have asthma. The air quality is getting worst due to human activities. Thus, supporting green buildings is in desperate need [29]. With better air quality, people can breathe easier as airborne pollutants can be removed through air circulation.

The second-ranking factor that affects the willingness of the public to purchase green residences is to enhance occupant comfort and health. Houses will be the place where occupants spend the longest time throughout the day apart from the working period and it is the only place belongs to a person to relax. Unfortunately, anxiety issues are a common occurrence for everyone. According to the study of Ithnain et al. [40], there are 260 out of 369 experienced mild, 54 people have moderate anxiety, and 41 and 14 people have severe and extremely severe anxiety respectively. Once occupants are in a comfortable status, they will feel less anxious and stressed, which will make falling asleep easier. This shows that green residences are important to improve the quality of the living environment and residents' health [25,31].

The third-ranking factor affecting the willingness of the public to purchase green residential is to lower greenhouse gas emissions. The result of this study aligned with Li et al. [41], that green buildings could reduce greenhouse gases emission. Low greenhouse gas emissions are a must to slowing global climate change and reducing outdoor air pollution. Natural disasters such as increasing droughts, sea-level rise, forest fires, and others will be caused by global warming. These events will give temporary or permanent harm to humans as well as the development of the country. Reducing greenhouse gas emissions aids in working towards a cleaner, greener, safer, and healthier society around the globe.

Next, the results show improving lighting, visual, and acoustic comfort, enhancing and protecting eco-system, and having innovation in design and environmental design initiatives are also considered by the respondents. The least emphasize aspects by the respondents are reducing energy consumption, reusing and recycling materials, reducing operational cost, using a rainwater harvesting system and low building maintenance. Therefore, key stakeholders should focus on the most influencing factors identified in this study which are improving indoor air quality, enhancing occupant comfort and health and lowering greenhouse gases emissions.

5 Conclusion

This study provided an overview of GBI as a green building rating tool and the factors that affect the public willingness to purchase green residences. The analysis results show the top three factors are "improve indoor air quality", "enhance occupant comfort and health" and "lower greenhouse gases emission". Besides, these three factors are significantly relevant to the indoor environment quality (EQ) criterion of GBI. This seems to imply that the public is paying more attention to their health and comfort than saving the cost since these three factors focus on social and environmental aspects. This study has its limitation as there were only 53 respondents in this study which could not provide strong support for the reliability of the results. Since this study has discussed the willingness of potential buyers towards the green residence, it is recommended to conduct a future study to collect opinions from other key stakeholders towards green building development.

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
Khoo Terh Jing https://orcid.org/0000-0002-6442-1301
Teh Soo Chin https://orcid.org/0009-0002-0026-9846

References

[1] N. Rashid, M.R. Shaharudin, Customer's purchase intention for a green home, International Journal of Procurement Management 10 (2017) 581-599. https://doi.org/10.1504/IJPM.2017.086402.
[2] M.N. RAZALI, M.Y. HAMID, Assessing green property management implementation among commercial buildings in Malaysia, WIT Transactions on Ecology and the Environment 226 (2017) 827-835. https://doi.org/10.2495/SDP170721.
[3] B.A. Portnov, T. Trop, A. Svechkina, S. Ofek, S. Akron, A. Ghermandi, Factors affecting homebuyers' willingness to pay green building price premium: Evidence from a nationwide survey in Israel, Building and Environment 137 (2018) 280-291. https://doi.org/10.1016/j.buildenv.2018.04.014.
[4] J.S. Khan, R. Zakaria, S.M. Shamsudin, N.I.A. Abidin, S.R. Sahamir, D.N. Abbas, E. Aminudin, Evolution to emergence of green buildings: A review, Administrative Sciences 9(1) (2019) 6. https://doi.org/10.3390/admsci9010006.
[5] E.K. Simpeh, J.J. Smallwood, Analysis of the benefits of green building in South Africa, Journal of Construction Project Management and Innovation 8(2) (2018) 1829-1851. https://doi.org/10.36615/jcpmi.v8i2.161.

[6] A. Darko, A.P. Chan, Review of barriers to green building adoption, Sustainable Development 25(3) (2017) 167-179. https://doi.org/10.1002/sd.1651.
[7] K. Fan, E.C. Hui, Evolutionary game theory analysis for understanding the decision-making mechanisms of governments and developers on green building incentives, Building and Environment 179 (2020) 106972. https://doi.org/10.1016/j.buildenv.2020.106972.
[8] Y. Li, M. Li, P. Sang, P.-H. Chen, C. Li, Stakeholder studies of green buildings: A literature review, Journal of Building Engineering 54 (2022) 104667. https://doi.org/10.1016/j.jobe.2022.104667.
[9] L.N. Dwaikat, K.N. Ali, Green buildings cost premium: A review of empirical evidence, Energy and Buildings 110 (2016) 396-403. https://doi.org/10.1016/j.enbuild.2015.11.021.
[10] H.S. Abdulaali, M.M. Hanafiah, I.M. Usman, N.U.M. Nizam, M.J. Abdulhasan, A review on green hotel rating tools, indoor environmental quality (IEQ) and human comfort, International Journal of Advanced Science and Technology 29 (2020) 128-157.
[11] M. Shan, B.-g. Hwang, Green building rating systems: Global reviews of practices and research efforts, Sustainable cities and society 39 (2018) 172-180. https://doi.org/10.1016/j.scs.2018.02.034.
[12] S.N. Kamaruzzaman, E.C.W. Lou, N. Zainon, N.S.M. Zaid, P.F. Wong, Environmental assessment schemes for non-domestic building refurbishment in the Malaysian context, Ecological Indicators 69 (2016) 548-558. https://doi.org/10.1016/j.ecolind.2016.04.031.
[13] N.M. Abd Rahman, C.H. Lim, A. Fazlizan, Optimizing the energy saving potential of public hospital through a systematic approach for green building certification in Malaysia, Journal of Building Engineering 43 (2021) 103088. https://doi.org/10.1016/j.jobe.2021.103088.
[14] S. Pandey, Impact of green building rating systems on the sustainability and efficacy of green buildings: case analysis of green building index, Malaysia, Malaysia Sustainable Cities Program, Working Paper Series [(accessed on 24 August 2019)] (2018).
[15] G.B. Index, GBI assessment criteria–for residential new construction, 2013.
[16] M. Marhani, M. Muksain, GBI assessment checklist: Level of awareness of the contractors in the Malaysian construction industry, IOP Conference Series: Earth and Environmental Science, IOP Publishing, 2018, pp. 012024. https://doi.org/10.1088/1755-1315/117/1/012024.
[17] C.Q. Li, Interpreting ASHRAE 62.1: ASHRAE Standard 62.1 is best known for its regulation of the amount of ventilation air delivered to each space in a commercial building by HVAC systems through various ventilation approaches to system design, Consulting Specifying Engineer 56 (2019) 35-43.
[18] N. Nizarudin, M. Hussain, I. Tukiman, The application of the Green Building Index (GBI) on sustainable site planning and management for residential new construction: prospects and future benefits, Sustainable Tropical Environmental Design Conference 2010 (SUSTED 2010), 2010.
[19] S.M. Algburi, A. Faieza, B. Baharudin, Review of green building index in Malaysia; existing work and challenges, International Journal of Applied Engineering Research 11 (2016) 3160-3167.
[20] A. Ahuja, Integrated M/E Design: Building Systems Engineering, Springer Science & Business Media, 2013.
[21] B. Manzoor, I. Othman, S.S. Gardezi, E. Harirchian, Strategies for Adopting Building Information Modeling (BIM) in Sustainable Building Projects—A Case of Malaysia, Buildings 11 (2021) 249. https://doi.org/10.3390/buildings11060249.
[22] N. Shabrin, S.B.A. Kashem, A comprehensive cost benefit analysis of green building, in: Proceedings of 94th The IIER International Conference, 2017.
[23] W.-L. Tan, Y.-N. Goh, The role of psychological factors in influencing consumer purchase intention towards green residential building, International Journal of Housing Markets and Analysis 11(5) (2018) 788-807. https://doi.org/10.1108/IJHMA-11-2017-0097.
[24] P. Sang, H. Yao, L. Zhang, S. Wang, Y. Wang, J. Liu, Influencing factors of consumers' willingness to purchase green housing: A survey from Shandong Province, China, Environment, Development and Sustainability 22 (2020) 4267-4287. https://doi.org/10.1007/s10668-019-00383-8.
[25] S. Ofek, S. Akron, B.A. Portnov, Stimulating green construction by influencing the decision-making of main players, Sustainable cities and society 40 (2018) 165-173. https://doi.org/10.1016/j.scs.2018.04.005.
[26] Q. He, H. Zhao, L. Shen, L. Dong, Y. Cheng, K. Xu, Factors influencing residents' intention toward green retrofitting of existing residential buildings, Sustainability 11(5) (2019) 4246. https://doi.org/10.3390/su11154246.
[27] M.O. Oyewole, A.A. Ojutalayo, F.M. Araloyin, Developers' willingness to invest in green features in Abuja, Nigeria, Smart and Sustainable Built Environment 8(3) (2019) 206-219. https://doi.org/10.1108/SASBE-06-2018-0031.
[28] I.M.C.S. Illankoon, W. Lu, Cost implications of obtaining construction waste management-related credits in green building, Waste Management 102 (2020) 722-731. https://doi.org/10.1016/j.wasman.2019.11.024.

[29] C. He, S. Yu, Q. Han, B. de Vries, How to attract customers to buy green housing? Their heterogeneous willingness to pay for different attributes, Journal of Cleaner Production 230 (2019) 709-719. https://doi.org/10.1016/j.jclepro.2019.05.160.

[30] M. Golbazi, A.E. Danaf, C.B. Aktas, Willingness to pay for green buildings: A survey on students' perception in higher education, Energy and Buildings 216 (2020) 109956. https://doi.org/10.1016/j.enbuild.2020.109956.

[31] W. Ren, Y. Wang, Study on the Factors Affecting the Green Housing Purchase Intention in Urban Residents—Taking the Beijing-Tianjin-Hebei Region as an Example, Sustainability 15(4) (2023) 3735. https://doi.org/10.3390/su15043735.

[32] S. Ofek, B.A. Portnov, Differential effect of knowledge on stakeholders' willingness to pay green building price premium: Implications for cleaner production, Journal of Cleaner Production 251 (2020) 119575. https://doi.org/10.1016/j.jclepro.2019.119575.

[33] Department of Statistic Malaysia, Demographic Statistics Fourth Quarter 2022, Malaysia, 2023. https://www.dosm.gov.my/portal-main/release-content/8c705dac-ef05-11ed-96d5-1866daa77ef9.

[34] R.V. Krejcie, D.W. Morgan, Determining Sample Size for Research Activities, Educational and Psychological Measurement 30 (1970) 607-610.

[35] E. Bell, A. Bryman, B. Harley, Business Research Methods, Oxford University Press, 2018.

[36] J.W. Creswell, J.D. Creswell, Research design: Qualitative, quantitative, and mixed methods approaches, Sage Publications, 2017.

[37] M. Saunders, P. Lewis, A. Thornhill, Research methods for business students, Pearson Education, 2009.

[38] M. Alvi, A Manual for Selecting Sampling Techniques in Research, University of Karachi, Iqra University, 2016.

[39] J. Pallant, S.S. Manual, A step by step guide to data analysis using SPSS for windows, SPSS Survival Manual 14 (2007) 20-30.

[40] N. Ithnain, S.E. Ghazali, N. Jaafar, Relationship between smartphone addiction with anxiety and depression among undergraduate students in Malaysia, International Journal of Health Sciences and Research 8(1) (2018) 163-171.

[41] Y. Li, L. Yang, B. He, D. Zhao, Green building in China: Needs great promotion, Sustainable Cities and Society 11 (2014) 1-6. https://doi.org/10.1016/j.scs.2013.10.002.