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INVESTIGATING THE AWARENESS AMONG POTENTIAL HOMEBUYERS TOWARDS ELEMENTS OF GREEN RESIDENTIAL BUILDING

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Abstract

The number of green residential buildings in Malaysia is on the rise trend. However, there is an imbalance in the amount of green residential buildings available in main cities. Why do things like this happen? Is there a lower demand for green residential buildings in Malaysia's other main cities? Are potential homebuyers aware of the elements of green residential buildings? Therefore, this research was conducted to identify the demand for green residential building and to investigate potential homebuyers' awareness towards the elements of green residential building. The city of Ipoh, Perak, was chosen as the study's focal point, and Ipoh residents with good professions were chosen as respondents. This is because Ipoh has less green residential buildings than some other cities in Malaysia. A quantitative approach was adopted. A total of 384 responses were accepted for analysis. The collected data were analyzed using frequency analysis and the relative importance index (RII). According to the data, the majority of potential homebuyers in Ipoh, Perak, are aware on the elements of green residential building and are willing to purchase it in the future. This indicates that this residential concept is in high demand in the Ipoh market. Ipoh residents are also well aware of the elements of a green residential building. Hence, developers and the state authority would be able to increase the number of green residential developments in Ipoh.

Keywords: Awareness, green, residential building elements

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INTRODUCTION

In response to this scenario, Perak's Chief Minister announced in 2019 that contractors and developers should emphasize green technology in the development (Bernama, 2019). This is to ensure that Perak's development moves towards green development. However, according to Adzmi and Abdullah (2018), demand for the green building concept is still low compared to the conventional building because the Malaysian are still lacking an awareness of environmental concern. Agreed by Lim et al. (2018), that found one the obstacle to the development of the green buildings in Malaysia is the lack of public awareness. Therefore, this research was conducted to identify the demand for green residential buildings and to investigate the awareness of potential home buyers towards the elements of green residential buildings. The findings of this research can help developers and state authorities in determining whether there is a demand for the concept of green residential in Ipoh, as well as their awareness of the concept and elements of green residential to predict future green residential development plans.

LITERATURE REVIEW

The issue of global warming, which has been debated around the world, has contributed to the growth of green buildings, including the construction of green residential buildings in Malaysia. Green residential buildings are a subcategory of green building concepts that focus on green amenities and features incorporated in the operation of residential buildings. This study will discuss more about the demand for green residential buildings, as well as the elements that come with this type of property.

Demand for Green Residential Building

There are many definitions for green building, but none of them are completely satisfactory (Sayce et al., 2007). The green building also known as sustainable building (Fauzi, Johari, Chuweni et al., 2021) and high performance building (Shaikh et al., 2019). The main key for green building is to minimize environmental impact and costs while maximizing occupant comfort and satisfaction (Fauzi, Johari, Zainuddin et al., 2021).One of the green residential criteria, according to Elias and Khai (2015), is the house that can achieve long-term sustainability through energy efficiency, green technology applications, rainwater collection, and recycled materials, and that it is operated with sustainable resources in order to achieve the goals of sustainable development.

The number of green residential properties in Malaysia has been steadily increasing (GBI, 2013). According to Kasim et al. (2015), the housing sector's need and demand were excessive, particularly in urban areas. This is due to the increasing demand for sustainability in building design and construction (Uche et al., 2013). Not only that, Uche et al. (2013)believe the demand for green

building nowadays increasing due to green building materials are getting more affordable and the design also becoming more widely accepted, which fulfil the demand of the tenants and potential homebuyers. According to Shafiei et al. (2017) there are various factors which led to the occurrence of a rapid green development in this country which is included due to increasing awareness of environmental issues, increasing demand for architectural environmental quality, development of various green building technologies, successive implementation of green building assessment criteria and other relevant policies and regulations.

Elements of Green Residential Building

Many develop country had implemented the green building concept. There are 56 list of rating tools that are administered by the World Green Building Council. The difference adoption of building guidelines and rating systems are influenced by the climate, economy, and culture of the location. For Malaysia, Green GBI has been introduced and adopted as a green building rating tool since 2009. For residential green building, GBI rating systems focus on energy efficiency (EE), indoor environmental quality (EQ), sustainable site planning and management (SM), materials and resources (MR), water efficiency (WE), and innovation (IN) (GBI, 2013).

Energy Efficiency (EE)

According to the GBI (2013), EE can be achieved through several initiatives that includes of passive design, and active design. Passive design is one of the methods for lowering energy use while simultaneously increasing energy savings. In line with GBI (2013) the objective of passive design for EE is to minimize energy consumption in buildings so that CO2 emissions are reduced. According to(Ann and Abualrejal (2015), building orientation, window location, shading, size and form, planning and design, and construction elements are all included in passive design. According to Kibert (2016), the location and the design of the building are the two primary components of passive design whereby for the location element, the building's construction must be carried out appropriately in order to minimize the building's energy profile and for the design element The building's orientation, aspect ratio, day lighting, ventilation, and other architectural factors should be included. The appropriate orientation allows the structure to benefit from natural resources such as enough daylight. According to Ann and Abualrejal (2015), a window orientation may help in the creation of natural daylight, natural ventilation, and heat reduction, therefore reducing the usage of energy such as light bulbs and air conditioners.

While, active system, are the approaches will help to improve energy efficiency in the building. This is consistent with GBI (2013) that aims to minimise reliance on energy used while at the same time to maintain a comfortable indoor environment. The mechanical and electrical methods are the

two major methodologies used in active systems. Heat, ventilation, and air conditioning are examples of mechanical systems, whereas light and electrical motors are examples of electrical systems (Kibert, 2016). One of the active systems utilised in property development companies is the sensor system in lighting (Ann & Abualrejal, 2015) whereby, this device detects any movement and is often mounted on the ceiling. The purpose of a sensor system or an automated lighting system is to reduce energy waste and achieve energy efficiency by preventing waste in the use of power or lighting systems. Aside from that, using LED light bulbs in lighting systems may also help conserve energy. Apart from using less energy, it may also minimize heat generation, lowering the need for air conditioning in the structure.

The EE also promotes the use of renewable energy systems to reduce energy costs and promote the usage of green energy (GBI, 2013). According to Kibert (2016), the term "renewable energy technology" refers to the energy that can be generated on-site. Photovoltaic, wind energy, and biomass are three ways that may be utilized to create sustainable energy. A photovoltaic panel is also known as a solar panel that is able to convert solar energy into electrical energy (Ann & Abualrejal, 2015). The installation of a solar photovoltaic panel (PV) can provide a number of benefits to the building user, including lower electricity bills, limitless power storage and generation, and no harmful influence on the environment (Ann & Abualrejal, 2015). EE also emphasises external lighting and control, which encourages the use of energy-efficient lighting and sensors to maximise energy savings in external or common areas, as well as internet connectivity, which encourages working from home via an internet connection, thereby reducing unnecessary commuting (GBI, 2013). Thus, in order to ensure that the green building elements continue to operate as intended, a well-sustainable maintenance plan must be created.

Indoor Environmental Quality (EQ)

The aim of indoor environmental quality is to achieve high efficiency in air quality, acoustics, visual, and lighting. These may require the use of low volatile organic compound materials, effective air filtration, proper air temperature regulation, and motion and humidity control. According to Abdulaali et al. (2020), the design of a building could have an influence on indoor environmental quality. He went on to say that by leveraging natural resources such as organic compounds, air filtration quality, accessible temperature control, and air humidity, indoor air quality (IAQ) may be improved. IAQ, lighting, visual, and sound are the four main components of indoor environmental quality (Abdulaali et al., 2020).

Sustainable Site Planning and Management (SM)

The aim of sustainable site planning and management is to select ideal places with scheduled access of public transportation facilities, community facilities, open spaces, and landscaping. According to Faulhaber (2011), a sustainable site plan is one that has a low environmental effect while yet accomplishing the client's objectives. Added, the site selection, site or building layout, and impervious surfaces are all important aspects of sustainable site planning in order to avoid and conserve environmentally sensitive places. Therefore, appropriate site selection is critical. Moreover, reusing and recycling an old building structure for a new building design on a brownfield site, it will assist to revitalise the property and its surroundings, making it a better place to live (Zin, 2012). Faulhaber (2011) mentioned, in order to encourage people to utilise public transportation, the development of green buildings must include the public mobility aspect. Effective design and effective public transportation system construction can help to minimize the number of individual transportation on the road that indirectly able to reduce congestion and air pollution (Zin, 2012).

Material & Resources (MR)

Material and resources are more towards promoting the reuse and recycling of environmentally friendly products. According to Sharma (2012), pre-construction, construction, and post-construction stages are the three main stages in which materials and resources can be improved in a green building development. In order to protect occupants from interior pollutants such as indoor air pollution, developers or contractors must choose appropriate sustainable materials (Zin, 2012). Contractors can reuse any excellent building components and waste materials throughout the construction stage to save waste while also reducing negative environmental effect.

Water Efficiency (WE)

Water efficiency is mostly concerned with long-term water usage, such as planned rainwater harvesting, in order to reduce water use. Any usage of materials that improve the efficiency of water is also taken into account in this criterion. The efficacy and efficiency of a green building's water consumption differ from the conventional building with no water-savings features (Cheng et al., 2016). According to Cheng et al. (2016), as compared to conventional buildings, green buildings used water more effectively.The use of green roofs helps to minimize storm water runoff and combined sewer overflows, but it comes with a cost (Nelson, 2007). Aside from that, rainwater can be collected and used for plant irrigation and washing, allowing the building to save a significant amount of water (U.S Green Building Council, 2021).

Innovation (IN)

Innovation is used as a complementary feature to add more value to the building and produce a more sustainable design. According to the GBI rating tools, innovation can be used in the construction process, such as self-cleaning facades and real-time energy and water usage displays, as well as installation or equipment of daily use, such as solar hot water systems and five stars energy efficiency appliances (building occupant). Growing innovation in the real estate industry shows an improvement in social life since innovation management has proved linked to significant social advantages (Ma et al., 2017).

METHODOLOGY

The quantitative method was adopted for this research, whereby the questionnaire instruments used to collect the data. The questionnaire instrument is divided into two parts includes of Part A for demographic questions, while Part B questioning on awareness towards the elements of the green residential buildings. The questionnaire was distributed to 500 respondents through several online mechanisms of WhatsApp, email and telegram. Residents of Ipoh who are working, own a house but want a more comfortable house, as well as potential first-time homebuyers, are the target respondent for this research. The non-probability sampling design named voluntary sampling technique was used. A total of 458 people responded to the survey. However, when the outliers' replies were removed, only 384 responses were left for analysis. After counting around 829,700 residents in Ipoh, Perak, this still fulfils the minimal requirement of the Raosoft sampling calculator that required a minimum sample of 384 samples.

The frequency analysis used in the data analysis to identify the demand for green residential building, and to investigate potential homebuyers' awareness of the elements of green residential building. Ipoh, Perak. Frequency analysis is a very fundamental tool to describe the data. While the relative important index (RII) analysis was employed in order to identify the level of awareness for each element available that encounter for green residential building. RII is a good tool for ranking indicators that are scored on a Likert scale (Mohd Adnan et al., 2017; Rooshdia et al., 2018). This research adopted five-point Likert scales for the questionnaire instruments that start from strongly disagree, disagree, neutral, agree and strongly agree. According to Rooshdia et al.(2018), five important levels are transformed from importance values. They commence with high (H) ($0.8 \leq RI \leq 1$), high medium (H–M) ($0.6 \leq RI \leq 0.8$), medium (M) ($0.4 \leq RI \leq 0.6$), medium-low (M-L) ($0.2 \leq RI \leq 0.4$) and low (L) ($0 \leq RI \leq 0.2$). A low RII indicates that the item is less aware, whereas a high index indicates that the item is more aware and agreeable.

RESULTS

The frequency analysis in Table 1 shows, male respondents accounted for 60.9 percent of all respondents to this questionnaire survey, while female respondents accounted for 39.1 percent. This is because the male population in Ipoh is higher than the female population. The respondent's age has been divided into three categories: 20–30 years old, 31–40 years old, and 41 years old and up. It reveals that respondents between the ages of 20 and 30 had the largest frequency, with 180 respondents accounting for 46.9% of the total. Then there are responders between the ages of 31 and 40, who make up 31.0 percent of the total. The least likely demographic to reply to this poll is those aged 40 and up, with 85 respondents (22.1%). It reveals that respondents in this age group are more likely to buy for investment or to live. The job category has been divided into four categories: government sector, private sector, and self-employment. The government sector has the largest frequency of respondents, with 172 respondents (44.8%). Then there are respondents from the private sector, who account for 137 (35.7%) of the total, and self-employed people, who account for 75 (19.5%) of the total. The researcher has sorted out unemployed respondents because one of the study's major goals is to discover a potential buyer.

From Table 1, 51.8 percent of respondents have not yet purchased a house, whereas 48.2 percent of respondents have purchased a house. The table's findings also indicated that respondents are well-versed in the elements and benefits of green residential. This is demonstrated by the results, which reveal that 67% of them are really aware, 8% are aware, but not really aware, and 25% are not aware. The results also indicated that there is a demand for green residential because 75% of respondents stated they wanted to buy green residential, while 25 % stated they don't. It demonstrates that the respondents to this poll are interested in purchasing a green residential building, either to live in or to invest in the future.

Table 1: Demographic, awareness and future purchase decision

	Item	**F**	**%**
Gender	Male	234	60.9
	Female	150	39.1
	Total	**384**	**100.0**
Age	20-30 years old	180	46.9
	31-40 years old	119	31.0
	>41 years old	85	22.1
	Total	**384**	**100**
Occupation	Government Sector	172	44.8
	Private Sector	137	38.7
	Self-employed	75	19.5
	Total	**384**	**100.0**
Previous house buyer	Yes	185	48.2

	No	199	51.8
	Total	**384**	**100.0**
Awareness on elements of green residential building	Not Aware	96	25.0
	Away But Not Really Aware	31	8.0
	Really Aware	257	67.0
	Total	**384**	**100**
Want to purchase green residential building	Yes	288	75.0
	No	96	25.0
	Total	**384**	**100.0**

Source: Authors' Research, 2021

The results in Table 2 demonstrate that the majority of the RII's results indicate more than 0.8, with ten elements above 0.9 and another eight over 0.8. This implies that respondents are quite aware about green residential building elements, particularly those relating to wall orientation and window placement (1st rank; 0.9156), automatic lighting systems (2nd rank; 0.9151), and renewable energy (3rd rank; 0.9141). They are, nevertheless, well-versed in sustainable material elements (13th rank; 0.7188). This is because the RII findings are less than 0.8 but more than 0.6. When looking at the groups' element, energy efficiency comes on top (0.9149), followed by water efficiency in the second (0.9078). While innovation is ranked third (0.9026), indoor environmental quality is ranked fourth (0.8859), sustainable site design and management is ranked fifth (0.9149), and materials and resources is ranked sixth (0.8563).

The findings are in line with earlier studies, which found that building orientation and windows allow inhabitants to benefit from natural lighting and fresh air (Tjenggoro & Khusnul Prasetyo, 2018). The use of an automated lighting system is a typical sustainable building practice. Further, the most popular element of green building is renewable energy, such as solar system installation (Omer, 2014). Furthermore, earlier research has discovered water-saving fittings that are frequently utilized in sustainable residential building (Razali et al., 2015). Rainwater harvesting systems commonly adopted in green buildings that can reduce about 40 to 60% of global water use (Alsadi et al., 2019; Misra et al., 2016; Yusop & Syafiuddin, 2018), while 68% reduce water consumption specifically. Irrigation is another popular application. Moreover, previous research also emphasised the Innovation aspect, which is more connected to the adoption of new technology and innovation tools (Ohueri et al., 2018; Pandey, 2016; Razali & Hamid, 2018) with the goal of providing better long-term value. Therefore, it's not surprising that the majority of respondents in Ipoh are aware with these three primary aspects. Although the other aspects are not in the top three, the respondents are aware of them because the results are more than 0.8, indicating a high degree of awareness.

Table 2: RII results of awareness on green residential building elements

	Item		RII	Level	Rank	RIIG	RankG
Energy Efficiency	EE1	Wall orientation and windows placement	0.9156	H	1	0.9149	1
	EE2	Automated lighting system	0.9151	H	2		
	EE3	Renewable energy	0.9141	H	3		
Indoor Environment Quality	EQ1	Good ventilation system	0.9083	H	9	0.8859	4
	EQ2	Good quality of lighting	0.9104	H	6		
	EQ3	Wall colour	0.8661	H	15		
	EQ4	Sound quality	0.8589	H	17		
Material & Resources	MR1	Site selection and Planning	0.8719	H	14	0.8563	5
	MR2	Nearest to public transportation service	0.8599	H	16		
	MR3	Strategic location	0.8370	H	18		
Water Efficiency	WE1	Water saving appliances	0.9115	H	4	0.9078	2
	WE2	Irrigation system	0.9115	H	4		
	WE3	Rainwater harvesting	0.9005	H	10		
Innovation	IN1	Innovated system	0.9089	H	7	0.9026	3
	IN2	Construction process	0.8901	H	13		
	IN3	Equipment and appliances	0.9089	H	7		

Source: Authors' Research (2021)

CONCLUSION

The research concludes that the majority of respondents in Ipoh, Perak are aware of the green residential building concept and they are positives towards owning the house. This implies that there is demand for this type of residential property in the Ipoh city market. Research also revealed residents in Ipoh are highly aware of the elements of the green residential building. Therefore, developers and state authority are able to increase the number of green residential development in Ipoh city. Aside from that, a wider range of designs should be available to provide more options to the potential homebuyers. Moreover, further research should be conducted to discover any demanded design and type of residential green building desired by the potential homebuyers.

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REFERENCES

Abdulaali, H. S., Hanafiah, M., Usman, I. M. S., Nizam, N. U. M., &Abdulhasan, M. (2020). A review on green hotel rating tools, indoor environmental quality (IEQ) and human comfort. Vol, 29, 128–157.

Adzmi, A., & Abdullah, L. (2018). A study on the awareness among local residents towards green home concept.http://ir.uitm.edu.my/id/eprint/46720/1/46720.pdf

Alsadi, A., Cabrera, N., Faggin, M., He, Y., Patel, M., Trevino, F., Boyajian, D., & Zirakian, T. (2019). Comparative study on the cost analysis of a green versus conventional building. *Civil Engineering Technolog*, *3*(5), 1–5.

Ann, C. M., & Abualrejal, H. M. (2015). Energy efficiency in green building to achieve company sustainability. *Symposium on Technology Management and Logistics (STMLGoGreen)*, *December 2015*.

Bernama. (2019). Perak manufacturing industry urged to adopt green technology | Money | Malay Mail. Www.Malaymail.Com. https://www.malaymail.com/news/money/2019/04/30/perak-manufacturingindustry-urged-to-adopt-green-technology/1748411

Chang, Q., Devine, A. (2019). Environmentally-certified space and retail revenues : A study of US. *Journal of Cleaner Production*, 211, 1586–1599.

Cheng, C.-L., Peng, J.-J., Ho, M.-C., Liao, W.-J., & Chern, S.-J. (2016). Evaluation of water efficiency in green building in Taiwan. Water, 8(6), 236.

Elias, E. M., & Khai, C. (2015). The empirical study of green buildings (residential) implementation : perspective of house developers. *Procedia Environmental Sciences*, 28(2014), 708–716.

Fauzi, N. S., Johari, N., Chuweni, N. N., Ali, S. N. M., Arshad, H., & NurulanisAhmad@Mohamed. (2021). The crossfire of corporate real estate sustainable management with corporate sustainable objectives in Malaysia. *Planning Malaysia Journalof the Malaysian Institute of Planners*, *19*(2), 186–198.

Fauzi, N. S., Johari, N., Zainuddin, A., & Chuweni, N. N. (2021). The importance of

sustainability implementation for business corporations. *Planning Malaysia Journalof the Malaysian Institute of Planners*, *19*(3), 237–248.

GBI. (2013). GBI Assessment Criteria for NRNC . Green Building Index Sdn. Bhd: 2013

Kasim, A. C., Abdul Rahman, M. M. G. M., & Raid, M. M. (2015). Impacts of indoor environmental quality (IEQ) elements on residential property market: A review. *Jurnal Teknologi*, *73*(5), 99–106.

Kibert, C. J. (2016). Sustainable construction: green building design and delivery. The United States of America: John Wiley & Sons,

Ma, Y., Hou, G., & Xin, B. (2017). Green Process Innovation and Innovation Benefit : The Mediating Effect of Firm Image. *MDPI Journal*, 22–24.

Misra, S., Prasad, G. R. K. D. S., Kumar, N., Sah, S. K., Kumar, S., & Maurya, R. (2016). Comparison analysis of Green building materials and conventional materials in energy efficiency performance. *Internationa Research Journal of Engineering and Technology*, *03*(05), 80–84.

Mohd Adnan, Y., Aman, N. U., Razali, M. N., Daud, M. N., & Adnan, Y. M. (2017). The implementation of green lease practices for office buildings in Kuala Lumpur, Malaysia. *Property Management*, *35*(3), .306-325.

Nelson, P. A. (2007). Measuring from the High Watermark: Defining Baseline form Water Efficiency in Green Buildings. NYUJ Legis. & Pub. Pol'y, 11, 105.

Ohueri, C. C., Enegbuma, W. I., & Kenley, R. (2018). Energy efficiency practices for Malaysian green office building occupants. *Built Environment Project and Asset Management*, *8*(2), 134–146.

Omer, A. M. (2014). Energy use and environmental impacts : a general review. *Journal of Renewable and Sustainable Energy*, *053101*(2009).

Pandey, S. (2016). Impact of green building rating systems on the sustainability and efficacy of green buildings case analysis of green building index , Malaysia. In *Malaysia Sustainable Cities Program*.

Razali, M. N., & Hamid, M. Y. (2018). Assessing green property management implementation among commercial buildings in Malaysia. *WIT Transactions on Ecology and the Environment*, *June 2017*.

Razali, M. N., Kamarudin, N. R., & Othman, S. H. (2015). Green property management for commercial buildings Green property management for commercial buildings. *WIT Conference on Sustainable Development and Planning, 19-21 June 2015, Istanbul, Turkey*, *June*.

Rooshdia, R. R. R. M., Majid, M. Z. A., Sahamir, S. R., & Ismail, N. A. A. (2018). Relative importance index of sustainable design and constructionactivities criteria for green highway. *Chemical Engineering Transaction*, *63*(2007), 151–156.

Sayce, S., Ellison, L., Parnell, P., Sayce, S., Ellison, L., & Parnell, P. (2007). Understanding investment drivers for UK sustainable property. *Building Research & Information*, *35*(6), 629–943.

Shafiei, M. W. M., Abadi, H., & Osman, W. N. (2017). The indicators of green buildings for malaysian property development industry. *International Journal of Applied Engineering Research*, *12*(10), 2182–2189.

Shaikh, P. H., Shaikh, M. S., Kumar, M., Shaikh, F., Uqaili, M. A., & Bhatti, I. (2019). *Environmental Assessment of Green Buildings*. In Encyclopaedia of Renewable and Sustainable Materials, Elsevier, 2019, 92–97.

Sharma, N. K. (2012). Sustainable building material for green building construction,conservation and refurbishing. *Management in Construction Research Association (MiCRA) Postgraduate Conference.*

Tjenggoro, F. N., & Khusnul Prasetyo. (2018). The usage of green building concept to reduce operating costs (study case of PT. Prodia Widyahusada). *Journal of Accounting Reaearch*, *3*(1), 72–81.

Uche, G., Maizon, A., Afeez, H., Sanni, O., & Nita, K. (2013). Review of Green Building Demand Factors for Malaysia. *Journal of Technologies and Policy*, *3*(11), 471–478.

U.S Green Building Council. (2021). Press: Benefits of green building | U.S. Green Building Council. https://www.usgbc.org/press/benefits-of-green-building.

Yusop, Z., & Syafiuddin, A. (2018). A review of rainwater harvesting in Malaysia. *MDPI Journal*, 1–21.

Zin, M. H. M. (2012). Six Basic Elements For Sustainable Building Design. Australian Journal of Basic and Applied Sciences, 5–10. https://www.researchgate.net/publication/340571775_Six_Basic_Elements_For_Sustainable_Building_Design

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