

# Perceived Level of Awareness of Green Residential Building Benefits among the Homebuyers in Sarawak

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## Abstract

Green residential buildings (GRBs) have been widely introduced as one of the most effective methods to cope with the issue of global warming. However, the development of GRBs in Malaysia is in an imbalanced state whereby none of it has been developed in Sarawak. This might be due to the low awareness level and many homebuyers are reluctant to pay the higher cost for GRBs. Thus, the objective of this paper is to examine the awareness level of Sarawak homebuyers towards the benefits of GRBs. Quantitative methodology via questionnaire survey was employed to collect data from 200 respondents and Statistical Package for the Social Sciences was used for data analysis. The results indicated that the majority of Sarawak homebuyers are highly aware of the environmental benefits rather than the socioeconomic benefits of GRBs. Such findings can become a meaningful insight for the awareness and readiness of potential homebuyers in accepting the green concept for their future residential properties.

## 1. Introduction

The concept of Green Residential Buildings (GRBs) has received considerable attention as an effective strategy to address the challenges associated with global warming. In an increasingly environmentally conscious world, the adoption of sustainable housing solutions has emerged as a promising approach to mitigate the adverse impacts of climate change. However, the development of GRBs in Malaysia exhibits an evident disparity. Notably, Sarawak, a state with significant potential for sustainable construction, has yet to witness the emergence of prominent GRB projects. This anomaly can be attributed to various factors, including a relatively limited awareness among prospective homebuyers and their reluctance to bear the initial higher costs associated with GRBs.

In this context, awareness is defined as an individual's state of being alert, knowledgeable, and attentive, encompassing their ability to perceive and understand the importance of GRBs [1]. Research from diverse sources suggests that a crucial factor influencing the proliferation of GRBs, particularly in residential settings, is the level of awareness among potential homebuyers (Wong et al., 2020). The availability of GRBs is closely linked to demand, which is driven by awareness and comprehension of the potential benefits [1]. Consequently, limited awareness among homebuyers can hinder the broader adoption of GRBs and impede the growth of the green construction sector [2].

Despite the increasing body of research on homebuyers' awareness of GRB benefits, it is essential to acknowledge the potential regional disparities. While past studies have reported varying awareness levels in different regions, the specific context of Sarawak remains largely unexplored. Therefore, this study aims to

illuminate the unique awareness levels and preparedness of potential homebuyers in Sarawak to embrace environmentally friendly housing concepts in their future residential properties.

### 1.1 Literature Review

Awareness is generally defined as the state of being alert, cognizant, and observant of any events or objects. Whereas, some researchers describe awareness as one's ability or skill to deal with certain situations [1]. The term has been adapted into the context of GRBs to refer to homebuyers' ability to understand the implementation of GRBs. According to Wong et al. [3], there are more commercial buildings which adopt the Green Building (GB) concept as compared to residential buildings in Malaysia. A survey regarding the perception of construction players in Malaysia revealed that the supply of GBs depends on the demand among buyers, which is related to their awareness level. For instance, the low demand for GBs might be due to homebuyers' unawareness of its benefits, leading to the low implementation of GBs from the construction players' side. Previous literature has revealed that homebuyers' education and awareness of GB benefits are one of the factors affecting their purchase intention [2]. This is supported by several researchers who stated that the hindrance to enhancing the GRB market is larger compared to green commercial buildings in China. The future advantages of GH could not be completely comprehended in the transaction costs since the majority of homebuyers are unable to determine the life-cycle benefits. This factor prompts a lower demand for GRBs in the market, which then limits GB development in China [4]. Figure 1 shows the trifecta benefits of GBs towards economic, environmental, and social sustainability, also known as the Triple Bottom Line concept [5].

From the economic aspect, GBs help the occupants to save costs associated with energy consumption, maintenance, and operation [6]. A previous study proved that GB occupants who were content with the building's water usage were also satisfied with the building's energy consumption and maintenance costs, which were in line with their expectations. This is due to the lower operating cost of GBs as compared to conventional buildings [7]. As supported by Wood [8], GBs often incur lower maintenance costs through various ways, such as limiting unpleasant odours to a minimum and reducing emissions to ensure the lifespan and usability of the building components [9]. Moreover, the assessment criteria of the Green Building Index (GBI) have included maintenance as one of the significant elements. This indicates that the maintenance process plays a vital role in the implementation of GBs towards the path of sustainability [10].



**Fig. 1** Triple bottom line concept [5]

From the environmental aspect, GBs consume resources at an optimum level while maximising their energy and water efficiency. The quality of the indoor environment is another factor which has to be accounted for when considering the environmental impact. The embodied energy of a building and its occupants are significantly impacted by the conditions of the indoor environment. According to a survey of Danish households, the primary factors influencing indoor environmental issues include the quality of air, aesthetic, acoustic, and thermal comfort. A building's Indoor Environmental Quality (IEQ) carries a crucial implication towards the occupants. This is in line with a past study which found that the majority of GB occupants in Malaysia who were satisfied with the air quality were also satisfied with the building's lighting and ventilation [5].

From the social aspect, the benefits of GBs also revolve towards the comfort and wellness of the occupants. According to Iyer-Raniga and Kashyap [11], occupants are an important stakeholder group since they not only affect how a building operates but also utilise the services inside the building, which might compromise operations when they are not engaged. This is because, to achieve comprehensive GB outcomes, energy-efficient buildings must not overlook the socio-psychological well-being of the occupants regardless of how well they were built. For instance, GBs provide greater visual comfort compared to conventional buildings. Furthermore, conventional buildings mainly emphasise the amount of lighting present with less focus placed on how the illumination affects the occupants' behaviours. Visual comfort is crucial since it is insufficient to merely provide enough lighting in a space. Improper control of a building's lighting will lead to discomfort in the occupants' vision due to the adaption

of the eyes towards the light. GBs tend to enhance good visual comfort by providing high-quality artificial lighting, natural illumination, and outdoor views. This suggests that the occupants' emotions, mood, and contentment are greatly affected by the visual comfort of GBs.

Vast research has been conducted on the awareness of homebuyers towards the benefits of GRBs. According to Alsulaili et al. [12], 52% of the respondents in Kuwait associated GBs with plants while 78% of them were unaware of the concept. In the local context, Mazli and Fauzi [13] found that most potential homebuyers in Peninsular Malaysia, such as Ipoh and Perak, are aware of the 27 elements of GRBs. This is consistent with Adzmi and Abdullah [5] who mentioned that the majority of homebuyers in Sri Iskandar were familiar with the idea of a "green home" and perceived that it would improve their quality of life. However, this result is not applicable in Sarawak due to different locality factors.

## 1.2 Methodology

This research adopted a quantitative method whereby the data collection process was designed via systematic manner. It began with the literature review stage in gathering valuable information to produce the research model. A questionnaire survey was then developed comprising two parts. The first part contained 5 questions regarding the respondents' demography, namely living division, age, education level, job category, and household monthly income. Meanwhile, the second part contained 17 questions that examined their level of awareness towards the economic, social, and environmental benefits of GRBs. The 7-point Likert scale was utilised for this purpose, ranging from strongly disagree, disagree, somewhat disagree, neutral, somewhat agree, agree, and strongly agree. The questionnaire survey underwent several checks and revisions to improve its comprehensibility and efficacy in gathering accurate data.

The target respondents of this research were working adults in the Kuching, Sibul, and Miri divisions of Sarawak. They resembled potential Sarawak homebuyers who might be interested in purchasing green homes in the future. These locations were selected as the housing demands in Kuching, Miri, and Sibul were among the highest in Sarawak throughout the first quarter of 2022. This is evidenced by the property data published by the National Property Information Centre [15] whereby these divisions have the highest rankings in terms of the number and value of residential property transactions. Additionally, the working adult population in the Kuching (24,642), Miri (14,357), and Sibul (15,939) divisions collectively amounts to 54,938 individuals [16].

A digital version of the questionnaire survey was created using Google Forms. The required sample size of respondents was determined using Raosoft software, a widely used tool for calculating sample sizes and response rates. A total of 400 questionnaires were distributed via email, WhatsApp, and Telegram, resulting in 200 completed responses. According to Babbie [17], a response rate of 50% is acceptable for research purposes. Therefore, the 200 responses obtained were deemed sufficient and consistent with prior research on Sarawak homebuyers' perceptions of GRBs, as conducted by Magdalen et al. [18] in the same divisions. A voluntary sampling technique was employed to recruit participants who were willing to complete the survey. The collected data was analyzed using descriptive and factor analyses with the Statistical Package for the Social Sciences (SPSS) software.

## 1.3 Result and Discussion

Table 1 shows the demographic profiles of the 200 respondents. It can be observed that the majority of them belonged to the age range of 21 to 30 years old. The perception and preferences of those under 35 years old, also known as "new-comer", will lead to long-term development in the housing market [19].

**Table 1** Demographic profiles

Characteristics	Number	Percentage (%)
<b>Living Division</b>		
Kuching	88	44.0
Sibu	67	33.5
Miri	45	22.5
<b>Age</b>		
21-30 years old	84	42.0
31-40 years old	50	25.0
41-50 years old	36	18.0
51 years old and above	18	9.0
Below 21 years old	12	6.0

Characteristics	Number	Percentage (%)
<b>Education Level</b>		
Bachelor’s degree	119	59.5
STPM or Diploma	40	20.0
SPM or lower level	21	10.5
Postgraduate or higher level	20	10.0
<b>Job Category</b>		
Private sector	101	50.5
Government sector	56	28.0
Self-employment	43	21.5
<b>Household Monthly Income</b>		
RM2,001-RM4,000	68	34.0
RM2,000 and below	38	19.0
RM4,001-RM6,000	28	14.0
RM10,001 and above	27	13.5
RM8,001-RM10,000	24	12.0
RM6,001-RM8,000	15	7.5

### 1.4 Data Reduction Procedure: Exploratory Factor Analysis (EFA)

Exploratory Factor Analysis (EFA) was applied to the 17 items measuring the awareness level of Sarawak homebuyers towards the benefits of GRBs via varimax rotation. These items were rotated into two major components. The results revealed that the number of items remained similar as the factor loadings exceeded 0.50. According to Truong and McColl [20], factor loading which is greater than 0.50 contributes to better results. The results in Table 2 further demonstrated that the Bartlett’s test of sphericity was significant (Chi-Square = 5318.757, p-value = .000) while the measure of sampling adequacy via Kaiser-Meyer-Olkin (KMO) was 0.959. It depicts that the sampling data was adequate for factor analysis as the Bartlett’s test was less than 0.01 and the KMO was greater than 0.80 [20].

**Table 2** Kaiser-Meyer-Olkin measure of sampling adequacy (Level of awareness)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.959
<i>Bartlett’s Test of Sphericity</i>	Approx. Chi-Square	5318.757
	Df	136
	Sig.	.000

The output demonstrates that the two dimensions extracted had eigen values above 1.0. As shown in Table 3, the factor loadings of all 17 items measuring the awareness level of Sarawak homebuyers towards the benefits of GRBs exceeded the 0.50 threshold, hence contributing to better results [20]. Meanwhile, two dimensions were extracted and renamed as socioeconomic benefits awareness (10 underlying items) for component 1 and environmental benefits awareness (7 underlying items) for component 2 to demonstrate that the common items were grouped under the same component.

#### Component 1: Socioeconomic Benefits Awareness

Table 3 demonstrates the ten items underlying this component. The results showed that the two items with the highest factor loadings were “I am aware that living in GRBs can improve occupants’ quality of living” (Sig. = .858) and “I am aware that living in GRBs can enhance occupants’ comfort” (Sig. = .824). In contrast, the two items with the lowest factor loadings were “I am aware that GRBs contribute to the value of the property” and “I am aware that GRBs contribute to the reduction of maintenance costs” with the same significant value of .680.

#### Component 2: Environmental Benefits Awareness

Table 3 shows the seven items underlying this component. The two items with the highest factor loadings were “I am aware that GRBs contribute to efficient energy consumption” (Sig. = .872) and “I am aware that GRBs contribute to the reduction of environmental issues” (Sig. = .861). On the other hand, the two factors which had

the lowest factor loadings were “I am aware that GRBs contribute to the reduction of waste” (Sig. = .833) and “I am aware that GRBs contribute to sustainable site planning and management” (Sig. = .785).

**Table 3** *The components and factor loadings for the level of awareness of Sarawak homebuyers towards the benefits of green residential buildings*

Level of Awareness towards Benefits	Factor Loading
<i>Component 1: Socioeconomic Benefits Awareness</i>	
I am aware that living in GRBs can improve occupants' quality of living.	.858
I am aware that living in GRBs can enhance occupants' comfort.	.824
I am aware that living in GRBs can enhance occupants' health.	.809
I am aware that GRBs are constructed with better indoor environmental quality.	.808
I am aware that GRBs have high aesthetic qualities.	.758
I am aware that GRBs contribute to the reduction of household expenditures via electricity charges.	.720
I am aware that GRBs contribute to the optimisation of life-cycle economic performance.	.715
I am aware that GRBs contribute to the reduction of household expenditures via water charges.	.690
I am aware that GRBs contribute to the value of the property.	.680
I am aware that GRBs contribute to the reduction of maintenance costs	.680
<i>Component 2: Environmental Benefits Awareness</i>	
I am aware that GRBs contribute to efficient energy consumption.	.872
I am aware that GRBs contribute to the reduction of environmental issues.	.861
I am aware that GRBs contribute to the reduction of carbon footprint.	.858
I am aware that GRBs contribute to efficient material and natural resources consumption.	.858
I am aware that GRBs contribute to efficient water consumption.	.835
I am aware that GRBs contribute to the reduction of waste.	.833
I am aware that GRBs contribute to sustainable site planning and management.	.785

According to Liu et al. (2018), consumers tend to develop a favourable attitude towards the usage of a technology which claims to have the advantage of decreasing operating costs and energy consumption. A study by Adzmi and Abdullah [5] reported that local residents in Seri Iskandar, Perak are less aware of the economic benefits of GRBs, which include optimising life-cycle economic performance compared to the environmental benefits such as enhancing water and air quality. Moreover, many potential homebuyers in Ipoh are less aware of the indoor environmental quality of GRBs, such as better ventilation system, colour of walls, quality of sound, and better quality of lighting, due to the lower ranking compared to the criteria of energy efficiency [14]. The low awareness of the socioeconomic benefits of GRBs can be accounted to the fact that the majority of homebuyers in Sarawak do not have in-depth knowledge about the benefits of GRBs. This is in line with past research which found that many Sarawak homebuyers perceived that they have less exposure to promotions about the benefits of the GB concept from relevant authorities [17].

## 1.5 Conclusion

The findings of this study indicate a noteworthy disparity in the level of awareness among Sarawak homebuyers of the benefits associated with GRBs. While there exists a substantial level of awareness concerning the environmental advantages of GRBs, a conspicuous awareness level is observed regarding its socioeconomic benefits [5]. This observation implies that although Sarawak homebuyers acknowledge the positive environmental impacts of GRBs, a knowledge gap persists concerning potential enhancements in aspects such as quality of life, comfort, property values, and reduced maintenance costs that GRBs can potentially provide.

Such findings underscore the imperative for initiatives and educational campaigns aimed at augmenting awareness specifically focused on the socioeconomic benefits of GRBs among prospective homebuyers in Sarawak [21]. These initiatives should be meticulously tailored to cater for the informational needs of this demographic,

elucidating how GRBs can substantially ameliorate their overall quality of life, enhance living comfort, and contribute to their financial well-being. Furthermore, developers and relevant authorities should undertake comprehensive cost-benefit analyses to elucidate the long-term advantages of GRBs, particularly in terms of reduced maintenance expenditures and augmented property values [5]. These data-driven insights can serve as persuasive tools in conveying the economic merits of GRBs to potential homebuyers.

The role of governmental authorities in Sarawak is also pivotal in facilitating the proliferation of GRBs. Policymakers can assume a crucial role by instituting policies and incentives aimed towards incentivising the construction of GRBs. These policy measures may encompass tax incentives, subsidies, or streamlined approval processes for GRB projects, thus promoting their attractiveness to developers and prospective homebuyers alike. Moreover, collaborative efforts among governmental bodies, developers, and environmental organisations are vital in fostering a comprehensive approach to promoting GRBs [21]. Collaborative partnerships can synergize their resources and expertise to disseminate knowledge effectively among the public and expedite the adoption of sustainable building practices.

In terms of future research, a deeper exploration of the socioeconomic benefits of GRBs is warranted. This entails conducting exhaustive studies that assess the tangible impacts of GRBs on occupants' quality of life, comfort, and financial well-being. Longitudinal studies could be employed to monitor these impacts over time, providing a more nuanced understanding of their evolution. Comparative studies encompassing various regions within Malaysia will also yield valuable insights into regional variations in awareness and attitudes toward GRBs [13]. Such investigation can unearth specific challenges and opportunities peculiar to different geographical areas, facilitating more tailored strategies. Furthermore, a market segmentation analysis can be instrumental in identifying specific demographic segments within Sarawak where awareness and acceptance of GRBs are more pronounced. Understanding the demographics and preferences of these segments can be invaluable in devising targeted marketing strategies to maximise their outreach. Drawing inspiration from successful GRB projects in other regions or countries, case studies can also provide valuable insights into effective strategies for promoting GRBs in the Sarawak context [21]. This is because lessons learned from such cases can guide local initiatives and implementations. Finally, research focusing on behavioural interventions and incentives to encourage Sarawak homebuyers to opt for GRBs over conventional housing warrants further exploration. Experimental approaches, including pilot programs, can be employed to test and refine these interventions, thereby augmenting their effectiveness.

In conclusion, heightening awareness of the socioeconomic benefits associated with GRBs among Sarawak homebuyers is paramount for the sustainable advancement of green residential construction within the region. The findings of this study underscore the imperative for targeted educational endeavours, policy support, and further research to galvanize the promotion of GRBs and effectively address the issue of global warming.

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## Conflict of Interest

Authors declare that there is no conflict of interests regarding the publication of the paper.

## Author Contribution

The authors confirm contribution to the paper as follows: **study conception and design:** Afzan Ahmad Zaini, Zul Azman Yaakub; **data collection:** Anny Tang Jia Siew, Zul Azman Yaakub; **Analysis and interpretation of results:** Afzan Ahmad Zaini, Nurul Nadia Abd Aziz; **draft manuscript preparation:** Nur Khairina Khairul Hisham, Afzan Ahmad Zaini, Anny Tang Jia Siew.

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