AN EXPLORATORY FACTOR ANALYSIS AND RELIABILITY ANALYSIS FOR GREEN AFFORDABLE HOUSING CRITERIA INSTRUMENT

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Abstract

A Green Affordable Housing (GAH) criteria questionnaire was developed to determine stakeholders' preferences and their willingness to pay according to GAH criteria and features in Malaysia. This study was conducted in Johor Bahru, Klang Valley, and Penang to elaborate the development of valid and reliable instrument. Reliability test and exploratory factor analysis (EFA) was used to measure the instrument so as to produce an empirical verification of the validity and reliability of the questionnaire. Literature search and pilot study with potential homebuyers, developers, and local authorities in Johor Bahru were carried out and appropriate items were extracted. From 39 items composed, 26 items remained to be completed by study sample because some items were not applicable to be incorporated into Malaysia's local conditions. The instrument measured six constructs namely Energy Efficiency (EE), Sustainable Site Planning and Management (SM), Water Efficiency (WE), Material and Resources (MR), Indoor Environmental Quality (EQ), and Innovation (IN) with 7-point Likert Scale. All six constructs have high reliability index value which is between 0.988-9.989. Accordingly, the factor analysis final outcome was six criteria with eigen value more than 1 that explained 66.67 percent of variance in the data. Factor loading for each criteria ranged from 0.534-0.829, reflecting the dimension of the six criteria. The result obtained has proven that this study's instrument has high reliability and validity.

Keywords: *Willingness to Pay, Green Affordable Housing Criteria, Reliability, Validity, Exploratory Factor Analysis (EFA)*

1.0 INTRODUCTION

Recently, a considerable literature has grown up within the activities and interest in the field of green building. This is as a result of a total shift by the developers and other professionals such like builders and architects, towards the implementation of green building criteria and features such as energy efficiency for a better use of needed materials in housing development. Benefits from this shift have also affected the development of affordable housing. As an initiative to support sustainability and to reduce global warming, green building standard and certification have been upgraded to a new standard level called Green Affordable Housing (GAH). In United Kingdom, the latest version of BREEAM is called Eco Homes, a type of housing with green criteria and features that is designed to be sustainable and affordable (Hayles, 2005; Building Research Establishment (BRE), 2012). Meanwhile, in the United States, the LEED version of GAH is called Green Communities. The objective of Green Communities is to support developers to build green housing in cost effective manner.

Trassos (2005) stated that the Green Communities guides the developers to integrate green criteria and features into affordable housing according to design and decision making tools. In Australia, the Green Star version of green affordable housing was called Ecocents Living which consists of assessment framework that combines the concept of green with affordable housing as part of the green building criteria and features (Pullen et al., 2009). However, in developing countries for example, green affordable housing concept has not yet been established. This is because none of these developing countries especially in Asia, were able to develop the GAH guidelines. Compared to developed countries such like UK, US, or Australia. In Japan and China, the ideas of incorporating the criteria of a green building and its features into a reasonable and affordable housing development have been implemented within the two countries. In Japan for example, the idea is to build zero utility cost housing with photovoltaic (PV) and to create a design that decreases the energy consumption of each house (Konami, 2009; Sekisui, 2005).

Meanwhile, in China, the Future Home Project is about integrating green building criteria and features along with Feng Shui design to create affordable housing development. Howe et al. (2007) posited that green criteria and features in this project follow the indoor environmental quality. On the other hand, in Singapore, the Green Mark program focuses on the assessment criteria for green housing that match with the country's tropical climate. The design and implementation of mechanical and electrical engineering aspects follow the guidelines from United States and Europe (Solidiance, 2010). In Malaysia, "affordable housing criteria" has already existed as outlined by the National Housing Policy, as well as "green housing criteria" from the Green Building Index Malaysia. However, a combination of these two aspects, "GAH criteria and features" has not yet existed due to lack of fundamental approach in finding the right methods and standards to determine GAH criteria and features.

Preliminary studies have proven that these two fundamentals provide a gap for this study and become an obstacle towards successful implementation of GAH criteria and features (Geng, 2004 and Metibogum and Raschid, 2013). Elforgani and Rahmat (2011) Argued that, there should be more research to be carried out to deal with the green design development and methodologies in Malaysia. This is because green building design in Malaysia is measured as below accepted average. This aim of this study is supported by the Malaysia's Ministry of Urban Wellbeing, Housing, and Local Government through its third objectives of *Dasar Perumahan Negara* (National Housing Policy) to set a direction for sustainability of the housing sector with the implementation of green technology and innovations in Thrust 5 of the policy.

Hence, the study to determine green building criteria and features to suit with the kinds of affordable housing in respect to Malaysia's local condition is appropriate. In order to determine the GAH criteria and features, the questionnaire used in this study should be reliable and valid to ensure accuracy in its findings (Mariah and Mohammad, 2015). High values of reliability and validity indicate a high quality of research instrument. Whereas reliability indicates that instrument scores were stable and consistent (Creswell, 2012). The score should be consistent and nearly the same when a researcher runs the instrument many times at different times. However, when a research instrument is used to measure the items the process is said to be a validity (Cooper and Schindler, 2014). Reliability and validity are combined together in complex ways. Creswell (2012) stressed that the scores need to be reliable so they become valid, vice versa. In addition, scores must firstly be stable and consistent before they can be meaningful.

Accordingly, the objectives of this paper are: 1) To acquire the reliability of GAH questionnaire; and 2) To obtain the validity of the questionnaire. To achieve the objectives of this paper and develop accurate instrument which is designed to measure stakeholders' perspectives towards GAH, further discussion involves GAH criteria and features, methodology, data analysis, findings, discussion, and conclusion.

2.0 GREEN AFFORDABLE HOUSING CRITERIA AND FEATURES

The concept of Green Affordable Housing refers to an equitable housing price, which incorporates green building criteria and its features to sustain the environment and improve the value of life for all citizens in respect of the level of their incomes (Zulkepli et al., 2012). In United States of America, United Kingdom and Australia, the concept of green affordable housing become increasingly more common, this is due to the implementation of state and local policies that favor or require green building practices for publicly owned or funded buildings. Green affordable housing also provides a unique opportunity to connect stakeholders in housing industry which include designers, developers, community advocates, and policy makers in the broader, all-encompassing challenge of global warming (Global Green USA, 2007).

Green Affordable Housing in this study is defined as an affordable landed or non-landed property that is incorporated with green building criteria and features within the price range between RM120,000-RM180,000. According to the National Census in 2012, the middle income household which covered 40 percent of the Malaysian population received RM 4,573 per month. However, findings from a study by Aziz, Hanif and Singaravello (2011) in Klang Valley, Johor Bahru and Penang revealed that these three areas are categorized as higher income proportion due to the urbanization and per kapita income for these cities. This affects the categorization of household income per month for middle income in these cities to be between RM 2000 and RM 8000 with housing price affordability ranging from RM 120, 000 to RM 180, 000. This is a serious issue for this middle income groups as affordable housing provided by the government only cater the needs for the lower income groups (Aziz et al., 2011; Musa et al., 2011; Tawil et al., 2011; Mousavi et al., 2013).

The research in GAH criteria and features should be observed more closely. Hopefully by using instruments which are reliable and valid for the study proposed, it will help the stakeholders in finding the most significant criteria and features for green affordable housing development in Malaysia. From the preliminary study and previous literature, this study recommends six criteria and twenty features for GAH. The following Table 1 is the summary of GAH criteria and features from previous literature. The criteria and features are summarized according to GBI criteria but the features have been enhanced according to GAH requirements which are suitable with affordable housing in Malaysia's local condition.

2.1 Energy Efficiency (EE)

EE is said to be a process of minimizing the amount of energy required providing buildings and operations as well as to achieve minimum energy consumption. In the other hand, Energy-efficient affordable housing was meant to provide a high quality housing so as to reduce utility cost especially in the urban settlements. Interestingly, a striking observation was made by Philips (2006) who's found that energy efficiency and quality are compromised to reduce construction costs in most low-income housing.

2.2 Sustainable Site and Management (SM)

Previous research suggests sustainable site and management are necessary criteria for green affordable housing that demand the framework to be included. The term sustainable design and site planning are vital sustainable tools that reduces environmental impact and improve human health condition, minimizes construction cost, maximize energy efficiency, augment water and natural resource conservation, improve operational efficiencies, and promote alternative transportation. Conforming to Connelly (2006), affordable housing developers can provide buildings that are easier to maintain with more splendid amenities, while at the same time infiltrating storm-water quality as well as reducing cost.

2.3 Water Efficiency (WE)

Recent developments in water conservation have heightened the need to provide financial and environmental benefits and warrants inclusion in the Green affordable housing framework. Water efficiency reduces utility bills while conserving fresh water resources. Installation of water efficiency equipment and other plumbing materials can lead to a reasonable water savings. Subsequently, building that has irrigation system for landscaping and plants watered using non-potable or recycled water have significant features preferred by the developers. As stated by Connelly (2006), water efficiency minimizes the energy consumption for heating the water, this results into a significant utility savings.

2.4 Material and Resources (MR)

Green building materials and resources are tending to be used housing system in every society. The specifications of these materials and resources could cause massive environmental influence of project performance. In agreement with ECP (2007), utilizing the usage of building materials by adopting the concept of reduce, reuse and recycling of the said building materials will drastically control the emissions from manufacturing and transportation of raw materials. Moreover, Connelly (2006) observed that recent researches in affordable housing comprise of several techniques to make the building more durable and less cost to maintained, recycle demolished and construction waste, as well as recycled the materials during construction at five percent less. In addition, for the goals to be achieved in green affordable housing, the two significant methods to be used are recycling on site and minimizing the consumption of raw materials.

2.5 Indoor Environmental Quality (EQ)

In the new global facet of Greener environment, Green Affordable Housing is more than safeguarding the ecosystem in a particular society and saving the cost, but improving the indoor air quality, as well as improving the residents' health. Volatile organic compound means not using finishes that emitting internal air pollutant such as adhesives and paints. Formaldehyde minimization which used product with no added urea formaldehyde such as carpet also the main important features in order to ensure the good indoor air quality in affordable housing. Of importance, indoor environmental quality minimizes the level of noise pollution, low indoor air pollution and significantly improves indoor air quality. Considering the risk to the health of the residence as a result of the long stay indoors, the indoor air quality became the significant aspect of a green building. However, Sparks (2007) reports that various consultants in the area of Green Building considered indoor air quality as the furthermost important feature of Green Homes apart from Energy Efficiency.

2.6 Innovation (IN)

It has been previously been observed that, Innovation is an important criteria in Green Affordable Housing development. As stated by Elforgani and Rahmat (2011) innovation in design creates an opportunity to encourage continual development. The innovation of the design divided into two, namely new green idea which is environmental idea and new design initiatives which focus on design ideas. The green design initiatives is an important features for green affordable housing to enhance the quality and performance of affordable housing which are not only affordable but also green.

Elforgani and Rahmat (2011) in their study also mentioned that developers should be more competent to implement innovative idea in design rather than the site and architectural aspects that include shape, orientation, and building envelop. However this feature depends on project budget allocated by the client considering their roles played in the green architectural innovations, especially for affordable housing that have limited budget. Table 1 is the summary of the GAH criteria and features that are from previous literature. The summary of the criteria and features had been arranged according to GBI criteria but the features were enhanced according to GAH requirement which are suit to affordable housing in Malaysia local condition.

3.0 RESEARCH METHODOLOGY

3.1 Sample of Study and Data Collection

The study was design and carried out in three of the Malaysian cities, which includes Johor Bahru, Klang Valley, and Penang. This is because they have the most potential homebuyers' whom falls within the middle-income group in Malaysia. A total of 600 questionnaires were received from these three metropolitan states of Malaysia in the first stage of data collection. In this study, potential home buyers are defined as capability of buying based on income, which is focused on middle income groups social class in Malaysia and either they willing or not willing to buy will not considered. As claimed by Hamid (2007), a group of people in a social class characterized a society structure.

This study used the term potential home buyers rather than prospective home buyers who have willingness and ability to purchase (Hamid, 2002) because this study involves new concept of green affordable housing. As mentioned in the pilot study, respondent does not have awareness towards the concept, therefore they may willing or not to purchase. However they have capability to buy since the study focus to green the affordable housing within their affordability. Capability in this study is relating to the affordability context according to the ranges of housing price afforded by the middle income group which is between RM120k until RM180k as stated from the study done by Aziz et al. (2011). This study used the formula in determining the sample size as recommend by (Israel, 1992). The sample size has been divided by proportions of middle income groups of potentials homebuyers by state of Johor Bahru, Klang Valley and Penang.

Second stage of data collection also used survey questionnaire to which are distributed to 25 developers who are certified with Green Building Index in these three major cities. 15 valid replies were received, representing a response rate of 60 percent.

Data collection for both stages used face-to-face survey questionnaire. This method was chosen because it allows a large number of subjects to be studied and the results can be generalized to the population. This method of data collection is particularly useful in explaining results and examining what, how, and why people think that way as the researcher met the potential homebuyers and developers themselves. The meeting was used to discuss suitable criteria and features with them. The study also follows McKenna (1994) who stated that data collection through this method enhances direct contact with respondents and increases the validity of questionnaires.

Table 1: GAH Criteria and Features

No:	Green Criteria	Green Features	Sources
1	Energy Efficiency (EE)	1) Energy efficient heating, ventilation and air conditioning systems (HVAC) 2) Energy saving appliances and light fittings 3) Walls and roof fitted with materials that reduce solar heat gain 4) Solar panels 5) North-south orientation	Gunawansa (2011), Elforgani (2011) Kellongs and Keating (2011), Pullen, *et al.* (2009), Sparks (2007), Global Green USA (2007), Rather (2006)
2	Sustainable Site and Management (SM)	6) Plants and greenery planted on the facade and roof of high-rise buildings 7) Extensive landscaping 8) Public transport accessibility	Green Building Index Malaysia GBIM (2013), Hayles (2006), Trassos (2005), Mousavi (2013)
3	Water Efficiency (WE)	9) Water saving appliances and fittings, and low water usage 10) Rain water harvesting	
4	Material and Resources (MR)	11) Building installed with materials that minimize depletion of natural resources 12) Building installed with materials adopt reduce, reuse and recycle concepts 13) Sustainable construction practices 14) Good waste management principles 15) Provision of separate bins/chutes	
5	Indoor Environmental Quality (EQ)	16) Design with low noise level, low indoor air pollutants and high indoor air quality 17) Volatile Organic Compounds 18) Formaldehyde Minimisation	
6	Innovation (IN)	19) Environmental Idea 20) Design Idea	

3.2 The Instrument (Questionnaires)

This study uses Green Building Index Criteria Malaysia (GBIM) as the main reference tool. The questionnaires are divided into three sections: A, B, and C for potentials homebuyers, and four sections: A, B, C, and D for developers. The validity and reliability of Section B for both questionnaires will be discussed.

Before the survey started, the questionnaire was pretested and adjusted according to respondents' feedbacks. Section B for potential homebuyers contains questions on respondents' preferences and willingness to pay for GAH on a 7-point scale (7="Extremely Willing" while 1="Not Willing"). On the other hand, developers' questionnaire in Section B contains their perspectives on green building criteria and features that are importance to affordable housing on a 7-point scale (7="Extremely Important" while 1="Not Important"). These questionnaires measure 26 items which are six criteria and twenty features of GAH.

Both of questionnaires used 7 point likert scale. The advantages of the 7- and 9- point scales are a better approximation of a normal response curve and extraction of more variability among respondents, commonly used in marketing as well as the descriptors (for example, importance, familiarity) and other characteristics (Cooper and Schindler, 2014; Malhotra, 2014).

3.3 Data Analysis

The main idea of this study phase is to determine the correctness of the items and the inner structure of the constructs measured by the instrument. In order to realize the idea, an Exploratory Factor Analysis (EFA) was conducted to examine the factor structure of the scale. Next, a reliability analysis was carried out to test the reliability of the questionnaires.

3.3.1 Exploratory Factor Analysis (EFA)

Exploratory Factor Analysis (EFA) was used in this study to group the criteria and features according to Malaysian Green Building Index (GBI). EFA is a data reduction technique used to reduce a large number of variables to a small set of underlying factors that summarize the essential information contained in the variables (Richard and Dean, 2007). More frequently, factor analysis was used as an exploratory technique to summarize the structure of a set of variables (EFA). A Kaiser-Meyer-Olkin (KMO) test and Bartlett's Test of Sphericity were first conducted to verify if the data set was suitable for factor analysis. The purpose of both tests is to measure the sampling adequacy in order to determine the factorability of the matrix or data set as a whole (Richard and Dean, 2007). If Bartlett's Test of Sphericity is large and significant, and the KMO measure is greater than 0.50, it can be assumed that the factorability in data set does exist.

The Principal Axis Factoring (PAF) extraction method with Direct Oblimin rotation method was used to extract the underlying factors in this study. By combining these two methods, the value of eigenvalues and Scree plot analysis were obtained and then, the number of factors that exist in data set can be obtained. The value of eigenvalues must exceed '1' in order to classify it as one factor. The Scree Plot technique was also used in order to confirm the results obtained from the analysis of eigenvalues (Richard and Dean, 2007). In order to confirm whether all factors extracted from this analysis are reliable or not as suggested by MacCallum, Widaman, Zhang, and Hong (1999), the communality value for each item must be within 0.3 range. Meanwhile, when the sample size is close to 615 samples, items with communalities less than 0.3 range must be excluded from the analysis. This sample size is good enough, provided there are relatively few factors each with only small number of items.

Another criterion that was used to assess the factors that were extracted by the factor analysis to see if it was reliable or not is by assessing the value of factor loading for each item. Factor loadings can be assessed by looking at the pattern matrix table. Field (2009) argued that the most preferable loading value for each item must exceed 0.30 and the item loading value which is less than 0.30 must be excluded from this analysis. The next criterion, which is the reliability analysis, was conducted on the set of factors that was extracted from this analysis to ensure all items contained in each factor consistently reflect the construct that is measured (Sheridan et al., 2010).

3.3.2 Reliability Analysis

The quality of this research instrument used for the purpose of this study, the reliability measurement was carefully tested. The analysis of Cronbach's Alpha-Coefficient was performed to assess the reliability of the measurement. According to Haron (2010), argued that the widely accepted social science cut-off point, alpha value should be .70 or higher for a set of items to be considered a scale, but some use 0.75 or 0.80, while others are as lenient as 0.60. Cronbach's Alpha values are quite sensitive to the number of items in the scale and the Cronbach's Alpha values will reduce below 0.60. In this case, these are deemed as appropriate.

4.0 RESULTS AND DISCUSSION

From 39 items composed, 26 items were remained in this study because some items are not applicable to be incorporated within Malaysia's local condition as suggested in the pilot study. The revised instrument which consists of 26 items with six construct was completed by 600 homebuyers. They belong to the middle-income group.

4.1 Descriptive Statistics

Table 2 illustrates the descriptive statistics which include mean, standard deviation, minimum, and maximum of six proposed criteria of GAH instrument. It was discovered that Water Efficiency has high importance criteria for GAH (M=4.88), Material and Resources (MR) ((M=4.85), Indoor Environmental Quality (EQ) (M=4.83), Innovation (IN) (M=4.79), and Sustainable Site and Management (SM) (M=4.66). Meanwhile, Energy Efficiency (EE) has lower importance criteria with (M=4.62).

Furthermore, the minimum and maximum values were the same for all six criteria which are one and seven respectively. Next, the results revealed that the variable is approximately normally distributed based on the degree of skewness and kurtosis as both were less than one and the value of *z*-score of Skewness and Kurtosis coefficients in the range of ±1.96 standard error ($p>0.05$).

Costello and Osborne (1994) and Field (2009) argued that with a large sample, it is essential to test the statistical significance of skewness and kurtosis to assess the normal distribution. It is significance with this study as it involves 615 respondents. In short, all three variables were approximately normally distributed as majority of the criteria were used to check for normality.

4.2 Exploratory Factor Analysis (EFA) for Validity

Exploratory Factor Analysis is a procedure used to identify, reduce, and organize a large number of questionnaire items into a specific construct for independent variable in the study. EFA was conducted on the 26 items with varimax rotation using SPPS version 21. In this study, six criteria of GAH namely (i) energy efficiency, (ii) sustainable site and management, (iii) water efficiency, (iv) material and resources, (v) indoor environmental quality, and (vi) innovation were used to establish the pattern of structure for twenty items of GAH and create a scree plot.

The Kaiser-Meyer-Olkin (KMO) indexes of sampling adequacy for all factor analyses were explored using Kaiser-Meyer-Olkin (KMO) this is to ensure the sufficiency of covariance in the scale items to warrant factor analysis. The Bartlett's test for sphericity was also applied to each analysis to ensure the correlation matrix was not an identical matrix. KMO indices for all analyses were >0.80, while almost all KMO values for individual items were >0.50, which is above the acceptable limit of 0.50 (Field, 2009).

Meanwhile, the Kaiser-Meyer-Olkin measure demonstrated the sampling adequacy for the analysis, KMO=0.876, which is above the acceptable limit 0.5. Meanwhile, Bartlett's test of sphericity, $\chi 2(325)=3471.889$, $p<0.000$ specified that the correlations between items were adequately large for EFA. As a result, six factors had eigenvalues more than one, like the scree plot which is illustrated in Figure 1. In short, 26 item structures were found to explain 66.665 percent of variance in the data as shown in Table 3.

The first criteria accounted for 39.136 percent of the total variance with an eigenvalues of 10.175. Factor loading for items in this criteria was ranged from 0.759-0.794 as shown in Table

4. The first criteria reflected the energy efficiency dimension and therefore, being classified as "energy efficiency".

Next, second criteria accounted for 48.065 percent of the total variance with an eigenvalue of 2.322. Factor loading for items in this criteria ranged from 0.597-0.794. The second criteria reflected the sustainable site and management dimension, and therefore being classified as "sustainable site and management".

Third criteria accounted for 53.239 percent of the total variance with an eigenvalue of 1.345. Factor loading for items in this criteria ranged from 0.534-0.597. The third criteria reflected the water efficiency dimension and therefore, being classified as "water efficiency".

Furthermore, fourth criteria accounted for 58.066 percent of the total variance with an eigenvalue of 1.255. Factor loading for items in this criteria ranged from 0.618-0.786.

The fourth criteria reflected the material and resources dimension and therefore, being classified as "material and resources".

Additionally, fifth criteria accounted for 62.504 percent of the total variance with an eigenvalue of 1.154. Factor loading for items in this criteria ranged from 0.789-0.829. The fifth criteria reflected the indoor environmental quality dimension and therefore, being classified as "indoor environmental quality".

Finally, the sixth criteria accounted for 66.665 percent of the total variance with an eigenvalue of 1.082. Factor loading for items in this criteria ranged from 0.769-0.787. The sixth reflected the innovation dimension and therefore, being classified as "innovation".

4.3 Item Analysis for Reliability

The purpose of reliability function is to estimate the degree of a measurement either it is free of random or unstable error (Cooper and Schindle, 2014). An item analysis was conducted to test the reliability of GAH instruments. The entire instruments used in this study have an excellent internal consistency of measurement. It is because each measurement has Cronbach's Alpha value more than 0.90.

Table 3: Eigen values, Total Variances Explained for GAH Criteria and Features

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	10.175	39.136	39.136	10.175	39.136	39.136	7.135	27.444	27.444
2	2.322	8.929	48.065	2.322	8.929	48.065	4.809	18.497	45.941
3	1.345	5.173	53.239	1.345	5.173	53.239	1.646	6.330	52.271
4	1.255	4.827	58.066	1.255	4.827	58.066	1.299	4.995	57.266
5	1.154	4.438	62.504	1.154	4.438	62.504	1.225	4.713	61.979
6	1.082	4.161	66.665	1.082	4.161	66.665	1.218	4.686	66.665

Table 4: The Six Criteria and Features of the GAH Instrument

	Criteria					
	1	**2**	**3**	**4**	**5**	**6**
Criteria 1: Energy Efficiency						
1.Unit has good natural ventilation inside the unit	0.767					
2. Unit is fitted with energy saving appliances and light fittings	0.794					
3. Walls and roof in the unit is fitted with materials that reduce solar heat gain	0.792					
4. Unit is fitted with renewable energy such as solar panels to generate electricity	0.783					
5. Unit has north-south orientation to reduce solar heat gain	0.759					
Criteria 2: Sustainable site planning and management						
6.Plants and greenery planted on the facade and roof of high-rise buildings		0.794				
7. Extensive landscaping with plants on the premises and grounds around the home		0.682				
8. Public transport accessibility: home is within walking distance of public transportation station		0.597				
Criteria 3: Water efficiency						
9. Unit is fitted with water saving appliances and water efficient fittings, and low water usage			0.597			
10. Building has irrigation system for landscaping and plants watered using non-potable or recycled water			0.534			
Criteria 4: Material and Resources						
11.Certification that the building has been installed with materials that minimize depletion of natural resources				0.618		
12. Certification that the building has been installed with materials that adopt reduce, reuse and recycle concepts				0.653		
13. Certification that sustainable construction practices have been adopted by contractors during construction stage				0.648		
14. Certification that during construction stage, the contractor had adopted good waste management principles				0.710		
15. Provision of separate bins/chutes that enable waste to be sorted (metal, plastics, paper, thrash)				0.786		
Criteria 5:Indoor environmental quality						
16. Design that leads to low noise level, low indoor air pollutants and high indoor air quality					0.807	
17. Volatile Organic Compounds - Not using finishes that emitting internal air pollutant.					0.789	
18. Formaldehyde minimisation – Used product with no added urea formaldehyde					0.829	
Criteria 6: Innovation						
19. Environmental Idea						0.787
20. Design idea						0.769

Table 5: Cronbach's Alpha for Each Criteria and Features of the GAH Instrument

	Cronbach's Alpha	Cronbach's Alpha Based onStandardized Items	Number of Items
Energy Efficiency	0.970	0.970	5
Sustainable site planning and management	0.930	0.930	3
Water efficiency	0.938	0.938	2
Material and Resources	0.960	0.960	5
Indoor environmental quality	0.960	0.960	3
Innovation	0.956	0.956	2

5.0 CONCLUSION AND RECOMMENDATIONS

The development of a new instrument to determine the GAH criteria and features is significant for the future green affordable housing development and will provide valuable and practical guidelines for stakeholders in green affordable housing industry and researchers in this field. This study has been using the previous literature and comprehensive reviews with regards to GAH as a guide to develop a new instrument to measure green building criteria and features to be incorporated into GAH development. The reliability and validity aspects of the developed instrument were proven and being used to measure the adequacy of the GAH instrument.

As an outcome from EFA, six criteria of the instrument of GAH clarify 66.665 percent of the variance among the items. All six criteria produce high reliability (all Cronbach's α>.966). Twenty items remained with (i) Energy Efficiency: 5 items; (ii) Sustainable Site and Management: 3 items; (iii) Water Efficiency: 2 items; (iv) Material and Resources: 5 items; (v) Indoor Environmental Quality: 3 items; and (vi) Innovation: 2 items. As a result, six criteria of GAH instrument have successfully been established through this study. Furthermore, data encompassing this study were suitable to run the EFA based on descriptive analysis.

The 615 respondents were sufficient for EFA as bigger sample can help find out whether or not the factor structure and individual items are valid (Costello and Osborne, 1994).

Previous research in Malaysia only focus on certain criteria to be incorporated into affordable housing such as water efficiency (Mousavi et al., 2013), rain water harvesting (Tawil et al., 2011), material and resources, indoor environmental quality, and water efficiency (Abdul Rahman et al., 2013) and fast track wall system (FTW) by Abd Majid et al. (2012) which is based on material and resources criteria. As there has been no policy and criteria developed for the purpose of classifying GAH to be used by the construction industry, less methodologies were studies and no standard criteria for GAH were developed (Elforgani and Rahmat, 2011; Geng, 2004; Metibogum and Raschid, 2013).

Therefore, this instrument is beneficial for housing construction industry to develop GAH. This instrument gives an advantage to the industrial players as it was developed based on both perspectives which involve potential homebuyers and developers. Both perspectives play an important role because in property market, the main goal of developers is to create demand which is influenced by customers' urchasing power (Case and Fair, 2002; Hamid, 2007).

GAH instrument that has been developed and validated in this study shows how to measure GAH, as well as the criteria and features that should be included in GAH criteria and features in order to boost and enhance GAH development in Malaysia. However, the present study has its own limitation. The first limitation is related to the methods being used, EFA and reliability analysis. These two methods are not suitable to test the theoretical foundation of the instrument.

Hence, this study suggests future research to be carried out using Confirmatory Factor Analysis (CFA) to add and enhance understanding in the field of Green Affordable Home.

The generalizability of this study is subjected to certain limitations related to its findings. For instance the study only involves middle-income group in three Malaysia states, covering the areas of Johor Bahru, Klang Valley and Penang. This is because all developers that are currently active in the housing industry particularly GAH and are certified by GBI Malaysia are mainly based at these three developed states.

This study also assumes that potential homebuyers are aware, knowledgeable, and have a high level of acceptance towards the green housing. This is indicated through the significant amount of ongoing projects done at their states. However, it is unclear whether the results can be generalized beyond the middle-income group of potential homebuyers in others state in Malaysia. The findings can possibly be generalized only in Malaysia's developed states but do not represent the whole population of middle-income group of potential homebuyers.

Based on the limitations of study in the context of generalizability, this study suggest that it would be practical for future studies to be conducted at all states in Malaysia rather than focusing on the state with many green housing development. It is also important to glance through the differences between each state as the criteria for middle-income group of potential homebuyers in these states are quite similar. In terms of developers' perspective, the study discovered that it is not a problem to generalize the findings because the developers that were chosen in this study are those certified by GBI Malaysia. In this case, it is recommended for future studies to increase the number of developers as a sample study to enrich the findings in the same field and enable the assessment to be done using more advanced analysis.

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