Strategic Approach to Green Home Development in Malaysia- the Perspective of Potential Green Home Buyers

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Abstract: Construction industry consuming enormous energy compared with other industries needs to step forward to the sustainable development to optimize energy consumption and minimize negative impacts on the environment. Malaysia Government has launched the Green Building Index in 2009 to support the sustainable approach to construction and protect natural environment. Applying the green features to achieve the GBI certification leads to higher construction cost for developers, consequently it will cause higher price for green buildings customers.The aims of this paper are to identify potential green house buyers' awareness of green homes, to determine the extra price that potential home buyers are willing to pay for green home, to explore favorable green features which potential home buyers are willing to pay extra for and to provide recommendation how many green features can be acceptable and affordable for potential green homebuyers. To collect data, a questionnaire survey was conducted by research team in different parts of Malaysia. 2180 questionnaires were distributed among the people selected randomly in the most important cities in Malaysia. A total 817 questionnaires (37.48%) have been received. The analysis method in this research is descriptive. SPSS software was used to analysis the primary data. This study finds out that public awareness about green homes' benefits is average and the majority of respondents are willing to pay less than 5% premium cost to buy green homes. In addition, the most favorable green features from green home buyers' point of view are indoor environment quality, energy efficiency and greenery. Therefore, they prefer to pay higher price for green homes which are facilitated with their preferred green features.
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1. Introduction

There is no doubt that global warming is the well-known phenomenon of industrialization in the world. There are a number of research and reports that have proven the devastating concept of the current situation on our planet and its ongoing effects on humankind. By understanding the wide range of the global warming impacts on human life, there is growing interest for sustainable development as a global remedy. Construction industry consuming enormous energy compared with other industries needs to step forward to sustainable development to optimize energy consumption and to minimize negative impacts on the environment. Environmentally construction is responsible for high energy consumption, solid waste generation, global greenhouse gas emissions, external and internal pollution, environmental damage and resource depletion (Zimmermann, 2005). U.S Environmental Protection Agency Green Building (EPA, 2004) has reported that Buildings use 40% world raw materials and consume 12.2% of total water supply and 40% of world's energy. Malaysia with high-speed urbanization growth is one of the main CO2 producers in the Southeast. Construction industry alone contributes to 24% of the country's total carbon dioxide (IEA, 2009). This figure shows the direct carbon dioxide emission from construction industry activities, therefore be considered as direct and indirect CO2 emission resulted from construction field have to be higher than above figure.

In an attempt to meet an international commitment for decreasing CO2 emission at a national level, Malaysia Government launched the Green Building Index in 2009 to support the sustainable approach to the construction and the natural environment. The Green Building Index (GBI) is a rating system which is applicable in both residential and non-residential buildings. Six criteria which are rated by the GBI in all buildings are as follow:

1) Energy Efficiency
2) Indoor environmental Quality
3) Sustainable site and Management
4) Material and Resources
5) Water Efficiency
6) Innovation

After an assessment has been done by qualified professionals based on the performance score, buildings are categorized in particular levels- Platinum (> 86 point), Gold (76-85), Silver (66-75) and Certified (50-65). Applying the GBI rating system provides easy public evaluation of what are authentic green buildings and key design principle for architects and engineers to

adopt their designs accordingly. In addition, GBI sets the performance parameters for better total building performance and comparison among buildings in term of their impacts on the environment.

Applying the green features to achieve the GBI certification leads to higher construction costs for developers. Consequently, this causes higher prices for green buildings customers. Higher cost is related with the level of certification. This means that construction costs for achieving the platinum level will be much higher than certified level. Depend on the green features applied in building, construction costs might be 3%-15% higher than conventional method (CBRE, 2010). The willingness of green home buyers to pay extra for buying green homes instead of traditional non-green homes in Malaysia is not well known. This study aims to investigate the strategic approaches needed to promote sustainable development of green homes in Malaysia by providing customers' preferences for green features within an acceptable price range. The specific objectives are to 1) find out potential home buyer's awareness of green homes, 2) determine the extra price that potential home buyers are willing to pay for green home, 3) uncover the favorable green features which potential home buyers are willing to pay extra for; 4) provide recommendation on how more green features can be acceptable and affordable for potential green home buyer.

2. Literature Review

2.1 Defining Green Building

Generally, a green building is known as building located in the appropriate site and designed, constructed and operated for improving the health and well-being of occupants by minimizing the environmental impacts. The term "green" in construction refers to environmentally friendly practices from early design stage to the end of the construction and operation period. The Office of the Federal Environmental Executive (2003) has defined green building as "practice of 1) increasing the efficiency with which buildings and their sites use energy, water, and materials, and 2) reducing building impacts on human health and the environment, through better sitting, design, construction, operation, maintenance, and removal the complete building life cycle."

According to the US Green Building Council (2009), green building is "the practice of increasing the efficiency of new buildings, and reducing their impact on human health and the environment through better site location, design, construction, operation, maintenance, and removal." An environmentally friendly building covers a wide range of requirements. It might be just energy efficient building that saves energy as much as possible or in higher level. The building designers try to adopt their design with social, economic and environmental aspects in order to achieve sustainable building. It is important to note that green buildings are not only measured based on the energy efficiency but also on the improved isolation, the advance design strategies and high-tech construction. Beside these aspects that have been mentioned green building provides other factors that often taken into account such as operating costs, health and social aspects (Lutzkendorf, 2009).

Green building as a concept must be flexible; this feature allows it to be applicable in different locations with different climates and in the social and economic conditions. Furthermore, the best green buildings built today are not 100% sustainable. This is due to that these buildings have consumed more natural resources than the buildings will return to the earth (Kats and Capital, 2003). Although there are different definitions for green building in the world, some fundamental features are similar among all of them. For instant, optimizing site, optimizing energy use, saving water, using the environmentally friendly materials in the building, enhancing indoor air quality and optimizing the operational and maintenance practices. These factors are the fundamental items for buildings which are categorized as green building.

2.2 Costs of Green Building

Generally, green building perceived to be more expensive compared to non-green conventional buildings and the saving caused by green features is not worth being compared with extra costs. Kats and Capital (2003) have divided the green building costs to two main parts: first, Soft Cost (incremental design effort by architect, certification application fee, energy modeling and etc) and second, Hard Cost (additional costs compared with non-green traditional methods with respect to facility, technology and material). They stated that higher cost mostly originated from soft cost and green design is not only expensive but also unpredictable and could be the cause of delays and cost overrun.

CBRE (2010) and Bertrand (2007) stated two major causes for higher costs of green buildings compared with traditional non-green buildings: 1) Increased construction cost which depends on the particular development and the level of certification applied for the average 3-15% additional cost, 2) Application costs, application fee for GBI certification that depends on the size of project can be 2000 to 45000 RM. According to the research, soft cost of green building has been ignored (exclude application fee). As mentioned earlier, the major cause of high cost of green buildings is the soft cost. Therefore, the real cost gap between green buildings and non- green buildings might be higher than the above figures. Compared to the other developed countries, lower standard energy efficiency benchmarks are lack of

awareness among the professionals, imported technologies and lack of government's incentives. They are the causes for higher cost of green building project in Malaysia (CBRE.2010, Kerr 2008).

Table 1. Green Building Premium Cost Based on Award Type

Green Mark award type	Certified	Silver (Gold)*	Gold (Gold Plus)*	Platinum
U.S (LEED)	0%-2.5%	0%-3.3%	0.3%-5%	0.3%-8.5%
Singapore (BCA)	0.3%-1%	1%-2%	1%-3%	3%-8%

*Apply for BCA Singapore
Resource: USGBC, BCA Singapore

2.3 Green Building Development Barriers

Chan et al. (2009) have listed a number of obstacles which might decrease or halt the green building development in Southeast of Asia. The perceived higher upfront costs were the main barriers influencing the green building market. Higher upfront costs potentially can be the cause of higher price for final products reducing the level of competition among construction firms and increasing the risk in applying finance from banks and financial firms. In Hong Kong, low demands for innovations in term of green building in private sector have created entry barriers for some developers and contractors (Chiang, 2001).

The lack of education among the professionals is another obstacle of green building development, in Singapore. Knowledge of ISO 14000 as an international environmental friendly standard is not diffuse among construction professionals. Although, the majority of architects perceived the necessity of green features, they cannot apply them into their design process. Briefly, they are not able to transfer their knowledge to practical zone (Ofori, 2004). In Malaysia, 70% of the construction professionals (architectures, civil engineers, Quantity surveys) stated that they have never been involved in a green project and 44% of them have believed that they do not have commitment to the green building (Kerr, 2008). Another factor that influences green buildings development is high price for their purchasers. This makes them not affordable especially in the residential sector. A majority of households are willing to buy green homes and desire to have environmentally friendly houses; however because these houses are more expensive than traditional homes, they cannot afford to pay the extra costs (Bernstein, 2007, SGBC, 2010,). In order to tackle with this problem, governments have introduced a wide range of financial packages for green building developers and green building buyers to make green building more affordable and attractive for all parties involved.

The lack of public awareness is one of the main barriers for the green building development. When a society does not have a clear understanding about the importance and benefits of green buildings, it becomes impossible to convince people to pay more for having green homes and offices. Improving the communication and increasing the public awareness about green homes' benefits creates a strong foundation for the green home development at the national and local level (Langdon, 2010). Applying market assessment and market assistance approaches will lead to raise public awareness and owners' interest to green home as an economic option (Turcotte et al., 2006). Raising public awareness will drive demand side. Increasing public interest in green homes as healthier, cleaner and more affordable (based on operation and maintenance cost) choice will naturally enhance demand for more environmentally friendly homes. Consequently this situation will promote green housing at both local and national level and ameliorate competition among the developers and contractor to build homes with more green features at lower price.

In Malaysia the biggest problem that green home developers faced with is the low level of demand for green homes (Alias et al., 2010). A majority of Malaysian home buyers still are not going to accept the green home concept as a new kind of life style. Although government has launched programs to enhance peoples' awareness about green housing since 2007, until now sustainable development has not been able to achieve the appropriate level in Malaysia. The low level of demand might be caused by the low level of awareness, higher price, less competition among developers, fewer choices based on design and inaccessibility at the area. To clarify the level of public awareness about green homes, their benefits for individuals and society can provide a strong foundation for sustainable development. The perception of real demand and people preferences will allow developers to invest appropriately and provide green features which are more acceptable for their clients in term of financial constraints and life style.

2.4 Environmental Benefits

Construction consumes the massive amount of natural resources and has negative effects on the environment. Various appraises in the United States show that construction consumes 30% of the raw materials (EPA, 2001).

Table 2. Negative effects of construction on their environment

Construction	Operation	Demolition
Materials Use Reduction of nonrenewable resources Pollution from produce materials Construction waste material Site pollution Change the animals life Destruction of wild life Soil erosion Impairment of Natural resources(tree, exotic plant ,et) Urban sprawl Water quality	Energy Use Air pollution Greenhouse gas, GHG (CO_2 and CH_4) Global warming Water pollution Nuclear waste fuel extraction Building Operations Impairment in Groundwater Changes in microclimate around Buildings and urban heat island effects Light pollution Air Pollution Land Pollution Ozone depletion Reduction of Bbiodiversity Waste Production	Demolition waste (Environment resource) Energy consumption Disturbance of urban life

2.4.1 Major Impact of Construction Industry on Environment

Of the global energy consumption, 75% occurs in cities and 80% of Green House Gas (GHG) emissions emanate from cities (Environmental Facts, 2010).

During construction / maintenance / end of life:

- Minerals consumption (> 50% of extracted materials)
- Waste production (180 Million t / year)
- Site related nuisances (traffic, noise, etc)

Buildings account for 17% of world's fresh water withdrawals, 25% of world's wood harvest, and 40% of world's materials and energy flows (Ding, 2008). Green building can decrease using:

- Energy, 25-40%
- Water, 35-40%
- Solid waste, 70%

2.4.2 Positive Effects of Green Homes

- **Emissions Reduction:** pollutants produced by fossil fuel such as ozone depletion, air pollution and acid rain threat human life (USGBC, 2003). In Green building some techniques like solar energy, powering, reduce fossil fuel consumption and greenhouse gas emission (GHG). Furthermore, they enhance energy efficiency and decrease harmful emissions.
- **Water Conservation:** using rainwater and non-potable water for the plant irrigation and washing can save a significant amount of portable water. It also increases cost savings for green home owners and reduces strain on urban water supply (USGBC, 2003).
- **Storm water Management:** green building uses special techniques and permeable material (green roof) to control and utilize rainwater in order to use in the building (USGBC, 2003).
- **Temperature Moderation:** The heat retention originated of construction activities and materials like asphalt and concrete are the initial causes of heat island effect (USGBC, 2003).
- **Waste Reduction:** construction produces enormous waste products that amount up to180 Million ton per year globally. According to National Association of Home Builders in 1988, the amount of demolition green building in the full scale is much less than conventional buildings (waste production).

2.5 Economic Benefits

Green building has many economic advantages such as:

- **Energy and Water Savings**: Special green design and technology in green building decrease operation costs and recoup any extra project costs as well long-term savings (USGB, 2003).
- **Increased Property Values**: Low maintenance costs and energy saving in green building increase occupancy rate up to 3.5% and property values (USGB, 2003).
- **Improved Employee Attendance**: In green building, the guarantee of physical and emotional human health is of great importance. Green building can save human life which now seems to be in danger and gives to the next generation a chance to live in peace and relax. Based on green design, the natural lighting and control of ventilation and temperature are used in order to increase employee health (USGB, 2003). In 2000, the U.S. Environmental Protection Agency stated that buildings with enhanced indoor environment

quality cause a reduction in users' health care costs.

- **Increased Employee Productivity:** Low indoor environment quality reduces the productivity of personnel in commercial buildings which causes undeniable financial lost for companies. For example, the enhanced lightening system in offices can reduce headache among the employees up to 27% (Aras et al., 1998).
- **Sales Improvements:** Green homes improve occupants' health, productivity and comfort. In addition, green buildings allow their owners to have more saving from utility bills, operation and maintenance costs. Understanding these benefits throughout society can increase green home demand and sale improvement.
- **Development of Local Talent Pool:** Construction industry is moving toward sustainability. This is especially true in the field of building design, since the awareness of people about a climate change and reduction of non-renewable energy sources have increased. People who have experience in green building industry can accommodate the raising market demand for sustainable development (USGBC, 2003).

2.6 Social Benefits

Usually the social benefits of green buildings are often disregarded compared with environmental and economic benefits of green buildings. Some benefits are as follow (Ewing et al. 2006).

- Minimizing strain on local infrastructure
- Heightening aesthetic qualities
- Improving overall quality of life
- Having Healthier Lifestyles and recreation
- Enhancing occupant comfort and health

3. Methodology

The aims of this research are to:

- Identify potential green house buyers' awareness of green homes.
- Determine the extra price that potential home buyers are willing to pay for purchasing green home.
- Explore the favorable green features which potential home buyers are willing to pay extra for.
- Provide recommendation how many green features can be acceptable and affordable for potential green home buyers.

The real estate market strongly relates to supply and demand. Hence, green homes market is driven by supply and demand as well. In order to achieve sustainable development in green homes in Malaysia, we have to pay equal attention to both demand and supply sides. The majority of research in green buildings is more considered on the supply side such as developers' and contractors' interests, their obstacles in this field and other related matters to construction companies. In addition, other studies argued about green homes benefits, costs and environmental impacts. There is a serious lack of comprehensive academic research concerning the role of green home buyers to promote and support green home development at the national level. A clear understanding of green home buyers' preferences and limitations are required. These limitations will allow the authorities and developers to choose the most appropriate strategy. Regarding approach, it will aid sustainable development with lower financial risk in term of investment in the green home projects. Considering home buyers this study finds out their needs and preferences for green features for their next home purchase and provides a strong foundation for decision makers in developer firms and local governments.

For data collection, a questionnaire survey was conducted by research team in the different parts of Malaysia. The questionnaire was designed at three parts. In order to make the questionnaire standard and collect significant data, a pilot survey has been launched and two questions were removed. At the first part, respondents were asked to answer four questions about their background including age, gender, occupation and education level. The aim of this part is to create a clear vision of our respondents who were initially involved in the survey.

As mentioned in literature part, one of the main obstacles for green homes development is public awareness; therefore, the second part of questionnaire was going to find out the level of Malaysian awareness about green homes. At the initial step, they were asked about their general knowledge of green homes. In the next step, respondents rate their awareness about specific benefits of green homes such as environment benefits, economic benefits and social benefits. At the third section, researchers tried to explore the willingness of green home buyers to pay extra in order to purchase a green home as well as to find out the most favorable green features from green home buyers' point of view. Understanding which features are more preferred by potential green home buyers, developers, designers and contractors can be useful in decreasing the risk of investment and costs with the intension of reducing green home prices to more desirable range for green home buyers. It will lead to the increasing demand for green homes and sustainable development for green building at higher level.

In all, 2180 questionnaires were distributed among the people selected randomly in the most important cities in Malaysia. A total of 817 questionnaires (37.48%) were received during 75 days period. After collecting all the primary data, an appropriate analysis method was applied. The analysis

method in this research was descriptive. SPSS version 19 was used to analyze the primary data.

Reliability statistics used in this research is Cronbach's alpha. It is defined as determining the internal consistency or average correlation of items in a survey instrument to gauge reliability (Cronbach, 1951). Cronbach's alpha can be written as a function of the number of test items and the average inter-correlation among the items (Bruin, 2006). The formula of Cronbach's alpha is:

$$\alpha = \frac{N.\bar{C}}{\bar{v} + (n-1).\bar{c}}$$

N = number of items

$\bar{C}$ =average inter-item covariance among the items

$\bar{v}$ = average variance

The reliability of each part of questionnaire was investigated to ensure that data are reliable and trustful. Cronbach α is between zero and one. If α-Cronbach is less than 0.5, data are not reliable; therefore, the results which were achieved through the data analysis are not applicable. In opposite, when α-cronbach is near 1, data is reliable.

Table 3. Reliability Statistics Section B

Cronbach's Alpha	N of Items
.871	11

Table 4. Reliability Statistics Section C

Cronbach's Alpha	N of Items
.876	18

4. Finding and discussion

The data revealed that most of respondents were between 25-35 years old and female. At the education level, about 45% of research respondents were under graduate or post graduate. Based on table 3, a total 83.3% of respondents were under 35 years old. This age group in society is considered as "new comer" in today's housing market. Therefore, perceiving their needs and preferences about the homes will lead a long term planning for housing market. By clarifying their needs and preferences for their future homes, risk of long term investment will decrease for green home developer companies.

Table 5. Respondents background

Age		Percent	Valid Percent	Cumulative Percent
Valid	x<25	16.7	16.7	16.7
	25≤x<35	66.7	66.7	83.3
	35≤x<45	8.3	8.3	91.7
	x≥45	8.3	8.3	100.0
	Total	100.0	100.0	
Gender				
Valid	Male	45.8	45.8	45.8
	Female	54.2	54.2	100.0
	Total	100.0	100.0	
Occupation				
Valid	Student	27.6	27.6	27.6
	Public sector	44.3	44.3	71.9
	Private sector	20.3	20.3	92.2
	Self-employ	7.8	7.8	100.0
	Total	100.0	100.0	
Education level				
Valid	Diploma	43.8	43.8	27.1
	BS level	27.1	27.1	45.3
	MS level	18.2	18.2	56.3
	PhD level	10.9	10.9	100.0
	Total	100.0	100.0	

Table below shows the relationship between respondents' awareness and their education levels. According to the results, as respondents' education level increases, their awareness about green homes benefit rises. Through 10th Malaysia Plan, government is going to increase number of academic certifications among the young generation. Therefore, the more the education level rises, the more public awareness on green homes will increase. This situation will lead to higher demand for green homes at near future in Malaysia. It also applies an appropriate strategy to direct this market to meet potential demands of green homes.

Table 6. Level of respondent's awareness about green home benefits

		Very low	Low	Average	High	Very high	Total
Education level	Diploma	12.7%	25.1%	26.9%	27.7%	7.6%	100.0%
	BS level	7.4%	22.6%	39.3%	28.6%	2.1%	100.0%
	MS level	19.0%	14.3%	0%	52.4%	14.3%	100.0%
	PhD level	0%	19.8%	67.9%	4.4%	7.9%	100.0%

Table 7. Environment benefits

		Enhance and protect ecosystems	Improve air and water quality	Reduce material wastage	Conserve and restore natural resources
N	Valid	192	192	192	192
	Missing	0	0	0	0
Mean		3.83	4.21	3.75	3.88
Minimum		2	2	2	3
Maximum		5	5	5	5

Table 8.Economic benefits

		Reduce operating costs	Improve occupant productivity	Optimize life-cycle economic performance
N	Valid	192	192	192
	Missing	0	0	0
Mean		3.42	3.58	3.75
Minimum		2	2	2
Maximum		5	5	5

Table 9. Social benefits

		Enhance occupant comfort and health	Improve overall quality of life	Minimize strain on local infrastructure
N	Valid	192	192	192
	Missing	0	0	0
Mean		3.55	3.58	3.41
Minimum		1	2	1
Maximum		5	5	5

At this section, study is going to find out the respondents awareness about green home benefits. In order to organize this process, benefits were categorized into three main groups: environment benefits, economic benefits and social benefits. In term of environment benefits, the majority of respondents were more aware of the improvement indoor air quality and water quality than other factors. The average mean is 3.91. This confirms that the Malaysian awareness about green home environmental benefits is quite high. Next item that had been evaluated was economic benefits of green homes. Green homes bring variation of financial benefits for their owners such as lower cost cycle, improvement occupation productivity, optimization of life cycle economic performance and etc. The economic benefits can recap the premium costs of green homes for their buyers. The lower life cycle and operating costs will naturally lead higher saving for home owners. This may be considered as an incentive for green home buyer to pay more in order to enjoy higher saving during the building life cycle. According to the Singapore Green Building Council (2010), the acceptable break period even from home buyers' point of view is less than 5 years. Therefore, if the society has high level of awareness about the green home financial benefits, it may encourage them to pay higher prices to buy green home with the knowledge of earning more in near future due to the fact that the premium costs will be recouped by saving on utility bills and operating costs compared to non-green traditional homes (Mc Grow Hill, 2007; SGBC, 2010). In addition to environmental and economic benefits which are generally well-known, green homes have other intangible benefits for their owners. Enhancement

of occupants' comfort and improvement of their quality of life are benefits that are difficult to measure; therefore, were ignored by many of researchers and people. Respondents are less aware of the social benefits (average mean 3.51) compared with environmental and economic benefits (average mean 3.91and 3.58). According to the U.S. green building council optimizing natural lightning in green homes can reduce the incidence of headache and improve the occupant's quality of life. The general awareness of green homes among Malaysian is average (Full awareness, 5). Thus, Malaysia government needs to establish and launch new programs to improve public awareness in order to achieve national sustainable development objectives.

Table 10. Respondents awareness

	N	Minimum	Maximum	Mean
level of awareness on green home benefit	192	1	5	3.00

As mentioned in earlier literature review, green homes are more expensive than non-green conventional homes and for the majority of home buyers this extra cost is unaffordable. Therefore, in order to have sustainable green home development, investors and developers need to explore the affordable price range which home buyers are willing to pay in order to buy a green home. Having this information will allow design teams, planners and contractors to have clear estimate of maximum price they can charge buyer for each unit. Hence, design team can choose the appropriate ranking for green rating system based on the final project price. For instance, when the target customers are willing to pay less than 2% extra to buy green homes, consequently this project cannot be applied for gold or platinum certification from GBI. It would also threaten the reduction of investment and meet customers' needs and requests. The majority of green home buyers are only willing to pay 3% or less than the equivalent for non-green home prices. To meet the green home market demand, developers and designers must pay more attention to this issue and drive the green home projects with the intension of adopting with customers' favorable price range.

Table 11. GBI Rating systems

GBI Rating	**Points**
Certified	50-65
Silver	66-75
Gold	76-85
Platinum	86+

Table 12. Premium cost that home buyers are willing to pay for green home

Premium costs	0 ≤x<3	3≤x<5	5≤x<8	8≤x<12	x≥12	Total
respondents	408	228	88	25	68	817
	49.93%	27.90%	10.77%	3.06%	8.34%	100.00%

Table 13. Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.908a	.825	.823	.192

a. Predictors: (Constant), minimize strain on local infrastructure, improve the overall quality of life, improve occupant productivity, conserve and restore natural resources, reduce material wastage, enhance and protect ecosystems , reduce operating costs, improve air and water quality, optimize life-cycle economic performance, enhance occupant comfort and health

b. Would you pay extra in order to purchasing green homes?

Table 14. Green home features

Code	**Green elements**	**Code**
GE1	Unit has good natural ventilation inside.	Energy efficiency
GE2	Unit is fitted with energy saving appliances and light fittings.	
GE3	Walls and roof in the unit are fitted with materials that reduce solar heat intake.	
GE4	Unit is fitted with renewable energy such as solar panels to generate electricity.	
GE5	Unit has north-south orientation to reduce solar heat intake.	
GG1	Plants and greenery planted on the facade and roof of high rise buildings.	Greenery

GG2	Extensive landscaping with plants on the premises and grounds around the home.	
GW1	Unit is fitted with water saving appliances and water efficient fittings for reduced water usage.	Water efficiency
GW2	Building has an irrigation system for landscaping and plants watered using non potable or recycled water.	
GS1	Certification by developers that the building has been installed with	Sustainable construction
GS2	Certification by developers that the building has been installed with materials that adopt, reduce, reuse, and recycle concepts.	
GS3	Certification by developers that sustainable construction practices have been adopted by contractors during the construction stage	
GM1	Certification by developers that during the construction stage, the contractor had adopted good waste management principles.	Waste management
GM2	Provision of separate bins/chutes that enable waste to be sorted (metal, plastics, paper, thrash).	
GI1	Indoor environment: design that leads to low noise levels, low indoor air pollutants and high indoor air quality.	Indoor environmental quality
GP1	Public transport accessibility: home is within walking distance of an MRT station.	Public transport management

Table 13 illustrates correlation among potential green home buyers' willingness for paying extra price as dependent variable and public awareness about green home benefits as independent variables. From the above data analysis, it can be observed that there is strong relationship (R Square: 0.825, sig: 0.000) between home buyers willingness to pay premium price for purchasing green and home buyers' awareness about green home benefits. Therefore, higher general perception of green home benefits can increase demand for green homes in the society. As public awareness on the benefits of green homes is moderate (Table 10), a majority of people are not going to pay extra for purchasing green homes. This issue can be considered as the main obstacle of green home development.

To find out which green features are important for green home buyers, we asked respondents to rate the level of importance for each item. All the green features were organized in the seven main categories. Based on the analysis of data through SPSS, results were shown in Tables 15 and 16. The most important items ranked based on the mean are indoor environment quality that leads to lower noise, low indoor air pollutants and high indoor quality, home that is fitted with energy saving appliance and light fittings, walls and roof in the unit that is fitted with material which reduce solar heat intake.

The most favorable type of green feature selected by respondents was indoor environment quality (mean 4.04). It shows that most of potential green home buyers consider indoor air quality as an important factor. High indoor environment quality will lead to the increased productivity and health condition. In addition, reducing sound pollution can provide more comfortable environment for home residences and enhance their satisfaction in many areas (Ghodrati et al. 2012).

The next item that green home buyers are willing to pay extra for is energy efficiency (mean 3.87). Increasing the energy price and an especial need for using the air conditioning system in Malaysia are the main home buyers' concerns. A majority of home buyers intend to have homes which are facilitated by energy efficiency appliances to reduce their utility bills. In the tropical climate air conditioning system is the main energy consumer at the residential buildings. Therefore, homes that are fitted with energy saving appliances and well isolated can bring huge saving for their owners.

Third category ranked by respondents was greenery with mean score 3.70. Greenery was divided into two subtitles. First, plants and greenery planted on the façade and the roof of high rise buildings. This method can reduce absorption rate of sun light by roof and thereby decrease heat transmitted from roof to units. The second was landscape design concerning the appropriate selection of plants that can improve not only air quality but also sound isolation within buildings (IMCSD, 2009). Other factors such as water efficiency, accessible to the public transport, sustainable construction certificate and waste management during construction stage were ranked at lower levels.

From the data analysis (Table 16), it can be observed that green features which affect green home owners directly are more preferred by green home buyers. The result was almost the same line with research group assumption as well. Therefore, factors which are related to construction stage or can be profitable for contractors and developers are at the end of home buyers' preference list. In some cases this conflict about owners, developers and contractors' benefits can hinder green housing development. As for sustainable green home development, making balance

between green home owners' benefits and construction companies' profits is a critical issue.

Table 15. Ranking result on Green home features

Code	Minimum	Maximum	Mean	Mode	Rank
GE1	3	5	3.83	4	6
GE2	2	5	3.97	4	2
GE3	1	5	3.96	5	3
GE4	1	5	3.88	4	4
GE5	2	5	3.74	3	7
GG1	2	5	3.54	4	11
GG2	1	5	3.87	4	5
GW1	2	5	3.71	4	8
GW2	1	5	3.58	3	9
GS1	1	5	3.50	3	12
GS2	1	5	3.42	3	13
GS3	1	5	3.00	3	14
GM1	1	5	3.21	3	16
GM2	1	5	3.25	3	15
GI1	1	5	4.04	4	1
GP1	1	5	3.57	4	10

Table 16. Correlations

How percentage is you willing to pay extra in order to by a green home?			Waste management	Sustainable construction	Greenery	Energy efficiency	Indoor environmental quality	Public Transport management	Water efficiency
How percentage is you willing to pay extra in order to buy a green home?	Pearson Correlation	1	.113**	.167**	.373**	.394**	.413**	.258**	.327**
	Sig. (2-tailed)		.001	.000	.000	.000	.000	.000	.000
	N	817	817	817	817	817	817	817	817
Waste management	Pearson Correlation	.113**	1	.327**	.299**	.424**	.190**	.338**	.051
	Sig. (2-tailed)	.001		.000	.000	.000	.000	.000	.143
	N	817	817	817	817	817	817	817	817
Sustainable construction	Pearson Correlation	.167**	.327**	1	.184**	.220**	.315**	.076*	.152**
	Sig. (2-tailed)	.000	.000		.000	.000	.000	.031	.000
	N	817	817	817	817	817	817	817	817
Greenery	Pearson Correlation	.373**	.299**	.184**	1	.714**	.532**	.303**	.488**
	Sig. (2-tailed)	.000	.000	.000		.000	.000	.000	.000
	N	817	817	817	817	817	817	817	817
Energy efficiency	Pearson Correlation	.394**	.424**	.220**	.714**	1	.793**	.632**	.419**
	Sig. (2-tailed)	.000	.000	.000	.000		.000	.000	.000
	N	817	817	817	817	817	817	817	817
Indoor environmental quality	Pearson Correlation	.413**	.190**	.315**	.532**	.793**	1	.665**	.606**
	Sig. (2-tailed)	.000	.000	.000	.000	.000		.000	.000
	N	817	817	817	817	817	817	817	817
Public Transport management	Pearson Correlation	.258**	.338**	.076*	.303**	.632**	.665**	1	.652**
	Sig. (2-tailed)	.000	.000	.031	.000	.000	.000		.000
	N	817	817	817	817	817	817	817	817
Water efficiency	Pearson Correlation	.327**	.051	.152**	.488**	.419**	.606**	.652**	1
	Sig. (2-tailed)	.000	.143	.000	.000	.000	.000	.000	
	N	817	817	817	817	817	817	817	817

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

5. Conclusion and recommendation

Malaysia, with its high level of urbanization and fast economic growth, is located in the tropical areas of Southeast Asia. Tropical climate condition requires a special strategic approach to green home development. This strategy can be applied not only in Malaysia but also in the countries with the same climate condition. Some of the main results which are explored by this research are as follows:

- Malaysians' awareness about green home benefits is considered average and they do not have comprehensive knowledge about social and economic benefits of green homes.
- The majority of potential home buyers are willing to purchase green homes but their willingness to pay higher premiums is limited up to 3% higher than normal homes. However, the final price for green home is up to 15% higher. It makes green home unaffordable for most of average families.
- Indoor environmental quality, energy efficiency and greenery are the most favorable green features because they can bring more benefits to the owners.
- The government should stimulate social concern on green home benefits through national plans by supporting NGO activities and promoting green building voluntary rating systems.
- The government should support green home purchases by offering financial incentives. Some of the incentives, which can be applied by the government, are as follows: tax reductions, grants, rebates and special mortgage rates for green home purchases.
- To make green homes more affordable for home buyers, the government should provide a lower interest fund for green home developers. Developers can then decrease the retail prices of green homes.
- Green home developers and designers should use integrated design approaches and cost effective strategies to keep final prices at an affordable range for potential purchasers.
- To achieve sustainable green home development, construction firms should build green homes which meet home buyers' preferred green features.

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