Green Features Project Management: Value Added to Residential Property

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ABSTRACT

Green buildings with green features are sustainable buildings and have less harmful effects on the natural environment, resource consumption and human health. Since the global warming issue has worsened and the number of housings is increasing, the role of green features in green housing has become highly important in creating a good sustainable living environment. However, to date, the level of developed green housing is still below the mainstream housing even though Green Buildings Index (GBI) has been implemented in Malaysia. The objectives of this study are to identify current green features that are applied in green housing, to quantify the construction costs of green features that are applied and to identify the factors that influence the acceptance levels of green housing. The scope of the study included collecting data from developers through five case studies of housing projects. Questionnaire and semi structured interviews and documents' review were conducted to gather information from the respondents, of developers or architects, and 120 home buyers on green housing. The result shows that current green features that are mostly applied by housing developers are passive green features such as building orientation, window and daylight. From the perspectives of cost effectiveness and to meet the purpose of comfortable housing, developers will choose to apply passive green features. The construction cost of green feature window and daylight is the highest. The main factors that influence the acceptance level of green housing by home buyers is the comfort of green housing followed by the green housing pricing. Further, the research recommends looking into the details of the cost of savings in the long term for green features and developers' opinions on the perception of the home buyers when it comes to factors that influence their acceptance level of green housing. It is recommended that an in-depth study be conducted on green features to study the problems and issues related to improve the green features design.

Keywords: Green Building, Green Features, Green Cost Premiums, Factors Acceptance Level

INTRODUCTION

Global warming as an international environmental issue is getting ample important as it has an adverse effect on the environment and humankind. The global warming issue started to become worsen at the beginning of the current century mainly due to the increase of greenhouse gases and carbon dioxide emission (Shahzad & Riphah, 2015), Jaleel et al., (2023). According to (Sagheb, et al., 2011), buildings are the dominant energy consumers and greenhouse gas emitters in both the developed and developing countries. Buildings are responsible for the consumption of more than 40% of the global energy and release one-third of global Greenhouse gas emissions (GHG) (Reddy. Vanakuru & Giduthuri, 2017). Based on (Reddy.Vanakuru & Giduthuri, 2017), the growth rate of carbon dioxide emissions recorded between the year 1971 to 2004 through

the use of residential buildings is 1.7%.

LITERATURE REVIEW

Green Buildings Features

Green buildings are then introduced and play an important role in combating climate change by conserve natural resources and maintain harmony with the nature. The most effective way to reduce the emission of gases is by using renewable energy (Shahzad & Riphah, 2015). The demand for green buildings has been increased as environmental awareness grows especially among developers and professionals since the existence of the Green Buildings Index (GBI) and Singapore's Building and Construction Authority's Green Mark Scheme (BCA). The implementation of energy alternatives in green building enables to minimize the energy costs through the use of electricity or fuel more efficiently or by helping to eliminate the costs entirely with incorporate the renewable energy sources (Vanek & Vogel, 2007). Following the benefits of green building, it is highly encouraged to be implemented in most of housing development for sustainable development and a better future. In general, the green features applied in the green buildings are important in upgrading the value of the housing property (Kamaruddin et al., 2020).

To date, the level of developed green building is still below the mainstream where it only focuses on big projects. Although GBI has been implemented in Malaysia yet the achievement is still below the targeted level required by the Minister of Natural Resources Malaysia. The green features are still rarely emphasized by the developers when developing new housing. One of the main reasons is due to the higher construction cost of housing with green features. According to (Lee, 2014), the green residential building costs were 10.77% more than the traditional residential buildings. The environmental impact of buildings is often underestimated, while the perceived costs of green buildings are overestimated (Samari, 2013). Most developers highly emphasised and control the construction cost as it influences their selling price and profit. Developers refuse to build green housing due to green features incurred high cost (Alias, et al., 2010). The drop in the market economy latterly indirectly has caused the drop and instability of the selling price of housing in Malaysia. Since the construct of green housing increases the selling price, developers have more preference to design housing with limited green features or just normal housing which are affordable to customers.

According to (Samari, 2013), the minimal increases of about 2% in upfront costs to support green design would result in project life cycle savings of 20% of total construction costs, which is estimated to be more than ten times the initial investment. The majority of savings from a green building are in the maintenance part and utility costs. However, the benefits and potential cost savings of the green features only can be seen in the long term. To some of the house buyers' perception, they only concern about the pricing for a house with green features is much higher without considering the importance in go green (Hasan, et al., 2018). Some owners even do not appreciate the green features that are constructed in their houses. There are still many people lacking knowledge and awareness of the advantages of green features that will benefit them in the long term. The lack of understanding of the factors that influence the acceptance levels of buyers on green housing is one of the barriers to the development of green products (Handayani & Prayogo, 2017).

Green Building Concepts

A green building is defined as a building where the construction and lifetime of operation assure the healthiest possible of the environment. Green building is a building with a modern architectural concept which focuses on the environment by reducing energy consumption, materials and resources as well as minimize the impact of construction (Oleiwi, et al., 2014). Building a green building is a process where every element of the design is optimized. Then, the impact and interrelationship of the various elements and systems within the building and site are re-evaluated, integrated and optimized as part of a whole building solution (Pandey, 2014), Jaleel et. al (2023). According to (Green Building Index, 2013), green buildings are able to sustain and improve the quality of human life whilst maintaining the capacity of the ecosystem at the local and global levels; make efficient use of resources, and have significant operational savings as well as increases workplace productivity. In addition to that, it sends the right message about a company or organization that they are responsible and committed to the future. The green building concepts are efficient in the use of resources and increases

operational savings and productivity for future generations which should be the goals for companies or organizations involved in construction. Basically, and ultimately, the green building ensures that the quality of life-based on a sustainable ecosystem is sustained and improved (Islam, et al., 2019).

Green Building Criteria and Rating Systems

Green building evaluation is an important tool to encourage sustainable development in the building sector (Pandey, 2014). The rating system act as a design tool through setting sustainable design priorities and goals, develop sustainable design strategies and determine the performance measures to guide the sustainable design and decision-making processes. Besides, it also acts as a management tool to organize and structure environmental concerns during the design, construction and operational stages. Based on (Altin, 2017), the green building rating system is transforming the construction industry by focusing on high-performance, energy-efficient, economical and environmentally friendly buildings.

The green building rating system plays an important role in supporting this transition (Pandey, 2014), Jaleel et. al (2023). To develop an efficient building, there are important criteria to consider for rating the green building. At present, there is still no common standard set of criteria for the rating of green buildings because each country has their own rating systems (Bahaudin, et al., 2014). Many green building rating systems have been developed around the world. Table 1 shows a comparison of selected established rating systems. The criteria that are focused by them are different.

Table 1: Comparison of Green Rating Assessment Tools

Tool	Nation	Year	Assessment Criteria
BREEAM	UK	1990	1. Management 2. Health & Comfort 3. Energy 4. Transportation 5. Water Consumption 6. Materials 7. Land Use 8. Ecology 9. Pollution
LEED	USA	1996	1. Sustainable Site 2. Water Efficiency 3. Energy & Atmosphere 4. Materials & Resources 5. Indoor Environmental Quality 6. Innovation & Design/Construction Process
GREEN STAR	Australia	2003	1. Management 2. Transport 3. Ecology 4. Emissions 5. Water 6. Energy 7. Materials 8. Indoor Environmental Quality
GREEN MARK	Singapore	2005	1. Energy Efficiency 2. Water Efficiency 3. Environmental Protection 4. Indoor Environmental Quality 5. Other Green Features
GBI	Malaysia	2009	1. Energy Efficiency 2. Indoor Environmental Quality 3. Sustainable Site & Management 4. Materials & Resources 5. Water Efficiency 6. Innovation
4o			

Source: Altin, (2017)

Green Building Features

Green building is a design and construction of a building that emphasises in protecting the existing ecologies or improving the environment that may have been damaged in the past (Zafar, 2017). Green building also utilizes fewer materials through the elimination of unnecessary finish materials and efficient building design. Green features in green buildings are make-up from many elements. It can be categories into passive or active features. Figure 1 and Table 2 show the example of the green features of a green building.

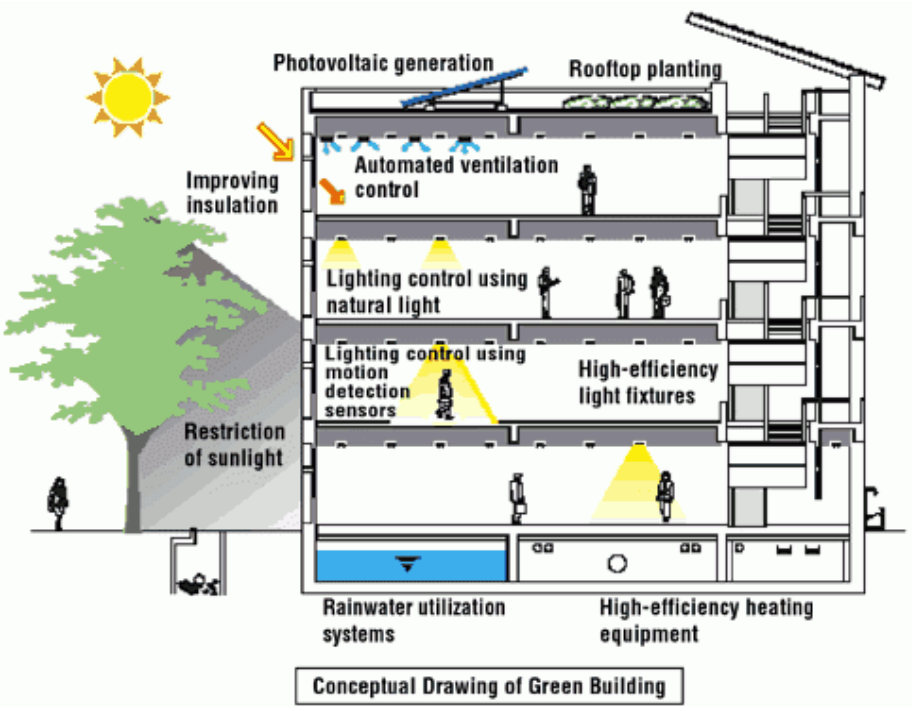

Figure 1: Features of a Green Building (Zafar, 2017)

Table 2: Green Features

No.	Features	Researcher	Description
1	Building Orientation	(Anumah, 2017), (The Constructor Civil Engineering, 2019)	• Important to its overall energy efficiency. • Strong correlation between wind direction and solar radiation. • North-south orientation is best for daylighting and visual comfort. • Larger expanse of windows recommended on the south facade for sun's light and warmth.
2	Window and Daylight	(The Constructor Civil Engineering, 2019), (Chong, 2015), (Winter, 2015), (Green Building Index, 2013)	• Provides natural daylight to living and private spaces while respecting passive solar heating and cooling rules. • Windows and large openings in walls with heavy shutters should be on northern and western faces for diffused, indirect light. • Saves up to 30% energy consumption through passive solar design.
3	Rain Water Harvesting System (RWHS)	(Lo, 2018), (Green Building Index, 2013)	• Payback time of 10-20 years based on current water charges. • Collected rainwater can be used for non-potable purposes. • Reusing rainwater can save 13,650 liters of water per month per household.
4	Low-pressure Water Tap	(Nielson, 2009), (Potex, 1995), (Green Building Index, 2013)	• Increases water pressure and includes automatic closer. • Reduces water consumption significantly, with cost implications as 40% of household electricity is used to heat water. • Water-saving shower head limits output to 6-9 liters/min depending on the model.

5	Photovoltaic (Solar Panel)	(Nielson, 2009), (Green Building Index, 2013)	• Saves up to 80% on monthly electricity bills. • Provides an endless supply of energy with no extra charges. • Solar power is becoming more popular due to rising gas and oil prices.
6	Autoclaved Aerated Concrete (AAC)	(Nielson, 2009), (Green Building Index, 2013)	• Precast structural product made from natural raw materials, known as autoclaved cellular concrete. • Economical and sustainable, provides fire and termite resistance, and offers thermal and acoustic insulation.
7	Clay Roof Tiles	(Chnebierk, 2016), (First Quality Roofing & Insulation, 2018), (Green Building Index, 2013)	• Made of earth and 100% natural materials. • Benefits include durability, temperature control, energy efficiency, low maintenance, long life, and low-cost repairs. • Estimated to be 3°C cooler than concrete roofs, reducing the need for air conditioning and saving energy.

Green Building Cost

Despite the fact that green buildings bring many benefits, the higher cost of green building has become the main challenge that hinders the widespread of green buildings development (Dodge Data & Analytics, 2016). Hence, there is a need to provide strong evidence to overcome the cost barrier in promoting green buildings (Weerasinghe, 2017). The green building cost includes green cost premiums along with operation and maintenance costs. Green cost premiums are defined as the differential cost between a green building and a traditional building (Kats, 2010). In general, green cost premiums can be known as the additional capital costs for green building features (Hwang, et al., 2017). Based on (Kats, 2010), the study showed that the construction of green buildings incurred a cost of roughly 2% more than traditional buildings. There are also industry professionals who have insight that the design and construction costs of green buildings are 10% to 20% higher than traditional buildings (World GBC, 2013).

The green building investors focus on minimising the construction cost of building without considering the life cycle economic performances (Waidyasekara & Fernando, 2012). They do not consider the cost benefits of green buildings that can be achieved such as lower energy consumption as well as annual electricity cost, lower annual water and wastewater cost, lower annual fuel cost and also waste disposal cost. In fact, green buildings indirectly create long term benefits to home buyers or tenants. According to the United Nations Environment Programme, it is possible to cut the energy consumption of buildings from 30% to 80% if the right green technologies are used (UNEP, 2009).

Factors Influence Acceptance of Home buyers on Green Housing

The concept of green building development has been the most effective strategy to ensure future environmental sustainability. Although green building is important, the demands of potential buyers have played an important role to promote green buildings (Zhang, et al., 2018). Buyers' choice and willingness to buy green housing is vital in boosting green building development. The developers will develop more green buildings only if the buyers are willing to pay the additional cost for green housing

(Yau, 2012). There are some factors that influence the acceptance of home buyers to buy green housing. The factors identified as factors affecting home buyers' acceptance of green housing can be summarized as green housing price awareness of environmental protection, green building materials and internal structures, and green housing comfort.

The factors identified as the main factors are summarized as green housing prices. The main hindrance to the development of green building is the cost as a high number of public calls in question on the green building

costing. There are even consultants who expressed considerable attention on initial incremental cost but neglect the social and environmental benefits in the green housing life cycle. The green building technique is estimated 10% to 15% higher than the original budget increase cost, economizes on utility bills and extends the construction lifecycle for almost 20 years. (Lan & Sheng, 2014), (Zhang, et al., 2018).

In addition, other factors identified as factors that influence aspects that also influence the acceptance of home buyers towards green housing are also formulated as awareness of environmental protection. Due to the failure to understand the real request on the awareness of environmental protection and consumption, green products are often unacceptable by people. With the increase of awareness at acceptable levels, people will be more aware of the importance of green housing because people's mentality is basic psychology (Lim, 2013), (Zhang, et al., 2018), Nazihah et al., (2022).

Other factors identified as factors are also summarized as green building materials and internal structures. Green construction material is known as an environmental construction material that has features such as ecological maintenance, low consumption of resources, energy-saving, safe, recycle and reuse (Nor Nazihah et al., (2022). It refers to the comfortable internal spacing especially with good ventilation, sufficient light and energy saving. Buyers consider on the material and internal structure since they look forward to housing with a better quality of life. For example, they consider either the construction or the house structure contains safety with fireproof or shock-proof (Lan & Sheng, 2014).

In addition, other factors identified as factors are also the aspect of green housing comfort. People are pursued for a better living comfort by upgrading their living environment. The improvement in housing comfort indirectly provides good living experiences and enhance the quality of life. The health-concerned and wealthy people are more emphasized on living comfort. They are willing to pay to improve the degree of their living comfort. (Li, et al., 2013), (Zhang, et al., 2018).

RESEARCH METHODOLOGY

The scope of the study included collecting data from developers through five case studies of housing projects. Thereafter, structured interviews and document reviews were carried out on either the developer or architect for each of the case study. In addition, questionnaires have been distributed to survey 120 home buyers in Johor. Subsequently, the data was then analysed using content analysis method. The descriptive analysis was applied to identify the highest and lowest mean score of the factors.

In this paper, interview and questionnaire approach were utilized in the data collection process. It is a mixed method research as both quantitative and qualitative method are used in the research. There are three objectives in this research which to identify current green features that are applied in green housing; to quantify the construction cost of green features; and to identify the factors that influence the acceptance level of green housing.

FINDING AND DISCUSSION

Case studies on five (5) housing projects in Johor have been selected from developers to further study on green features that have been applied in the housing design. The information on the costing of the green features also has been collected to quantify the construction cost of the green features. Then, for

each case study, the person in-charge of the project were chosen to carry out a structured interview. In addition, the information in respect to the perception of developers or architects on the green features concerning the development has been collected through interviews.

Then, the factors that influence the acceptance level of green housing have been identified through the questionnaires to 120 home buyers on green housing.

The background of the five projects which have been collected through structured interviews are shown in Table 3. The projects involved are named as Project A, B, C, D and E.

Table 3: Background of Projects

No.	Project	Project Description Development
1	A	Construction of Semi-Detached House on, Mukim Tebrau, Daerah Johor Bahru, Johor Darul Takzim.
2	B	Construction Semi-Detached House, Bandar Nusajaya, Mukim Pulai, Daerah Johor Bahru, Johor Darul Takzim.
3	C	Construction of Terrace House, Pasir Gudang, Mukim Plentong, Daerah Johor Bahru, Johor Darul Takzim.
4	D	Construction Terrace House, Taman Impian Emas, Mukim Tebrau, Daerah Johor Bahru, Johor Darul Takzim.
5	E	Construction of Terrace House, Mukim Tebrau, Daerah Johor Bahru, Johor Darul Takzim.

Respondents' Awareness of Green Housing

The people's awareness on the benefits of green housing is important to encourage them in accepting and purchasing green housing. As discussed in the literature review, green housing brings many benefits in the aspect of the environment, social and economic. Hence, determining the people's agreement on the benefits of green housing is important.

The result shows in Table 4 presented with the mean and standard deviation. Based on the result, most of the respondents agreed that green housing helps to improve the quality of life which has a mean score of 4.46. It is then followed by reducing greenhouse gas emissions, protect biodiversity and ecosystems and conserve natural resources with mean scores of 4.43, 4.40 and 4.39 respectively.

In addition, reduce life-cycle costs and expand for green products or services have obtained a mean score of 4.38 and 4.33 respectively. The lowest mean score is 4.22 which enhances aesthetic qualities. It has revealed that nowadays, people are more emphasised on the quality of life than the aesthetic quality.

The higher the awareness of people on the benefits indirectly will increase the probability for them to purchase green housing.

Table 4: Average mean of respondents' awareness of the green housing' benefits

No.	Benefits of Green Housing	Mean	Standard Deviation	Rank
1	Conserve natural resources	4.39	0.68961	4
2	Reduce greenhouse gas emissions	4.43	0.78573	2
3	Protect biodiversity and ecosystems	4.40	0.76036	3
4	Improve the quality of life	4.46	0.78746	1
5	Enhance aesthetic qualities	4.22	0.85192	7
6	Expand for green products or services	4.33	0.65251	6
7	Reduce life-cycle costs (Water efficiency, electricity efficiency)	4.38	0.75796	5

Respondents' Preference for Green Features

Green housing is constructed with various green features. When designing green housing, there are various green features that developers and architects may choose and applied. The preferences of home buyers are important as they are the owner of the house. The result of the survey is shown in Table 5. Through the survey

results, it can be observed that green feature "window and daylight", "Rain Water Harvesting System (RWHS)" and "solar panel" are most preferred by respondents with the mean scores of 4.33, 4.13 and 4.02 respectively. Only these three green features obtained a mean score above 4.0. Recently, RWHS and solar panels have been widely applied in most semi-detached houses and bungalows. This shows that the level of acceptance on them also increasing. It is then followed by "building orientation", green foundation "Autoclaved Aerated Concrete (AAC)" and clay roof tiles with the mean score of 3.86, 3.83 and 3.68. The "low pressure water tap" has the lowest mean score which is 3.51. It shows that the function or benefit of a low-pressure water tap is less understandable or discoverable. It indirectly showed that low-pressure water tap might be less appreciated if constructed in green housing.

Table 5: Average mean and standard deviation of respondents' preference on green features

No.	Green Features	Mean	Standard Deviation	Rank
1	Building Orientation	3.86	0.90094	4
2	Window (ventilation) and Daylight	4.33	0.77061	1
3	Rainwater Harvesting System (RWHS)	4.13	0.75519	2
4	Low Pressure Water Tap	3.51	1.10762	7
5	The Photovoltaic Cells (Solar Panel)	4.02	0.89802	3
6	Green Foundations- Autoclaved Aerated Concrete (AAC)	3.83	0.85664	5
7	Clay Roof Tiles	3.68	0.88082	6

Costing for Green Features

The data about the costs that are considered while buying green housing are included as initial cost only, maintenance cost, operation cost and cost saving in the long term. Based on the finding, it shows that only 17.5% of the respondents only consider the initial cost. Majority of respondents which is 70.8% considered cost saving in the long term. They are concerned on the features or design of the houses that might help cost saving in long term. Apart from that, 53.3% and 30.8% of the respondents considered maintenance cost and operation cost respectively. The operation cost is less concerned because the operation cost might only contribute to a small amount and have no significant impact. Moreover, the cost of the green features that acceptable by the home buyers also collected.

Willingness and Factors that are Considered in Buying Green Housing

Respondents highly agreed that green housing is important with a mean score of 4.43. Furthermore, none of the respondents disagree that green housing is important. The statement "I prefer to buy a house with green features" also obtained a high mean score of 4.22. However, the statement of "I am willing to pay extra money to buy green features housing" obtained a mean score of only 3.64. The results have revealed that although people are aware of the importance of green housing, not all people are willing to pay extra money to buy green features housing. Moreover, the mean scores for the statement "I will recommend my friend to buy green features housing" and "I feel more confident towards developers which construct green housing" are 3.94 and 3.88 respectively. These revealed that most of the people still lack interest or confidence in green housing.

Factors that Considered in Buying Green Housing

There are some significant factors that influence the buyers' acceptance and willingness to pay for green housing. These factors are vital to be identified so that it can be more focused in order to unveil the factors that influence the acceptance level of home buyers on purchasing green housing. Green housing comfort is the most significant factor which has a mean score of 4.41. The second significant factor is that the green housing price with a mean score of 4.37. The results showed that most of the respondents are more emphasized on the comfort compared to the green housing price. It is then followed by the awareness of environment protection, eco-friendly construction material and internal structure, and neighbours' or friend's assessment which the

mean scores are 4.34, 4.26 and 3.71 respectively. Most of the respondents are less influenced by the other's opinions while purchasing green housing.

Current Green Features that are Applied in Green Housing

Through the case studies, interview and document review, the current green features that are applied in green housing have been defined. Table 6 shows the summaries of green features that are applied to five housing projects. The result reveals that building orientation is the green feature that is most emphasized by the developer or architect. All the projects have constructed their housing with the best building orientation which is facing North or South. Next, the green feature of window and daylight was applied in four out of five projects. The bigger and full height windows are designed to create better ventilation and optimise the use of natural sunlight. This has also be known to be one of the important selling points of houses.

Table 6: The green features that are applied in case studies

No.	Green Features	Project A	Project B	Project C	Project D	Project E	Total Project Applied
1	Building Orientation	√	√	√	√	√	5
2	Window and Daylight	√	√	√	X	√	4
3	Rainwater Harvesting System (RWHS)	√	√	X	X	X	2
4	Low Pressure Water Tap	√	√	X	X	X	2
5	The Photovoltaic Cells (Solar Panel)	√	√	X	X	X	2
6	Green Foundations- Autoclaved Aerated Concrete (AAC)	X	X	X	X	X	0
7	Clay Roof Tiles	X	√	√	√	X	3

There are three out of five housing projects that applied clay roof tiles as roof covering. Clay roof tiles are favoured by developers or architects because this green material may enhance the comfort of the housing. On the other hand, for the green features of Rainwater Harvesting System (RWHS), solar panel and low-pressure water tap, two projects had applied them respectively. Among the 5 projects, Project A and B are semi-detached houses and Project C, D and E are terrace houses.

The data shows that RWHS, solar panel and low-pressure water tap are only applied at the semi-detached housing projects. The RWHS is applied at Project A and B because it is a requirement. However, for solar panels and low-pressure water tap, they are applied to improve the quality of life of the residents. Among all the green features, only Autoclaved Aerated Concrete (AAC) blocks is not used by any of the projects. AAC blocks is not applied in the projects due to lack of suppliers, unstable price, poor labours skill, cracking issue and lack of confidence. Overall, the developers and architects are more focused on passive green features than active green features. Active green features are only applied to high-end products such as semi-detached houses.

Based on the survey, the green feature window and daylight is most preferred by home buyers. As mentioned, this feature is also emphasized by developers or architects. Besides, the RWHS and solar panel are also highly preferred by home buyers. These green features are common and accepted by most people. However, the case studies show that they are only provided at semi-detached houses but not for terrace houses. The building orientation is rate as the fourth green feature preference by home buyers. The building orientation is applied because the developer only needs to plan at the early stage of the master layout without requiring any additional cost. It is followed by the AAC blocks and clay roof tiles which are green materials that are environmentally friendly. Clay roof tiles is considered common and recommended by developers whereas AAC blocks is still a new green feature at Johor housing development.

Among all the green features, low pressure water tap ranks the last preference by home buyers. However, the low-pressure water tap is provided by the developer, especially for high-end housing. This is because the low-pressure water tap is important in saving water and cost in the long term. The survey shows that some of the home buyers do not agree to have low pressure water tap in their houses. The low-pressure water tap is not appreciated by most people.

Table 7 shows the ranking of green features that are applied by developers and green features that are preferred by home buyers. Overall, both the developers and home buyers emphasised on the window and daylight. They agreed that the green feature window and daylight are important and worth to be provided to improve the comfort of living.

Table 7: Ranking of green features applied by developers and preferences by home buyers

No.	Green Features	Ranking	
		Applied at Current Housing Projects	Preference of Home Buyers
1	Building Orientation	1	4
2	Window and Daylight	2	1
3	Rainwater Harvesting System (RWHS)	4	2
4	Low Pressure Water Tap	4	7
5	The Photovoltaic Cells (Solar Panel)	4	3
6	Green Foundations- Autoclaved Aerated Concrete (AAC)	7	5
7	Clay Roof Tiles	3	6

Construction Cost of Green Features

Table 8 shows the summarise construction cost of the green features based on the 5 projects in percentage. The table also reveals the average construction cost for the green features. The result shows that the building orientation did not incur any cost whereas the window and daylight have incurred the highest cost which is an average of 2.21%.

The building orientation is the adjustment of buildings on the master layout without any additional features or systems. However, the bigger and full height windows or openings has increased the cost for aluminium frame and glazing.

Table 8: Green features' construction cost based on case studies

No.	Green Features	Project A (%)	Project B (%)	Project C (%)	Project D (%)	Project E (%)	Average (%)
1	Building Orientation	0	0	0	0	0	0
2	Window and Daylight	2.20	2.84	1.72	No	2.07	2.21
3	Rainwater Harvesting System (RWHS)	0.41	0.52	No	No	No	0.47
4	Low Pressure Water Tap	0.08	0.21	No	No	No	0.15
5	The Photovoltaic Cells (Solar Panel)	1.0	0.83	No	No	No	0.92
6	Green Foundations-Autoclaved Aerated Concrete (AAC)	No	No	No	No	No	No
7	Clay Roof Tiles	No	0.20	0.18	0.23	No	0.20
	Total	3.70	4.60	1.90	0.23	2.07	3.95

2" 0.42

It is then followed by solar panel, RWHS and clay roof tiles which have covered 0.92%, 0.47% and 0.20% of construction cost respectively. The solar panel is a higher cost because the system is expensive and the installation is more complicated. The more efficient the solar panel is, the more expensive it is. Where as RWHS is simpler, and the cost is included in the tank and piping connection. The study shows that the clay roof tiles have top-up 0.20% of the construction cost compared to concrete roof tiles. The cost of clay roof tiles is slightly higher than the concrete roof tiles due to the better roof tiles material. The clay roof tiles is more durable and has less cracking issue. In addition, the low-pressure water tap has top-up 0.15% of construction cost compared to a common water tap. Since the Autoclaved Aerated Concrete (AAC) blocks is yet to be provided in any project, thus the cost has not been defined. In general, the average of green feature construction cost for one unit of house is 3.95% of the construction cost.

Table 9 shows the green features cost, cost premium and construction cost for each of the projects if they did not apply any green features. Project B has shown the highest green premium which is 4.6% as the project has emphasized on green features and 6 out of 7 green features have been applied in the project. The construction cost will be decreased from RM750,046.30 to RM715,484.81 if there are no green features applied in the project.

Table 9: Projects' construction cost and construction cost without green features

No.	Project	Construction Cost (RM)	Green Features Cost (RM)	Cost Premium (%)	Construction Cost without Green Features (RM)
1	A	566,077.35	20,916.38	3.70	545,160.97
2	B	750,046.30	34,561.49	4.60	715,484.81
3	C	200,270.47	3,805.14	1.90	196,465.33
4	D	221,036.40	508.38	0.23	220,528.02
5	E	272.343.00	5,657.20	2.07	266,685.80

For Project A, the construction cost has increased by RM20,916.38 with 3.7% to provide better housing with green features. Since Project A and B are semi-detached housing, developers have also allowed more cost to provide green features to enhance the quality and comfort of the house. The construction cost of Project A will be RM545,160.97 if there are no green features applied in the project. For Project E, C and D, the cost premium are 2.07%, 1.90% and 0.23% respectively. Three of these projects are terrace houses where the green features provided by developers are also limited to control the increase of construction cost. Project E has incurred green features cost of RM5,657.20 which is for the green feature of window and daylight whereas Project C has only incurred green features cost of RM3,805.14 to provide the green feature of clay roof tiles, window and daylight. In addition, Project D construction cost will only decrease slightly from RM221,036.40 to RM220,528.02 if there are no green features applied in the project where only RM508.38 is incurred for the clay roof tiles.

Throughout the survey, the home buyers have shown positive feedback on willingness to pay extra for the green features, future operation and maintenance cost. There are even respondents that are willing to pay more than the minimum cost. This shows that they are not only aware on the importance of the green features but also willing to pay to have them.

However, there is still part of respondents that aware on the importance of green features, but they cannot afford to purchase green housing.

Table 10 shows the average cost premium, operation cost and maintenance cost of the green features based on the results of case studies and interviews. The construction cost of green feature window and daylight is the highest (2.21%) whereas building orientation is the lowest as it does not incur any cost. Then, it is followed by solar panel, RWHS, clay roof tiles and low- pressure water tap which has covered 0.92%, 0.47%, 0.20% and

0.15% of construction cost respectively. In general, the average green features construction cost for one unit of house is 3.95% of the construction cost. The result also shows that only RWHS and solar panel has operation and maintenance cost. The operation cost for the RWHS and solar panel is 0.5% of the green feature cost whereas the maintenance cost is 0.35% of the green feature cost. The study also has identified that buyers are more emphasised on the savings in the long term rather than the operation or maintenance cost.

Table 10: Average cost premium, operation cost and maintenance cost of the green features

No.	Green Features	Cost Premium (%)	Operation Cost (%)	Maintenance Cost (%)
1	Building Orientation	0	-	-
2	Window and Daylight	2.21	-	-
3	Rainwater Harvesting System (RWHS)	0.47	0.5% of the RWHS cost	0.35% of RWHS cost
4	Low Pressure Water Tap	0.15	-	-
5	The Photovoltaic Cells (Solar Panel)	0.92	0.5% of solar panel cost	0.35% of solar panel cost
6	Green Foundations- Autoclaved Aerated Concrete (AAC)	Not defined	-	-
7	Clay Roof Tiles	0.20	-	-
	Total	3.95	-	-

Factors Influence the Acceptance Level of Green Housing

The awareness of respondents on the green housing' benefits and their perception on green housing are surveyed. The survey has ranked the awareness of respondents on the green housing' benefits which are:

i. Improve the quality of life
ii. Reduce greenhouse gas emissions
iii. Protect biodiversity and ecosystems
iv. Conserve natural resources
v. Reduce life-cycle costs (Water efficiency, electricity efficiency)
vi. Expand for green products or services
vii. Enhance aesthetic qualities

Based on the survey on the perception of respondents, the result showed that almost all the respondents agreed that green housing is important but not all of them are willing to pay extra money to buy green features housing. Therefore, the survey has summarized and ranked the factors that influence the acceptance level of home buyers on green housing which are:

i. Green housing comfort
ii. Green housing price
iii. Awareness of environmental protection
iv. Eco-friendly construction material and internal structure
v. Neighbours' or friend's assessment or opinion

The result shows that from the perspective of home buyers, they have emphasized mostly on the comfort of green housing. Better green housing comfort could increase the quality of residents' lives. Although the green housing price is an important factor that influences the acceptance levels of home buyers, they might still be willing to buy due to better comfort even if the price is slightly higher. Since the implementation of green housing, the price is one of the main factors that influence the acceptance levels of green housing. The high selling price of the green housing might cause some buyers to not be able to afford to purchase them, even if they wish to do so. They will only be able to buy green housing pricing that is affordable to them.

In addition, the awareness of environmental protection also influences buyers to buy green housing. If home

buyers are aware and understand green housing's roles in protecting the environment, the probability of purchasing green housing may increase. Whereas factors such as eco-friendly construction materials, internal structure and neighbours' or friend's assessment or opinion have less influence on the acceptance level of green housing. Also, they are less focused on the eco-friendliness of construction materials and internal structures but are more focused on the overall comfort of a house. They are also not easily influenced by their neighbours' or friends' assessments or opinions because most of them will purchase a house based on their preferences and/or ability. All these data are correlated with each other. The developers and architects need to emphasize on the factors that are highlighted and are concerned by the home buyers. Strategies must be implemented to improve and increase the acceptance levels of home buyers when it comes to the green features of a house.

CONCLUSION

Based on the findings, it can be concluded that based on the current green features that have been discussed, the green features that are applied in housing are building orientation, window and daylight, Rain Water Harvesting System (RWHS), low-pressure water tap, solar panel and clay roof tiles. Only Autoclaved Aerated Concrete (AAC) which is green wall foundations is not applied in any project. Green features that are most applied in housing development are building orientation and window and daylight. From the perspectives of cost-effectiveness and to meet the purpose of comfortable housing, developers will choose to apply passive green features. Most of the active green features such as solar panel and Rainwater Harvesting System (RWHS) will be provided in order to fulfill the requirement. The AAC blocks is not applied in the housing construction due to lack of suppliers, unstable price, poor labours skill, cracking issue and lack of confidence in the product. Hence, the developers still preferred to use brick walls as wall foundation since the wall covered most parts of the building and that it is more reliable to the perception and preference of home buyers on green features.

Based on the study, the finding shows that the location and type of housing to be developed will influence the green features that will be applied in the housing. The green features that are decided to provide are limited to avoid the high increase in construction cost. The construction cost of green feature window and daylight is the highest whereas building orientation is the lowest as it does not incur any cost. Then, it is followed by solar panel, RWHS, clay roof tiles and low- pressure water tap. In general, the average green features construction cost for one unit of house is 3.95% of the construction cost. The result also shows only RWHS and solar panel has operation and maintenance cost. The operation cost for the RWHS and solar panel is 0.5% of the green feature cost whereas the maintenance cost is 0.35% of the green feature cost. The study has also defined that buyers are more emphasised on savings in the long-term than the operation or maintenance cost.

The highest mean score factors are green housing comfort, green housing price and awareness of environment protection where the lowest score factors are eco-friendly construction material and internal structure, and neighbors' or friend's assessment. The findings have concluded that home buyers are most emphasised on the comfort of green housing. Although the green housing price is always highlighted, the housing comfort is significant to attract people to buy even the price slightly higher because they know it is worth to buy. The green features such as building orientation, window and daylight are green features that improve the comfort of houses. Other green features such as Rainwater Harvesting System (RWHS), solar panel and low-pressure water tap helps to improve the quality of life. The factors that influence the acceptance level of home buyers are important as the developers should aware and understand the concern of home buyers and further improve green housing by considering the factors.

RECOMMENDATION

It is an effort of the government, the association of builders, developers and all parties to explore the motivation for green real estate investment, especially the benefits of choosing a certain level of green certification, estimating not only the economic benefits of either maximizing returns or cost reductions but also the socio-environmental benefits that can contribute to the decisions of developers and investors to encourage more green certification of residential and municipal development in the future. In addition, this research aims to facilitate related parties and organizations to provide incentives, recognition, and actions to increase awareness of investors and buyers related to green residential buildings. Finally, a study also needs to be done

to fill the gaps in previous research and encourage future research in green residential building industrial development, whether local or international level, especially the cost aspect which gives a lot of influencing factors to its selection. The development that many parties have proposed regarding the conceptual framework in green housing development can actually be implemented by various parties, especially developers who can then promote greener real estate development, especially in emerging markets in Malaysia.

Further, the research recommends looking into the details of the cost of savings in the long term for green features and developers' opinions on the perception of the home buyers when it comes to factors that influence their acceptance level of green housing. It is recommended that an in-depth study be conducted on green features to study the problems and issues related to improve the green features design.

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