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## **Community Perceptions on the Implementation of Residential Green Building in Indonesia, Malaysia and Thailand**

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### **Abstract**

Green building that refers to an environmentally sustainable, designed, constructed and operated building, which plays important roles in developing country in order to achieve the goals such as reducing greenhouse gases emissions, energy and water savings, and the better adoption of recycling and greenery. However, its regular implementation appears mostly in large construction projects driven by local authorities, and it is rarely appearing in the household or residential units. Realizing this, the public's knowledge on green building is one of the key factors to allow the smooth implementation of household or residential green building in a rapidly developing country. Therefore, the main purpose of this research is to understand the public concerns and participation on household or residential green building development in Indonesia, Malaysia and Thailand respectively. We believe that by observing the public concerns on this matter and further analyzing the data collected scientifically could allow us to understand the hidden barriers in implementing the household or residential green building in Indonesia, Malaysia and Thailand. Meanwhile, we have compared and analyze the opinions of the people in these three countries, and explore the commonalities and differences of public opinions on the development of green buildings in developing countries. We hope that via looking this issue from different perspectives and in different country could give us a clear revelation about the strategy to widely implement the household or residential green building in developing countries. In short, the ultimate goal of this research is to increase the public attentions and interests to implement green building design and construction at their home in the near future.

### **Keywords**

Residential Green building, Developing country, Community perceptions, Green building knowledge, satisfaction

### **Introduction**

In recent years, environmental issues such as climate changing, energy crisis, and increasing of environmental pollution have attracted global attention. Among various

industries, the construction industry “contributes” a lot to these environmental issues. According to International Energy Agency (IEA) the construction and development are responsible for nearly half of the total energy consumption in the world, and the greenhouse gases from the buildings are substantial as well (Hamilton et al, 2020).

Since 1990s, various measures have been taken to minimize the impact of construction on the environment, and many sustainable development approaches have been introduced to improve quality of life of future and the current generation. For instance, the Maastricht Treaty 1992, Rio Earth summit 1992, Kyoto conference on Global warming 1997, Johannesburg Earth Summit 2002 and Washington Earth Observation Summit 2003 were introduced as a guideline for the sustainable development in the past 30 years (Foo, 2013).

More specifically, in order to achieve sustainable development goals in the construction industry, the green building concept was introduced decades ago. Green building, which refers to sustainable or high-performance construction that builds structures through procedures that are environmentally conscious and energy-efficient across the life cycle of a building from implementation to installation, construction, operation, maintenance, remodeling, and demolition, which plays an important role in achieving the goal of sustainable development in terms of protecting the environment and improving the quality of human life. According to the brief market report drafted by U.S. Green Building Council, Malaysia and Thailand had a total number of around 5 million sqm of certified and registered green building projects, while Indonesia only had 1 million sqm of certified green building. Meanwhile, the most developed country in ASEAN, Singapore with area which is about 2,600 times smaller than Indonesia had around 4 million sqm of certified green building that meets the US green building accreditations (US GBC, 2022). In other words, this scenario indicates that Malaysia, Thailand and Indonesia are lagging behind in green building development despite the huge potential market that exist in these developing countries. Some experts from ASEAN also argued that the main driving factor for this situation is that the developers and local tenants being uncertain of the return and benefits associated with green building (Diyana & Abidin, 2013).

Many previous research show that the impact of building construction and operational transformation are significant as environmental impacts are expected to increase with population growth and affected other factors such as demographic and economic factors (Zuo & Zhao, 2014). In other words, the effect of building construction transformation will be greater in rapidly developing countries than in developed countries because of the differences in levels and scale of development. Nowadays, the benefits of green building construction have been well recognized worldwide and it has been greatly implemented in developed countries. As the strong powers among developing countries in South East Asia, green building development in Malaysia, Indonesia and Thailand should not be left behind either, despite there are some loopholes to be rectified in the implementation. In short, while commercial buildings have always been the main focus of green building development, the sheer number of residential buildings is also a target that cannot be overlooked as well and this research is structured to understand the public concerns and participation on household or residential green building development in Indonesia, Malaysia and Thailand respectively. We believe that by

observing the public concerns on this matter and further analyzing the data collected scientifically could allow us to understand the hidden barriers in implementing the household green building in Indonesia, Malaysia and Thailand.

Following the introduction, an overview of green building development in Malaysia, Thailand and Indonesia are explained briefly. Then, the methodology applied in the study is described. In the results and discussion, the status of public satisfaction with places of residence, green building-related knowledge and willingness to implement green buildings will be reviewed, challenges and potential improvement measures will also be discussed. Finally, the study will be concluded along with the limitations and recommendations for future research.

## **Green Building Development in Malaysia**

In Malaysia, there is growing public awareness and concern about how green buildings can impact the environment and the energy conservation. Currently, the sustainable development of the construction industry relies on the involvement of local authorities, professional bodies and private companies. According to the latest 2023 Malaysian federal budget, under the Green Technology Financing Scheme (GTFS), Malaysia government will establish a fund amounting up to RM3 billion to promote the adoption of green technology. As a developing country, Malaysia is beginning to realize that a greener construction industry is seen as an integral and important contributor to reducing carbon footprint and emissions as well as the national development.

The Architectural Association of Malaysia (PAM) organized the Green Design Forum in January 2009 to introduce the Malaysia Green Building Index (GBI). This was prompted by the local construction industry's acknowledgement of the necessity for a green rating tool that could aid in improving and adapting to the tropical climate of the country. The Green Building Index (GBI) was developed using other international rating systems such as BREEAM (Building Research Establishment Environmental Assessment Method) and LEED (Leadership in Energy and Environmental Design), and has since been revised to suit the unique climate conditions of Malaysia. As an exhaustive rating system and environmental assessment tool, it is utilized to evaluate the environmental design and performance of buildings in Malaysia.

In Malaysia, more than 1115 registered Green Building Index (GBI) projects have been constructed to date. For instance, Merdeka 118, located in Kuala Lumpur, is expected to be completed in February 2023, and will become Malaysia's first building to meet the triple green building platinum accreditations both locally and internationally, namely GBI, Green Real Estate (GreenRE), and LEED, as well as obtaining WELL certification. In another global study looking at the performance of green building development in different countries and taking into account LEED certification, Malaysia has a total of 4,664,812 square meters of LEED certified green building projects (US GBC, 2022). It might sound quite a lot, but in fact the certified green building projects only occupied about 5% of the total site area of the Malaysia international airport (KLIA). This implicates that sustainable building development in Malaysian neighborhoods is still relatively low at the moment. The sustainable construction projects in Malaysia are mostly at the pioneering stage, which means that the Malaysian

construction industry still has a long way to go before it can become more sustainable. (Zainul, 2009).

## **Green Building Development in Indonesia**

Indonesia's membership in the World Green Building Council (WGBC) is facilitated through the registered institution, the Green Building Council Indonesia (GBCI). Founded in 2009 by prominent professionals and companies in the Indonesian building industry, the Green Building Council Indonesia is an independent, non-profit organization with the aim of transforming the industry into a more responsible and sustainable one. The organization operates four key programs, which include rating development, training and education, green building certification, and stakeholder engagement.

GBCI employs the GREENSHIP certification system, which is a point-based system developed by the Green Building Council Indonesia in 2009 using GREENSHIP Rating Tools. The certification process encompasses six criteria: appropriate site development, energy efficiency and conservation, water conservation, material resources and cycle, indoor health and comfort, and building environment management. Buildings that utilize GREENSHIP can achieve certification levels ranging from bronze to silver, gold, and the highest level of platinum, depending on their level of achievement. The rating commission of the Green Building Council Indonesia developed GREENSHIP, with support from the World Green Building Council. This comprehensive rating scheme is the first of its kind to evaluate the environmental design and performance of buildings in Indonesia. GREENSHIP was specifically tailored to suit the local market, taking into account the unique environmental and developmental context, cultural and social needs, and tropical weather conditions of the region.

The green building movement in Indonesia is a relatively recent development, with the establishment of the GBCI in 2009 playing a crucial role in its advancement. Despite its recent inception, the GBCI has made significant efforts to promote sustainable building practices. In 2016, only 16 buildings were awarded GREENSHIP certificates by the council (Wimala et al., 2016). However, the number of certified buildings increased significantly in 2019, with 49 buildings receiving certification. It is worth noting that the certification is concentrated primarily in the Jakarta metropolitan area (Hamonangan, 2019).

According to a study by Wimala et al. (2016), the primary obstacle to the green building movement in Indonesia is the insufficient comprehension of the concept by building occupants and other stakeholders. This critical issue can lead to other problems, such as challenging implementation, lack of awareness, neglect, and resistance to adopting a new green lifestyle.

## **Green Building Development in Thailand**

Amid the situation of climate change and environmental crisis, sustainable, energy saving and/or Green Building become part of the main approach in real estate, building and construction industry. Nevertheless, Thailand is not yet part of the World Green Building Council (WGBC). Similar to Malaysia and Indonesia, Thailand also have own Green Building

Index, focusing on energy and environmental factor and aim to raise awareness of Thais on the sustainable green buildings, so called TREES or Thai's Rating of Energy and Environmental Sustainability which developed by Thai Green Building Institute in 2008, and later received joint contribution from The Association of Siamnese Architects under the Royal Patronage of His Majesty the King and Engineering Institution of Thailand. Though, there are only around 12 buildings that are certified with TREES from 74 registered project. In Thailand, LEED (Leadership in Energy and Environmental Design) and Green Mark are also utilized for certifying green buildings. LEED was first introduced in 2007, while Green Mark was introduced a year earlier in 2006. As of Lohmeng et al. (2017) report, more than 113 buildings have been certified by LEED, while three buildings have been certified by Green Mark.

However, the development of Green Building approach is still facing several issues, significantly limitation of Green Building construction technologies and material, and financial pressure and high cost which led to the unmotivated notion of construction of Green Building of the estate owner. Lack of support from the government is also the mentioned issue apart from the government attempts to promote Green Buildings through TREES certification (Shen et al., 2018). Furthermore, we still see very limited number of concrete example or criteria of Green Building approach in the household residential landscape in which this project will aim to explore and further discuss.

## **Methodology**

In general, according to the briefly introduction above, even though policies related to green building are gradually improving and more and more emerging commercial buildings are being built in a way that meets green building standards, but the development of residential green buildings is still not popular due to various of reasons. Therefore, this research tries to assess the level of knowledge of green building concepts in the community, understand the community satisfaction on their place of residence, identify the barriers and willingness in adoption of household green building concept in Malaysia, Indonesia and Thailand.

In this study, respondents were randomly selected from the public in three countries, and the method of data collection was an online questionnaire. All questionnaires were sent to respondents via social media platforms.

The survey questionnaire form consists of three following parts:

- Part A: Respondent background – 10 questions
- Part B: Awareness and knowledge of green building (Quiz) - 10 questions
- Part C: Community satisfaction on their place of residence and living quality – 5 questions
- Part D: Barriers/Willingness in adoption of residential green building concepts – 9 questions

Responses from respondents were tabulated and statistically analyzed. During the data analysis, the respondents were analyzed in three groups based on the country in which they

lived. This classification enables comparisons among citizens of the three countries, who may have different perceptions on the implementation of the green building concept.

## **Results and discussion**

### **1. Respondents' details**

**Indonesia:** From Indonesia, 116 respondents participated, with 62% of them female. Most respondents (48%) come from the youth age group, 17-25 years old, while the remaining 26% are 26-35 years old. In terms of educational background, most of the respondents were finishing their bachelor's degree (61%) then 26.7% had already completed at the postgraduate level or above. Half of the respondent's work/study is related to the environment. In terms of Living area, most of the respondents live in metropolitan city areas, and 32% live in suburban areas. Most of the respondents live in bungalows and Terrace houses with the same percentage, namely 39% each. These two types of buildings are widespread in Indonesia. Over 44% of the respondents' places belong to their parents/family, while 22 % and 29% rent and own the home by themselves. 37% of respondents already live there for over ten years, while the others have lived less than one year (25%) and less than five years (24%).

**Malaysia:** In terms of demographic profile of the respondents, 131 respondents, 74 respondents were male (56.5%), 55 respondents were female (42%), and 2 respondents did not disclose their gender. When age was analyzed, 85.5% were within 17-35 years old, the remaining 14.5% of the respondents were all older than 35 years old. Among the respondents, 72.5% of respondents have tertiary and above education qualification, 14.5% of respondents have a level of education diploma and the rest of the respondents have a secondary education level or below. Only 16.8% of the respondents have work or education background related to environmental protection and environmental greening. The majority of respondents live in cities (74%). In terms of place of residence, 45.8% of respondents from Malaysia were living in terraced house, and 30.5% were living in high-rise apartments. Most of these places of residence belong to the occupant's family (48.1%), more than a quarter (26.7%) of the respondents were renting the space and only 13.7% of them were living in self-owned housing. In general, the building age of the respondents' place of residence between 21-50 years were highest with 32.8%, and the building age less than 20 years consisted 51.9% of respondents. In addition, 57.2% of respondents indicate living in their current place of residence less than 5 years, whereas the remaining 42.8% have lived in their current place for more than 5 years.

**Thailand:** From the number of 62 respondents, 40 respondents were female (64.5%) while 22 of the respondents were male (35.5%). In terms of age group, 27.4% are between 26-35 years old, following by 25.8% with 36-45 years old, 21.0% with 17-25 years old, 19.4% with 46-55 years old, and 6.5% of the respondents are above 56 years old. Majority of the respondents with 61.3% has highest education of Bachelor Degree or equivalent, following by Postgraduate degree or above at 33.9%. Only 2 respondents (3.2%) have Secondary Level or equivalent education background and 1 respondent (1.6%) is from Vocational collage. While the respondents of 72.6% are working in private sector and 16.1% are student, most of their

work or education were not environmental protection and environmental greening (74.2%). Only 25.8% work or study in relation to the environmental sector. The respondents of 61.3% reside in the Metropolitan area, while 35.5% live in suburban area and 3.2% live in rural area. Looking at type of residence, the number of respondents who dwelling Bangalow or single-family housing type and Terraced house are equal at 27 respondents (45.3%). 11.3% of the respondents live in Apartment/Condominium and 1.6% live in other type of residence. Most of the residence are belong to the respondents' parents with 46.8%, while 38.7% own the residence. Only 11.3% of the respondents rent their house and 3.2% stated as others. Regarding the building age 33.9% are at around 21 -50 years old, and 27.4% are 5 to 10 years old. Both buildings of Less than 5 years old and 11-20 years old are rated at 16.1%. Only 3.2% are above 50 years old and another 3.2% of the respondents are not sure about their residence building's age. Lastly, over 31 respondents (50%) have been living in their current home for more than 10 years, while 32.3% live for around 1-5 years. 12.9% of the respondents have been living for 6-10 years and only 4.8% live in their house for less than a year.

## 2. Knowledge and Awareness level of green building concept

We tested the knowledge and awareness of the respondents regarding green buildings with several questions. The questions are in multiple-choice form. To test respondents' knowledge by asking questions related to green building and other related matters such as energy-saving practices. Meanwhile, to test respondents' awareness of green buildings, we tried to ask questions directly related to the green building certification system. Adjustments were made to questions for each country in asking these questions. Some questions are specific to a particular country, Indonesia, Malaysia, or Thailand. For example, the questions about the certification system in each country were different in each country's quiz. We classify the level of public knowledge and awareness into five levels, namely: (0-20) = very low, (21-40) = low, (41-60) = moderate, (61-80) = high, (81-100) = very high.

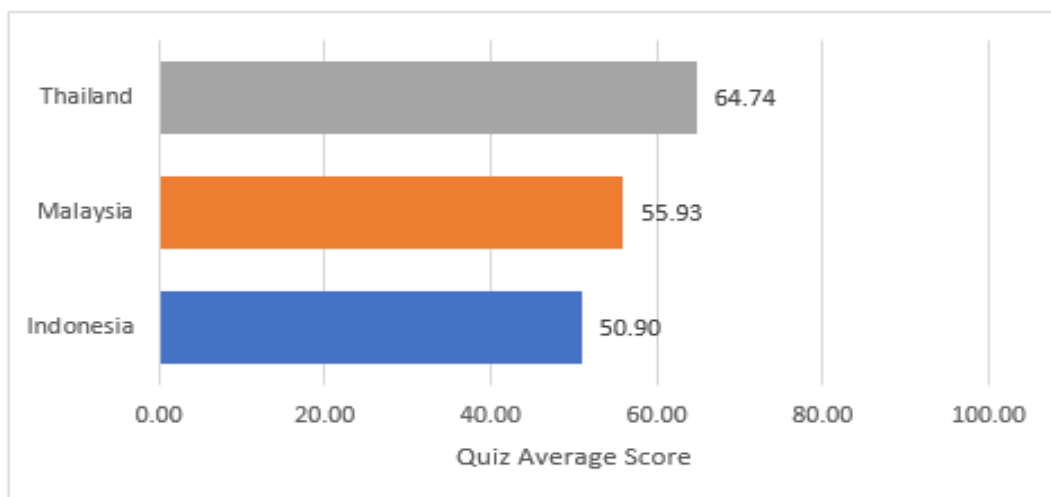


Figure 2.1 The average score obtained by respondents from each country

To find out the respondents' knowledge level in general, we calculated the average value obtained by respondents from all the questions asked. The analysis results of the average

value obtained are shown in Figure 2.1. The highest score was obtained by respondents from Thailand, while respondents from Indonesia received the lowest average score. It indicates that Indonesian and Malaysian respondents' knowledge of green building, in general, is still at a moderate level. In comparison, respondents' knowledge level in Thailand is at a reasonably higher level.

Next, we calculate the average score of several questions related to green building certification separately to indicate the respondent's awareness. Three questions cover green building criteria, green building certification system, and residential green building certification. From these questions, the percentage of respondents who answered correctly was relatively high in the three countries, as shown in Figure 2.2. It indicates that most respondents are aware of/have heard of green building certification. Both respondents from Indonesia, Malaysia, and Thailand have a reasonably high level of awareness regarding the green building certification systems in their respective countries.

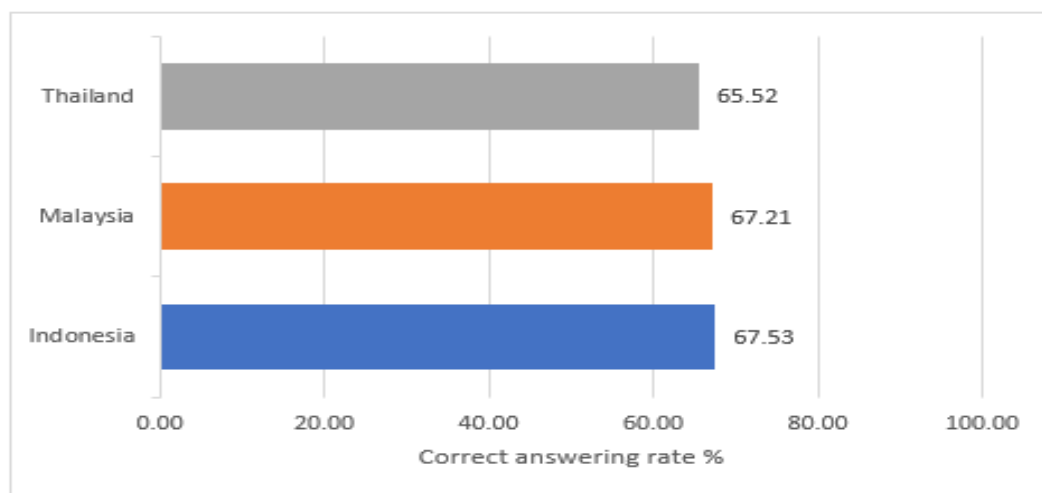


Figure 2.2 The correct answering rate of the question related to the residential green building certification.

### 3. Public satisfaction with their place of residence

This section aims to assess the respondent's satisfaction with their resident, living habits, and quality of life in relation to green building implementation and environmental protections. The overall satisfaction trend of 3 countries in figure 3.1 reveals that most of the respondents were relatively satisfied with their place of residence.



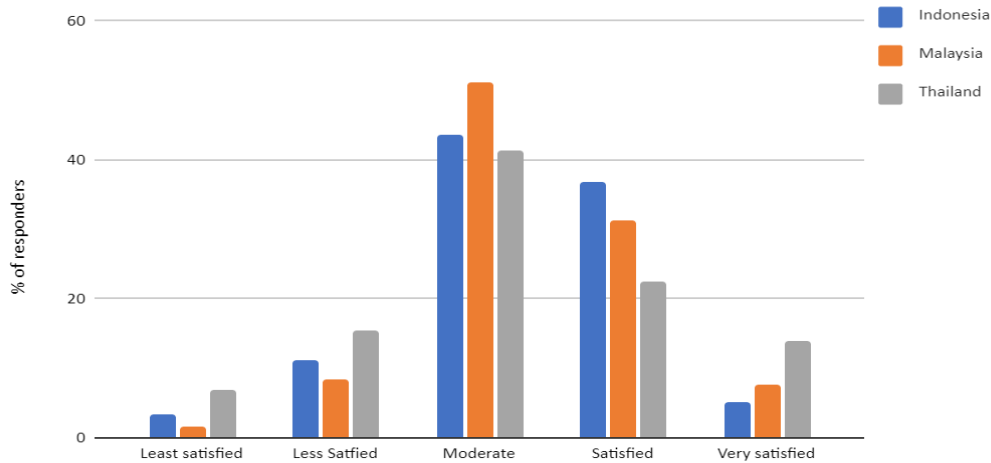


Figure 3.1 Community Overall Satisfaction on their place of residence and living habits. Very satisfied indicates the respondents are satisfied with their residence and living habits whereas least satisfied indicates the opposite.

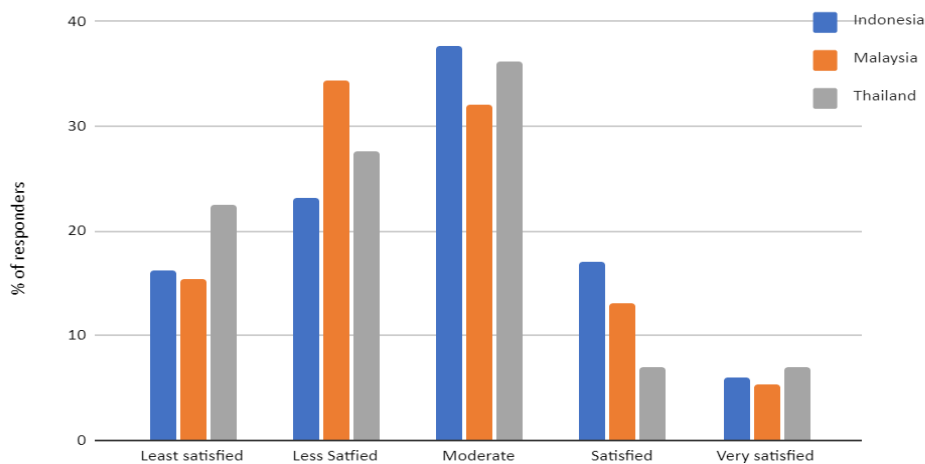


Figure 3.2 Community Satisfaction on the uses of Green/ Smart technologies in their residents. Very satisfied indicates the respondents are satisfied, whereas least satisfied indicates the opposite.

However, looking at the specific rating, in this case, on the use of Use of Smart/Green technology, presented in figure 3.2, which can reflect the implementation of green building technologies in residential level of the 3 countries. we may see at first glance that the trend is leaning toward “least satisfied”. Looking at each country, started with Indonesia, though over 30% of the respondents have moderate satisfaction, over 20% feel less satisfied and over 10% feel least satisfied. In contrast, the respondents who rated “very satisfied” is less than 10%. Overall, the Indonesian (mean=2.74) are generally feeling moderate with the uses and application of Smart/Green technology. At the same time, Malaysia has the highest rate of “less satisfied” respondent of over 34%. Around 32% of the respondents feel moderate and 15.3%

are least satisfied. The respondents who rated “Satisfied” and “Very Satisfied” were only at around 13% and 5% respectively. Overall, the Malaysian with the mean score at 2.59, feels moderate, however, leaning more toward unsatisfied comparing to the Indonesian. Lastly, Thailand, which the majority of the respondents of around 36% rated “moderate”. Only around 7% of the respondents answer “satisfied” or “very satisfied”. On the other hand, over 27% and 22% of the respondents answer “less satisfied” and “least satisfied” respectively. Similar to the Malaysian, Thais (mean=2.51) generally feel moderate, but the trend is leaning toward unsatisfied.

#### 4. Barriers and willingness to adopt residential green building concepts

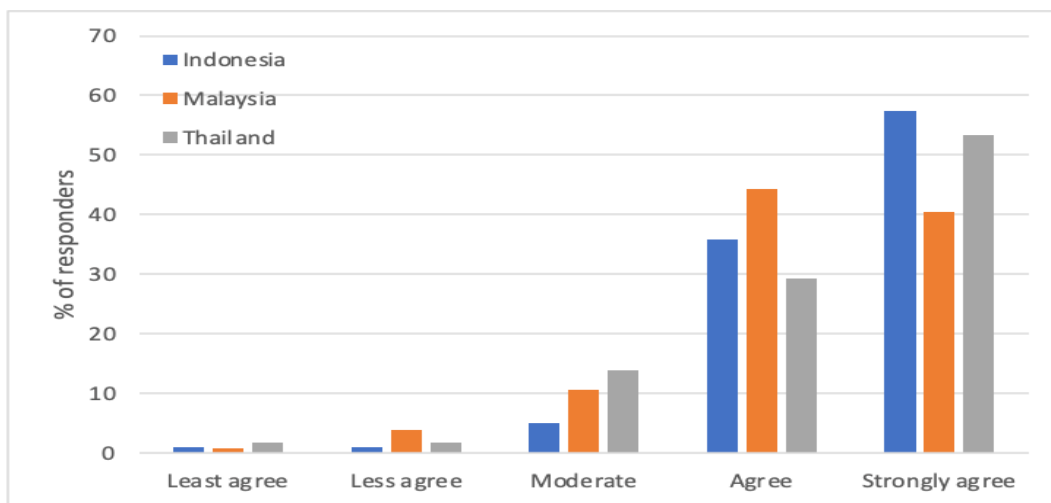


Figure 4.1 Community perceptions on the benefits of green buildings. Strongly agree indicates the respondent believes that green buildings will bring benefits to residents, whereas least agree indicates the opposite.

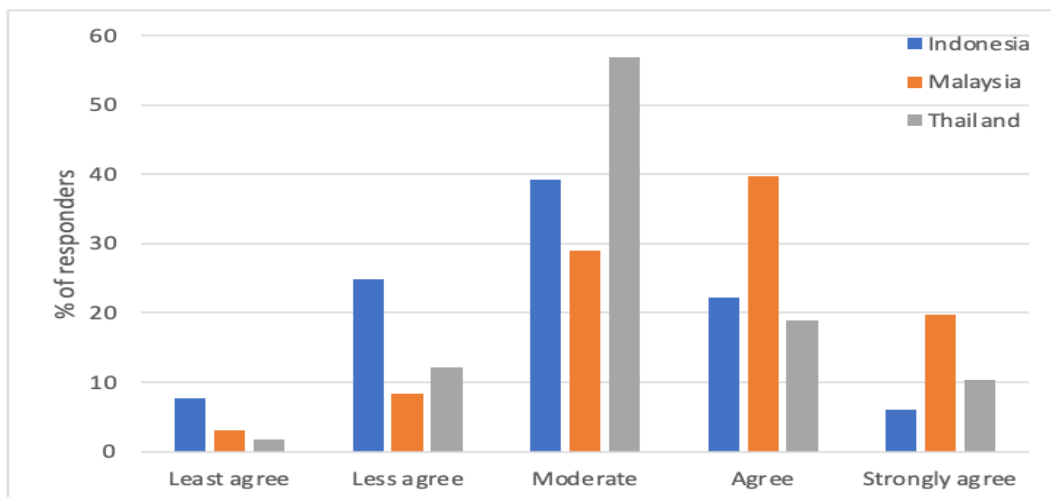


Figure 4.2 Community perceptions on the difficulty of implementation of green buildings. Strongly agree indicates the respondent believes that green buildings be difficult to implement locally, whereas least agree indicates the opposite.

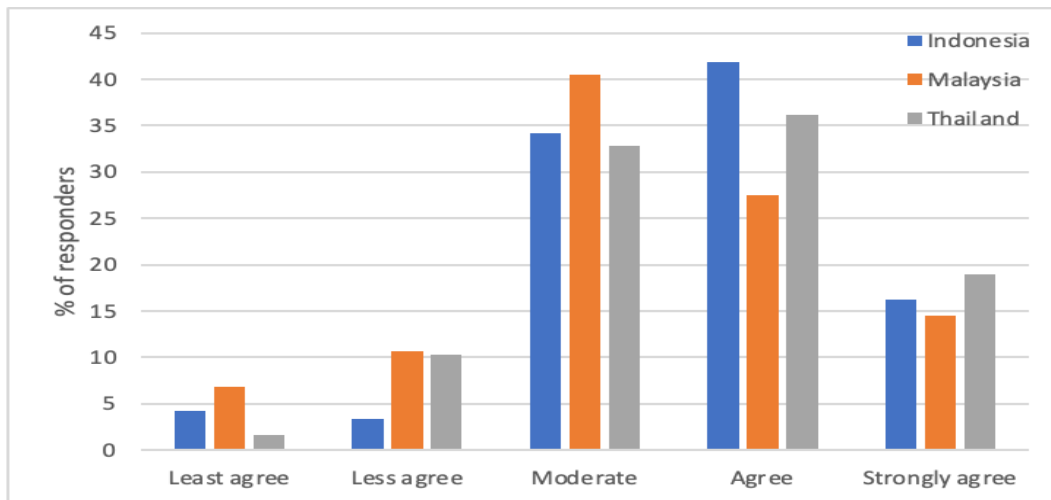


Figure 4.3 Community willingness to pay an additional 10% of the cost to implement green buildings. Strongly agree indicates the respondent are more willing to pay, whereas least agree indicates the opposite.

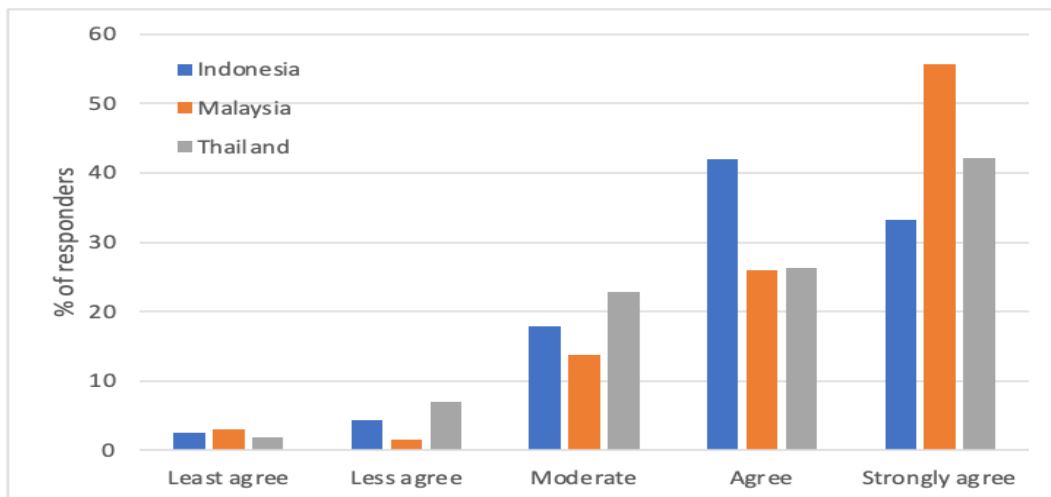


Figure 4.4 Community perceptions on the sufficiency of education and promotion related to green buildings. Strongly agree indicates the respondent believes there is a lack of education and promotion related to green buildings locally, whereas least agree indicates the opposite.

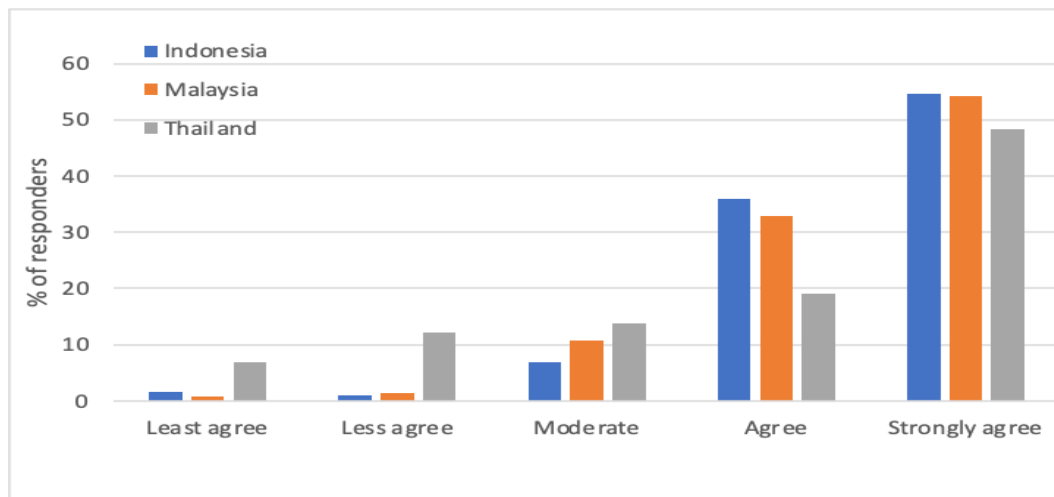


Figure 4.5 Community perceptions on the responsible party for the development of green buildings. Strongly agree indicates the respondent believes that government and developers play important role in developing green buildings locally, whereas least agree indicates that the development of green buildings should be the responsibility of individuals

One of the main goals of the study was to understand the reason for the lower degree of green building development in developing countries compared to developed countries. From the assessment of green building awareness, and the community perceptions on the benefits of green buildings presented in Figure 4.1 show that the residents in Indonesia, Malaysia and Thailand generally equipped with certain amount of green building knowledge and they all highly believe that green buildings can bring various benefits to the residents. Among them, Indonesians have the best impression of green buildings, but what is interesting is that Indonesians also scored the lowest in green building awareness assessment. As demonstrated in Figure 4.2, both Malaysians and Thais with higher awareness levels find it difficult to implement green buildings compared to Indonesian. This may indicate that after a deeper understanding of the benefits that green buildings can bring to residents, residents may want to have a greener home, but they encounter difficulties in the process of practice, which leads to residents having such contradictory mentality.

By analyzing whether the respondents from different countries would like to live in green buildings in the future, the mean score for the question was identified. (mean score > 4; strongly agree). Indonesian (mean=4.32) takes the first rank among all the others. Then, it is followed by Thais with a mean score of 4.14 and Malaysian (mean=3.87). Similar trend was demonstrated in Figure 4.3 as well; whether residents are willing to pay 10% additional cost to live in green buildings; Indonesians were most willing to pay, followed by Thais and Malaysians. When discussing why residents are unwilling to pay extra costs to live in green buildings that they believed will bring benefits to them, our team found that the lack of promotion and education on green buildings may be one of the factors. Figure 4.4 presents that more Malaysians who think green building implementation is difficult and are unwilling to pay more to live in green buildings think that the promotion and education of green buildings in their country is insufficient compared to Thais and Indonesian. While Figure 4.5 indicate that

most of the Indonesians and Malaysians were strongly agree that government and developers should play crucial role in development of green buildings such as providing more options for home buyers and introducing more practical methods to attract residents to own a green building. But in comparison, although Thais (mean=3.89) also generally agree that the government and developers play an important role in the development of green buildings, their approval rate are not as high as those of Malaysia and Indonesian. The reason behind this is also a topic worthy of being explored in the future.

The overall trends from this study may reveal that although after years of environmental education and promotion, people in developing countries may already have a certain awareness regarding green buildings, and most of the residents also would like to live in green buildings. However, the lack of actual promotion, such as the actual explanation of the return on investment of green buildings, and the fact that the government and developers did not provide green buildings option to home buyers have caused the development of green buildings to stagnate.

Therefore, as from this study if the development of green buildings is expected to be smoother, the relevant authorities may need to use some more practical benefits and improve the promotion strategies to boost the development of green buildings locally.

## **Conclusions**

This study presents the outcomes of a questionnaire survey conducted in Indonesia, Malaysia, and Thailand regarding the level of awareness of the green building concept, community perceptions of satisfaction with their current place of residence, and barriers to green building development. Several key findings were made during the study:

1. Even though the level of factual and conceptual green building knowledge of Malaysian and Indonesian respondents is moderate, they have a high level of awareness about green building certification system. In comparison, Thais respondent has both high level of green building knowledge and high level of awareness about green building certification system.
2. Looking at all collected data, the majority of the respondents from all 3 countries generally have moderate satisfaction, leaning toward satisfied in their residential buildings, related to the satisfaction in general utilities bills, implementation of green building technologies and environmental protection practices.
3. The majority of respondents from all three countries (86.9%) were believing that green buildings will benefit the residents, and 75.8% of them were willing to live in a green building in future. However, Malaysians and Thais with higher awareness regarding green building compared to Indonesians, were expressed about the local implementation of green building is more difficult.

4. Respondents from all countries agree that there is a lack of promotion and education about green building concept and people also generally agree that the government and developers should provide more options and measures to boost the development of green buildings locally.

As conclusion, the outcomes of the study can be used for decision-making regarding green buildings. In other words, the results obtained in this study can help local authorities or developer companies plan residential green buildings not only due to environmental factors but also taking into account public perception.

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