Barriers of implementing sustainable housing in Malaysian residential property sector

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Abstract. Designing and constructing sustainable housing by changing its design, construction and operation could help in reducing resource consumption and mitigate climate change. However, it is found that there are barriers impeding the implementation of sustainable housing. This research aims to determine such barriers in Malaysian residential property sector. A questionnaire was designed and distributed to the key stakeholders (i.e. engineers, real estate agents, contractors and home buyers) in Malaysia. This questionnaire asked the respondents to rate the relative importance of 21 barriers which were categorized into four key categories (i.e. design and technical barrier, economic barrier, institutional barrier and socio-culture barrier). The results showed that economic barrier is the most critical category among the four categories of barriers. Out of the 21 barriers, the top critical barrier is high capital/investment cost. This research identified the importance of different barriers based on the perceptions of and experiences of the respondents. While most studies focused on the professional stakeholders or home buyers, there are only few studies dedicated to the combination of the perceptions for both professional stakeholders and homebuyers in Malaysia. This research could contribute to both the knowledge and practices of sustainable housing implementation in Malaysia.

1. Introduction

Triple bottom lines requirements (i.e. social, economic and environmental aspects) are essential for sustainable housing, in the design, construction and operation stage [1, 2], in the early days. Recently, some researchers explored that sustainable housing could be defined as residential property which is ecologically suitable, flexible, long-lasting, resource efficient and can ensure occupants’ comfort as well as health and safety [3-5].

Previous studies had proved on the advantages of sustainable housing in terms of the occupants comfort and energy efficiency [6]. A study supported this notion by stating that sustainable housing could have obvious outcome to the house owners by enhancing the environment and air quality of the house [7]. Despite the evidences on its advantages, houses with sustainability features are not widely adopted in Malaysia [8].

The adoption of sustainable housing in Australia, Germany, and Sweden are evidenced with the support from government and the positive return on investment [6, 9, 10]. However, there is little-to-no evidence on the adoption of sustainable housing in Malaysia. The Green Building Index (GBI), a rating tool utilized in Malaysia are mainly focusing on the commercial building instead of the
residential property [11]. Therefore, it seems to be a research gap on the implementation of sustainable housing in Malaysian residential property sector.

The aim of this paper is to determine the barriers of implementing sustainable housing in Malaysian residential property sector. This research focuses on both supply chain agents and demand-side stakeholders in the property sector, to provide a complete picture on the opinions of both supply and demand stakeholders. It is worth noting that the supply chain agents recruited in this research only consist of engineers, real estate agents and contractors. These three groups of supply chain agents were recruited as engineers involved in the design of the houses, contractors involved in the construction stages, and real estate agents involved in selling houses to the home buyers.

2. Identification of potential barriers
Multiple studies had examined on the barriers that affect the implementation of sustainable housing. For instance, [12-15] discussed on the barriers of sustainable construction implementation through the interview and/or questionnaire survey methods with the supply chain agents, such as contractors, consultants, architects, quantity surveyors etc. [16] provided a thorough literature review on the key barriers of green building adoptions. However, most of the studies were carried outside Malaysia (such as Ghana and Finland) and did not combine the perspectives of supply chain agents and demand side stakeholder (i.e. home buyers). The barriers extracted from the literature review were summarized in Table 1. Twenty-one barriers were identified from the main literatures.

Table 1. List of identified barriers from literature review

| Identified barriers | Literature |
|---------------------|-----------|
|                     | 1 2 3 4 5 6 7 8 |
| Lack of professional expertise in sustainability | ✓ ✓ ✓ ✓ |
| Lack of knowledge on sustainability technologies | ✓ ✓ ✓ ✓ ✓ |
| Lack of experts in operating sustainable related technologies | ✓ ✓ ✓ ✓ ✓ ✓ |
| Complexity in pre-project planning | ✓ |
| Lack of green building measurement rating tools/program | ✓ ✓ ✓ ✓ |
| High capital/investment cost | ✓ ✓ ✓ ✓ ✓ ✓ |
| Lack of proper property valuation system on sustainability | ✓ |
| Market competition hold back sustainability adoption | ✓ |
| Lack of financial incentives | ✓ ✓ ✓ |
| Ineffective mortgage system/financial mechanism | ✓ ✓ |
| Long period of return of investment | ✓ ✓ ✓ |
| Lack of government incentives | ✓ ✓ ✓ ✓ ✓ ✓ |
| Resistance to change | ✓ |
| Slow process in certificating and policy approval for construction sustainable housing | ✓ |
| Lack of institutional cooperative consciousness collaborations | ✓ ✓ ✓ |
| Lack of education and training | ✓ ✓ |
| Lack of public awareness and interest on sustainability | ✓ ✓ ✓ ✓ ✓ ✓ |
| Lack of understanding on the sustainability trend in the current business | ✓ ✓ |
| Challenges in changing exiting customers’ mindsets | ✓ |
| Lack of end users demand | ✓ ✓ ✓ |
| Lacked of knowledge on benefits of sustainable practices | ✓ ✓ |

Note: 1 = [12]; 2 = [13]; 3 = [14]; 4 = [15]; 5 = [8]; 6 = [17]; 7 = [18]; 8 = [16]
3. Research methodology

3.1. Development of questionnaire

The targeted populations were supply chain agents (i.e. engineers, real estate agents, and contractors) and demand-side stakeholder (i.e. home buyers) who play important roles in implementing sustainable housing in Malaysia. The data collection method was questionnaire survey. Due to the limitation of time, this quantitative research method was adopted to ensure that the data could be collected and analyzed completely.

The main questions in the questionnaire was requiring the respondents to rate the relative importance of 21 barriers which were categorized into four key categories (i.e. design and technical barrier, economic barrier, institutional barrier and socio-culture barrier). These questions were presented in the Likert scale, with 1 being not impacting at all to 5 being strongly impacting. Table 2 showed the classification and the abbreviations allocated for the 21 barriers.

| Code | Barriers                          |
|------|-----------------------------------|
| DT   | **Design and technical barriers** |
| DT1  | Lack of professional expertise in sustainability |
| DT2  | Lack of knowledge on sustainability technologies |
| DT3  | Lack of experts in operating sustainable related technologies |
| DT4  | Complexity in pre-project planning |
| DT5  | Lack of green building measurement rating tools/program |
| E    | **Economic barriers**             |
| E1   | High capital/investment cost      |
| E2   | Lack of proper property valuation system on sustainability |
| E3   | Market competition hold back sustainability adoption |
| E4   | Lack of financial incentives      |
| E5   | Ineffective mortgage system/financial mechanism |
| E6   | Long period of return of investment |
| I    | **Institutional barriers**        |
| I1   | Lack of government incentives     |
| I2   | Resistance to change              |
| I3   | Slow process in certificating and policy approval for construction sustainable housing |
| I4   | Lack of institutional cooperative consciousness collaborations |
| I5   | Lack of education and training    |
| I    | **Socio-cultural barriers**       |
| SC1  | Lack of public awareness and interest on sustainability |
| SC2  | Lack of understanding on the sustainability trend in the current business |
| SC3  | Challenges in changing exiting customers’ mindsets |
| SC4  | Lack of end users demand          |
| SC5  | Lacked of knowledge on benefits of sustainable practices |
3.2. Data collection method
The data collection was conducted from 1st July 2019 to 1st September 2019, and approached the targeted respondents through face-to-face visitation or email. The targeted participants were real estate agents, contractors, engineers and home buyers. These supply chain agents were identified through Construction Industry Development Board (CIDB), and the Google search. The home buyers were identified through the author’s connections as well as the real estate companies.

The questionnaire was distributed to 200 targeted participants through email (180 participants) and face-to-face visitation (20 participants). There were 28 valid responses (i.e. 14% response rate) received and used in the data analysis.

4. Results and discussions

4.1. Demographic details
Fifty per cent of the respondents (14 respondents) were engineers, 39% (11 respondents) were home buyers, 7% (two respondents) were contractors and 4% (one respondent) was real estate agents. This seems to indicate that majority of the respondents were engineers and home buyers, with minority (11%) of the respondents were contractors and real estate agents. Hence, this paper had classified the respondents into three groups (i.e. G1 – Engineers, G2 – home buyers, G3 – real estate agents and contractors).

For experience in the construction industry, 82% of the respondents (23 respondents) have less than 5 years of experience and 14% (four respondents) with experience of 6-10 years. There was one respondent who worked as contractors (i.e. G3) had the working experience of more than 20 years. This seems to support the results obtained in G3 as one of the respondents is quite experienced.

4.2. Key categories of the barriers in sustainable housing implementation
The respondents were asked to rank the importance of four key categories barriers from the scale 1 to 4, with 1 being least important to 4 being most important (see Table 3).

The result showed that economic barrier (E) was ranked as the most important barrier among the four key categories of barriers, with the mean value ranging between 3.10 and 3.67 among different group of respondents. This seems to indicate that the stakeholders may presume that the cost of sustainable housing is higher compared to the other normal housing, and/or it may take longer period of time for the return of investment. According to [19], the real estate market perceived a premium price be achieved for the building with high sustainability features. However, this discussion was related to the commercial building. Research carried out by [9, 10, 20] showed that sustainability features had a positive impact on the selling and/or rental price of the residential properties, as well as comparatively shorter listing period in the real estate market. Hence, the economic barrier could be an arguable barrier if more evidence could prove that the cost of investing in sustainable housing is reasonable and the return on investment (in terms of selling/renting price) is positive.

The ranking of design and technical barrier (DT), socio-cultural barrier (SC) and institutional barrier (I) were ranked as second, third and fourth important barriers respectively by engineers (G1), home buyers (G2) and overall group respectively. This seems to imply that the respondents had the similar opinions on the level of importance on all the barriers. Real estate agents and contracts (G3), on the other hand, had the same opinions on all these three barriers, with same mean value and the standard deviation was zero. This may due to the low number of respondents in this group (G3), which leads to the similar rankings on these three barriers.
Table 3. Mean, standard deviation and ranking of key categories of barriers in sustainable housing implementation

| Categories | Overall | G1 | G2 | G3 |
|------------|---------|----|----|----|
|            | Mean    | SD | Rank | Mean | SD | Rank | Mean | SD | Rank |
| DT         | 3.04    | 0.53 | 2   | 3.08 | 0.64 | 2   | 3.00 | 0.47 | 2   | 3.00 | 0.00 | 2   |
| E          | 3.36    | 0.70 | 1   | 3.50 | 0.67 | 1   | 3.10 | 0.74 | 1   | 3.67 | 0.58 | 1   |
| I          | 2.70    | 0.95 | 4   | 2.69 | 0.94 | 4   | 2.56 | 1.13 | 4   | 3.00 | 0.00 | 2   |
| SC         | 2.78    | 0.64 | 3   | 2.86 | 0.54 | 3   | 2.60 | 0.84 | 3   | 3.00 | 0.00 | 2   |

Notes: G1 – Engineers; G2 – Home buyers; G3 – Real estate agents and contractors
DT – Design and technical barrier; E – Economic barrier; I – Institutional barrier; SC – Socio-cultural barrier

4.3. Barriers of sustainable housing implementation

There were different key barriers under the four categories of barriers. The results of the relative importance of the 21 key barriers were shown in Table 4. High capital/investment cost (E1) was ranked as the most important barriers by engineers (G1) and home buyers (G2), which leads to the highest ranking in the overall group. This seems to be tallied with the findings in Table 3 that economic barrier is the most critical category of barrier. This finding was supported by the literature review finding by [13-16].

The second most important barrier was lack of professional expertise in sustainability (DT1), under the category of design and technical barrier (mean value = 3.93). There is possibility that the respondents’ believed they intend in sustainability but there is a lack of expertise that could construct and/or operate sustainable housing in Malaysia. This ‘vicious circle of blame’ could hinder the adoption of sustainable housing [21]. The home buyers (G2), and real estate agents and contractors (G3) ranked this barrier as the third and second most important barrier respectively. The engineers (G1), interestingly, ranked this barrier in the place of tenth (mean value = 3.77). This seems to indicate that there is a discrepancy of opinions on different groups of stakeholders on the barriers that hinder the implementation of sustainable housing in Malaysia.

The barriers listed under the categories of institutional and socio-cultural barriers seems to be ranked as least important barriers compared to the other two categories. This may indicate that the respondents were not very concern on the barriers listed under institutional and socio-cultural barriers. However, the mean value of the least important barrier (SC2) was 3.30, which seems to indicate that the respondents did considered the importance of all barriers.
actors and real barrier. The two most important barriers were high capital cost, and lack of professional expertise in sustainability: building information files and performance certificate. Queensland University of Technology Australia.

Table 4. Mean, standard deviation and ranking of barriers in sustainable housing implementation

| Barriers | Overall | G1 | G2 | G3 |
|----------|---------|----|----|----|
| DT1      | 3.93    | 1.00 | 2  | 3.77 | 1.01 | 10 | 4.00 | 1.00 | 3  | 4.33 | 1.16 | 2  |
| DT2      | 3.89    | 1.17 | 4  | 3.93 | 1.21 | 4  | 3.91 | 1.30 | 5  | 3.67 | 0.58 | 14 |
| DT3      | 3.61    | 0.99 | 13 | 3.57 | 1.09 | 16 | 3.55 | 1.04 | 12 | 4.00 | 0.00 | 5  |
| DT4      | 3.64    | 1.06 | 12 | 3.43 | 1.02 | 20 | 3.73 | 1.19 | 8  | 4.33 | 0.57 | 1  |
| DT5      | 3.52    | 1.11 | 16 | 3.43 | 0.94 | 19 | 3.55 | 1.29 | 13 | 3.67 | 1.53 | 15 |
| E1       | 4.21    | 0.79 | 1  | 4.29 | 0.75 | 1  | 4.18 | 1.30 | 1  | 4.00 | 1.00 | 8  |
| E2       | 3.41    | 0.84 | 20 | 3.54 | 0.70 | 17 | 3.09 | 1.33 | 19 | 4.00 | 1.00 | 8  |
| E3       | 3.93    | 1.02 | 3  | 3.79 | 1.05 | 7  | 4.09 | 1.04 | 2  | 4.00 | 1.00 | 8  |
| E4       | 3.85    | 1.06 | 6  | 4.00 | 1.00 | 2  | 3.64 | 1.03 | 10 | 4.00 | 1.73 | 13 |
| E5       | 3.52    | 0.85 | 15 | 3.54 | 0.97 | 18 | 3.36 | 0.81 | 16 | 4.00 | 0.00 | 5  |
| E6       | 3.88    | 0.99 | 5  | 4.00 | 1.08 | 3  | 3.60 | 0.84 | 11 | 4.33 | 1.16 | 2  |
| I1       | 3.70    | 0.91 | 9  | 3.92 | 0.95 | 5  | 3.36 | 0.81 | 16 | 4.00 | 1.00 | 8  |
| I2       | 3.54    | 1.03 | 14 | 3.62 | 1.04 | 13 | 3.70 | 1.06 | 9  | 2.67 | 0.58 | 21 |
| I3       | 3.52    | 1.12 | 17 | 3.77 | 0.93 | 9  | 3.00 | 1.18 | 20 | 4.33 | 1.16 | 2  |
| I4       | 3.50    | 0.76 | 18 | 3.57 | 0.85 | 14 | 3.44 | 0.73 | 15 | 3.33 | 0.58 | 16 |
| I5       | 3.44    | 1.00 | 19 | 3.64 | 0.84 | 12 | 3.18 | 1.17 | 18 | 3.33 | 1.16 | 19 |
| SC1      | 3.71    | 0.94 | 8  | 3.79 | 1.05 | 7  | 3.73 | 0.91 | 7  | 3.33 | 0.58 | 16 |
| SC2      | 3.30    | 0.99 | 21 | 3.38 | 0.87 | 21 | 3.00 | 1.18 | 20 | 4.00 | 0.00 | 5  |
| SC3      | 3.64    | 0.95 | 11 | 3.57 | 1.02 | 15 | 3.91 | 0.83 | 4  | 3.00 | 1.00 | 20 |
| SC4      | 3.71    | 0.90 | 7  | 3.86 | 0.77 | 6  | 3.45 | 1.04 | 14 | 4.00 | 1.00 | 8  |
| SC5      | 3.70    | 0.91 | 9  | 3.69 | 0.95 | 11 | 3.82 | 0.98 | 6  | 3.33 | 0.58 | 16 |

Notes: G1 – Engineers; G2 – Home buyers; G3 – Real estate agents and contractors
DT – Design and technical barrier; E – Economic barrier; I – Institutional barrier; SC – Socio-cultural barrier

5. Conclusions
This paper investigated the perspectives of supply chain agents (i.e. engineers, contractors and real estate agents) and demand stakeholder (i.e. home buyers) on the barriers of the lack of sustainable housing in Malaysia. The results proved that the most important category of barrier was economic barrier, followed by the design and technical barrier. The two most important barriers were high capital cost, and lack of professional expertise in sustainability. This paper also proved that there is a discrepancy of opinions between different stakeholders on the importance of the barriers. For example, engineers (G1) and home buyers (G2) ranked high capital cost as the most important barrier, while the contractors and real estate agents (G3) only ranked high capital cost as the 8th most important barrier.

This paper contributed to both the knowledge and practices of sustainable housing implementation in Malaysia. It could serve as the basis for the supply chain agents to look into different barriers when implementing sustainable housing in Malaysia. The home buyers could realize that there are different opinions between different stakeholders and utilize the list of barriers to make informed decision when purchasing a property. The government could come out with mitigation strategies to overcome these barriers.

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