Image Perception of Future Tropical Houses in Thailand

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Abstract

The statistics of Thai family type in the past 25 years reveal that it has a tendency to change from the past. Future home buyers therefore have different requirements to todays. Generation X and Y groups of people represent important home buyers for the near future. This research studied the perceptions of Generation X and Y groups of people on the image of the detached house in the next 10 years. Four samples that presented various roofs and facades from current construction to a more technologically advanced one were investigated with 200 online rating scale questionnaires, 100 for Generation X and 100 for Generation Y client representatives, respectively. It was found that the perceptions towards the image of future house and that of tropical house shared the same direction. The levels of agreement increased according to the new types of building envelope. This was especially true for the building façade, which can be seen more easily than the roof. The trends were found in almost all client representatives regardless of any personal factors. It can be concluded that building envelope has more impact on people's perceptions towards the image of future house and tropical house than personal factors.

Keywords: image, perception, future design, tropical design, detached house

1. Introduction

1.1 The Change of Generation and Living Style

Architecture has always changed according to the social context. In Thailand, statistics show that family type has considerably changed in the past 25 years (1987-2013). Extended family type that consists of multi-generation family members has increased for more than 1.3 times. This tends to be the majority in the future (Peek, Im-em, & Tangthanaseth, 2015). Therefore, the future home buyers will have different requirements to todays. The Thai family situation corresponds to that in foreign countries. In the US, multi-generation families have increased from 12% to 18% in the past 30 years (Fry & Passel, 2014). In Australia, one-fifth of the population lives in multi-families (Liu & Easthrope, 2012). This has increased for 30% in the past 25 years (Easthrope, Liu, Burnley & Judd, 2017).

Today's marketing studies pay particular attention to the groups of Generation X and Y because they have the highest purchasing power worldwide (Burgiel & Sowa, 2017). The focus is on Generation Y or Millennials who present significant ratio of the population (Moreno, Lafuente, Carreon & Moreno, 2017). In fact, they have the maximum number of population today (Smith, 2011). According to an article in the Mortgage Reports, financial and real estate consultancy companies in the US categorize the potential home buyers in the future into 2 groups: Generation X and Generation Y (Chandler, 2017).

Generation X (born between 1961 and 1976) represents the group of people who currently own residential assets at the highest ratio. However, they also present the highest group to buy new home and have tendency to continue buying. The main reason derives from the needs of new residences in the suburbs with larger and more flexible spaces to accommodate the expansion of the family. A Generation X tends to be the head of the family and lives together with the other generations in the same house.

Generation Y (born between 1977 and 1999), on the other hand, mostly buys their first houses. They tend to get married late and therefore live with parents who start to become elderly. However, since they have higher starting income than the former generation, their first houses are large to accommodate future family expansion. The information corresponds to the survey results by US National Association of Realtors. The study on Generation X's and Y's home purchasing behaviors finds that there is a higher demand for multi-generation home. Generation X's buy it to take care of their parents, to save costs and to prepare for their children. Generation Y's also buy it to live with their parents (NAR, 2019).

This investigation focuses on multi-generation house with the target groups of Generation X and Y. To best demonstrate the reality of purchasing power, the target groups have to be 25 years old or more. Therefore, the study selects those who were born between 1961 and 1992 as the actual potential client representatives for further investigation.

1.2 The Trend of Detached House Design

A study of Jareemit, Inprom & Sukseeda, (2016) on housing design in Thailand finds that 2-story detached house is the most popular type among low-rise housing today with the market share of 53%. Most of the design components are found to be similar from one project to another, especially building envelope. Building facades normally do not provide shading to openings and use darker color today (Figure 1). Almost all design (96%) uses hip roofs with overhang from 0.8 to 1.2 meters.

The detached house design is expected to change in the near future from several driving forces. Economic expansion and the rapid development of mass transit will significantly affect the land price, making the conventional 2-story detached house development hardly be feasible. An interview with a real estate development expert reveals that future detached houses tend to grow taller to 3 stories or more, both to be economically feasible and to serve the clients' changing needs. In fact, 3-story detached houses have started to be seen in residential areas near CBDs and the areas close to important streets.

The immergence of photovoltaic (PV) cells will also play a great role on detached house design. Global growing concerns on environmental problems from fossil fuel consumption along with the scarcity of the fossil fuel resources have continuously been boosting the popularity of renewable energy. Solar power technology has become more affordable and more efficient. The price has also continued to decrease. PV module costs are down 89% since 2010 and it is predicted that by 2030, the costs will be down by 34% from today (BloombergNEF, 2019). The roofs of the future detached houses therefore have high potential for energy generation by PV cells. Currently, numerous roofing materials have been developed to integrate PV cells such as flat and carved PV roof tiles.

Figure 1. Typical detached houses 10 years ago (row above) and today (row below) from 3 leading real estate companies in Thailand (**Source**: Land and Houses Public Company Limited (2019), Supalai Public Company Limited (2019), Pruksa Real Estate Public Company Limited (2019))

The fast growing Information Technology has a positive impact on building automation. It has changed people's expectation on personal control for their comfort and convenience. This should affect the building façade design of the future detached house as well. Today's façade design has low performance on solar shading and is unable to operate. The future's more advanced and more affordable façade control technology will be likely to replace the conventional static façade with a dynamic and user-friendly one.

This study investigates the perceptions of potential clients on the design of the future detached houses over the time frame of 10 years. It starts with the identification of the images of the possible future house. Then, survey questionnaires are created, disseminated, and analyzed. The results finally give a conclusion of the characteristics of the future detached house that the potential clients expect.

2. Identifying the Images of Future Tropical House

Building envelope is the building's skin that covers interior functional space and therefore represents what people see from the outside. It comprises of 2 apparent components: façade and roof. This study investigated the perceptions of potential clients towards the image of the future house. Therefore, the type of building façade is the main focus of the study, comparing the conventional systems with possible new systems that would be the norms in the next 10 years. In addition, climatic control is the most important task of building envelope. Thailand is located in the tropics. Hence, the buildings should have components that well respond to the hot and humid climate. The study also investigated the perceptions towards the image of the tropical house.

The façades of detached houses could dramatically change in the near future. The conventional façade comprises of large fenestrations, dark color walls and decorative vertical and horizontal fins. These components hardly demonstrate any technological advancement nor have high performance of climatic control. Recently, there have been abundant attempts to find new solutions for better building's façade. Adaptive solar shading systems have widely been studied and proved to be one of the better solutions (Hraska, 2018). They can either be controlled by the users or operate automatically according to the changing climatic conditions during the day. Because of their better performances, adaptive solar shading systems are expected to increase in numbers in the near future (Aelenei, Aelenei & Vieira, 2016). Vertical green façades are another new possible option. They provide not only public benefits for reducing urban heat island and improving outdoor air quality, but also private benefits for increasing energy efficiency and improving indoor air quality (Sheweka & Mohamed, (2012). Vertical green facades are relatively inexpensive and will be significant components of sustainable architecture for the future (Rakhshandehroo, Yusof & Najd, (2015). Both the adaptive solar shading systems and vertical green façades represented the new façade in this study.

The roofs of detached houses could also significantly change in the near future. The conventional hip roof is constructed with concrete roof tiles. It is heavy and stores a lot of heat. The most imminent development for building's roof is the integration of PV cells, which can be either incorporated to the roof tiles or used as another layer for the roof system. For better thermal performance, especially for space that is mainly used during the night time such as bedrooms, it is advisable to use a double roof (Tantasavasdi, Chenvidyakarn & Pichaisak, 2011). The double roof with PV cells as the outer layer therefore represented the new roof in this study.

The study crossed the conventional façade and roof with the new façade and roof. This resulted in 4 case studies that ranged from the most conventional design to the most altered design including

1) Conventional façade and roof,
2) Conventional façade and new roof,
3) New façade and conventional roof and
4) New façade and roof.

The images as a result of the matching were then created (Figure 2) using a 3-story new house design as a base. These images were then used in the online questionnaires. It is noted that the study needed people to see the overall picture of the building rather than each individual component. This is because the people who involved in the survey had different background and might not understand architectural components if they were separated from the building. However, the results should roughly tell which components are the most important.

3. Studying Process

This investigation studied factors that influenced the images of future tropical houses. The first hypothesis was that building's façades had a different impact on people's perception from roofs. This was to understand the differences between the people's perception on both components. The second hypothesis was related to personal factors. Age, gender, occupation and income, each had an impact on the perception towards future tropical houses. Online survey questionnaires presented the tool for the study, with quota sampling of 200 potential clients. The minimum income of the participants must be 25,000 Baht per month. The samples were evenly divided into 2 groups: Generation X and Generation Y, according to their ages. Each group was given 100 questionnaires. The information asked in the questionnaires comprised of 2 parts as follows.

1) Perceptions towards the image of the future tropical detached house. There were 2 questions on the images that presented the future house and that presented the tropical house. Definitions of the terms were given. 'Future house' referred to the design that demonstrated concepts and/or materials that reflected the characteristics of the future. 'Tropical house' referred to the design that presented effective solar shading and rain protection, enhanced passive cooling and lived well with water. Each of the questions had answer choices on the scale of 1 to 5, representing the levels of agreement from lowest to highest.

a) b) c) d)

Figure 2. Images of the future tropical detached house with a) conventional façade and roof, b) conventional façade and new roof, c) new façade and conventional roof and d) new façade and roof

2) Personal factors. These included age, gender, occupation and monthly income. The answers to the questions in this section were also given in choices. The participants had to choose one answer to each of the questions.

The survey results were then analyzed, focusing on the different impacts from the façade and roof on the people's perceptions. The average score of each image was used to compare to the others. Then the analysis of personal factors studied the test of normality with an SPSS program, using Kolmogorov-Smirnov Test (K-S Test) method. Finally, tests on the relationship of each factor were statistically studied.

4. Survey Results

The 200 survey questionnaires had given the results on the 2 questions in the same direction. The image on case 4 had the highest scores on both the question regarding the future house and that regarding the tropical house. The score of case 3, 2 and 1 were lower, respectively. The results of the perceptions towards future house (Figure 3a) showed that case 4 had the highest average score of 3.81 with the standard deviation (SD) of 0.93. Case 3 had the second best average score of 3.51 with the SD of 0.92. Case 2 had the third best average score of 3.36 with the SD of 0.86. Lastly, case 1 had the lowest average score of 3.00 with the SD of 0.90.

The results of the perceptions towards tropical house (Figure 3b) showed that case 4 had the highest average score of 3.73 with the standard deviation (SD) of 0.90. Case 3 had the second best average score of 3.49 with the SD of 0.90. Case 2 had the third best average score of 3.28 with the SD of 0.89. Lastly, case 1 had the lowest average score of 3.04 with the SD of 0.87.

The survey revealed the following personal information. Among the 200 participants, 92 were male and 108 were female. Regarding occupation, 79 of the participants were in the areas of finance, marketing or business management, 26 were in the areas of health science, medical science or basic science, 26 were in the area of engineering, 37 were in the area of architecture and 33 were in the areas of law, social science, education or arts.

5. Analysis and Discussion

5.1 The Influence of Building Envelope

The survey results of the impact of the façade and roof can be analyzed as follows. Comparing to case 1, which used both conventional façade and roof, case 2 that incorporated new roof gave better average scores of 0.36 for the question regarding the future house and 0.24 for the question regarding the tropical house. Case 3 that integrated new façade, on the other hand, provided larger differences of the average scores to case 1 (0.51 and 0.45, respectively). Therefore, it can be claimed that the change of façade has greater impact on the perception of people than the change of roof.

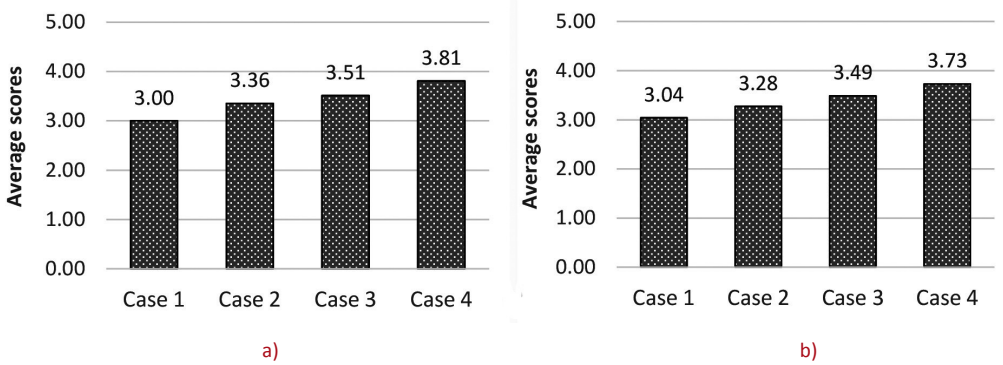

Figure 3. The average score from the survey showing a) the perception towards future house and b) the perception towards tropical house

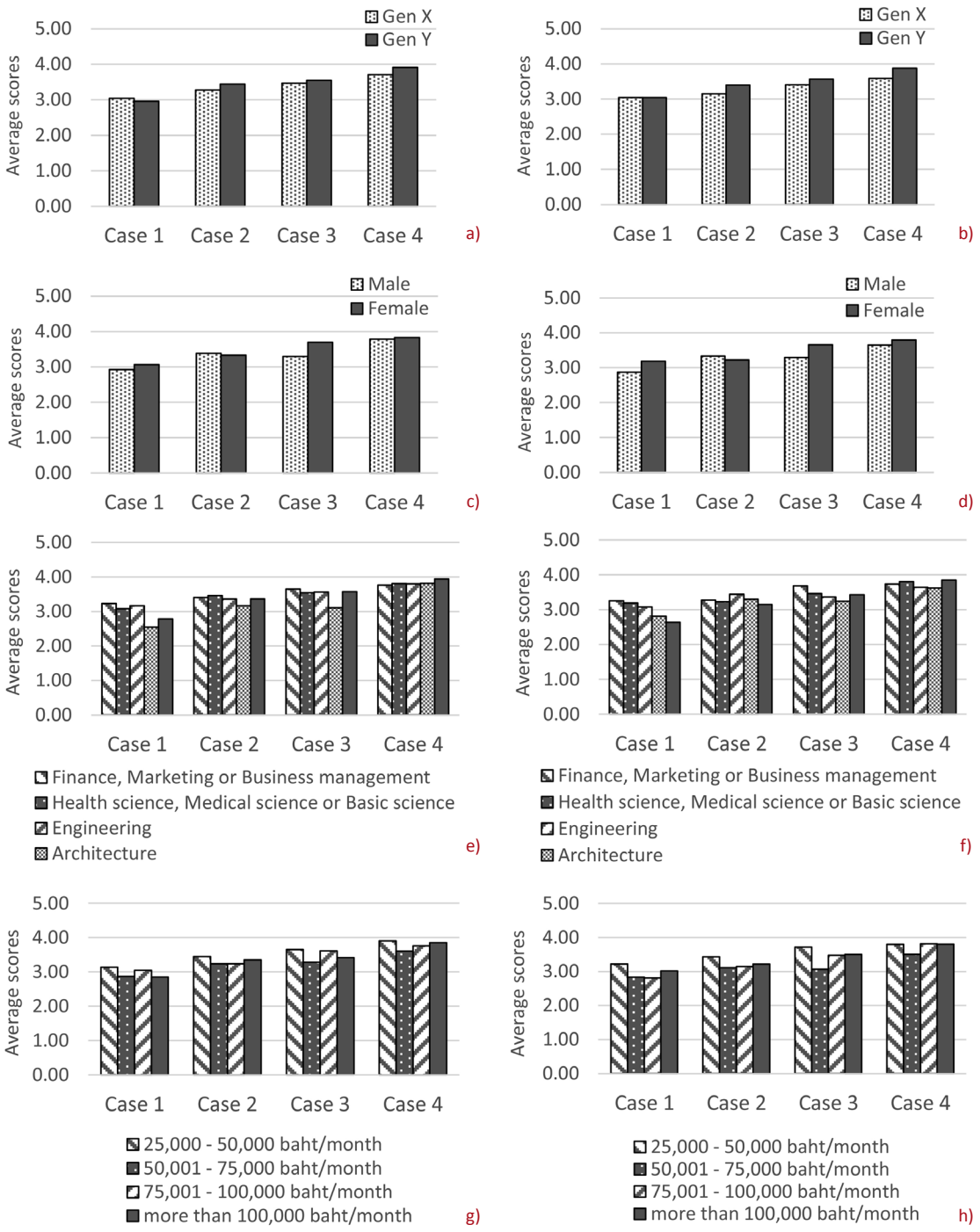

Figure 4. The average results on future house (left) and tropical house (right) according to personal factors of age (a and b), gender (c and d) occupation (e and f) and income (g and h)

When the same comparison was further analyzed according to personal factors (Figure 4), the results demonstrated the same trend. The participants perceived the change of façade had more impact than the change of roof. The exception was the groups of male (Figure 4c and d) and architecture occupation (Figure 4e and f). In these two groups, the change of roof slightly had more impact than the change of façade.

From the results, it can be predicted that the new building envelope would become more popular in the near future. The new façade systems that consist of the adaptive solar shading systems and/or the vertical green façades and the new double roof with PV cells as the outer layer would replace the conventional systems. This is because the new building envelope not only presents better perceptions of the future design and tropical design but also has higher performances, especially on climatic control. Although the new technologies are more expensive at the time being, they show signs of reducing prices and would be the norms for buildings in the near future. In addition, if the additional costs are a concern for a project development, one may choose to give priority to the building's facades, which can be perceived more clearly than the building's roofs.

Table 1. Tests of Normality

Case	Kolmogorov-Smirnov[a]		
	Statistic	df	Sig.
Case 1	.255	200	.000
Case 2	.226	200	.000
Case 3	.227	200	.000
Case 4	.251	200	.000

a. Lilliefors Significance Correction

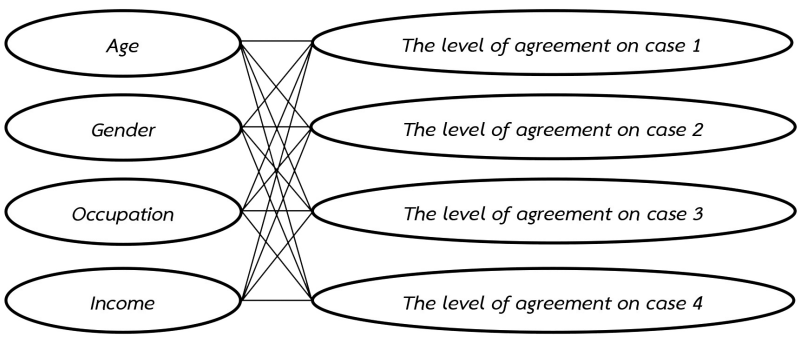

Figure 5. The 16 matching cases of personal factor testing

5.2 Relationship of Personal Factors and Image Perception

The analysis of personal factors comprised of 2 steps: the test of normality and the test of the relationships of the factors. The test of normality tested the level of distribution of the data regarding the score of each case. The study used K-S test on an SPSS program at the 5% level of significance (0.05) and the following hypothesis:

H_0 (Null Hypothesis): Normal distribution

H_1 (Alternative Hypothesis): Non-normal distribution

It was found that the levels of perceptions towards all of the 4 cases had a 0.000 level of significance which is less than 0.05 (Table 1). Therefore, it rejected H0 Hypothesis and accepted H_1 Hypothesis. The data had non-normal distribution.

The second step was the test of the relationship of each factor. The survey results were separately analyzed according to each of the personal factors. For each question, each factor was matched against all of the building cases, resulting in 16 matching cases (Figure 5). Chi-square, which is nonparametric statistics, was used to test on each matching case because the data had non-normal distribution. Moreover, since each of the factors was a categorical variable that consisted of more than 2 sub-factors, Cramer's V statistical value was used to represent the relationship level of the factors.

Chi-square statistical test with an SPSS program at 5% level of significance (0.05) had the following hypothesis:

H_0 (Null Hypothesis): The parameters are independent

H_1 (Alternative Hypothesis): The parameters are dependent

The test found that age, gender and occupation showed some relationship to the perceptions towards the cases. For the future house, age had medium relationship to case 1 (Cramer's V = 0.263). Gender had low relationship to case 2 and 3 (Cramer's V = 0.251 and 0.236, respectively) and occupation had low relationship to case 1 (Cramer's V = 0.220). For the tropical house, age had low relationship to case 4 (Cramer's V = 0.229). Gender had low relationship to case 1 and 3 (Cramer's V = 0.222 and 0.246, respectively) and career had low relationship to case 1 (Cramer's V = 0.192). It can be seen that personal factors have little to no impact on the perceptions towards the image of the future tropical house.

6. Conclusions

This study investigated the perceptions of potential clients towards the characteristics of future tropical house. 4 cases as combinations of conventional/new facades and roofs were used on the survey of 200 online questionnaires. Statistical analysis was then made to find the relationship of all the involving factors. Based on the results, the following conclusions can be drawn:

1) The new building envelope better presents the future tropical house than the conventional one. Adaptive solar shading systems, vertical green façades and double roofs with PV cells are perceived to have better characteristics than the current façades with large fenestrations, dark color walls and decorative fins, and hip roofs.

2) Buildings' façades have more impact on people's perceptions than the roofs. Façades are on the side of the buildings. They can be seen more easily by most people than the roofs, which are on the top of the buildings.

3) Personal factors have little to no impact on the perceptions towards the image of the future tropical house. Almost all groups of people tend to agree on the same direction.

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