Determinants of the Interior Design of Mock-Up Houses in Housing Projects with the Use of Modified Analytic Hierarchy Process

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Abstract

The Mock-up unit is one of the key marketing mixes in presenting houses to promote buyers' purchasing decisions. This research aimed to analyze the determinants and their coefficients to help determine the interior design of the mock-up units within housing projects which will drive customers' decisions to buy. The study process was done by collecting determinants from the literature review, followed by the determinants assessment process done by experts in the industry. The determinant groups and determinants were then taken into a survey asking about the influence level on the purchasing decisions by making Pairwise comparisons. Influence weights on purchasing decisions were analyzed using the Modified Analytic Hierarchy Process (Modified AHP). The determinant list obtained from this research has a total of 18 determinants which were grouped into four main determinant groups, including the group of interior design style, the group of interior usable area, the group of furniture and decoration selections and the factor of interior atmosphere. The analysis also showed the determinants' influence weights on purchasing decisions. Real estate developers and designers can use the research result to determine the interior design of the mock-ups which can boost buyers' decisions and help developers to meet their goal of sales.

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1 Introduction

The creation of good images and decoration of the houses must not only respond to the residents' physical needs but also psychological desires (Petchraj, 2011; Horayangkura et al., 2010). The mock-up house is therefore one of the tools of marketing mixes that is important in the product presentation to expedite the purchasing decisions. The strategy is to create the outstanding and interesting interior decoration of the mock-up houses, such as expressing the product identity, selling points that stand out from the others, including accessories in the interior and assistive technologies according to the needs and interests of consumers in each level of projects. All of these factors will lead to the increase of purchasing decisions, while the new normal life caused by the current epidemic is influencing a tendency of buyers to be more interested to live in housing projects than condominiums (Real Estate Information Center, 2020), of which demand was at the lowest in five years. Condominium projects' demand was decreased by as much as 41.8 percent, while the housing projects' demand managed to increase by 3.5 percent. Hence, the design of mock-up houses that can motivate buyers' purchasing decisions is of great importance.

From the reasons mentioned, it became an issue for the researchers to be interested in studying the guidelines for mock-up house decoration within housing projects. The objective was to analyze the determinants and their coefficients to help real estate developers and interior designers determine the interior design of the mock-up houses within the housing projects, which helps boost the purchasing decisions. This research chose housing type and house price to be the primary variables and studied single, semi-detached houses and townhouses of different price levels. This research helps entrepreneurs and related parties understand the influence level of interior design elements of mock-ups on the consumers' purchasing decisions for each housing type and price range. They can also set interior design problems to suit the type and price level to focus on stimulating purchasing decisions and to best respond to the consumer demands, to achieve sales and lead to the success of the projects.

2 Literature Review

From the literature review, it was found that to design mock-up units is related to various theories, since show unit decoration can create motivations for consumers to buy. It is necessary to study the design elements, human behaviors and the concepts of decision-making to be used in the interior design planning for the entrepreneurs which are detailed as follows.

2.1 Interior Decoration and Atmosphere

Interior design refers to the design of spaces and other areas inside buildings and places, including the study of the building structures, the construction techniques, the spaces and their usability (Study.com, 2021). It is important to create good housing images in accordance with behavioral needs and expectations that lead to satisfaction and impression of consumers (Horayangkura, Klinmalai & Settaworakit, 2010). Quality interior design requires planning and process with an understanding of the residents' routines or behaviors, as well as the changing social conditions and contexts. It creates indoor environments that promote comfort and convenience in human daily life in terms of functionality and aesthetics, with the following components (Duangsamran, 2021; Decorative Art, 2021).

2.1.1 Function of the Interior Design

The function of interior design must focus on the proportional balance of usability and convenience that support the users' behaviors, both in terms of user volume, area size and activities, to appropriately analyze the furniture styles (Techakanjanakit, 2020). The literature review suggested that in present, there are

several important concepts of interior design for usability which are: (1) Universal design, referring to the design of environments and other components that are accessible and usable for all users, without discrimination of ages, sizes or disabilities (Rose, 2000). There are various principles to such design, including equitability, flexibility, simple and intuitive usability, perceptible information, tolerance for error, low physical effort and suitability of size and space. These factors are fundamental conditions of a good design. In every design process, the diverse needs and abilities of everyone must be considered (MOGEN, 2021) and (2) Green and sustainable design, which are the process of integrating economic and environmental concepts into the product design to achieve the minimum consumption of natural resources, energy and environmental impact, by considering the product life cycle from the initiation stage until it is destroyed or recycled. This concept requires a strategy to consider the product design both in the marketing and reducing environmental impacts at the same time, which will result in positive outcomes on business, society and the environment (Lee et al., 2013).

2.1.2 Aesthetics of the Interior Design

The aesthetics of the house style is one of the factors that can best satisfy consumers, with elements of taste, aesthetics, harmony with the atmosphere and decoration (Kuanchom, 2006). From the literature review, it is found that the aesthetics of decoration can be classified into several styles, namely (1) Modern style, which emphasizes on the absence of decorative accessories, on the building materials and the productions which are obtained from industrial processes, on simplicity, everyday function and as well as the ability to tuck and hide certain features to save space (Flint, 2014). (2) Minimal style, which emphasizes on the coordinate system or the modular system, on the use of furniture that is produced as big lots instead of making to order, on the clear and simple specific style as well as primarily focusing on true functions of materials and usefulness (Malan & Bredemeyer, 2002). (3) Contemporary style, which usually avoids complexity but focuses on the basic and simple pattern design and makes use of decorations that reflect modern trends. This style often emphasizes the feeling of simplicity, comfort and warmth, with the application of various functionalities mainly focused to meet the needs of residents (Harris & Lipman, 1989). (4) Loft style which reveals the building structure or displays bare structures and raw surfaces. The ground floor may be designed to open to a mezzanine (double space) with large openings, emphasizing the exposure to natural light (Zukin, 2013). (5) Vintage style which is the combination of the classic of the past with the modern days' design. This style offers a classy atmosphere with the use of floral patterns or color schemes and accessories to make the space looks like the old times (Miwalarth, 2018) and (6) Classic style, which focuses more on luxurious atmosphere and less on functionality. Rooms are excessively spacious with high ceilings. Symmetrical balance concept is used, along with the natural materials, such as marble, granite, terrazzo, offering a sense of polished surface for luxury. The furnishings are selected to display refined feelings and atmospheres (Home Buyers Teams, 2018).

2.1.3 The Layouts of the Interior Work

The layout of spaces in terms of space type and usage in and around the house is important for the balance and the well-being of life. When applied with the spaces of each unit of the housing projects, we will be able to arrange the overall spaces according to the nature of privacy, namely public space, semi-public space and indoor private space (Ekim & Vasilaki, 2015). Moreover, the layout arrangement should also focus on the human dimensions and interior spaces, since the human body strongly relates to the usage patterns. Therefore, the concern of the human dimension helps support the efficient usage of the areas (Chudhavipata, 2015). In addition, the selection of colors and furniture should also be acquired by carefully studying the residents' behaviors in each area of the house (Al Shihabi, 2013).

2.1.4 Psychology of the Interior Design

The literature review pointed out that lights and colors strongly affect the feelings and routines of the residents. Designers should be concerned about the different usages of spaces, as well as the residents' personal tastes, since these factors directly affect their emotions. For example, color can reflect the overall atmosphere and the residents' appreciation, while lighting can support the residents' usage of each space in the house. Taking these factors into consideration will help create the most efficient functionality for interior design (Dong, 2014; The Standard, 2017).

2.2 Type of Houses and the Theory of Consumers' Behavior

In Thailand, there normally are two types of mock-up houses in each housing project, including (1) an empty mock-up house which is a unit absent of any decoration for the visitors to see the actual product in the same way as to how they will receive the house for further inspection and (2) decorated mock-up house which is a furnished unit equipped with accessories and ready to move in to create purchasing desires in buyers since they can imagine themselves moving in or adding more furniture in the future (Home Buyers Teams, 2020).

From the literature review on the purchasing decision process, it was found that there are five stages, including (1) problem recognition (2) information search (3) evaluation of alternation (4) purchase and related decisions and (5) post-purchase behavior (Kotler & Keller, 2015). Along with these steps, developers are obliged to study the behavior of home buyers to respond to their requirements by presenting information to reduce the time of information search which directly affects the customers' evaluation of alternation and leads to the actual purchase. Project developers must pay crucial attention to the post-purchase behavior to maintain the project's standard.

Moreover, according to the theory of the Customer's Black Box, it was found that during the purchasing decision process, home buyers are stimulated by two factors, including (1) Environmental stimuli which are related to the context of each place and time, such as the occurrence of global pandemic or other limitations in each area and (2) Stimuli from the marketing mix which are the marketing strategies created and selected by sales and marketing team to promote buyers' purchasing decisions (Kotler & Keller, 2015).

2.3 Analytical Hierarchy Process (AHP)

Nowadays, the use of modern techniques to assist with modeling in various fields has begun to play an increasingly important role (Dechkamfoo *et al.*, 2022; Naruephorn *et al.*, 2021; Sitthikankun, 2021). The Analytical Hierarchy Process or AHP is the process used to analyze data to achieve the most efficient decision-making. It is a widely popular and universally accepted method invented by Dr. Thomas Saaty. The process uses the sequential division of the problem components by determining the comparative weight for each pair of factors of each hierarchy, consisting of various options until the final desired solution is obtained. This process is created mimicking a structure of the human thought process. Therefore, this technique is suitable for both individual and group decision-making. Its strengths are that: (1) The survey results are more reliable than other methods because they use a pairwise comparison approach to make decisions before answering questions; (2) It is structured as a hierarchical chart that mimics the human thought process, making it easy to understand and apply; (3) The result is a numerical quantity, making it easy to orderly prioritize and to compare with other agencies; (4) Biased decisions are eliminated; (5) It is applicable to both individual and group decision-making; (6) It creates compromise and referendum; And (7) there is no need for supervising expertise (Arun, 2006).

However, quite a number of researchers have applied the Analytical Hierarchy Process to match with their research problems. Some examples especially those from the real estate development industry include

the work of Tochaiwat & Likitanupak (2012) which studied the qualifications of contractors for public utility work in the housing projects by using the Likert Scale instead of the Pair-Wise Scale. Other examples were done by Sirithananonsakun (2017), Tochaiwat et al. (2017), Sirithanyarat (2020), Tochaiwat, et al. (2021), which used the Modified Analytic Hierarchy Process that stops the analysis when the coefficients of the determinants are obtained, which did not include the alternatives into decision-making.

3 Research Methodology

This research used the mixed methodology, aiming to study the level of influences on the purchasing decisions and draw guidelines of the interior design of the mock-up houses that are preferred by the customers in each house type and price level in Bangkok Metropolitan (Pathumthani, Nonthaburi, Samutprakarn, Nakhonpathom and Samutsakorn). The analysis of the factors gathered from literature reviews and additional interviews were done to determine the priority by the Modified Analytic Hierarchy Process (Modified AHP) to analyze the design guidelines of show units. The researchers had limited the areas to be surveyed and analyzed to housing projects in Bangkok Metropolitan. The criteria for selecting the samples were set for a group of homebuyers who partook in the decision-making process to buy a residence in housing projects in the category of single, semi-detached houses and townhouses in Bangkok. These housing projects have different price levels from (1) lower than $91,970 (2) $91,971 – $153,280 (3) $153,281 – $306,560 (4) higher than $306,561 - $613,120, where the exchange rate was 32.62 baht per US dollar (Bank of Thailand, 2021), resulting in a total of 12 sample groups of 405 samples. The number of samples in each group is not less than 30, causing the data average to be in accordance with the Normal Distribution as determined by the Central Limit Theorem (CLT) (Lslam, 2018).

Two types of tools were used in this research: (1) Interview forms gathered in-depth data from five experts who have experiences and expertise from designing for more than five housing projects. This number is not less than the minimum recommended by Nastasi & Schensul (2005). The interviews consisted of three main parts which are general information of the interviewees, information about the influences on purchasing decisions from interior design elements and creating good atmospheres in the mock-up houses and information about the interior design elements of the mock-up houses and the interior design styles desired by customers in different categories and price levels of housings. (2) Another research tool was the questionnaires created from factors gathered from the literature review and information from the in-depth interviews as mentioned in (1). The questionnaires can be broken into four parts which are: (1) general information of the respondents, (2) questionnaires in the pairwise comparison pattern of the influence level on purchasing decisions that the interior design determinant groups have, in pairs, for each project type and price level, (3) questionnaires in the pairwise comparison pattern of the influence level on purchasing decisions that the determinants of interior design have, in pairs, for each project type and price level. However, before using the interview forms and questionnaires, the researchers tested these tools by consulting with three experts who understood the research process to achieve the content validity by analyzing the Item Object Congruence or IOC index, which should not be less than 0.60 in value (Polit & Hungler, 1999; Streiner & Norman, 1995).

Once the data was obtained from both the interviews and the questionnaires, the researchers then analyzed the influence levels on purchasing decisions of each factor and sub-factor of the interior design styles in the mock-up houses according to Best's (1977) criteria. The determinant groups and determinants which have moderate influences on the purchasing decisions were selected (the average of 2.61 on the Likert scale of five levels and higher). The data analysis was divided using the Modified Analytic Hierarchy Process (Modified AHP), to find the coefficient of each determinant group and determinant by the pairwise comparative method and calculating from a matrix table (Wind & Saaty, 1980).

4 Results and Discussion

From the result analysis, the process of analyzing influence level on purchasing decisions must be done before the data can be then analyzed using the Modified Analytic Hierarchy Process (MAHP). The data summary and results can be obtained from the questionnaires as follows.

4.1 Determinants of the Interior Decoration within the Mock-up Houses

Five experts who contributed to this research had 11 to 33 years of working experience in the management of housing projects. All of them participated in at least five projects, according to the criteria set by the researchers. From the analysis of the data obtained from these experts, it was found that the experts valued the influence levels on the purchasing decisions among the factors in the interior decoration of the mock-up houses as the following order: the determinant group of design style ($\bar{x} = 4.80$, very-high level of influence), the determinant group of usable interior living space in average ($\bar{x} = 4.40$, very-high level of influence), the determinant group of furniture and decorative accessories selections ($\bar{x} = 4.20$, high level of influence) and the determinant group of the interior atmosphere ($\bar{x} = 3.80$, high level of influence). Each group has respectively three, four, six and five determinants of a moderate or higher level of influence on the purchasing decisions (bearing the average value of 3.41 or higher on a scale of five), making a total of 18 determinants (Best, 1977). This allows the researchers to plot the data according to the Modified Analytic Hierarchy Process into a chart derived from the interview results as shown in Figure 1, where the numbers in the parentheses are the average values of influence levels on the purchasing decisions according to the experts (with the highest score of five).

4.2 Influence Level on the Purchasing Decisions of the Determinant Groups and Determinants

Results of the analysis of the influence level on the purchasing decisions of the determinant groups and determinants of the interior design within mock-up houses can be exemplified according to the pairwise comparison method. It revealed the value of the coefficient of each determinant group and determinant as summarized in Table 1. The numbers shown in Table 1 refer to the coefficient of the influence level on the purchasing decision of each factor and sub-factor which were taken into consideration. The highlighted groups and determinants belong to the group of groups with the highest total coefficient of more than 50 percent. These groups of determinants and determinants are the most important and should be concerned first and foremost.

From Table 1, the researchers could summarize guidelines for the interior design within the show units of the housing projects in Bangkok Metropolitan as follows.
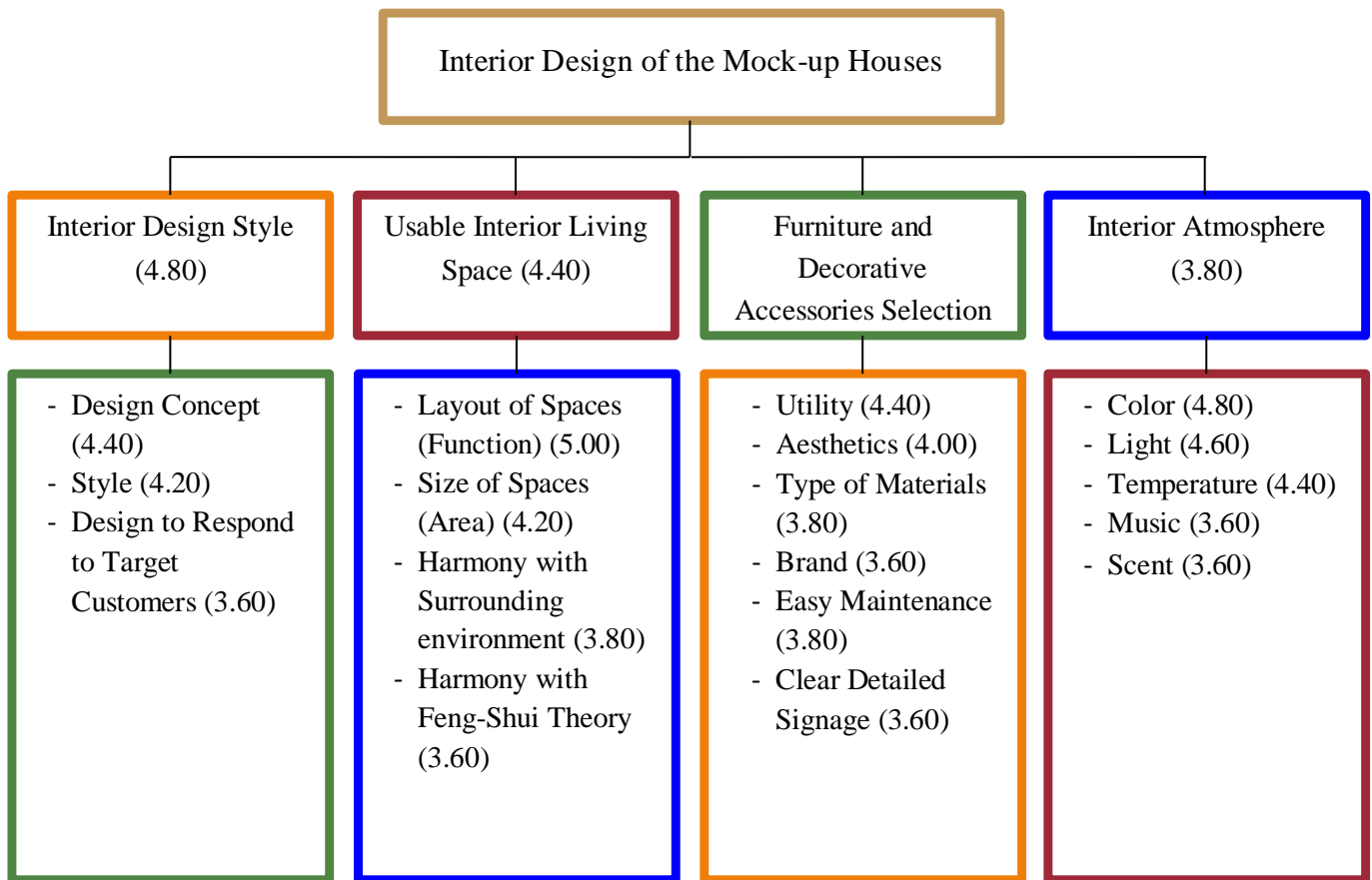
1) Mock-up units for single-detached house

For the interior design of the mock-up units of single-detached houses, it was found that the style of decoration has great significance to the projects priced not higher than $153,280. At the same time, color, light and size of spaces tend to have more influence on the purchasing decisions for projects priced over $91,970. Layout arrangement according to the feng-shui theory and indoor temperature is the most important for projects priced higher than $153,280. Moreover, the researchers also discovered that the aesthetics, the brand and easy maintenance of the furniture and decorative accessories, as well as clear and detailed signs in the projects, have great effects on buyers of residences priced lower than $91,970. While materials and functions are of great importance for projects priced between $91,971–153,280 and $153,281–306,560, respectively.

Table 1: Coefficients of Determinant Groups and Determinants, Categorized by Housing Type and Price Level

Housing Type	Price Level (MB)	Determinant Group				Determinant Group of Interior Design Style			Determinant Group of Usable Interior Living Space				Determinant Group of Furniture and Decorative Accessories Selection						Determinant Group of Interior Atmosphere				
		Interior Design Style	Usable Interior Living Space	Furniture and Decorative Accessories Selection	Interior Atmosphere	Design Concept	Style	Design to Respond to Target Customers	Function	Area	Harmony with Surrounding Environment	Harmony with Feng-shui Theory	Utility	Aesthetics	Material	Brand	Easy Maintenance	Clear Detailed Signage	Color	Light	Temperature	Music	Scent
Single House	≤ $91,970	13	16	49	22	1	9	3	2	2	4	8	4	15	4	8	9	9	3	4	7	4	4
	$91,971 – $153,280	13	16	22	49	3	6	4	2	5	5	4	5	2	5	3	5	2	20	13	6	5	5
	$153,281–$306,560	7	41	18	35	4	2	1	19	8	3	11	1	5	2	5	1	4	10	7	10	4	4
	≥ $306,561	7	34	21	38	1	3	3	8	10	2	14	2	2	5	3	2	7	9	9	9	6	5
Semi-detached House	≤ $91,970	17	44	16	23	11	2	4	22	3	7	12	4	3	2	2	2	3	10	5	4	3	1
	$91,971–$153,280	12	30	16	42	1	8	3	14	7	4	5	1	3	3	2	6	1	10	8	12	6	6
	$153,281–$306,560	26	8	28	38	8	12	6	2	2	1	3	7	4	3	4	5	5	9	7	11	6	5
	≥ $306,561	13	49	16	22	8	2	3	21	4	7	17	2	4	3	2	4	1	7	5	4	3	3
Town house	≤ $91,970	16	13	22	49	5	7	4	5	2	2	4	3	1	3	8	4	3	19	11	7	6	6
	$91,971–$153,280	10	23	29	38	3	6	1	7	9	3	4	4	8	3	6	4	4	14	9	6	5	4
	$153,281–$306,560	6	27	40	27	1	3	2	10	4	5	8	3	14	3	4	9	7	8	6	5	5	3
	≥ $306,561	6	40	17	37	1	3	2	16	5	7	12	3	1	6	1	3	3	13	10	7	3	4

Note: Numbers shown in the table are the coefficient of determinant groups or determinants of the mock-up units on the purchasing decisions (in percent)

Figure 1: The Modified AHP Network Derived from the Interview Results.

2) Mock-up units for semi-detached house

The research results suggested that the determinants of function, design concept, harmony with the surroundings, colors and harmony with the feng-shui theory tend to have high influences on the purchasing decisions for projects in all price ranges. While the style, light and indoor temperature are of great importance for the projects priced between $91,971 – $306,560.

3) Mock-up units for townhouse

For the mock-up houses in townhouse projects, light and color are the most important determinants for all price levels. The aesthetics of furniture and decorative accessories are of great importance for projects priced between $91,971-$306,560, while harmony with feng-shui theory has high importance for projects priced higher than $153,281. Function factor is highly important for projects priced at $91,971 and above. Moreover, the research results also revealed that brand, the temperature in the mock-up units and design styles have a high influence on purchasing decisions for projects priced lower than $91,970. While function determinant is important for projects priced between $91,971-$153,280, easy maintenance for those priced between $153,281-$306,560 and harmony with the outdoor surroundings for those priced over $306,560.

5 Conclusion

This research found determinant groups and determinants of the mock-up houses in housing projects. The values of influence coefficient on purchasing decisions were then analyzed by collecting determinant groups and determinants from the literature review and assessed by the experts. These groups and determinants were then used in the questionnaires about the influence level on the purchasing decisions by using the pairwise comparison questions, as well as the Modified Analytic Hierarchy Process (Modified

AHP). As a result, the researchers were able to obtain 18 determinants from four determinant groups, namely the determinant group of the interior design style, the determinant group of interior usable living areas, the determinant group of furniture and decorative accessories selections and the determinant group of the interior atmosphere.

This research discovered that from the designers' perspective towards the mock-up house interior design, they often emphasize the design concept elements as a priority, while the visitors usually pay more attention to what they can directly perceive, see and feel. And it is easier for them to convey those perceptions into simple words such as beautiful, modern or functional. This is why the results obtained from the questionnaires turned out that the design concept has less importance level than what the researchers expected.

In addition, the researchers noted that, for all three types of residential projects priced higher than $306,560, the interior usable space factor has the same highest importance level among the sample groups. And while the single-detached house residents pay high attention to feng-shui, the semi-detach and townhouses buyers focus more on the layouts and interior usable spaces.

The research result is consistent with Panich (2015), which stated that soft color tones have positive influences on purchasing decisions. Nonetheless, this research contradicts the work of Panich (2015) which suggested that scents and detailed signs have certain influences, while this research found that they scarcely do. The most distinguishable difference between the two pieces of research is that this one provides a categorization of different housing types and prices, while the work of Panich (2015) does not.

However, the interior design and decoration of the mock-up houses cannot be used as a definite measure of sales. Many projects of which the interior designs are inconsistent with this research's suggestions may also have good sales rate, since it depends on other factors that are also very important to the purchasing decisions, such as locations, transportations, utilities, etc.

6 Availability of Data and Material

Data can be made available by contacting the corresponding author.

7 Acknowledgement

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