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Virtual Technology (VR) Attractiveness Attributes in Influencing House Buyers' Intention to Purchase

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ABSTRACT

This study aims to investigate the response from selected potential buyers on the marketing communication channel by using the application of virtual reality (VR) in new housing schemes. The objective of this study is to test the hypothesis relating to the channel attributes and potential buyers' purchase intentions through a within-subject design with 100 prospective house buyers. Data were analysed using correlation analysis in IBM SPSS software. It was found that the channel attributes are related to the house purchase intention as indicated by correlation values of 0.793, which indicates strong correlations. As the study uses a quantitative survey method, the data obtained may not be as precise as data obtained using a qualitative research method. Respondents can only select a few options, making it harder for them to express their true opinions. As a contribution to the housing industry, this study emphasizes the importance of VR house models in marketing communication by providing useful empirical results and recommendations based on the research results. The study integrates the current knowledge derived from the research conceptual framework to develop a smart real estate marketing strategy using VR.

1. Introduction

Marketing trends are changing because of advances in technology and consumer preferences. In order to stay ahead of the competition, marketing teams must keep up with these rapid developments. In addition, the evolution of technology has changed the marketing communication of a company approaching its targeted buyers. Belniak and Radziszewska-Zielina [1] stated that marketing communication channels have become more necessary in today's business world as it develops trust between the company and the targeted buyers.

Studies outlined by Joanna and Agnieszka [2] suggested that the most important element in marketing communication is to identify objectives and audience because there is a direct relationship

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between consumer expectations and demands and the medium of communication that has been chosen.

In the context of real estate sector, typical examples of offline marketing channels that being applied by the property developers are traditional approach such as three-dimensional (3D) mock-up model, showcase of completed house at site, promotion during property exhibition, and printed media, likes brochures, newspapers magazines, and billboards. Despite these traditional marketing channels is more connective and interactive but there are also some disadvantages, for example house buyers must attend the property exhibition or review through the brochures to get the information about the selling house. House buyers might not receive more in-depth information and images about the houses that they are interested in due to the limitless of showing information through the marketing channels used by the property developers. Besides, potential house buyers are unable to comprehend the quality of the house and visualize themselves inside the house using these marketing approaches [3]. This scenario is occurred due to these marketing channels have numerous limitations included constrained data, destitute sense of involvement among consumers [4]. For example, the printed media solely depend on the ability of consumers to view the real environment of the selling house [5] and the interaction between consumer and product is entirely static as its attributes is perceptual that rely exclusively on sight which no multiple angle manipulation of the product is possible [6].

However, traditional advertising had come to a halt since the outbreak of the coronavirus disease 2019 (COVID-19) pandemic. As Azmi *et al.,* [7] stated in their study, the pandemic has had a large economic impact and resulted in a considerable shift in marketing tactics toward digital marketing. Real estate is one of the critical sectors that were affected by the outbreak, as prospective buyers were unable to view properties for sale and make purchasing decisions [8]. In this case, advanced technology is required to boost the real estate marketing business. Interestingly, the emergence of mobile technology such virtual reality (VR) has attract a lot attention among the marketing researchers in various field which focused on adoption of VR as marketing tool in influencing the consumer behavior. For example, in the field of retail stores [9, 10, 11], tourism [12, 13] and virtual mobile gaming [14, 15, 16].

According to Sihi [17], digital visualization's marketing research potential has also been explored in the residential real estate industry. For instances, Widiastuti *et al.,* [18] studied the indoor thermal comfort through three-dimensional simulation, while Wang *et al.*, [19] explored on the digitalization of building facility management for high rise building. Similarly, the leading residential real estate agencies in the United States, such as Redfin and Sotheby's has adopted new approach in promoting their selling property estate by emphasizing the adoption of virtual tours which allow viewers to be immersed in the simulated area and experience the house via 3D virtual walkthroughs. A recent study found that virtual have a favorable impact on the home purchasing process, providing both house buyers and realtors with significant time savings, for example, by allowing house buyers to experience homes in various geographical areas. Houses in development or under construction can also be visualized using virtual reality, which is especially useful for houses sold off-plan using the sell-then-build method. Recently, Azmi *et al.*, [7] studied the comparison of house purchasing intention between the real environment and virtual environments which addressed pleasure and arousal emotions. While, Mohamad Kamil *et al.*, [20] explored the buyer's purchase intention through VR technology which focused on interior layout and design. Thus, these studies could be referred to by the current study by emphasizing on the attractiveness of AR attributes as a marketing channel in promoting the selling house and the respondents may explore the design and layout of virtual house at interior and exterior view.

When clients are exposed to VR, they are exposed to many communication cues and rich media features, as opposed to a static image [21]. A VR experience increases customer purchase intention, attachment, and visit intentions to a destination, as well as impulsive desires [22, 23]. Thus, this study aims to determine the relationship between the house buyers' response to the channel attributes of Virtual Reality (VR) in real estate and their intention to purchase.

2. Methodology

2.1 Research Instrumentation

Research instrumentation is a tool that could be used as a medium in gathering data to measure the outcome of the phenomena under investigation. As this study aims to explore the influence of VR technology on house purchasing behavior, a survey method through a set of booklet questionnaires was employed. Survey method was used in this study as this method is fit for explanatory research [24] as well as provides a standardized inquiry which would be presented in the same method among different respondents [25]. The booklet of survey form was designed by dividing into three main sections; Section A: respondent's demographic profile, Section B: attractiveness of VR technology as a promotion tool and Section C: house buyer's intention to purchase. All items in section B and C used a 5-point Likert scale. Thus, the respondents have to indicate their level of agreement on the item ranging from 1 = Strongly Disagree to 5 = Strongly Agree.

Besides the development of survey form, this study also has developed a prompt research instrumentation to increase the understanding among the respondents on the study that being conducted. Thus, a 2-storey house was developed by applying VR technology, in which respondents reviewed the house design through VR apps. According to Kazmi *et al.,* [26] the prompt research instrumentation likes VR enables the development of interesting experiences among the respondents through the superimposing elements of virtual nature.

The house model in VR application for this study as shown in Figure 1 was developed through the following procedures:

i. The 3D model of house was developed through AutoDESK Revit software
ii. Generate realistic 3D textures to the house model by applying simple shading to create diffuse, normal and ambient environment
iii. Place a light source to increase the brightness and contrast
iv. Install the VR plugin (i.e., Enscape) for AutoDESK Revit software
v. Use W-A-S-D keyboard to walk through the house model

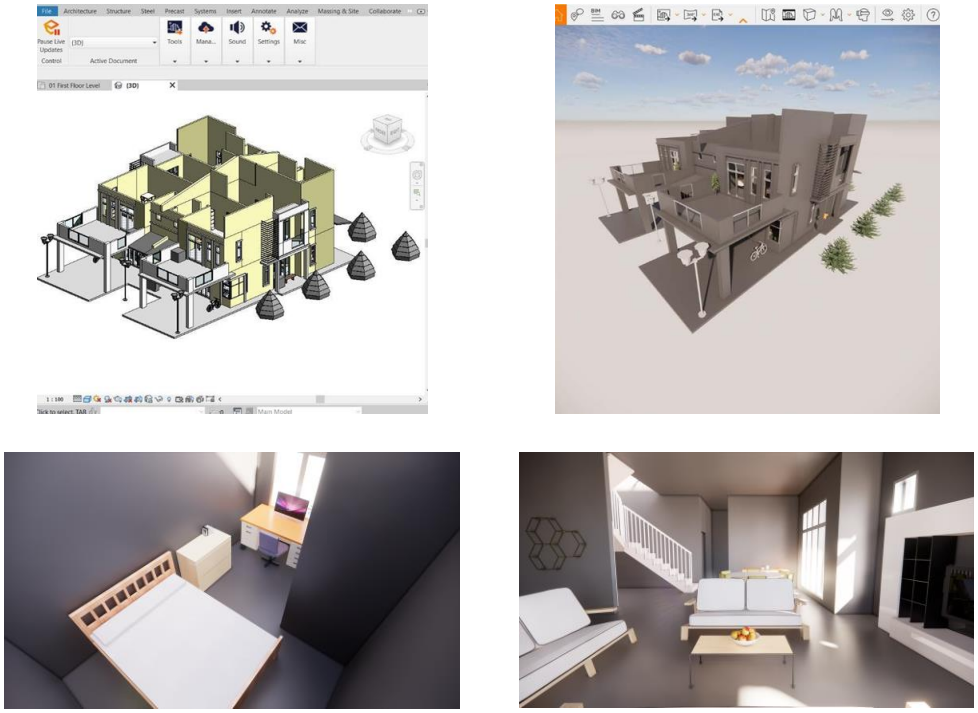

Fig. 1. Autodesk Revit 2022 software and Enscape plugin

The combination of method through survey form and 3D VR of house model may generate a significant finding as the respondents has more clear idea on the questions that is being asked in the survey form.

2.2 Population and Targeted Respondents

Population is defined as the entire set of cases that a study to make inferences about [27, 28]. Thus, the population in this study is refers to household in Malaysia which generally categorized as a group of people living in one dwelling, and its members are not necessarily related to one another. In 2020, the total household in Malaysia was 8.2 million and 97.3 per cent of it was private households [29]. Around 42 per cent of household's demand for housing unit in the range of RM250,000 to RM500,000 [30]. Based on this published statistic, it can be said the total population is more than 1 milion. Thus, Cohcran formula was adopted similar to the study of Heravi *et al.,* [31] in order to calculate the sample size of the current study as follows:

$$n = \frac{\left(\frac{t^2 S^2}{d^2}\right)}{1+\frac{1}{N}\left(\frac{t^2 S^2}{d^2}\right)} \quad (1)$$

where n is the number of data; t is selected level of confidence: here based on a 95% confidence level, t=1.96; S is the estimated standard deviation in the population: S=0.5; d is the acceptable margin of error: d=10% by considering exact approach of previous studies [31, 32, 33]; and N is the population size: 3.34 million). As a result, the minimum sample size is calculated as 97. Even the sample size of the current study is small, the sample is considered sufficient where it can provide similar result between population of 200 million and 4000 population [34]. The respondents that will be involved in the data collection only include a person between 25 – 60 years old to ensure the significance of research findings of the study. By doing this approach, it can guarantee validity of the

results of the study [35]. Inclusion criteria of age among targeted respondents are being applied due the following reasons:

i. Current selling or market price for a 2-storey house in Perlis is between RM 275,000 to RM 400,000. Based on current interest housing loan rate, monthly installment is around RM 1,200 to RM 1,800 for 30 – 35 years of tenure.
ii. Most of the people in Malaysia completed their diploma or first bachelor study around 21 – 23 years old. Based on famous job seeker websites for the private sector in Malaysia (e.g., JobStreet, JobSeeker and MYFutureJobs) and Public Services Commission for the government sector, the average salary for diploma graduates is RM 1,500 and RM 2,200 for degree graduates.
iii. Thus, it needs 2 – 4 years to get yearly increment and stable financial stability to secure a housing loan which permits them to commit the above monthly installment.
iv. Pension age policy for government servants is between 55 – 60 years old. It is expected that the private sector applied a similar approach.

2.3 Data Collection

This study adopted purposive sampling which is one of the non-probability samplings. The primary criterion for purposive sampling is the criteria set by the researcher. The survey forms developed were distributed to the respondents through personally administrated techniques as it able to collect the completed responses within a short period, while any doubts about the research could be clarified by the researcher on the spot [28].

Before proceed for their respond, they were briefly explained the aims of the study. They were also given ample time to experience the house model in VR application through a laptop that bring along with researcher. After interacting with the house model, the respondents complete the survey form.

Despite only 97 samples required for the current study, this study has distributed extra 30% of survey form to increase the percentage of response rate. In return, 100 out of 130 survey forms are duly returned which equal to 76.92% of response rate. This response rate is considered reasonable because it surpasses the marginal response rate of 60% [36]. In further, Draugalis and Plaza [37] stated that, study sample with statistically powerful response rates can ensure that it accurately represents the target population. Before further analysis of the data was executed, this study applied a standard statistical procedure where data screening and test of assumptions were conducted to ensure the data represent the research aim.

3. Results

Table 1 shows that 64.0% of total respondents are dominated by female respondents. For ethnicity, the majority of respondents are Malay (83.0%) followed by Chinese (10.0%) and Indian (5.0%). Both items reflect on the social environment in Malaysia where currently women hired as a workforce in any organisation keep increasing, whereas composition of ethnicity in Malaysia is mostly from Malay, Chinese and Indian. Most of the respondents (55.05%) are 35 – 44 years old and 60% of them have a salary between RM 3,000 to RM 5,999. These indicate that, the respondents involved in this study have a firm monthly income which qualifies them to secure a housing loan.

Table 1
Demographic Profile of Respondents and Marketing Interest

Variable		N	Percentage (%)
GENDER	Male	36	36.0
	Female	64	64.0
ETHNICITY	Malay	83	83.0
	Chinese	10	10.0
	Indian	5	5.0
	Others	2	2.0
AGE (Years Old)	25 – 34	27	27.0
	35 – 44	55	55.0
	45 – 54	16	16.0
	55 - 60	2	2.0
MONTHLY INCOME (RM)	< 3,000	29	29.0
	3,000 – 5,999	60	60.0
	6,000 – 8,999	9	9.0
	≥ 9,000	2	2.0

As this study aims to examine the effect of VR attributes in influencing intention to purchase a house, this study has employed a Pearson correlation. Pearson correlation coefficient (also known as Pearson product-moment correlation coefficient) (r) is a metric used to identify the relation (rather than the difference) between two quantitative variables (interval/ratio) and the degree to which they correlate. For the purpose of data interpretation, this study adopted the correlation coefficient indicator as suggested by Schober & Schwarte [38]. The result of correlation's strength and interpretation are presented in Table 2.

Table 2
Correlation Coefficient Strength Indication

Correlation Coefficient	Interpretation
0.00 – 0.10	Negligible Correlation
0.10 – 0.39	Weak Correlation
0.40 – 0.69	Moderate Correlation
0.70 – 0.89	Strong Correlation
0.90 – 1.00	Very Strong Correlation

The results of the analysis are presented in Table 3. Based on the table, the relationship between house buyers' intention to purchase and channel attributes has a correlation value of 0.793. It can be inferred that house buyers' intention to purchase has a significant positive relationship with the AR application attributes, as the correlation value of 0.793 falls into the area of strong correlation. This result is in line with prior studies [9, 10, 11, 7, 20] which found a positive impact of VR application in influencing consumer behaviour of intention to purchase a product. Replication of positive findings of researches that relates to impact of VR application on intention behaviour due to the attributes of VR that enable the housing buyers to shape their experiences as well as fell the sense of presence with the real house which enhance their reactions and responses [39, 40].

Table 3
Correlation between variables observed

		House Buyers' Intention to Purchase	Channel Attributes
House Buyers' Intention to Purchase	Pearson Correlation	1	0.793
	Sig. (2-tailed)		.000
Channel Attributes	Pearson Correlation		1
	Sig. (2-tailed)		

It can be summarized that, VR have a strong impact in influencing the intention to purchase a house among the respondents. Thus, the hypothesis of the study which stated there is a correlation between the channel's attributes of VR on intention to purchase is accepted. The summary of this relationship is shown in Table 4.

Table 4
Summary of Correlation between variables observed

Hypothesis	r value	Relationship	Result
The channel attributes are positively influencing the buyers' intention to purchase.	.793	strong	accept

4. Conclusions

This study added to the existing body of information in the residential real estate literature, particularly in terms of using virtual reality as part of a marketing plan. The outcomes of this study found that potential house buyers prefer visiting a show house in VR over brochures, social media, and 3D mock-up models since it has better visuals and is more lifelike. As a result, for VR to be utilized effectively as a pre-purchase evaluation tool to impact house purchase intention, property developers must portray the house's atmosphere in a virtual environment to inspire enjoyment among potential house buyers.

This finding could provide a new paradigm for researchers, property developers, and architects to address a new method for influencing users' emotions and behaviours through virtual reality. Instead of using students as experiment subjects, this study used real potential house owners, allowing the findings to be more generalizable.

Following the Industrial Revolution 4.0 (IR 4.0) initiatives, the results of this study will allow real estate companies to adapt their marketing strategies to the digital platform by utilizing VR as a housing marketing strategy that considers the enjoy-ability and behaviour of its users is discussed in this study based on notable empirical evidence and recommendations. Based on the findings of this paper regarding the marketing communication process and channel attributes in a residential context in a virtual environment, this paper paves the way for various development possibilities relating to the use of VR and user-centricity, particularly for research in intelligent buildings that are responsive to users' needs.

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