

## Research Article

# The Influence of Augmented Reality on Purchase Intention in the Housing Industry

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Rapid emergence of technology communication has demanded the business organization to adapt with the most optimal marketing approach to ensure long-term survival in the modern business environment. Research on technologies adaptation in relation to marketing were conducted in various sectors in order to study the marketing communication channels in persuading targeted customers to purchase the selling products or utilize the services offered in the market. In contrast, the advancement of technology was not thoroughly harnessed by the property sector, which lagged in adopting the innovative marketing approach to promote their selling house. Accordingly, this research is aimed at investigating the effect of marketing communication channels via the adoption of AR to encourage the intention to purchase among the targeted house buyers. A total of 130 booklets of survey forms were distributed using the self-administered method along with the prompt material of housing design in AR applications. In return, 100 booklets of survey forms were received. As a result, the findings indicated that AR application as a marketing communication channel has an impact on the intention to purchase among potential house buyers. It is expected that AR technologies would create a new norm with extraordinary modification and advancement to promote housing projects and provide guidance to the developer. This initiative is able to improve their marketing communication, thus attracting house buyers based on their interests.

## 1. Introduction

Housing industry is one of the major sectors of the construction industry, which includes the development, construction, and sale of houses. It also refers to the housing market that indicates the supply and demand for houses [1]. Currently, provided that consumers purchase houses as living space and investment, the advancement of technology has caused the industry to change their marketing strategy to increase the success in promoting their selling housing projects to the targeted buyers. In this phenomenon, housing developers face increasingly difficult challenges, such as continual growth, new designs, and new presentation skills to match consumer demands.

In the current competitive business environment, the survival and advancement of an undertaking cannot be isolated from the presence of exact and point-by-point customer data. Hence, diverse types of the marketing communication channel are utilized to approach buyers, which is aimed at conveying item data to target buyers and reaching an agreement with the company. According to Miklenčičová and Čapkovičová [2], buyers would be more convinced and faithful through the advertisement of a total encounter that goes beyond a basic buy, which increases confidence in the company recommendation. Hence, the most imperative objective of marketing communication channels includes the formation and alteration of consumer behavior through the impact of items, costs, and dissemination.

Innovative developers using extended reality (XR), augmented reality (AR), and virtual reality (VR) to create and introduce new technologies into the housing industry as a result of the quick growth of technology. However, Yung and Khoo-Lattimore [3] highlighted that the need for specialized mindfulness, destitute accessibility, long execution time, and unwillingness to acknowledge virtual options are issues in the housing industry that should be addressed. Sidhant [4] highlighted that the conventional marketing communication channels in the housing industry, such as brochure and 3-dimensional (3D) mock-up model come with numerous limitations, which include constrained data and a destitute sense of involvement among consumers. In this case, customers need to envision the authentic conclusion item, which will diminish the certainty and fulfilment of the company. Moreover, the two-dimensional (2D) images on brochures and advertisements solely allow the ability to view the objects in 3D images [5]. This situation leads to confusion among consumers and misconstrues the data presented by marketers. In this case, consumers are compelled to envision the end product without a realistic observation, which would diminish the company's authenticity and commitment levels in consumer perception. Figure 1 illustrates the example of printed brochure material and a 3D mock-up model used by housing developers to represent their selling property.

To improve the sensibleness of marketing communication channels, consumer input and conduct are crucial factors to be considered which customer input is characterized as customer communication of approximate items or administrations, which clarifies to clients the reasons, place, and method through which an item or brand can be acquired [6]. Furthermore, the elucidation of client-obtaining conduct remains completely elusive due to its relation to the human intellect. Nevertheless, diverse eras have different encounters, values, convictions, states of mind, inclinations, sentiments, and concepts. In addition, the emergence of technology has shifted the paradigm in the way customers think and make decisions [7]. By understanding the differences between Generation X, Generation Y, and baby boomers, marketers utilize the most sensible, viable, and suitable methodologies to communicate with consumers of different generations [7, 8]. This action could facilitate the development, item advancement, and construction of a steadfast customer base.

This research aims to analyze the impact of AR application as a marketing communication channel on the consumer's intention to purchase a house. In this research, the marketing communication process in the housing industry among the potential house buyers was addressed through the application of AR technology in order to provide a fundamental reference for housing developers on the viable elements of marketing communication channels to communicate with consumers. Ashurst [9] highlighted that studying feedback from customers would be the ideal method to review marketing issues and their shortcomings. Conducting this study is believed to be able to incorporate more knowledge in terms of the benefits of technology to the housing sector.

## 2. Literature Review

*2.1. Marketing Communication.* Marketing communications is the planning process for a product or service that customers obtain from all the relevant and consistent brand contacts. This condition ensures that messages are delivered along with the use of media [10]. Consumer behavior may change as a result of new knowledge gained through reading, observation, discussion, or actual experience and the use of marketing communication channels to provide them with information which enhance their understanding and satisfaction with the products or services offered in the marketplace. Notably, marketing communication plays an important role in changing customer attitudes and influencing customer behavior. According to Fill [11], different techniques are applied as marketing communications to change customer attitudes. For example, marketing communications through product demonstrations by highlighting its features and functions could be used to change customer misunderstandings about products or brands which will lead to customer decision and action towards the product offered in the marketplace. This scenario implies that the marketing communication has a direct impact in changing customer perception and behavior.

Marketing communication or famously known as promotion is based on several theories and models which explain a series of steps that customers go through and how it affected customer decision-making in purchasing products or utilizing services. For instance, Rehman et al. [12] and Sukma Wijaya [13] discussed several response hierarchy models but not limited to model of AIDA by Strong (1925), Hierarchy of Effects by Lavindge and Steiner (1961), and DAGMAR by Colley (1961). Regardless of differences between these response hierarchy models, it shares a common idea on the human behavior with promotion which could be simplified into three main attitudinal phases, i.e., cognitive-affective-conative (C-A-C). Cognitive refers to a mental activity that reflects personal thought about the aspect of their world, while affective is defined as the degree of feeling and emotion, and lastly, conative is related to intention to perform behavior [13]. Figure 2 shows the summary of response hierarchy models based on C-A-C phases.

The response hierarchy models have been investigated by researchers in different scope of research as well as used by the marketing practitioners with the aim of understanding the effect of marketing communication on the consumer behavior. However, the hierarchy of effect (HoE) model is one of the most essential models that posits the cognition-affect-conation sequence in understanding the advertising effect over a period of time [14]. This HoE model has been adopted by several researchers in the context of assessing the prepurchasing behavior such as by Gabriella and Agus [15], Nurrahmi et al. [16], and Zhu et al. [17] to study the intention to purchase via online shopping medium. Similarly, this HoE model has been adopted by other researchers to study the effect of modern marketing technology such as Facebook [18, 19] and YouTube [20] on consumer behavior. Despite these studies were conducted in different research scopes, it could be summarized that the response hierarchy



FIGURE 1: Common promotion tool in housing sector.

	AIDA (Strong, 1925)	Hierarchy of effect (Lavidge and Steiner, 1961)	DAGMAR (Colley, 1961)	(Rogers, 1983)	(Court, 2009)
Cognitive	Attention	Awareness	Awareness	Awareness	Awareness
Affective	Interest	Knowledge	Comprehension	Persuasion	Familiarity
	Desire	Liking Preference	Conviction		Consideration
Conative	Action	Conviction Purchase	Purchase	Decision Implementation	Purchase

FIGURE 2: Summary of response hierarchy model based on C-A-C phase.

such as HoE has a significant impact in influencing intention to purchase among the consumer. Thus, this study proposes the following hypothesis:

*H1: response hierarchy has positive impact on intention to purchase among the potential house buyers.*

**2.2. Marketing Communication Channel.** Appropriate and effective adoption of marketing communication channels as promotion tools is necessary for the product or service providers who aim to initiate the actions of customers that lead to corporate profits [21]. The emergence of technology should be utilized as a promotion tool, given that they are believed to exhibit better features in delivering the message about the products or services. While nonconventional methods have evolved and become more common, the variety of promotion tools to persuade customers continues to increase. Moreover, the old promotion tools are changing and developing over time, which requires changes among the products or services provider to deliver the optimal message and create and influence the purchasing behavior among customers.

With the current advancement of communication technology, previous studies related to marketing communication channels and purchasing behavior place more focus on web-based marketing, such as e-marketing [22–24] and social media [25, 26]. The growth of mobile technology has gained the attention of researchers in the marketing field to study the application of mobile AR technology in encouraging purchasing behavior. For example, Whang, et al. [27] investigated AR applications on beauty products, while Faqih [28] conducted research on AR in relation to mobile

games. Apart from that, the general philosophy of user behavior in relation to AR was investigated by Hung et al. [29] and Hsu et al. [30]. It could be summarized that the application of AR technology as a marketing medium has a significant impact in influencing purchase behavior among consumers.

While a few studies on AR application and the built environment were not in the scope of marketing, other aspects were focused on. To illustrate, Stoltz et al. [31] conducted a study on AR applications in the warehouse operation, while Chi et al. [32] and Wang et al. [33] investigated on the potential future research in the built environment related to the application of AR. However, these studies are not related to the housing sector which indicates a lack of interest among researchers to study this new technology in the aspect of marketing and purchasing behavior in the housing sector.

Notably, AR technology may become a new norm of marketing in the housing industry, particularly in utilizing this technology as a promotion tool. The use of AR technology would offer business profits to housing developers and provide immersive experiences among potential house buyers in terms of neighborhood insights, house layout, and design visualization [34]. Furthermore, these attributes of AR could increase the effectiveness in decoding the information and design of the selling property, which leads to the formation of intuitive communication between housing developers and house buyers. Ultimately, it could be concluded that the use of AR as a promotion tool significantly influences the behavior of house buyers. Based on this theoretical discussion and the findings of past studies, this study develops the following hypothesis:

*H2: AR technology application has a positive effect on intention to purchase among the potential house buyers.*

**2.3. Research Conceptual Model.** From the discussion of literature above, this study would like to confirm whether the four dimensions of hierarchy response (awareness, knowledge, liking, and preferences) have a significant impact on the intent of purchasing, and whether the use of AR technology as a promotion tool has an impact on intention to purchase among the potential house buyers. The research conceptual model of this study is shown in Figure 3.

### 3. Methodology

**3.1. Research Instrumentation.** Research instrumentation refers to tools that are used as the media to collect the research data and measure the outcome of the phenomena under investigation. Following the aim of the research to study the influence of response hierarchy and AR technology as a marketing communication channel, on the intention to purchase among potential house buyers, a survey method was employed to obtain the research data through a set of questionnaires. This method was selected, given that it is suitable for explanatory research [35] and provides a standardized inquiry, which would be presented in the same method among different respondents [36]. Moreover, to increase the understanding of the research topic among the respondents, a 2-storey house was developed using AR technology, in which the respondents reviewed the house design through AR apps. For the purpose of housing modeling development through AR apps, this study took the following procedures:

- (i) Use AutoDESK REVIT software to develop the 3D modeling
- (ii) Import the 3D modeling of AutoDESK REVIT into Unity 3D software and apply high-definition textures to the house modeling in order to create realistic and interactive 3D environments and contents
- (iii) Generate realistic 3D textures by applying simple shading to create diffuse, normal, and ambient occlusion maps
- (iv) Create a Vuforia account for the target (floor plans) mapping of the 3D modeling
- (v) Implement an accurate system to avoid any interference among users which enables the viewer to move from one point to another point through mobile devices
- (vi) Set the dependencies package for android
- (vii) Finally, export the apk.file of Unity 3D modeling and install it on the mobile device

This house model in AR apps functions as a prompt material, which enables the development of interesting experiences among the respondents through the superimposing elements of virtual nature [37]. By combining this approach

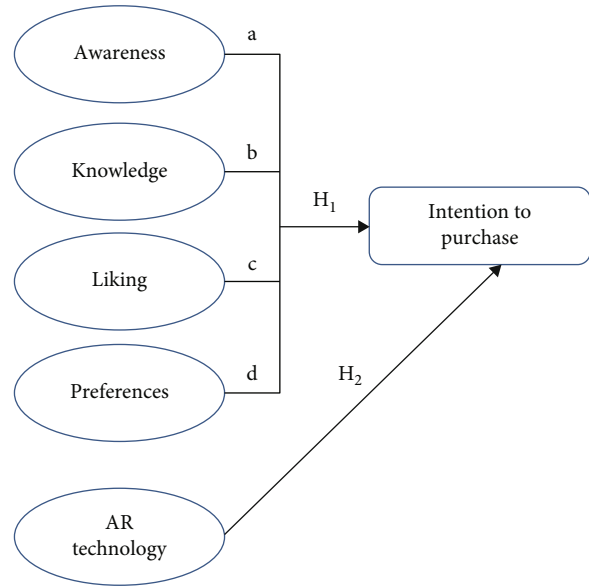


FIGURE 3: Research conceptual model.

as research instrumentation, this research may generate a significant finding following the clear idea among the respondents regarding the question that is being asked in the set of questionnaires. Figure 4 illustrates the housing model in AR application.

The booklet of survey form was designed by dividing it into three main sections. Section A presents the respondents' demographic profile, while Section B shows the measurement items of response hierarchy, and lastly, Section C listed out measurement items of attractiveness of AR technology as a marketing communication channel. All items in Sections B and C used a 5-point Likert scale. The respondents were required to indicate their level of agreement on the item, which ranged from 1 (strongly disagree) to 5 (strongly agree).

**3.2. Population and Targeted Respondents.** Population denotes the entire set of cases that researchers aim to study or make inferences about [38, 39]. The targeted respondents in this study were described as households in Malaysia. A household is generally classified as a group of people living in one dwelling, and its members are not necessarily related to one another. DOSM [40] reported that the total households in Malaysia were 8.2 million in 2020 of which 97.3 percent were private households. In addition, Cheah et al. [41] estimated around 42 percent of households demand for housing units in the price range of RM 250,000 to RM 500,000. By considering these statistics, the total population is larger than 1 million. Thus, this study used a similar approach by Heravi and Mohammadian [42] to determine the sample size by using Cochran formula as follows:

$$n = \frac{((t^2 \cdot S^2) / d^2)}{1 + (1/N)((t^2 \cdot S^2) / d^2)}, \quad (1)$$

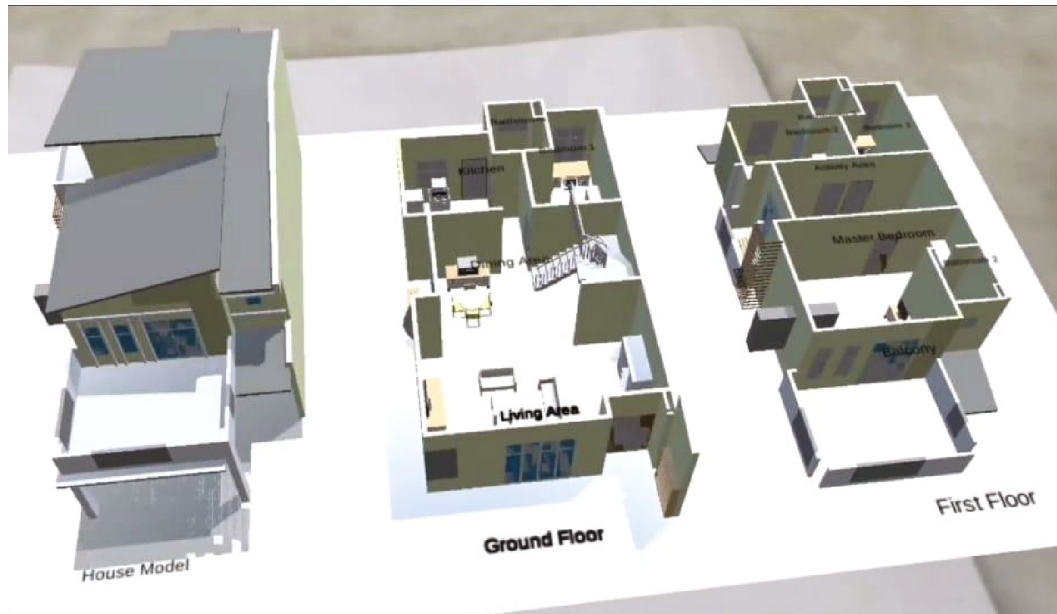


FIGURE 4: Housing model in AR application.

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 strategy of previous studies (such as Heravi and Mohammadian [42], Chiguvu [43], and Shazwan et al. [44]); and  $N$  is the population size: 3.34 million. As a result, the minimum sample size is calculated as 97. Mang et al. [45] stated that even if the sample size of study is small, it is considered sufficient for a business study and can provide exactness results between a population of 200 million with 4000 population.

However, the targeted respondents who were involved in the data collection comprised individuals aged between 25 and 60 years old to ensure the significance of the findings of this study. According to Patino and Ferreira [46], the inclusion criteria, such as the demographic among targeted respondents, are important in ensuring the validity of the study results. This inclusion was adopted from a study of Ibrahim et al. [47] in terms of the age of the targeted respondents for the following reason:

- (i) The average of current selling or market price for a 2-storey house ranges from RM275,000 to RM400,000. Based on the current interest housing loan rate, the monthly instalment amounts from approximately RM1200 to RM1800 for 30–35 years of tenure
- (ii) Most of the individuals in Malaysia have completed their diploma or first bachelor's study at the age of approximately 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 starting salary for diploma grad-

uates amounts between RM1500 and RM2200 for degree graduates

- (iii) Two to four years are required to gain yearly increment and financial stability to secure a housing loan, which permits the execution of the above monthly instalment
- (iv) The retirement age policy for government servants is between 55 and 60 years old. It is expected that the private sector applies a similar approach

**3.3. Data Collection.** The sampling frame of the study was determined through the convenience sampling method as it fulfills the condition that the sampling complies with some criteria set by the researcher [39]. Thus, to record the research data, booklets of survey forms were distributed to the targeted respondents through the use of personally administered techniques. This administered survey technique offers a few benefits, including its ability to collect the completed responses within a short period, while any doubts about the research could be clarified by the researcher on the spot [39].

To create an understanding of the topic under study, the respondents were briefly explained the aims of the survey. For the purpose of exploring the housing model in AR application, this study has printed out the two-dimensional (2D) floor plan of the housing which enables the respondents to view the housing design in 3D view through AR application. The respondents were instructed to interact with the AR application that was installed in the enumerator's smartphone and given ample time and opportunities to view the housing design through AR application (as depicted in Figure 4). After interacting with the mobile application, they were asked to complete the survey form.

In this study, a total of 130 booklets of survey form were distributed, followed by the return of 76.92% of the forms

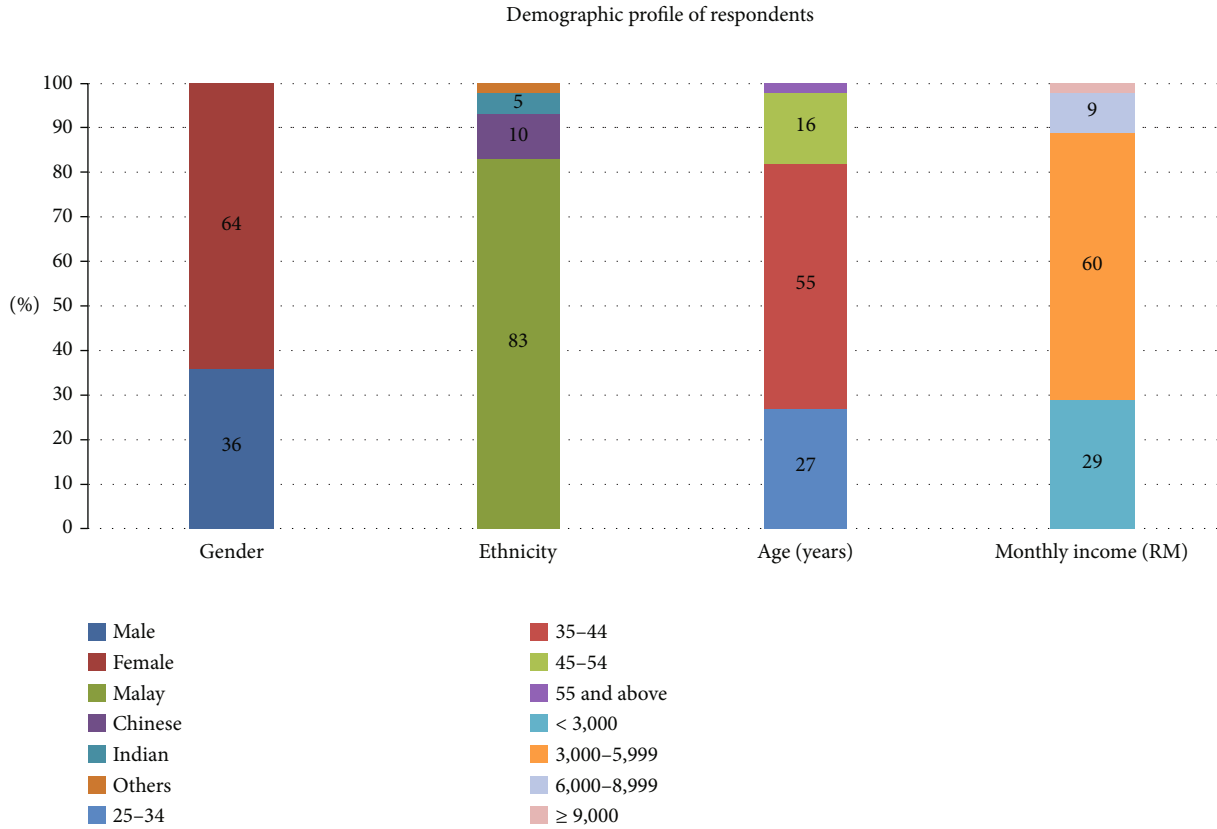


FIGURE 5: Demographic profile of respondents.

and their use for data analysis. This response rate was considered reasonable as it surpassed the marginal response rate of 60% [48]. Following that, the data obtained were analyzed using Statistical Package for Social Science (SPSS) software. Hoekstra et al. [49] stated that checking on possible violations of assumption could guarantee a valid interpretation of research data. Thus, before further analysis of the data, data screening and assumption tests were conducted to ensure that the return response was suitable for the analysis to fulfil the research aim.

#### 4. Results and Discussion

**4.1. Respondent Profiles.** As seen in Figure 5, it shows the demographic profiles of respondents involved in the survey. Overall, it could be concluded that the respondents who were involved in this study substantially contributed to the significance of the research findings.

**4.2. Reliability Analysis of Research Instrument.** Verification was performed using Cronbach’s  $\alpha$  coefficients to review the reliability of the measured items in this study. The results of the Cronbach’s  $\alpha$  analysis as depicted in Table 1 shows that the value is between 0.806 and 0.870, which all exceeded the universally accepted reliability measure score of 0.70 as suggested by Bagozzi and Yi [50]; thus, the reliability of the measurement item is ensured.

**4.3. Hypothesis Testing.** For further analysis to ascertain the influence of response hierarchy and AR technology as a promotion tool on intention to purchase among potential house buyers, correlation analysis was conducted in this study by referring to the  $r$  value of Pearson product-moment correlation coefficient. To analyze the strength of the correlation coefficient between the variables, the rules of thumb in Pearson correlation by Schober et al. [51] is used as a reference. Table 2 presents the details of the correlation coefficient range for data interpretation.

As shown in Table 3, correlation analysis demonstrated the correlation between the hierarchy process, AR technology, and the intention to purchase the housing. Overall, the  $r$  value is between 0.177 and 0.655 which indicates an existence of a relationship with different strength correlations between these variables.

Based on the analysis of the relationship between the subfactor of response hierarchy and intention to purchase, knowledge ( $r = 0.333, p < 0.001$ ), liking ( $r = 0.408, p < 0.000$ ), and preferences ( $r = 0.655, p < 0.000$ ), the result indicates a significant effect on the degree of purchasing intention among the respondents. Thus, the hypotheses of H1b, H1c, and H1d are accepted. Hypothesis of H1a is rejected as the result revealed insignificant correlation between awareness ( $r = 0.177, p < 0.079$ ) and intention to purchase. In addition, the application of AR technology as an advertising tool in promoting the house has a significant impact ( $r = 0.621, p < 0.000$ ) on intention to purchase among the

TABLE 1: Measurement items and Cronbach's  $\alpha$  value.

Questionnaire	$\alpha$ value
Awareness: measure house buyers' awareness, acceptance, and familiarity with the real estate business and augmented reality (AR) housing models	
Aw1: I am aware that real estate business is a business which deals with the buying, selling, management, or investment of real estate properties (houses/buildings)	0.806
Aw2: I know some of the marketing techniques which are available and commonly used by real estate agents to advertise the real estate properties/houses. (e.g., printed publications, websites, and social medias)	
Aw3: I am aware that the AR house model is one of the marketing techniques which is commonly used by real estate agents to advertise the real estate properties/houses	
Aw4: I know there is a real estate exhibition happening when I saw the AR house model being presented at the booth	
Knowledge: measure the familiarity and understanding of house buyers towards the real estate marketing and its information through augmented reality (AR) house model	
Kn1: I understand that the AR house model is a scale of a house's model which is used for presenting the actual house/property at the site	0.843
Kn2: AR house models can present the house/property in a more realistic manner	
Kn3: AR house models can provide a better visuality for the houses/property	
Kn4: the presented houses/property's design is much more detailed in the AR house model	
Kn5: I can understand the complex information easily by viewing through the AR house model (house design, spacing organization, location, etc.)	
Liking: measuring how house buyers like or favor augmented reality (AR) house models marketing channels in transferring information during the marketing communication process	
Lk1: vision attractiveness	0.870
Lk2: design presentation	
Lk3: clarity of information provided (design, layout, and spacing)	
Lk4: conciseness/accuracy of information	
Lk5: houses' layout/organizations visuality	
Lk6: visuality pleasureness	
Lk7: design attributes	
Preference: measuring the favor and level of preference of house buyers towards the marketing communication channels during the marketing communication process	
Pr1: how likely would you prefer an AR house model in presenting the house's design?	0.807
Pr2: how likely would you prefer an AR house model in presenting the house's space organizations?	
Pr3: how likely would you prefer an AR house model in presenting the house's visual pleasureness?	
Pr4: how likely would you prefer an AR house model in presenting the house's overall information (design, layout, and visual)?	
AR technology: measuring the effectiveness of house buyers towards augmented reality (AR) model compare to other marketing communication channels (e.g., brochures and 3D mock-up model)	
AR1: it enables to view the property/house's design in a better way.	0.864
AR2: it enables to view property/house's interior layout in a better way	
AR3: it enables to visualize each of the room sizes from the house model and floor plan layout	
AR4: it enables to view the openings (windows and doors) of the property/house easily	
AR5: it enables to view the orientation of each section in the property/house clearly	
AR6: more informative than others (e.g., brochures and 3D mock-up model)	
AR7: more convenient than others (e.g., brochures and 3D mock-up model)	
AR8: more enjoyable than others (e.g., brochures, 3D mock-up model)	
AR9: more acceptable than others (e.g., brochures and 3D mock-up model)	
AR10: more reliable than others (e.g., brochures and 3D mock-up model)	
AR11: more entertaining than others (e.g., brochures and 3D mock-up model)	
AR12: more appropriate than others (e.g., brochures and 3D mock-up model)	

TABLE 2: Correlation Coefficient Strength Indication.

Magnitude of 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

TABLE 3: Summary of hypothesis testing.

Hypothesis	<i>r</i> value	Correlation strength	Significance	Support
H1				
H1a	0.177	Negligible correlation	$p < 0.079$	Reject
H1b	0.333	Weak correlation	$p < 0.001$	Accept
H1c	0.408	Moderate correlation	$p < 0.000$	Accept
H1d	0.655	Moderate correlation	$p < 0.000$	Accept
H2	0.654	Moderate correlation	$p < 0.000$	Accept

Correlation is significant at the 0.01 level (2-tailed).

potential house buyers which reflected the acceptance of hypothesis (H2) developed in this study.

## 5. Discussion

This study is aimed at examining the effect of response hierarchy and AR technology on customers' intention to purchase in the housing sector. This study sought to achieve this aim by integrating the response hierarchy model and developed two main hypotheses. The analysis showed a mixed result and found a few interesting findings.

All subfactors of response hierarchy (knowledge, liking, and preferences) except for awareness significantly influence the house purchase intention among the respondents. Overall, this finding supports the previous studies [27, 28] which established the perspective of the hierarchy of effect models in altering consumer purchasing behavior. This result could be mainly contributed by the preference stage in which the potential buyers may prefer the AR house model as a promotion tool compared to other tools. The use of AR technology as a promotion tool helps consumers have better imagination of the real product as it allows the consumers to walk through the house and surroundings, evaluate the proportion and scale using intuitive interactive modeling environments, and simulate the effects of interior design [52]. As a result, the response hierarchy model is considered to function and follow a specific sequence where the prospect is present in a series of phases, which are from unawareness through product purchase [12]. Several individuals may state that they develop a liking and preference for a product before making a cognitive judgement about it, while other individuals argue that people develop preferences and knowledge at the same time. Despite the fact that each argument includes its respective support, the general model (cognition first, affective second) appears to be valid, particularly in relatively complex or high involvement

decision-making situations. This feature provides a conceptual framework for the perception of the sequence of events, which begins with initial awareness and ends with the final action.

In terms of application of AR technology as a marketing communication channel, the result is in line with prior studies [53–55] which found a positive impact of AR apps in influencing consumer behavior of intention to purchase a house. Replication of this similar finding is due to the attributes of AR apps that enable to provide an immersive environment in terms of house layouts, and design visualization which in turn, stimulates respondent purchase intention. This scenario is totally different compared to printed 2D plans or 3D perspective images on brochures and 3D mock-up models where the potential house buyers solely depend on their ability to imagine the real exterior and interior layout of the selling house. Furthermore, the AR apps overcome the limitation of printed brochure and mock-up models in which these promotion channels are entirely static and its attributes are perceptual that rely exclusively on sight that no multiple angle manipulation of the product is possible.

## 6. Conclusion

This study proposes to examine the influence of response hierarchy and AR technology on intention to purchase in the context of the housing sector. Thus, two main hypotheses have been developed to achieve the aims of the study. Based on the results of analysis and hypothesis testing, there are several conclusions that can be drawn to answer the research questions that are being investigated by the current research.

This study found a positive correlation between the response hierarchy, AR technology, and intention to purchase in the housing sector. It was indicated that the use of AR technology as a marketing tool in promoting the sale of houses is a valuable marketing strategy. To illustrate this point, potential home buyers have begun to develop a preference for marketing communication processes and are able to make a better review of the general view of the real product compared to conventional promotion tools, such as brochures and 3D mock-up models.

Despite the possibility of consumers having a preference for more than one type of product technology, the housing developer should ensure that consumers shift their focus from rival products to their own products. This action directly engages and generates interaction among potential house buyers with real-world items around them and the generated and given virtual content through the AR application. They may also imitate interior spaces and the surrounding environment for exploration and enjoyment.

Overall, this study has contributed to the existing literature on marketing, particularly the response hierarchy and consumer behavior in the housing sector. It supports the literature on response hierarchy and marketing communication channels in influencing consumer behavior. The research could also provide guidance for housing developers and entrepreneurs regarding the methods of improving



marketing communication by collecting consumer feedback, thereby protecting buyers' social interests. Furthermore, the findings provide additional information on the research related to AR applications. In terms of practicability, housing developers may employ this technology as a prepurchase evaluation tool to show acceptance among potential house buyers. This initiative would benefit the housing developers in terms of time consumption, profitability, the return rate of investment, and overall management.

## 7. Limitations and Future Research

This study has several limitations, which provides an avenue for additional research in terms of purchasing behavior in relation to marketing in the housing sector. To note, the response hierarchy could be summarized into three main phases: cognitive, affective, and conative. This study excludes the conative phase as the aim of this study is to investigate the prepurchase behavior in the context of the housing sector. The purchasing behavior for house is excluded as this study did not represent any current selling house, but the house model in the AR application is chosen randomly. Other than that, this study would like to explore the potential of AR technology as an alternative marketing communication channel in promoting the selling house among the housing developers. Thus, similar research could be executed by considering the conative phase and develop the house model based on the current selling house. Furthermore, the current study is cross-sectional, whereas further research could explore qualitative and longitudinal approaches.

In terms of statistical analysis, this study employed correlation analysis in order to test the hypotheses as well as examine the strength of relationship between the variables (response hierarchy and AR technology with intention to purchase). Consideration for further study could be extended by employing regression analysis which could indicate the items that mostly influence the purchasing intention among the potential house buyers.

To note, the data for this study was collected prior to the COVID-19 coronavirus pandemic, which hindered this study to collect more data. Based on the Cochran formula ( $t = 1.96$ ,  $S = 0.5$ ,  $d = 5\%$ ), this study planned to distribute around 400 sets of survey booklets. However, due to several travel restrictions by the Malaysian government, this study was only able to distribute 130 sets of survey booklets. Fortunately, the distributed and returned sets of survey booklets were sufficient and appropriate to generalize the data that represent the whole population based on a similar approach adopted in previous research ( $t = 1.96$ ,  $S = 0.5$ ,  $d = 10\%$ ). In addition, the COVID-19 coronavirus may have influenced the attitudes of respondents involved in this study. Hence, this study could be repeated by extending the sample size and assess the prepurchasing or purchasing behavior in a normal daily life scenario.

## Data Availability

The correlation analysis data used to support the findings of this study are included within the article.

## Conflicts of Interest

The authors declare that they have no conflicts of interest.

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## References

- [1] M. Öztürk and P. Batum, "How housing brands use social media in their marketing communications?: a content analysis," *Yönetim Bilimleri Dergisi*, vol. 17, no. 33, pp. 111–135, 2019.
- [2] R. Miklenčičová and B. Čapkovičová, "Environmental management and green innovation in businesses," in *Marketing Identity: Explosion of Innovations Book Series: Marketing Identity*, pp. 482–493, FMK, Trnava, 2017.
- [3] R. Yung and C. Khoo-Lattimore, "New realities: a systematic literature review on virtual reality and augmented reality in tourism research," *Current Issues in Tourism*, vol. 22, no. 17, pp. 2056–2081, 2019.
- [4] A. Siddhant, "Review on application of augmented reality in civil engineering," in *International Conference on Interdisciplinary Research in Engineering and Technology*, pp. 68–71, New Delhi, India, 2016.
- [5] P. Katsioloudis, V. Jovanovic, and M. Jones, "A comparative analysis of spatial visualization ability and drafting models for industrial and technology education students," *Journal of Technology Education*, vol. 26, no. 1, pp. 88–101, 2014.
- [6] H. H. Kumar, S. F. John, and S. Senith, "A study on factors influencing consumer buying behavior in cosmetic products," *International Journal of Scientific and Research Publications*, vol. 4, no. 9, pp. 1–6, 2014.
- [7] R. Chakravarty and N. N. Sarma, "Evolutionary framework of hierarchy of effects models: exploring relevance in the shifting of customer path," *Vilakshan - XIMB Journal of Management*, vol. 19, no. 1, pp. 59–68, 2022.
- [8] M. Solomon, M. Hogg, S. Askegaard, and G. Bamossy, *Consumer Behaviour: A European Perspective*, Pearson Education, 7th ed. edition, 2019.
- [9] A. Ashurst, "Customer feedback," *Nursing and Residential Care*, vol. 2, no. 11, pp. 554–554, 2000.
- [10] PIMT, *Consumer behavior & marketing communication*, Pimt.Ac.In, 2014, <http://www.pimt.ac.in/pdfgallery/1373261525.pdf>.
- [11] C. Fill, *Marketing Communications: Interactivity, Communities and Content*, Financial Times Prentice Hall, 5th ed. edition, 2009.
- [12] F. Rehman, T. Nawaz, I. Ahmed, and S. Hyder, "Some insights in the historical prospective of hierarchy of effects model: a short review," *Information Management and Business Review*, vol. 6, no. 6, pp. 301–308, 2014.
- [13] B. Sukma Wijaya, "The development of hierarchy of effects model in advertising," *International Research Journal of Business Studies*, vol. 5, no. 1, pp. 73–85, 2012.
- [14] J. Zhang and E. Mao, "From online motivations to ad clicks and to behavioral intentions: an empirical study of consumer

- response to social media advertising,” *Psychology & Marketing*, vol. 33, no. 3, pp. 155–164, 2016.
- [15] D. R. Gabriella and A. A. Agus, “Product cognition, platform emotion, behavior intention, and actual behavior stage in cross border E-commerce (case study: Shopee as the biggest cross border E-commerce in Indonesia),” in *2020 3rd International Conference on Computer and Informatics Engineering (IC2IE)*, Yogyakarta, Indonesia, 2020.
- [16] F. Nurrahmi, J. Sari, R. F. Marta, Y. B. Setiawan, and R. Rahim, “Aceh young users purchase intention by online store exposure on Facebook,” *International Journal of Data and Network Science*, vol. 41–48, pp. 41–48, 2018.
- [17] W. Zhu, J. Mou, and M. Benyoucef, “Exploring purchase intention in cross-border E-commerce: a three stage model,” *Journal of Retailing and Consumer Services*, vol. 51, pp. 320–330, 2019.
- [18] A. A. Agneta, *Effects of Facebook advertising on cosmetics sales and purchase by women in Kenya, [Ph.D. thesis]*, University of Nairobi, 2018.
- [19] R. G. Duffett, “Facebook advertising’s influence on intention-to-purchase and purchase amongst millennials,” *Internet Research*, vol. 25, no. 4, pp. 498–526, 2015.
- [20] R. Duffett, “The YouTube marketing communication effect on cognitive, affective and behavioural attitudes among generation Z consumers,” *Sustainability*, vol. 12, no. 12, p. 5075, 2020.
- [21] R. A. Mariana Febrianti, C. N. Assiva, A. Salsabila, K. R. Salsabila, N. P. Octarian, and W. C. Sinaga, “The role of marketing communication and innovation on consumer purchase intention (case study at restaurant X in Bandung City),” *Review of International Geographical Education (RIGEO)*, vol. 11, no. 3, pp. 1376–1385, 2021.
- [22] N. Chen and Y. Yang, “The impact of customer experience on consumer purchase intention in cross-border E-commerce—taking network structural embeddedness as mediator variable,” *Journal of Retailing and Consumer Services*, vol. 59, no. 102344, article 102344, 2021.
- [23] T. Hwei and L. Youngsook, “Factors affecting continuous purchase intention of fashion products on social E-commerce: SOR model and the mediating effect,” *Entertainment Computing*, vol. 41, no. 100474, article 100474, 2022.
- [24] Mudjahidin, N. L. Sholichah, A. P. Aristio, L. Junaedi, Y. A. Saputra, and S. E. Wiratno, “Purchase intention through search engine marketing: E-marketplace provider in Indonesia,” *Procedia Computer Science*, vol. 197, pp. 445–452, 2022.
- [25] B. K. P. D. Balakrishnan, M. I. Dahnil, and W. J. Yi, “The impact of social media marketing medium toward purchase intention and brand loyalty among generation Y,” *Procedia, Social and Behavioral Sciences*, vol. 148, pp. 177–185, 2014.
- [26] H. Masuda, S. H. Han, and J. Lee, “Impacts of influencer attributes on purchase intentions in social media influencer marketing: mediating roles of characterizations,” *Technological Forecasting and Social Change*, vol. 174, article 121246, 2022.
- [27] J. B. Whang, J. H. Song, B. Choi, and J.-H. Lee, “The effect of augmented reality on purchase intention of beauty products: the roles of consumers’ control,” *Journal of Business Research*, vol. 133, pp. 275–284, 2021.
- [28] K. M. S. Faqih, “Factors influencing the behavioral intention to adopt a technological innovation from a developing country context: the case of mobile augmented reality games,” *Technology in Society*, vol. 69, no. 101958, article 101958, 2022.
- [29] S.-W. Hung, C.-W. Chang, and Y.-C. Ma, “A new reality: exploring continuance intention to use mobile augmented reality for entertainment purposes,” *Technology in Society*, vol. 67, article 101757, 2021.
- [30] S. H.-Y. Hsu, H.-T. Tsou, and J.-S. Chen, ““Yes, we do. Why not use augmented reality?” customer responses to experiential presentations of AR-based applications,” *Journal of Retailing and Consumer Services*, vol. 62, article 102649, 2021.
- [31] M.-H. Stoltz, V. Giannikas, D. McFarlane, J. Strachan, J. Um, and R. Srinivasan, “Augmented reality in warehouse operations: opportunities and barriers,” *IFAC-PapersOnLine*, vol. 50, no. 1, pp. 12979–12984, 2017.
- [32] H.-L. Chi, S.-C. Kang, and X. Wang, “Research trends and opportunities of augmented reality applications in architecture, engineering, and construction,” *Automation in Construction*, vol. 33, pp. 116–122, 2013.
- [33] X. Wang, M. J. Kim, P. E. D. Love, and S.-C. Kang, “Augmented reality in built environment: classification and implications for future research,” *Automation in Construction*, vol. 32, pp. 1–13, 2013.
- [34] F. Ullah, P. Sepasgozar, and T. H. Ali, “Real estate stakeholders technology acceptance model (RESTAM): user-focused big9 disruptive technologies for smart real estate management,” in *Proceedings of the 2nd International Conference on Sustainable Development in Civil Engineering (ICSDC 2019)*, pp. 25–27, Jamshoro, Pakistan, 2019.
- [35] N. Jain, “Survey versus interviews: comparing data collection tools for exploratory research,” *The Qualitative Report*, vol. 26, no. 2, pp. 541–554, 2021.
- [36] I. Brace, *Questionnaire Design: How to Plan, Structure and Write Survey Material for Effective Market Research*, Kogan Page, London, 4th Edition edition, 2018.
- [37] S. H. Kazmi, R. R. Ahmed, K. A. Soomro, E. A. R. Hashem, H. Akhtar, and V. Parmar, “Role of augmented reality in changing consumer behavior and decision making: case of Pakistan,” *Sustainability*, vol. 13, no. 24, p. 14064, 2021.
- [38] M. Saunders, P. Lewis, and A. Thornhill, *Research Methods for Business Students*, Pearson, London, UK, 6th Edition edition, 2012.
- [39] U. Sekaran and R. Bougie, *Research Methods for Business: A Skill Building Approach*, John Wiley & Sons, London, UK, 7th Edition edition, 2016.
- [40] DOSM (Department of Statistic Malaysia), “Launching of report on the key findings population and housing census of Malaysia 2020,” 2022, Nov 2022, <https://www.dosm.gov.my>. [https://www.dosm.gov.my/v1/index.php?r=column/c t h e m e B y C a t & c a t = 1 1 7 & b u l \\_ i d = a k l i V W d I a 2 g 3 Y 2 V u b T V S M k x m Y X p 1 U T 0 9 & m e n u \\_ i d = L o p h e U 4 3 N W J w R W V S Z k I W d z Q 4 T l h U U T 0 9](https://www.dosm.gov.my/v1/index.php?r=column/c t h e m e B y C a t & c a t = 1 1 7 & b u l _ i d = a k l i V W d I a 2 g 3 Y 2 V u b T V S M k x m Y X p 1 U T 0 9 & m e n u _ i d = L o p h e U 4 3 N W J w R W V S Z k I W d z Q 4 T l h U U T 0 9).
- [41] S. L. Cheah, S. Almeida, M. Shukri, and L. S. Lim, *Imbalances in the Property Market*, Bank Negara Malaysia, 2017.
- [42] G. Heravi and M. Mohammadian, “Investigating cost overruns and delay in urban construction projects in Iran,” *International Journal of Construction Management*, vol. 21, no. 9, pp. 958–968, 2021.
- [43] D. Chiguvi, “The influence of after sales services on marketing performance in the retail sector in Botswana,” *Dutch Journal of Finance and Management*, vol. 4, no. 1, p. em0060, 2020.
- [44] M. A. Shazwan, J. V. Quintin, N. A. Osman, S. K. Suhaida, and M. I. Ma’arof, “The importance of cleanliness in a proper construction site management in Malaysia: a contractor’s

- perspective,” *Materials Science and Engineering*, vol. 271, article 012048, 2017.
- [45] J. Mang, R. Zainal, and I. S. Mat Radzuan, “Factors influencing home buyers’ purchase decisions in Klang Valley, Malaysia,” *Malaysian Journal of Sustainable Environment*, vol. 7, no. 2, pp. 81–94, 2020.
- [46] C. M. Patino and J. C. Ferreira, “Inclusion and exclusion criteria in research studies: definitions and why they matter,” *Journal brasileiro de pneumologia: publicacao oficial da Sociedade Brasileira de Pneumologia e Tisiologia*, vol. 44, no. 2, p. 84, 2018.
- [47] F. A. Ibrahim, N. Ishak, J. Y. W. Kueh et al., “Virtual technology (VR) attractiveness attributes in influencing house buyers’ intention to purchase,” *Journal of Advanced Research in Applied Sciences and Engineering Technology*, vol. 29, no. 2, pp. 126–134, 2023.
- [48] R. Hendra and A. Hill, “Rethinking response rates: new evidence of little relationship between survey response rates and nonresponse bias,” *Evaluation Review*, vol. 43, no. 5, pp. 307–330, 2019.
- [49] R. Hoekstra, H. A. L. Kiers, and A. Johnson, “Are assumptions of well-known statistical techniques checked, and why (not)?,” *Frontiers in Psychology*, vol. 3, no. 137, 2012.
- [50] R. P. Bagozzi and Y. Yi, “Specification, evaluation, and interpretation of structural equation models,” *Journal of the Academy of Marketing Science*, vol. 40, no. 1, pp. 8–34, 2012.
- [51] P. Schober, C. Boer, and L. A. Schwarte, “Correlation coefficients,” *Anesthesia and Analgesia*, vol. 126, no. 5, pp. 1763–1768, 2018.
- [52] D. Bouchlaghem, H. Shang, J. Whyte, and A. Ganah, “Visualisation in architecture, engineering and construction (AEC),” *Automation in Construction*, vol. 14, no. 3, pp. 287–295, 2005.
- [53] A. Azmi, R. Ibrahim, M. Abdul Ghafar, and A. Rashidi, “Smarter real estate marketing using virtual reality to influence potential homebuyers’ emotions and purchase intention,” *Smart and Sustainable Built Environment*, vol. 11, no. 4, pp. 870–890, 2022.
- [54] D. Sihi, “Home sweet virtual home,” *Journal of Research in Interactive Marketing*, vol. 12, no. 4, pp. 398–417, 2018.
- [55] M. Y.-C. Yim, S.-C. Chu, and P. L. Sauer, “Is augmented reality technology an effective tool for E-commerce? An interactivity and vividness perspective,” *Journal of Interactive Marketing*, vol. 39, pp. 89–103, 2017.