"Motivations and barriers to embracing augmented reality: An exploratory study with Vietnamese retailers"

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MOTIVATIONS AND BARRIERS TO EMBRACING AUGMENTED REALITY: AN EXPLORATORY STUDY WITH VIETNAMESE RETAILERS

Abstract

The most crucial key to successfully approaching customers is enhancing the interaction experience between customers and retailers. This study explores the motivations for adopting augmented reality (AR) in retailing small and medium-sized retailers in Vietnam. A structured questionnaire was delivered to a total sample of 302 Vietnamese retailers and got 215 clean and valid responses. The survey was conducted both online and offline for ten months, from February 2021 to December 2021. The chosen surveyors are retailing managers and owners of retailing firms. These firms sell fashion products, technology gadgets, and household products. The data were statistically analyzed using Smart PLS software and the partial least equation structural model. The findings indicate three direct, positive, and significant factors that influence the retailer's AR adoption, including (1) organizational attitude toward AR, (2) organizational innovativeness, and (3) competition pressure in which organizational attitude toward AR and organization innovativeness are two critical motivational drivers. The competition pressure has been identified as the challenge barrier. The cost barriers affect organizational attitude toward AR but do not significantly influence AR adoption. Along with theoretical contributions, this paper also gave some theoretical and practical implications for retailers who have the intention to adopt AR and integrate AR into their current retailing system.

INTRODUCTION

Augmented reality (AR) is a cutting-edge technology that combines virtual content with the real-world environment of a customer (Hinsch et al., 2020). First time introduced in the 1950s in the cinema industry (Carmigniani et al., 2011), then adopted in airlines and military in the 1970s (Kumar, 2021), but when smartphones, mobile users, and e-commerce boomed in some recent years, augmented reality (AR) have been popularly used in marketing and retailing industry. As the symbols of experiential marketing, benefits of in-store environment enhancement (Bonetti et al., 2018), and customers' shopping experience optimization (Pantano, 2015), AR and VR (Virtual reality) have drawn the attention of both academics and practitioners. By integrated AR applications in retail, enterprises provide an experiential-centric platform for customers (Porter & Hepplemann, 2017) in which customers have opportunities to "try on" products from a distance. As a result, the AR application is one of the most promising (Kumar, 2021) and practical tools for digital marketing and sales (Chylinski et al., 2020) because AR supports the functions of mutual interaction among customers and brands. For example, in the AR application of

Maybelline on Shopee and Lazada, customers may try various color swatches on their lips. Then they may be aware of which lipstick swatches fit with their own before making any further behavioral intentions without any physical interaction at the brick-and-mortar store. This function is one of the absolute benefits of AR applications (Fan et al., 2020) that fulfill the traditional online business's limitations and experiential challenges. According to Chylinski et al. (2020), by integrating realistic virtual technologies, AR applications assist digital affordances that enhance customer experience and urge customers to respond to brands' products/services. Also stated by Hilken et al. (2017), the virtually – enhanced marketing environment – creates the virtual marketing context for the customer that triggers the *"situated – cognition"* in which customers easily interact with the brand and their products and gain the actual try-on experience as the typically physical environment.

As being used in the retailing sector, AR and VR have equipped a solid weapon for retailers in competition and brought customers a better experience, especially with purely E-business enterprises. The traditional brick-and-mortar retailers surpass the online ones in terms of hands-on experience. In contrast, the E-retailers have the advantage of approaching a more significant number of customers. Each method has its strengths and weaknesses; hence, by adopting AR and VR technologies and integrating them into the current retailing system, retailers may exploit the advantages of each model to overcome their current challenges. Although recognizing the benefits of AR in optimizing the customer experience and smoothing customer journey, however, the decision to adopt AR technology requires numerous conditions, including financial and technological investment (Fan et al., 2020), peer pressures from competitors, and customer preferences (Nikhashemi et al., 2021).

Moreover, until now, AR and VR have still been considered innovations that only innovators who love to experience new technologies may try and consume. Therefore, understanding the troublesome stimuli of retailers is crucial in both practical and academic fields. Most research focuses on customers' adoption and opinions, whereas the research with retailers is quite limited. Moreover, research in this field mainly highlighted the technological aspects (Fan et al., 2020) rather than actual usage and innovation adoption.

1. LITERATURE REVIEW AND HYPOTHESES

The Covid-19 pandemic has brought numerous landmark changes to the whole society, creating "golden" opportunities for the E-commerce and E-business sectors. It cannot be denied that online business has developed so fast and step by step, replacing the role of traditional physical stores in the retailing system. However, the coronavirus and social distancing have pushed the integration of technology innovation into business and administration to a higher level (Nguyen & Tran, 2022). However, being dominated by the retailing system, lacking sensory experience has put barriers and challenges to developing online business activities (Heller et al., 2019). So then, marketing researchers and practitioners have tried integrating AR and VR technologies into retailing and marketing to enhance the sensory experience to customers by allowing them to have feelings of touch, which is missed in regular online business stores.

The core concept of augmented reality (AR) is augmenting and digitalizing the product's design, information, and functions in the real world (Do et al., 2020). AR is specifically defined by Carmigniani and Furht (2011) as "a real-time direct or indirect view of a physical environment that has been augmented by adding virtual computer-generated information". As Caboni and Hagberg (2019) discussed, AR has three distinct elements: augmented content, augmented real environment, and augmented experience. Augmented content is defined as digitalizing the contents, including photos, product design, video clips, and other types of information, by re-producing in 2.5D or 3D. The augmented real environment brings AR users to the context where they may have perceptions and feelings as real. Finally, augmented experience enables users to interact with AR content provided by brands in real-time, affecting their sensory experience.

In retailing, AR has been applied by retailers worldwide, especially in dynamic business re-

gions such as Asian countries (China, South Korea, Japan, Singapore, and Malaysia). AR applications have been introduced to enhance the customer experience with the brand (Flavián et al., 2019) along their shopping journey. There have been three dominant applications of AR that are most popular and widely used, including in-store-based, on-web-based, and mobile-app-based (Caboni & Hagberg, 2019). When experiencing the contents provided by AR applications, consumers can interact and touch the product in an augmented way (Brengman et al., 2019) that allows customers to see how a product fit them personally (Olsson et al., 2013). Moreover, customers may have confidence in purchasing after intangibly touching products and trying them on (Pantano & Vannucci, 2019). From retailers' perspectives, AR adoption may increase the opportunities to optimize the sensory experience for their customers. AR also enhances enterprises' marketing and adverting capabilities (Brengman et al., 2019) by providing real-time augmented content that customers can experience without coming to stores. Consumers perceive AR ads as novel and engaging (Yang et al., 2020). In addition, AR brings advantages for shop owners as customers may increase the speed of obtaining product information (Dacko, 2017) as all product information is augmented most realistically.

Although widely used in other markets, the adoption of AR in the Vietnamese retail sector has still been limited. Both retailers and consumers are eager to these innovative applications due to their advances and benefits to customer experience. However, more stimuli and supported conditions are required to reach further development levels. This study combined three different theoretical models, including the technology acceptance model (TAM), the stimuli-organism-response (SOR) model, and the Technology-Organization-Environment model (TOE), to explore the stimuli and barriers to AR adoption in retail enterprises. The TAM model has been widely used in research technology adoption studies.

In contrast, the SOR has been used to determine the influenced factors, attitudes, and opinions, then the behavioral reaction of the customer under the effects of stimuli. The TOE model approaches technology adoption from the other side with TAM. The decision to adopt any technology innovation relies much on technical aspects, but it also mainly depends on organizational and environmental context (Kumar et al., 2016). Hence, there have been four significant determinants (both stimuli and barriers) of AR adoptions in an enterprise, which have been identified by Kumar et al. (2016), Plotkina and Saurel (2019), Van Esch et al. (2019), Rauschnabel et al. (2019), Heller et al. (2019), Yang et al. (2020), and Alam et al. (2021). They include (1) organizational attitude toward AR, (2) organizational innovativeness, (3) perceived cost/cost barrier, and (4) competitive pressure.

In the TAM model, perceived usefulness (PU) and perceived ease of use (PEoU) are two factors that may influence the attitude toward technology then the intention to accept that technology. Van Esch et al. (2019), Cabero-Almenara et al. (2019), and Rauschnabel et al. (2019) examined these relationships in the context of AR technology. They proved the mediating role of attitude toward AR in the effects of PU and PEoU on AR adoption. In these studies, organizational attitude toward AR is the most crucial factor determining the intention to adopt AR technology of a firm. Organizational innovativeness was introduced by Fan et al. (2020) and Alam et al. (2021) as the antecedent of AR adoption. Furthermore, the perceived cost is one of the main barriers to AR adoption in specific and technology adoption in general (Alam et al., 2021). Hence, cost raises challenges for enterprises when they have the intention to integrate AR into their current system.

Kumar et al. (2016) stated that any enterprise that intends to adopt a new innovative technology must have financial strength. Competition pressure was agreed to impact AR adoption by E-commerce firms (Kumar et al., 2016; Van Esch et al., 2019). Competition and peer pressure from competitors substantially influence the intention to adopt the AR of a firm. Hence, to explore the AR adoption stimuli, barriers, and current situation of Vietnamese retailers, the study proposed the following research model and eight following hypotheses:

H1: *Perceived usefulness significantly affects organization's attitude toward AR.*

H2: *Perceived ease of use significantly affects organization's attitude toward AR.*

H3: *The organization's attitude toward AR significantly affects AR adoption of retailers.*

H4: *The cost barrier significantly affects organization's attitude toward AR.*

H5: *The cost barrier significantly affects AR adoption of retailers.*

H6: *Organization innovativeness significantly affects organization's attitude toward AR.*

H7: *Organization innovativeness significantly affects AR adoption of retailers.*

H8: *Competition pressure significantly affects AR adoption of retailers.*

2. METHODS

This study is conducted to determine the motivations and challenges of augmented reality (AR) in the retailing sector, where the SME was the focus. A five-phase procedure was adopted to execute the statistical analysis, including: (1) reviewing the literature and developing a research model, hypotheses, (2) pre-testing measurement constructs and items , then developing the final questionnaire, (3) preliminary testing both online and offline, (4) collecting

the responded data and taking analysis with SPSS and Smart PLS software, (5) writing the manuscript.

Initially, the structured questionnaire consisted of 6 measures and 28 items. Previous research and scales were adopted to construct the measures and items for this study. However, statements were adjusted and modified for a better fit to the context and culture of local business, then translated into Vietnamese. The scale for perceived usefulness and ease of use was adopted from Cabero-Almenara et al. (2019). Organizational attitude toward AR was developed from the items of Plotkina and Saurel (2019), whereas the cost barrier was developed from the scale introduced by Alam et al. (2021). The scale for organizational innovativeness was adapted from the study of Van Esch et al. (2019), and the AR adoption scale was developed by Cabero-Almenara et al. (2019) and Alam et al. (2021).

The surveying process took around ten months, from February 2021 to December 2021, with the participation of 215 retailing managers and retailing business owners. The demographical profile of respondents could be summarized as follows. (1) Position: 33.0% – retailing business owners, 67.0% – retailing managers. (2) Tenure in the retailing sector: 30.2% – less than 3 years, 45.1% – from 3 to 5 years, 24.7% – more than 5 years. (3) Retailing products: fashions products (clothes/accessories) – 41.4%, households – 22.3%, technology gadgets – 36.3%. (4) Retailing channel adoption: 20.9% – solely offline, 22.8% – solely online, 56.3% – combination of both online and offline. (5) AR applications usage: 19.1% – already adopted, 80.9% – not yet adopted.
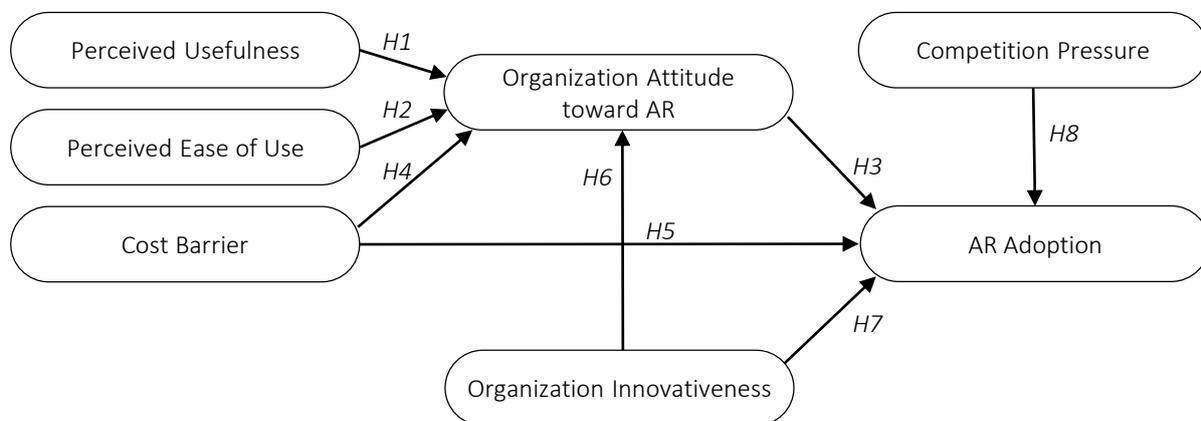

Figure 1. Proposed research model

3. RESULTS

The partial least square structural equation model (PLS-SEM) and Smart PLS statistical software were employed to develop the theoretical model and interpret the variables. Hair et al. (2019) recommended a two-step process for PLS-SEM analysis, which includes evaluating the measurement and structural models.

3.1. Measurement model assessment

Hair et al. (2017) proposed the following measures to check the convergent validity of the measurement model: factor loadings, composite reliability (CR), and average variance extracted (AVE). The outer loadings and composite reliability (CR) should both be greater than 0.70, while the AVE should be greater than 0.50. The measurement constructs would be more credible and valid after removing two items: ATT4 and ARA4, as outer loading values less than 0.70. With outer loadings > 0.70 and AVE > 0.50, all 28 items fulfill convergent validity and reliability standards (Table 1).

Table 1. Outer loadings, Cronbach's alpha, composite reliability, and AVE

Constructs	Items	Loadings	CA	CR	AVE
Perceived Usefulness	PU1	0.825	0.850	0.899	0.690
	PU2	0.842			
	PU3	0.816			
	PU4	0.839			
Perceived Ease of Use	PEoU1	0.825	0.828	0.885	0.659
	PeoU2	0.791			
	PeoU3	0.826			
	PeoU4	0.805			
Organization Attitude toward AR	ATT1	0.852	0.805	0.885	0.720
	ATT2	0.842			
	ATT3	0.851			
Cost Barrier	CB1	0.760	0.809	0.867	0.621
	CB2	0.731			
	CB3	0.863			
	CB4	0.791			
Organization Innovativeness	OI1	0.831	0.884	0.915	0.683
	OI2	0.808			
	OI3	0.828			
	OI4	0.835			
	OI5	0.829			
Competition Pressure	CP1	0.808	0.807	0.874	0.633
	CP2	0.774			
	CP3	0.787			
	CP4	0.814			
AR Adoption	ARA1	0.853	0.816	0.891	0.731
	ARA2	0.865			
	ARA3	0.848			

The discriminant validity test is the second step in evaluating the measurement model, which determines how different a construct is from other constructs (Hair et al., 2017). The Fornell-Larcker criterion and the HTMT technique are often utilized to measure discriminant validity. On the other hand, Henseler et al. (2015) recommended the HTMT because of its superior reliability. To meet discriminant validity between two reflective conceptions, the HTMT value must be smaller than 0.90. All the results in Table 2 – HTMT are less than 0.90. As a result, the measurement model had sufficient convergent and discriminant validity.

Table 2. HTMT

	ARA	ATT	CB	CP	OI	PEoU	PU
ARA							
ATT	0.719						
CB	0.187	0.259					
CP	0.618	0.316	0.138				
OI	0.661	0.653	0.105	0.539			
PEoU	0.318	0.514	0.124	0.151	0.450		
PU	0.395	0.524	0.074	0.259	0.479	0.059	

The Variance Inflation Factors (VIF) is an indicator proposed by Kleinbaum et al. (2013) to examine collinearity issues among each set of predictor variables to analyze structural models, with Hair et al. (2014) stating that when the VIF value is larger than five, the multicollinearity issue occurs. The lowest VIF score is 1.036, and the highest is 2.266, both of which are less than five, showing no multicollinearity issue.

3.2. Structural model assessment

The structural model was evaluated using a 5000-subsample bootstrapping approach. Hair et al. (2016) proposed utilizing the SRMR value to evaluate the structural model's quality; the SRMR value should be less than 0.10. The SRMR score of 0.057 – less than 0.10 – in the model fit summary indicates a strong model fit for theory testing (Table 3). The percentage of variance in the dependent variables explained by the independent variables in the model is represented by R^2, which is the primary technique to quantify the model's prediction accuracy. The R^2 values of ARA = 0.501 and ATT = 0.475 all surpassed the substantial level of $R^2 > 0.26$, as reported in Table 3 and compared to Cohen (2013). According to these figures, perceived utility, perceived ease of use, financial

Table 3. R², Q², and SMRM

Constructs	VIF		R2	Q2	SMRM
	ARA	ATT			
AR Adoption (ARA)	1.885		0.501	0.356	
Organizational Attitude toward AR (ATT)	1.093		0.475	0.332	
Cost Barrier (CB)	1.430	1.036			
Competition Pressure (CP)	2.266				0.057
Organization Innovativeness (OI)		1.839			
Perceived Usefulness (PU)		1.429			
Perceived Ease of Use (PEoU)		1.413			

obstacles, and organizational innovativeness can account for 50.1 percent of the variation in corporate attitudes toward AR. Then, 47.5 percent of the variance in AR adoption is due to organizational attitude toward AR, competitive pressure, and organizational innovativeness. Q2 was proposed by Akter et al. (2011) as a measure to determine the model's predictive significance. If the Q2 value exceeds 0, the model has predictive relevance for the dependent construct in question. The ARA (0.356) and ATT (0.332) values in Table 3 all exceeded "0," demonstrating that AR adoption and organizational attitude toward AR are both predictively relevant.

The path coefficients (values) show the degree of change in the dependent variable for each independent variable, according to Gronemus et al. (2010). Table 4 shows that all presented hypotheses have a positive and significant link because the values of all pathways are greater than 0. Because all p values were less than 0.05, the route coefficients for seven of the eight associations were statistically significant (Table 4). H5 was rejected because the p-value was greater than 0.05. All the other hypotheses are correct. Cost constraints are one of four discovered variables of organizational attitude toward AR that has a negative impact, while others have a positive impact. Organizational attitude toward AR, organization innovativeness, and

competition pressure are all elements that influence AR adoption.

Hair et al. (2017) also proposed considering the effect size (f2) for each path, with Cohen (2013) indicating that f2 values of 0.02, 0.15, and 0.35 imply minor, medium, and major effects, respectively. The findings suggest that perceived utility, perceived ease of use, and organizational attitude toward AR and competition pressure, as well as attitude toward AR adoption, had medium to large impacts, with f2 = 0.151, 0.172, 0.150, and 0.196, respectively. The f2 values for all three connections vary from 0.02 to 0.15, indicating a minor to medium impact.

4. DISCUSSION AND IMPLICATIONS

In recent years, along with the fast digitalization movement, retailers in specific must challenge with technology updates by which new and advanced technology must be considered and researched to integrate into the current system. These activities may enhance the customer experience and optimize responses along the customers' shopping journey. By equipping the ability to interact and experience product information and functions in real-time and with the most realistic

Table 4. Hypotheses testing result

| Hypotheses	β	t-value	f2	p-value	2.5%	97.5%	Decision
H1: ATT → ARA	0.384	5.149	0.196	0.000	0.228	0.517	Accepted
H2: PU → ATT	0.317	7.681	0.151	0.000	0.235	0.398	Accepted
H3: PEoU → ATT	0.335	7.226	0.172	0.000	0.247	0.429	Accepted
H4: CB → ATT	−0.205	5.585	0.078	0.000	−0.281	−0.139	Accepted
H5: CB → ARA	−0.036	0.849	0.002	0.396	−0.122	0.041	Rejected
H6: OI → ATT	0.271	4.698	0.092	0.000	0.151	0.375	Accepted
H7: OI → ARA	0.205	2.411	0.049	0.016	0.044	0.369	Accepted
H8: CP → ARA	0.308	5.909	0.150	0.000	0.209	0.411	Accepted
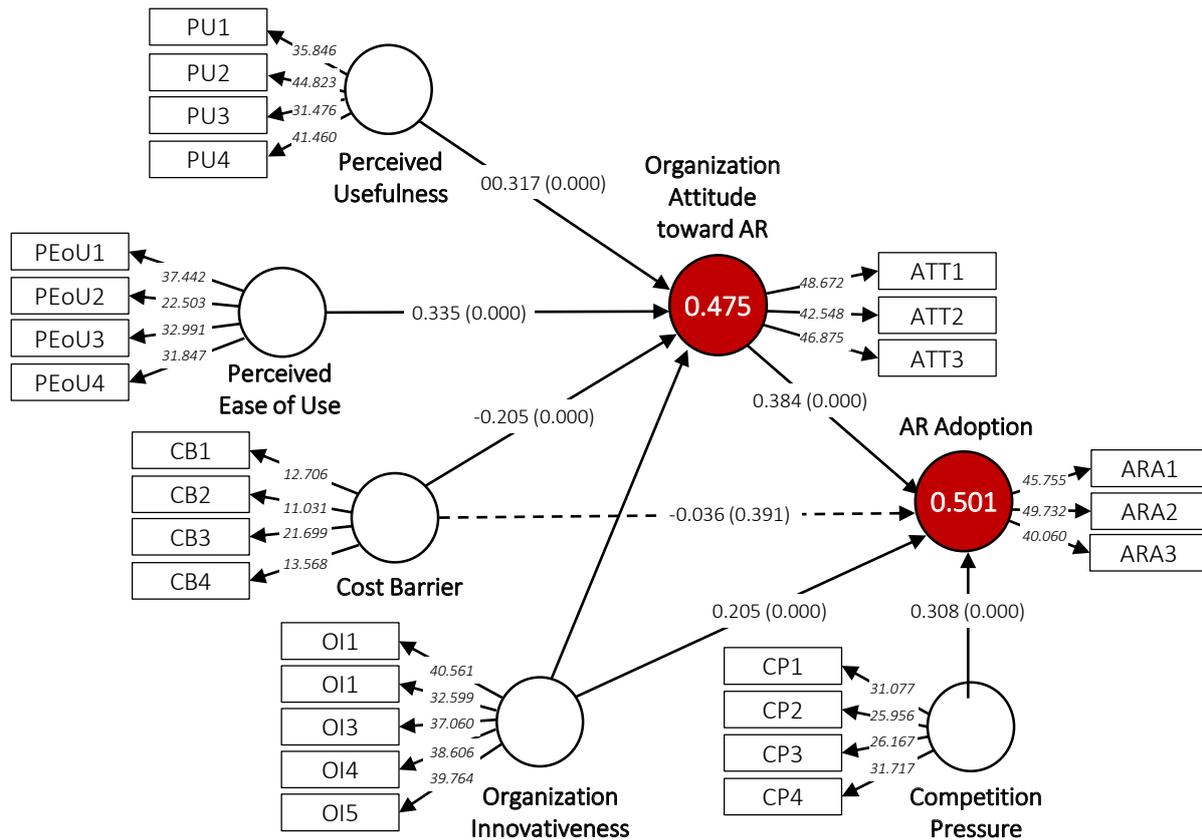
Figure 2. Structural model

feelings, AR and VR have emerged to be practical tools for retailers in pproaching closer customers in terms of emotional and sensory experience. Because of that, those who can exploit the advantages of these technologies might have chances to satisfy customer experience, and vice versa might lag. The current study has made theoretical and practical contributions.

Theoretically, this paper contributed to the existing literature on experiential marketing by exploring determinants that influence the intention to adopt AR. The organizational attitude toward AR has been determined as the mediating factor in the relationships among proposed factors. This finding supports Van Esch et al. (2019), Cabero-Almenara et al. (2019), Rauschnabel et al. (2019), and Alam et al. (2021). Four factors determined the organizational attitude toward AR, including perceived usefulness, perceived ease of use (aligned with Van Esch et al. (2019) and Cabero-Almenara et al. (2019)), cost barriers (supported by Kumar et al. (2016)), and organizational innovativeness (supported by Alam et al. (2021)). Besides, AR adoption was affected by organizational attitude to-

ward AR (aligned with Rauschnabel et al. (2019)), organizational innovativeness (supported by Fan et al. (2020)), and competition pressure (aligned with Alam et al. (2021) and Kumar et al. (2016)). However, different from other previous studies, the findings of this study show the insignificant impact of cost barriers on AR adoption. It means cost and worry for investment are not critical troublesome and challenge for retailers when they intend to adopt AR. This finding contrasts Cabero-Almenara et al. (2019) and Alam et al. (2021).

Practically, from the exploratory research, this paper has some recommendations and implications for remailers if they have the intention to adopt and integrate AR into their current system.

First, having a positive attitude toward AR must be one of the necessary conditions for the faster and easier adoption of AR. AR and other technological advances require a lot of effort and resources to understand and adopt fully. Hence, the positive perspective toward AR may be considered the first cornerstone in digitalizing the retailing system and augmenting all contents.

Second, retailers must innovate their current system and make it more innovative for customers. Omnichannel is an example of combining different and separated channels into one integrated system. Customers will have a similar experience with enterprise in all channels and touchpoints regardless of the physical or online environment. Innovativeness and digitalization have brought fair competition for small enterprises compared to the giant players.

Third, although the cost has been identified as not directly impacting AR adoption, it still signifi-

cantly influences attitude toward AR. Hence, researching and choosing an appropriate scale may enhance the positive attitude rather than doing nothing and keep an out-of-date opinion that AR and VR are technologies and applications reserved for giant enterprises.

Fourth, cooperating with AR allowed companies to determine the most effective roadmap for AR integration into the current system. This action will help retailers increase competitive advantages and avoid peer pressure from competitors with a clear and systematic development plan to adopt AR.

CONCLUSION AND LIMITATIONS

This study explored key motivators and barriers to AR adoption in retailing sectors. Quantitative research methods with PLS-SEM analysis techniques were used to analyze proposed hypotheses. The findings show that organizational attitude toward AR plays the role of mediating factors among relationships in the proposed model. Although not directly impacting AR adoption, cost barriers have an indirect impact on organizational attitude toward AR. The organizational attitude toward AR was affected by four major factors, while three factors determined the AR adoption.

Although contributing to both literature and practice, several limitations could be fixed and overcome in future research. First, the quantitative research method only helps determine the relationship, but it could not provide further explanation for retailers' insights. In the subsequent studies, a qualitative research method should be used to explore the hidden aspects of each identified factor. Second, the number of research participants is small compared to millions of retailers on the market. Third, the reason and challenges for why retailers do not have the intention to adopt AR also need to be examined.

AUTHOR CONTRIBUTIONS

Conceptualization: Hai Ninh Nguyen.
Data curation: Hai Ninh Nguyen.
Formal analysis: Hai Ninh Nguyen.
Funding acquisition: Hai Ninh Nguyen.
Investigation: Hai Ninh Nguyen.
Methodology: Hai Ninh Nguyen.
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Resources: Hai Ninh Nguyen.
Software: Hai Ninh Nguyen.
Supervision: Hai Ninh Nguyen.
Validation: Hai Ninh Nguyen.
Visualization: Hai Ninh Nguyen.
Writing – original draft: Hai Ninh Nguyen.
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