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Consumer Perception and the Evaluation to Adopt Augmented Reality in Furniture Retail Mobile Application

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ABSTRACT

The importance of retailers to utilize interactive technology, such as Augmented Reality (AR), in their mobile applications is considered due to the change in consumer behavior from in-store to online. However, there is limited study in understanding consumer perception to evaluate the effectiveness of AR implemented by retailers during the COVID-19 pandemic in developing countries like Indonesia. The research examined the relationship between AR characteristics, consumer perception, and attitude toward AR in mobile furniture retail applications. The intention to adopt was also included in measuring behavioral responses. Using 383 valid data, the researchers empirically tested the insights through Partial Least Square-Structural Equation Modelling (PLS-SEM). The results reveal that AR characteristics have a significant influence on consumer perception. Besides, perceived functional benefit and trust in AR directly relate to attitude toward AR and indirect on intention to adopt AR applications. Thus, the research provides managerial implications for retailers to adopt AR technology as interactive media to enhance customer experience during online shopping in the current and after the pandemic. It is also expected to help government regulation in digital infrastructure to support AR implementation in industry and users' data privacy. In addition, the research contributes to theoretical development in AR adoption, interactive marketing, and consumer behavior.

Keywords: consumer perception, evaluation to adopt, Augmented Reality (AR), furniture retail mobile application

INTRODUCTION

There is an increase in the utilization of technology advancement in many countries due to people conducting physical distancing after the World Health Organization (WHO) announced COVID-19 as a global pandemic in March 2020. Particularly in developing countries such as Indonesia, most people stay at home. They do their activities virtually since the central government sets the enforcement of social restrictions to reduce the spread of the COVID-19 infection (BPS, 2020). The virtual activities during the COVID-19 pandemic have also changed consumer shopping behavior from conventional to online. According to the Central Bureau of Statistics (BPS, 2020), 72% of consumers are shopping online during the pandemic. Around 31% of them experience an increase in shopping activity. During the pandemic, the growth of online shopping in Indonesia accounts for impacting consumers' consistency in online shopping. Moreover, the survey by McKinsey reveals that 60% of respondents plan to continue their online purchase activity until after the COVID-19 pandemic (Potia & Praseco, 2020). Although there is a high percentage of people doing online shopping, it is a challenge for digital retailers to provide a satisfying shopping

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experience and journey similar to in-store shopping activities.

Then, the utilization of technology has resulted in various options for retailers to provide and present their products virtually to increase customer experience (Kowalczuk, Siepmann, & Adler, 2021). For example, IKEA has launched IKEA Place in furniture retail, which adopts Augmented Reality (AR) to attract digital shoppers to create their experience using a mobile application. As one of the promising options in recent years, AR is defined as a technology (in mobile phones or supported devices) that allows a 3D virtual object to be presented to the real-world environment (Fan, Chai, Deng, & Dong, 2020; Yavuz, Çorbacıoğlu, Başoğlu, Daim, & Shaygan, 2021). With AR adopted in IKEA Place, consumers can modify the 3D furniture by zooming in (or out), moving it to a certain location, and rotating it to the appropriate position to meet the suitable product during the selection (Fan et al., 2020). Therefore, they can make sure that the furniture fits in and is designed functionally for their room.

Previous researchers have attempted to examine the level of consumer adoption and intention to use AR in retails through incorporating perception, augmentation, consumer emotion, evaluation, and other psychological predictors (Barhorst, McLean, Shah, & Mack, 2021; Jung, Park, Moon, & Lee, 2021; Kowalczuk et al., 2021; Nikhashemi, Knight, Nusair, & Liat, 2021; Park & Yoo, 2020; Qin, Peak, & Prybutok, 2021; Yim, Chu, & Sauer, 2017). However, the implication of AR on consumer perception is still debatable, particularly in developing countries (Saleem, Kamarudin, Shoaibb, & Nasar, 2021). Moreover, although some researchers have discussed the effectiveness of AR, there is a limitation of what key factors make consumers adopt and accept this technology (Thaichon, Phau, & Weaven, 2020). In particular, it is to know how the application of AR is suitable to be used by retailers to answer the change of consumer behavior from in-store shopping to online. In addition, from a practical view, the adoption of AR in mobile retail is less than 35% (Park & Yoo, 2020). Actually, the use of AR technology can help retailers to fulfill consumers' pleasant experiences when shopping online through virtual interactions of 3D products (Dehghani, Lee, & Mashatan, 2020; Kowalczuk et al., 2021).

Therefore, considering that the use of AR is an upcoming trend in retail (Thaichon et al., 2020), researchers need to understand the consumer perception to evaluate the effectiveness of AR to be implemented by retailers in the era caused by the pandemic. The potential impact of studying AR on mobile retail applications also needs to be considered, especially how consumers respond to the adoption of new technologies for shopping. The research attempts to add some literature and find evidence from Indonesia (representing the developing country) regarding the intention to adopt AR in mobile applications to fill the gap. The research is also encouraged by the Indonesian government that actively prioritizes digitalization to stimulate post-COVID-19 economic recovery (Devanesan, 2020). The implementation of AR in businesses will be thriving due to the support by the government to make digital technology profitable as an economic booster. Therefore, understanding the consumer perspective is necessary.

However, the research is limited to furniture products considering that home decoration and interior design have become viral and trending topics on social media (particularly Twitter) in recent years. The trend of home decoration took center stage in 2020 due to the changing home design needs and preferences, as many people were homebound during pandemics (Dzulkifly, 2020). Moreover, in furniture retail, the implementation of AR-based product presentation in the mobile application has been successfully carried out by IKEA through IKEA Place. Therefore, the research aims to examine consumer perception and intention to adopt AR in furniture retail mobile applications.

According to Kowalczuk et al. (2021), AR characteristics can be classified into five categories. First, interaction with virtual products is defined as the overall constructs contributing to users' interaction with virtual products, such as rotation, position, and zoom in (or out). Second, processing quality is how the system provides accuracy, reliability, and speed in the requested service. In AR mobile applications, processing quality is important to create user experience during shopping, particularly in relation to technical and functional quality. Third, the following AR characteristic is information about virtual products, which refers to the amount of information supplied from AR. Fourth, the quality of virtual product presentation shows the graphical visualization quality that is adhered to virtual product presentation. Fifth, handling personal information is the consumer perception toward overall security and privacy when using AR. The AR characteristics mentioned influence users' perception and have implications on the final evaluation of using this technology for shopping.

In the context of mobile applications, especially retail mobile applications, AR has resulted in positive and negative consumer perceptions. For example, the study regarding AR in digital retails finds that AR interactively affects South Korean consumers' mental imagery, which, furthermore, drives their attitude toward AR (Park & Yoo, 2020). Similarly, it is also found that AR encourages positive perception and attitude, impacting behavioral intention to use AR (Qin et al., 2021). The perception in the study of Qin et al. (2021) is related to consumer perception of the ease of using technology and consumer gratification, both utilitarian and hedonic. Moreover, in China, the previous researchers find that in addition to a positive perception of consumer behavior (ease of use and usefulness), negative perception like risk influences consumers to have no intention to use AR technology (Zhuang, Hou, Feng, Lin, & Li, 2021). Furthermore, according to Dehghani et al. (2020), using mix-reality (a combination of virtual and augmented reality) in

retail services shows that perceptions have an indirect relationship to behavioral intentions, and perceived functional benefit is the most significant construct in influencing behavior. Lastly, it is also revealed that positive perception of AR that is effective and efficient to use has directly impacted consumer attitude and intention, which leads to consumer experiential value and behavioral intention to use AR (Wu, Chiu, & Chen, 2020).

In Indonesia, the research area of the implementation of AR in shopping applications is still limited, so it is important to identify consumer perception toward AR by asking them directly. These considerations motivate the researchers to conduct a Focus Group Discussion (FGD) to build a model relationship. FGD is conducted to achieve an in-depth understanding of Indonesian consumers regarding their point of view in the implementation of AR (Malhotra, 2010). Moreover, this approach is used to find appropriate perception variables for the Indonesian context and quantify the variables found from the FGD by relating them with behavioral outcomes using survey data.

The FGD consists of eight participants (three females, five males), who regularly shop online, are technology literate (advanced smartphone users), have used or are familiar with AR, and are interested in furniture or home decoration. After the researchers analyze and categorize the most mentioned words using conventional notes, this FGD approach generates three perception factors reflecting consumer perception toward AR application in furniture retail mobile applications. There are perceived functional benefit, perceived trust, and perceived product risk. These factors are related to the findings from prior studies in the context of technology adoption, which have influenced consumer attitude and behavioral intention (Gupta & Duggal, 2021; Ho, Wu, Lee, & Pham, 2020; Kaushik, Mohan, & Kumar, 2019; Um, 2019). To investigate the relation of these factors comprehensively, the researchers also conduct a literature review and formulate hypotheses.

The value that consumers perceive in AR comes from the realistic virtual presentation of how it fits with the actual product (Kowalczuk et al., 2021). The reality congruence is significantly related to enhancing AR functional benefit in purchasing a product online. This statement is supported by Nikhashemi et al. (2021). A clear representation of an image in AR has stimulated consumers to feel excitement and control over virtual and real-world environments. Moreover, the presentation of vividness in AR leads to a higher level of consumers' motivation to process the information (Barhorst et al., 2021). The clear visual presentation influences consumer trust and reduces the risk of using online shopping technology. Since there is no research examining the reality congruence on consumer trust and product risk, the researchers argue that the high quality of virtual product presentation increases consumer trust in the AR when purchasing and decreases consumer risk perception to the product presented in the application. Based on these arguments, the following hypotheses are proposed.

H1a: There is a significant relationship between AR characteristics of reality congruence and perceived functional benefit.

H1b: There is a significant relationship between AR characteristics of reality congruence and perceived trust.

H1c: There is a significant relationship between AR characteristics of reality congruence and perceived product risk.

System quality in AR is related to how technology responsiveness provides a quick response to requested services (Kowalczuk et al., 2021). Technology responsiveness in mobile shopping technology benefits consumers when purchasing online. The relation of system quality on usefulness as it functional benefit (Tseng & Lee, 2018), and consumer trust is examined by previous studies in the context of technology service. It is found positively significant (Luo, Wang, Zhang, Niu, & Tu, 2020; Nguyen, Chiu, & Le, 2021; Sarkar, Chauhan, & Khare, 2020). Although there is no study regarding the impact of AR system quality on consumer perceived product risk, system quality captures the capacity of AR technology systems to perform reliable and accurate product presentations. It is identified to reduce consumer perceived product risk. The following hypotheses are proposed by considering these relations.

H2a: There is a significant relationship between AR characteristics of system quality and perceived functional benefit.

H2b: There is a significant relationship between AR characteristics of system quality and perceived trust.

H2c: There is a significant relationship between AR characteristics of system quality and perceived product risk.

AR is a technology that enables consumers to interact with virtual products because of its ability to create a virtual product that looks like an actual product (Kowalczuk et al., 2021). This advantage of AR has increased consumer trust in the product (Saprikis, Avlogiaris, & Katarachia, 2021) and avoided the risk that consumers perceive on the product when they purchase digitally. The quality of AR product information that describes interactive and real-time product presentation is considered the most significant benefit of using AR when shopping (Smink, Frowijn, Reijmersdal, Noort, & Neijens, 2019). Moreover, a previous study has found this perceived informativeness as a significant factor in consumer trust (Liu, Bao, & Zheng, 2019). Similar to how the product interaction in AR shopping applications will

avoid consumers' perceived risk to the product (Park & Yoo, 2020), the following hypothesis is related to the statement that the quality of product information in AR shopping applications will reduce risk perception. Considering limited previous research on AR characteristics, namely interaction with the virtual product and product informativeness on consumer perception, the researchers propose the hypotheses of the last dimensions of AR characteristics.

H3a: There is a significant relationship between AR characteristics of interaction with virtual products and perceived functional benefit.

H3b: There is a significant relationship between AR characteristics of interaction with virtual products and perceived trust.

H3c: There is a significant relationship between AR characteristics of interaction with virtual products and perceived product risk.

H4a: There is a significant relationship between AR characteristics of product informativeness and perceived functional benefit.

H4b: There is a significant relationship between AR characteristics of product informativeness and perceived trust.

H4c: There is a significant relationship between AR characteristics of product informativeness and perceived product risk.

Perceived functional benefit is defined as the consumers' perception of the overall benefit of technological functions (absolute and relative), including the effective and efficient process, cost, and time consumption compared to conventional ones (Althunibat et al., 2021; Shareef, Baabdullah, Dutta, Kumar, & Dwivedi, 2018). In most previous studies, perceived functional benefit (also called a utilitarian benefit) is a significant predictor of perception related to consumer motivation to make a final decision (use or purchase). For example, the use of technology in banks (mobile banking) provides functional benefits in the form of simple and easy transactions instead of going to a physical bank (Shareef et al., 2018). Those are factors of consumers' perception of positive benefit functions found to drive consumers' intention to adopt mobile banking at all consumer service phases (static, interaction, and transaction). It is supported by a recent study in smart-government service adoption, in which perceived functional benefit is significantly related to a person's final decision (Althunibat et al., 2021).

In the study of mixed reality, perceived functional benefit can increase consumer satisfaction and have indirect relations on behavioral intention (Dehghani et al., 2020). Although there is a limited examination of functional benefit on consumer attitude, consumer evaluation of the technology applied in mobiles application as good and favorable is repeatedly mentioned in group discussion. Many studies that apply the theory of planned behavior by Ajzen (1991) find that attitude directly influences behavioral intention (Gupta & Duggal, 2021; Kaushik et al., 2019; Sadiq, Dogra, Adil, & Bharti, 2021; Troise, O'Driscoll, Tani, & Prisco, 2021; Wan, Shen, & Choi, 2017). It is usually used as the first factor to examine consumer evaluation to make a final decision. Therefore, the research finally proposes a hypothesis that there is a relationship between consumers' perceived functional benefit and attitude toward AR in mobile furniture applications.

H5: There is a significant relationship between customers' perceived functional benefit and attitude toward AR in mobile applications.

Perceived trust is defined as the degree of attitudinal confidence for integrity, credibility, reliability, and safety of mobile applications from its technical and organizational standpoint and customer service value if required (Dehghani et al., 2020; Shareef et al., 2018). In digital applications, consumers' perceived trust can help to reduce the complexity and uncertainty of online purchasing decisions (Um, 2019). Trust also plays a crucial role in purchasing decisions in retail mobile applications. Customers are unlikely to purchase a product through a mobile application (online) if they do not trust it (Kaushik et al., 2019). Trust is a crucial construct that influences consumer attitude and final decision-making (Sarkar et al., 2020). For instance, previous studies explain that perceived trust is the dominant variable influencing users' attitudes toward digital applications (Kaushik et al., 2019; Mufarih, Jayadi, & Sugandi, 2020; Sarkar et al., 2020; Um, 2019). In addition, previous research has also found that trust in application weakens consumers' perception of the risk (Marriott & Williams, 2018; Mufarih et al., 2020).

However, to the best of the researchers' knowledge, the relationship of consumers' perceived trust on attitude and product risk in the context of AR mobile applications has not been discussed in previous studies yet. So, the research attempts to present a novel result by examining the relationship of perceived trust on consumer attitude toward AR and perceived trust on perceived product risk. The hypothesis, which refers to previous studies regarding perceived trust, is correlated to consumer attitude and perception of risk in mobile technology (Mufarih et al., 2020). Therefore, the following hypotheses are proposed.

H6: There is a significant relationship between consumers' perceived trust and attitude toward AR in mobile applications.

H7: There is a significant relationship between perceived trust and perceived product risk in AR mobile applications.

The main cause of perceived risk in online shopping activities is that consumers cannot interact (touch, feel, and try) with the product before

purchasing (Bonnin, 2020). According to Dowling and Staelin in Bonnin (2020), perceived risk is defined as the consumers' perception of uncertainty and adverse consequence to the product or service during their purchase (shopping) activities. Perceived risk is also related to consumers' concerns about the quality of the product (Vonkeman, Verhagen, & Dolen, 2017). It also means that the probability and the outcomes of purchase activities are uncertain. Meanwhile, according to Ariffin, Mohan, and Goh (2018), perceived risk is divided into two, namely indecisions (the probability and favorability of outcomes) and consequences (the importance of losses).

In online shopping, perceived product risk is more highly concerned with consumers when purchasing the product. It has come from the potential loss of products that do not meet consumers' expectations with the standard and quality of the product (Ariffin et al., 2018). AR applied in retail mobile applications can help consumers to reduce their perceived risk of purchasing the product online (Beck & Crié, 2018). Previous studies in online shopping and digital technology find that perceived risk (mainly product) has a negative relation to consumer attitude (Gupta & Duggal, 2021; Ho et al., 2020; Sadiq, Dogra, Adil, & Bharti, 2021; Troise et al., 2021). Therefore, the research assumes that perceived product risk presented by AR in mobile furniture applications has decreased consumer attitude toward AR. The following hypothesis is as follows.

H8: There is a significant relationship between consumers' perceived product risk and attitude toward AR in mobile apps.

In the psychological context, the behavioral theory of final decision making has been discussed by Ajzen (1991) in the theory of planned behavior. The theory explains attitude as one of the direct influences on consumer intention to behave a certain behavior. Based on Ajzen (1991), attitude is defined as the favorable or unfavorable degree of an individual to the specific behavior in the question. In other words, when consumers respond positively to a stimulus, it can directly influence a positive attitude and relate to individuals' intention to behave in the future. According to Ajzen (2002), measuring attitude should include experiential (affective) and instrumental (benefit, function) dimensions. Based on Wan, Shen, and Choi (2017), experiential attitude is labeled hedonic because it operates by asking consumer behavioral rates such as sound, pleasant, sensible, and others. Meanwhile, an instrumental attitude is labeled as a utilitarian attitude because it comes from the functional performance of the product.

According to Ajzen (1991), behavioral intention refers to the degree of an individual's motivation to behave. This motivation depicts the effort people expend and the willingness they perform to behave. Measuring behavioral intention is the way to evaluate future behavior resulting from consumers' actions to execute the decision (Chennamaneni, Teng, & Raja, 2012). Although the behavioral intention is the preliminary stage for actual consumer behavior, intention is still considered a strong predictor for future consumer behavior (Sheeran 2002). Previous studies have discussed the relationship, association, and impact between attitude and behavioral intention in technology implementation and adoption. The result is found to be significantly positive (Gupta & Duggal, 2021; Ho et al., 2020; Kaushik et al., 2019; Lee, Xu, & Porterfield, 2021; Lee & Cho, 2019; Mufarih et al., 2020; Sadiq et al., 2021; Um, 2019; Yavuz, 2021). Therefore, the overall consumer attitudes have a relationship and influence on the intention to behave, which is a significant predictor as described in Ajzen (1991). The last hypothesis is as follows.

H9: There is a significant relationship between consumer attitude toward AR and intention to adopt AR in mobile applications.

According to the literature review above, a comprehensive conceptual model is illustrated in Figure 1 (see Appendices). It shows ellipse as latent variable, rectangle dash arrow as the group factor in AR characteristics variable, and solid arrows as the relationship between variables.

METHODS

The research is classified as mixed-method research consisting of qualitative and quantitative. In qualitative research, the research conducts FGD which has been dealt with in the previous section. In quantitative research, a cross-sectional survey data collection is applied to online buyers in Indonesia through a structured in-person administered questionnaire. Online survey data collection is conducted due to the social distancing policy during the COVID-19 pandemic, limiting physical contact with the respondents. The online questionnaire is uploaded on Google Form and administered for two months using the purposive sampling technique. The criteria for respondents are (1) Indonesians with a minimum age of 18-year-old who consistently do activities at home during pandemic (occasionally going out from home is tolerated); (2) they are technology literate; (3) they are familiar with online shopping platforms; (4) they are familiar with AR technology; and (5) they purchase at least one household appliance or furniture online during the COVID-19 pandemic.

The perception about AR application from the survey data only evaluates the visual and cognitive perception obtained through detailed text and a video in the survey combined with the perception generated by respondents' experience to use AR technology. The questionnaire design is adjusted based on this consideration, adopted by several sources, and adjusted to the context of AR and characteristics of Indonesian consumers. All construct items in the

research are measured using a seven-point Likert scale (1= "strongly disagree" to 7= "strongly agree"). The researchers also conduct a comprehensive discussion to find the best wording in the sentence and ease of understanding the main idea of questions. Table 1 (see Appendices) presents the summary of several items and the source of each item. About 397 data are collected from the respondents. After discarding inappropriate and missing data, 383 valid data can be used for analysis. To quantify the primary data, the researchers utilize Partial Least Square-Structural Equation Modelling (PLS-SEM) using SmartPLS 3.3.3 to analyze the measurement and structure models. Since SmartPLS can analyze complex models, PLS-SEM is more appropriate than other statistical tools.

RESULTS AND DISCUSSIONS

In descriptive analysis, the researchers find that the majority of respondents are female (66%). It is possibly due to more women purchasing online during the pandemic (BPS, 2020). Most respondents are between the ages of 23-27 years old from the total sample. Then, most of them have high school to undergraduate degrees, and around 30% are employees. Moreover, more than 80% of respondents live in Java and have income from 1 to 5 million IDR (about 70,11 to 350 USD) per month. Furthermore, the majority of respondents shop online once to ten times during the pandemic, and specifically, 89,8% indicate that they shop for furniture products online with a similar frequency.

In PLS-SEM analysis, the first step done in the measurement model is assessing the indicator loadings. According to Hair Jr., Howard, and Nitzl (2020), the minimum level of acceptance should be at least 0,707. As shown in Table 1 (see Appendices), most indicator loadings are above the acceptable threshold. However, there are two indicators of an intention to adopt with a value of about 0,6. Thus, the researchers remove it.

The next step is assessing reliability to measure the consistency of indicators in explaining the constructs. According to Hair Jr. et al. (2020), reliability evaluation is divided in two ways, namely Cronbach's alpha (α) and Composite Reliability (CR). The results displayed in Table 1 (see Appendices) indicate a high level of reliability that the values range from 0,88 to 0,98.

Next, convergent validity is to analyze whether the indicators in the constructs can measure the same thing (Hair Jr, Black, Babin, & Anderson, 2019). Average Variance Extracted (AVE) is the common method for measuring convergent validity. In the research, all the AVE values are more than 0,5. It indicates the internal convergent validity of the constructs.

Discriminant validity is established by Fornell-Larcker Criterion (Hair Jr. et al., 2019). In Table 2 (see Appendices), the Fornell-Larcker Criterion is supported since the AVE square root values (in bold) exceed the construct correlations than the other constructs in the model.

PLS algorithm and Blindfolding are utilized in assessing the quality of the structure model by evaluating the level of coefficient determination (R^2), effect size (f^2), and predictive relevance (Q^2). As displayed in Table 3 (see Appendices), the research finds that the predictive power in the model is moderate as the R^2 value is higher than 0,5, except for the attitude toward AR and intention to adopt AR. Following the step by Hair Jr. et al. (2019), the researchers conduct the effect size analysis with the interpretation if specific exogenous is omitted from the model, the result elucidates the effect with respectively 0,02 (weak), 0,15 (medium), and 0,35 (large). Besides, Stone-Geisser's Q^2 test is used for predictive relevance assessment by conducting Blindfolding based on cross-validated redundancy (Hair Jr. et al., 2020). The analysis reveals the model evidence of predictive relevance with a value of more than zero (see Table 3 in Appendices).

A bootstrap procedure with 5.000 resamples is conducted to analyze hypotheses by testing the structural relationship on the significance of path coefficients. The research uses 5% of the two-tailed significance level (t-value = 1,96) as a statistical decision based on Hair Jr. et al. (2019). The researchers find that most of the relationships supported the hypotheses, except for H1c, H3c, H4c, and H8, as shown in Table 4 (see Appendices) and illustrated in Figure 2 (see Appendices).

The significant path coefficients further show that the AR characteristic of reality congruence increases consumer perception of AR functional benefit and trust while shopping online in the pandemic era. In many countries, particularly Indonesia, the increase of COVID-19 cases makes the central government issue a policy to temporarily close non-essential stores (non-grocery and non-pharmacy) and encourage taking advantage of online commerce. However, purchasing goods like furniture products online is not as easy as purchasing groceries. It requires physical contact to ensure that the material, size, and design match the room where the furniture will be placed. In the research, using IKEA Place, the researchers show that the reality congruence fits the actual products more than other digital channels, such as websites and e-catalogs. This advantage is related to AR, allowing consumers to furnish the room through the 3D virtual product virtually. The technology enables virtual products as if they are confirmed in shape, size, and design (Qin et al., 2021). This benefit implies that the quality of reality congruence in presenting the product will shape consumer perception that AR applications are functionally effective and efficient to use. Thus, it increases trust in apps when purchasing furniture products online.

Prior studies have explained that system quality in service technology will increase overall positive consumer perception of technology use (Baabdullah, Alalwan, Rana, Kizgin, & Patil, 2019). The findings

in the research support previous studies like Luo et al. (2020), Nguyen et al. (2021), and Sarkar et al. (2020) and develop further insight into the system quality, which increases consumers' perceived functional benefit in online shopping and trust. AR system quality also decreases consumer perception that the purchased product through AR-based applications is riskier. Because system quality is identified as the main driver of IKEA Place functionality (Kowalczuk et al., 2021), the prompt response and reliable performance of AR technology (compared to web-based product presentations) will generate consumers' belief in usability benefits and relieve the feeling of uncertainty about the product they purchase using AR application. Therefore, consumers have evaluated that AR with high system quality will increase their perception of functional benefit and trust in the application for online shopping. Besides, it decreases their perceived risk on the product accuracy.

Moreover, AR application quality of virtual product information generates a high perception of functional benefit and trust in AR application when purchasing furniture online. This implication is supported by the fact that AR-based product presentation, as proposed to be used as the new alternative for consumers to purchase furniture during the COVID-19, has the advantage of providing clear product information. It can be seen on the IKEA Place feature called 'For You Feed' that offers IKEA product suggestions and daily inspiration in designing room interiors based on users' interests (Miller, 2019). The 'Browse' feature also provides more than thousands of furniture products based on selected collections or categories with specific information for each product. From the visual interpretation in a promotional video during the survey, these two features are seen when the model chooses a product. The application clearly presents product information, such as name, category, price, and recommends similar products. This product information ensures that ordered online products meet users' expectations, given the limited conditions for coming to the store. This finding is consistent with Yim et al. (2017). AR provides effective communication benefits.

The last AR characteristic is product interaction that also significantly increases perceived functional benefit and trust. Unlike product information, product interaction allows consumers to interact with the virtual products and respond to the stimuli from the AR technological system. Moreover, AR application provides a 3D virtual product technology feature of 360^{o} that enables consumers to rotate, zoom, and move virtual products to more specific points in the actual environment compared to other channels, such as web-based product presentations that only provide 2D visual products (Qin et al., 2021). Consumers' visual perception generated from promotional video of IKEA Place shows that AR presents the product interactively. Allowing consumers to control the product improves their perception of the application as a beneficial and trustworthy medium during online shopping. Furthermore, the feature strengthens consumer perception that the application is beneficial because it helps consumers to decide the products quickly and precisely and encourages effective and efficient online purchasing. Therefore, the more users can interact with the virtual product, the more their trust will be in the overall AR application features when utilizing them before purchasing online.

Consumers' visual perception about the functional benefit of using IKEA Place and their trust in the overall AR features before purchasing furniture online increases consumer attitude toward AR application. Previous studies in the technological context have approved the direct relation of perceived functional benefit and trust on attitude (Gupta & Duggal, 2021; Kaushik et al., 2019; Mufarih et al., 2020). Specifically for the AR study, the result is consistent with the research by Yim et al. (2017). The benefits of AR in generating medium usefulness result in consumers' positive attitudes. Therefore, this finding implies that when consumers look into the application that can display realistic 3D furniture and digitally select, place, and move virtual products through one-touch (Dehghani et al., 2020), their evaluation of the application is positive. It is similar to the reason for perceived trust in IKEA Place, which is significantly positive on consumer attitude. It shows consumers' belief in AR performance since the application provided and developed by IKEA can display realistic furniture products (size, color, and shapes) and information (price and product details). Thus, it increases overall cognition, emotion, and behavior.

The hypothesis result indicates that the more the consumers think that AR application is trusted for shopping furniture, the less the consumers perceive the risk to the offered product. The previous finding supports the significant relationship between trust and perceived risk by Kaushik et al. (2019). This finding goes according to consumers' visual perception that AR application has quality in processing system and quality in virtual product presentation and information and allows consumers to interact with virtual products. Therefore, the trust in the AR application will attenuate the risk that consumers perceive about the products.

The last result further reveals that a positive consumer attitude has a significant relationship with the intention to adopt AR applications when purchasing a furniture product. This finding supports previous research regarding consumer evaluation of the AR having implications on their behavioral intention by Park and Yoo (2020), Qin et al. (2021), and Zhuang et al. (2021). According to Manchanda and Deb (2021), consumer attitude in AR positively affects the intention to adopt m-commerce. This finding indicates that consumers who form attitudes toward AR application positively have greater intention to download, use, and recommend the app in the future.

Based on the research findings, the research has numerous managerial implications for retailers and application developers to gain information regarding

consumers' responses to the AR technology in mobile applications. The finding describes the importance of implementing AR technology, particularly in furniture retail mobile applications, to create a customer experience that is not found in competitors. The research suggests that reality congruence and product informativeness in AR can be effective tools to enhance consumers' perceived functional benefit and trust in applications. Thus, if furniture retailers implement AR technology, retailers and application developers should provide quality virtual product presentations and key product information in the AR interface. The improvement can be considered through graphical and pixelated quality, the size accuracy of augmented products with their real products, and detailed information based on consumers' frequently asked questions when purchasing online.

The results also indicate the importance of managing system quality in AR to facilitate better overall consumer perception of the AR, such as functional benefit, trust, and reduced risk perception to virtual products. Application managers or developers should develop AR shopping mobile applications with good processing speed (minimum delay response), accurate and reliable service as requested, and trouble-free when presenting virtual products in real environments. Thus, when furniture (and other business categories) retailers use AR as alternative marketing and sales channel, maintaining AR system quality periodically can benefit their brands. It should be done to create a customer experience during the purchase of a product and avoid the risk that the consumers perceive to product performance.

Encouraging consumers' positive perception of AR applications is beneficial in terms of functions and making them trustworthy applications for shopping. It is crucial for application managers and developers to provide excellent quality in virtual product interaction. Practitioners should consider the seamless possibility of consumers interacting with virtual products by improving the quality of human-computer interaction functions such as rotation, zoom (in and out), color change, and well-defined 360-degree 3D product presentation.

The research also shows that it is advantageous for retail managers to cultivate consumer attitude toward AR using the consumers' perceived functional benefit and trust in AR. When retailers decide to apply AR and manage consumer attitude toward their AR applications positively, it will evoke consumer intention to download the AR application, take them as a priority channel for shopping online, and recommend them to other people.

Persuading consumers to use AR must be intensively carried out, particularly in emerging markets that rarely utilize AR mobile applications in online shopping. Retailers can take advantage of social media marketing (on Instagram, Twitter, YouTube, or TikTok) by creating attractive, innovative, and informative content regarding the use of AR-based applications when shopping online. Persuasive communication that retailers can do in social media platforms should focus on how the application provides functionally beneficial features when shopping online. Creating social media content that can evoke consumer trust in AR applications includes reposting Instagram and Twitter users' content when using the company's AR apps during shopping. Moreover, promoting applications with the help of influencers is recommended to increase consumers' sensory experience that AR is functionally beneficial and trusted for online shopping. The advantage of this marketing strategy can also avoid consumers' perception that shopping by using AR is riskier because the products they receive may not like as shown on the applications.

Lastly, as the research utilizes IKEA Place that is AR-based for product presentations, the researchers suggest that IKEA in emerging markets integrates the online commerce's store in the application because currently, some emerging countries such as Indonesia are not available. However, consumers can still utilize the application only to visualize AR-based furniture. This consideration makes it easier for consumers to purchase IKEA furniture products through the AR application. They should also adjust the information presented on IKEA Place with the local showroom (price, product availability, and collection). Since the application is not available for some smartphone types, the researchers suggest that IKEA and AR application developers conduct technical research to ensure that consumers can easily access the apps. In addition, the research is addressed to the government to produce regulations and policies in infrastructure support, personal data privacy, and other stimuli that can help the development of AR implementation in the business sector.

CONCLUSIONS

The research, which focuses on consumer perception, attitude, and adoption of technology in retails, provides a comprehensive study related to consumer perception and the evaluation to adopt AR mobile applications as part of consumers' online shopping experiences. A total of 383 valid data are collected using an online survey. Then, PLS-SEM is applied to analyze data from the model developed through FGD. The result finds that AR characteristics, such as reality congruence, system quality, product informativeness, and product interaction, are significantly related to perceived functional benefit and trust based on the consumer evaluation of the IKEA Place promotional video. Besides, only AR characteristic of system quality has a negative significant relationship on perceived product risk, which supports the hypothesis. The result also shows the significant relation between perceived functional benefit and trust on attitude toward AR. It indirectly impacts the intention to adopt AR.

The contribution of the research to the literature is

three-fold. First, the researchers build a comprehensive theoretical model based on results of FGD combined with models that have been developed in the literature. It can be seen in several variable relationships that previous studies have never discussed the AR-based retailer applications context. Accordingly, apart from extending the correlation of existing variables in AR studies, the researchers also present new ones. Second, to the best of the researchers' knowledge, previous studies have not explored consumer adoption of AR retail mobile applications in the context of furniture in Indonesia from a set of characteristics in AR to users' perception and behavioral responses. The research can be considered as one among pioneer research that presents the psychological consequences of implementing AR-based technology in mobile retail applications. Third, the research examines the relationship between AR characteristics and consumer perception, which is indirectly related to consumer attitude and behavioral adoption. Since there are no studies with this relationship, the researchers provide a new light for other researchers to assess consumer perceptions of AR as influenced by the characteristics of the technology. Therefore, these three important aspects further enrich the literature in AR, consumer behavior in retail, and technological adoption in an emerging country perspective during the COVID-19 pandemic.

Despite the contribution, the research has some limitations that can guide the agenda for future research. First, consumer evaluation of the AR-based product presentations on IKEA Place is only based on the promotional video on IKEA Place and the customer experience of using AR technology from other platforms. Future research that uses IKEA Place as a sample platform may collect data from customers who experience using IKEA Place regularly. Second, the research only collects data from one of the emerging markets. It is suggested for future research to conduct comparative data collection, such as across developing countries or comparing developing and developed countries datasets. Third, questionnaire bias cannot be avoided since the research applies a survey strategy. Future research is suggested to conduct experiment studies by comparing participants' perceptions and attitudes toward AR mobile applications and other mobile applications. Lastly, the research focuses solely on AR in furniture retail mobile applications. The result may be impactful for furniture retail practitioners and literature. Thus, future research may explore different product categories, such as clothing, accessories, cosmetics, and others, to broaden the understanding of literature in AR mobile application, consumer behavior, and technological adoption.

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APPENDICES

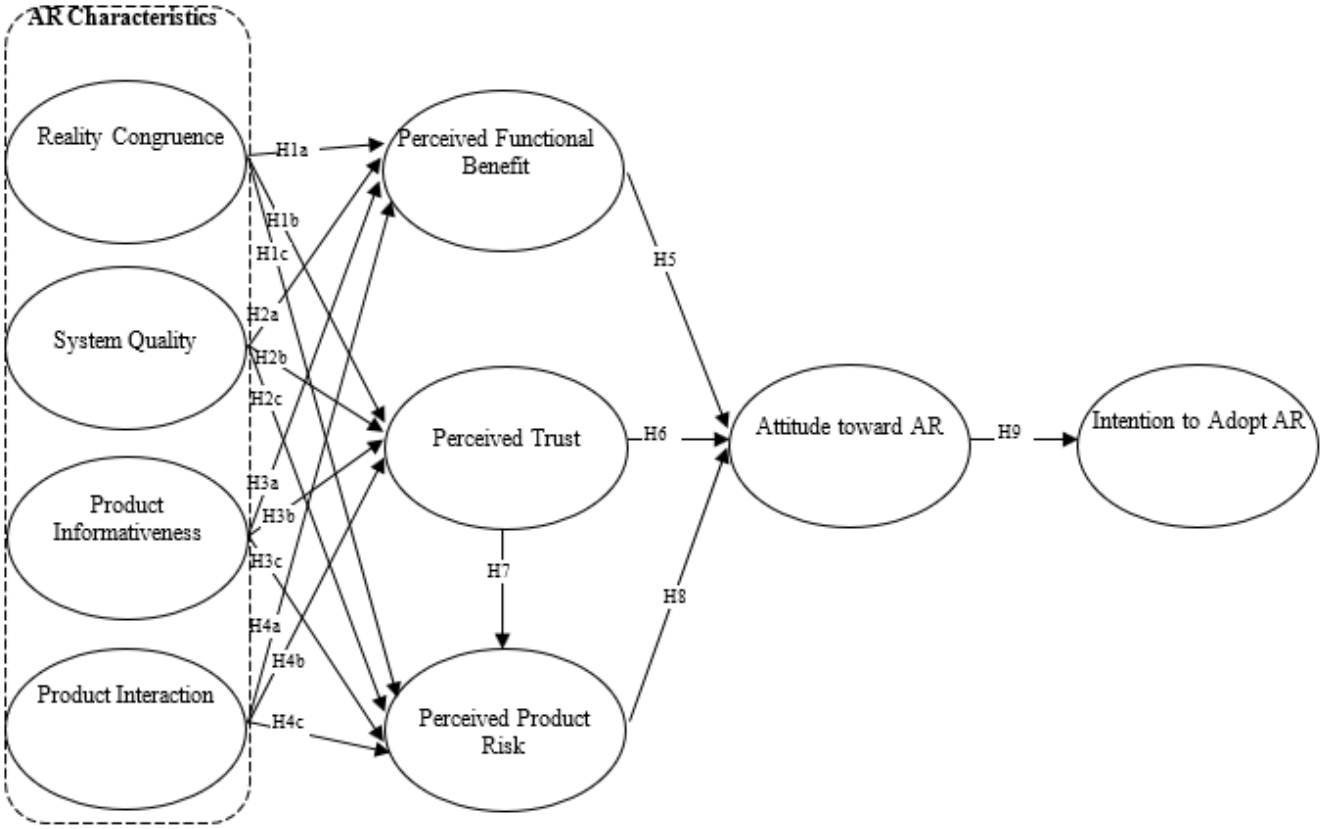


Figure 1 Conceptual Model

Table 1 Constructs and Measurement Items

Constructs and Items	Loadings	Sources
Product Interaction (PIN; α= 0,89; CR= 0,93; AVE= 0,76)		Pantano, Rese, and Baier (2017)
AR has a profound picture of the product	0,848	
AR has remarkable interaction features	0,885	
AR has information that is tailored to my specific needs	0,895	
Interaction with virtual products in AR is outstanding	0,858	
System Quality (SQL; α= 0,90; CR= 0,93; AVE= 0,77)		Kowalczuk (2018) and Park, Kim, and Ohm (2015)
I think AR is promptly responsive to the requests with good results	0,873	
The AR performs its functions quickly and efficiently	0,922	
The AR provides perfect and precise services in line with the purpose of the system	0,901	
I assume no limitations or problems in using the AR smartphone applications	0,822	
Product Informativeness (PIF; α= 0,96; CR= 0,97; AVE= 0,88)		Rese, Schreiber, and Baier (2014)
I think AR shows the information I expect	0,936	
The AR provides detailed information about the products	0,954	
The AR provides complete information about the products	0,946	
The AR provides information that helps me in my decision	0,933	
The AR provides information to compare products	0,910	
Reality Congruence (RCG; α= 0,94; CR= 0,95; AVE= 0,76)		Pantano et al. (2017)
I find that the AR presents virtual products impressively	0,882	
I find that the AR presents virtual products attractively	0,882	
The design of the virtual products in AR is visually pleasant	0,868	
I find that the AR presents virtual products visually appealingly	0,882	
I find that the AR presents the design of the virtual products (e.g., colors and shapes) realistically	0,833	
Perceived Functional Benefit (PFB; α= 0,88; CR= 0,92; AVE= 0,80)		Shareef et al. (2018)
After watching IKEA Place promotional video…		
… the ability to use IKEA Place from anywhere is convenient	0,912	
… the ability to use IKEA Place at any time is convenient	0,920	
… I assume that using IKEA Place is more efficient to use than the website when purchasing furniture at home	0,855	
Perceived Product Risk (PPR; α= 0,93; CR= 0,95; AVE= 0,79)		Dai, Forsythe, and Kwon (2014) and Masoud (2013)
After watching IKEA Place promotional video …		
… I may not receive the exact quality of furniture that I purchase using IKEA Place accurately.	0,897	
… I may not receive the furniture designs that I purchase using IKEA Place accurately.	0,887	
… the risk of purchasing furniture using IKEA Place is very high	0,898	
… there is too much uncertainty associated with purchasing the product online using IKEA Place	0,903	
… using IKEA Place is riskier compared to other online furniture buying methods	0,861	
Perceived Trust (TRS; α= 0,93; CR= 0,95; AVE= 0,75)		Kaushik et al. (2019
After watching IKEA Place promotional video …		
… I believe that IKEA Place is trustworthy	0,838	
… I believe that IKEA Place is reliable	0,889	
… I believe that IKEA Place has integrity	0,878	
… I believe that most IKEA Place will perform for the customer benefits	0,866	
… I think that I will trust IKEA Place when shopping for furniture	0,863	
… I think that I will strictly follow the terms of use while using IKEA Place	0,852	

Attitude towards AR (ATT; α= 0,98; CR= 0,98; AVE= 0,77)		Lee and Cho (2019) and Lee et al. (2021)
After watching IKEA Place promotional video, using AR technology in IKEA Place to shop for furniture will be …		
… pleasant	0,859	
… favorable	0,874	
… impressive	0,886	
… attractive	0,894	
… effective	0,914	
… helpful	0,897	
… functional	0,877	
… necessary	0,846	
… practical	0,888	
… fun	0,907	
… exciting	0,897	
… delightful	0,867	
… thrilling	0,854	
… enjoyable	0,857	
Intention to Adopt AR (ITA; α= 0,89; CR= 0,91; AVE= 0,69)		Rese, Baier, Geyer-Schulz, and Schreiber (2017)
If I want to buy furniture in the future, I will …		
… download or use IKEA Place immediately	0,926	
… give the IKEA Place priority than website or catalog magazine	0,935	
… use IKEA Place than other alternatives	0,939	
I will recommend using IKEA Place to friends or family	Removed	
I will use IKEA Place regularly in the future	Removed	

Table 2 Discriminant Validity (Fornell-Larcker Criterion)

Constructs	1	2	3	4	5	6	7	8	9
1. Attitude toward AR	**0,880**								
2. Perceived functional benefit	0,405	**0,896**							
3. Intention to adopt	0,706	0,567	**0,830**						
4. Product informativeness	0,759	0,453	0,729	**0,936**					
5. Product interaction	0,400	0,724	0,535	0,465	**0,872**				
6. Perceived product risk	-0,291	-0,636	-0,557	-0,370	-0,672	**0,889**			
7. Perceived trust	0,388	0,769	0,591	0,478	0,766	-0,801	**0,864**		
8. Reality congruence	0,432	0,713	0,547	0,511	0,810	-0,654	0,766	**0,873**	
9. System quality	0,394	0,756	0,601	0,469	0,834	-0,768	0,806	0,825	**0,880**

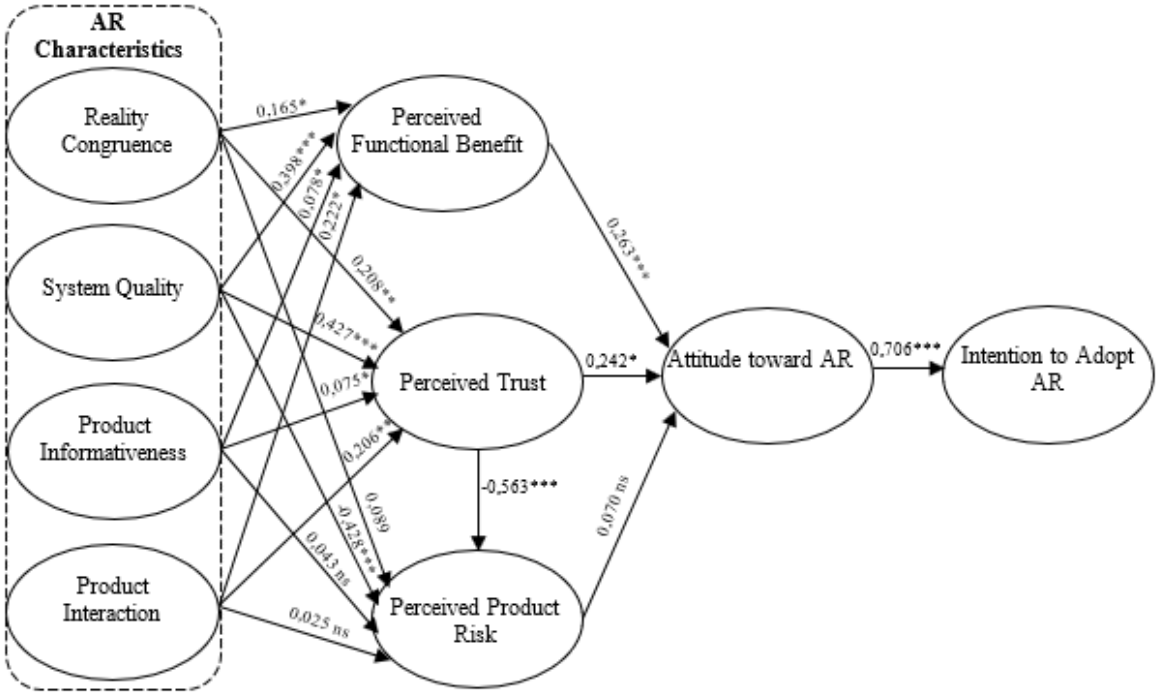
Table 3 Determination and Predictive Relevance

Endogenous Construct	R^2	Q^2
Attitude	0,174	0,134
Functional benefit	0,611	0,486
Intention to adopt	0,498	0,327
Perceived trust	0,694	0,515
Product risk	0,685	0,537

Table 4 Result of Path Coefficients and Hypotheses

Hypothesis/Relationships		Path Coef.	P-Value	Result	Effect Sizes (f^2)
H1a	RCG → PFB	0,165	0,047	Supported	0,018 (medium)
H1b	RCG → TRS	0,208	0,005	Supported	0,037 (medium)
H1c	RCG → PPR	0,089	0,141	Not Supported	0,006 (not significant)
H2a	SQL → PFB	0,398	0,001	Supported	0,098 (medium)
H2b	SQL → TRS	0,427	0,000	Supported	0,144 (medium)
H2c	SQL → PPR	-0,428	0,000	Supported	0,123 (medium)
H3a	PIF → PFB	0,078	0,037	Supported	0,012 (weak)
H3b	PIF → TRS	0,075	0,034	Supported	0,014 (weak)
H3c	PIF → PPR	0,043	0,273	Not Supported	0,004 (not significant)
H4a	PIN → PFB	0,222	0,016	Supported	0,033 (medium)
H4b	PIN → TRS	0,206	0,010	Supported	0,036 (medium)
H4c	PIN → PPR	0,025	0,683	Not Supported	0,000 (not significant)
H5	PFB → ATT	0,263	0,000	Supported	0,034 (medium)
H6	TRS → ATT	0,242	0,013	Supported	0,018 (medium)
H7	TRS → PPR	-0,563	0,000	Supported	0,309 (medium)
H8	PPR → ATT	0,070	0,324	Not Supported	0,002 (not significant)
H9	ATT → ITA	0,706	0,000	Supported	0,996 (large)

Note: RCG: Reality Congruence, SQL: System Quality, PIF: Product Informativeness, PIN: Product Interaction, PFB: Perceived Functional Benefit, TRS: Perceived Trust, PPR: Perceived Product Risk, ATT: Attitude toward AR, and ITA: Intention to adopt AR



Note: ns: not significant; * $p \leq 0,05$; ** $p \leq 0,01$; *** $p \leq 0,001$

Figure 2 PLS-SEM Path-Coefficient Result