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CRAFTING ENHANCED CUSTOMER ENGAGEMENT THROUGH AUGMENTED REALITY: THE MEDIATING ROLE OF PERCEIVED TANGIBILITY

Muhammad Tehmas Akram
Department of Commerce: The Islamia University, Bahawalpur.
Email: *tehmasakram70@gmail.com*

Tayyba Fatima
Department of Management Science: Shifa Tamere-e-Millat University, Islamabad.
Email: *tfatima92@gmail.com*

Abstract

This study focuses on understanding the role of AR characteristics in the consumer engagement process while providing them a more real-like experience (perceived tangibility). Keeping in the limelight of these aspects, the current research examined the role of AR characteristics in consumer engagement through perceived tangibility. In order to examine the effect of AR characteristics on purchase intention and E-WOM via perceived tangibility as a mediator, data were collected from 473 individuals, and the analysis was performed on Smart PLS. The results found that interactivity, product informativeness, service quality, and reality congruence have direct effects on perceived tangibility. Whereas perceived tangibility also acted as a mediator between the relationship of perceived tangibility and customer engagement. Specialized augmented reality (AR) applications' orientations are more likely to result in potential advantages, including greater motivation. The ultimate objective of AR display developments is to provide reality-like, crystal-clear visuals that can replicate, blend into, or reconstruct the surrounding world while avoiding unpleasantness. It adds value in the literature of augmented reality and consumer behaviour during online purchase. Further it helps to understand that how augmented reality effect the purchase pattern of consumers.

Keywords: *Augmented Reality, Customer Engagement, Perceived Tangibility, E-WOM, and e-commerce.*

INTRODUCTION

E-commerce is growing at very fast pace with the advent of technology and internet (Subchan & Setiadi, 2020). In recent times, global pandemic situation has also pushed a big shift of retailing business from brick to click structure. Higher growth of e-commerce industry is witnessed during Covid-19 (Alfonso et al., 2021). Covid-19 has played significant role in changing consumer behaviour towards online-shopping. A positive attitude towards online shopping is observed during and after pandemic (Arrouf et al., 2021; Jiang et al., 2024). E-Commerce Europe (2020) indicates that e-commerce is growing rapidly in east Europe accounting for 70% of overall value and in west Europe have 83% for online shoppers. The worldwide growth of E-commerce is observed both in numbers of customers and volume (Statista, 2021). E-commerce industry in Europe is also growing as 293 million consumers shop online during 2020 whereas there were 286 million consumers in 2019 (PastNord report, 2020). Among countries survey, Germany and United Kingdom were found largest e-commerce markets and France is on third number in the list followed by Spain and Italy.

The growth and strengthen aspects of this industry are govern by different factors such as technology, website quality and customer experience (Mittal et al., 2021; Chen et al., 2024). Online shopping environment is completely different from physical experience. Different factors play significant role in shaping the consumer behaviour and shopping experience (Majchrzak-Lepczyk, 2021; Tan et al., 2024). Price, delivery service, web site quality, return or change policy are identified as significant factors influencing the European market consumers (Majchrzak-Lepczyk, 2021). In online marketplace individuals are not able to see or touch the product physically, they can only see the picture or video of product. Making a high-end purchase very risky, while only seeing the only picture of product (Mittal et al., 2021). In this regard scholars have identified the role of website design and quality in developing consumer behavior (Chen & Xu, 2024; Gupta & Gupta, 2020; Gupta & Jain, 2016; Gupta & Valecha, 2016; Jain & Gupta, 2018; Mihai, 2020). It is identified by scholars that if consumers do not like the design, quality and features of website their purchase intention will decrease (Mihai, 2021).

To increase effective online experience a well-designed digitally enhance product presentation is needed (Mihai, 2021). Modern technology has provided the opportunity to online business to improve the online experience with use of augmented reality (AR) "an innovative tool that superimposes virtual objects (e.g., images, texts, and sounds) on the user's real environment (Faust et al., 2012)." AR expands the "physical environment with computer-generated perceptual information, leveraging visual, auditory, haptic, somatosensory, and olfactory modalities" (Roggeveen & Sethuraman, 2018, p. 3). It provides highly vivid presentation of products which offer better experience near to reality. AR based products presentation increase customer value and create outstanding customer experience throughout the journey (Kowalczuk, Siepmann, & Adler, 2021). A very few retailors have explored the usefulness of AR i.e., IKEA, Ray-Ban, and Sephora. IKEA let the consumers to check the catalog items in their home to have a real-life experience. AR have huge growth potential expected to reach market size of $85 billion by 2025. However, AR need huge investment; therefore, a better understanding of its effectiveness is needed. Though, AR is not a recent phenomenon, but marketers are still unaware of comprehensive effectiveness of AR on consumer behaviour (Moriuchi, Landers, Colton, & Hair, 2021). Literature has witnessed the role of AR in marketing and branding, but a little research is done on understanding the consumer purchase journey through AR based retailing (Huang, 2021; Li & Zhang, 2024).

Focusing on these aspects, the present research aims to understand the role of AR characteristics in consumer engagement process through purchase journey. This study will focus on understanding the role of AR characteristics in consumer engagement process while providing them a more real-like experience (perceived tangibility). It will help to understand the e-retailors and marketers that how it will influence consumer purchase process and they will be able to understand it worth and decide that whether to invest or not. As AR need high investment; for that understanding of its effectiveness and consumer response is very crucial. Keeping in the limelight all of these aspects, the current research will examine the role of AR characteristics in consumer engagement through perceived tangibility.

LITERATURE REVIEW

Augmented reality (AR) is considered as one of the most promising prospects for next-generation digital platforms, have the ability to change how

we view and engage with diverse online data (Zhan et al., 2020).Chen and Li (2024) address the importance of augmented reality in improving the retail customer experience, particularly its potential to bridge the gap between physical and digital purchasing environments. They observed that AR applications, such as virtual try-ons and interactive product visualizations, lead to higher customer engagement and satisfaction. Specialized AR applications orientations are more likely to result in potential advantages, including greater motivation (Diegmann et al., 2015). The ultimate objective of AR display developments is to provide reality-like, crystal-clear visuals that can replicate, blend into, or reconstruct the surrounding world while avoiding unpleasantness. The most widely accepted definition of AR proposed by Azuma et al. (2001) emphasizes not only the cohabitation of virtual and real in one area, but also dynamic synchronization and reciprocal registering of technology produced sources with physical reality. This research focused on the four dimensions of augmented reality. The dimensions are interactivity, system quality, product innovativeness and real congruence. These dimensions are adopted from Kowalczuk et al. (2021) which were also used by Carmigniani et al. (2011).

INTERACTIVITY

Product display forms are likely to influence perceptions of tangibility. Users are given pertinent indications regarding the product's functioning through enhanced digital demonstration modes. Consumers need details from interactive encounters with products to build a real and concise picture of real products and its applications (Schlosser, 2003). The integration of perceived tangibility is extremely important to build interaction with AR service automation. Also, generation Y consumers more prefer to interact (Wessels and Steenkamp, 2009), so we assume that;

SYSTEM QUALITY

The grade of service provided by service providers to corporate customers is referred to as service quality. And service quality is a critical factor while studying online consumer services (Gorla et al., 2010). These kind of online services just like AR are most likely to be consumed by Gen Y and Z

nowadays (Bhattacharyya et al., 2021). A good quality of system leads to satisfaction of consumers and satisfaction is best explained by perceived tangibility (Essiam, 2013). Also, there is a strong association between perceived tangibility and the service provided (Hefer and Cant, 2014). So, we hypothesize that.

PRODUCT INFORMATIVENESS

Product informativeness is a key component of AR augmented products (Rese et al., 2017). The level toward which web and mobile capacitive sensors give useful product information for purchasing decision is referred to as product informativeness. Users now must focus their decision making on much less knowledge when purchasing online than when visiting in-store, in which they may physically touch the marketed goods. Although interactive product displays on websites allow for a virtual investigation of the products (Yoon et al., 2008). The main consideration in product informativeness tends to revolve as to how businesses can incorporate unique innovation in products; however, seeing as their options have little or no tangibility, network operators must search for ways to stimulate novel modifications in the company's current methods, which comprise the majority of their intangible services (Nelson et al., 2005, Hausman, 2005). So, it is stated as:

REALITY CONGRUENCE

As a newly particular stage of development, reality congruence is proposed. The usefulness of media is boosted by reality congruence (Kowalczuk et al., 2021). It entails the compatibility of virtualized items. 3D believability depicts the fit between the real and projected items in web-based commercial offerings (Algharabat and Dennis, 2010). Proposed a model based on augmented reality, in which real congruence is necessary for metaverse experience (Jot et al., 2021). For perceived tangibility, reality congruence plays a vital role (Lo, 2013), so we assumed that;

H_1: (a) Increased interactivity, (b) Increased system quality, (c) Increased product innovativeness, and (d) Increased reality congruence have significant impact on perceived tangibility.

ROLE OF PERCEIVED TANGIBILITY ON CUSTOMER ENGAGEMENT

We have included 2 dimensions of customer engagement which are purchase intention and electronic word of mouth. There is a direct effect of

tangibility on purchase intention (Liang and Qiu, 2017, Kim et al., 2017) and increases customer satisfaction (Chimedtseren and Safari, 2016). The employment of a visual presentation as a tangibility signal can offer a framework people's psychological images of an intangible item. This also aids companies in selecting the best style guide for digital resources (Liang and Qiu, 2017). In the previous literature it is stated that perceptions of consumers are highly related to E-WOM (Alsaggaf and Althonayan, 2018). And service tangibility and E-WOM are related to each other (Fine et al., 2017). Because Information is also necessary in the case of items, which are already noticeable due to their tangibility (Rossmann et al., 2016). So, we hypothesize that.

$H_{2:}$ Perceived tangibility significantly increases (a) purchase intention and (b) E-WOM.

THE MEDIATING ROLE OF PERCEIVED TANGIBILITY

Verhagen et al. (2013) proposed that to increase purchase intention, perceived tangibility and interactivity plays an essential role. And perceived tangibility highly influences purchase intention (Verhagen et al., 2014). Also, interactivity with perceived tangibility highly relates to E-WOM (Thorson and Rodgers, 2006). It was discovered that when customers may immediately engage with an ecommerce site, rather than passively receiving static stimuli, the perceived tangibility of the product enhanced (Verhagen et al., 2014). Product informativeness is considered as an important factor in determining the value (Arora et al., 2020), which leads to repurchase behavior and more electronic word of mouth via social media (Mccormick and Livett, 2012). Previous research has found that website design has an effect on the perceived service quality and online willingness to buy (Dedeke, 2016). Also, service quality has a direct association with E-WOM (Pandey and Sahu, 2020, Uslu, 2020) and reality congruence and all characteristics have associations with E-WOM and Purchase intention. Product informativeness and reality congruence also boost product tangibility, according to AR features (Jot et al., 2021). So, we assumed that.

$H_{3:}$ Perceived tangibility mediates the relationship between interactivity and (a) purchase intention and (b) E-WOM.

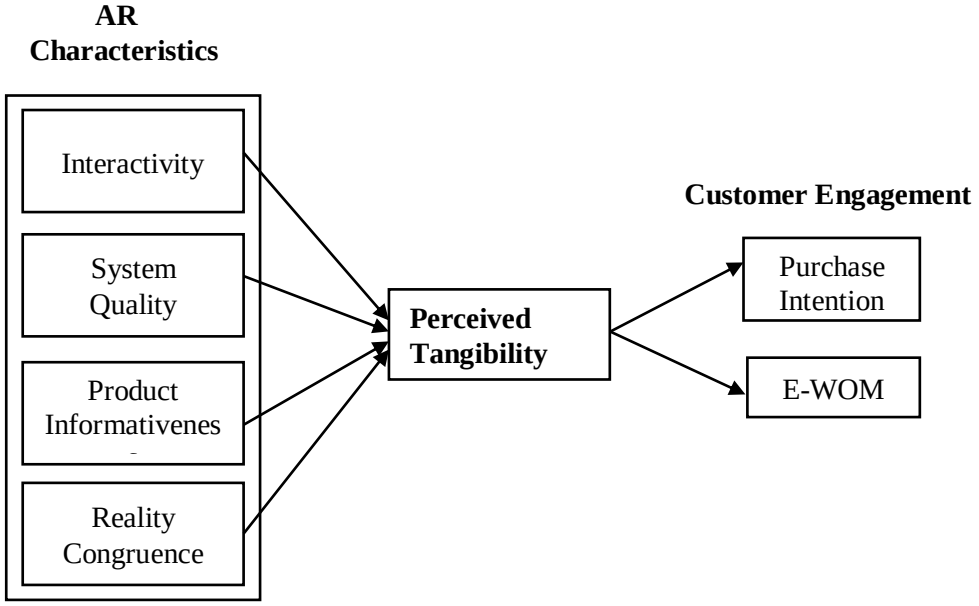
$H_{4:}$ Perceived tangibility mediates the relationship between product

informativeness and (a) purchase intention and (b) E-WOM.

$H_{5:}$ Perceived tangibility mediates the relationship between service quality and (a) purchase intention and (b) E-WOM.

$H_{6:}$ Perceived tangibility mediates the relationship between reality congruence and (a) purchase intention and (b) E-WOM.

FIGURE I: RESEARCH FRAMEWORK



RESEARCH DESIGN

A positivist paradigm was employed in this study since data was collected premised on empirically proved numeric and factually precise findings. A quantitative data analysis approach was chosen because numerical data was gathered to evaluate assumptions using a structured data gathering strategy (Saunders et al., 2007). Since, a positivist approach is opted for this study, all the hypotheses were generated by using the literature from the studies in past (Williams, 2007, Mcburney, 2001).

SAMPLE SIZE AND DATA COLLECTION

To achieve the objective of this research, the data was collected from general consumers to check their attitude towards augmented reality. A survey questionnaire was used, and the data was collected through online e-commerce website. i.e., Draz. Pk, Elo, and Chase value. Those customers who have purchased in previous one-month were requested to fill the questionnaire. Initially, response rate was very low then respondents were contacted through social media and data was collected. Data was collected from 425 individuals, which is very good according to the rule of thumb. And the sample size was also greater than calculated sample according to the 10 observations per item of Hair et al. (2010) because the total number of items were 31.

MEASURES

The data is acquired using online surveys meant for the general populace have some attitude towards augmented reality. We adopted a standardized 5-point Likert scale to assure compliance in the measurements. The measurement scales adopted from the previous studies for the proposed theoretical model is given in Table 1.

Table 1: Variables and Measurement Sources

Variables	*Measurement Sources*
Interactivity	*Pantano, Rese, & Baier (2017)*
Product informativeness	*Rese, Schreiber, & Baier (2014)*
System quality	*Kowalczuk (2018); Park, Kim, & Ohm (2015)*
Reality congruence	*Pantano et al. (2017)*
Perceived tangibility	*Magnusson (2005)*
Purchase intention	*Yim, Chu, & Sauer (2017)*
E-WOM	*Yim et al (2017)*

To conduct the research, the measurement items for the variables were adopted from the previous studies. A 4 item scale was adopted from Pantano et al. (2017) to measure interactivity. System quality was measure using 6 item scale (Kowalczuk, 2018, Park et al., 2015). To measure product informativeness a 5 item scale was adopted from Rese et al. (2014). A 6 item scale by Pantano

et al. (2017) was used to measure reality congruence. To measure perceived tangibility, a 5 items scale was adopted from (Magnusson, 2005). In the end a 4 item scales were used to measure purchase intention by Yim et al. (2017) and E-WOM by (Yim et al., 2017).

RESPONDENTS PROFILE

Data was collected from 425 respondents the respondents profile show that mostly respondents belong to age group less than 30 and mostly respondents were female. Further the household income, shopping frequency and amount spent on online purchase is shown in table given below. Table 2 shows the complete profile of the respondents.

Table 2: Demographic Profile of the Respondents

Profile	***Code***	***Percentage***
Gender	*Male*	*34%*
	Female	*66%*
Age Groups	*Below 25*	*39%*
	26-30	*29%*
	31-35	*17%*
	36-40	*12%*
	41 and above	*3%*
Household Income	*Less than 30k*	*19%*
	30k-49k	*15%*
	50k-69k	*17%*
	70k and above	*49%*
Shopping Frequency	*Once a week*	*4%*
	Once in 2 weeks	*10%*
	Once in 3 weeks	*11%*
	Once a month	*74%*
Employment	*Employed*	*37%*
	Unemployed	*51%*
	Self-employed	*12%*
Shopping Amount	*1k-5k*	*55%*
	6k-10k	*28%*
	11k-15k	*12%*
	15k and above	*5%*

RESULTS

To carry out the data analysis, SmartPLS4 was used as a statistical tool (Hair et al., 2013). Further in SmartPLS4, structural equation modelling was used to analyze the data. SmartPls4 analyze the data in two steps; first measurement model analysis and second step is structural model analysis (Jannoo et al., 2014).

COMMON METHOD BIASNESS

We collected the data by using a single source which can sometimes create biasness. So, before starting the main analysis, we conducted full collinearity test to check if the data was biased or not. The VIF values were studied, and all of the values were below 3.3, which show there is no biasness in our data which was collected using single source.

The main analysis comprised of 2 processes. First of all, we analyzed the measurement model to evaluated the reliability and validity of the measurement instruments as proposed by Anderson and Gerbing (1988) in acquiescence with Ramayah et al. (2018), Sarstedt et al. (2019) and then in the second stage, we tested the proposed hypothesis by measuring structural model.

ASSESSMENT OF MEASUREMENT MODEL

To assess the measurement model, the composite reliability, average variance extracted and Chronbach's alpha were evaluated. The acceptable values of these must be higher than 0.70, greater than or equal to 0.50 and greater than 0.70, respectively. All of our values evaluated comes under the limit and are acceptable as shown in Table 3. So, our proposed theoretical model is accepted.

Table 3: Assessment of the Measurement Model

Constructs	***CA***	***CR***	***AVE***
E.WOM	*0.876*	*0.923*	*0.801*
Int	*0.807*	*0.873*	*0.633*
PI	*0.772*	*0.823*	*0.542*
PT	*0.725*	*0.836*	*0.603*

Pinf	*0.900*	*0.926*	*0.715*
RC	*0.851*	*0.899*	*0.690*
SQ	*0.789*	*0.863*	*0.612*

Note:Interactivity (Int), Product informativeness (Pinf), System quality (SQ), Reality congruence (RC),Perceived tangibility (PT), Purchase intention (PI), Electronic word of mouth (E-WOM),CA= Cronbach Alpha, CR= Composite Reliability, AVE= Average Variance Extracted.

In the next step, we evaluated the discriminant validity by using the HTMT criteria (Henseler et al., 2015). According to Franke and Sarstedt (2019), the HTMT values should be less than or equal to 0.85. In some papers, 0.90 is also considered acceptable. As shown in Table 4, the HTMT - statistics are below than the more stringent 0.85 criteria; nonetheless, we may conclude that the respondents understood that all of the items are distinct. When most of these validity measurements are combined, it is demonstrated that the measurement items are more reliable and adaptive.

TABLE 4: DISCRIMINANT VALIDITY THROUGH HTMT

Constructs	*E.WOM*	*Int*	*PI*	*PT*	*Pinf*	*RC*	*SQ*
E-WOM	*--*						
Int	*0.694*	*--*					
PI	*0.024*	*0.07*	*--*				
PT	*0.706*	*0.693*	*0.083*	*--*			
Pinf	*0.618*	*0.684*	*0.084*	*0.707*	*--*		
RC	*0.701*	*0.783*	*0.045*	*0.728*	*0.724*	*--*	
SQ	*0.782*	*0.798*	*0.085*	*0.803*	*0.865*	*0.75*	*--*

Note: Interactivity (Int), Product informativeness (Pinf), System quality (SQ), Reality congruence (RC), Perceived tangibility (PT), Purchase intention (PI), Electronic word of mouth (E-WOM).

RESULT OF STRUCTURAL MODEL

In this section we assessed whether the proposed hypotheses are supporting or not supporting. To check the hypotheses, we evaluated the t values and p values and bootstrapped it with 5000- sample bootstrapping technique (Ramayah et al., 2018). Since, p values are not considered a good criterion to check the supportiveness of the assumed hypotheses. So, we incorporated the lower class intervals and upper class intervals in the path analysis (Hahn and

Ang, 2017, Anwar et al., 2020). Table 5 summarizes the criteria we utilized to evaluate the presented hypotheses.Interactivity (β = .16, p= 0.040), product informativeness (β = .18, p= 0.000), reality congruence (β = .24, p= 0.000) and system quality (β = .20, p= 0.000) are all positively related to perceived tangibility. So, H1, H2, H3 and H4 are accepted. Perceived tangibility is also positively related to purchase intention (β = .59, p= 0.000), and E-WOM (β = .59, p= 0.000). This shows that hypotheses 5 and 6 are also accepted.

To test the mediation, the approach by Preacher and Hayes (2004), (Preacher and Hayes, 2008) was used by bootstrapping the indirect effects.

Table 5: Results of the Structural Model (Direct Effects)

Relationships	***Beta***	***t***	***p***	***F^2***	***CI (2.50%, 97.50%)***		***VIF***
Interactivity -> Perceived Tangibility	*0.162*	*2.057*	*0.040*	*0.012*	*-0.071*	*-0.024*	*1.00*
System Quality -> Perceived Tangibility	*0.209*	*2.808*	*0.005*	*0.019*	*-0.003*	*-0.003*	*2.11*
Product informativeness -> Perceived Tangibility	*0.188*	*2.885*	*0.004*	*0.029*	*0.004*	*0.004*	*1.00*
Reality Congruence -> Perceived Tangibility	*0.248*	*4.175*	*0.000*	*0.061*	*0.085*	*0.085*	*2.45*
Perceived Tangibility -> E-WOM	*0.590*	*13.292*	*0.000*	*0.534*	*0.447*	*0.563*	*2.14*
Perceived Tangibility -> Purchase Intention	*0.591*	*13.869*	*0.000*	*0.537*	*0.466*	*0.563*	*1.00*

Whereas, if confidence interval does not include a 0, we may deduce that mediation is considerable.

Table 6: Results of the Structural Model (Indirect Effects)

Relationships	***M***	***SD***	***t***	***p***
Interactivity->Perceived Tangibility -> E.WOM	*0.096*	*0.048*	*2.001*	*0.046*
Product informativeness -> Perceived Tangibility -> E-WOM	*0.111*	*0.039*	*2.868*	*0.004*
Reality Congruence -> Perceived Tangibility -> E.WOM	*0.150*	*0.039*	*3.712*	*0.000*
Service Quality -> Perceived Tangibility -> E.WOM	*0.121*	*0.045*	*2.707*	*0.007*
Interactivity -> Perceived Tangibility -> Purchase Intention	*0.097*	*0.048*	*2.005*	*0.045*
Product informativeness -> Perceived Tangibility -> Purchase Intention	*0.111*	*0.039*	*2.871*	*0.004*
Reality Congruence -> Perceived Tangibility -> Purchase Intention	*0.151*	*0.040*	*3.697*	*0.000*
Service Quality -> Perceived Tangibility -> Purchase Intention	*0.122*	*0.046*	*2.703*	*0.007*

All of our mediations were supported. As shown in table 6. Perceived tangibility mediated the relationships between AR characteristics and E-WOM and AR characteristics and purchase intention.

DISCUSSION

The aim of this study is to understand the role of AR characteristics in consumer engagement process through purchase journey. This study will focus

on understanding the role of AR characteristics in consumer engagement process while providing them a more real-like experience (perceived tangibility). To achieve the objectives of study a quantitative study was conducted, and hypotheses were tested. The result of study indicates that augmented reality characteristics significantly increase the perceived tangibility of product during online purchase. As it is also witnessed by literature that interactivity has significant impact on perceived tangibility as this study also prove tangibility is influenced by interactivity (Essiam, 2013). Moreover, system quality also influences the perceived tangibility of e-commerce website as it is also witnessed by prior researchers (Bhattacharyya et al., 2021). Other AR characteristics also prove that product informativeness and reality congruence also increase the tangibility of product (Jot et al., 2021). Previous researcher has also proved that these quality of e-commerce website increase the perceived tangibility of product (Jot et al., 2021; Jalal Ajeh et al., 2024).

Further, the mediating role of perceived tangibility was also examined. The study results prove that perceived tangibility significantly mediates the relationship between AR characteristics and purchase intention and word of mouth (Rossmann et al., 2016). In the previous studies, we have seen a direct relation of service quality with purchase intention. Which shows that this mediation could be partial as well if we tested direct effects of AR characteristics with purchase intention and E-WOM. This can be a limitation and a drawback of this study as well. Contrary to this our results indicated that perceived tangibility helps consumer take decision hustle free in case of online purchases. Perceived tangibility basically help consumer by providing decision making touch points. So, in short, this perceived tangibility provide value to the consumers and customers as well. Furthermore, the structural equation modelling in this research investigates how customers react to the AR-based product presentations' system attributes of interactivity, system quality, product informativeness, and reality congruence. Interactivity promotes emotive reactions such as engagement, satisfaction, and product liking in this situation. The more customers sense the ability to interact with a virtual brand, the more absorbed and engrossed they get in the scenario, so the more they love the technologies.

CONCLUSION FUTURE DIRECTIONS, PRACTICAL IMPLICATIONS

Sutherland's modest visual experiment in 1965 may be traced back to the beginnings of augmented reality. Later, in the 1990s, the effects of AR in industrial areas were more widely acknowledged in research and business. Following that, comparable AR studies were released by Airbus, BMW, and Ford, resulting in an exponential growth in AR research in the industry. We conducted this study to check the effect of AR characteristics; interactivity, service quality, product informativeness and reality congruence on perceived tangibility and customer engagement. Positive relation was observed between AR characteristics and Perceived tangibility and between perceived tangibility and E-WOM and purchase intention. Consumer behaviour and purchasing patterns are evolving at a rapid pace all across the world. Thoughtful consumption appears to be a topic deserving of future academic investigation because it reflects changes in the marketplace and was evident in the consumers. Practically, Organizations who manufacture AR devices and generate AR apps may use monetization strategies. These tactics may include monitoring and evaluating user activity, embedding virtual advertisements in the actual environment, and attempting to change people's behaviour. AR technology may not be available to everyone. Some individuals may be unable to purchase it, while others would be denied accessibility owing to a technology's limited availability features. Based upon previous studies concerns, future AR systems must include the safety and privacy demands of non-users. Future study can use the longitudinal approach instead of cross-sectional and different outcome variables like brand equity can also be studied.

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