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# How Customers Perceive Virtual Mirror Technology in the 4th Industrial Revolution Environment

**Junghee JO[1], Yoon C. CHO[2]**

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## Abstract

**Purpose:** The purpose of this study is to explore how customers perceive virtual mirror technology in the 4th industrial revolution environment. In particular, this study investigated how virtual mirror technology affects customer satisfaction and intention to use that are rarely examined in previous studies. Research questions include how proposed variables including sensory stimulation, enjoyment, product quality, telepresence, interactivity, and immersion affect satisfaction and intention to use and how satisfaction affects intention to use. **Research design, data and methodology:** This study conducted an online survey and applied factor and regression analyses to test hypotheses. **Results:** The results of this study found that effects of sensory stimulation, telepresence, and immersion on satisfaction were significant, while effects of enjoyment, product quality, and immersion on intention to use were significant. Therefore, variables affecting satisfaction and intention to use were different, while effects of immersion were significant both on satisfaction and intention to use. **Conclusions:** This study concluded that the role of virtual mirror technology helps customers determine product quality and increase satisfaction level, while it also helps customers enjoy shopping and increase intent to use the service. The results of this study provide how to foster better relationship with customers by applying advanced technologies.

**Keywords :** Customer Satisfaction, Intention to Use, Virtual Mirror Technology, Customer Relationship Management.

**JEL Classification Code**: M31, M10, M30

## 1. Introduction*

Humanities have developed from the ancient times to modern society by inventing and creating new tools which many times aided in making our lives more convenient. Customers have applied inventions that became to change behavior and way to make decisions. Grewal, Hulland, Kopalle, and Karahanna (2019) addressed that new technologies have revolutionized nearly every aspect of human existence, including the ways that firms market products and services to consumers. An industrial revolution signified a massive upheaval in technology and processes, which marked a newfound level of human productivity (Zoldan, 2021). Apăvăloaie (2014) addressed that especially after the third revolution, the enormous potential brought in the development of a business, stimulated the appearance and promotion of new concepts, such as electronic business and electronic commerce and, over time, this has proved to be viable electronic alternatives and extremely profitable alternatives, of the traditional way of doing business or commerce. Technology development in the 4th industrial evolution, the industry 4.0 era, provides significant impacts on consumer behavior (Ahmad, Masri, Chong, Fauzi, & Idris, 2020) by connecting people using mesh networking (Cilfone, Davoli, Belli, & Ferrari, 2019) and by adopting advanced technologies

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1 First Author. Graduate, KDI School of Public Policy and Management, Korea Email: jungheejo77@gmail.com
2 Corresponding Author. Professor, KDI School of Public Policy and Management, Korea, Email: ycho@kdischool.ac.kr

such as virtual reality, augmented reality, artificial intelligence, robotics, the Internet of Things, etc. (Hoyer, Kroschke, Schmitt, Kraume, & Shankar, 2020). Schwab (2016) also stated that the possibilities of billions of people connected by mobile devices and possibilities multiplied by emerging technology breakthroughs in various fields such as artificial intelligence, robotics, the autonomous vehicles, 3-D printing, nanotechnology, biotechnology, materials science, etc.

Due to the change of customer behavior and adoption of technologies, many of traditional brick-and-mortar businesses faced difficulties and required to adopt advanced technologies to help customer decision making. In particular, when customers perceive the quality of sensory products, adoption of high-technology services such as virtual reality technologies will enhance customers' satisfaction through experiences. Indah and Suryadinata (2019) addressed that the rapid development of digital technology has led us to the 4th industrial revolution and the growth of Y generations (millennial generation) which caused changes in consumer behavior, especially in purchasing fashion products. In contrast to physical brick-and-mortar businesses, click-and-mortar businesses sell sensory products have encountered limitation as customers cannot touch, smell, and taste products. While various technologies such as virtual mirror and mannequins in the click-and-mortar businesses, particularly applied to help customers make decision for the purchase of products including clothing, advanced technologies such as virtual mirror technology have begun to adopt in brink-and-mortar businesses as well. Therefore, application of such technologies for purchase decision of products, particularly for clothing is necessary in both click- and brick-and-mortar businesses, since those help customers make decision without actually touching and wearing products.

Based on the consideration above, this study investigated how customers experience high-technology services for sensory products that are offered by both brick- and click-and mortar businesses in the era of the 4th industrial revolution. As such, advanced technology is having a powerful impact on both brick- and click-and mortar businesses. Therefore, this study aimed to investigate how does advanced technology provided by brick- and click-and mortar business affect customer satisfaction and intention to use in the environment of the 4th industrial revolution. In particular, this study focused on effects of virtual mirror technology that allows consumers to create a digital image of themselves and offers them the opportunity to see how a product would look "on them" when they cannot physically test or wear the product (Cho & Schwarz, 2012). The purpose of this study is to examine the effect of virtual mirror technology on customer satisfaction and intention to use particularly when they use such technology in clothing stores. This study investigates how virtual mirror technology helps promote customer relationship management through customer's sensory product experiences and how such technology helps reduce the set of choices and considerations. This study filled the gap as there are lack of studies to measure such effects of sensory experiences particularly with the use of virtual mirror technology on customer satisfaction, intention to use, and behavior empirically. This study proposed the following research questions: i) How does perceived sensory stimulation from customer experience of using virtual reality technology affect satisfaction and intention to use? ii) How does perceived enjoyment from virtual reality technology affect satisfaction and intention to use? iii) How does perceived product quality from virtual reality technology affect satisfaction and intention to use? iv) How does perceived telepresence affect satisfaction and intention to use? v) How does perceived interactivity affect satisfaction and intention to use? vi) How does perceived immersion affect satisfaction and intention to use?, and vii) how does perceived satisfaction affect intention to use?

## 2. Literature Review

### 2.1. Experiential Marketing

Lemon and Verhoef (2016) addressed that understanding customer experience and customer journey is critical for firms. Schultz (2009) defined experiential marketing as a live event marketing experience where consumers have the opportunity to interact with a product or brand face to face. Experiential marketing is defined as the process of identifying and satisfying customer needs and aspirations, profitably, engaging them through two-way communications that bring brand personalities to life and add value to the target audience (Smilansky, 2009). Experiential Marketing is also the process of engaging customers with in-depth experiences of the product or a brand (Adeosun & Ganiyu, 2012). According to Wang, Wang, Chang, Yan, and Lin (2014), experiential marketing is a strategy that uses the past experience of consumers, history records, experiences, and other ways to conduct product marketing strategies, such as blog marketing, social marketing, story marketing, database marketing, public-praise marketing, and so on. Experiential Marketing focused on customer experiences that evoke the senses (sight, smell, sound, touch & taste), heart, and the mind (Shukla, 2007). Consumers feel engaged as a product/service for a sensory experience because their senses are effective in achieving emotions (Pereira, Coelho, & Bairrada, 2016). Pine and Gilmore (2013) addressed that the shift into today's experience economy, where experiences have become the predominant economic offering comes with a number of implications that companies should keep in mind. Prahalad and Ramaswamy

(2000) stated that companies must create opportunities for customers to experiment with and then decide the level of involvement they want in creating a given experience with a company to provide personalized experiences. Yuan and Wu (2008) supported that experiential marketing induces customer satisfaction through experiential value. In the service sector, we can consider successful firms such as Starbucks, who have elevated the consumption of a routine commodity, coffee, to a memorable experience (Williams, 2006).

Sensory marketing has been widely applied to foster customer experiences. Sensory marketing is defined as marketing that engages the consumers' senses and affects their perception, judgment, and behavior (Krishna, Cian, & Sokolova, 2016). According to Hultén, Broweus, and Dijk (2009), sensory marketing is defined as an individual's perception of goods or services or other elements in a service process as an image that challenges the human mind and senses. Krishna (2012) described sensory marketing as marketing that engages the consumers' senses and affects their perception, judgment and behavior. Sensory marketing is marketing through the five senses of taste, touch, sight, sound, and smell, which are the basis of forming perception and influencing consumer behavior (Lintelle, 2014). As reported by Hussain (2019), sensory marketing is an innovative marketing strategy to stimulate a customer's relationship with a brand, which fosters an enduring emotional connection that optimizes brand loyalty. Nadanyiova, Kliestikova, and Kolencik (2018) addressed that sensory marketing is beneficial for building brand value, including ensuring loyalty of standing customers as well as gaining new ones, building a successful brand and positive perception of the brand and product by users. Explained by Simonson and Schmitt (1997), firms can use aesthetic output of its look and feel strategically to create a variety of sensory experiences that will ensure customer satisfaction and loyalty and sustain lasting customer expressions about a brand's or organization's special personality. According to the Petit, Velasco, and Spence (2018), a technology for sensory marketing can be categorized into two parts including common interfaces (i.e., mental imagery, sensory congruency, interactivity) and new sensory-enabling technologies (i.e., mental imagery, telepresence/immersion, enjoyment, flow, interactivity, self-congruity, ownership, need for touch, curiosity). Cian, Krishna, and Elder (2014) proposed that static visuals can evoke a perception of movement (i.e., dynamic imagery) and thereby affect consumer engagement and attitudes. Elder and Krishna (2012) demonstrated that visual product depictions within advertisements, such as the subtle manipulation of orienting a product toward a participant's dominant hand, facilitate mental simulation and evoke responses.

Song and Zinkhan (2008) identified the determinants that enhance user perceptions of interactivity in a communication scenario in which consumers send instant messages to an e-store. Van Noort, Voorveld, and Van Reijmersdal (2012) tested that a visitor's flow experience in a specific brand web site mediates the effects of interactivity on the number and type of thoughts, on attitudes toward the brand and web site and on several behavioral intentions. Choi and Taylor (2014) examined the vividness of mental imagery as a mediator, and consumers' need for touch and product type as moderators of the effects and the vividness of mental imagery influence attitudes and intentions by mediating the effects of 2D versus 3D. Empirical results of Huang and Liao (2017) revealed that three decorating psychological states directly induced a multisensory flow experience. Animesh, Pinsonneault, Yang, and Oh (2011) investigated how technological and spatial environments in virtual worlds influence the participants' virtual experiences (i.e., telepresence) and how experiences subsequently affect their response. Klein (2003) evaluated the effect of media characteristics including user control and media richness on the creation of telepresence and assessed the impact of telepresence on consumer beliefs and attitudes toward the advertised product. A research by Nah, Eschenbrenner, and Dewester (2011) applied theories of flow, telepresence, positive emotions, and brand equity to examine the effect of virtual world environments on telepresence, enjoyment, brand equity, and behavioral intention. Yim, Chu, and Sauer (2017) evaluated the effectiveness of augmented reality (AR) as an e-commerce tool using products. Kim and Forsythe (2008a) examined the dual role of sensory experience enablers in the online soft goods shopping process for different types of sensory enabling technologies that are widely applied in online retail sites. Kim and Forsythe (2008b) investigated online apparel shoppers' use of Virtual Try-on to reduce product risks and increase enjoyment in online shopping. Huang (2012) examined the effects of interactive and social features on users' online experiences and their purchase intention of virtual goods from a social network site. Huang and Liao (2017) also examined factors that induce a multisensory flow experience in an e-shopping context through the use of augmented-reality interactive technology. Hoyer, Kroschke, Schmitt, Kraume, and Shankar (2020) highlighted that new technologies, such as Internet of Things (IoT), Augmented Reality (AR), Virtual Reality (VR), and robots, which are typically powered by Artificial Intelligence (AI), are dramatically transforming the customer experience.

## 2.2. Customer Relationship Management

Customer Relationship Management (CRM) is defined as a strategic approach that combines people, organizational processes, and information technology (IT) to build and improve relationships with profitable customers and segments (Chen

& Popovich, 2003). The objective of CRM is to build customer loyalty by creating and maintaining a positive attitude toward the company (Magasi, 2016). CRM referred to the integration of marketing and high-quality services through information technology with the aim of increasing the customers' satisfaction and loyalty to achieve the purpose of increasing business efficiency (Wang, 2008; Wang, Wang, Chang, Yan, & Lin, 2014). CRM is moving to be an integral part of the marketing management function (Aaltonen, 2004). Integration of the internet and database marketing enhanced the effectiveness of CRM practices, and customer information gathered through the internet can be used to improve CRM through the strategies (O'Leary, Rao, & Perry, 2004). CRM is emerging as a new business strategy and has become a hot issue among scholars and marketing executives (Heinonen, 2014). CRM unites the potential of relationship marketing strategies and IT to create profitable, long-term relationships with customers and other key stakeholders (Payne & Frow, 2005).

CRM is a management approach that enables organizations to identify, attract, and increase retention of profitable customers, by managing relationships with them (Adebanjo, 2003). CRM systems were also essential to support the move towards more customer-centric management strategies adopted at the early of the 1990s (Webber, 2013). Nasir (2015) addressed that CRM strategy is a customer centric business strategy and fits best with customer intimacy value discipline. Kumar and Reinartz (2006) emphasized the utilization of database marketing and developing communications strategies in order to build strong and profitable customer relationships. The deployment of new technologies gives an insight into the rate of growth of CRM applications (Adebanjo, 2003). E-CRM refers to the marketing activities, tools and techniques, delivered over the Internet using technologies with a specific aim to locate, build, and improve long-term customer relationships to enhance their individual potential (Lee-Kelley, Gilbert, & Mannicom, 2003). The importance of effective CRM implementation is intensified in the e-business environment, since customer loyalty is much more difficult to establish in this domain (Kımıloğlu & Zaralı, 2009). The quality of service, trust, and privacy, through customer satisfaction, significantly affect the success of E-CRM systems (Dehghanpouri, Soltani, & Rostamzadeh, 2020).

## 3. Theoretical Background

There is a growing body of evidence that customer satisfaction is predictive of firms' future financial performance (Bhattacharya, Morgan, & Rego, 2020). Customer satisfaction has received considerable attention both in the marketing literature and practice (Tsaur, Chiu, & Wang, 2007). The satisfaction judgment is generally agreed to originate in a comparison of the level of product or service performance, quality, or other outcomes perceived by the consumer with an evaluative standard (Westbrook & Oliver, 1991). Machleit and Mantel (2001) demonstrated that the effect of emotions on shopping satisfaction is moderated by the attributions that shoppers make for their feelings. Measuring and managing customer satisfaction is crucial for the survival, development, and success of service industries like tourism (Sirakaya, Petrick, & Choi, 2004). Both retrospective global judgments of consumption emotions as well as its in-process experience (i.e. their experience during the sequence of episodes composing the transaction) determine post-purchase satisfaction in multiple ways (Dubé & Morgan, 1998). Direction of change in satisfaction judgements is contingent on several factors (Zins, 2001). Maguire and Geiger (2015) suggested that the temporal perspective is a dominant cause of consumption emotions in services, influencing consumers' emotions from before the service encounter commences to its conclusion. Another theory supports this study. The technology acceptance model (TAM) explained the use of technology after proposed by Davis (1989). In the TAM, the user's perception of ease of use and usefulness affect attitudes and behavioral intentions (Davis, 1989). By applying the technology acceptance model, Septiani, Handayani, and Azzahro (2017) revealed that perceived usefulness is considered the one of the most critical internal beliefs that affects user acceptance.

## 4. Hypothesis Development

This study investigated how customers perceive application of virtual mirror technology, when they consider to purchase sensory products. The virtual mirror technology is defined by previous studies. Cho and Schwarz (2012) claimed that virtual mirror technology allows consumers to create a virtual model by uploading a digital image of themselves, offering them the opportunity to see how a product would look "on them", when they cannot physically test or see the product. Baek, Yoo, and Yoon (2016) stated that virtual mirror, an increasingly popular application of augmented reality (AR), allows consumers to view their visages overlaid with product images on digital displays. Cho and Schwarz (2012) also stated that such simulation technologies are not limited to online retailers, while conventional stores can take advantage of them by inviting shoppers to snap a self-portrait at a virtual mirror kiosk in the store, allowing for more efficient initial product trials. This study considered

virtual mirror technology as a technology that allows customers to upload their digital images and test how products look to them.

This study proposed independent variables including sensory stimulation and emotional response on satisfaction and intention to use. Sensory stimulation is analyzed to have a greater influence than the measurement of goods or services itself in shaping users' preferences in the overall experience (Hultén, Broweus, & van Dijk, 2009). In particular, in the case of sensory stimulation of virtual reality technology, most of the virtual reality technologies commercialized at the present time includes visual and auditory, and through virtual reality technology, visual and auditory stimulation can be created and an immersive experience can be provided (Radianti, Majchrzak, Fromm, & Wohlgenannt, 2020). The user's indirect experience through virtual reality technology affects the user's senses through the virtual reality interface (Chen, Ching, Luo, & Liu, 2008). Based on the exploratory research based on previous studies, this study proposed the following independent variables: i) the sensory stimulation of virtual reality technology as creating visual and auditory stimulation through virtual reality technology; ii) enjoyment that sensory stimulation of virtual reality technology represents positive emotions (Kim & Forsythe, 2008a,b; Lee & Chung, 2008; Nah, Eschenbrenner, & Dewester, 2011); iii) perceived product quality through virtual reality technology (Bordegoni & Ferrise, 2013; Ottosson, 2002); iv) telepresence that is formed by technological means and gives a feeling of being in reality (Animesh, Pinsonneault, Yang, & Oh, 2011; Klein 2003); v) interactivity that indicates a specific relationship established between the digital model and the user (Huang, 2012); and vi) immersion that is being absorbed in virtual reality technology (Yim, Chu, & Sauer, 2017). This study investigated effects of proposed variables on satisfaction and intention to use. Previous researches examined satisfaction and intention to use virtual reality technology, such as satisfaction of virtual reality information and intention to accept technology (Huang, Backman, Backman, & Moore, 2013). An individual's behavior can be predicted through behavioral intentions, so it is essential to understand behavioral intentions to understand user behavior (Bai, Law, & Wen, 2008). Mittal, Kumar, and Tsiros (1999) investigated whether satisfaction affects behavioral intentions toward the service provider. Finn, Wang, and Frank (2009) also examined that satisfaction is the major determinant of behavioral intentions, including the intention to recommend the website to other consumers, mediating the effects of disconfirmation. In this study, behavioral intention is a phenomenon that appears as a result of satisfaction.

**H1a**: Perceived sensory stimulation affects user satisfaction.
**H1b**: Perceived enjoyment affects user satisfaction.
**H1c**: Perceived Product quality affects user satisfaction.
**H1d**: Perceived telepresence affects user satisfaction.
**H1e**: Perceived interactivity affects user satisfaction.
**H1f**: Perceived immersion affects user satisfaction.
**H2a**: Perceived enjoyment affects intention to use.
**H2b**: Perceived enjoyment affects intention to use.
**H2c**: Perceived Product quality affects intention to use.
**H2d**: Perceived telepresence affects intention to use.
**H2e**: Perceived interactivity affects intention to use.
**H2f**: Perceived immersion affects intention to use.
**H3**: Perceived satisfaction affects user's intention to use for next time purchase.

## 5. Methodology

This study conducted an online survey. The composition of the survey was developed to measure the impact of virtual mirror technology of pleasure, product quality, remote reality, interaction, and immersion on customer satisfaction and intention to use. A total of 38 items were composed by combining the demographic variables of the survey respondents and general questionnaire items. Five point Likert scale was applied to measure proposed variables (1: Strongly disagree, 5: Strongly agree). This study added explanations about virtual mirror technology as part of introduction of the survey. This study randomly selected respondents who had experiences of virtual mirror technology in online and offline stores for clothing. 117 respondents completed the questionnaire with the response rate of 97%. Reliability analyses were conducted using Cronbach's alpha. Cronbach's Alpha results showed 0.666 for sensory stimulation, 0.891 for pleasure, 0.719 for product quality, 0.697 for remote reality, 0.783 for interaction, 0.822 for immersion, 0.843 for satisfaction with use, and 0.821 for intention to use (Table 1).

**Table 1: The Results of Reliability Analysis**

| Factor | Cronbach's Alpha |
|---|---|
| Sensory Stimulation | .666 |
| Enjoyment | .891 |
| Product Quality | .719 |
| Telepresence | .697 |
| Interactivity | .783 |
| Immersion | .822 |
| Satisfaction | .843 |
| Intention to Use | .821 |

## 6. Data Analysis

Table 2 summarized the results of demographic characteristics of respondents. In terms of gender, 56.4% were female and 43.6% were male. In terms of age, 36.8% were 20-29 years old, 23.9% were 30-39 years old, 12.0% were 40-49 years old, 17.9% were 50-59 years old, and 9.4% were over 60 years old. In terms of educational level, 27.4% were high school graduation, 46.2% had bachelor's degree, 19.7% had master's degree, and 6.8% had Ph.D. degree.

**Table 2: Demographic Characteristics of Samples**

| Division | Total | |
|---|---|---|
| *(N = 117)* | *%* | *N* |
| Gender | | |
| Female | 56.4% | (66) |
| Male | 43.6% | (51) |
| Age | | |
| 20 ~ 29 years old | 36.8% | (43) |
| 30 ~ 39 years old | 23.9% | (28) |
| 40 ~ 49 years old | 12.0% | (14) |
| 50 ~ 59 years old | 17.9% | (21) |
| Over 60 years old | 9.4% | (11) |
| Education | | |
| High School graduation | 27.4% | (32) |
| Bachelor degree | 46.2% | (54) |
| Master degree | 19.7% | (23) |
| Ph.D. degree | 6.8% | (8) |
| Job | | |
| Professionals | 22.2% | (26) |
| Office/Administrative Position | 6.8% | (8) |
| Production | 12.0% | (14) |
| Self-Employment | 18.8% | (22) |
| Official | 29.1% | (34) |
| Student | 2.6% | (3) |
| Housewife | 2.6% | (3) |
| Inoccupation | 6.0% | (7) |

| | | |
|---|---|---|
| Average household income per month (in Ten Thousand Won) | | |
| Less than 200 | 15.4% | (18) |
| Over 200~Less than 300 | 28.2% | (33) |
| Over 300~ Less than 400 | 12.0% | (14) |
| Over 400~Less than 500 | 12.8% | (15) |
| Over 500~ Less than 600 | 8.5% | (10) |
| Over 600 | 22.2% | (26) |

Factor analysis was performed to verify the validity of the variables. This study applied an extraction method with a varimax rotation of Kaiser Normalization. Table 3 summarized the results of independent variables including emotional stimulation, pleasure, product quality, remote reality, interaction, and immersion, while Table 4 summarized the results of dependent variables including satisfaction and intention to use. In the factor extraction process, eigenvalues greater than 1 were applied.

**Table 3:** Component Matrix: Dependent Variable

| Items | Components | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| SEN1 | .870 | | | | | |
| SEN3 | .864 | | | | | |
| SEN2 | .600 | | | | | |
| ENJ3 | | .923 | | | | |
| ENJ1 | | .873 | | | | |
| ENJ2 | | .853 | | | | |
| ENJ4 | | .832 | | | | |
| PRO1 | | | .848 | | | |
| PRO3 | | | .808 | | | |
| PRO2 | | | .754 | | | |
| TEL2 | | | | .818 | | |
| TEL1 | | | | .811 | | |
| TEL3 | | | | .746 | | |
| INT3 | | | | | .826 | |
| INT2 | | | | | .810 | |
| INT1 | | | | | .759 | |
| INT4 | | | | | .744 | |
| IMM2 | | | | | | .869 |
| IMM1 | | | | | | .839 |
| IMM4 | | | | | | .787 |
| IMM3 | | | | | | .761 |

SEN: Sensory stimulation; ENJ: Enjoyment; PRO: Product quality; TEL: Telepresence; INT: Interactivity; IMM: Immersion

**Table 4:** Component Matrix: Dependent Variable

| Items | Components | |
|---|---|---|
| | 1 | 2 |
| SAT3 | .926 | |
| SAT2 | .881 | |
| SAT1 | .816 | |
| INT2 | | .859 |
| INT1 | | .830 |
| INT3 | | .804 |
| INT4 | | .733 |

* SAT: Satisfaction; INT: Intention to Use

This study applied multiple regression analyses to test the hypotheses. Factor scores were used for regression analyses. Table 5 showed the results of variables on satisfaction. Overall, the results of ANOVA showed that the model was significant at 0.01 with $F = 26.595$ (*r-square* = 0.605). The results showed that effects of sensory stimulation, telepresence, and immersion on satisfaction were significant. Therefore, H1a, d, and f were accepted. When examining the relative influence of variables on the satisfaction level through the size of the standardized regression coefficient, the results found that the effect of immersion ($\beta = 0.291$) had the greatest influence, followed by the perceived telepresence ($\beta = 0.242$) and sensory stimulation ($\beta = 0.219$).

**Table 5:** Effects of Determinants of Satisfaction

| Variables (Independent → dependent) | Standardized Coefficient (*t*-value-Sig) |
|---|---|
| Sensory Stimulation → Satisfaction (H1a) | 0.219 (2.420**) |
| Enjoyment → Satisfaction (H1b) | -0.027 (-0.303) |
| Product Quality → Satisfaction (H1c) | -0.006 (-0.071) |
| Telepresence → Satisfaction (H1d) | 0.242 (2.747***) |
| Interactivity → Satisfaction (H1e) | 0.191 (1.970) |
| Immersion → Satisfaction (H1f) | 0.291 (2.598**) |

*** p < 0.01, ** p < 0.05, * p < 0.1 denotes statistical significance.

This study applied another multiple regression analyses to test the hypotheses. Factor scores were also used for regression analyses. Table 6 showed the results of variables on intention to use for next time purchase. Overall, the results of ANOVA showed that the model was significant at 0.01 with $F = 27.285$ (*r-square* = 0.616). The results showed that effects of enjoyment, product quality, and immersion on intention to use were significant. Therefore, H1b, d, and f were accepted. When examining the relative influence of factors on intention to use through the size of the standardized regression coefficient, the effect of enjoyment ($\beta = 0.470$) was found to have the greatest influence, followed by immersion ($\beta = 0.235$) and Product quality ($\beta = 0.174$).

**Table 6:** Effects of Determinants of Intention to Use

| Variables (Independent → dependent) | Standardized Coefficient (*t*-value-Sig) |
|---|---|
| Sensory Stimulation → Intention to Use (H2a) | 0.028 (0.323) |
| Enjoyment → Intention to Use (H2b) | 0.470 (5.422***) |
| Product Quality → Intention to Use (H2c) | 0.174 (2.092**) |
| Telepresence → Intention to Use (H2d) | -.128 (-1.518) |
| Interactivity → Intention to Use (H2e) | 0.116 (1.240) |
| Immersion → Intention to Use (H2f) | 0.235 (2.179**) |

*** p < 0.01, ** p < 0.05, * p < 0.1 denotes statistical significance.

ANOVA analysis on the effect of satisfaction on intention to use showed that the $F$ value was 65.975 (*r-square* = .373) at the significance level of 0.01. As shown in Table 7, H3 was accepted.

**Table 7:** Effects of Expected Satisfaction on Intention to Use

| Variable (Independent → Dependent) | Standardized Coefficient (*t*-value-Sig) |
|---|---|
| Satisfaction → Intention to Use (H3) | 0.611 (8.123***) |

*** p < 0.01, ** p < 0.05, * p < 0.1 denotes statistical significance.

## 7. Conclusions

### 7.1. Major Findings

The purpose of this study is to investigate how virtual mirror technologies provided by offline and online businesses affect satisfaction and intention to use in the era of the 4th industrial revolution environment that were rarely examined in previous studies. By adopting variables including sensory stimulation, enjoyment, product quality, telepresence, interactivity, and immersion as independent variables, this study examined how customers perceive and adopt the new technology. The results of this study found that effects of sensory stimulation, telepresence, and immersion on satisfaction were significant, while effects of enjoyment, product quality, and immersion on intention to use were significant. Therefore, variables affecting satisfaction and intention to use were different, while effects of immersion were significant both on satisfaction and intention to use. The results also found that effect size of variables on satisfaction showed greater with immersion than telepresence and sensory stimulation. The results found that effect size of variables on intention to use showed greater with enjoyment than immersion and product quality. Therefore, the results of this study implies that the role of virtual mirror technology helps

customers focus on products with increased satisfaction level, while it helps customers enjoy with increased level of intent to use the service. The results of this study implied that increased satisfaction affected intention to use the service for the next time purchase.

### 7.2. Managerial Implications

This study provides managerial implication to businesses. After the presence of e-commerce, how customers perceive products and services via telepresence has been changed. Firms have been applied advanced technologies to enhance interactivity and individualized services. In the era of the 4th industrial evolution, applications of advanced technologies on customer behavior have been exploded, therefore, customer expectations on better services has been increased. In particular, such expectations on sensory products in the online environment have been increased due to lack of physical presence. The role of virtual mirror technology plays pivotal role to improve the quality of services without physical presence, but with interactive experiences via telepresence. Therefore, in order to build better relationships with customers, firms should adopt advanced technologies such as virtual mirror technology to minimize uncertainty and enhance decision making. As the results of this study found, firms should devise a way to increase the intention to use by inducing interest of customers, improving immersion through enjoyment, and improving product quality. Firms also need to apply a more effective marketing strategy through re-verification of various and specific services for better development of online and traditional markets. When customers purchase a product, it should be possible to generate profits by analyzing the degree to which the values of immersion, telepresence, interactivity, sensory stimulation, enjoyment, and product quality perceived both on online and offline market. Virtual mirror technology could be also applied as a device to describe the product quality in more detail and to improve access to online and offline stores by minimizing physical interaction.

In particular, such efforts will help build long term relationships with customers that is key issue for CRM. Since CRM plays significant role for the integration of marketing and high-quality services through information technology to increase customer satisfaction and loyalty in order to achieve the goal of improving business efficiency ( Wang, Wang, Chang, Yan, & Lin, 2014), it is necessary for the firms continuously develop advanced technologies such as virtual mirror technology to meet customers' expectation and satisfaction by providing better experiences. Payne and Frow (2000) suggested that it is necessary for business organizations to increase customer satisfaction by adopting customer relationship marketing as a strategy for collecting and using data to increase customer value. Therefore, it is necessary for the businesses to continuously improve customer satisfaction and intention to use by adopting better technology. It is necessary for the firms to find meaningful patterns or rules by age, occupation, and income of customers through analysis of data collected via virtual mirror technology and to improve customer satisfaction and intention to use the service.

### 7.3. Limitations and Future Research

The sample size of the survey conducted for this study might not sufficient to explain all the customers who use the online and offline stores using virtual mirror technology. Therefore, future research, might consider to increase sample size. Factors affecting satisfaction and intention to use might differ depending on the product categories. Future study might also consider other aspects, such as product categories and different types of industry. Future research might consider to analyze differential effects from online and offline stores.

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