The Impact of Perceived Usefulness, Convenience, and Perceived Augmentation on Purchase Intention: A Study of Virtual Try-On for Cosmetic Products

Desya Andini Fitri Hasibuan

Abstract – The COVID-19 pandemic has accelerated the shift toward online shopping, especially for cosmetic products. However, a major challenge remains: consumers cannot physically try on products before purchase. Augmented Reality (AR) and Virtual Try-On (VTO) features address this issue by allowing consumers to virtually try on cosmetic products, creating a more realistic shopping experience.

This study analyzes the factors that affect the adoption of AR in the Indonesian cosmetics market, focusing on perceived usefulness, convenience, and perceived augmentation as determinants of customer engagement and purchase intention. Based on the Technology Acceptance Model (TAM) and the Theory of Interactive Media Effects (TIME), a conceptual framework was developed to analyze these relationships.

Quantitative methods were applied using convenience sampling and snowball sampling, with data collected from 350 respondents who had prior experience using VTO for cosmetics through mobile commerce. Structural Equation Modeling (SEM) with SmartPLS was used to test the proposed relationships between the variables.

The results of the study indicate that perceived usefulness, convenience, and perceived augmentation have a positive effect on customer engagement and purchase intention. Additionally, customer engagement was found to be a significant mediator between the three factors and purchase intention, highlighting its crucial role in driving consumer purchase intention.

I. INTRODUCTION

Makeup is considered important by most Indonesian women, especially those who work. The main drivers for the development of this market are rising incomes, purchasing power, and urbanization, as well as lifestyle shifts that have led to the growth of the cosmetics industry in Indonesia. Customers are buying more cosmetics online than ever before due to the COVID-19 pandemic (Hadiwidjaja, 2023). Customer behavior is shifting due to the convenience and speed of products that can now be accessed through e-commerce, leading to a preference for online purchases over conventional retailers (Ardinsyah, 2023). Mobile commerce, as an evolution of e-commerce using mobile devices and internet access, continues to grow due to advances in smartphones and self-service technologies, enabling fast and independent shopping (Ligaraba, Nyagadza, Dörfling, & Zulu, 2023).

One disruptive innovation that replaces the role of beauty advisors in helping customers choose products that suit their needs and preferences is virtual try-on (Fenanda, Triwijayati, & Wahyono, 2024). The virtual try-on (VTO) feature of Augmented Reality (AR) technology in e-commerce allows customers to directly evaluate the appearance of products before making a purchase (Fenanda, Triwijayati, & Wahyono, 2024), by allowing customers to see, try on, and interact with products directly before making a purchase, this

technology completely changes the way people shop online (Diaa, 2022). Using this technology, customers can experience products virtually before buying them (Butt, Ahmad, Ali, Muzaffar, & Shafique, 2023), and it provides flexibility for customers to search for, select, and purchase products and services (Abed, 2021). The virtual try-on feature of augmented reality technology requires a camera to record objects, allowing customers to engage more fully with the product (Hung, Chang, & Ma, 2021; Tabaeeian, Hossi, Fatehi, & Tehrani, 2024), enabling customers to evaluate products without having to go to a physical store (Ivanov, Head, & Biela, 2023).

Customers can virtually try the product on their face thanks to virtual try-on (Tandon, Ertz, & Sakshi, 2021). The virtual try-on feature of augmented reality technology makes customers feel more secure when making product choices with a realistic and detailed look, because this technology works to match the color of cosmetics with skin color (Liu, Balakrishnan, & Saari, 2024). Online customers can utilize the virtual try-on feature of augmented reality technology to virtually try on products and see how the product looks on their face (Barta, Gurrea, & Flavián, 2022). In addition, the purpose of this feature is to reduce customer concerns and uncertainties when making online purchases, especially when it comes to choosing colors for cosmetic products (Recalde, Jai, & Jones, 2024).

The virtual try-on feature of augmented reality technology allows customers to enhance their perception when having a virtual experience, even without a physical product, and increases their confidence when making a purchase (Tan, Chandukala, & Reddy, 2021). To try on products with virtual try-on, users must give permission to the app to use the phone's camera to take selfies and try on products digitally. Users can interact and explore different products with this technology (Recalde, Jai, & Jones, 2024).

According to previous research, individuals or customers will adopt new technologies such as virtual try-on if they see the benefits, which include the ability to see the product in person (Diaa, 2022), time and location efficiency for customers (Londoño-Giraldo, et al., 2024), and providing an illusory reflective experience in person (Watson, Alexander, & Salavati, 2020). Given that the use of virtual try-on features of augmented reality technology for beauty products will always evolve, further research is needed to deeply understand the adoption of these features in cosmetic products in Indonesia.

Despite its huge potential, virtual try-on is still not widely used. Customers still prefer physical stores over online stores to try on products, as they believe that physical stores provide a more tangible experience (Patnaik, Patnaik, Panigrahy, Rout, & Patnaik, 2024). Customers still rarely use virtual try-on technology, especially in Indonesia, even though this technology can improve the online purchasing experience.

According to a Statista survey, 31% of participants said that they would not use virtual try-on services because they prefer to interact directly with the product (Siahaan, 2023b). It is difficult for customers to give a proper product evaluation because they cannot try on or touch the product they want to buy (Dhianita & Rufaidah, 2024). According to a Milieu Insight survey, 51% of respondents in Indonesia are unaware of the virtual try-on feature, and this is also confirmed by the results of a survey conducted by Statista, which shows that most cosmetics customers in Indonesia are not aware of the existence of the virtual try-on feature, and some of them are not

even familiar with it at all (Siahaan, 2023a). Based on a survey conducted by Statista, 31% of customers prefer physical interaction with products, 28% enjoy the in-store shopping experience, 19% are concerned about data privacy, 8% feel that the technology used is not yet developed, 6% prefer to be served by salespeople in person, and 12% gave other reasons that were not mentioned (Siahaan, 2023b).

The inability of customers to try on products before making a purchase is one of the drawbacks of online purchasing. Expectation mismatches and increased product returns may occur due to customers' inability to choose the cosmetic color that best suits their skin tone. This aligns with the findings of Liu and Napitupulu (2020), who argue that augmented reality technology has a number of disadvantages from the customer's perspective, including difficulty of use, the need to provide too much personal information, lack of reliability for routine use, and the time required to understand how to use it.

Wang, Ko, & Wang (2022) asserted that color accuracy in beauty products is a crucial factor, so customers of cosmetic products can take advantage of virtual try-on features to impact their purchase intentions. However, the author's observation suggests that the perceived usefulness of the virtual try-on feature in augmented reality remains low, contributing to user hesitation. Customers often view the results as unrealistic, which alters facial appearance and discourages adoption. According to Ahmed, Ambika, & Belk (2023), if virtual try-on fails to provide actual self-representation, such as facial hue, skin color, and skin feel, it can negatively affect the mood of customers using the technology. Gabriel, Ajriya, &

Fahmi (2023) argue that the capabilities of the virtual try-on feature of augmented reality technology need to be improved to display colors more realistically and adjust product placement based on the identification of users' facial features.

Researchers from various perspectives are investigating augmented reality technology extensively, among which the interaction between products and customers can be strengthened by using augmented reality, such as for digital branding (Nabila & Negoro, 2023) and online retail promotion (Addo, Fang, Asare, & Kulbo, 2021). Various studies have investigated how augmented reality technology functions in various situations, covering different types of applications and features, as well as different product focuses, such as food delivery services (Londoño-Giraldo, López-Ramírez, & Vargas-Piedrahita, 2024). In addition, augmented reality has been studied in relation to online purchases of products, including tea (Zhao & Rojniruttikul, 2023), food (Le, et al., 2023), and movie tickets (Rahman & Nurlatifah, 2020).

According to Nikhashemi, Knight, Nusair, and Liat (2021), further research on augmented reality should be conducted, with an emphasis on attributes and features that can increase theoretical and practical knowledge in creating and maintaining customer engagement. According to Diaa (2020), augmented reality in relation to cosmetic products is still relatively new, so further research is needed to find out how this technology can retain customers. It is very important to optimize the use of this technology at various stages of the customer journey.

Nikhashemi, Knight, Nusair, & Liat (2021) recommend that further research be conducted on augmented reality with a focus on characteristics and

features that can enhance theoretical as well as practical understanding of developing and maintaining customer engagement. Some of the augmented reality attributes that can influence customer engagement include perceived usefulness (Duffett & Maraule, 2024), convenience (Londoño-Giraldo, López-Ramírez, & Vargas-Piedrahita, 2024; Zhao & Rojniruttikul, 2023), perceived augmentation (Ganesan & Kumar, 2024; Ahmed, Ambika, & Belk, 2023), and through these constructs, are expected to lead to purchase intention. Each of these variables is hypothesized to have a significant and positive impact in the context of customer purchase intention on the virtual purchase of cosmetic products that provide virtual try-on features from augmented reality technology. The theoretical framework of this research is as follows:
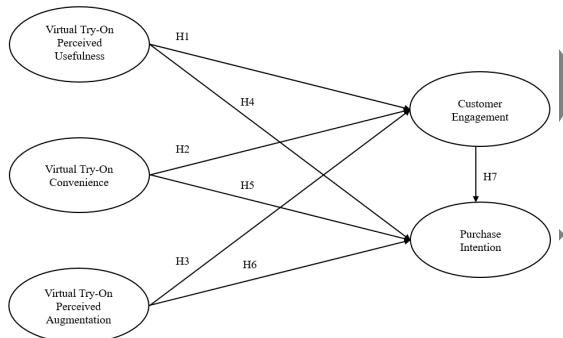

Figure 1 Theoretical Framework

The theoretical framework in Figure 1 above shows that this research has three independent variables, including Perceived Usefulness, Convenience, and Perceived Augmentation. Each independent variable has a hypothesis (H1, H2, H3) which is assumed to have a direct impact on Customer Engagement. Perceived Usefulness, Convenience, and Perceived Augmentation have a direct impact with Purchase Intention in hypotheses H4, H5, and H6. Furthermore, hypothesis H7 assumes that Customer Engagement is assumed to have a direct impact with Purchase Intention.

This study integrates the Technology Acceptance Model (TAM) and the Theory of Interactive Media Effects (TIME) to construct a conceptual model of augmented reality adoption. These two theories explain the factors that influence the adoption of user-friendly technology, particularly virtual try-on for facial beauty products, and support the development and marketing of such technology. The Technology Acceptance Model (TAM) evaluates the use of information technology and states that user satisfaction is proportional to the frequency of system use (Yin & Lin, 2022). Meanwhile, the Theory of Interactive Media Effects (TIME) views technology attributes as basic capabilities that reflect the potential for action based on the perceptual characteristics of the system (Lee, Xu, & Porterfield, 2021).

II. METHODS

This research design is quantitative and aims to establish a causal relationship between the variables. This research design is quantitative, aimed to establish a causal relationship between the variables under study and produce conclusions based on numerical data that can be processed and analyzed through statistical methods (Bougie & Sekaran, 2020). This research adopts a descriptive and causality approach. Descriptive research aims to gather characteristics of individuals, groups, or situations, while collecting quantitative data such as production figures, sales, customer satisfaction scores, or demographic information (Bougie & Sekaran, 2020). Causality research aims to evaluate the effect of one variable on another and whether there is a change in the variable. Causality is used to explain

one or more causal variables in a problem (Bougie & Sekaran, 2020).

The research population consists of individuals or customers who have used the virtual try-on feature to virtually try on cosmetic products through mobile commerce. Convenience is the only factor taken into account when sampling; if a person is found to be a viable source of data, they are selected as a sample. In addition to convenience sampling, the researcher also used snowball sampling. Snowball sampling allows each initial respondent to recommend other relevant people, thus effectively expanding the network of respondents and ensuring that the data collected is appropriately representative of the target population. Researchers can use the social networks of the initial respondents to reach out to larger and harder-to-reach groups. Therefore, individuals or customers who have used the virtual try-on feature to virtually try on cosmetic products through mobile commerce in the past 6 months and reside in major Indonesian cities were specifically selected as the sample.

The minimum sample size should be ten times the maximum number of arrows pointing to latent variables in a PLS path model (Hair Jr., et al., 2021). Given that this study has seven arrows pointing to latent variables, a minimum sample size of 10 x 7 or 70 respondents is required. A list of statements was submitted to respondents using Google Forms as part of the data collection process. The approach used in this research is the online distribution of questionnaires through Google Forms, which allows for quick and effective responses from respondents. The author shared the questionnaire link through social media (WhatsApp, Instagram, TikTok), accompanied by a poster and an explanation of the research objectives.

This study applied structural equation modeling using SmartPLS version 4.0, also known as variance-based partial least squares equation modeling (PLS-SEM), to evaluate data and create models with latent variables. The use of a 4-point Likert scale in this questionnaire aims to avoid neutrality bias, thereby increasing data accuracy and reducing ambiguity. Neutral options are considered irrelevant because this instrument is designed to measure attitudes that can be actively expressed by respondents. This scale also facilitates statistical analysis with the assumption of equal distances between points, thereby supporting data accuracy and the relevance of results.

To understand the problems potentially related to the topic under study, the author carried out preliminary research. The author conducted quick research on various cosmetic products marketed through mobile commerce. The author found that not all cosmetic products offer the virtual try-on feature, and some brands could not provide information about products that support the feature. In addition, some brands only provide virtual try-on features through their official websites.

The author observed that most customers tend to purchase cosmetic products online without utilizing the virtual try-on feature, even though this feature is designed to facilitate the selection of cosmetic colors that match the customer's skin tone. As a result, many customers make purchases based on images in the catalog, known as blind buying. However, the difference between the color display in the catalog and the result of the product application on the face often results in the product received not matching the customer's expectations. The virtual try-on feature often does not meet customer expectations. The cosmetic colors displayed in this feature tend to be

less realistic and different when applied directly on the face. Although the feature can display product information and images virtually, many users feel that the visual results are inadequate. As a result, this feature is rarely utilized as an effective and useful tool.

The author conducted a trial of the virtual try-on feature and found that it was quite helpful for customers in selecting cosmetic colors. However, the accuracy of the displayed colors is greatly affected by factors such as lighting, camera distance, and head position stability. If the lighting is inadequate, the camera distance is inappropriate, or the head is moving, the displayed results tend to be inaccurate or unrealistic. To obtain optimal results, this feature requires proper lighting and appropriate camera positioning so that skin and lip colors appear more accurately.

Before distributing the research questionnaire, the author conducted preliminary research with close relatives to explore their familiarity with the virtual try-on features. The results show that although some people are familiar with it, there are still individuals who do not know at all about the existence of the virtual try-on feature.

III. RESULTS AND DISCUSSION

The author distributed the research questionnaire online using Google Forms, which contained pre-designed questions. Promotion to fill out the questionnaire was carried out by sharing posters and invitation captions through social media such as WhatsApp, Instagram, and TikTok. Within 8 days, from November 11 to November 18, 2024, the author managed to collect 549 responses. After going through the screening question process, 350 valid respondents were obtained.

The characteristics of the respondents obtained were evaluated through screening questions placed at the beginning of the questionnaire, as described in the previous chapter. A total of 13 respondents did not pass the first screening question where they were not willing to be respondents in the author's research, 121 respondents did not pass the second screening question where they had not used the virtual try-on feature in the last 6 months and did not live in a big city in Indonesia, and 65 respondents did not pass the third screening question where they were not female, not in the age range of 18 to 29 years old, had a salary $\geq$ Rp. 5,000001. The number of valid samples that the author gets is greater than the minimum number required in Chapter III, which is 200, then the answers from 350 valid respondents will be analyzed using SmartPLS software.

The discussion section shows how the author interprets the results in light of what was already known and explains the new understanding of the problem after taking your results into consideration. The discussion must connect with the Introduction, so it tells how your study contributes to the body of knowledge and society.

Table 1 Characteristics of Respondents Based on Cosmetic Brands

Cosmetic Brands Tried Using the Virtual Try-On Feature

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	L'Oreal	34	9.7	9.7	9.7
	Maybelline	69	19.7	19.7	29.4
	Luxcrime	27	7.7	7.7	37.1
	Revlon	17	4.9	4.9	42.0
	Others	203	58.0	58.0	100.0
	Total	350	100.0	100.0	

Table 1 shows that out of a total of 350 respondents, 203 respondents (58%) have tried cosmetic products from various brands, virtually using the virtual try-on feature. Additionally, respondents who tried products from specific brands include: Maybelline with 69 respondents

(19.7%), L'Oréal with 34 respondents (9.7%), Luxcrime with 27 respondents (7.7%), and Revlon with 17 respondents (4.9%).

Table 2 Characteristics of Respondents Based on Cosmetic Brands

Types of Cosmetics Tried Using the Virtual Try-On Feature

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Lip Blush (lip tint, lip matte, lipstick, and others)	88	25.1	25.1	25.1
Blush On	43	12.3	12.3	37.4
Foundation	49	14.0	14.0	51.4
Others	170	48.6	48.6	100.0
Total	350	100.0	100.0	

Table 2 shows that out of a total of 350 respondents, 170 respondents (48.6%) tried more than one type of cosmetic product virtually using the virtual try-on feature, including Lip Blush, Blush, and/or Foundation. Meanwhile, respondents who only tried one type of product consisted of 88 respondents (25.1%) who tried Lip Blush, 49 respondents (14%) who tried Foundation, and 43 respondents (12.3%) who tried Blush.

Table 3 Characteristics of Respondents Based on Monthly Income

Monthly Income

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Rp.5.000.001-Rp.7.000.000	287	82.0	82.0	82.0
Rp.7.000.001-Rp. 9.000.000	27	7.7	7.7	89.7
≥ Rp.9.000.000	36	10.3	10.3	100.0
Total	350	100.0	100.0	

Table 3 shows that of the total 350 respondents, the majority had a monthly income in the range of Rp5,000,001–Rp7,000,000, namely 287 respondents (82%). Furthermore, 36 respondents (10.3%) had an income of ≥ Rp9,000,001, and 27 respondents (7.7%) were in the range of Rp7,000,001–Rp9,000,000."

Table 1 Characteristics of Respondents Based on the Need to Buy Cosmetic Products

The Need To Buy Cosmetic Products

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Daily activities	86	24.6	24.6	24.6
	Work	40	11.4	11.4	36.0
	Party	40	11.4	11.4	47.4
	Gifts	18	5.1	5.1	52.6
	Others	166	47.4	47.4	100.0
	Total	350	100.0	100.0	

Table 4 shows that out of a total of 350 respondents, 166 respondents (47.4%) purchased cosmetic products for various purposes, such as daily activities, work, parties, and/or as gifts. Furthermore, respondents who purchased cosmetics for a single purpose included 86 respondents (24.6%) for daily activities, 40 respondents (11.4%) each for work and parties, and 18 respondents (5.1%) who purchased cosmetics as gifts.

Table 2 Characteristics of Respondents Based on Reasons for Shopping Online

Reasons For Shopping Online

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Attractive promotions	64	18.3	18.3	18.3
	Save time and effort	59	16.9	16.9	35.1
	Cheaper prices	42	12.0	12.0	47.1
	Others	185	52.9	52.9	100.0
	Total	350	100.0	100.0	

Table 5 shows that out of a total of 350 respondents, 185 respondents (52.9%) shop for cosmetics online for more than one reason, such as attractive promotions, time and energy savings, and lower prices. Meanwhile, the most common single reason was attractive promotions (64 respondents or 18%), followed by saving time and effort (59 respondents or 16.9%), and lower prices (42 respondents or 12%).

Table 3 Characteristics of Respondents Based on Last Education

Last Education

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid High school or equivalent	133	38.0	38.0	38.0
Diploma	64	18.3	18.3	56.3
Bachelor	142	40.6	40.6	96.9
Postgraduate	11	3.1	3.1	100.0
Total	350	100.0	100.0	

Based on the data in Table 6, out of a total of 350 respondents, the majority had a bachelor's degree (S1) as their highest level of education, with 142 respondents (40.6%), followed by high school graduates or equivalent with 133 respondents (38%), diploma holders with 64 respondents (18.3%), and postgraduate degree holders with 11 respondents (3.1%).

Table 4 Characteristics of Respondents by Occupation

Occupation

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Student	104	29.7	29.7	29.7
Public Employee	41	11.7	11.7	41.4
Private Employee	129	36.9	36.9	78.3
Self-employed	45	12.9	12.9	91.1
Others	31	8.9	8.9	100.0
Total	350	100.0	100.0	

The data in Table 7 shows that out of a total of 350 respondents, the majority worked as private employee (129 respondents, 36.9%), followed by students (104 respondents, 29.7%), self-employee 45 respondents (12.9%), public employee 41 respondents (11.7%), and 31 respondents (8.9%) working outside the job categories listed in the questionnaire.

Table 5 Respondent Characteristics Based on City of Residence

City Origin

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid DKI Jakarta	146	41.7	41.7	41.7
Surabaya City	34	9.7	9.7	51.4
Bandung City	27	7.7	7.7	59.1
Bogor City	36	10.3	10.3	69.4
Tangerang City	37	10.6	10.6	80.0
Others	70	20.0	20.0	100.0
Total	350	100.0	100.0	

From the data obtained in Table 8, all respondents, or 350 respondents, came from various big cities in Indonesia, which have a crowded market with easy internet access and a high level of trust in the use of modern technology (Mulachela, 2022; Gusmiarti, 2024). The largest number of respondents came from DKI Jakarta with a percentage of 41.7% (146 respondents), followed by Surabaya City with 9.7% (34 respondents), Bandung City with 7.7% (27 respondents), Bogor City with 10.3% (36 respondents), Tangerang City with 10.6% (37 respondents), and the remaining 20% (70 respondents) came from other major cities not specified in the questionnaire.

This study involved 20 indicators representing five variables or constructs. Data was obtained from 350 valid respondents, with each variable consisting of four indicators. Descriptive statistical analysis conducted using SmartPLS 4 produces mean and standard deviation values for each indicator. This analysis provides an in-depth description of respondents' perceptions and responses to each variable, making it easier to interpret the research results.
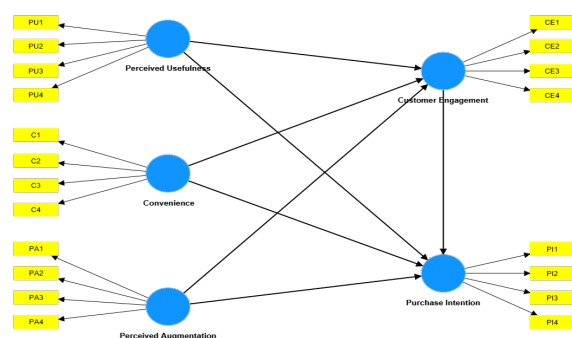

Figure 2 Theoretical Framework for Reliability and Validity Test

Figure 2 shows that the reliability test in this study uses a total of 20 indicators spread over 5 variables. Data was collected from 350 respondents through a research questionnaire using Google Forms. The data obtained was then converted to an Excel file and analyzed using SmartPLS 4 software. The PLS-SEM simulation results show the outer loading values as follows:

Table 9 Factor Loading Test Results

	Convenience	Customer Engagement	Perceived Augmentation	Perceived Usefulness	Purchase Intention
C1	0,807				
C2	0,751				
C3	0,766				
C4	0,815				
CE1		0,811			
CE2		0,761			
CE3		0,762			
CE4		0,785			
PA1			0,812		
PA2			0,733		
PA3			0,734		
PA4			0,831		
PI1					0,794
PI2					0,753
PI3					0,736
PI4					0,811
PU1				0,795	
PU2				0,731	
PU3				0,724	
PU4				0,808	

Table 9 shows that the outer loadings of each indicator in the model have a value $\geq$ 0.708; based on these results, all items or indicators and constructs used are declared valid. This indicates that the statements are valid and can be used for further analysis.

Table 6 Composite Reliability and Convergent Validity Test Results

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
Convenience	0,793	0,794	0,865	0,617
Customer Engagement	0,785	0,785	0,861	0,608
Perceived Augmentation	0,782	0,786	0,860	0,606
Perceived Usefulness	0,764	0,766	0,850	0,586
Purchase Intention	0,776	0,777	0,857	0,599

Data in Table 10, Internal Consistency Reliability, has very good results overall. Cronbach's alpha and composite reliability (rho_a and rho_c) of all latent variables (perceived usefulness, convenience, perceived augmentation, customer engagement, and purchase intention) have a value > 0.6, which indicates that all constructs in this study can be considered reliable and can be used for further analysis. All research variables

have AVE values > 0.50, so based on these results, all items or indicators and constructs used are declared valid.

Table 7 Fornell-Larcker Criterion Test Results

	Convenience	Customer Engagement	Perceived Augmentation	Perceived Usefulness	Purchase Intention
Convenience	0,785				
Customer Engagement	0,609	0,780			
Perceived Augmentation	0,463	0,665	0,779		
Perceived Usefulness	0,537	0,625	0,572	0,765	
Purchase Intention	0,585	0,683	0,595	0,597	0,774

The validity test results presented in Table 11 show that the Perceived Usefulness variable has an AVE square root value of 0.765> from the AVE value of 0.586. Convenience has an AVE square root value of 0.785> from the AVE value of 0.617. Perceived Augmentation has an AVE square root value of 0.779> from the AVE value of 0.606. The Customer Engagement variable has an AVE square root value of 0.780> from the AVE value of 0.608, and Purchase Intention has an AVE square root value of 0.774> from the AVE value of 0.599.

Table 8 Heterotrait-monotrait ratio (HTMT) Test Results

	Convenience	Customer Engagement	Perceived Augmentation	Perceived Usefulness	Purchase Intention
Convenience					
Customer Engagement	0,767				
Perceived Augmentation	0,583	0,848			
Perceived Usefulness	0,682	0,802	0,739		
Purchase Intention	0,743	0,872	0,761	0,771	

In addition, based on Table 12, the heterotrait-monotrait ratio (HTMT) value with loading <0.9 on all constructs shows adequate discriminant validity. Therefore, the research instrument can be said to be discriminantly validity, meaning that the instrument is able to distinguish between different latent variables.

Table 9 Collinearity Test Results

	VIF
C1	1,853
C2	1,453
C3	1,457
C4	1,795
CE1	1,770
CE2	1,439
CE3	1,486
CE4	1,657
PA1	1,744
PA2	1,391
PA3	1,411
PA4	1,861
PI1	1,662
PI2	1,404
PI3	1,407
PI4	1,711
PU1	1,721
PU2	1,320
PU3	1,411
PU4	1,732

The test results that the authors conducted for testing the level of collinearity based on the research questionnaire response data with a sample of 350 respondents with 20 indicator items using SmartPLS 4 are presented in Table 13 above. From the results of testing the level of collinearity that the authors conducted, all indicators have a VIF value < 3, which indicates that collinearity does

not occur, and the structural model test can proceed. Furthermore, the authors used non-parametric bootstrapping to determine the quality of the reflective model passed, which aims to produce path coefficients and the level of significance of each relationship in the research model.

Table 10 Path Coefficients Test Results

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
Convenience -> Customer Engagement	0,299	0,300	0,050	5,987	0,000
Convenience -> Purchase Intention	0,207	0,208	0,053	3,950	0,000
Customer Engagement -> Purchase Intention	0,326	0,327	0,072	4,525	0,000
Perceived Augmentation -> Customer Engagement	0,387	0,386	0,061	6,370	0,000
Perceived Augmentation -> Purchase Intention	0,180	0,182	0,059	3,039	0,002
Perceived Usefulness -> Customer Engagement	0,244	0,243	0,059	4,116	0,000
Perceived Usefulness -> Purchase Intention	0,179	0,175	0,081	2,205	0,027

Based on the data in Table 14, all tested hypotheses show acceptable results. Hypothesis 1, which states that perceived usefulness affects customer engagement, is accepted with a t-statistic value of 4.116 (> 1.96) and a p-value of 0.000 (< 0.05), which indicates that an increase in perceived usefulness will increase the level of customer engagement. Furthermore, hypothesis 2, which examines the effect of convenience on customer engagement, is also accepted with a t-statistic value of 5.987 (> 1.96) and a p-value of 0.000 (< 0.05), which indicates that the higher the level of convenience, the higher the customer engagement. Hypothesis 3, which states that perceived augmentation affects customer engagement, is accepted with a t-statistic of 6.370 (> 1.96) and a p-value of 0.000 (< 0.05), indicating that an increase in perceived augmentation will increase customer engagement.

In terms of impacts on purchase intention, hypothesis 4, which states that perceived usefulness affects purchase intention, is accepted with a t-statistic of 2.205 (> 1.96) and a p-value of 0.027 (< 0.05), indicating that the higher the perceived usefulness, the greater the purchase intention. Hypothesis 5, which examines the effect of convenience on purchase intention, is accepted with a t-statistic of 3.950 (> 1.96) and a p-value of 0.000 (< 0.05), which indicates that an increase in convenience can increase purchase intention. Hypothesis 6, which states that perceived augmentation affects purchase intention, is accepted with a t-statistic of 3.039 (> 1.96) and a p-value of 0.002 (< 0.05), indicating that the higher the perceived augmentation, the greater the purchase intention. Finally, hypothesis 7, which states that customer engagement affects purchase intention, is accepted with a t-statistic of 4.525 (> 1.96) and a p-value of 0.000 (< 0.05), indicating that higher levels of customer engagement will increase purchase intention.

Table 115 R-square Test Results

	R-square	R-square adjusted
Customer Engagement	0,591	0,588
Purchase Intention	0,558	0,553

The R-square (R^2) values shown for the customer engagement and purchase intention variables in Table 15 are 0.591 and 0.558 respectively, which means that 59.1% and 55.8% of the variation can be

explained through perceived usefulness, convenience, perceived augmentation as independent variables in the model and the rest (40.9% and 44.2%) are impacted by other factors outside the model.

Table 12 $Q2_{PREDICT}$ Test Results

	Table	PLS-SEM_RMSE	PLS-SEM_MAE	LM_RMSE	LM_MAE
CE1	0,316	0,569	0,461	0,583	0,473
CE2	0,373	0,558	0,462	0,569	0,463
CE3	0,366	0,562	0,466	0,573	0,468
CE4	0,334	0,598	0,483	0,616	0,496
PI1	0,320	0,574	0,460	0,587	0,466
PI2	0,291	0,625	0,498	0,633	0,490
PI3	0,253	0,594	0,463	0,593	0,456
PI4	0,323	0,585	0,470	0,595	0,472

Based on the results of the Q^2predict analysis presented in Table 16, all indicators in the model have a Q^2predict value > 0, which indicates that this model is predictively relevant. When comparing the prediction results using PLS-SEM with the linear regression model (LM) based on the root mean squared error (RMSE) and mean absolute error (MAE), it was found that the MAE analysis showed that PLS-SEM was superior to LM in the majority of indicators (6 out of 8), namely CE1, CE2, CE3, CE4, PI1, and PI4. However, for indicators PI2 and PI3, the PLS-SEM MAE value is higher than the LM. This indicates that the predictive power of the model in terms of MAE is at a moderate to high level. Overall, the PLS-SEM model based on RMSE proved to be reliable for predictive purposes, although there are still opportunities for improvement in the PI3 indicator to improve the model's predictive performance.

Table 13 $Q^2_{predict}$ Test Results

	Q²predict	RMSE	MAE
Customer Engagement	0,578	0,656	0,491
Purchase Intention	0,499	0,717	0,506

The overall test results for Q^2predict in predicting customer engagement and purchase intention variables in Table 17 show that the customer engagement variable has a higher Q^2predict value of 0.578, which indicates a more accurate model and has a lower prediction error compared to purchase intention. This indicates that the current model already shows a fairly good ability to predict purchase intention and can be considered as a solid basis for further analysis.

Table 14 Goodness of Fit Test Results

	Saturated model	Estimated model
SRMR	0,067	0,067
d_ULS	0,947	0,947
d_G	0,321	0,321
Chi-square	646,808	646,808
NFI	0,788	0,788

In the context of evaluating measurement and structural models, Goodness of Fit (GoF) aims to assess the fit of the model. The test results shown in Table 18 show that the standardized root mean residual (SRMR) value is 0.067, which means that the SRMR in this research model is <0.10, and it can be concluded that this model is suitable or fits the data.

The discussion in this study begins with Hypothesis H1, "Perceived usefulness has a positive and significant effect on customer engagement," which can be accepted. Technologically literate individuals, especially those aged 18–29 with a bachelor's degree, find it easier to understand and appreciate practical features such as virtual try-on. This group adapts quickly and is open to innovation, so they feel the benefits more quickly. In addition, those who live in large cities with

good technological infrastructure find it easier to utilize these features. This shows that perceived usefulness directly increases customer engagement without the need for additional factors..

Hypothesis H2, "Convenience has a positive and significant effect on customer engagement," can be accepted. Quick and easy access to virtual technology in large cities, supported by good technological infrastructure, reinforces this. Busy private sector workers place a high priority on convenience, including when shopping. The virtual try-on feature allows for deeper interaction and a practical, easy-to-use hands-on experience. With barrier-free access, customers feel more engaged and are more likely to continue using this technology without the need for additional factors.

Hypothesis H3, "Perceived augmentation has a positive and significant effect on customer engagement," can be accepted. Customers who prioritize visual accuracy, such as in lip blush products, are more responsive to shopping experiences with realistic and attractive product representations. These representations increase customer confidence in products that are tried on virtually. The 18–29 age group, who are more open to new technology, tend to continue using virtual try-on features if the product color visualization appears realistic and detailed. This realistic experience strengthens engagement while boosting their confidence to continue interacting without needing additional factors.

Hypothesis H4, "Perceived usefulness has a positive and significant effect on purchase intention," can be accepted. The tangible benefits of the virtual try-on feature are powerful enough to impact purchasing decisions without other factors. For example, individuals with a monthly income of Rp5,000,001–Rp7,000,000 prioritize clear benefits before making a purchase. They choose technology that makes shopping easier and reduces product uncertainty. This feature helps customers make quick and accurate decisions with an accurate product visualization without having to purchase immediately. As a result, purchase intention increases and aligns with the efficiency and convenience offered by the technology, aligning with customers' rational preferences. Thus, purchase intention increases and aligns with the efficiency and convenience offered by technology in accordance with customers' rational preferences, without the need for other additional factors.

Hypothesis H5, "Convenience has a positive and significant effect on purchase intention," can be accepted. Technological conveniences, such as virtual try-on features, accelerate customer interaction and purchase intention without the need for additional factors. Private sector workers who prioritize efficiency and convenience choose technologies that are easily accessible and easy to use. Especially those who live in big cities with fast and reliable access to technology, they take advantage of these features to shop easily and enjoyably. This allows them to make quick and accurate decisions without having to go to a physical store. This allows them to make quick and accurate decisions without having to visit a physical store, thereby increasing their intention to purchase without the need for other additional factors.

Hypothesis H6, "Perceived augmentation has a positive and significant effect on purchase intention," can be accepted. Individuals, especially those aged 18–29, who are open to technology, expect a realistic shopping experience and feel more confident about products with accurate visualizations. The virtual try-on feature, which uses augmented reality

technology, provides an accurate picture, helping customers make quick decisions on products such as lip blush. This accurate visualization immediately increases customer appeal and trust without requiring any additional factors.

Hypothesis H7, "Customer engagement has a positive and significant effect on purchase intention," can be accepted. The use of the virtual try-on feature directly increases customer motivation to purchase cosmetic products. Customer interaction with products through this feature builds purchasing desire without requiring additional factors. For example, individuals with an income of Rp5,000,001–Rp7,000,000 have stable purchasing power and high motivation to utilize augmented reality technology during the purchasing process. Customers who actively engage tend to be more focused on the product and have higher purchase intent, as evidenced by the high level of engagement when using the virtual try-on feature.

IV. CONCLUSION

Augmented reality technology in relation to cosmetic products is still relatively new, so further research is needed to understand how this technology can retain customers. Therefore, this study aims to fill this gap by analyzing the impacts of virtual try-on attributes of augmented reality technology on purchase intention. Until this study was conducted, there was a knowledge gap regarding the interaction of these three attributes in the context of virtual try-on technology in cosmetic products in Indonesia.

The results of the study indicate that the three main attributes (perceived usefulness, convenience, perceived augmentation) have a positive and significant effect on customer engagement and purchase intention, providing important contributions both theoretically and practically, as well as answering the questions posed in Chapter 1 and the literature review in Chapter 2.

Previous literature reviews also indicate that augmented reality (AR) technology in e-commerce can enhance the online shopping experience by allowing consumers to try products on virtually. This is consistent with research findings, where virtual try-on technology increases consumer comfort and trust in cosmetic products, as explained by Liu, Balakrishnan, and Saari (2024). Research by Abed (2021) also highlights that the convenience offered by this technology can enhance the shopping experience and, in turn, consumers' purchase intentions. In this context, perceptions of usefulness and convenience are key factors in increasing engagement and purchase intentions. However, despite these findings indicating positive impacts, some literature suggests that consumers still tend to prefer physical shopping experiences because they feel more confident with direct interaction with the product (Siahaan, 2023b). This indicates challenges in the adoption of virtual try-on technology in Indonesia, which need to be addressed to expand the adoption of this technology.

Based on the findings of this study, cosmetic products that use augmented technology in their e-commerce platforms should pay attention to three main factors—perceived usefulness, convenience, and perceived augmentation—to increase customer engagement and purchase intention. Cosmetic products can focus their efforts on improving the accuracy of product displays on the virtual try-on feature and ensuring the convenience of using the application through an intuitive and user-friendly interface design. Additionally, companies need to enhance consumer

education about the existence and benefits of the virtual try-on feature. Many consumers, particularly in Indonesia, still do not fully understand the benefits of this feature (Siahaan, 2023a). Therefore, more aggressive marketing strategies leveraging influencers or educational marketing campaigns about virtual try-on could be an effective step to increase adoption. Although this study provides important insights into the influence of virtual try-on features on purchase intention, there are several limitations that should be noted. First, this study only observed consumers in major cities in Indonesia, which may not fully reflect the experiences of consumers in smaller or less developed areas in terms of technological infrastructure. Second, this study relies on data collected through online surveys, which may lead to selection bias among respondents who are more familiar with technology.

For future research, it is recommended to expand the research sample to various regions in Indonesia, including areas that are less developed in terms of technology, to see if the same results can be obtained in different geographical contexts. Research could also consider using qualitative methods, such as in-depth interviews or focused group discussions, to delve deeper into why consumers remain hesitant to use augmented reality technology despite its proven ability to enhance convenience and engagement. Additionally, future research could explore the role of other factors, such as data security and privacy, in influencing the adoption of augmented reality technology for online cosmetic shopping.

REFERENCES

Abed, S. S. (2021). Examining augmented reality adoption by consumers with highlights on gender and educational-level differences. *Review of International Business and Strategy, 31*(3), 397-415. doi:http://dx.doi.org/10.1108/RIBS-08-2020-0100

Addo, P. C., Fang, J., Asare, A. O., & Kulbo, N. B. (2021). Customer engagement and purchase intention in live-streaming digital marketing platforms. *The Service Industries Journal, 41*(11-12), 767-786. doi:https://doi.org/10.1080/02642069.2021.1905798

Ahmed, K. E.-S., Ambika, A., & Belk, R. (2023). Augmented reality magic mirror in the service sector: experiential consumption and the self. *Journal of Service Management, 34*(1), 56-77. doi:https://doi.org/10.1108/JOSM-12-2021-0484

Ardinsyah, M. (2023). Dampak Perkembangan E-Commerce Terhadap Bisnis Ritel Tradisional: Peluang Dan Tantangan. *J-Mabisya, 4*(1), 1-8. Diambil kembali dari https://jurnal.stain-madina.ac.id/index.php/j-mabisya/article/view/1236/977

Barta, S., Gurrea, R., & Flavián, C. (2022). A View of Augmented Reality in the Beauty Industry from an Exploratory Perspective: Generations X and Z. *Marketing and Smart Technologies* (hal. 575-583). Springer.

Bougie, R., & Sekaran, U. (2020). *Research methods for business : a skill-building approach (Eighth edition).* New Jersey: John Wiley & Sons, Inc.

Butt, A., Ahmad, H., Ali, F., Muzaffar, A., & Shafique, M. N. (2023). Engaging the customer with augmented reality and employee services to enhance equity and loyalty. *International Journal of Retail & Distribution Management, 51*(5), 629-652. doi:https://doi.org/10.1108/IJRDM-04-2021-0165

Dhianita, S., & Rufaidah, P. (2024). The Role of Virtual Try-On Augmented Reality of Cosmetic Products on Purchase Intention Mediated by Brand Trust. *Jurnal Manajemen Bisnis, 11*(2), 1111-1123. doi:https://doi.org/10.33096/jmb.v11i2.797

Diaa, N. M. (2022). Investigating the effect of augmented reality on customer brand engagement: The mediating role of technology attributes. *The Centre for Business & Economic Research. 13*, hal. 356-375. Egypt: ROGE. Diambil kembali dari https://cberuk.com/cdn/conference_proceedings/2022-09-16-09-31-05-AM.pdf

Duffett, R. G., & Maraule, M. (2024). Customer engagement and intention to purchase attitudes of generation Z consumers toward emojis in digital marketing communications. *Young Consumers, 25*(5), 607-624. doi:https://doi.org/10.1108/YC-08-2023-1817

Fenanda, Z. I., Triwijayati, A., & Wahyono, S. A. (2024). THE EFFECT OF USING VIRTUAL TRY-ON ON PURCHASE INTENTION WITH ELECTRONIC WORD OF MOUTH AS A MEDIATION VARIABLE (CONSUMER PERSPECTIVE OF ECOMMERCE INDONESIA). *Journal of Sustainable Technology and Applied Science (JSTAS), 5*(1), 6-17. doi:https://doi.org/10.36040/jstas.v5i1.9344

Gabriel, A., Ajriya, A. D., & Fahmi, C. Z. (2023). The influence of augmented reality on E-commerce: A case study on fashion and beauty products. *Cogent Business & Management, 10*(2). doi:https://doi.org/10.1080/23311975.2023.2208716

Ganesan, M., & Kumar, B. D. (2024). Augmented reality: the key to unlock customer engagement potential. *Marketing Intelligence & Planning, 42*(6), 976-1009. doi:https://doi.org/10.1108/MIP-08-2023-0408

Hadiwidjaja, M. (2023, May 17). *Peta jalan untuk pertumbuhan dan inovasi kosmetik di Indonesia.* Diambil kembali dari Connect In-Cosmetics: https://connect.in-cosmetics.com/trends-en/a-roadmap-for-cosmetic-growth-and-innovation-in-indonesia/

Hair Jr., J. F., Hult, G. M., Ringle, C. M., Sarstedt, M., Danks, N. P., & Ray, S. (2021). *Partial Least Squares Structural Equation Modeling (PLS-SEM) Using R.* Springer Cham. doi:https://doi.org/10.1007/978-3-030-80519-7

Hung, S.-W., Chang, C.-W., & Ma, Y.-C. (2021). A new reality: Exploring continuance intention to use mobile augmented reality for entertainment purposes. *Technology in Society, 67*(4), 101757.

doi:https://doi.org/10.1016/j.techso
c.2021.101757

Ivanov, A., Head, M., & Biela, C. (2023).
Mobile shopping decision comfort
using augmented reality: the effects
of perceived augmentation and
haptic imagery. *Asia Pacific
Journal of Marketing and
Logistics, 35*(8), 1917-1934.
doi:https://doi.org/10.1108/APJML
-06-2022-0518

Le, T. T., Bui Thi Tuyet, N., Le Anh, T.,
Dang Thi Kim, N., Trinh Thi Thai,
N., & Nguyen Lan , A. (2023). The
effects of online restaurant menus
on consumer purchase intention:
evidence from an emerging
economy. *British Food Journal,
125*(7), 2663-2679.
doi:https://doi.org/10.1108/BFJ-10-
2022-0916

Lee, H., Xu, Y., & Porterfield, A. (2021).
Consumers' adoption of AR-based
virtual fitting rooms: from the
perspective of theory of interactive
media effects. *Journal of Fashion
Marketing and Management, 25*(1),
45-62.
doi:https://doi.org/10.1108/JFMM-
05-2019-0092

Ligaraba, N., Nyagadza, B., Dörfling, D.,
& Zulu, Q. M. (2023). Factors
influencing re-usage intention of
online and mobile grocery
shopping amongst young adults in
South Africa. *Arab Gulf Journal of
Scientific Research, 41*(3), 389-
415.
doi:https://doi.org/10.1108/AGJSR-
06-2022-0088

Liu, R., Balakrishnan, B., & Saari, E. M.
(2024). The Impact of Augmented
Reality (AR) Technology on
Consumers' Purchasing Decision
Processes. *Frontiers in Business,*

*Economics and Management,
13*(2), 181-185.
doi:http://dx.doi.org/10.54097/1r7f
1x56

Liu, S., & Napitupulu, T. A. (2020).
ANALYZING FACTORS
AFFECTING SATISFACTION
AND PURCHASE INTENTION
TOWARDS MOBILE
AUGMENTED REALITY E-
COMMERCE APPLICATIONS IN
INDONESIA. *Journal of
Theoretical and Applied
Information Technology, 98*(22),
3503-3517. Diambil kembali dari
https://www.jatit.org/volumes/Vol9
8No22/14Vol98No22.pdf

Londoño-Giraldo, B., López-Ramírez, Y.
M., & Vargas-Piedrahita, J. (2024).
Engagement and loyalty in mobile
applications for restaurant home
deliveries. *Heliyon, 7*, 1-13.
doi:https://doi.org/10.1016/j.heliyo
n.2024.e28289

Nabila, W. K., & Negoro, D. A. (2023).
Pengaruh Digital Marketing,
Customer Engagement, dan Brand
Awareness Terhadap Purchase
Intention Produk Fashion Lokal
Pada Generasi Z. *Jurnal
Pendidikan Tambusai, 7*(3), 20207-
20218. Diambil kembali dari
https://jptam.org/index.php/jptam/a
rticle/view/9462/7715

Nikhashemi, S. R., Knight, H. H., Nusair,
K., & Liat, C. B. (2021).
Augmented reality in smart
retailing: A (n) (A) Symmetric
Approach to continuous intention
to use retail brands' mobile AR
apps. *Journal of Retailing and
Consumer Services, 60*, 102464.
doi:https://doi.org/10.1016/j.jretcon
ser.2021.102464

Patnaik, A., Patnaik, A. K., Panigrahy, T., Rout, M., & Patnaik, S. R. (2024). Exploring The Evolution Of Virtual Try-On Technologies: A Comprehensive Review From A User-Centric Perspective. *Educational Administration: Theory and Practice, 30*(4), 8271-8287. doi:https://doi.org/10.53555/kuey.v30i4.2723

Rahman, H., & Nurlatifah, H. (2020). Analisis Pengaruh Perceived Ease of Use, Trust, Online Convenience terhadap Purchase Intention melalui Online Shopping Habits (Studi Kasus Pembelian Tiket Bioskop pada Aplikasi Gotix). *Jurnal Al Azhar Indonesia Seri Ilmu Sosial, 1*(1), 29-39. doi:https://doi.org/10.36722/jaiss.v1i1.458

Recalde, D., Jai, T. C., & Jones, R. P. (2024). I can find the right product with AR! The mediation effects of shopper engagement on intent to purchase beauty products. *Journal of Retailing and Consumer Services, 78*. doi:https://doi.org/10.1016/j.jretconser.2024.103764

Siahaan, M. (2023a, May 2). *Consumer awareness of virtual try-on services Indonesia 2022*. Diambil kembali dari Statista: https://www.statista.com/statistics/1317342/indonesia-consumer-awareness-of-virtual-try-on-services/

Siahaan, M. (2023b, May 2). *Reasons to not use virtual try-on services Indonesia 2022*. Diambil kembali dari Statista: https://www.statista.com/statistics/1317867/indonesia-reasons-to-not-use-virtual-try-on/

Tabaeeian, R. A., Hossi, F. A., Fatehi, M., & Tehrani, A. F. (2024). Investigating the effect of augmented reality packaging on behavioral intentions in traditional Iranian nougat GAZ packaging. *British Food Journal, 126*(6), 2438-2453. doi:https://doi.org/10.1108/BFJ-11-2023-1046

Tan, Y.-C., Chandukala, S. R., & Reddy, S. K. (2021). Augmented Reality in Retail and Its Impact on Sales. *Journal of Marketing, 86*(1), 48-66. doi:https://doi.org/10.1177/0022242921995449

Tandon, U., Ertz, M., & Sakshi, K. (2021). POD Mode of Payment, Return Policies and Virtual-Try-on Technology as Predictors of Trust: An Emerging Economy Case. *Journal of Promotion Management, 27*(6), 832-855. doi:https://doi.org/10.1080/10496491.2021.1888174

Wang, Y., Ko, E., & Wang, H. (2022). Augmented reality (AR) app use in the beauty product industry and consumer purchase intention. *Asia Pacific Journal of Marketing and Logistics, 34*(1), 110-131. doi:https://doi.org/10.1108/APJML-11-2019-0684

Watson, A., Alexander, B., & Salavati, L. (2020). The impact of experiential augmented reality applications on fashion purchase intention. *International Journal of Retail & Distribution Management, 48*(5), 433-451. doi:https://doi.org/10.1108/IJRDM-06-2017-0117

Yin, L.-X., & Lin, H.-C. (2022). Predictors of customers' continuance intention of mobile banking from the perspective of the interactivity theory. *Economic Research-Ekonomska Istraživanja, 35*(1), 6820-6849. doi:https://doi.org/10.1080/1331677X.2022.2053782

Zhao, H., & Rojniruttikul, N. (2023). Enhancing Online Customer Engagement for Zhang Yiyuan Tea Products: An Analysis of Convenience, User-Friendliness, Customer Support, and Security Assurance in the Online Purchase Process. *IMMS '23* (hal. 41-47). New York: Association for Computing Machinery. doi:https://doi.org/10.1145/3625469.3625476