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

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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 features address this issue by allowing consumers to virtually try on cosmetic products, creating a more realistic shopping experience. This research 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 virtual try-on for cosmetics through mobile commerce. Structural Equation Modeling (SEM) with SmartPLS was used to test the proposed relationships between the variables. The results 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.

Keywords: virtual try-on, mobile commerce, customer engagement, 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 driven 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, 2022). 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 et al., 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 et al., 2024). The virtual try-on feature of AR technology in e-commerce allows customers to directly evaluate product appearance before purchase (Fenanda et al., 2024). By allowing customers to see, try on, and interact with products 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 et al., 2023), and it provides flexibility for customers to search for, select, and purchase products and services

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(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 et al., 2021; Tabaeeian et al., 2024) and evaluate products without going to a physical store (Ivanov et al., 2023).

Customers can virtually try the product on their face thanks to virtual try-on (Tandon et al., 2021). The virtual try-on feature of AR technology makes customers feel more secure when making product choices, offering a realistic and detailed look, because this technology matches cosmetic colors to skin tones (Liu et al., 2024). Online customers can utilize the virtual try-on feature of augmented reality technology to virtually try on products and see how they look on their faces (Barta et al., 2022). In addition, this feature aims to reduce customer concerns and uncertainties when making online purchases, especially when choosing colors for cosmetic products (Recalde et al., 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. It increases their confidence when making a purchase (Tan et al., 2021). To try on products with virtual try-on, users must grant the app permission 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 et al., 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 et al., 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 to online stores to try on products, as they believe that physical stores offer a more tangible experience (Patnaik et al., 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 with the product in person (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 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 et al. (2022) assert that color accuracy in beauty products is a crucial factor, so customers of cosmetic products can use 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 et al. (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 et al. (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 et al., 2021). Various studies have investigated how augmented reality technology functions in various situations, covering diverse applications and features, as well as different product focuses, such as food delivery services (Londoño-Giraldo et al., 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 et al. (2021), further research on augmented reality should be conducted, with an emphasis on attributes and features that enhance theoretical and practical knowledge for creating and maintaining customer engagement. Then, according to Diaa (2020), augmented reality in the
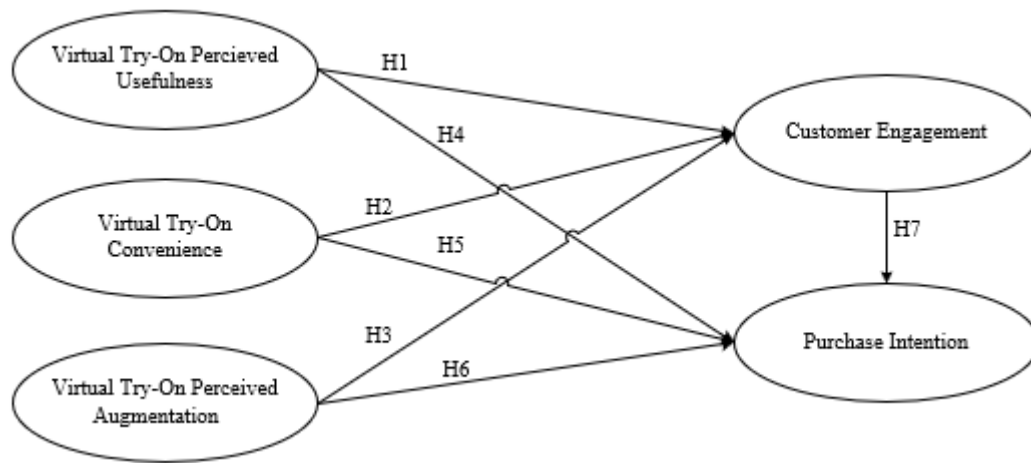
Figure 1 Theoretical Framework

context of cosmetic products is still relatively new, so further research is needed to determine how this technology can retain customers. It is very important to optimize the use of this technology accross the customer journey.

Nikhashemi et al. (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 et al., 2024; Zhao & Rojniruttikul, 2023), perceived augmentation (Ganesan & Kumar, 2024; Ahmed et al., 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 in Figure 1 shows that this research has three independent variables, including Perceived Usefulness, Convenience, and Perceived Augmentation. Based on the theoretical framework and previous empirical findings, the hypotheses of this research are formulated.

H1: Perceived Usefulness has a direct and significant impact on Customer Engagement.

H2: Convenience has a direct and significant impact on Customer Engagement.

H3: Perceived Augmentation has a direct and significant impact on Customer Engagement.

H4: Perceived Usefulness has a direct and significant impact on Purchase Intention.

H5: Convenience has a direct and significant impact on Purchase Intention.

H6: Perceived Augmentation has a direct and significant impact on Purchase Intention.

H7: Customer Engagement has a direct and significant impact on Purchase Intention.

This research integrates the TAM and the 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. TAM evaluates the use of information technology and states that user satisfaction is proportional to the frequency of system use (Yin & Lin, 2022). Meanwhile, TIME views technology attributes as basic capabilities that reflect the potential for action based on the perceptual characteristics of the system (Lee et al., 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 using statistical methods (Bougie & Sekaran, 2020). This research adopts a descriptive and causal 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 try on cosmetic products through mobile commerce virtually. Convenience is the only factor considered 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, 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 are 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 research has seven arrows pointing to latent variables, a minimum sample size of 10 x 7, or 70 respondents, is required. A list of statements is submitted to respondents using Google Forms as part of the data collection process. The approach 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 research applies structural equation modeling using SmartPLS version 4.0, also known as variance-based partial least structural 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 respondents can actively express. 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 potential problems related to the topic, a preliminary research is conducted on various cosmetic products marketed through mobile commerce. The findings reveal that not all cosmetic products offer the virtual try-on feature, and some brands cannot provide information about products that support the feature. In addition, some brands offer virtual try-on features only on their official websites.

Most customers tend to purchase cosmetic products online without using the virtual try-on feature, even though it is designed to help them select cosmetic colors that match their skin tone. As a result, many customers make purchases based solely on images in the catalog, a practice known as blind buying. However, the difference between the color displayed in the catalog and the product's application on the face often means the product received does not match 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 used as an effective and useful tool.

The author conduct a trial of the virtual try-on feature and find that it is 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. The author also conducted preliminary research with close relatives to explore their familiarity with the virtual try-on features. The results showed that while some are familiar with the feature, others had not known at all about the existence of the virtual try-on feature.

III. RESULTS AND DISCUSSIONS

The research questionnaire are distributed online using Google Forms, which contained pre-designed questions. Promotion to fill out the questionnaire is 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, 549 responses were collected. After completing the screening question process, 350 valid respondents are obtained.

The characteristics of the respondents obtained are evaluated through screening questions placed at the beginning of the questionnaire. A total of 13 respondents does not pass the first screening question where they are not willing to be respondents in the author's research, 121 respondents do not pass the second screening question where they have not used the virtual try-on feature in the last 6 months and do not live in a big city in Indonesia, and 65 respondents do not pass the third screening question where they are not female, not in the age range of 18 to 29 years old, have a salary $\geq$ Rp5,000,001. The number of valid samples is greater than the minimum number of 200, so the responses from 350 valid respondents are analyzed using SmartPLS software.

Table 1 shows that out of a total of 350 respondents, 203 (58%) have used the virtual try-on feature to try cosmetic products from various brands. 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 shows that of 350 respondents, 170

Table 1 Characteristics of Respondents Based on Cosmetic Brands

		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 2 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 3 Characteristics of Respondents Based on Monthly Income

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Rp5,000,001-Rp7,000,000	287	82.0	82.0	82.0
	Rp7,000,001-Rp9,000,000	27	7.7	7.7	89.7
	≥ Rp9,000,000	36	10.3	10.3	100.0
	Total	350	100.0	100.0	

Table 4 Characteristics of Respondents Based on 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 5 Characteristics of Respondents Based on 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	

respondents (48.6%) try more than one type of cosmetic product through the virtual try-on feature, including Lip Blush, Blush, and/or Foundation. Meanwhile, respondents who try only one type of product comprise 88 respondents (25.1%) who tried Lip Blush, 49 respondents (14%) who tried Foundation,

and 43 respondents (12.3%) who tried Blush.

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

income of Rp7,000,001–Rp9,000,000.

Table 4 shows that of 350 respondents, 166 respondents (47.4%) purchase cosmetic products for various purposes, such as daily activities, work, parties, and/or as gifts. Furthermore, respondents who purchase 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%) for gifts.

Table 5 shows that of 350 respondents, 185 (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 is attractive promotions with 64 (18%), followed by saving time and effort with 59 (16.9%), and lower prices with 42 (12%).

Based on Table 6, out of 350 respondents, the majority have a bachelor's degree 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 7 shows that out of a total of 350 respondents, the majority worked as private employees with 129 (36.9%), followed by students with 104 (29.7%), self-employed with 45 (12.9%), public employees with 41 (11.7%), and 31 (8.9%) working outside the job categories listed in the questionnaire.

Based on Table 8, 350 respondents are 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 (Gusmiarti, 2024; Mulachela, 2022). The largest number of respondents came from DKI Jakarta with a percentage of 41.7% (146 respondents), followed by Surabaya with 9.7% (34 respondents), Bandung with 7.7% (27 respondents), Bogor 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 research involves 20 indicators representing five variables or constructs. Data are obtained from 350 valid respondents and each variable consists of four indicators. Descriptive statistical analysis conducted using SmartPLS 4 produces mean and standard

Table 6 Characteristics of Respondents Based on 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	
	Total	350	100.0	100.0	

Table 7 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	

Table 8 Respondent Characteristics Based on Residency City

		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	

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 shows that the reliability test uses a total of 20 indicators spread over 5 variables. Data are 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.
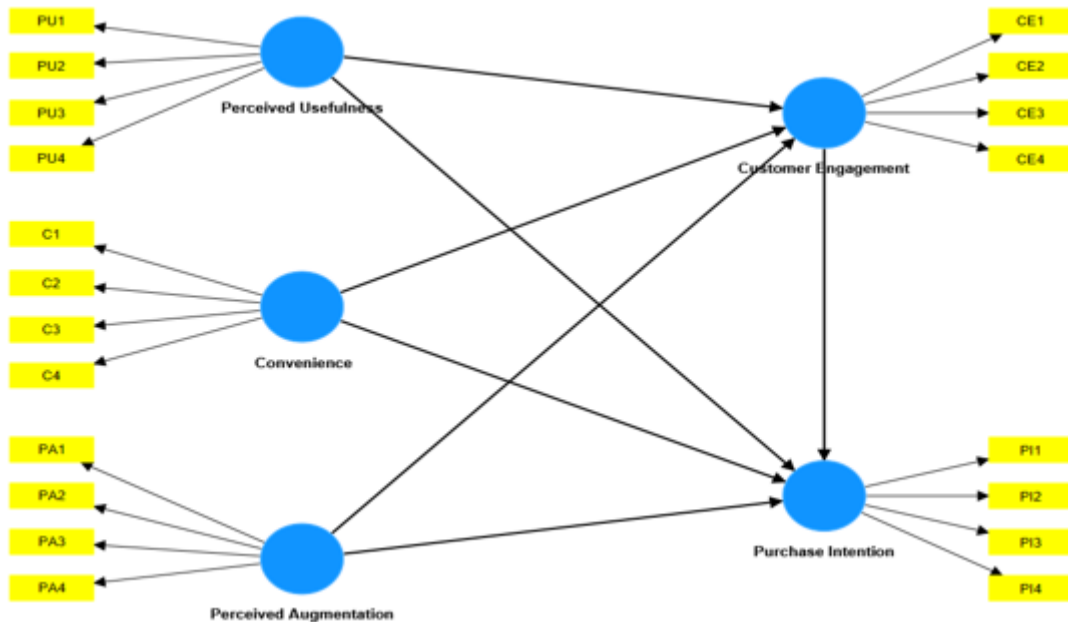

Figure 2 Theoretical Framework for Reliability and Validity Test

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	

Notes: Convenience (C), Customer Engagement (CE), Perceived Augmentation (PA), Perceived Uselfuness (PU), Purchase Intention (PI)

Table 9 shows that the outer loadings for each indicator in the model are ≥ 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 10 shows that Internal Consistency Reliability has very good results. Cronbach's Alpha and composite reliability (rho_a and rho_c) for all latent variables (perceived usefulness, convenience, perceived augmentation, customer engagement, and purchase intention) have a value > 0.6, indicating all constructs can be considered reliable and can be used for further analysis. All research variables have AVE values > 0.50. Based on these results, all indicators and constructs used are declared valid.

The validity test results 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.

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 discriminant validity, meaning that the instrument is able to distinguish between different latent variables.

Table 13 shows the collinearity test results based on questionnaire response data from 350 respondents with 20 indicator items analyzed using SmartPLS 4. From the results, all indicators have a VIF value < 3, which indicates that collinearity does not occur, and the structural model test can proceed. Furthermore, the non-parametric bootstrapping are applied 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.

Based on the data in Table 14, all tested hypotheses show acceptable results. H1, 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). The

Table 10 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

Table 11 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

Table 12 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	

result indicates that an increase in perceived usefulness will increase customer engagement. Furthermore, H2, 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), indicating that the higher the level of convenience, the higher the customer engagement. H3, 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.

Regarding impacts on purchase intention, H4, 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. H5, 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. H6, 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, H7, 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 are associated with purchase intention.

Table 13 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

Table 14 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

Table 15 R-square Test Results

	R-square	R-square Adjusted
Customer Engagement	0.591	0.588
Purchase Intention	0.558	0.553

The R-square (R²) values in Table 15 for the customer engagement and purchase intention variables are 0.591 and 0.558, respectively. This indicates that 59.1% of the variation in customer engagement and 55.8% of the variation in purchase intention can be explained through perceived usefulness, convenience, and perceived augmentation as independent variables. The remaining 40.9% and 44.2% are impacted by other factors outside the model.

Based on the results of the Q²predict analysis in Table 16, all indicators in the model have a Q²predict 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 is found that the MAE analysis shows that Partial Least Square Structural Equation Model (PLS-SEM) is 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 model's predictive power, measured by MAE, is moderate to high. Overall, the PLS-SEM model based on RMSE is reliable for predictive purposes, although there is still room for improvement in the PI3 indicator to improve the model's predictive performance.

The overall test results for Q2predict in Table 17 show that the customer engagement variable has a higher Q2predict 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.

Regarding evaluating measurement and structural models, GoF aims to assess the fit of the model. The test results 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 research begins with H1, which states that perceived usefulness has a positive and significant effect on customer engagement. The hypothesis can be accepted. Technologically literate

Table 16 Q2PREDICT 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

Table 17 Q²predict Test Results

	Q²predict	RMSE	MAE
Customer Engagement	0.578	0.656	0.491
Purchase Intention	0.499	0.717	0.506

Table 18 Goodness of Fit (GoF) 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

individuals, especially those aged 18–29 with a bachelor's degree, tend to 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 living in large cities with good technological infrastructure find it easier to use these features. This shows that perceived usefulness directly increases customer engagement without the need for additional factors.

H2, which states that 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 relationship. 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.

H3, which states that 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.

H4, which states that 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.

H5, which states that 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 requiring additional factors. Private sector workers who prioritize efficiency and convenience choose technologies that are easily accessible and easy to use. Especially for those living in big cities with fast and reliable access to technology, these features make shopping easier and more enjoyable. This allows people to make quick and accurate decisions without having to go to a physical store. Thereby, increasing their intention to purchase without the need for other additional factors.

H6, which states that 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.

H7, which states that 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 strong 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 engagement levels when using the virtual try-on feature.

IV. CONCLUSIONS

Augmented reality technology in relation to cosmetic products is still relatively new, creating a need for deeper research to understand how the technology can retain customers. Therefore, this research aims to fill this gap by analyzing the impacts of virtual try-on attributes of augmented reality technology on purchase intention. Prior this research, there is a knowledge gap regarding the interaction of perceived usefulness, convenience, and perceived augmentation in the context of virtual try-on technology in cosmetic products in Indonesia. The results indicate that the three main attributes have a positive and significant effect on customer engagement and purchase intention. Thus, these findings offer important theoretical and practical contributions, as well as answering the research questions.

Previous literature reviews also indicate that augmented reality 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. This research finding

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, consumers still tend to prefer physical shopping experiences because they feel more confident with direct interaction with the product. This indicates challenges in the adoption of virtual try-on technology in Indonesia, which need to be addressed to expand its use.

Based on the research findings, cosmetic products that use augmented technology on their e-commerce platforms should focus on three main factors—perceived usefulness, convenience, and perceived augmentation—to increase customer engagement and purchase intention. Cosmetic products can focus on improving the accuracy of product displays in the virtual try-on feature and on 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. 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 research provides important insights into the influence of virtual try-on features on purchase intention, several limitations should be noted. First, this research 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 research relies on data collected through online surveys, which may lead to selection bias toward respondents who are more familiar with technology.

For future research, it is recommended to expand the sample to various regions in Indonesia, including areas that are less developed in technology, to determine whether the same results can be obtained in different geographical contexts. Future research could also consider using qualitative methods, such as in-depth interviews or focus group discussions, to explore 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.

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