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The Brand Usage Intent towards Adoption of AR Virtual Try-on Technology for Beauty Brand in Malaysia

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Abstract

Malaysia became a fertile ground for digital marketing advancements. In this landscape, beauty brands constantly sought innovative ways to engage consumers. Augmented Reality (AR) virtual try-on technology offered a revolutionary approach, allowing customers to virtually test products before purchase. This study delved into brand usage intent towards the adoption of AR virtual try-on technology within the Malaysian beauty industry. Employing a quantitative research approach, a survey instrument was designed to gather data from a representative sample of Malaysian beauty consumers. The survey captured participants' demographics, perceptions, and technology usage behavior towards AR virtual try-on technology. Additionally, it measured perceived usefulness, ease of use, enjoyment, and risk associated with AR virtual try-on experiences. Finally, the survey assessed brand usage intent for beauty products using AR technology. Through statistical analysis, the research identified the most significant factors influencing the consumer usage behavior of AR virtual try-on technology and its connection to brand usage intent. The findings provided valuable insights for Malaysian beauty brands to develop data-driven AR marketing strategies that optimized customer experience, enhanced brand image, and ultimately drove sales growth. This research contributed to the understanding of consumer behavior in the context of AR technology adoption within the Malaysian beauty industry.

Keywords: Brand Usage Intent, Augmented Reality, Virtual Try-On, Beauty Brands, Technology Adoption

Introduction

Million cases of Covid-19 infection, resulting in 31,678 fatalities overall (Noramalina, N. et al., 2022). As a result, Malaysia's economy and businesses were greatly impacted by the country's response to COVID-19. Lockdowns and other social distancing measures, coupled with the implementation of COVID-19-related policies, caused significant changes, especially in the beauty industry in recent years. Moreover, consumers had already become unwilling to use product samples even before COVID-19 because they were concerned about how many lips or fingers had already tried the samples (Grant, 2022). Therefore, in order to limit and decrease social interaction during the pandemic, countries worldwide implemented necessary measures like contactless shopping (Rachel, 2023). Many beauty brands had to improve their online presence, such as by exploring virtual try-on technologies that could mimic the in-store experience virtually. Additionally, the future of e-commerce, physical stores, apps, and websites of beauty industries shifted toward virtual technologies. Virtual Try-On (VTO) technologies redefined shopping with an estimated value of $20.99 billion by 2027 (Banuba, 2023). Since VTO technologies were described as "website features that allow the creation and manipulation of product or environment images to simulate or surpass the actual experience with the product or environment," they also transformed the way consumers purchased beauty products from conventional methods to an innovative experience (Mouna Al Morabet, 2021). Furthermore, Virtual Try-On technologies offered numerous benefits to both beauty brands and customers, ranging from enhanced customer experience and increased sales to convenience, confidence-building, and inclusivity. Since 75% of brands had begun implementing AR to alter how products were marketed and tried on by consumers, it was evident that the advantages of virtual try-on technologies were significant and revolutionized the beauty industry (Emilie S. et al., 2021). Virtual try-on technology helped 45% of online shoppers save time on purchasing decisions, as customers could test over 5,000 beauty products (Banuba, 2023). With the help of AR technologies, new shopping experience had enabled customers to virtually experience beauty products before making a purchase. A Markets and Markets report predicted that the global virtual makeup market would grow at an incredible compound annual growth rate (CAGR) of 22.6% between 2021 and 2026, reaching an astounding $1.3 billion by that time (QReal, 2024). By examining the history, virtual try-on technology adoption raised questions about usage behavior of beauty brands, despite its apparent advantages. Therefore, the study aimed to investigate customer usage behavior of the adoption of AR virtual try-on technology for beauty brands in Malaysia. The goal of the research was to analyze the adoption of VTO by beauty brands attempting to navigate the changing Malaysian beauty market by thoroughly examining usage behavior. To achieve the aims of this study, the following research objectives have been established:Therefore, this study aims to explore how consumer usage behavior influences brand usage intent towards the adoption of AR virtual try-on technology among beauty brands in Malaysia. Specifically, it focuses on identifying the key behavioral factors (perceived usefulness, perceived ease of use, perceived enjoyment, and perceived risk) that drive the intention to use AR-based beauty applications, using the Technology Acceptance Model (TAM) as the guiding theoretical framework. The scope of this study covers Gen Z and Millennial consumers in Malaysia who have experience using AR beauty tools through digital platforms.This study adopts the Technology Acceptance Model (TAM) as its theoretical foundation. TAM explains how individuals accept and use technology based on their perceptions of its usefulness and ease of use (Davis, 1986). In the context of AR virtual try-on technologies, TAM provides a lens to understand how consumers evaluate both the

functional (usefulness, ease of use) and experiential (enjoyment, perceived risk) aspects of AR tools when forming intentions to engage with beauty brands.

1. To determine the usage behavior that influenced brand usage intent towards AR virtual try-on.
2. To identify the factors of brand usage intent towards AR virtual try-on technology for beauty brands.
3. To identify the most significant factor of brand usage intent towards AR virtual try-on technology.

The Usage Behavior Towards AR Virtual Try-On

According to Emilie, S. et al., (2021), based on the article "Augmented Reality: A Beneficial Tool for Marketing Cosmetics? The Impact of Virtual Mirrors on Customer Perceptions and Behavioral Outcomes" by Emilie Stange Post and Stephanie Beck Petersen, there were more outcomes of usage behavior formed but the researcher focus on the brand usage intent.

Brand Usage Intent

Brand usage intent referred to the tendency of consumers to use one particular brand compared to others (Faizal Ardiyanto, 2022). It demonstrated how committed and devoted consumers were to a brand and how likely they were to remain with it through additional purchases and future interactions. The intention to use a brand was influenced by several factors, such as brand reputation, perceived value, product quality, customer satisfaction, and brand loyalty programs. Businesses had to take into account critical factors such as measuring the strength of brand relationships and assessing the likelihood of repeat business and long-term customer retention. This further supported the idea that businesses should engage with their clientele, as satisfied consumers were more likely to behave non-transactionally toward the brand (Emilie, S. et al., 2021). The results for AR VTO indicated that the virtual try-on had a negligible effect on the increase in brand usage intent, with the brand usage intent found to be 4.3 (95% CI, 3.8 – 4.8). Particularly, 64.3% of the respondents said that their virtual try-on experience would lead them to visit Matas' website again (Emilie et al., 2021). This data illustrated how satisfied, engaged, and trusted customers were with the VTO technology offered by the company. As a result, there was likely to be more consumer loyalty and engagement if people continued to use the brand's VTO platform to research and purchase beauty products, as indicated by high brand usage intent. Scholtz & Duffy provided additional support for this, claiming that AR apps promoted a relationship between consumers and brands that went beyond simple transactions (Emilie, S. et al., 2021).

The Conceptual Framework Implemented Using TAM

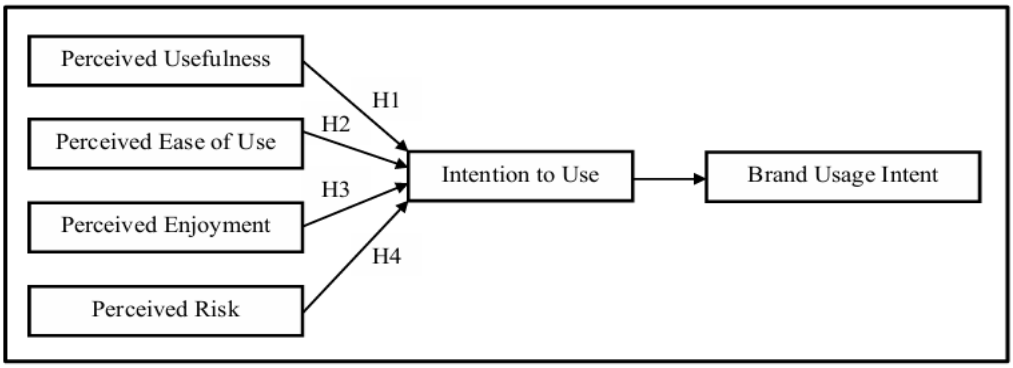

Figure 1: The applied Technology Acceptance Model (TAM)
Source: Emilie, S. et al., 2021

TAM focuses on perceived variables: The four perceived variables that affected the consumer's intention were:

1. Perceived Usefulness (PU): It described how much consumers thought technology could benefit them and make shopping a better experience.
2. Perceived Ease of Use (PEOU): It described how easy users thought it would be to learn and use the AR virtual try-on technology.
3. Perceived Enjoyment (PE): It referred to the degree of enjoyment, happiness, or fun that a user anticipated having while utilizing the AR virtual try-on technology.
4. Perceived Risk (PR): It described how the user viewed potential limitations to using the AR virtual try-on technology.

TAM predicted usage behavior:
The goal for this research was to identify how usage behavior influenced brand usage intent. Brand Usage Intent (BUI): This referred to a customer's readiness to interact with and make use of an AR virtual try-on technology provided by a particular beauty brand.

Method

Participants

For this research, the necessary sample size was based on the total population of Gen Z and Y women in Malaysia who had tried the virtual try-on (VTO) makeup. The Department of Statistics reported that in 2019, Gen Z made up 26% of No. 8, 2024, E-ISSN: 2222 -6990 © 2024 Malaysia's 32.6 million citizens, or roughly 8.476 million people of Generation Z in Malaysia alone (Rosalind, F. et al., 2021). Additionally, it was stated that the population of Generation Y, which includes individuals born between 1981 and 1996, accounted for 29% of the total population in Malaysia (Nor, H. et al., 2022). Furthermore, the pilot test was recommended to have at least 30 respondents, as this was the bare minimum needed to conduct the test (Mohamad, E. et al., 2024). For this pilot test, the researcher decided to select 34 respondents to fill out the form. This study adopts a quantitative cross-sectional survey methodology. The instrument comprised demographic items and multi-item scales assessing perceived usefulness (PU), perceived ease of use (PEOU), perceived enjoyment (PE), perceived risk

PR), and brand usage intent (BUI). Items were measured on a five-point Likert scale. Sampling employed purposive, non-probability techniques targeting Malaysian Gen Z and Millennial consumers who had experience with AR VTO tools. The survey was distributed online via social media and university mailing lists. A total of 419 valid responses were collected after data cleaning.

Procedure and Measures

This research consisted of Sections A, B, and C of the questionnaires. Section A contained questions about the respondent's demographics, such as gender, age, race, and position. Section B consisted of questions for the dependent variable, which focused on brand usage intent as the outcome of using a beauty brand. Meanwhile, section C focused on the independent variables, which included perceived ease of use, usefulness, risk, and enjoyment, all of which were considered as usage behaviors towards AR VTO technology. In terms of the details of the sections, Section A was designed with a set of Multiple-Choice Questions (MCQs). MCQs were created to collect demographic data for a study on brand usage intent towards the adoption of AR virtual try-on technology for beauty brands in Malaysia. These multiple-choice questions provided a comprehensive summary of the study participants' demographic details. They were designed to be simple and easy to understand, ensuring that responders could quickly and accurately provide the requested information. The implementation of a standardized approach facilitated the gathering of consistent data, which was essential for examining consumer attitudes towards the use of AR virtual try-on technology by beauty brands in Malaysia.

Data Analysis

Data analysis followed standard psychometric and inferential procedures. Reliability was assessed using Cronbach’s alpha. Descriptive statistics characterized the sample. Pearson correlations explored bivariate relationships among constructs. Multiple linear regression tested the joint predictive power of PU, PEOU, PE, and PR on BUI. All analyses were performed using SPSS.

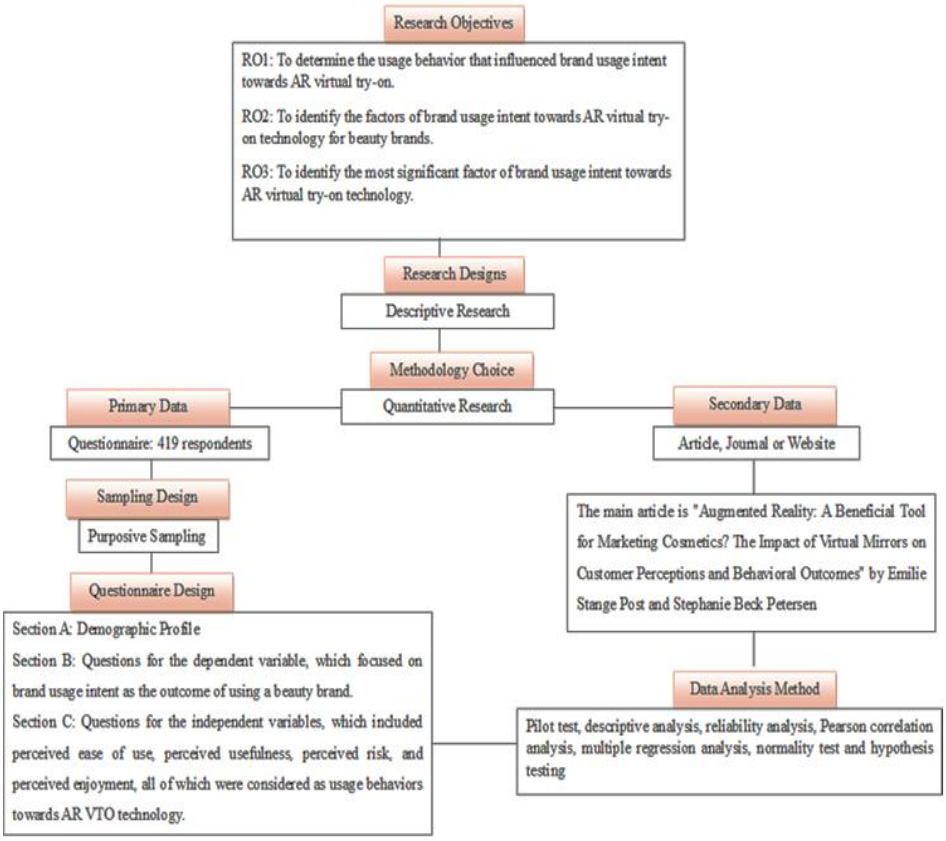

Figure 2: Research Framework

Results and Discussion

A total of 419 respondents took part in the study, with the most dominant being 379 women (90.5%) and 190 individuals between the ages of 18 and 24 (44.0%). Three-quarters (32%) of the survey participants were Indian, and the majority of participants, 182 in total (43.4%), were employed or currently had a job. The majority of those who responded to the survey, 159 people with incomes between RM3001 and RM5000, came from the central region, which includes Selangor, Kuala Lumpur, and Putrajaya, comprising roughly 111 people (26.5%). Additionally, 189 people mainly selected the response that they occasionally purchased beauty products. Since all 416 participants clicked "Yes" (99.3%), they were all using Augmented Reality Virtual Try-On technology to try products. Gen Z in Malaysia, between the ages of 18 and 24, made up a significant proportion of the population that actively used digital tools and technologies. The central area, which includes Selangor, Kuala Lumpur, and Putrajaya, was the center of urban growth and economic activity, drawing people with greater No. 8, 2024, E-ISSN: 2222 -6990 © 2024 incomes and access to cutting-edge shopping experiences. As augmented reality technologies gained popularity among tech-savvy consumers, Malaysians started to emphasize digitalization in the beauty industry, with a high rate of AR VTO adoption among respondents. According to Statista (2024), the demand for entertaining shopping experiences and the rising use of smartphones drove Malaysia's e-commerce market's 11.3% yearly growth. These patterns highlighted how crucial it was to use AR-VTO technology to meet the shifting preferences of young customers.

Table 1
Summary of Descriptive Analysis of Demographic Respondents

Demographic	Demographic Details	Frequency	Percentage (%)
Gender	Female	379	90.5
Age	18-24 years old	190	45.3
Race	Indian	134	32
Occupation	Employee	182	43.4
Income	RM 3001 – RM 5000	159	37.3
Region	Central Region (Selangor, Kuala Lumpur, Putrajaya)	111	26.5
How often do you shop for beauty products?	Occasionally	189	45.1
Have you ever used AR Virtual Try-On technology in order to try beauty products online like beauty filters?	Yes	416	99.3

Cronbach's alpha for the combined scale was 0.931, indicating excellent internal consistency across items. Means and standard deviations for the primary constructs suggested generally positive perceptions of AR VTO tools. Respondents rated perceived enjoyment highest, indicating strong hedonic appeal. Pearson correlations revealed moderate to strong positive associations between PU, PEOU, and PE, whereas PR was negatively correlated with these constructs. These bivariate relationships signal that usefulness and ease of use tend to co-occur with hedonic appreciation. The multiple regression model predicting brand usage intent was statistically significant, explaining approximately 55% of the variance in BUI ($R^2 = 0.55$). Perceived usefulness ($\beta = 0.41$) and perceived enjoyment ($\beta = 0.38$) were the primary positive predictors, while perceived risk had a small negative coefficient ($\beta = -0.10$). Perceived ease of use contributed positively but less strongly ($\beta = 0.29$). The model indicates that both instrumental and affective drivers are important for brand-related intentions in AR contexts.

Table 2
Correlation Matrix

	PU	PEOU	PE	PR
PU	1.00	0.62	0.74	-0.18
PEOU	0.62	1.00	0.58	-0.12
PE	0.74	0.58	1.00	-0.15
PR	-0.18	-0.12	-0.15	1.00

Note. Correlations are Pearson r values; significance p < .01 for primary positive correlations.

TABLE 3
Multiple Regression Predicting Brand Usage Intent

Predictor	B	β	SE	t	p
Perceived Usefulness (PU)	0.52	0.41	0.06	8.67	<.001
Perceived Enjoyment (PE)	0.48	0.38	0.07	6.86	<.001
Perceived Ease of Use (PEOU)	0.34	0.29	0.08	4.25	<.01
Perceived Risk (PR)	-0.12	-0.10	0.05	-2.40	.016

Model summary: $R = 0.74$, $R^2 = 0.55$, Adjusted $R^2 = 0.54$, $F(4,414) = 125.7$, $p < .001$.

The prominence of perceived usefulness echoes core TAM predictions: consumers are more likely to form positive intentions when they believe a technology will enhance task performance in this case, simplifying product selection and improving shade matching. The sizable role of perceived enjoyment indicates an extension of TAM where hedonic motives are central to adoption in beauty contexts.

Hypothesis 1: There was no significant relationship between perceived usefulness and brand usage intent Based on the results of the coefficient, perceived usefulness showed a p-value of 0.117, which was greater than 0.05 ($p = 0.117 > 0.05$). According to this result, there was no significant relationship between perceived usefulness and brand usage intent toward AR-VTO technology. Perceived usefulness, known as people's belief that technology can increase their performance and assist them in achieving their objectives, was the focus of the behavioral science and management concept. It also aligned with the idea that the user's intention to use a digital service was strongly influenced by how useful they believed it to be (Nevynda, E. et al., 2024). In the context of AR-VTO (Augmented Reality Virtual Try-On) technology, it could be defined as the degree to which users felt the technology enhanced their shopping experience and enabled them to make more confident and informed decisions about what to buy. However, the absence of a significant relationship might have suggested that users valued other aspects more than functionality, such as fun or ease of use. According to recent research, this finding supported the idea that when users interacted with products or services, elements like enjoyment and engagement might have mattered more than the functionality itself (Ardy, S. et al., 2020). For example, even when the functional features were not as noticeable, consumers were more likely to choose goods or services that offered a memorable or pleasurable experience. This was due to the fact that user preferences were frequently influenced by experiential and emotional ties rather than just functional advantages in the highly competitive digital world of today. Moreover, this evidence could be strengthened by research done by Mouna, where the perceived usefulness was expected to have a relationship with the product virtual try-on condition but did not mediate, as her data also showed no significance with this variable (Mouna, 2021). In conclusion, hypothesis one was rejected. This study concluded that perceived usefulness did not have a significant influence on brand usage intent toward AR-VTO technology.

Hypothesis 2: There was a significant relationship between perceived ease of use and brand usage intent Based on the results of the coefficient, perceived ease of use showed a p-value of < 0.001, which was less than 0.05 ($p = 0.001 < 0.05$). According to this result, there was a significant relationship between perceived ease of use and brand usage intent toward AR-VTO technology. According to Davis's 1986 introduction of the Technology Acceptance Model (TAM), one of the most important factors in users' acceptance of a system was perceived ease of use, which is the degree to which users believed that using a specific system would be effortless (Tahar, A. et al., 2020). That is, the more users thought a system was easy to use, the more eager they were to use it. When it came to AR-VTO technology, user engagement depended on how simple it was to use. If the virtual try-on feature was simple to operate, required minimal technical know-how, and provided an intuitive interface, users were more likely to embrace it. Then, it was claimed that users were more likely to adopt a technology if they believed it to be simple to learn and use (Enjian Yao, 2024). This indicated that when

people thought technology was useful and easy to use, they were more likely to accept it and maintain a positive attitude toward it. The results of the study indicated that perceived ease of use had a significant impact on brand usage intent toward AR-VTO technology. Beauty brands could increase user adoption and create more enduring relationships with their customers by designing AR-VTO features with accessibility and simplicity as top priorities. This meant that consumers believed that AR-VTO was simple to use, and they started to adopt or foster favorable connections with the brand offering the technology. In conclusion, hypothesis two was accepted. This study concluded that perceived ease of use had a significant influence on brand usage intent toward AR-VTO technology.

Hypothesis 3: There was a significant relationship between perceived enjoyment and brand usage intent Based on the results of the coefficient, perceived enjoyment showed a p-value of < 0.001, which was less than 0.05 ($p = 0.001 < 0.05$). According to this result, there was a significant relationship between perceived enjoyment and brand usage intent toward AR-VTO technology. According to Freda, A. et al., (2024), perceived enjoyment was the degree to which using a particular system was regarded as a fun activity in and of itself, independent of any performance issues that may arise. Accordingly, regardless of a system or technology's functional or performance advantages, perceived enjoyment was the level of pleasure or satisfaction a user experienced while interacting with it. Users were more likely to use the technology more frequently and be more satisfied with the experience as a result of this pleasurable interaction, which also produced a positive emotional response. As for this technology, it was also supported by the fact that perceived enjoyment could influence consumer sentiments about a brand as when customers were pleased with their AR experience due to the virtual try-on function (Widyastuti, 2024). AR-VTO had influenced the intention of brand usage and generated enjoyment. AR-VTO technology was more likely to be used and recommended to others by respondents who found it engaging and entertaining. This provided trust in the idea that enjoyment improved the whole experience, making the technology more appealing by making it both simple to use and pleasurable. This combination promoted customer loyalty and enduring relationships with brands, helping them stand out in highly competitive markets. Brands could transform normal transactions into remarkable experiences by emphasizing pleasurable, technologically advanced interactions. In conclusion, hypothesis three was accepted. This study concluded that perceived enjoyment had a significant influence on brand usage intent toward AR-VTO technology.

Hypothesis 4: There was a significant relationship between perceived risk and brand usage intent Based on the results of the coefficient, perceived risk showed a p value of < 0.001, which was less than 0.05 ($p = 0.001 < 0.05$). According to this result, there was a significant relationship between perceived risk relief and brand usage intent toward AR-VTO technology. An individual's subjective assessment of the possible drawbacks or losses that might result from acquiring a particular good or service was known as perceived risk (Arjun Remesh, 2024). The idea behind perceived risk was that people typically chose less hazardous actions that were more likely to result in a positive outcome. The importance of establishing trust through reducing the risk, ensuring quality, accuracy, and transparency was emphasized by this principle. Brands could increase acceptance rates, boost customer satisfaction, and foster trust by addressing and reducing perceived risks. According to respondent results in Table 1, the hypothesis was accepted as users were more likely to interact with the brand and use AR-VTO technology if they believed there were fewer risks involved, such as privacy issues,

product mismatches, or data security concerns. Brands could foster trust and entice users to explore and utilize AR-VTO features by successfully managing these risks. For example, after virtually trying a product, 52.4% of those surveyed said they were less concerned about how well it fit (Emilie, S. et al., 2021). Therefore, the virtual try-on technology could offer a service that was comparable to what one would get in a physical store by preventing customers from purchasing an unsatisfactory product or color, which would lead to a loss. In conclusion, hypothesis four was accepted. This study concluded that perceived risk had a significant influence on brand usage intent toward AR-VTO technology.

Limitations and Future Directions

Throughout this study, the researcher encountered several obstacles. One significant limitation was the researcher's decision to emphasize Gen Z and Millennials, which might have limited the pattern of the results to older populations. Since the study was restricted to a specific age group, the findings might not have fully represented the behaviors of all generations, which could have compromised the applicability of the findings. Due to time constraints, the researcher also decided to distribute the survey exclusively through Google Form in order to save time. Despite being effective, this approach might have excluded people who did not have internet access or were not familiar with using Google Forms. Due to the potential inequality for people who were less tech-savvy or lacked reliable internet access, this could have introduced bias into the sample. Another difficulty was the diversity of the beauty industry itself. The AR-VTO adoption factors might have differed among brands, industries, and geographical areas because different beauty brands may not have had the same ability to provide the AR-VTO technologies. The overall validity and reliability of the study's findings might have been impacted by this diversity, making it challenging to draw consistent conclusions across the whole beauty industry. Lastly, the researcher was under limited time to complete all stages of data collection, analysis, and findings discussion. Despite all of these restrictions, the researcher managed to gather information from 419 respondents. However, the researcher understood that the time constraints affected the breadth of the data analysis, as speed had to take precedence over thorough analysis, which might have limited the capacity to thoroughly examine all variables or trends. Thus, more time might have enabled a more comprehensive review of the data, which could have potentially revealed deeper patterns among the variables.

As a result, a number of suggestions have been made to improve the breadth and depth of upcoming research. In order to gather information from a variety of consumer segments outside of Millennials and Gen Z, the researcher needed to consider a wider demographic range to gain a deeper understanding of consumer attitudes and actions regarding the adoption of AR-VTO technology by including an older age group that only utilized AR-VTO. Additionally, in the future, the researcher might have considered combining qualitative and quantitative methods. While a quantitative approach can focus on collecting large amounts of data through surveys and questionnaires, a qualitative approach can use methods like face-to-face encounters and interviews to explore customer motivations through observation (Qlarity Access, 2020). The addition of a qualitative approach would have enabled open-ended conversations that could reveal complex viewpoints, especially regarding the individual experiences and difficulties encountered by AR-VTO technology users. These techniques would have enhanced the overall results and supported the quantitative data. Then, the researcher recommended that future research examine the adoption of AR-VTO in sectors

other than beauty, like fashion or retail. By doing this, researchers could have identified distinctive factors impacting AR-VTO adoption across different sectors by performing cross-industry comparisons. This would have helped the researcher comprehend the impact and adoption dynamics of AR virtual try-on technology on a larger scale. This could have also helped collect data on the effectiveness of AR-VTO from respondents who are familiar with and use virtual try-on but not in the beauty industry, as they might utilize it in different industries. Last but not least, the researcher suggested carrying out longer periods, such as choosing longitudinal research to monitor shifts in customer perceptions over time. This is because longitudinal studies allow researchers to look at changes over time by analyzing any developmental shifts (Julia Simkus, 2023). An extended period of time would have allowed the researcher to monitor patterns and ascertain the long-term impacts of AR-VTO technology on usage patterns.

Conclusion

This research contributes both theoretically and contextually to the growing body of literature on technology adoption and consumer behavior in digital marketing. Theoretically, it extends the Technology Acceptance Model (TAM) by incorporating hedonic and risk-related dimensions—perceived enjoyment and perceived risk—within the framework, providing a more comprehensive understanding of technology adoption in the AR-driven beauty industry. This integration highlights that consumer decisions in immersive digital environments are shaped not only by functionality but also by emotional engagement and trust perceptions. Contextually, this study offers valuable insights into the Malaysian beauty market, particularly among Gen Z and Millennial consumers, who represent the most active digital adopters. By identifying the behavioral factors influencing AR-VTO adoption, the study guides beauty brands in designing user-centric AR experiences that strengthen brand engagement, loyalty, and purchasing intent. The findings thus contribute to both academic theory and practical brand strategies in Malaysia's rapidly evolving digital economy. The objectives of this research were effectively met by offering crucial knowledge about consumer usage behaviors toward the adoption of AR-VTO technology for beauty brands in Malaysia. The results demonstrated the crucial role that perceived enjoyment, ease of use, risk, and usefulness played in shaping brand usage intent. The adoption of AR-VTO technology by beauty consumers could be better understood thanks to these factors. Further investigations could have built on these findings to offer a broader perspective by addressing the limitations noted in this study and taking into account the suggestions for additional research. To better understand the changing landscape of AR-VTO adoption, future research efforts could have looked into cross-industry applications, qualitative approaches, and diverse demographics.

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