CONSUMERS ACCEPTANCE TOWARDS AUGMENTED REALITY BEAUTY SHOPPING APPLICATION IN MALAYSIA

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BY

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A final year project submitted in partial fulfilment of the requirement for the degree of

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MAY 2023

DECLARATION

I hereby declare that:

(1) This undergraduate FYP is the end result of my own work and that due acknowledgement has been given in the references to ALL sources of information be they printed, electronic, or personal.
(2) No portion of this FYP has been submitted in any application for any other degree or qualification of this or any other university, or other institutes of learning.
(3) Sole contribution has been made by me in completing the FYP.
(4) The word count of this research report is 15796.

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Finally, appreciation also goes to those who have been involved or engaged directly and indirectly towards the completion of my Final Year Project. Without their commitment, support, and guidance, this project would not have been possible, and for that, I will always be grateful to them.

DEDICATION

I would like to dedicate this Final Year Project to my respected supervisor, Ms. Rae Hooi, who guided me throughout this entire journey. Furthermore, I would also like to express my gratitude to my friends and family members who have supported me, encouraged me, and assisted me in completing my Final Year Project. I could not have made it this far without their unwavering support.

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LIST OF ABBREVIATIONS

AR	Augmented Reality
AVE	Average Variance Extracted
CA	Consumers' Attitude
COM	Compatibility
CP	Complexity
CR	Composite Reliability
CRA	Cronbach's Alpha
CUI	Consumers' Usage Intention
DIT	Diffusion of Innovation Theory
DV	Dependent Variable
HTMT	Heterotrait-Monotrait Ratio
IR 4.0	Industrial Revolution 4.0
IV	Independent Variable
JENDELA	Jalinan Digital Negara
M	Mediator Variable
PENJ	Perceived Enjoyment
PLS-SEM	Partial Least Square Structural Equation Modelling
RA	Relative Advantage
SN	Subjective Norm
SPSS	Statistical Package for Social Science
TAM	Technology Acceptance Model
UNCTAD	United Nations Conference on Trade and Development
VIF	Variance Inflated Factor
WHO	World Health Organization

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PREFACE

Technology has revolutionized the way people shop for goods and services, especially in the beauty sector. Consumers can now access beauty goods at the touch of their fingertips through the functionality of the Internet. However, online beauty shopping has its own set of risks and challenges, such as not being able to try on the products physically before making purchases. The emergence of Augmented Reality (AR) technology has become one of the solutions to this problem, where consumers can now try on the beauty products virtually before buying the items. Therefore, the implementation of AR technology has shown potential to revolutionize the beauty industry. However, in Malaysia, the adoption of this technology in the beauty industry is relatively new, with low users' awareness on the technology. Thus, it is crucial to understand the consumers' attitude towards the implementation of AR technology in beauty application so that companies can develop effective marketing strategies to promote the use of these applications and increase their market share. With that, this research project aims to investigate consumers' acceptance of AR beauty shopping application in Malaysia.

ABSTRACT

Consumers have changed their shopping habits during the pandemic as they shifted from making purchases in brick-and-mortar shops to online e-commerce platforms. As the e-commerce industry continues to grow, there is increasing adoption of augmented reality (AR) technology in several sectors such as the beauty industry. These technological innovations have the ability to fundamentally change the current practice, management, and marketing strategies of industry players. Therefore, present research aims to identify the influences of perceived behavioral factors such as relative advantage, compatibility, complexity, perceived enjoyment, and subjective norm towards the consumers' attitude and intention to use the AR beauty shopping application. Researcher had adopted both Technology Acceptance Model (TAM) and Diffusion of Innovation Theory (DIT) to find a better conceptual framework based on the context of AR shopping application.

By using the convenient sampling method, 376 sets questionnaire were distributed to the residents in Malaysia through several online platforms. However, only 348 sets of responses were valid to use for analysis in the present study. The findings shown that Malaysia residents have positive attitude and usage intention towards the AR beauty shopping application. Besides, it is found that complexity, perceived enjoyment, and subjective norms significantly influenced the acceptance of AR beauty shopping application. On the other hand, relative advantage and compatibility were found to be insignificant predictors.

To sum up, the findings of current study have provided some meaningful theoretical and practical implications to both the literature and industry players, which could lead to positive effects on the long-term growth of the beauty industry.

CHAPTER 1: RESEARCH OVERVIEW

1.0 Introduction

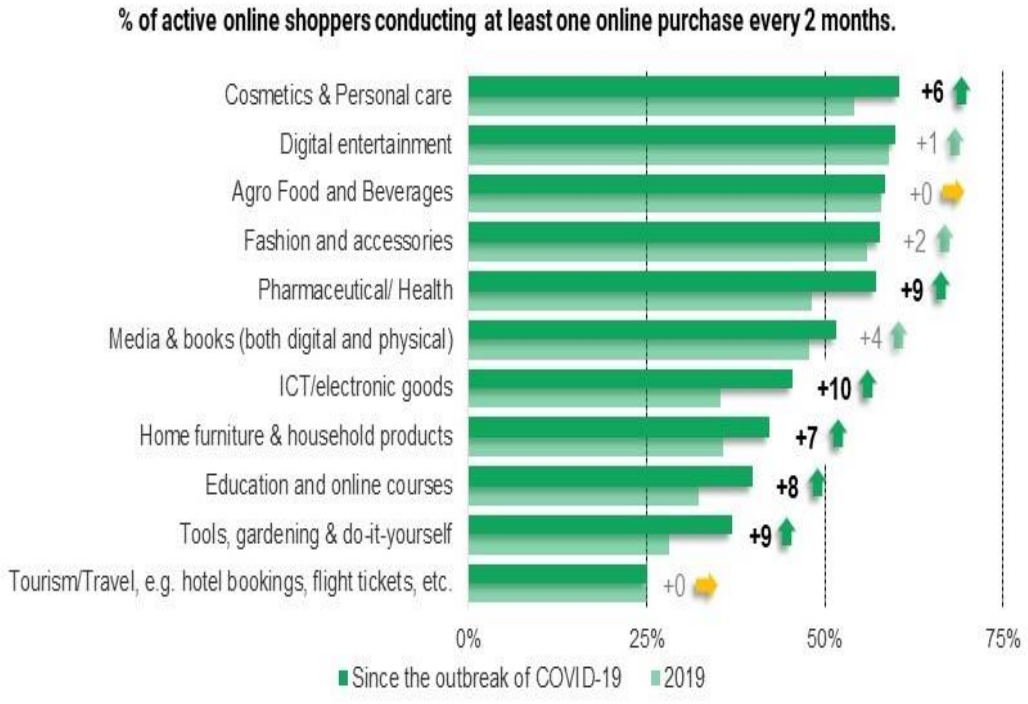
The main focus of this study is to examine the various factors that affect consumer acceptance towards beauty shopping application with augmented reality technology in Malaysia. This chapter will provide an overview of the research background and problem statement. Additionally, it will outline the research objectives, research questions, hypothesis development and the significance of research.

1.1 Research Background

The global industry has drastically changed ever since the World Health Organization (WHO) declared a Public Health Emergency of International Concern on the outbreak of coronavirus in 2020 (Kim & Kwon, 2022; World Health Organization, n.d.). The economic activities and financial stability across the globe have been damaged as people shifted from brick-and-mortar shops towards online shopping (Barua, 2020; Laato et al., 2020). Before the pandemic, consumers would travel to physical stores to make purchases. However, due to the pandemic, countries all over the world have adopted necessary measures such as contactless shopping to restrict and reduce social interaction (Donthu & Gustafsson, 2020). The survey conducted by UNCTAD has also found that online purchases increase by 6 to 10 percent across most product categories including cosmetics and personal care, pharmaceuticals, and electronic goods during the pandemic (UNCTAD, 2020). Therefore, in response to this situation where online

shopping accelerated globally, most businesses went digitalized as e-commerce's share of global retail has shown an increase of 3% in 2020 (UNCTAD, 2021).

Figure 1.1: Percentage of Online Shoppers Making Online Purchase at least Once Every Two Months



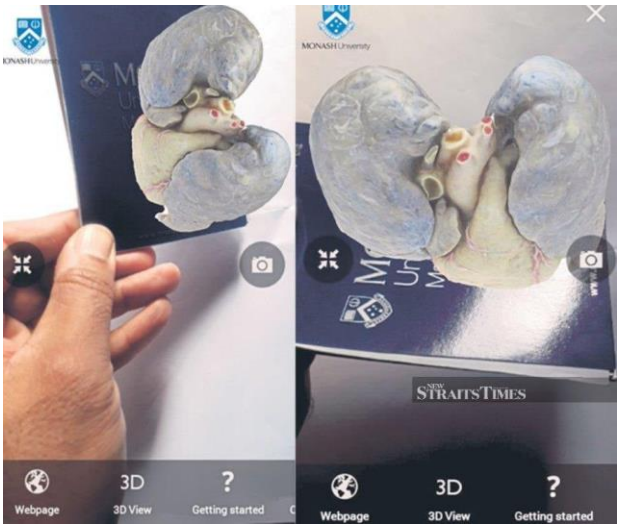
Source: UNCTAD (2020). *Covid-19 has changed online shopping forever, survey shows.* Retrieved November 11, 2022, from https://unctad.org/news/covid-19-has-changed-online-shopping-forever-survey-shows

As the e-commerce industry continues to grow, there is increasing adoption of augmented reality (AR) technology in several sectors such as beauty and cosmetics, apparel fitting, footwear, and furniture (K et al., 2022). This is because AR has the ability to enhance human perception of reality in the virtual world as it integrates individual objects in real word with virtual complements to provide realistic, meaningful and personalized experiences to users (Kannaiah & Shanthi, 2015;

Carmigniani & Furht, 2011). In other words, AR affects the way consumers view a brand and is likely to affect consumers' purchasing decisions (Javomik, 2016). For example, in education context, AR allows knowledge to be delivered in an attractive and immersive way by enabling students to access study materials beyond time and space (Vuta, 2020; Asadzadeh et al., 2021). It is also easier for students to understand complex abstract concepts such as physics, astronomy, and anatomy (Sahin & Yilmaz, 2020). As for consumer goods industry such as IKEA, Home Depot, Levi's, and Kendra Scott, have also adopted AR shopping application so that their target customers can safely preview the products and make purchases directly on the same platform if they are satisfied with the products' appearance on the screen (Papagiannis, 2022). Leaders of the beauty industry such as L'Oréal and Sephora have also acquired AR technology to increase online business sales by mimicking in-store consultation experience. This indicates that AR technology is able to provide seamless interaction to users (Castellanos, 2020; Papagiannis, 2022).

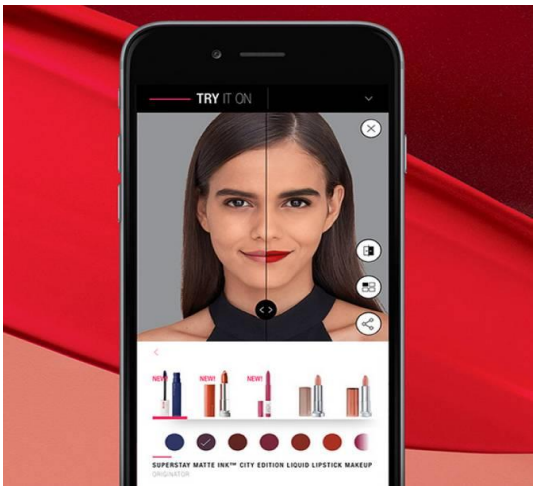
Based on the examples, it is true that Augmented Reality technology has penetrated different sectors, particularly the retail sector, to create digital experiences that can enhance the relationship between consumers and brands. This is because consumers were able to get a close to real-life shopping experiences with the AR 'try on' and 'try out' option using their digital devices (K et al., 2022). Therefore, it is clear that the usage of AR technology has brought benefits to both the consumers and industries players.

Figure 1.2: Monash Augmented Reality Anatomy Learning Objects (Marolo)



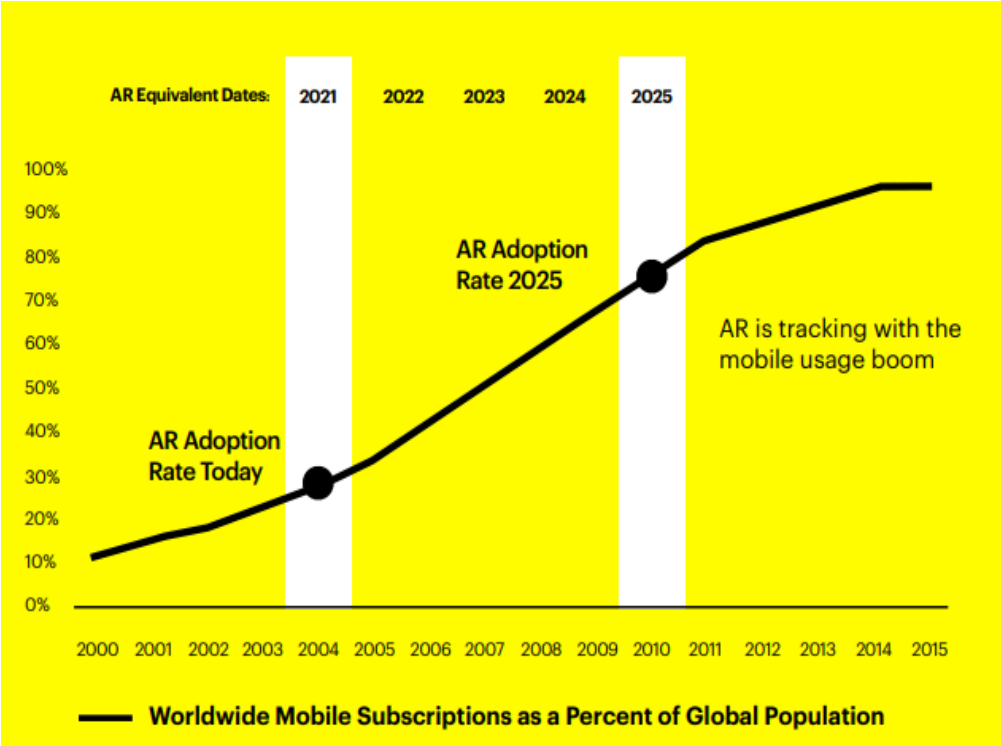
Source: Rafidi (2020). Bringing learning to life. *New Straits Times.* Retrieved November 11, 2022, from https://www.nst.com.my/education/2020/02/562767/bringing-learning-life

Figure 1.3: L'Oréal's Virtual Makeup Try-On Technology



Source: L'Oréal Groupe (n.d.). *Makeup Virtual Try-on Maybelline.* Retrieved November 11, 2022, from https://www.loreal.com/en/articles/science-and-technology/makeup-virtual-try-on-maybelline/

Figure 1.4: Prediction of AR Adoption



Source: Deloitte (2021). *Snap Consumer AR Global Report 2021*.

Apart from that, in the global environment, the situation of global economics is seen to been improving with the implementation of AR in businesses as online sales continue to grow. According to Deloitte Digital report on Snap Inc., there is more than 100 million consumers shopping with AR online in 2022 and the count is expected to reach around 75% of the global population by 2025 (Deloitte, 2022). This indicates that the online shopping behavior with AR is expected to stick and continue to increase in an extremely persistent pace even after the pandemic (Linggvist et al., 2021; United Nations Conference on Trade and Development, 2021; Fallon, 2022). Not only that, but it is also proven that the usage of AR has positive impact on sales as the AR market in the retail industry is expected to reach $2,094.08 billion by 2027, with a market growth rate of 68.5% (Tan et al., 2022; Vardomatski, 2021). According to Deloitte

(2022), AR increases the conversion rate by 94%. This is because AR technology is able to enhance the product selection process and product value (Vilkina & Klimovets, 2020). As a result, individuals have better assessment of the products and feel more connected to the brands (Deloitte, 2022). Besides, consumers are continuously expecting more personalized and engaging experiences from the brands; hence, there is an imperative need for brands to accelerate and grow the AR ecosystem to gain more market share (Deloitte, 2022). Thus, it is confident that AR is the future trend, especially for the retail industry.

From Malaysia's perspective on the use of the AR technology, Jalinan Digital Negara (JENDELA) (2021) and Lim (2020) have stated that the Malaysian government authorities had encouraged the use of AR technology by launching the MyDigital blueprint as a move towards Industrial Revolution 4.0 (IR4.0). This is because it is important for Malaysian businesses to recognize and gear up with digital technology such as Internet of Things (IOT), AR, Virtual Reality (VR) to improve the country's economic growth (New Straits Times, 2021). To encourage active adoption of new technologies such as AR, the government has allocated funds from Budget 2022 to spur the use of digital applications among local businesses (Digital News Asia, 2021; Lim, 2020). However, Malaysians are usually slow in adopting new technologies; hence, the adoption and usage of AR in consumer goods business are much lesser compared to other industries such as medical, military, and education (Wafa & Hashim, 2016). Although the implementation of AR in local businesses remains low in Malaysia, there is still a certain degree of awareness on the rise of AR technology through the applications provided by multinational companies. For instance, the AR filters provided by Instagram, and AR games such as Pokémon Go, have allowed Malaysians to experience AR technology. According to the research of Verizon Media in 2020, it is shown that 75% of the consumers wants new interactive experiences and 60% mentioned they are more likely to purchase from brands that create content with innovative technologies (New Straits Times, 2021).

1.2 Research Problems

Although it is undeniable that the implication of AR in businesses brings various benefits, research demonstrates that Malaysians are slow in adopting new technology (Ng & Ramasamy, 2018). Lim (2020) also mentioned that compared to the international market, AR is relatively new and unproven in the Malaysian market. Thus, most AR technology that is currently available in the Malaysian market is provided by the multinational companies that are operating in Malaysia. Zulkifli et al. (2016) mentioned that only 44% of Malaysians are familiar with Malaysia's AR technology. Thus, there is a need to enrich our understanding of AR adoption process and consumers' acceptance of AR to keep up with the fast-paced trend aligned with the IR 4.0.

Besides, previous research on AR in Malaysia mainly focuses on the field of education and tourism. For instance, the study of mobile augmented reality elements on smart tourism in Penang (Abumandil et al., 2022), the research on augmented reality technology for primary school education in Perlis (Bistaman et al., 2018), and the study on trends in educational augmented reality in Malaysia (Sirakaya & Sirakaya, 2018). Apart from that, most of the studies done previously were viewed from the service providers' perspectives. For example, research on AR adoption intention among travel and tour operators in Malaysia (Alam et al., 2022) as well as study focusing on AR training from Technical and Vocational Education and Training (TVET) instructors' perspective (Abdul et al., 2022). In short, this has shown that the research on consumers acceptance towards AR in the retail industry, in particular, the beauty sector, remains scarce.

As AR's implementation in businesses have proven to bring market profitability, creativity, and enhancement of existing goods and services, it is important to study and

examine the factors affecting consumer usage intention on AR shopping application in Malaysia to reduce unnecessary investment (Hassan & Rahimi, 2016). To fill in this gap, this research will be done from consumers' perspective to examine whether there is a demand on the implementation of AR in beauty shopping application. Consumers acceptance and intention to use the AR application will be further discussed in the research paper, so that beauty corporations can implement a better business model for the future, focusing on consumers' interest while keeping up with the technological change.

1.3 Research Objectives

The research objectives are generated in two categories which are the general objective and specific objectives.

1.3.1 General Objective

The main root of this research is to examine the factors that influence consumers' acceptance towards beauty shopping application with augmented reality technology in Malaysia.

1.3.2 Specific Objectives

i. To examine the influence of relative advantage on consumers acceptance towards augmented reality beauty shopping application in Malaysia.

ii. To examine the influence of compatibility on consumers acceptance towards augmented reality beauty shopping application in Malaysia.

iii. To examine the influence of complexity on consumers acceptance towards augmented reality beauty shopping application in Malaysia.

iv. To examine the influence of perceived enjoyment on consumers acceptance towards augmented reality beauty shopping application in Malaysia.

v. To examine the influence of subjective norm on consumers acceptance towards augmented reality beauty shopping application in Malaysia.

vi. To examine the mediating effect of consumers' attitude towards the usage intention of augmented reality beauty shopping application.

1.4 Research Questions

Present study proposed the following questions:

i. Does factors such as relative advantage, compatibility, complexity, perceived enjoyment, and subjective norm, affect the consumers acceptance towards AR shopping application?

ii. How would consumers' attitude as a mediator affect the usage intention of augmented reality beauty shopping application?

1.5 Research Significance

This research is able to make contributions towards a few sectors. Firstly, from the perspective of business operators, specifically those in the beauty sector, this research may provide them with better insights on the implementation of Augmented Reality

(AR) technology in their business operations. This is because although AR is able to provide new prospects for businesses to serve and attract consumers in an innovative way, huge investment and long period of time are required for researching purposes before the implementation. Therefore, it is important to research more on willingness of Malaysian consumers to use AR technology before introducing the AR services to avoid wasting resources such as capital, time, and manpower. Besides, this study will also make it easier for business operators to identify and pinpoint possible pitfalls to successfully implement AR technology that is acceptable by the consumers into their businesses.

Apart from that, this study will investigate the reaction of the consumers residing in Malaysia towards the utilization of AR services on beauty e-commerce platform. A conceptual framework had been developed concretely for this research to examine whether the AR services may create values for the Malaysian community if it is implemented into the e-commerce platforms. On top of that, this research will provide a better understanding of consumers' real thoughts, perception as well as acceptance towards the implementation of AR technology in online shopping platforms. Therefore, this research may act as a guidance for future researchers that study consumers' attitude and behavioral intention towards technology or innovation adoption.

Lastly, this research is conducted to see whether there is a possibility for beauty retail stores to eliminate the use of testers in the physical stores and replace it with AR virtual try-on for environmentally friendly purposes. This is because studies show that the production of beauty products highly contributed to environmental pollution as waste is generated by formula testers and items that expire on store shelves (Cernansky, 2021; Rai, 2019; Bashir et al., 2021). For instance, the non-recyclable packaging of microbeads and plastics, environmental-harmful product ingredients such as volatile organic compounds (VOCs) as well as unrecyclable single-use beauty products such as wet wipes and sheet masks, are all considered as harmful pollution wastes (Rai, 2019; Bashir et al., 2021). Thus, if the acceptance and usage intention of consumers on AR

virtual try-on in the beauty industry is high, beauty corporations may slowly eliminate physical testers and adopt the AR application to help preserve the environment.

1.6 Summary

This chapter gives a brief background on augmented reality (AR) technology, the change in consumer purchasing behavior and the adoption of augmented reality technology in business operations of various sectors amidst the pandemic around the world. However, the adoption of AR in Malaysia is still low. Therefore, this study would like to further research on the acceptance of consumers towards AR shopping applications, focusing on the beauty sector in Malaysia. Several theories have been adopted as the foundation of this research.

CHAPTER 2: LITERATURE REVIEW

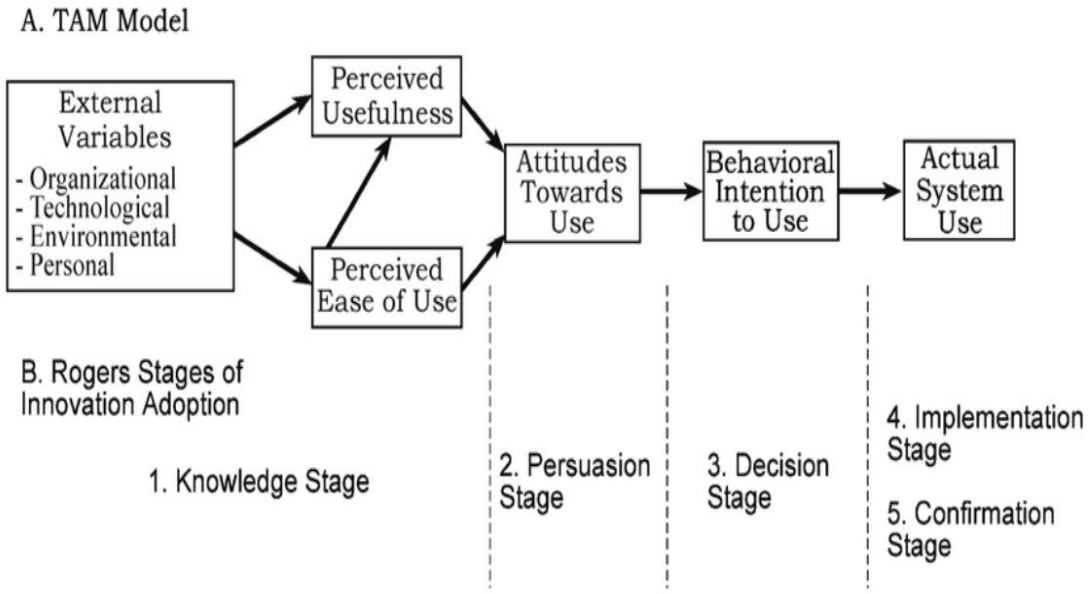
2.0 Introduction

The second chapter further discusses the model theories of Technology Acceptance Model (TAM) and Diffusion of Innovation Theory (DIT) that have been used to structure the conceptual framework. Besides, the variables and hypothesis of this study will also be reviewed and supported by relevant journals, textbooks, and past research.

2.1 Underlying Theories and Models

Past study of Wymer and Regan (2011) has adopted both Technology Acceptance Model (TAM) and Diffusion of Innovation theory (DIT) together to examine the factors affecting adoption and use of E-business and e-commerce information technology. This has proven that both models can be utilized in one study to investigate technology adoption among users.

Figure 2.1: A Model Combining TAM & DIT



Source: Wymer, S., & Regan, E. A. (2011). Influential factors in the adoption and use of E-business and E-commerce information technology (EEIT) by small & medium businesses. *Journal of Electronic Commerce in Organizations (JECO)*, *9*(1), 56-82.

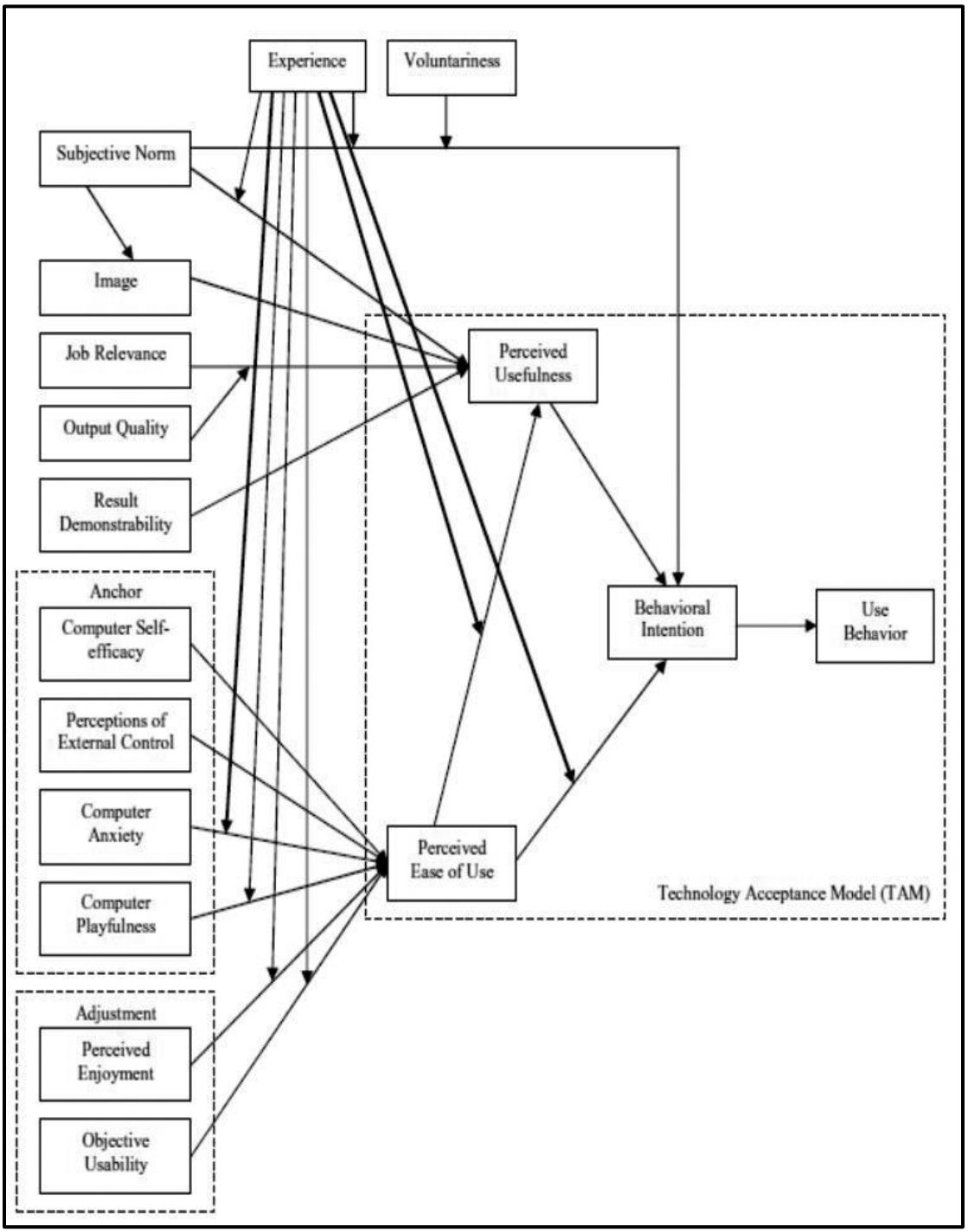
2.1.1 Technology Acceptance Model (TAM)

TAM is an acceptance model that is developed from the adaptation of Theory of Reasoned Action (Fishbein & Ajzen, 1975), by Davis et al. (1989) to predict the use of intelligent products and services. David et al. (1989) suggested that the potential acceptance or rejection of technology is determined by user's attitude, which can be influenced by perceived usefulness and perceived ease of use.

Due to its simple construction, TAM has been adopted widely by researchers to investigate users' acceptance of different technologies under various context (Granic & Marangunic, 2019) However, due to its simplicity, researchers often have to extend TAM by adding additional explanatory variables depending on the specific technology context (Sung & Yun, 2010). Venkatesh and Davis (2000) as well as Venkatesh and Bala (2008) have improvised TAM by introducing TAM2 and TAM3 to increase the predictive validity as well as to enhance the understanding of the determinants of technology acceptance. According to Maranhunic and Granic (2015), Ventakesh has introduced new factors and variables to TAM that can be categorized into (1) factors from related models (e.g., subjective norm and perceived behavioral control), (2) additional belief factors (e.g., trialability and result demonstrability), and (3) external variables (e.g., personality traits and demographic characteristics). The continuous evolution and enhancement of the TAM model has made significant contributions to the field of AR adoption theories for future researchers to develop their conceptual framework.

Past studies have stated that the TAM model can determine an individual's attitude towards using a given system, which in turn, determines individual's intentions to adopt the particular system (Diop et al., 2019; Xu et al., 2010). In other words, in TAM, an individual's acceptance towards technology can be identified by his or her attitude towards the technology, which may further influence their behavioral intention to adopt the technology (Xu et al., 2010).

Figure 2.2: Technology Acceptance Model (TAM3)



Source: Venkatesh & Bala, 2008, p. 280. *Technology Acceptance Model 3 and a Research Agenda on Interventions.* Decision sciences, 39(2), 273-315. https://doi.org/10.1111/j.1540-5915.2008.00192.x

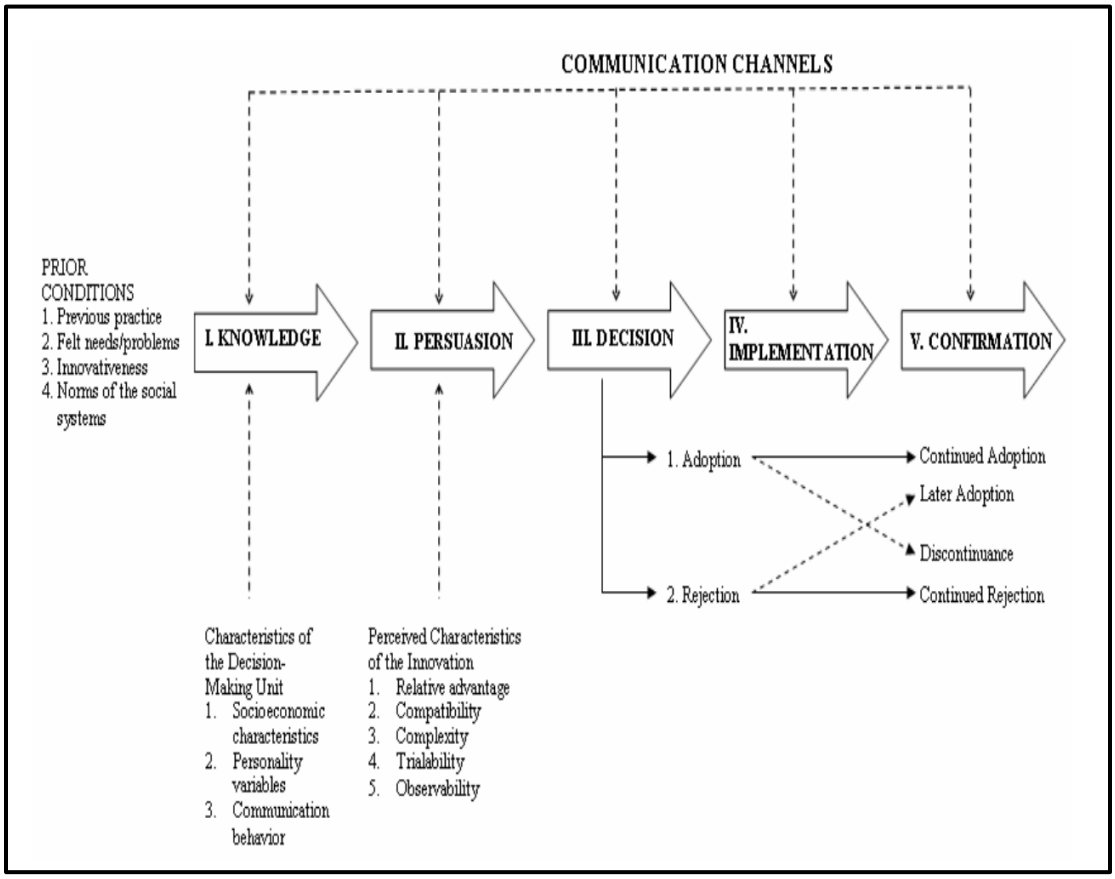
2.1.2 Diffusion of Innovation Theory (DIT)

In contrast to TAM, DIT is an extensive social and psychological theory that encloses more specific characteristics to assist in the prediction of how people make adoption decisions on new innovation by finding their adoption patterns (Rogers, 1995; Rogers & Shoemaker, 1903). The DIT outlines the adopter distribution following a bell-shaped curve over time, offering insights about how an innovation is diffused over time among users (Rogers, 1983). According to Rogers (1995), the willingness and ability of individuals to adopt and share an innovation is affected by their awareness, interest, evaluation, trial, and adoption. Therefore, Rogers (1995) came out with a five-stage model of the adoption process which is knowledge, persuasion, decision, implementation, and confirmation.

The first stage of DIT is knowledge, which refers to potential adopters who are aware of and learning the existence of the innovation. This research will be focusing on the second stage, which is the persuasion stage. This stage consists of the main characteristics of an innovation that affects the adoption or rejection of users and measures users perceptions based on five perceived variables which are: (1) relative advantages (economic gains or perceived convenience), (2) complexity (relatively free of effort to use), (3) compatibility (Being consistent with existing values, needs, and past experiences of potential adopters), (4) observability (assessment of implication), and (5) trialability (Mundy et al., 2019; Rogers, 1995). These characteristics were said to be able to predict the rate of adoption of innovations (Rogers, 2003). Studies have also shown that these attributes, especially those of relative advantage and compatibility, are the most notable factors for the adoption of Internet and mobile technologies (Koenig-Lewis et al., 2010; Liu & Li, 2010). Furthermore, at the decision

stage, individuals will decide to adopt or reject the innovation while implementation stage refers to putting innovation into practice (Roges, 2003). The final stage of DIT is the confirmation stage where the innovation-decision has already been made.

Figure 2.3: A Model of Five Stages in the Innovation-Decision Process



Source: Diffusion of Innovations, Fifth Edition by Everett M. Rogers. Copyright (c) 2003 by The Free Press. Reprinted with permission of the Free Press: A Division of Simon & Schuster.)

2.2 Overview of Augmented Reality Technology in Beauty Industry

2.2.1 Overview of Augmented Reality (AR) Technology

According to Amin and Govilkar (2015), the term augmented virtuality which refers to Virtual Reality (VR) and Augmented Reality (AR), is created by Milgram to recognize systems that are mostly synthetic with some real-world imagery added. As mentioned by Billinghurst et al. (2015) and Chen et al. (2019), VR aims to replace reality by creating an immersive environment while AR technology strive to enhance the physical real-world environment by adding interactive virtual computer-generated information such as images, 3D models, and music to it and responding to user input in real time. Furthermore, an augmented environment can only be experienced through displaying hardware devices such as mobile displays, computers, Head-Mounted Displays, and projecting systems (HMDs) (Amin and Govilkar, 2015).

Amin and Govilkar (2015) have mentioned that the AR system consists of 3 steps which are: (1) recognition, (2) tracking, and (3) mix. The term recognition refers to the ability of an AR system to recognize any image, object, face, or space to allow virtual overlays in real world in the form of video, 3D, 2D, or text. On the other hand, tracking is crucial and should be as accurate as possible to create realistic illusion of the virtual content (Billinghurst et al., 2015). This is because high accuracy in AR is needed to deceive and persuade the human eye on the merging of real and virtual graphics. AR has to identify the point-in-time position and maintain a specific state through recognition to achieve high completeness (Lee et al.,

2021). In other words, AR has to be registered in correct alignment between virtual and real world for a naturalistic effect and usage experience. Mix in the AR system is referring to the overlapping of virtual content after the AR recognized the real-world environment.

According to Chen et al. (2019), the rapid development of computing power of computer software and hardware has provided people with new ways to recognize and experience things around. The use of AR is proven to be helpful in creating values and convenience for different industries. In particular, AR is deemed to be one of the most promising technologies by authoritative organizations such as the American Times Weekly. On top of that, many industries have implemented AR by developing different classes of AR applications such as medical visualization, games and entertainment, advertising, education, and military (Bottani & Vignali, 2019; Carmigniani & Furht, 2011; Parekh et al., 2020). For instance, in the field of medical, AR has been adapted as a visualization tool in surgical robotics to use during the Robot-Assisted surgery (RAS). An example of it will be the da Vinci robotic system, which is capable of rendering a stereo laparoscopic video to the robot's console window during surgery (Bodner et al., 2004; Makhataeva & Varol, 2020). The implementation of AR in the medical industry has assisted doctors to perform better with high accuracy during complex surgeries (Parekh et al., 2020).

The usage of AR in daily operations is increasing and becoming a trend. This can be proven with the research of Rankohi and Waugh (2013), where they identified that Internet-based mobile AR systems are the future trend of the construction industry for construction and maintenance phases. Furthermore, in terms of education, the study of Buttner et al. (2017) has identified the opportunities in developing AR applications to improve user's learnability and quality. Besides, AR is also proven to have practical uses in Human-Machine Interaction, product design, logistics, production

system management, and safety maintenance. (Damiani et al., 2018; Segura et al., 2018). Apart from that, from the view of e-commerce, AR is said to be an advantageous tool as it increases consumers' satisfaction and enhances purchase intention (Dacko, 2017; Flavián et al., 2019; Yim et al., 2017).

All the examples mentioned above have clearly shown that the world is experiencing global technology shift due to technological advancement. Companies from different industries have either adopted or are reorganizing their business structure by shifting from traditional to innovative ways such as AR and VR. Thus, this research proceeds with further consideration of AR implementation in the beauty industry, especially in Malaysia.

2.2.2 Overview of Augmented Reality Technology in Beauty Industry

Digital and online channels have been developing rapidly in the retail industry to offer interesting and memorable emotional shopping and brand experiences to the consumers (Grewal et al., 2017; Park et al., 2006; Watson et al., 2018; Woodside & Mir, 2019). According to Menear (2019), the beauty industry was one of the first commercial sectors to embrace digital platforms and maximize the power of large-scale data capturing and analytics to respond to customer demand. For instance, cosmetic brands such as L'Oréal and Sephora have already recognized the potential of AR and developed AR mobile shopping applications that allows consumers to experience virtual facial make up (Scholz & Duffy, 2018). This technology allows consumers to receive product information as if they were in the physical stores with direct product trials (Kim & Forsythe, 2008). The implementation of AR application is expected to hold a strong future in

beauty retailing as profits can been seen increasing (Rauschnabel et al., 2019). This is because AR offers consumer personalized experiences with interactive and vivid contextual information using virtual try-on tools, which allows them to virtually wear and customize the products by themselves (Yim et al., 2017). Therefore, the immediate interaction that is provided by AR enhances consumer purchasing experiences as they feel more engaged in the process (Hilken et al., 2018).

2.3 Literature Review of Variables

2.3.1 Consumers' Usage Intention (CUI) towards AR Beauty Shopping Application

The term "intention to use" is derived from the definition of behavioral intention developed by Fishbein and Ajzen (1975). It refers to the strength of an individual's intention to perform various specific behavior (Fishbein & Ajzen, 1975). According to Venkatesh et al. (2003), several reference disciplines and IT literatures have demonstrated the importance of CUI in forecasting technology adoption intention. For instance, the framework of Theory of Planned Behavior (TPB) and Theory of Reasoned Action (TRA) which consists of CUI have been widely used by researchers to investigate technology acceptance. TPB has also stated that behavioral intention remains as one of the most influential predictors of behavior (Venkatesh et al., 2012; Yiu et al., 2007). However, studies have suggested that TAM was more powerful compared to TPB and TRA to predict and assess behavioral intention of users towards different technological tools (Chow et al., 2012; Venkatesh & Davis, 2000; Wu, 2012). In this study, TAM addresses users' acceptance and usage towards technology through the three main constructs

of: (1) Factors affecting personal intentions, (2) Intention to use AR beauty shopping application, and (3) Actual use (Teo et al., 2014).

In the context of technology acceptance, numerous past studies on information system (IS) have shown that CUI towards technology is influenced by "worthwhile experience" (Kukk & Leppiman, 2016). As an example, the study of learning enhancement via AR among art gallery visitors and another study on the positive effect of AR experience on science festival visitors' engagement (Tom Dieck et al., 2018). Sundar et al. (2015) also mentioned that immersive experiences enhanced by AR leads to an impact on behavioral responses. This is because when individuals find an application to be useful in achieving certain outcome, usage intention will be developed as they perceive the application to be beneficial (Ayeh et al., 2013).

Therefore, this research aims to further study the mediator effect of attitude towards CUI, perceived variables, and subjective norms towards consumers' usage of AR beauty shopping application.

2.3.2 Consumers' Attitude (CA)

According to Ajzen and Fishbein (1980), it is suggested that attitude can predict the intention to behavior. CA involves judgement where individuals make positive or negative evaluation towards an action or behavior by shaping his or her perception of the world through filtered information (Ajzen & Fishbein, 1980). Furthermore, CA is also found to be playing the mediating role (e.g., TAM framework) in information technology acceptance (Davis et al., 1989). However, according to Krosnick and Petty (1995), studies pointed out that CA can be a weak predictive of

corresponding behaviors (Agarwal & Prasad, 1999; Davis et al., 1989; Moon & Kim, 2001; Taylor & Todd, 1995; Vijayasarathy, 2004).

Petty et al. (1997) has mentioned that the formation of a strong attitude towards technology adoption can be influenced by both individual and contextual variables such as experiences, knowledge, and personal target. For instance, the study of Petty and Cacioppo (1986) has demonstrated that the greater the amount of one's knowledge relevant to a behavior, the more likely that one would have the intention to engage in performing the behavior. In the context of AR technology, if users acquired sufficient knowledge and information about the system and the benefits it brings, a favorable attitude (e.g., confidence) may be developed towards the use of system. Therefore, in this case, attitude on usage intention of technology system may be significant enough to be a critical factor in mediating the relationship between suggested variables and usage intention.

Besides, several past studies have also found that CA is able to affect users' behavioral intention (Kasilingam, 2020; Liu & Li, 2011). For example, Kasilingam (2020) mentioned that attitude significantly influenced the intention to use and adopt technology such as chatbot technologies for mobile shopping. Not only that, but the study by He et al. (2018) has also confirmed that the adoption of AR may boost users' attitude and their mood which would lead to positive behavioral purpose. Therefore, when users perceive an item or a service as a good and favorable idea, they will have intention to adopt or use it (Aldhmour & Sarayrah, 2016; Ramadania & Braridwan, 2019).

2.3.3 Relative Advantage (RA)

Relative advantage is one of the perceived innovation attributes established by Rogers (1995). Rogers defined RA as the degree to which users perceive an innovation as superior to the precursor of that technology (Rogers, 1995). He further described that RA is often expressed as economic profitability, social prestige, immediacy of the reward, or other benefits (Rogers, 1995). Besides, Yusof (1999) argued that RA assists in determining user perception towards a new idea of innovation. Apart from that, Davis (1989) and Davis et al. (1989) have suggested that RA has similar attributes as perceived usefulness. Past research also demonstrated that perceived usefulness could affect CA towards the use of innovations (Agarwal & Prased, 2000; Kim & Forsythe, 2009; Rese et al., 2017; Wang et al., 2011; Zhang et al., 2019). In particular, Kim and Forsythe (2009) stated that perceived usefulness acts as a strong predictor of CA towards virtual try-on technology while Rese et al. (2017) mentioned that CA towards using retail AR application is positively and directly influenced by its perceived usefulness.

This study aims to investigate the RA perceived by users using AR shopping applications compared to traditional brick-and-mortar shopping as well as with traditional e-commerce platforms.

2.3.4 Compatibility (COM)

Compatibility refers to the degree whereby the innovations are considered to be consistent with consumers' current lifestyles, values, purchasing style, and perceived needs (Rogers, 1995; Yuen et al., 2018). According to Agag and El-Masry (2016), consumers made adoption decisions on new technology based on their usual habits, behavior, thinking and value system, as well as specific needs. According to previous studies, it is shown that compatibility is vital for examining how perceived usefulness and perceived ease of use (TAM model) can be affected by users' past experiences with similar technologies; thus, influencing the usage intention of consumers to experience new innovations and technologies (Agarwal & Prasad, 1999; Zhang et al., 2008).

In terms of adopting AR shopping application, compatibility may vary among consumers as individuals have different opinions, perceptions, and evaluation towards AR shopping applications. For instance, the degree of compatibility for busy individuals may be high as they do not have time to visit physical stores for purchases; hence, AR shopping applications being the best option that fit with their lifestyles and needs. In other words, if the innovation is compatible with the needs of individuals, uncertainty will reduce and tendency towards adoption of innovation will increase. Not only that, but studies have shown that the pandemic has changed consumers' purchasing habits and behaviors, where they shifted towards e-commerce platforms. Therefore, there has been a consistent compatibility with their personal needs and lifestyle for AR shopping applications (Donthu & Gustafsson, 2020; Kirk & Rifkin, 2020; Singh, 2020).

2.3.5 Complexity (CP)

According to Rogers (1995), complexity refers to *"the degree to which an innovation is perceived as difficult to understand and use".* This indicates that complexity differs itself from other attributes by being negatively correlated with the rate and tendency of adoption of an innovation. Yusof (1999) also mentioned that an innovation is a combination of complexity and simplicity, depending on the audience perception. According to previous research, complexity, and perceived ease of use from TAM are similar constructs (Moore & Benbasat, 1991). Both complexity and perceived ease of use are seen as the main factors influencing technology adoption by the researchers (Gillenson et al., 2002; Vijayasaranthy, 2004; Amaro & Duearte, 2015; Agag & El-Masry, 2016).

In terms of AR shopping application, users may have diverse perceptions on the complexity of the system. As an example, the younger generation who are more receptive and enthusiastic towards innovative technologies might perceive it as easy or interesting to adopt AR shopping applications. This can be proven with the study of Morris and Venkatesh (2000), showing that age does matter for technology adoption decision as the results suggested that acceptance decisions of younger generations are more noticeable than the older generation. According to Morris and Venkatesh (2000), the younger generation is more open to accepting new innovation as they are more likely to have been exposed to information technology at a relatively early age compared to the older generation.

2.3.6 Perceived Enjoyment (PENJ)

According to Davis and Wiedenbeck (2001), PENJ is defined as *"the extent to which the activity of using the technology is perceived to be enjoyable in its own right, apart from any performance consequences that may be anticipated".* In other words, PENJ refers to the rationale that individuals who experience pleasure or enjoyment from using an innovation, are more likely to develop usage intention towards the particular technology. Apart from that, TAM proposed that PENJ is similar to intrinsic motivation which can drive the performance of an activity that is not associated with any reason other than the process of performing the activity as well as leading to emotional arousal (Davis et al., 1992; Heijden, 2004). This indicates that PENJ belongs to the aspect of inner motivation as users feel entertained when interacting with the system or technology (Moon & Kim, 2001). Furthermore, TAM also suggested that PENJ is said to have a significant influence on consumers' usage intention on technology (Heijden, 2004).

Past studies have also shown that the more entertaining the information system is, the higher the PENJ, thus, leading towards a higher willingness of users to use and adopt the system (Lee et al., 2019; Moon & Kim, 2001). For instance, Childers et al. (2001) have proven that enjoyment is a powerful predictor of technology adoption decisions such as online shopping. Not only that, but PENJ has shown significant findings in the online context through its ability to influence users towards different products and services (Alalwan et al., 2018; Rouibah et al., 2016). It is highlighted by several researchers that the effect of virtual world enhanced by AR, has allowed consumers a more pleasurable and wonderful shopping experience (Butt et al., 2021; Holdack et al., 2020; Jang & Park, 2019). Rese et al. (2017) has also suggested that PENJ is an important factor in the study

of AR application. This is because the immersive and realistic environment provides entertainment value for consumers during the shopping process by enabling them to immerse themselves in the AR services (Yeo et al., 2017). In other words, the PENJ of users is high when they are internally motivated and feel enjoyment during the engagement process with a certain technology. If users feel happy and relaxed without voluntary adjustment needed during the activities, the goal of intrinsic motivation (i.e., perceived enjoyment) is said to be achieved and it is likely for users to adopt the innovation (Alalwan et al., 2018; Kehr et al., 2018; Lee at al., 2019).

2.3.7 Subjective Norm (SN)

According to Schepers and Wetzels (2007), SN refers to the pressure that a group exerts on individuals by altering their perceptions, opinions, attitudes, and behaviors. Individual's views, actions and behavior can be affected and altered by his or her social environment when their significant members in the social circles wish or expect him or her to act in a certain way (Bilgihan et al., 2016). The original framework of TAM did not include SN; however, being aware of the potential importance of SN in changing individuals' perception, Venkatesh and Davis (2000) have included SN in TAM2. This is because they found that people often make decisions whether to perform an action or not when one or more important referents say they should (Venkatesh & Davis, 2000).

Several researchers also defined SN as a factor that relates heavily to an individual's perception of the social pressure from key individuals such as family members and friends, to perform a particular behavior or not to perform (Abd Mutalib et al., 2017; Ajzen, 1991; Fauzi et al., 2019). In other words, it is implied that people tend to turn to their social networks for

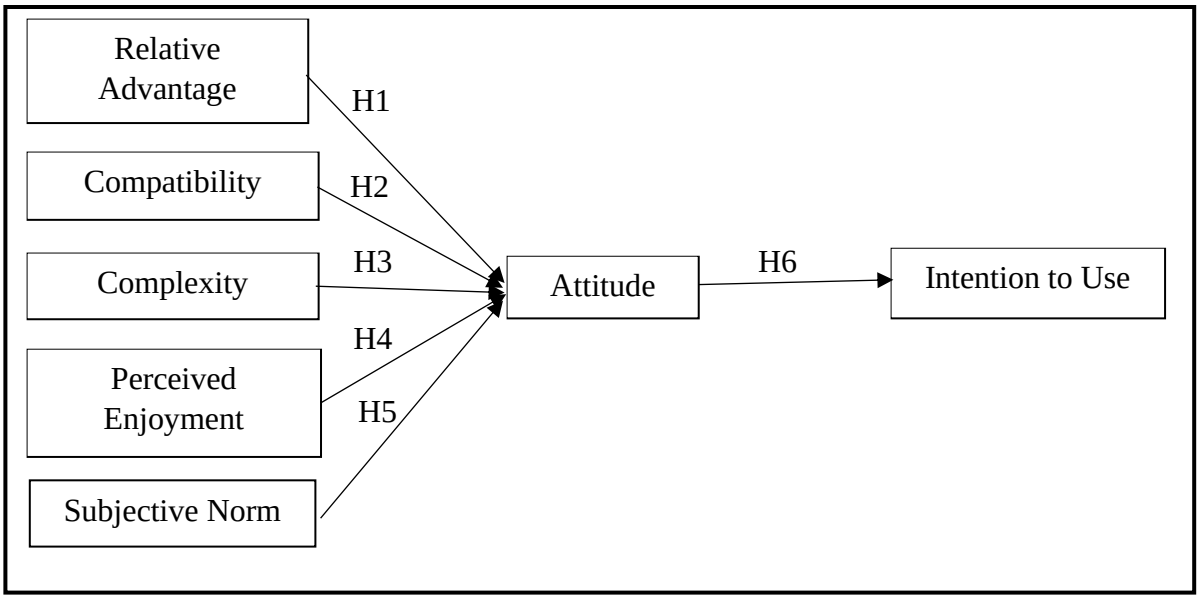
guidance and advice when they are uncertain about adopting a new technology or innovation to reduce their anxiety (Slade et al., 2015).

Apart from that, existing studies have found that SN can influence technology acceptance and usage intention, especially in the early stage of individual experiences with information system (AbuShanab & Pearson, 2007; Davis, 1989; Eckhardt et al., 2009; Lu et al., 2011; Wang et al., 2009). For instance, past research on the technology acceptance of hotel employees has shown that the stronger the SN, the higher the behavioral intention of individual to adopt information technology (Lam et al., 2007). In addition, the study on students' acceptance of AR application by Álvares-Marín et al. (2021) also proven that individual behavior can be affected by SN (e.g., the faculty and peers).

2.4 Proposed Research Framework

In this study, TAM was chosen as the foundation theory. However, it is suggested by previous studies that researchers who adopt TAM should consider making minor adjustment on the construct to fit research themes respectively (Venkatesh et al., 2003). Thus, DIT is also adopted in this study to create make the research framework a better fit for the research.

Figure 2.4 Proposed Research Framework



Source: Developed for this research

2.5 Hypotheses Development

2.5.1 The relationship between Relative Advantage (RA) and Consumers' Attitude (CA) towards AR Beauty Shopping Application

RA refers to a situation where new innovation is perceived to be providing more benefits to the users as compared to the previous or old innovation. There is ample evidence supporting that RA has favorable and positive effect on attitude, where users' attitude can be significantly predicted by RA (Chang et al., 2005; Cheung et al., 2005; Hsu & Lin, 2008; Sinha, 2010; Zendehdel et al., 2015). For example, research conducted on the mobile

Internet (Hsu & Lin, 2008) demonstrated that a greater degree of advantage offered is linked to higher levels of purchasing attitude. On top of that, it has also been observed that RA significantly affects the users' intention and attitude towards online shopping (Zendehdel et al., 2015).

Not only that, but prior studies have also suggested that CA is able to affect the attitudes of users towards technology, which will further increase their intentions towards technology adoption. For instance, the research of Lin and Chen (2012), RA is deemed to be a significant indicator to understand users' experiences in technology usage. The research of Lin and Chen (2012) also viewed RA at two levels which are (1) personal and (2) organizational. Personal level refers to the degree of convenience perceived by individuals while organizational level to their IT in products and services that are offered for consumers. According to the result of the research, RA at personal level viewed technology system positively as it increases work accessibility and convenience (Lin & Chen, 2012). However, on the organizational setting, RA of technology is not seen to be adding any values to the operation; thus, users have negative feelings and view on the system as they argued that the use of IT system may leads to a negative impact towards the company and their products (Lin & Chen, 2012).

In this study, RA on AR technology in beauty shopping application will be evaluated on individual level. If users perceive AR beauty shopping application offers more benefits and convenience compared to their current way of shopping, it is said that users have positive thoughts towards such innovation. Thereafter, this study hypothesized that:

H1: There is a significant relationship between RA and CA towards AR beauty shopping application.

2.5.2 The relationship between Compatibility (COM) and Consumers' Attitude (CA) towards AR Beauty Shopping Application

Ajzen (1998) and Ajzen and Fishbein (1997) have stated that compatibility is used as an indicator to assess attitude and behavior. It refers to the degree to which users perceive an innovation to be consistent with their current lifestyles, values, and perceived needs (Rogers, 1995; Yuen et al., 2018). When an innovation is compatible with users' experiences, values, beliefs and needs, users' uncertainty will be minimized as they positively view the innovation to be useful (Rogers, 1995). Another research has also proven that the compatibility of technology (e.g., Social Networking Services) affects attitude towards technology usage positively (Folorunso et al., 2010). Other than that, previous studies focus more on the effect of perceived ease of use (TAM) on attitude and behavior, which is said to be similar to compatibility in DIT (El-Gohary, 2012). With the abovementioned discussions, it is noticed that the research on the relationship between compatibility and CA towards technology remains scarce and limited. Therefore, this study recognizes the importance of compatibility towards CA in adopting technology by postulating the following hypothesis:

H2: There is a significant relationship between COM and CA towards AR beauty shopping application.

2.5.3 The relationship between Complexity (CP) and Consumers' Attitude (CA) towards AR Beauty Shopping Application

According to Rogers and Shoemaker (1983), complexity refers to users' perceived difficulty to use an innovation. In other words, if an innovation is too complex and difficult for users to comprehend, they would have negative feelings towards the innovation; thus, decreasing the intention to adopt or use the innovation. The study of Vouk (2008) has found that users are more likely to consider using technology (e.g., cloud computing) if more technical abilities and greater efforts are not required to use the system. This is further supported by the prior study on the effect of complexity of the use of technology (e.g., Automatic Teller Machines) which was seen to be positively significant to attitude of technology acceptance (Olatokun & Igbinedion, 2009, p.386).

Although there were studies on the effect of complexity of technology (in general) towards CA; yet there is insufficient research on AR technology as it is relatively new to the public. For these reasons, it is necessary to examine the influence of complexity on CA towards AR technology, specifically in the context of beauty shopping application. Accordingly, this study hypothesized that:

H3: There is a significant relationship between CP and CA towards AR beauty shopping application.

2.5.4 The relationship between Perceived Enjoyment (PENJ) and Consumers' Attitude (CA) towards AR Beauty Shopping Application

Numerous studies have found that PENJ leads to a significant effect towards consumers acceptance and CUI on technology (Heijden, 2004). For instance, the research of Al-Aulamie et al. (2012) and Cabada et al. (2017) have demonstrated that positive attitude towards information system is generated when users feel fun and joy from experiencing the particular system. As a result, the positive attitude of users will eventually lead to a higher level of intention to use and adopt the innovation. On top of that, it is also discovered that the entertainment value of technology may increase PENJ; hence, encourage the development of positive attitude towards the innovation (Kim & Forsythe, 2008).

Apart from that, Hale et al. (2002) pointed out that CA is expected to have mediating effect on other variables of behavioral intention such as PENJ. In this study, PENJ refers to the extent to which users perceive AR in beauty shopping applications to be fun and pleasurable. If users are able to experience enjoyment throughout the technology adoption process and be motivated to repeat the actions or behaviors, attitude towards CUI is said to be positive. Thus, this study postulated the following hypothesis:

H4: There is a significant relationship between PENJ and CA towards AR beauty shopping application.

2.5.6 The relationship between Subjective Norm (SN) and Consumers' Attitude (CA) towards AR Beauty Shopping Application

According to Bankole & Bankole (2017), it is suggested that individuals can be easily influenced by the majority. This indicates that individuals are inclined to modify their views and attitudes based on the social group they associate with. Although several past studies have removed SN as it was found to be the weakest predictor of intention; however, Shin et al. (2016) suggested that SN has a significant influence on intention to behavior indirectly via another variable. Furthermore, there is several empirical studies and results stated SN was an important and necessary path to increase the explanatory power of technology adoption as it could influence users' attitude (Fishbein & Ajzen, 1975; Fulk, 1993; Han & Kim, 2010; Ryu & Jang, 2006; Schmitz & Fulk, 1991). On top of that, Kaushik et al. (2015) has also found that subjective norms directly and significantly influence users' attitude towards the adoption of technology. Based on the above arguments, the present study is determined to investigate the effect of SN towards users' attitude on AR technology in beauty shopping app, which is relatively novel to consumers. Hence, the present study put forward the following hypothesis:

H5: There is a significant relationship between SN and CA towards AR beauty shopping application.

2.5.6 The relationship between Consumers' Attitude (CA) and Consumers' Usage Intention (CUI) towards AR Beauty Shopping Application

According to Davis (1989) and Davis et al., (1989), it is identified that CA towards new technology affects an individual's decision-making and behaviors. Several past studies on adaptation of information systems have also demonstrated the relationship of CA towards innovation and CUI (Chen et al., 2002; Davis et al., 1989; Hoque et al., 2015; Liu & Li, 2011). For example, Kasilingam (2020) mentioned that attitude significantly influenced the intention to use and adopt technology such as chatbot technologies for mobile shopping. Besides, several studies have also found that attitude had positive direct impact on intention to use online shopping where users perceive it as a good and favorable idea (Aldhmour & Sarayrah, 2016; Ramadania & Braridwan, 2019). Not only that, but the relationship between CA and CUI can also be observed in tourism and hospitality studies where CA is shown to be having positive effects on CUI (Ayeh et al., 2013; Cheng & Cho, 2011; Kim et al., 2008).

In this study, feelings towards AR in beauty shopping applications refer to having positive feelings about AR. If users have a high level of positive feeling towards AR, it is more likely to generate strong AR usage intention. This is because the intention to perform certain behaviors will only be developed if users have positive feelings towards the items, actions, or innovation. Thus, this study established the below hypothesis:

H6: There is a significant relationship between CA and CUI towards AR beauty shopping application.

2.6 Summary

This chapter discusses the background of Augmented Reality (AR) technology in general and the usage of AR in several industries. Subsequently, this chapter has also justified the underlying theories used in the research. A conceptual framework that includes seven variables has been developed and a total of six hypotheses have been made. The hypotheses formulated in Chapter 2 will be assessed and substantiated in the subsequent chapters using appropriate measures.

CHAPTER 3: RESEARCH METHODOLOGY

3.0 Introduction

This chapter describes the data collection procedures for analysis purposes. It comprised several elements such as research design, data collection methods, sampling design, research instruments, construct measurement, and the scale of measurement.

3.1 Research Design

Research design outlines the overall framework that a study will be conducted, including the hypotheses, data collection methods, data analysis procedures and more. (Creswell, 2014; Inaam Akhtar, 2016). According to Creswell (2014), research designs are types of inquiry used within qualitative, quantitative, and mixed methods approaches that offer precise guidance for the procedures in a research study. Furthermore, research design also served as a blueprint for the study to ensure that the research is conducted in a systematic, rigorous, and legitimate manner (Creswell, 2008; Creswell, 2014).

3.1.1 Descriptive Research

As defined by Siedlecki (2020), descriptive research is a quantitative research technique that studies a population's characteristics as well as helps to pinpoint problems that may exist within a group, an organization, or a population. Besides, descriptive research answers research questions that begin with "what", "when", "how", but not "why" (Siedlecki, 2020).

In this study, descriptive research is adopted to investigate CUI of beauty product purchasers in Malaysia towards the application of AR technology in online beauty shopping application.

3.1.2 Quantitative Research

According to Basias & Pollalis (2018), quantitative research is used to test objective theories by examining the relationship among variables, which can be measured and quantified through instruments to obtain numerical data. Numerical data is usually obtained through methods such as surveys or experiments and will then be analyzed using statistical procedures to identify the presence of relationship between the variables (Creswell & Creswell, 2018; Zikmund et al., 2013). In this study, quantitative research has been adopted to predict the CUI of beauty product purchasers in Malaysia towards the application of AR technology in online beauty shopping application. The data will be collected through the distribution of questionnaires to obtain the insights and subjective experiences of participants.

3.2 Sampling Design

After the formulation of the research design, sampling design has to be developed. Therefore, the following part will explain the target population, sampling frame, sampling location, sampling technique, and the sample size of the study.

3.2.1 Target Population

Target population refers to a group of individuals that a researcher intends to conduct the research with and draw conclusions from. In this study, the target respondents are Malaysia, particularly Klang Valley residents, regardless of nationalities, that had made beauty purchases from any online shopping platforms.

3.2.2 Sampling Frame and Sampling Location

The sampling frame points out the list of samples that will be drawn from the entire target population of a research. However, the sampling frame was not definable due to the presence of large target population.

Apart from that, sampling location refers to the specific location or area where the research is conducted. In this study, the sampling location was in Malaysia,

particularly Klang Valley. Thus, this research does not restrict on respondents' nationalities as anyone who resides in Klang Valley Malaysia will be deemed as the targeted respondents of this study.

3.2.3 Sampling Element

Sampling element refers to the unit of an analysis which may include individuals, group, association or institution. As this research intends to study about the consumer acceptance towards AR technology in beauty shopping application in Malaysia, anyone who have purchased beauty products from e-commerce platform and is residing in Malaysia, regardless of nationalities, are the sampling element of this study.

3.2.4 Sampling Technique

According to Taherdoost (2016), sampling techniques is divided into two types which are probability sampling and non-probability sampling. Probability sampling indicates that every individual or item in the population has an equal chance to be included in the sample (Taherdoost, 2016). On the other hand, non-probability sampling has been proven to be geographically assessable, easily approachable, inexpensive, and obtainable at a given time (Etikan et al., 2016).

In this study, non-probability convenience sampling is adopted as this research does not have a specific sample frame. This is because convenience sampling allows researchers to obtain information from large populations easily by

selecting participants that are readily and easily available (Taherdoost, 2016). Furthermore, it is also a least time-consuming and cost-effective option for students as compared to other sampling techniques. As an example, researchers do not have to spend time scheduling face-to-face interviews with the chosen respondents. To add on, it also does not require any cost to adopt free online tools such as Google Form, a survey administration software, to distribute research questionnaires.

3.2.5 Sample Size

In this study, a Z-value of 1.96 has been set, along with a desired margin error of 5% and a confidence level of 95%. Apart from that, according to New Straits Times (2022), there are 22 million digital customers in Malaysia, which is around 67.48% of the total population in Malaysia in 2022. Therefore:

The Cochran's formula is listed below:

$$n = \frac{Z^2 p(1-p)}{e^2}$$

Whereby, Z = The Z-value based on the confidence level

p = The estimated proportion of the population

e = Margin of error

In this study, the ideal margin error and confidence level are 5% and 95% respectively, with a given Z-value of 1.96. Apart from that, according to New

Straits Times (2022), there are 22 million digital customers in Malaysia, which is around 67.48% of the total population in Malaysia in 2022. Therefore:

$$n = \frac{1.96^2 \times 0.6748(1-0.6748)}{0.05^2}$$

$$= \frac{3.8416 \times 0.6748(0.3252)}{0.0025}$$

$$= 337.2079 \approx 337$$

Based on the calculation by using the Cochran's formula, the ideal sample size for this study is 337.

3.3 Data Collection Methods

Data collection is the process of collecting, measuring, and analyzing the collected data to answer research questions, to examine the hypotheses, as well as to draw conclusions. There are two main sources of data collection methods, which are primary sources and secondary sources (Zikmund et al., 2013).

3.3.1 Primary Data

Kabir (2016) defined primary data as information acquired from first-hand experience which includes unpublished experiments, questionnaire and interviews. Primary data is more reliable and authentic as the data collected is

specific to the research questions (Kabir, 2016). Therefore, a primary data collection method is adopted for this research. The data will be collected through the distribution of questionnaire via Google Form.

3.3.2 Secondary Data

According to Kabir (2016), secondary data refers to information collected from published sources such as textbooks, biographies, journal articles, and online databases. Secondary data allows easier yet cost-effective collection of data (Kabir, 2016). In this study, secondary data collection from various online platforms such as Google Scholar, UTAR library online database, and Emerald Insights are used for review purposes on the review of literature. Furthermore, secondary data is also adopted to collect more information and understanding on the research topic.

3.4 Research Instruments

According to Wilkinson and Birmingham (2003), research instruments are devices that are used to obtain information relevant to a particular research project. In other words, research instruments are measurement tools that help researchers to gather, assess, and analyze research data. In this study, the survey method is adopted as the research instrument to obtain primary data from the respondents on their intention to use the AR technology implemented in the online shopping platforms. This is because this method

is inexpensive to administer yet it helps to collect vast amounts of data from a variety of individuals (Wilkinson & Birmingham, 2003).

3.4.1 Questionnaire Design

The questionnaire of this study was developed and distributed in English as it is deemed as a suitable language to correspond with the respondents. Besides, the layout of the questionnaire was divided into four parts, which included the cover page, filtering section (section A), demographic section (section B) , and the main body of questions (section C).

Firstly, the cover page of the questionnaire had included the research topic, introduction and background of the researcher and study, data protection statement that assures confidentiality, as well as a photo that illustrated an Augmented Reality (AR) beauty shopping application.

The next section consists of a screening question to identify and exclude non-online beauty shoppers. Moving on to the demographic section, it helped to gather information on demographic profiles and the frequency of beauty purchases made online by the respondents. These data would enable researchers to comprehend and understand the respondents more accurately.

The following part was designed to capture respondents' degree of interest in using the AR beauty shopping application (dependent variable), and the factors that may influence respondents' acceptance of AR beauty shopping application (independent variables). In this section, a five-point Likert scale anchored from "strongly disagree" to "strongly agree" was used to measure all constructs.

Table 3.1: Total number of items included in each variable

Variables	Construct	Number of Items
	Filter Question	1
	Demographic Question	4
Independent Variable	Relative Advantage	5
	Compatibility	4
	Complexity	4
	Perceived Enjoyment	5
	Subjective Norms	4
Mediating Variable	Attitude	4
Dependent Variable	Intention to Use	4

Source: Developed for research

3.4.2 Pilot Test

The survey questionnaire was distributed to 30 respondents to reduce possible faults and errors. The feedback from the respondents was taken into consideration to review, revise and rectify the potential issues that would happen when distributing the real questionnaire. For example, during the conduct of the pilot test, several individuals were not familiar with the term with AR beauty shopping application; thus, were not able to grasp an idea for the technology. As a result, a photo was included in the questionnaire to illustrate an example of AR beauty shopping application. The data obtained from the respondents were able to enhance the quality of the questionnaire by omitting any errors detected in the survey.

Apart from that, a reliability test was done using the Smart Partial Least Squares (Smart-PLS) Version 4 software. According to Hair et al. (2021), the value of

0.7 or above for Cronbach's Alpha (CRA) and composite reliability (CR) were considered as acceptable reliability. In addition, recommended value for factor loadings would be above 0.708 (Hair et al., 2021). In this research, all constructs are reliable and valid as the values for Cronbach's alpha (CRA), and composite reliability (CR) are above 0.70, as well as with values of average variance extracted (AVE) greater than 0.50. The results of the reliability test are shown below in table 3.2.

Table 3.2: Reliability Analysis (Pilot Test)

Variables	**Indicators**	**Outer Loadings**	**CRA**	**rho_C (CR)**	**AVE**
Relative Advantage	RA1	0.857	0.914	0.935	0.744
	RA2	0.861			
	RA3	0.874			
	RA4	0.916			
	RA5	0.799			
Compatibility	COM1	0.855	0.925	0.946	0.815
	COM2	0.934			
	COM3	0.901			
	COM4	0.890			
Complexity	CP1	0.870	0.883	0.918	0.738
	CP2	0.845			
	CP3	0.832			
	CP4	0.889			
Perceived Enjoyment	PENJ1	0.864	0.932	0.948	0.786
	PENJ2	0.893			
	PENJ3	0.872			
	PENJ4	0.911			
	PENJ5	0.893			
Subjective Norms	SN1	0.916	0.900	0.931	0.771
	SN2	0.871			

	SN3	0.810			
	SN4	0.911			
Attitude	CA1	0.844	0.880	0.917	0.733
	CA2	0.856			
	CA3	0.880			
	CA4	0.845			
Intention to Use	CUI1	0.815	0.871	0.911	0.720
	CUI2	0.809			
	CUI3	0.885			
	CUI4	0.882			

Source: Developed for research

3.5 Construct Measurement

3.5.1 Origin of Constructs

Table 3.3: Origin of Constructs

Variables	Constructs	Adopted from
Relative Advantage	I feel AR beauty shopping application would be better than traditional display product display mode because it would improve my online shopping experiences.	Yuen et al. (2018)
	I feel AR beauty shopping application would be better than traditional display product display mode because it would make beauty purchase decision making easier.	
	I feel AR beauty shopping application would be better than traditional display product display	Moore & Benbasat

	mode because it would allow a more efficient online shopping process.	(1991); Yuen et al. (2018)
	I feel AR beauty shopping application would be better than traditional display product display mode because it would be more beneficial to me when making beauty purchases.	Yuen et al. (2018)
	I feel AR beauty shopping application would be better than traditional display product display mode because it would be the best way for me to experience beauty online shopping.	
Compatibility	I feel like AR beauty shopping application would be compatible with my lifestyle.	Yuen et al. (2018)
	I feel like AR beauty shopping application would be compatible with my actual needs.	
	I feel like AR beauty shopping application would be compatible with the way I like online shopping.	
	I feel like AR beauty shopping application would be compatible with my current situation.	
Complexity	I feel like AR beauty shopping application is easy to use.	Davis et al. (1989); Moore & Benbasat (1991)
	I feel like AR beauty shopping application is easy to learn how to use.	
	I feel like AR beauty shopping application requires only a little of mental effort to use.	
	I believe that AR beauty shopping application is convenient to use.	
Perceived Enjoyment	I think it is exciting to use AR beauty shopping application.	Hung et al. (2021)

	I think I would find great pleasure in using AR beauty shopping application.	
	I think it is interesting to use AR beauty shopping application.	
	I think it is great enjoyment to use AR beauty shopping application.	
	I would have fun interacting with the AR beauty shopping application.	Rese et al. (2017)
Subjective Norms	People who are important to me would think that it will be good if I use the AR beauty shopping application.	Venkatesh et al., 2003
	People who influence my thoughts and behavior will think it is good if I use AR beauty shopping application.	
	Media influences me to use AR beauty shopping application.	Bae & Choi (2021)
	There are a lot of people around me who recommend me to use AR beauty shopping application.	
Attitude	I am positive about trying AR beauty shopping application.	Min et al. (2019)
	I think using AR beauty shopping application is a good idea.	
	I think AR beauty shopping application is interesting that it makes me want to learn more about it.	Rese et al. (2017)
	I think other people should also use the AR beauty shopping application.	

Consumers' Usage Intention Towards AR Beauty Shopping Application	If I were to buy beauty products in the future, I would use AR beauty shopping application rather than another platform.	Rese et al. (2017)
	If I were to buy beauty products in the future, I would give AR beauty shopping application priority over physical stores.	
	I will recommend others to use the AR beauty shopping application.	
	I will use AR beauty shopping application regularly in the future.	

Source: Developed for research

3.5.2 Scale of Measurement

3.5.2.1 Nominal Scale

According to Zikmund et al. (2013), nominal scale is a measurement scale that identifies and classifies objects with unique labels or tags. This is because the items assigned under nominal scale are not quantitative or number oriented (Zikmund et al., 2013). In this study, the nominal scale was adopted to determine the demographics information of the respondents such as gender and education level.

3.5.2.2 Ordinal Scale

Ordinal scale refers to a measurement scale that reports the ranking and ordering of data (Tastle & Wierman, 2006). However, the distances between the categories or attributes are uneven or unknown (Tastle & Wierman, 2006). For example, in a survey that consists of a 5-point Likert scale, respondents will choose between the options that ranges from "1-Very Unhappy" to "5-Very Happy"; yet researchers are not able to answer the degree of happiness of the respondents. In other words, the answer options of an ordinal scale are usually polar, so the intensity of difference between those options are not able to be identified. In this research, a 5-point Likert scale was adopted to evaluate respondents' attitude and opinions regarding the factors affecting the usage intention of AR beauty shopping application.

3.6 Data Processing

Data processing refers to the situation where all the collected data from the questionnaire will undergo the process of data screening, data editing, data coding, data transcribing, and data cleaning. This is to filter valid and usable questionnaires as well as to omit and void questionnaires that did not meet the requirements of the study so that meaningful information can be generated.

3.6.1 Questionnaire Checking

Constant checking of the questionnaires before and after the distribution can provide better assurance of the data quality. This is because errors such as missing data and omission of data may occur during the collection of responses. By checking and observing the collected data thoroughly and repeatedly, the reliability and quality of the questionnaires are maintained as the errors are reduced and avoided from the study.

3.6.2 Data Editing

Data editing is defined as a preliminary check for accuracy and consistency by screening the questionnaires or responses. It consists of two processes which are editing and amending any detected errors in the questionnaires before analyzing the collected raw data. This is to ensure that the data obtained is complete, consistent, and related to the study.

3.6.3 Data Coding

Data coding refers to the process assigning a code or number to a particular response to a specific question. This is to ease and shorten the data transferring process to the data analytics software. In this study, the data collected are coded as shown below in table 3.4.

Table 3.4: Coding for Collected Data

Question	Options	Coding
Experience purchasing beauty products from e-commerce platforms	Yes	1
	No	2
Gender	Male	1
	Female	2
Age	18 – 23 years old	1
	24 – 30 years old	2
	31 – 40 years old	3
	41 – 50 years old	4
	50 years old and above	5
Education Level	High School	1
	Certificated / Foundation / A-Level	2
	Bachelor's Degree / Diploma	3
	Master / PhD	4
Purchase frequency of beauty products from e-commerce platforms	Once every month	1
	2 to 5 times every month	2
	6 to 10 times every month	3
	More than 10 times every month	4
All questions for IV, mediator, and DV	Strongly Disagree	1
	Disagree	2
	Neutral	3
	Agree	4
	Strongly Agree	5

Source: Developed for research

3.6.4 Data Transcribing

The process of data transcribing refers to transferring and inputting the coded data obtained from the responses into a statistical analysis platform. In this research, the data collected are converted from Microsoft Forms into Microsoft Excel. After that, the coded data will be transferred from Microsoft Excel to the Statistical Package of Social Science (SPSS) Version 29 for further data processing and analysis.

3.6.5 Data Cleaning

The data cleaning process consists of the identification and removal of missing data and outliers. In this study, unreliable and ambiguous results will be detected by the SPSS Version 29 software so that the consistency of the data collection is assured. All missing data and outliers that consist of extreme values were leveraged or excluded by the IBM SPSS as those will distort and mislead the interpretation of data.

3.7 Proposed Data Analysis Tool

3.7.1 Data Analysis

Data analysis is the process of transforming raw data into meaningful information that can be used to make informed decisions. In this study, Statistical Package for Social Science SPSS version 29, Smart Partial Least Squares (Smart-PLS), and Microsoft Excel are adopted to run and examine the collected data.

3.7.2 Descriptive Analysis

According to Zikmund et al. (2013), descriptive analysis is the most fundamental data analysis that is usually used to summarize the key features of data. In addition, descriptive analysis provides descriptive statistics which consists of the measures of central tendency and variation such as mode, mean, median, range, and variance (Zikmund et al., 2013).

Descriptive analysis was conducted in this research to illustrate and explain the analyzed data using tables or graphs such as pie chart or bar chart. For example, the demographic information of the respondents will be recorded and presented in a table with frequency and percentage.

3.7.3 Reflective Measurement Model Assessment

The reflective measurement model is assessed and estimated by Partial Least Squares Structural Equation Modeling (PLS-SEM) in terms of reliability and validity (Hair et al., 2021) Reliability assessment involves evaluating the consistency and stability of measures at both the indicator and construct levels, while validity assessment focuses on the accuracy and appropriateness of the measures in relation to the construct being measured (Hair et al., 2021). Additionally, the reflective measurement model assessment includes the procedures of assessing the indicator reliability, internal consistency reliability, convergent validity, and discriminant validity (Hair et al., 2021).

3.7.3.1 Indicator Reliability

According to Hair et al. (2021), indicator reliability examines the extent to which the construct explains the variance in each indicator. The indicator loadings in PLS-SEM are used to gauge the reliability of the, with values of 0.708 or higher being suggested as they account for over 50% of the indicator's variance The guidelines for assessing indicator reliability is demonstrated as below:

Table 3.5: Rules of Thumb of Indicator Reliability

Indicators Loadings	Rule of Thumb
≥ 0.708	Retain indicator
$0.4 \leq b < 0.708$	Retain indicator,

	if deletion does not increase measure(s) of internal consistency or convergent validity above the suggested threshold value, vice versa
< 0.4	Remove indicator

Adapted from: Hair Jr, J. F., Hult, G. T. M., Ringle, C. M., Sarstedt, M., Danks, N. P., Ray, S., ... & Ray, S. (2021). Evaluation of reflective measurement models. *Partial Least Squares Structural Equation Modeling (PLS-SEM) Using R: A Workbook*, 75-90. Switzerland: Springer International Publishing.

3.7.3.2 Internal Consistency Reliability

Internal consistency reliability examines whether the items in the same underlying construct are correlated (Hair et al., 2021). It is measured by composite reliability and cronbach's alpha, where a greater value denotes a better level of reliability (Hair et al., 2021). The difference between the two lies in the presence or absence of the tau-equivalence assumption. Composite reliability provides a more accurate estimate of true reliability than Cronbach's alpha as the latter assumes that all indicator loadings are the same (Hair et al., 2021). In addition, the recommended range for internal consistency reliability is between 0.8 and 0.9 (Hair et al., 2021). The table below shows the threshold value of composite reliability and Cronbach's alpha.

Table 3.6: Rules of Thumb of Composite Reliability and Cronbach's Alpha

Criterion	Rule of Thumb	Internal Consistency Reliability
Composite Reliability	$0.60 \leq rho < 0.70$	Acceptable
	$0.70 \leq rho < 0.90$	Good
	$0.90 \leq rho < 0.95$	Excellent

Cronbach's Alpha	$\alpha < 0.60$	Poor
	$0.6 \leq \alpha < 0.70$	Moderate
	$0.7 \leq \alpha < 0.80$	Good
	$0.8 \leq \alpha < 0.90$	Very Good
	$0.9 \leq \alpha < 0.95$	Excellent
	$0.95 \leq \alpha$	Too high; items are redundant

Adapted from: Hair Jr, J. F., Hult, G. T. M., Ringle, C. M., Sarstedt, M., Danks, N. P., Ray, S., ... & Ray, S. (2021). Evaluation of reflective measurement models. *Partial Least Squares Structural Equation Modeling (PLS-SEM) Using R: A Workbook*, 75-90. Switzerland: Springer International Publishing.

Hair Jr., J., & Page, M. (2015). The Essentials of Business Research Methods (3rd ed.). Routledge. https://doi.org/10.4324/9781315716862

3.7.3.3 Convergent Validity

According to Hair et al. (2021), convergent validity is evaluated by the average variance extracted (AVE) metric, which measures the extent to which a construct is able to explain the variance of its indicators. An AVE of 0.50, which is the minimum acceptable level for convergeny validity, or higher indicates that the construct explains 50% or more of the variance of the indicators that make up the construct (Hair et al., 2021).

3.7.3.4 Discriminant Validity

Discriminant Validity measures the degree to which a construct is distinct from other constructs in the model based on empirical evidence (Hair et al., 2021). Based on Garson (2016), heterotrait-monotrait ratio (HTMT) of correlation achieves greater specificity and sensitivity rate in examining the validity. Furthermore, according to Henseler et al. (2015), there are three approaches under HTMT which are $HTMT_{85}$, $HTMT_{90}$, and $HTMT_{inference}$. $HTMT_{80}$ outperformed the other two approaches with a higher average sensitivity rate of 99.90% compared to the 99.45% of $HTMT_{90}$ and the 97.01% of $HTMT_{inference}$ (Henseler et al., 2015). The metrics and thresholds of discriminant validity is tabulated as below:

Table 3.7: Rules of Thumb of Discriminant Validity

Criterion	Metrics and Threshold
Discriminant Validity	For conceptually similar constructs, HTMT < 0.90; Acceptable
	For conceptually different constructs, HTMT < 0.85; More conservative
	Test if the HTMT is significantly lower than the threshold value.

Adapted from: Hair Jr, J. F., Hult, G. T. M., Ringle, C. M., Sarstedt, M., Danks, N. P., Ray, S., ... & Ray, S. (2021). Evaluation of reflective measurement models. *Partial Least Squares Structural Equation Modeling (PLS-SEM) Using R: A Workbook*, 75-90. Switzerland: Springer International Publishing.

3.7.4 Inferential Analysis

Inferential analysis is a statistical approach used to draw conclusions about a population based on data sample drawn. It involves making inferences or predictions about the population parameters based on the information gathered from a representative sample.

In this study, Partial Least Square Structural Equation Modelling (PLS-SEM) was selected for the inferential analysis as it can simultaneously test the complex relationship between the variables (Hair et al., 2011). Smart PLS version 4 was adopted to conduct the analysis of present research.

3.7.5 Structural Model Assessment

The process of assessing the structural model in PLS-SEM begins by examining whether there is any potential collinearity among the predictor constructs in the regression of the structural model (Hair et al., 2021). Next, the significance and relevance of the path coefficients are evaluated, and the assessment concludes by analyzing the explanatory and predictive abilities of the model (Hair et al., 2021). In other words, PLS-SEM can assess structural models by examining variance inflated factor (VIF), coefficient of determination (R^2), cross-validated redundancy (Q^2), and path coefficients (β). Besides, the bootstrapping in SmartPLS is able to demonstrate the results of mediator analysis.

3.7.5.1 Assessment of Structural Model Collinearity Issues

According to Hair et al. (2021), the coefficient for the relationships between constructs in the structural model are obtained by estimating a series of regression equations. However, collinearity issues may bias the point estimates and standard errors; thus, the structural model regressions are examined using the variance inflated factor (VIF) values (Hair et al., 2021). Table 3.8 below illustrated the rules of thumb for collinearity issues:

Table 3.8: Rules of Thumb of Collinearity Issues

Collinearity Issue	Rules of Thumb
3 > VIF	Collinearity is not a problematic issue.
3 ≤ VIF < 5	Collinearity issues are usually not critical but should be examined.
VIF ≤ 5	Critical collinearity issues are likely to occur.

Adapted from: Hair Jr, J. F., Hult, G. T. M., Ringle, C. M., Sarstedt, M., Danks, N. P., & Ray, S. (2021). *Partial least squares structural equation modeling (PLS-SEM) using R: A workbook* (p. 117). Springer Nature.

3.7.5.2 Assessment of Structural Model Explanatory Power

According to Hair et al. (2021), the structural model's explanatory power can be assessed by measuring the coefficient of determination (R^2) of the dependent or endogenous constructs. R-squared (R^2) represents the variance explained in

the endogenous constructs that ranges from 0 to 1, with higher values indicating stronger explanatory power (Hair et al., 2021). In addition, the adjusted R^2 is a more conservative estimate of the R^2 as it accounts for the number of explanatory variables in relation to the data size (Hair et al., 2021). Moore et al. (2013) The rules of thumb of R^2 are shown as below:

Table 3.9: Rules of Thumb of R-squared (R^2)

R^2 Value	**Rules of Thumb**
$R^2 = 0.25$	Weak
$R^2 = 0.50$	Moderate
$R^2 = 0.75$	Substantial

Adapted from: Hair Jr, J. F., Hult, G. T. M., Ringle, C. M., Sarstedt, M., Danks, N. P., & Ray, S. (2021). *Partial least squares structural equation modeling (PLS-SEM) using R: A workbook* (p. 117). Springer Nature.

3.7.5.3 Assessment of Structural Model Predictive Power

Assessment of Structural Model Predictive Power is a method used to evaluate the accuracy of a structural model in predicting outcomes. As there are limitations of using R^2 statistic as a measure of a model's predictive power, cross-validation redundancy (Q^2) is used instead through a blindfolding procedure (Hair et al., 2014). However, this metric is only applicable to endogenous constructs that have reflective measurement (Hair et al., 2014). Therefore, Q^2 is usually used to assess the predictive relevance of the inner model where it compares the model's predicted outcomes to actual observed outcomes (Hair et al., 2014). A higher Q^2 value indicates smaller difference between the predicted and actual values, resulting in greater predictive accuracy

of the structural model (Hair et al., 2014). On the other hand, if the Q^2 value is greater than zero ($Q^2 > 0$), this indicates a predictive relevance between the endogenous and exogenous variables for a specific construct (Hair et al., 2014).

3.7.5.4 Assessment of Structural Model Path Coefficient

Hair et al. (2014) stated that the p-value is used to determine the significance of path coefficients and to identify the relationship between the constructs of endogenous variable and exogenous variable, with values ranging from -1 to +1. Values that are closer to -1 indicate strong negative relationships while values closer to +1 indicate strong positive relationships (Hair et al., 2014). Huber et al. (2007) as cited in Mohamed et al. (2018) had stated that the path coefficient value must be at least 0.100 and at a significance level of at least 0.05.

3.7.6 Mediator Analysis

According to Hair et al. (2021), bootstrapping is a better way to test the significance of mediating effects as compared to the Sobel test. This is because it yields a stronger statistical power compared to the latter (Hair et al., 2021). On top of that, Hair et al. (2021) has also suggested that the bootstrapping in PLS-SEM provides more accurate and precise results than other methods. Furthermore, Figure 3.1 shows the example of a mediator model that illustrated the indirect effect (p1 -> p2) and direct effect (p3). To add on, Figure 3.2 also shows the process to analyze the mediator effect.

The steps to determine the mediator effect are:

i. Determine whether p1 · p2 is significant.

ii. Determine whether p3 is significant.

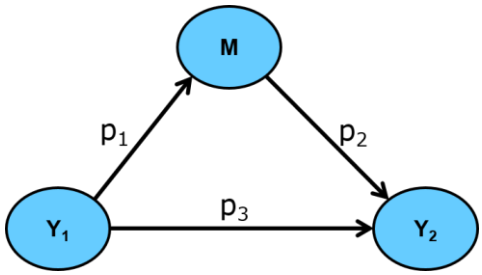
In this study, bootstrapping of PLS-SEM will be used to determine the significance of indirect effect of an independent variable (IV) on a dependent variable (DV) through the mediator variable (M). In other words, it is to examine whether the mediator variable partially, fully or does not explain the relationship between the IV and DV. The types of mediation are shown in the table below:

Table 3.10: Types of Mediation

Types of Mediation	**Rules of Thumb**
Full Mediation	Indirect effect: Significant Direct effect: Insignificant
Partial Mediation	Indirect effect: Significant Direct effect: Significant
Direct-only non-mediation	Indirect effect: Insignificant Direct effect: Significant
No-effect non-mediation	Indirect effect: Insignificant Direct effect: Insignificant

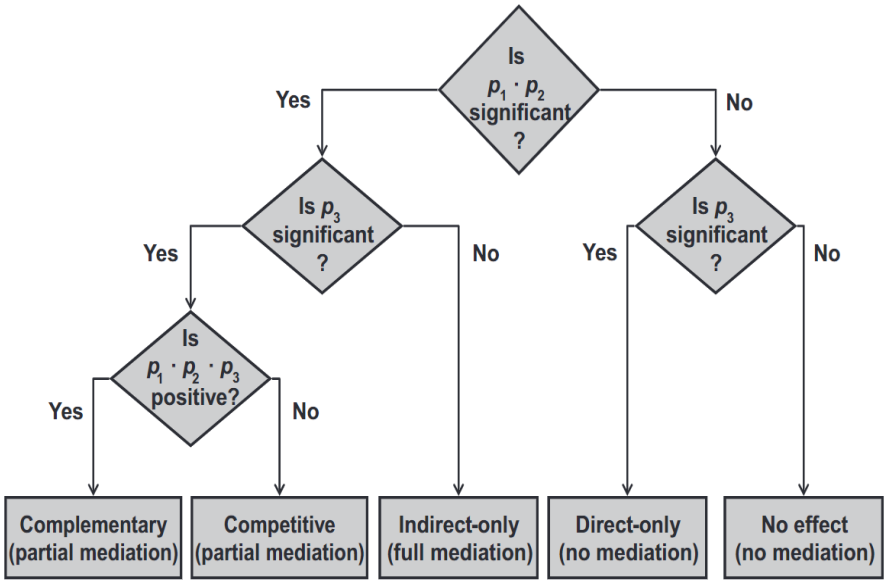
Source: Developed for research

Figure 3.1: Example of Simple Mediator Model



Adapted from: Hair Jr, J. F., Hult, G. T. M., Ringle, C. M., Sarstedt, M., Danks, N. P., Ray, S., ... & Ray, S. (2021). Evaluation of reflective measurement models. *Partial Least Squares Structural Equation Modeling (PLS-SEM) Using R: A Workbook*, 75-90. Switzerland: Springer International Publishing.

Figure 3.2: Mediator Analysis Process Model



Adapted from: Hair Jr, J. F., Hult, G. T. M., Ringle, C. M., Sarstedt, M., Danks, N. P., Ray, S., ... & Ray, S. (2021). Evaluation of reflective measurement models. *Partial Least Squares Structural Equation Modeling (PLS-SEM) Using R: A Workbook*, 75-90. Switzerland: Springer International Publishing.

3.7.7 Test of Hypotheses

According to Hair et al. (2019), the bootstrapping method in PLS-SEM is used to estimate standard errors, t-statistic, p-value, and confidence intervals of the structural model coefficients (Hair et al., 2019). To be deemed statistically significant, the p-value must be less than 0.05. Additionally, to determine whether to support or reject the hypothesis, the t-statistics with a significant level of 5% or 10% must be greater than the value of 1.96.

3.8 Summary

In a nutshell, this chapter has explained the methodology and research instruments that were applied in this study. Furthermore, a pilot test has been carried out through PLS-SEM before the actual distribution of the questionnaire. Subsequently, the following chapter will discuss and illustrate the results of data interpretation obtained from the research questionnaire responses.

CHAPTER 4: DATA ANALYSIS

4.0 Introduction

This chapter discusses the detailed results of the data analysis based on the methodology chartered in Chapter 3. The data obtained will run through a data cleaning process through the Statistical Package for Social Science (SPSS) Version 29 software before proceeding to data analysis using Smart Partial Least Squares (PLS) version 4.

4.1 Data Collection

The questionnaires were distributed in the form of Google Form to various online platforms such as Facebook, Instagram, WhatsApp, and Xiaohongshu, to reach a wider audience. The link of the questionnaires is posted and sent via social media channels; therefore, the response rate of present study cannot be determined.

4.2 Data Screening

A total of 376 responses were acquired from the distribution of the Google Form. Only 92.6% of the responses are usable (N=348) after the data is screened as 28 respondents were filtered by the filtering section. The 348 usable data were then inputted into the SPSS to undergo the data cleaning process.

4.3 Descriptive Analysis

4.3.1 Filter Question

Figure 4.1: Filter Question

Source: Developed for research

Table 4.1: Filter Question

Have you purchased beauty products from e-commerce platforms (e.g., Sephora, Shopee)?		
	Frequency	**Percent (%)**
Yes	348	92.6
No	28	7.4
Total	376	100

Source: Developed for research

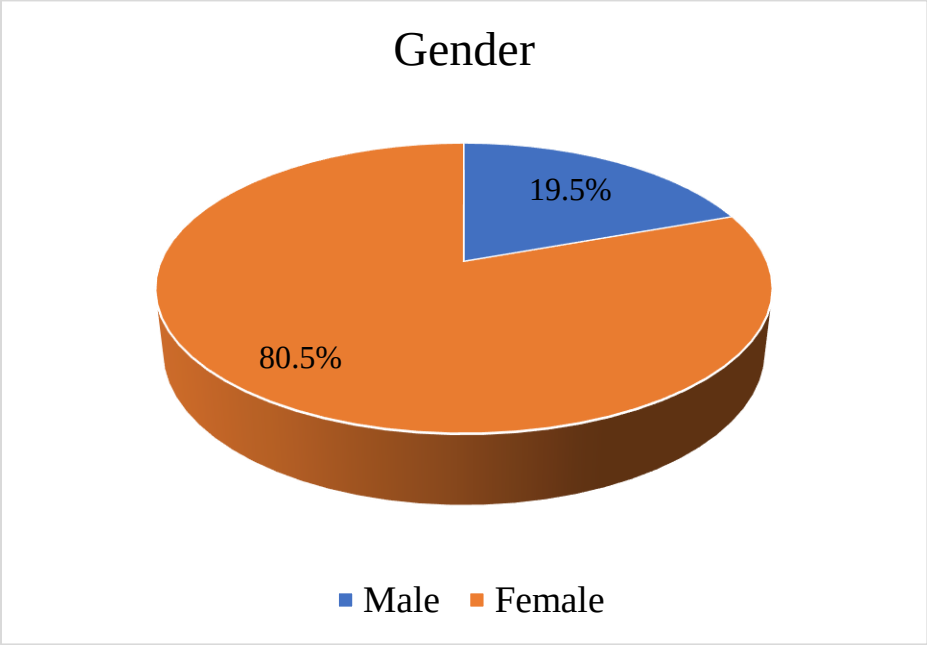
Based on Figure 4.1 and Table 4.1, 92.6% of the respondents (N= 348) have purchased beauty products from e-commerce platforms such as Sephora and Shopee, which had implemented the AR technology in their shopping applications. This indicates that the qualified respondents are online beauty shoppers that may have a chance to interact with the implemented AR technology on those online shopping platforms in the future. Furthermore, 28 out of the 376 respondents had never made purchases on beauty products from e-commerce platforms. Therefore, only 348 sets of questionnaires will be analyzed for the following questions. A total of 28 sets of unqualified data were excluded from this study.

4.3.2 Demographics Profile of the Respondents

The respondents' demographic profile is referred to the Section C in the questionnaire. There is a total of four (4) questions in this section which include gender, age, education, and the frequency of beauty purchases made on e-commerce platforms on a monthly basis.

4.3.2.1 Gender

Figure 4.2: Gender (N=348)



Source: Developed for research

Table 4.2: Gender (N=348)

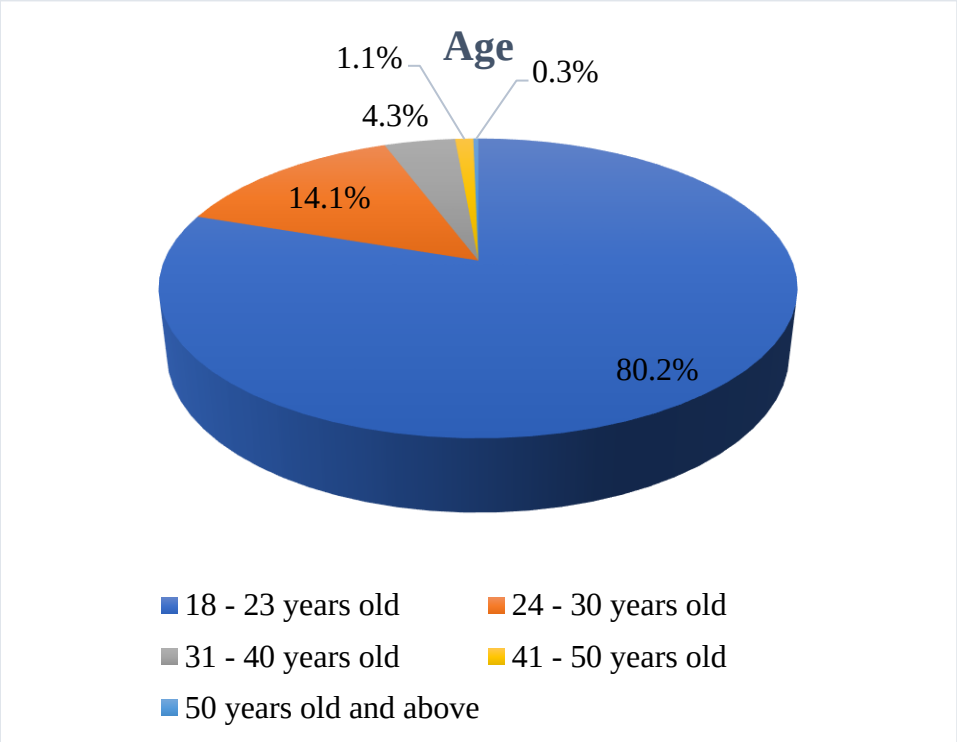
Gender	Frequency	Percent (%)
Male	68	19.5
Female	280	80.5
Total	348	100

Source: Developed for research

Figure 4.2 and Table 4.2 illustrated the gender of the respondents. 68 of the total respondents were male, which is accounted to 19.5% of the sample, while 280 of the remaining respondents (80.5%) were female. More number of females had participated in the study compared to male.

4.3.2.2 Age

Figure 4.3: Age (N=348)



Source: Developed for research

Table 4.3: Age (N=348)

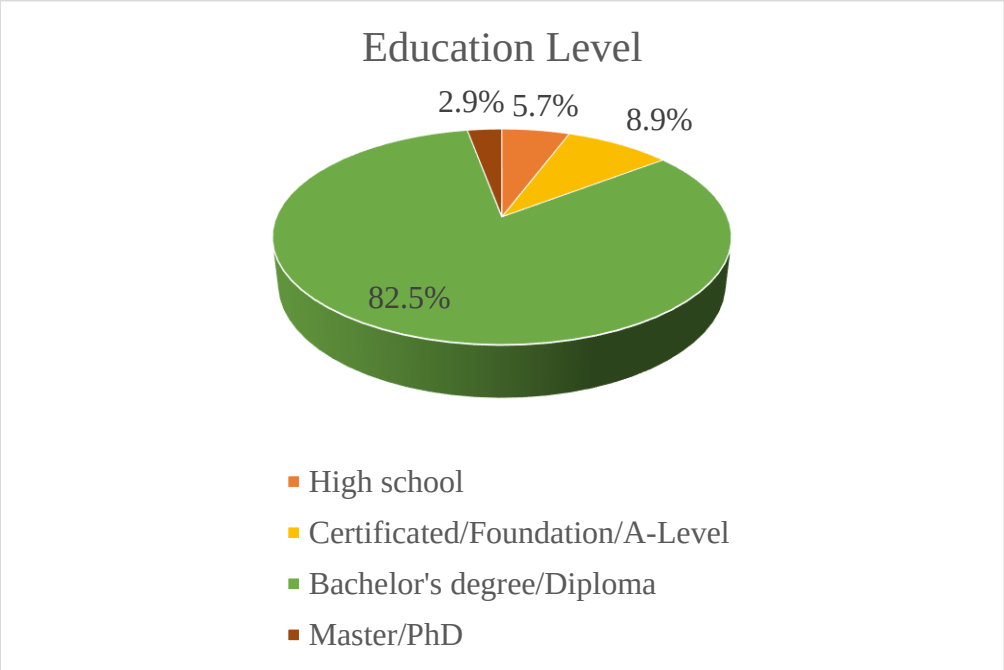
Age	Frequency	Percent (%)
18 – 23 years old	279	80.2
24 – 30 years old	49	14.1
31 – 40 years old	15	4.3
41 – 50 years old	4	1.1
50 years old and above	1	0.3
Total	348	100

Source: Developed for research

According to Figure 4.3 and Table 4.3, the majority of the respondents aged between 18 to 23 years old, accounted for 80.2% of the total sample. Next, 49 respondents (14.1%) aged between 24 to 30 years old, followed by 15 respondents (4.3%) that aged between 31 to 40 years old, and 4 respondents (1.1%) aged between 41 to 50 years old. There was only 1 respondent aged 50 years old and above in this study, which accounted for 0.3% of the total sample of present study.

4.3.2.3 Education Level

Figure 4.4: Education Level (N=348)



Source: Developed for research

Table 4.4: Education Level (N=348)

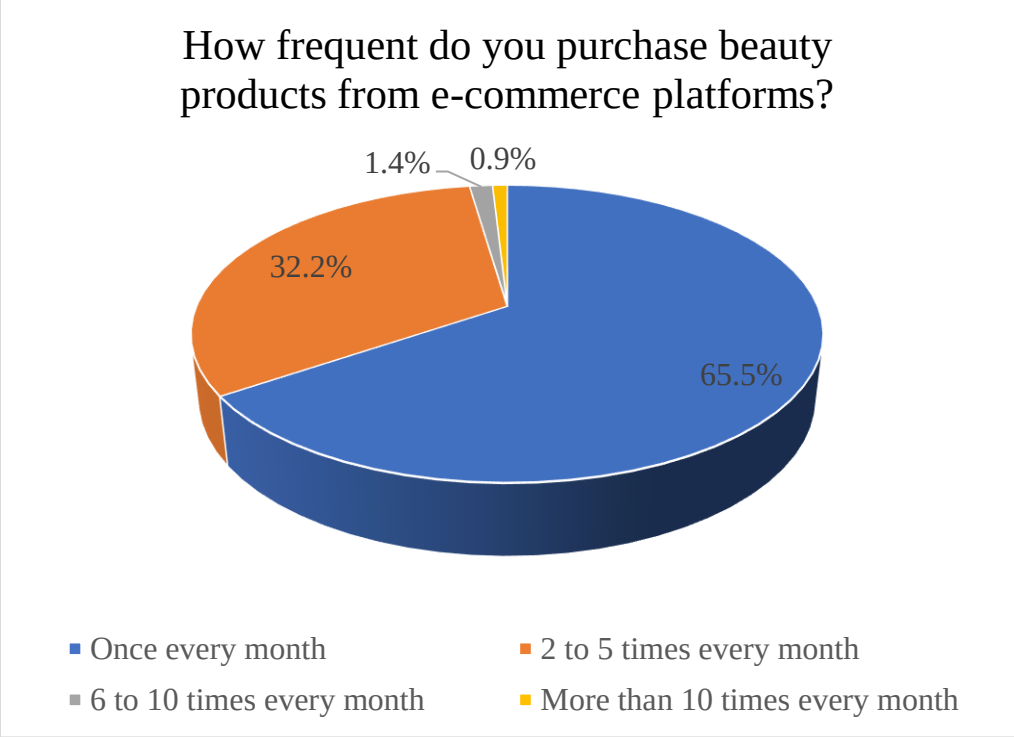
Education Level	Frequency	Percent (%)
High school	20	5.7
Certificated/Foundation/A-Level	31	8.9
Bachelor's degree/Diploma	287	82.5
Master/PhD	10	2.9
Total	348	100

Source: Developed for research

Figure 4.4 and Table 4.4 have shown the education level of the 348 respondents that participated in this study. Based on the data, most of the respondents hold a bachelor's degree or diploma, that is 287 respondents, amounting to 82.5% of the total sample. Followed by 31 respondents (8.9%) who were certificated, foundation, or A-Level certificate holders. In this research, 20 respondents (5.7%) had high-school certificates while the remaining 10 (2.9%) were Master or PhD holders.

4.3.2.4 Frequency of Online Beauty Purchases

Figure 4.5: Frequency of Online Beauty Purchases (N=348)



Source: Developed for research

Table 4.5: Frequency of Online Beauty Purchases (N=348)

Frequency of Online Beauty Purchases	Frequency	Percent (%)
Once every month	228	65.5
2 to 5 times every month	112	32.2
6 to 10 times every month	5	1.4
More than 10 times every month	3	0.9
Total	348	100

Source: Developed for research

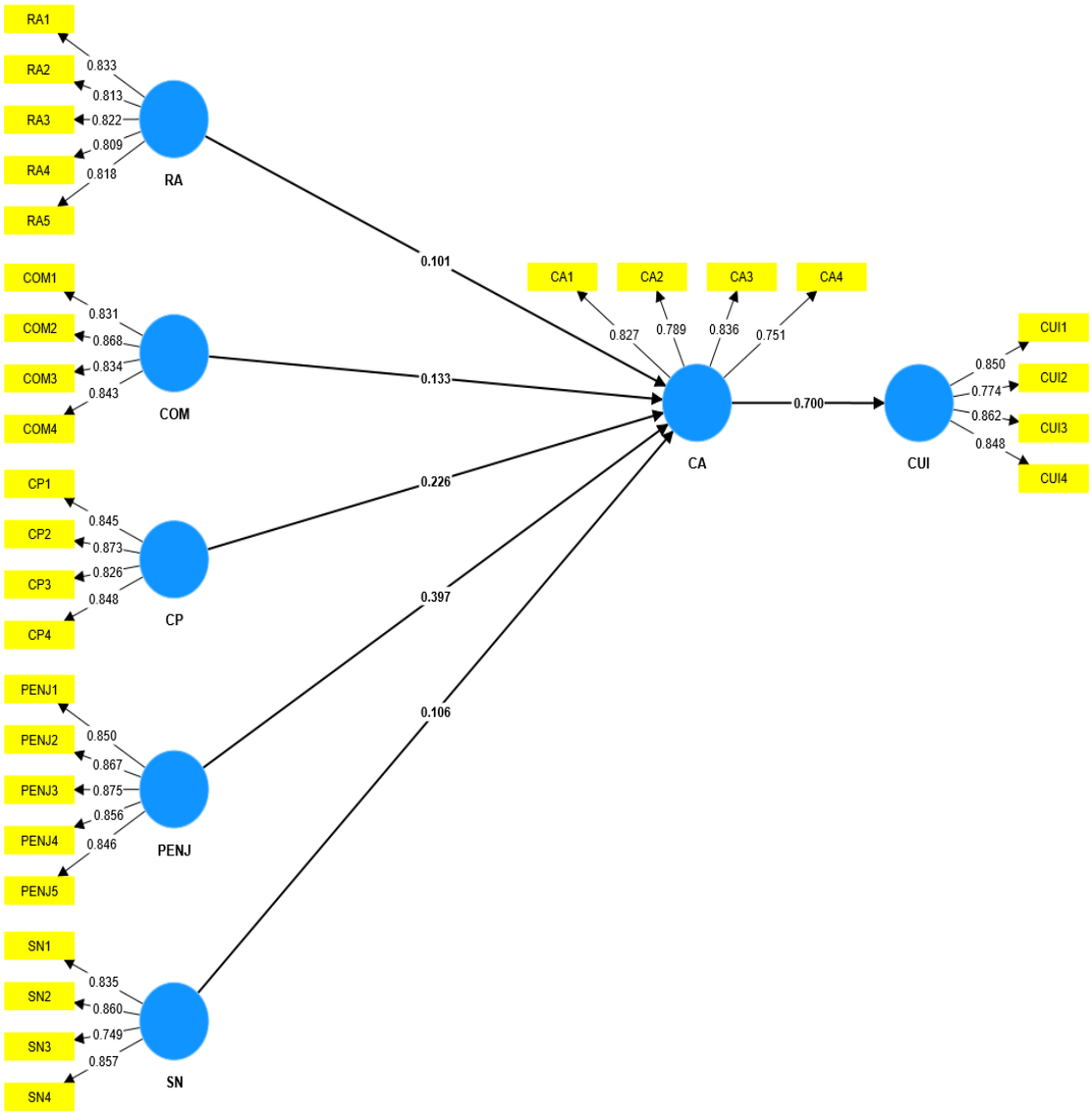
Figure 4.5 and Table 4.5 illustrated the frequency of beauty purchases made on e-commerce platforms by the respondents. The majority of the respondents made beauty purchases once a month, that is 228 respondents (65.5%), followed by 112 respondents (32.2%) who made online beauty purchases 2 to 5 times every month. Furthermore, 5 respondents (1.4%) made 6 to 10 beauty purchases on e-commerce platforms every month. Only 3 respondents (0.9%) purchased beauty products more than 10 times every month from the e-commerce platforms.

4.4 Measurement Model

4.4.1 Indicator Reliability

The outer loadings of all indicators within each construct were acceptable, with values above 0.708 in accordance with Hair et al. (2021). The outer loadings ranged from 0.749 to 0.875, as shown in Table 4.6 and Figure 4.6. Therefore, no indicators are removed from this study.

Figure 4.6: Indicator Reliability Result



Source: Developed for research

Table 4.6: Indicator Reliability Result

Variables	Indicators	Indicator's Outer Loadings
Relative Advantage	RA1	0.833

	RA2	0.813
	RA3	0.822
	RA4	0.809
	RA5	0.818
Compatibility	COM1	0.831
	COM2	0.868
	COM3	0.834
	COM4	0.843
Complexity	CP1	0.845
	CP2	0.873
	CP3	0.826
	CP4	0.848
Perceived Enjoyment	PENJ1	0.850
	PENJ2	0.867
	PENJ3	0.875
	PENJ4	0.856
	PENJ5	0.846
Subjective Norm	SN1	0.835
	SN2	0.860
	SN3	0.749
	SN4	0.857
Consumers' Attitude	CA1	0.827
	CA2	0.789
	CA3	0.836
	CA4	0.751
Consumers' Usage Intention	CUI1	0.850
	CUI2	0.774
	CUI3	0.862
	CUI4	0.848

Source: Developed for research

4.4.2 Internal Consistency Reliability

Table 4.7 illustrated the results of composite reliability (CR) and Cronbach's Alpha of the measurement model. The composite reliability for all constructs were between 0.878 and 0.934, which were above 0.70 and below 0.95; therefore, they were measured as good reliability as per recommended by Hair et al. (2021). Perceived enjoyment obtained the highest composite reliability of 0.934, followed by complexity (0.911), relative advantage (0.911), compatibility (0.908), consumers' usage intention (0.901), subjective norm (0.896), and consumers' attitude (0.878).

Apart from that, the Cronbach's Alpha for all constructs in present study ranged between 0.814 to 0.911, which was considered as acceptable internal consistency reliability (Hair et al., 2015; Hair et al., 2021). The Cronbach's Alpha for the construct of perceived enjoyment is 0.911, which was considered as having an excellent internal consistency reliability. On the other hand, relative advantage had the Cronbach's Alpha of 0.877, followed complexity (0.870), compatibility (0.866), consumers' usage intention (0.854), subjective norm (0.847), and consumers' attitude (0.814) were considered as having very good internal consistency reliability.

Table 4.7: Internal Consistency Reliability Result

Constructs	**Composite Reliability (rho_c)**	**Cronbach's alpha**
Relative Advantage	0.911	0.877
Compatibility	0.908	0.866
Complexity	0.911	0.870
Perceived Enjoyment	0.934	0.911

Subjective Norm	0.896	0.847
Consumers' Attitude	0.878	0.814
Consumers' Usage Intention	0.901	0.854

Source: Developed for research

4.4.3 Convergent Validity

Table 4.8 shows the AVE value of each construct. According to Hair et al. (2021), the minimum acceptable value of the average variance extracted (AVE) is 0.5. Furthermore, the AVE value of 0.5 or higher indicates that the construct explains 50% or more of the variance of the indicators that make up the construct (Hair et al., 2021). In this study, perceived enjoyment has the highest convergent validity as it has the highest AVE value of 0.738. This implies that complexity explains 73.8% of the variance.

Table 4.8: Convergent Validity Result

Constructs	**Average Variance Extracted (AVE)**
Relative Advantage	0.671
Compatibility	0.713
Complexity	0.720
Perceived Enjoyment	0.738
Subjective Norm	0.683
Consumers' Attitude	0.642
Consumers' Usage Intention	0.696

Source: Developed for research

Table 4.9 portrays the summary of construct reliability and validity which includes the value of indicators loadings, Cronbach's Alpha, rho_a, composite reliability (rho_c), and average variance extracted.

Table 4.9: Summary of Constructs Reliability and Validity

Variables	Indicators	Outer Loadings	Cronbach's Alpha	rho_a	Composite Reliability (rho_c)	AVE
Relative Advantage	RA1	0.833	0.877	0.878	0.911	0.671
	RA2	0.813				
	RA3	0.822				
	RA4	0.809				
	RA5	0.818				
Compatibility	COM1	0.831	0.866	0.867	0.908	0.713
	COM2	0.868				
	COM3	0.834				
	COM4	0.843				
Complexity	CP1	0.833	0.870	0.871	0.911	0.72
	CP2	0.873				
	CP3	0.826				
	CP4	0.848				
Perceived Enjoyment	PENJ1	0.85	0.911	0.911	0.934	0.738
	PENJ2	0.867				
	PENJ3	0.875				
	PENJ4	0.856				
	PENJ5	0.846				
Subjective Norm	SN1	0.835	0.847	0.852	0.896	0.683
	SN2	0.86				
	SN3	0.749				
	SN4	0.857				
Consumers' Attitude	CA1	0.827	0.814	0.817	0.878	0.642
	CA2	0.789				
	CA3	0.836				
	CA4	0.751				
Consumers' Usage Intention	CUI1	0.85	0.854	0.865	0.901	0.696
	CUI2	0.774				
	CUI3	0.862				
	CUI4	0.848				

Source: Developed for research

4.4.4 Discriminant Validity

Table 4.10 and Figure 4.7 demonstrated the value of Heterotrait-monotrait ratio (HTMT) of correlation for the measurement model. According to Garson (2016), the discriminant validity of a research can be detected by the threshold value of HTMT, where the value below 0.85 is considered as a more conservative approach while value below 0.90 is acceptable.

Table 4.10: HTMT Results

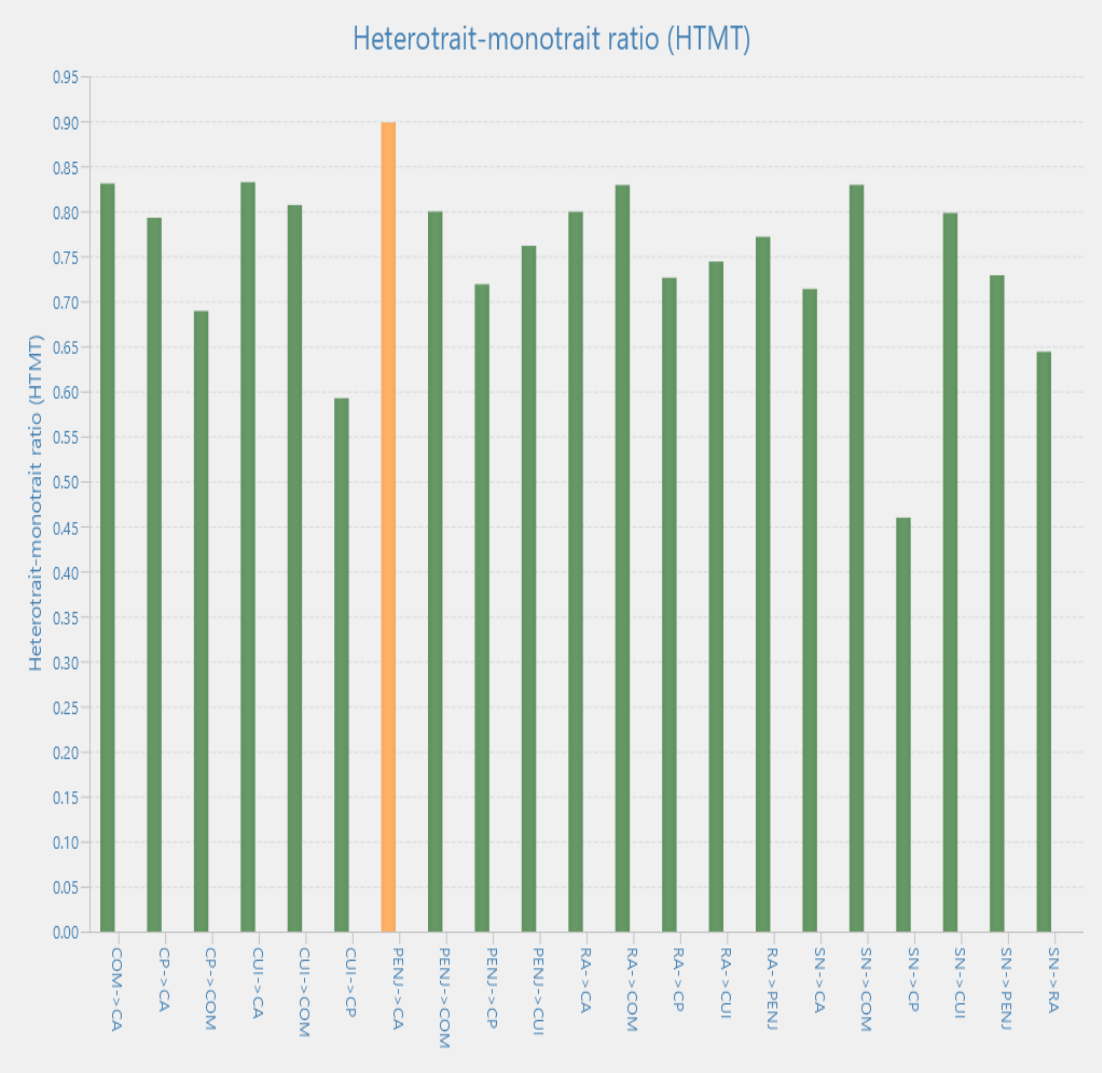
	CA	**COM**	**CP**	**CUI**	**PENJ**	**RA**	**SN**
CA							
COM	0.831						
CP	0.793	0.689					
CUI	0.832	0.807	0.592				
PENJ	**0.899**	0.800	0.719	0.761			
RA	0.799	0.829	0.726	0.744	0.772		
SN	0.714	0.829	0.460	0.798	0.729	0.644	

Source: Developed for research

Notes:

a) CA: Consumers' Attitude; COM: Compatibility; CP: Complexity; CUI: Consumers' Usage Intention; PENJ: Perceived Enjoyment; RA: Relative Advantage; SN: Subjective Norm
b) HTMT values below 0.85 and 0.90 criterion.

Figure 4.7: HTMT Results



Source: Developed for research

Notes:

a) HTMT values below 0.85 and 0.90 criterion.

Based on Table 4.10 and Figure 4.7, the majority of the constructs have fulfilled the threshold value of below 0.85, which is the more conservative cut-off value

recommended by Henseler et al. (2015). However, there was 1 correlation between the constructs having a HTMT value of 0.899, which was above 0.85 but lower than 0.90. The value was acceptable according to the HTMT90 threshold value.

4.5 Inferential Analysis

After examining the reliability and validity of the constructs, the PLS-SEM has been developed to investigate the relationship among the various constructs. The assessment of the structural model had been analyzed as below:

4.5.1 Structural Model Assessment

4.5.1.1 Collinearity Statistic

Table 4.11 illustrated the variance inflated factor (VIF) values for the structural model. The constructs of the compatibility had a VIF value of 3.290, which indicated the presence of collinearity issue. However, according to Hair et al. (2019), the VIF value between 3 and 5 are usually not critical which is considered acceptable. Furthermore, the VIF values of the remaining indicators were all below 3, which were in line with the recommendation of Hair et al. (2019). The maximum VIF value in this study was 3.290 while the lowest VIF value was 1.000. Therefore, collinearity is not a problematic issue for present study.

Table 4.11: VIF Results

Constructs	Indicators	VIF Outer Value	VIF Inner Value
Relative Advantage	RA1	2.282	2.611
	RA2	2.041	
	RA3	2.091	
	RA4	1.954	
	RA5	2.004	
Compatibility	COM1	1.990	3.290
	COM2	2.310	
	COM3	1.899	
	COM4	2.120	
Complexity	CP1	2.139	2.026
	CP2	2.534	
	CP3	1.926	
	CP4	2.086	
Perceived Enjoyment	PENJ1	2.475	2.832
	PENJ2	2.680	
	PENJ3	2.762	
	PENJ4	2.516	
	PENJ5	2.375	
Subjective Norm	SN1	2.714	2.317
	SN2	2.747	
	SN3	1.337	
	SN4	2.392	
Consumers' Attitude	CA1	2.085	1.000
	CA2	1.766	
	CA3	2.032	
	CA4	1.614	
	CUI1	2.032	-

Consumers' Usage Intention	CUI2	1.732	
	CUI3	2.185	
	CUI4	2.053	

Source: Developed for research

4.5.1.2 Coefficient of Determination

Table 4.12 presented the coefficient of determination (R^2) of the endogenous constructs, consumers' attitude (CA), and consumers' usage intention (CUI). Both R^2 value and adjusted R^2 value in CA and CUI are acceptable based on the threshold value suggested by Hair et al (2021). The construct of CA has a R^2 value of 0.685 and adjusted R^2 value of 0.680, which indicated a moderate effect size. This means that the five (5) exogenous variables (RA, COM, CP, PENJ, SN) have explained 68.5% of the variance in the consumers' attitude towards the implementation of AR technology in beauty shopping application, while the remaining 31.5% is explained by other variables that are not being discussed in present study. However, the construct of CUI had a slightly weaker effect size with a R^2 value of 0.490 and adjusted R^2 value of 0.489. This implied that consumers' attitude explained 49.0% of the variance in consumers' usage intention while the remaining 51.0% is explained by other variables that are not included in present study.

Table 4.12: Coefficient of Determination Results

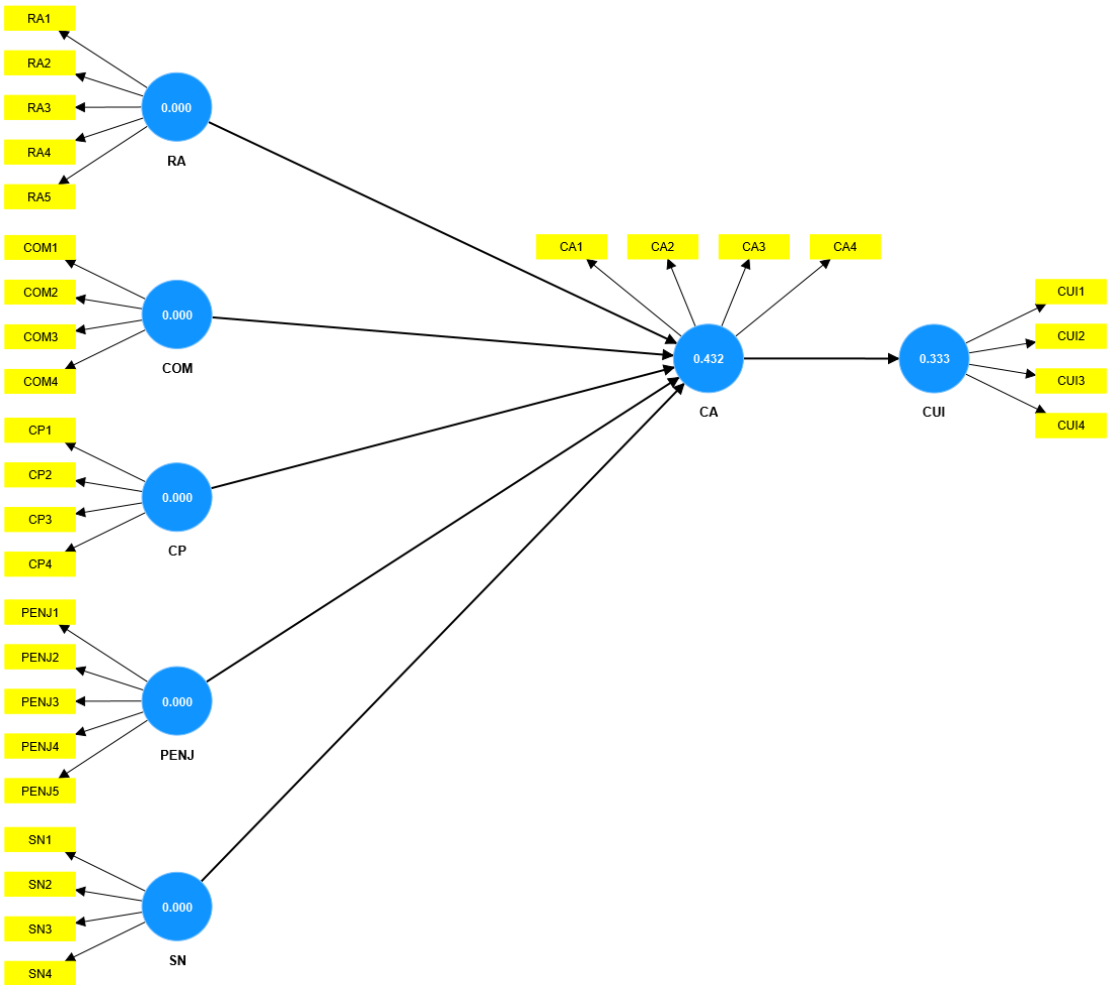
Constructs	R-Square	R-Square Adjusted
Consumers' Attitude	0.685	0.680
Consumers' Usage Intention	0.490	0.489

Source: Developed for research

4.5.1.3 Cross-Validated Redundancy

Figure 4.8 and Table 4.13 had shown the results of cross-validated redundancy (Q^2) for the structural model using blindfolding approach of PLS-SEM. The values of Q^2 in the endogenous constructs were greater than zero, which indicated predictive relevance in the structural model (Hair et al., 2014). The Q^2 value of the consumers' attitude was 0.432 while consumers' usage intention held a Q^2 value of 0.333, which fulfilled the threshold value of greater than zero. Thus, both CA and CUI had a good predictive relevance.

Figure 4.8: Cross-Validated Redundancy Results



Source: Developed for research

Table 4.13: Cross-Validated Redundancy Results

	SSO	SSE	Q^2 (=1-SSE/SSO)
Consumers' Attitude	1,392.000	790.821	0.432
Consumers' Usage Intention	1,392.000	928.926	0.333
Relative Advantage	1,740.000	1,740.000	-
Compatibility	1,392.000	1,392.000	
Complexity	1,392.000	1,392.000	
Perceived Enjoyment	1,740.000	1,740.000	
Subjective Norm	1,392.000	1,392.000	

Source: Developed for research

4.5.1.4 Path Coefficient

Table 4.14 demonstrated the value of path coefficient (β) among the endogenous and exogenous variables while Figure 4.9 illustrated the PLS path model of consumers' attitude and usage intention. Huber et al. (2007) and Mohammad et al. (2018) had stated that the path coefficient value must be at least 0.100.

Table 4.14: Path Coefficient Results

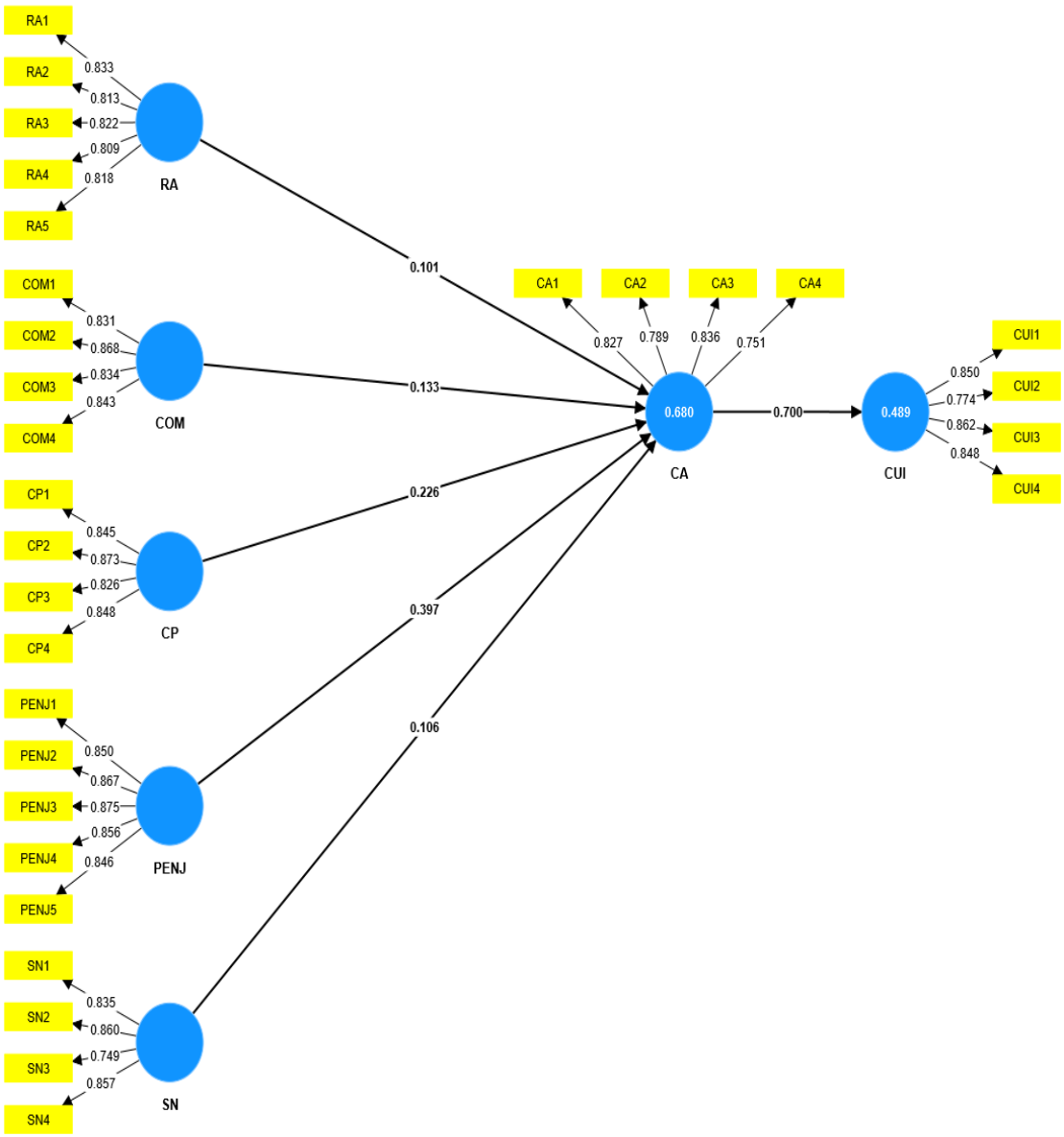
Hypotheses	Relationship	Path Coefficient (β)
H1	RA -> CA	0.101
H2	COM -> CA	0.133
H3	CP -> CA	0.226
H4	PENJ -> CA	0.397
H5	SN -> CA	0.106
H6	CA -> CUI	0.700

Source: Developed for research

Notes:

a) RA: Relative Advantage; COM: Compatibility; CP: Complexity; PENJ: Perceived Enjoyment; SN: Subjective Norm; CA: Consumers' Attitude; CUI: Consumers' Usage Intention

Figure 4.9: Path Model



Source: Developed for research

Based on Table 4.14 and Figure 4.9, the construct of consumers' attitude had the highest path coefficient value of 0.700 towards consumers' usage intention. On the other hand, among the independent variables, perceived enjoyment had the highest path coefficient value of 0.397 towards consumers' attitude. Furthermore, the path coefficient values of all six (6) hypothesized relationship (H1, H2, H3, H4, H5, H6) were greater than 0.1, as per the recommended value by Mohammad et al. (2018). Therefore, they fulfilled the minimum threshold value of 0.100 ($\beta \geq 0.1$).

4.6 Mediator Testing

In this research, the mediation effect of consumers' attitude is done through the bootstrapping procedure of PLS-SEM. According to the readings in Table 4.15, the results of mediating effect were discovered and tabulated in Table 3.16.

Table 4.15: Direct and Indirect Effects of Variables

	Original Sample (O)	**Sample Mean (SM)**	**Standard Deviation (STDEV)**	**T-statistics (|O/STDEV|)**	**P-values**
RA -> CA -> CUI (p1 · p2)	0.071	0.071	0.045	1.580	**0.114**
RA -> CUI (p3)					
COM -> CA -> CUI (p1 · p2)	0.093	0.093	0.051	1.833	**0.067**
COM -> CUI (p3)					
CP -> CA -> CUI (p1 · p2)	0.158	0.160	0.033	4.790	0.000
CP -> CUI (p3)					

PENJ -> CA -> CUI (p1 · p2)	0.278	0.279	0.047	5.961	0.000
PENJ -> CUI (p3)					
SN -> CA -> CUI (p1 · p2)	0.074	0.076	0.032	2.353	0.019
SN -> CUI (p3)					

Source: Developed for research

Notes:

a) RA: Relative Advantage; COM: Compatibility; CP: Complexity; PENJ: Perceived Enjoyment; SN: Subjective Norm; CA: Consumers' Attitude; CUI: Consumers' Usage Intention

Table 4.16: Summary of Results of Mediator Test

	Significance of p1 · p2	**Significance of p3**	**Mediating Effect**
RA	Not Significant	Not Significant	No Mediation
COM	Not Significant	Not Significant	No Mediation
CP	Significant	Significant	Partial Mediation
PENJ	Significant	Significant	Partial Mediation
SN	Significant	Significant	Partial Mediation

Source: Developed for research

Notes:

b) RA: Relative Advantage; COM: Compatibility; CP: Complexity; PENJ: Perceived Enjoyment; SN: Subjective Norm; CA: Consumers' Attitude; CUI: Consumers' Usage Intention

Based on Table 4.16, consumers' attitude (Mediator) does not mediate between RA and CUI as well as COM and CUI. On the other hand, consumers' attitude partially

mediates the relationships between CP and CUI, PENJ and CUI, as well as SN and CUI.

4.7 Hypothesis Testing

In this research, hypotheses testing is done through the bootstrapping procedure of PLS-SEM to estimate standard errors, t-statistic, p-value, and confidence intervals of the structural model coefficients. Present study had used a sub-sample of 5000 to assess the sample mean and a significance level of 0.05 (two-tailed); therefore, the t-statistic should be greater than the value of 1.96 so that the hypotheses can be accepted (Hair et al., 2019). To add on, p-values that are smaller than 0.05 are deemed to be statistically significant. In this study, t-statistic values and p-values were calculated and observed to assess the significance of path coefficient. A total of six (6) hypotheses had been proposed in the structural model. Table 4.15 shows the tabulated result of the hypotheses testing.

Table 4.17: Hypotheses Testing Results

Relationship	Path Coefficient (β)	Sample Mean (M)	Standard Deviation (STDEV)	T statistics (|O/STDEV|)	P-Values	Interference
H1: RA -> CA	0.101	0.100	0.062	1.617	0.106	Non-significant
H2: COM -> CA	0.133	0.133	0.073	1.826	0.068	Non-significant
H3: CP -> CA	0.226	0.228	0.045	5.049	0.000***	Significant
H4: PENJ -> CA	0.397	0.396	0.059	6.723	0.000***	Significant
H5: SN -> CA	0.106	0.108	0.044	2.408	0.016*	Significant
H6: CA -> CUI	0.700	0.703	0.044	15.795	0.000***	Significant

Source: Developed for research

Notes:

a) RA: Relative Advantage; COM: Compatibility; CP: Complexity; PENJ: Perceived Enjoyment; SN: Subjective Norm; CA: Consumers' Attitude; CUI: Consumers' Usage Intention
b) Significant at ***p<0.001; **p<0.01; *p<0.05
c) P-value below 0.05 (p<0.05); t-statistic value more than 1.96 (t>1.96) criterions.

According to Table 4.17, four out of six hypotheses have a significant relationship with their respective endogenous variables. The result has shown that the four hypothesized path relationship have a p-value less than 0.05 (p<0.05), which means that the exogenous variables (CP, PENJ, SN) are statistically significant towards consumers' attitude. Meanwhile, the relationship between consumers' attitude and consumers' usage intention was proven to be statistically significant with a p-value of 0.000 (p<0.05). On the other hand, two out of six hypotheses (H1, H2) do not have significant relationships with the endogenous variable of consumers' attitude. The hypothesized path relationship between RA and CA had a path coefficient value of 0.101, p-value of 0.106 (p>0.05), and t-statistic value of 1.617 (t<1.96). Whereas the hypothesized path relationship between COM and CA had a path coefficient value of 0.133 (β<0.1), p-value of 0.068 (p>0.05), and t-statistic value of 1.826 (t<1.96). Therefore, it can be concluded that CA is the predictor of CUI whilst CP, PENJ, and SN are the predictors of CA. RA and COM do not predict CA.

The relationship between relative advantage and consumers' attitude (H1) is rejected by a path coefficient value of 0.101, t-statistics value of 1.617 (t<1.96), and p-value of 0.106 (p>0.05), that is non-significant. Next, the relationship between compatibility and consumers' attitude (H2) is also rejected with a path coefficient value of 0.1388 statistics value of 1.826 (t<1.96), and p-value of 0.068 (p>0.05), which implies non-significant. Further, the relationship between complexity and consumers' attitude (H3)

is positive related and highly statistically significant with a path coefficient value of 0.226, t-statistics value of 5.049 ($t>1.96$), and p-value of 0.000 ($p<0.05$). Likewise, the relationship between perceived enjoyment and consumers' attitude (H4) is supported by the path coefficient value of 0.397, t-statistics value of 6.723 ($t>1.96$), and p-value of 0.000 ($p<0.05$), that shows that it is positive related and highly statistically significant. On top of that, the relationship between subjective norm and consumers' attitude (H5) is positive related and highly statistically significant with a path coefficient value of 0.106, t-statistics value of 2.408 ($t>1.96$), and p-value of 0.016 ($p<0.05$). Finally, the relationship between consumers' attitude and consumers' usage intention has a highly positive relation and extremely statistically significance, supported by a path coefficient value of 0.7, t-statistics value of 15.795 ($t>1.96$), and p-value of 0.000 ($p<0.05$). Thus, four hypotheses have been accepted and supported while two hypotheses have been rejected.

4.8 Summary

In this chapter, a comprehensive descriptive and inferential analysis of the research model has been presented. The descriptive analysis provided an interpretation of the respondents' demographic profile and general information, while the inferential analysis evaluated the outcomes of both measurement model and structural model. The reliability and validity of all indicators have been tested through the measurement model assessment and none of the items were removed. Apart from that, the result of the structural model assessment indicated that H3, H4, H5, and H6 were accepted and supported.

CHAPTER 5: DISCUSSION, CONCLUSION AND IMPLICATIONS

5.0 Introduction

This chapter discusses the results obtained from the analysis conducted in the previous chapter. It will begin with a brief overview of the statistical analysis summary, followed by a discussion of the significant findings, implications, and limitations of the research. On top of that, this study discusses the recommendations for future research and will be concluded with a chapter summary.

5.1 Discussion of Major Findings

The objective of the current study is to investigate the factors that impact the usage intention of Augmented Reality beauty shopping applications in Malaysia. A total of six hypotheses have been proposed in this study and the findings are summarized as below:

Table 5.1: Summary of the Hypotheses Testing Results

Hypotheses	Value Scored	Result
H1: There is a significant relationship between relative advantage and consumers' attitude towards AR beauty shopping application.	$\beta = 0.101$ $p = 0.106$	Not supported

H2: There is a significant relationship between compatibility and consumers' attitude towards AR beauty shopping application.	$\beta = 0.133$ $p = 0.068$	Not supported
H3: There is a significant relationship between complexity and consumers' attitude towards AR beauty shopping application.	$\beta = 0.226$ $p < 0.001$***	Supported
H4: There is a significant relationship between perceived enjoyment and consumers' attitude towards AR beauty shopping application.	$\beta = 0.397$ $p < 0.001$***	Supported
H5: There is a significant relationship between subjective norm and consumers' attitude towards AR beauty shopping application.	$\beta = 0.106$ $p < 0.05$*	Supported
H6: There is a significant relationship between consumers' usage intention towards AR beauty shopping application.	$\beta = 0.700$ $p < 0.001$***	Supported

Source: Developed for research

Table 5.2: Summary of Results of Mediator Test

Indirect Effect	**Mediating Effect**
Between Relative Advantage and Usage Intention via Attitude	No Mediation
Between Compatibility and Usage Intention via Attitude	No Mediation
Between Complexity and Usage Intention via Attitude	Partial Mediation
Between Perceived Enjoyment and Usage Intention via Attitude	Partial Mediation
Between Subjective Norm and Usage Intention via Attitude	Partial Mediation

Source: Developed for research

Notes:

a) RA: Relative Advantage; COM: Compatibility; CP: Complexity; PENJ: Perceived Enjoyment; SN: Subjective Norm; CA: Consumers' Attitude; CUI: Consumers' Usage Intention

5.1.1 Findings on Hypotheses

H1: There is a significant relationship between Relative Advantage (RA) and Consumers' Attitude (CA) towards AR beauty shopping application.

Based on Table 5.1, the results suggested that RA does not have any impact on consumers' attitude towards AR in beauty shopping applications. This is supported by the p-value of 0.196 ($p>0.05$), indicating that H1 is invalid and not statistically significant in this study. This outcome contradicted the previous study of Zendehdel et al. (2015) that claimed that RA significantly predicts users' attitude to purchase online. However, prior studies have also discovered that RA was found to be an insignificant factor in the acceptance of technological innovation such as cloud computing adoption (Alhammadi et al. 2015) and RFID technology acceptance in manufacturing. Past findings suggested that the reason to this scenario was due to potential adopters were less aware and familiar towards the innovation; thus, generating uncertainties (Wang et al., 2010). Therefore, in the context of present study, one possible reason for this may be that the beauty online shoppers in Malaysia are not aware of the AR technology implemented in the beauty shopping applications, forming less favorable attitude towards the usage of the AR technology in beauty shopping application.

H2: There is a significant relationship between Compatibility (COM) and Consumers' Attitude (CA) towards AR beauty shopping application.

According to Table 5.1, the results presented that COM does not have any effect on CA, with a p-value of 0.068, which is above the threshold value 0f 0.05. This means that H2 is invalid and is not statistically significant in this study. This

outcome goes against the findings of previous study of Zendehdel et al. (2015) that discovered that COM significantly predicts users' attitude to purchase online. However, past studies have also found that COM is insignificant in shaping CA (Lee & Chow, 2020). This may be resulted from the restricted accessibility of certain products and the inability to physically experience them before making purchases; hence, causing consumers to perceive a lack of compatibility when shopping online (Lee & Chow, 2020). Therefore, in the context of present study, one possible reason for this may be that the beauty online shoppers in Malaysia prefer trying on the beauty products in physical stores and that the implementation of AR in beauty shopping application is not compatible with their lifestyle or the way they like shopping.

H3: There is a significant relationship between Complexity (CP) and Consumers' Attitude (CA) towards AR beauty shopping application.

Results in Table 5.1 shows that CP has a β-value of 0.226 and a p-value of 0.000 ($p<0.01$), indicating a positive relation between CP and CA. This is consistent with the findings of prior studies of Ntemana & Olatokun (2012), Olatokun & Igbinedion (2009), and Vouk (2008), that stated that complexity was significant in influencing users' attitude. The is because the lower the complexity, the higher the tendency and intention to adopt an innovation (Ntemana & Olatokun, 2012). In other words, low complexity of innovation affects consumers' attitude to adopt an innovation. In this case, if consumers or users perceived that it is easy and not complex in learning and using the AR beauty shopping application, they would adopt it and use it for online beauty shopping.

H4: There is a significant relationship between Perceived Enjoyment (PENJ) and Consumers' Attitude (CA) towards AR beauty shopping application.

Based on the results shown in Table 5.1, the β-value and p-value of PENJ is 0.397 and 0.000 ($p<0.01$) respectively, which shows that there is a significant relationship between PENJ and CA. PENJ is also the most important predictor of CA that contributed the highest influence towards consumers' attitude in the usage of AR beauty shopping application. The result of current study is consistent with the previous studies of Al-Aulamie et al. (2012) and Cabada et al. (2017), and Kasilingam (2020), that presented that perceived enjoyment led to positive attitude towards innovation such as information system. This means that users will feel good if they perceive that the innovations are entertaining, fun, and enjoyable.

H5: There is a significant relationship between Subjective Norm (SN) and Consumers' Attitude (CA) towards AR beauty shopping application.

According to Table 5.1, the results supported H5 with a β-value of 0.106 and a p-value of 0.016 ($p<0.05$), indicating a significant relationship between SN and CA. This is consistent with the past studies of Bananuka et al. (2020) and Kaushik et al. (2015), that mentioned that SN is positive and significantly correlated with users' attitude towards technology adoption. This shows the influence of family, friends, and media will affect the attitude of users in adopting an innovation. Therefore, the outcome of the present study is acceptable.

H6: There is a significant relationship between Consumers' Attitude (CA) and Consumers' Usage Intention (CUI) towards AR beauty shopping application.

The final hypothesis (H6) is accepted in the present study with a β-value of 0.700 and p-value of 0.000 ($p<0.001$). This means that CA significantly influences CUI towards AR beauty shopping application. This finding is in accordance with the prior studies that mentioned that attitude significantly influenced the intention to use and adopt technology such as chatbot technologies for mobile shopping (Kasilingam, 2020) and online shopping (Aldhmour & Sarayrah, 2016; Ramadania & Braridwan, 2019). In the context of current study, it is said that beauty purchasers who have positive attitude towards AR beauty shopping application would intend to use the functions provided to purchase beauty products. Thus, the present study further validated the significant effect of attitude towards consumers' usage intention.

5.2 Implications of Study

5.2.1 Theoretical Implication

The conceptual framework of the present study was designed based on the theoretical framework of both Technology Acceptance Model (TAM) and Diffusion of Innovation Theory (DIT). This study aims to examine how consumers' attitude can be affected by five constructs (RA, COM, CP, PENJ, SN) and further influences the usage intention towards the AR beauty shopping application.

Firstly, the present study attempted to understand the feasibility and usefulness of AR beauty shopping application from the consumers' perspective. This is because

the innovation has not been explored among academicians, particularly in the context of users' acceptance that reside in Malaysia. This signified the lack of insights and information concerning the consumers' perspective on AR services provided in the beauty e-commerce, especially in Malaysia. Thus, the current study contributed to decreasing the literature and knowledge gaps by providing more insights on the awareness and acceptance of such innovation. Remarkably, this study could provide guidance and be used as a reference for future studies in a similar field.

Apart from that, results discovered by the present study contribute additional evidence to the applicability of both TAM and DIT model in the context of AR technology acceptance. Modification of any research model is imperative to nourish the models' pertinence and appositeness. In other words, it is to keep the model related to the constantly changing environment. Based on the findings of current research, the constructs of relative advantage and compatibility from DIT was found to be insignificant towards the consumers' attitude on innovation adoption. Therefore, future researchers may consider replacing these variables with other possible variables that may have significant impact on consumers' adoption of new innovation or technology.

5.2.2 Managerial Implication

Current research findings suggested several managerial implications and contributions for players in the beauty sector. Firstly, based on the study, consumers are willing to use the AR beauty shopping application if it is not complex. In other words, a user-friendly, easy navigation, and well-functioning system are the key elements that should be taken into consideration when designing and developing the program to attract consumers' usage. As an example, dividing the categories clearly with accurate navigation titles so that consumers can easily search for their desired try-on products to try it on virtually. Not only that, but the checkout process

should be simple, clear-cut, and easy to navigate. This is to elevate user experience as well as improving the conversion rate.

Apart from that, perceived enjoyment is also proven to have the strongest influence towards consumers' attitude towards the AR beauty shopping application. This means that consumers are looking forward to AR filters that are fun and enjoyable to use. Therefore, program developers and designers of beauty brands are suggested to develop appropriate mechanisms to attract and increase consumers' visitations to try out the AR filters. For example, enhancing the system in terms of designs or functionality, so that it becomes more realistic, immersive, and interactive to the consumers. On top of that, the beauty firms can also design the system in a way that users are able to combine and try out all beauty products such as foundation, blushers, lipsticks, hair dyes and more together at once. This may increase consumers' experience as they can try several make-up combinations at once instead of trying it on one-by-one virtually, which requires more time and effort.

The results also signified that subjective norms have an effect on consumers' attitude and usage intention towards AR shopping application. Therefore, beauty brands should identify individuals with strong personal influence on the targeted community to motivate them on trying out the AR shopping application. For instance, beauty brands can collaborate or hire with social influencers such as KOLs to advertise and promote the AR services provided on the shopping platform. Not only that, but the beauty brands should also utilize the social media platforms such as Facebook, Instagram, and TikTok, to promote and advertise their AR services. This is because social media is a less expensive yet effective way for brands to receive as much traffic as they can, obtaining mainstream media attention.

5.3 Limitations of Study

Like any other research, there are several constraints and limitations of this thesis that should be taken into consideration.

5.3.1 Generalized Approach towards Beauty Products

Current research focuses on beauty products in general, which covers a broad range of products such as make-up and haircare products. In other words, the present study did not specify the product category. However, different beauty products have different unique characteristics where users may have different preferences and expectations when they try on the AR filters provided on the AR beauty shopping platforms. For example, make-up products require more precise color matching compared to hair products such as hair dye. Therefore, different unique factors are required to examine the consumer acceptance towards AR technology for different product categories.

5.3.2 Lack of Beauty Brand Categorization

The present study did not categorize the beauty brands which could limit the ability to identify the differences in consumer acceptance of AR beauty shopping application based on the brands. This is because beauty brands can be categorized into different tiers based on factors such as price point and target audience. For example, when it comes to purchasing high-end or luxury beauty products such as Chanel or Dior, consumers may have different expectations and considerations to make purchase decision based on the virtual try-on effect provided by the AR technology on e-commerce platforms, as compared to when purchasing affordable

beauty products. By categorizing brands into different tiers, a more nuanced understanding of consumers' attitude and behavior towards the usage intention of AR beauty shopping application in making purchases can be observed.

5.3.3 Lack of Consideration of Certain Factors

For instance, the present study did not target a specific age group which may limit the ability to identify the differences in consumer acceptance of AR beauty shopping application based on age. However, different age groups may have different reactions, preferences, and considerations when it comes to using AR technology for beauty purchases. For example, the tech-savvy younger generation may be more comfortable with technology and have higher expectations for a seamless AR experience. On the other hand, the older consumers may have more concerns about security or privacy matters. In other words, the tendency and level to the acceptance of AR beauty shopping applications may vary based on age groups, where the younger are more likely to embrace the AR technology for beauty shopping, while older consumers may be more hesitant to AR adoption.

Not only that, but the younger generations are more likely to be interested in trying out different products and experimenting with their beauty routine as compared to the elder generation. However, as the younger consumers have limited financial resources which limits their purchasing ability, they may be more open to try on the products virtually through AR to select the best-suited ones. In contrast, the elder generation may have more established beauty routine and tend to stick with the products that they are familiar with, which make them less likely to see the value in using AR technology when making beauty purchases.

5.4 Recommendations for Future Research

The following proposed a few recommendations for the direction of future studies against the limitations of present study.

5.4.1 Focus on Specific Beauty Product Range

Future studies can tackle this limitation by focusing on a specific product category such as make-up or haircare to capture a more comprehensive understanding of how AR technology can be utilized across different beauty categories.

5.4.2 Categorize Beauty Brands

To address the limitation of lack of categorization of beauty brands, future researchers can consider classifying the brands based on factors such as price range and market positioning. For instance, future researchers may group brands into categories such as affordable, mid-range, and high-end. Another recommendation would be to focus solely on a specific category such as high-end beauty brands or drugstore beauty brands only. This would provide a more focused and detailed insight into the usage of AR technology within a specific beauty market segment. Not only that, but future study can also explore how consumers perceived the value of AR technology within different market segments. As an example, would consumers perceive the usage of AR technology for high-end beauty brands to be

more beneficial or whether it is equally valuable for both luxury and affordable beauty brands.

5.4.3 Explore Additional Constructs

Future research can consider adding moderators such as gender, age, income level, and education level, to see if these factors would affect the consumers' acceptance towards AR technology. For instance, future researchers could undergo interviews to ask more detailed questions about respondents' current beauty shopping behaviors, their willingness to try AR beauty shopping applications, and the factors that influence their purchase decisions. This can help businesses to identify whether the use of AR shopping beauty platforms helps in conversion rate. Not only that, but it is also important to note that generalizations and individual preferences may vary and that some elder generations may be just as interested in trying new beauty products as the younger ones. Therefore, other factors such as privacy concern, purchasing habits and comfort with technology, should be considered to gain a more accurate understanding of consumers' acceptance towards AR beauty shopping application. This could help businesses to make more informed decisions on leveraging the AR technology for beauty shopping and overcome potential barriers to adoption.

5.5 Conclusion

The present study attempted to understand the variables that affect consumers' acceptance towards AR beauty shopping application in Malaysia with the mediation of

consumers' attitude. To identify the factors, a comprehensive proposal was chartered with seven variables. The literature review of each variable has been discussed and covered in Chapter 2 while the methodology was outlined in Chapter 3. Based on the finding, the construct of attitude was found to have no mediation effect on relative advantage and compatibility.

In a nutshell, the present study has contributed some valuable insights and can be served as a guidance for future research to understand the factors affecting consumers' attitude in using AR beauty shopping application despite the presence of some limitations which could be enhanced in future studies.

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APPENDICES

Appendix A: Survey Questionnaire

TITLE OF RESEARCH:

CONSUMERS ACCEPTANCE TOWARDS AUGMENTED REALITY BEAUTY SHOPPING APPLICATION IN MALAYSIA

Dear respondents,

I am Rachel Lim Bei En, a final year undergraduate student who is currently pursuing Bachelor of International Business (HONS) at Universiti Tunku Abdul Rahman (UTAR). I would like to invite you to participate in this research by helping me to complete this questionnaire for my research entitled "Consumers Acceptance towards Augmented Reality Beauty Shopping Application in Malaysia". The purpose of this research is to study Malaysian consumers' awareness, attitude and acceptance towards Augmented Reality services provided in beauty shopping application.

Your participation in this study is on a voluntary basis. There is no known risks or direct benefits from participating in this research study. Please note that your personal data will **not** be collected from this questionnaire. Your response for this research study will be strictly confidential and will only be used for academic purposes.

Thank you very much for participating in this survey.

If you have any enquiries or need further clarification, please feel free to contact me via email rachellim0830@1utar.my

Again, I would like to express my gratitude for your time and cooperation in completing this survey.

Sincerely,

Rachel Lim Bei En

Faculty of Accountancy and Management (FAM)

Universiti Tunku Abdul Rahman (UTAR)

Section A: Filtering Section

Please tick (√) ONE answer that best represents you for each question below.

1. **Have you purchased beauty products from e-commerce platforms (e.g., Sephora, Shopee)?**
   - ☐ Yes
   - ☐ No

Section B: Demographic Information

Please tick (√) ONE answer that best represents you for each question below.

1. **Gender**
   - ☐ Male
   - ☐ Female

2. **Age**
   - ☐ 18 – 23 years old
   - ☐ 24 – 30 years old
   - ☐ 31 – 40 years old
   - ☐ 41 – 50 years old
   - ☐ 50 years old and above

3. **Education Level**
   - ☐ High school
   - ☐ Certificated/Foundation/A-Level
   - ☐ Bachelor's degree/Diploma
   - ☐ Master/PhD

4. How frequently do you purchase beauty products from e-commerce platforms?

- ☐ Once every month
- ☐ 2 to 5 times every month
- ☐ 6 to 10 times every month
- ☐ More than 10 times every month

Section C: Construct Measurement

This section is related to consumers' usage intention with relative advantage, compatibility, complexity, perceived enjoyment, subjective norms and attitude towards AR beauty shopping application.

Please indicate how strongly you agree or disagree with the statement from 1 to 5.

***(Strongly Disagree =1; Disagree = 2; Neutral = 3; Agree = 4; Strongly Agree = 5) ***

Relative Advantage

Definition: The degree to which a new product/innovation is superior to an existing one

Example: If you think e-wallet (new innovation) is better than cash payment, then relative advantage is high.

No.	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1.	I feel AR beauty shopping application would be better than traditional product display mode because it would improve my online shopping experience.	1	2	3	4	5
2	I feel AR beauty shopping application would be better than traditional product display mode because it would make beauty	1	2	3	4	5

	purchase decision making easier.					
3	I feel AR beauty shopping application would be better than traditional product display mode because it would allow a more efficient online shopping process.	1	2	3	4	5
4	I feel AR beauty shopping application would be better than traditional product display mode because it would be more beneficial to me when making beauty purchases.	1	2	3	4	5
5	I feel AR beauty shopping application would be better than traditional product display mode because it would be the best way for me to experience beauty online shopping.	1	2	3	4	5

Compatibility

Definition: Refers to the degree whereby the innovations are considered to be consistent with consumers' current lifestyles, values, purchasing style, and perceived needs.
Example: If shopping online fits your busy working lifestyle, compatibility is said to be high.

No.	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. 2	I feel like AR beauty shopping application would be	1	2	3	4	5

	compatible with my lifestyle.					
2	I feel like AR beauty shopping application would be compatible with my actual needs.	1	2	3	4	5
3	I feel like AR beauty shopping application would be compatible with the way I like online shopping.	1	2	3	4	5
4	I feel like AR beauty shopping application would be compatible with my current situation.	1	2	3	4	5

Complexity

Definition: Refers to the degree to which an innovation is perceived as difficult to understand and use.
Example: If you think it is easy to use e-wallet, complexity is low.

No.	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1.	I feel like AR beauty shopping application is easy to use.	1	2	3	4	5
2	I feel like AR beauty shopping application is easy to learn how to use.	1	2	3	4	5
3	I feel like AR beauty shopping application requires	1	2	3	4	5

	a little of mental effort to use.					
4	I believe that AR beauty shopping application is convenient to use.	1	2	3	4	5

Perceived Enjoyment

Definition: Refers to the perception that technology is enjoyable.
Example: If you think that using social media is enjoyable and interesting, perceived enjoyment is high.

No.	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1.	I think it is exciting to use AR beauty shopping application.	1	2	3	4	5
2	I find great pleasure in using AR beauty shopping application.	1	2	3	4	5
3	I think it is interesting to use AR beauty shopping application.	1	2	3	4	5
4	I think it is great enjoyment to use AR beauty shopping application.	1	2	3	4	5
5	I would have fun interacting with the AR beauty shopping application.	1	2	3	4	5

Subjective Norms

Definition: Refers to the belief that an important person or group of people will approve and support a particular behavior.
Example: If you think that your social circle is against smoking; thus, you do not smoke. Then, subjective norm is high.

No.	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1.	People who are important to me think that it will be good if I use AR beauty shopping application.	1	2	3	4	5
2	People who influence my thoughts and behavior will think it is good if I use AR beauty shopping application.	1	2	3	4	5
3	Media influences me to use AR beauty shopping application.	1	2	3	4	5
4	There are a lot of people around me who recommend me to use AR beauty shopping application.	1	2	3	4	5

Attitude

Definition: A feeling or emotion towards a fact or state (positive or negative).
Example: I am afraid of heights (negative feelings).

No.	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1.	I am positive about trying AR beauty shopping application.	1	2	3	4	5
2	I think using AR beauty shopping application is a good idea.	1	2	3	4	5
3	I think AR beauty shopping application is interesting that it makes you want to learn more about it.	1	2	3	4	5
4	I think other people should also use the AR beauty shopping application.	1	2	3	4	5

Intention to Use

Definition: Refers to the strength of an individual's intention to perform various specific behavior.
Example: Today, I will eat healthy food. (Having intention to eat healthy food)

No.	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1.	If I were to buy beauty products in the future, I would use AR beauty shopping application rather than another platform.	1	2	3	4	5
2	If I were to buy beauty products in the future, I would	1	2	3	4	5

	give AR beauty shopping application priority over physical stores.					
3	I will recommend others to use the AR beauty shopping application.	1	2	3	4	5
4	I will use AR beauty shopping application regularly in the future.	1	2	3	4	5

Appendix B: Frequencies Results for Demographic Profile

Frequency Table (SPSS)

Have you purchased beauty products from e-commerce platforms (e.g., Sephora, Shopee)?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	28	7.4	7.4	7.4
	Yes	348	92.6	92.6	100.0
	Total	376	100.0	100.0	

Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	280	80.5	80.5	80.5
	Male	68	19.5	19.5	100.0
	Total	348	100.0	100.0	

Age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18 - 23 years old	279	80.2	80.2	80.2
	24 - 30 years old	49	14.1	14.1	94.3
	31 - 40 years old	15	4.3	4.3	98.6
	41 - 50 years old	4	1.1	1.1	99.7
	50 years old and above	1	.3	.3	100.0
	Total	348	100.0	100.0	

Education Level

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Bachelor's degree/Diploma	287	82.5	82.5	82.5
	Certificated/Foundation/A-Level	31	8.9	8.9	91.4
	High school	20	5.7	5.7	97.1
	Master/PhD	10	2.9	2.9	100.0
	Total	348	100.0	100.0	

How frequent do you purchase beauty products from e-commerce platforms?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2 to 5 times every month	112	32.2	32.2	32.2
	6 to 10 times every month	5	1.4	1.4	33.6
	More than 10 times every month	3	.9	.9	34.5
	Once every month	228	65.5	65.5	100.0
	Total	348	100.0	100.0	