

A QUANTITATIVE STUDY ON THE ADOPTION OF
FACIAL RECOGNITION VIA SMARTPHONE IN
BANKING INDUSTRY, A MALAYSIAN
PERSPECTIVE

BY

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- (2) No portion of this FYP has been submitted in support of any application for any other degree or qualification of this or any other university, or other institutes of learning.
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LIST OF ABBREVIATIONS

- R Multiple Regression
- R² Multiple coefficient of determination/ R square
- SPSS Statistical Package for Social Sciences

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PREFACE

The current research project that is completed by me which constituted as a fulfilment of the requirement in pursuing the course of Bachelor of International Business (Hons). I had proposed “A quantitative study on the global adoption on facial recognition via smartphone in banking industry, a Malaysian perspective” as my topic of research project. In this paper, I had outlined few variables which the independent variables are perceived ease of use, perceived usefulness, awareness and security risk while the dependent variable is adoption of facial recognition.

This research would contributes to provide insights for the policy makers and financial institutions in term of understanding the main factors that affect the adoption of facial recognition in Malaysia. Thus, the policy makers and financial institutions are able to gain more knowledge and insights in developing facial recognition technology in Malaysia.

ABSTRACT

The main objective of conducting this research project is to bring awareness to nationwide application for facial recognition by all banks in East and West Malaysia. Therefore, various factors were investigated such as perceived ease of use, perceived usefulness, awareness and security will bring impact on the adoption of facial recognition. Quantitative method approach are used and 350 survey questionnaires are distributed to Malaysian that comes from different states by using convenient sampling technique. Among 130 surveys are hardcopy while 220 surveys are softcopy.

Through the use of Statistical Package for Social Science (SPSS), data that collected from the survey questionnaire are able to analyze. The results acquired from the SPSS shows that there is significant relationship between all independent variable towards the dependent variable. However, the variable awareness shown insignificant relationship towards the adoption of facial recognition. The research also mentioned about the limitations during the progress of research project and recommendation are provided for the future researchers.

CHAPTER 1: RESEARCH OVERVIEW

1.0 Introduction

The research intends to investigate on how the perceived ease of use, perceived usefulness, awareness and security affects the adoption of facial recognition in Malaysia. Chapter 1 of explains the research background, problem statement, questions for the research, the objectives of this study and justification or significance of the research.

1.1 Research background

1.1.1 Facial recognition

The emergence of facial recognition technology has become a striking way for the identification and verification purposes of a person's identity. (Introna & Nissenbaum) Based on technopedia, facial recognition is a technology for identification or verification of an individual facial features and store as a data by using the grid method and life captured.

1.1.2 Facial recognition in banking industry

Facial recognition is considered a common system for the population in China whenever they wish to proceed with payment. The country is embracing facial recognition technology, so that there will be no cash, no cards, no wallet, and no smartphone either. (Roxburgh, 2019) According to Ziegler and Braun (2019), they stated that this technology is used widely in China because every individual face is unique and unmistakable. Therefore, the possibilities for China in developing such technology as a part of daily life is high too.

Besides, Apple Company also implemented facial recognition technology in iPhone X since 2017. The face identification (Face ID) of the iPhone X depends on the unique characteristic of the user's face which is scan the face at first and recognize it later.

1.1.3 Facial recognition in Malaysia's banking industry

According to The Star Online, Malaysia Banking Bhd (Maybank) has launched its own facial recognition and voice recognition via their mobile Maybank2u App for the consumer as an authentication service. (Maybank launches face id and voice id for Maybank2u App, 2017) Thus, Maybank is the first bank that offer biometric login authentication features (fingerprint, facial recognition and voice recognition) on a financial mobile application.

Based on Datuk Hamirullah Boorhan, she claimed that the new biometrics capabilities are one of the group's strategy to strengthen its contribution in the digital world. This biometric capabilities can also meet the demands from the customers which are convenience and transaction speed.

In addition, OCBC also implemented facial biometric access (OCBC OneLook) for smartphones app. Such smartphone app only applicable for iPhone user who hold the new model of iPhone which runs the iOS12.1 operating system. (Dhesi, 2019) This facial biometric feature enable the users to access their own bank accounts, cards and investment easily.

On the other hand, Grab Company introduces facial recognition technology in its app. (Zainal, 2019). It is considered a necessary element for the first-time Grab user for one-time verification purposes. The application of facial recognition technology in Grab app is to enhance the safety of the drivers and passengers. Based on Grab, the verification method of the identity is through a live selfie option. (Grab, 2019) This passenger verification is a part of safety commitment which involved the collaboration with the Ministry of Transport in Malaysia that able to bring preventable incidents and increase the safety standards.

1.2 Problem statement

It is challenging for adoption of facial recognition technology to be successful as e-wallet in particular payment made at bank counters in Malaysia. Some Malaysians may face the problem of having limited knowledge about facial technology especially its

benefits while some are not aware of facial recognition technology existence. Thus, the problems above may affect the Malaysians not willing to use the facial recognition as their preferred payment method. To overcome this challenge, bringing awareness and adoption of facial recognition have become matter of my research.

The main issues on adoption discovered from past studies on the payment systems are basically affected by the security risk issue. It could be explained in the way that Malaysians may lack the confidence towards facial recognition technology in Malaysia because Malaysians do not trust the existing security risk systems. In addition, they also worry about the vulnerability of facial recognition system especially the hackers may have accessed into their personal banking information and possibility of leakage of private and personal information may be breached. In this research, the relationship between security risk and adoption of facial recognition will also be carried out.

Moreover, Malaysia has low ability in adopting the facial recognition technology as Malaysia is not advance like China and the United States of America. It is considered a challenge for Malaysia as it is not fully equipped with facilities that support it to fully utilize the facial recognition technology. Besides, lack of qualified professionals and knowledge in this field also causes Malaysia to avoid the adoption of facial recognition technology.

Besides, the law enforcement play an important role. Although there is Personal Data Protection Act 2010, but it is still not sufficient to cover the facial recognition technology. In other words, there is no law protecting the facial recognition technology.

This discovery has inflamed the interest of the researchers in exploring with the future successes of adopting this facial recognition technology in Malaysia. However, there are extremely limited academic literature regarding facial recognition technology that

is in my research area i.e. the adoption of facial recognition via smartphone. Despite that, researchers believed that such technology may improve and benefit the daily lives of Malaysians especially during performing their banking transactions. In my research, it is proposed that researchers have to focus in this area of research extensively with the additional time and resources given.

1.3 Research objective

1.3.1 General Objective

The major aim for this research study to be carried out is to bring awareness to nationwide application for facial recognition by all the banks in East and West Malaysia.

1.3.2 Specific Objectives

- i. To investigate if there is a positive relationship between perceived ease of use and adoption of facial recognition.
- ii. To investigate if there is a positive relationship between perceived usefulness and adoption of facial recognition.
- iii. To investigate if there is a positive relationship between awareness and adoption of facial recognition.

- iv. To investigate if there is a positive relationship between security risk and adoption of facial recognition.

1.4 Research Questions

- i. Is there any positive relationship between perceived ease of use and adoption of facial recognition?
- ii. Is there any positive relationship between perceived usefulness and adoption of facial recognition?
- iii. Is there any positive relationship between awareness and adoption of facial recognition?
- iv. Is there any positive relationship between security risk and adoption of facial recognition?

1.5 Hypothesis of Study

In order to study the relationship between the dependent variable, four independent variables and the acquisition of facial recognition technology, four hypotheses which are perceived ease of use, perceived usefulness, awareness and security risk had been proposed before achieving the stated objective of this study

H₁: There is a significant relationship between perceived ease of use and adoption of facial recognition.

H₂: There is a significant relationship between perceived usefulness and adoption of facial recognition.

H₃: There is a significant relationship between awareness and adoption of facial recognition.

H₄: There is a significant relationship between security risk and adoption of facial recognition.

1.6 Significance of study

The understanding of users' intention in the adoption of facial recognition technology via mobile is being studied relatively low although such technology is considered as a better alternative in security measure compared with other security approaches which involves in biometric technology. Therefore, there is an urgent need to carry out a research study on this new technology on mobile especially users' perspective on the adoption of facial recognition technology. This research will be useful to Malaysia especially in banking industries and government or to other countries that are considered to adopt facial recognition technology in mobile which able to offer better protection of their users.

1.7 Conclusion

In Chapter 1, the study background, aim of research, problem encountered and the importance of this study were discussed. In another words, the overview of this study was well described through Chapter 1. While in Chapter 2, the details of dependent variable and those 4 independent variables were described.

CHAPTER 2: LITERATURE REVIEW

2.0 Introduction

This chapter consists of the literature review and secondary data which is journals, textbooks and online resources have been used to support the research. Besides, a conceptual framework is suggested and hypothesis will be tested.

2.1 Face-recognition technology

Facial recognition is well known technology among the population of Asia and The United States of America. According to Rory and Zbigniew (2009), facial recognition is defined as a process which enables to identification of a person from a video frame or a digital frame from a video source automatically. Facial recognition is also a method of verifying human facial features through technology. (Symanovich, n.d.) Besides, face recognition could analyse multiple faces at the same time as it uses a non-invasive identification system which is faster than other systems. (Dinalankara, 2017)

Referring Tin & Sein (2011), face recognition consist one of the biometric systems. In addition, Lin (2000) stated that biometric methods own both high accuracy and low intrusiveness. Thus, according to Kelly (1970), many researchers changed their interest to computer vision from different fields in security, psychology and image processing since the early 70's.

2.2 Face recognition in Asia and The United States

Facial recognition is rapidly developed and advancement especially in mobile, machine learning an internet of things. Such technology had become real and widely spread although it is consign during the past few years. (Prakash, 2018)

2.2.1 China

China is well known for its facial recognition technology as it encompasses over 170 million closed-circuit television (CCTV) cameras, inbuilt with artificial intelligence feature with facial recognition. (Chinese man caught by facial recognition at pop concert, 2018) According to Liu (2018), Mr Ao was identified as the suspect among 50,000 people who attend the concert of pop star Jacky Cheung in Nanchang city without the concert's ticket entrance. Besides, domination of facial recognition technology also available in China's subway. In Shanghai, the subway system uses voice and facial recognition technologies which is developed by Alibaba Group Holding, which is one of e-commerce firms in China. (Perez, 2017) With such technology, it enables to verify the passengers as they pass through the gates.

Banking sectors in China also uses the facial recognition technology in Jinan city, which is adopted in three outlets of the Agricultural Bank of China (ABC). (An, 2017) Customer could withdraw their cash through its automatic teller machine (ATM) in any of the three outlets without bringing along the bank cards. Zhang Baojing, a banking manager works in ABC stated that the facial recognition technology could enhance the customer experience as it can

eradicate the risk of illegal copied bank cards and reduce the chances of cards eaten by ATMs. (An, 2017)

Furthermore, consumers able to enjoy to transact their payment by applying the facial recognition. Wenzhou city, a historical shopping street was the first city which introduces the facial recognition technology for consumers whenever they are making payments. (China's first facial recognition payment-based shopping street opens in Wenzhou, 2019) The growing of facial recognition technology in China also leads the tech giants such as Alibaba and Tencent to make huge investment in such technology. (Yoan, n.d.) With this, consumers are able to shop online by scanning their face via mobile to complete the payment.

In brief, facial recognition is gradually becoming a part of daily life in China, citizens are applying it in diverse fields from public security and transport to retail and financial services. (Meng, 2018)

2.2.2 United States

As the face recognition technology became more developed, the policy makers of the United States are adopting it slowly. The claim above can be supported by the analysis of facial recognition databases operated by the police stations among almost 50% of the adults in the U. S. (Waddell, 2016) The facial recognition are also widely spread in many fields mainly in the airline industry, banking industry, security and others.

Figure 2.1: Map of facial recognition technology in different usage



Source: D’Onfro, J. (2019). *This map shows which cities are using facial recognition technology-And which have banned it.* Retrieved July, 31 from <https://www.forbes.com/sites/jilliandonfro/2019/07/18/map-of-facial-recognition-use-resistance-fight-for-the-future/#45fd3a6a7e61>

The Figure 2 above shows a map whereby the policy makers operate the facial recognition technology in the United States. According to Jansen (2018), the first airport in the country which practice the facial recognition was at Orlando International Airport. It scan all international visitors by analyzing their face less than 2 seconds and brings the results of 99% accuracy or match rate. In addition, Biometric Exit which is a new federal program whereby the airport across the country are deploying facial recognition to track those visa holders which leaving or flying out of the United States. (Forrest, 2017)

Besides, the government also adopting facial recognition for security purposes. Andone (2018) stated that by using the facial recognition technology, the shooter of Maryland was identified. Also, the collaboration between the police

department and the Amazon's home security subsidiary named Ring. (Ng, 2019) Such Ring system were offered free or discounted doorbells to the residents in order to encourage them to share their security footage. (Ng, 2019) On the other hand, BoA mobile banking app which enable the users to access such app via the iris-based authentication techniques. This newly iris-based authentication techniques are developed by the Bank of America and the partnership of Samsung. (Lee, 2017)

2.2.3 Japan

By applying face recognition technology in the future, sleepy workers that tend to fall asleep during working hours are forced to stay awake as they might be detected and noticed by face recognition cameras. For instance, the electronic giant NEC and the manufacturer of air conditioning, Daikin had invented a system which is able to monitor and observe the types of eyelid movement that indicate to sleepiness. (That's cold: Japan tech blasts snoozing workers with air-con, 2018) Therefore, whenever the workers fall asleep, Daikin air condition will automatically lower the temperature that keeps workers to stay alert during the working hours. (That's cold: Japan tech blasts snoozing workers with air-con, 2018)

Furthermore, facial recognition technology also applying in the Tokyo's Haneda airport which the gates will scan the faces of the passenger and match the images with the data of photographic that encrypted on microchips in passports. (Aoki, 2018) 15 seconds were taken to accomplish the whole process. Meanwhile, the trialling usage of facial recognition services by several banks in Japan that enables the employees to verify their purchases in every

transaction made. (Boden, 2016) Also, the new invention of facial recognition technology for smartphones in banking and transactions were developed by both Dai Nippon Printing and the Bank of Yokohama. (Smartphone facial recognition tech developed for Japan banks, 2017)

Japan is a country unlike any other country, it implements the facial recognition to address the social challenges such as gambling addiction. (Perala, 2018) The advance of facial recognition cameras were explored by the Japanese casinos in order to scan the number of time of a person entering a casino. (Perala, 2018) In the coming future, Japan plans to use the facial recognition cameras in the 2020 Tokyo Olympics which enables the athletes and media to enter venues without relying on ID cards that can be easily forged or duplicated. (Olympics to deploy facial recognition technology to screen staff, athletes and reporters, 2017)

2.2.4 Singapore

Singapore is classified as the capital of Asia which involve high-technology. In the banking industry, facial recognition are adopted in one of the Singapore's OCBC bank's branches. (OCBC successfully deployed a facial recognition system at its Holland Village branch, 2018) The main purposes of using facial recognition is identification of Premier Banking customers whenever they enter the branch. With this technology, the Premier Service Manager (PSM) are able to be well prepared to serve the customers. (OCBC successfully deployed a facial recognition system at its Holland Village branch, 2018)

In addition, the Singapore's Changi Airport uses the facial recognition technology to track and spot passengers who are late or lost for their board. The

passengers are able to check in on their own including immigration and boarding in Changi Airport's T4 terminal with its self-service facial recognition technology. (Aravindan & Geddie, 2018) According to Yon (2016), he stated that the subway's system of Singapore try to implement a new method that enables the users to enter the terminal via facial recognition instead of using the physical cards.

2.3 Face recognition in online platform

2.3.1 Facebook

In this modern era, Facebook is considered one of a social media platform for people around the world for entertainment, gaining information and knowledge and so on. Some users like to share their photos through Facebook as a method to share news, pictures and memories with friends and family members. (Vital Design, n.d.) With the new facial recognition technology introduced in Facebook, it helps the users in tagging the photos automatic. (Snider, 2018) Unfortunately, such technology failed to protect users' privacy and gain proper agreement from users for linking biometric identifiers with individual users directly.

2.3.2 Amazon

In 2017, Amazon introduced its own facial recognition software which known as Amazon Rekognition. Such software able to identify the objects, people, text, activities and even to detect inappropriate content by just provide image or video. It provides a high match rate of facial analysis and able make comparison on faces for a wide variety in terms of user verification, people counting and public safety use cases. According to Andy Jassy, Amazon Rekognition will serve the federal government in the condition of using the software responsibly. (Reuters, 2019)

2.4 Face recognition in Malaysia

It is not an exception for Malaysia in the adoption of the facial recognition technology. Face recognition technology were launched in banking industries since 2017. Malayan Banking Bhd (Maybank) which is one of the banking companies in Malaysia introduced its facial and voice recognition security authentication service for the customers who uses mobile Maybank2u App. (Maybank launches Face ID and Voice ID for Maybank2u App, 2017) The facial and voice recognition security authentication service that involved named Face ID and Voice ID respectively. (Maybank launches facial and voice recognition security service for its customers, 2017) Datuk Hamirullah Boorhan, the head of community financial services of Maybank stated that the main reason for launching of Face ID and Voice ID are to strengthen Maybank's offering in the digital space and increasing convenience and transaction speed of customers.

(Maybank launches facial and voice recognition security service for its customers, 2017)

As we know, the most common ways of tracking the attendance of students is by taking a roll call or signing the attendance sheet manually. (Srivignesh & Bhasker, 2016) Using these traditions ways of attendance system, some students may prone to making fake attendance. Also, using attendance sheet to indicate students' attendance may increase the usage of paper. To avoid such cases to be happened, a student from Universiti Utara Malaysia (UUM) had developed a system which is able to replace the manual method. Such system named Smart Attendance System with the function of detecting the students in the classroom by facial recognition technology. (UUM, 2019) According to Nurul Husna Mohd Fauzi, the developer of Smart Attendance System, it able to make comparison between the faces record direct in the classroom and the student's pictures in the database and therefore the similarity picture found will mark as present in the class. (UUM, 2019) In whole, the invention not only protect the environment but also consider a good start for Malaysia to adopt the facial recognition as such system won awards at the Innovative Research, Invention and Application (I-RIA) 2019 Exhibition. (UUM, 2019)

On the other hand, Penang introduced the first facial recognition CCTV surveillance in Malaysia. (Mok, 2019) Based on Chief Minister Chow Kon Yeow, these facial recognition were installed by the Penang Island City Council (MBPP) featuring artificial intelligence (AI) by IBM. (Lo et al, 2019) The amount of CCTVs installed by MBPP is around 767 and around 130 were installed by Seberang Perai Municipal Council (MPSP) on the mainland. (Mok, 2019) Such system enables the Penang's police to trace the criminals on the street which could ensure the safety of the citizens. (Mok, 2019) Also, with the upgraded CCTV that involved with Intelligent Video Analytics (IVA), it able to capture various traffic violations. (Mok, 2019) In the coming future, the installation of CCTVs by MBPP will be increasing.

2.5 Review of Literature

2.5.1 Perceived ease of use

Perceived ease of use is one of the factors that might affect adoption of facial recognition technology. According to Elena & Detmar (1998), perceived ease of use is defined as the level for a belief of an individual on using something or system that would be simple. While David (1993) claims that perceived ease of use are defined as the “degree to which an individual believes that using a particular system would be free of physical and mental effort.”

Based on Jahangir & Begum (2008), they stated that perceived ease of use was intensity of acceptance by a person if it does not involve any cost with using an exact method. In other words, the attention of users in using biometric involves a minimal effort. In whole, both researchers believe that a good understanding about something including technology is vital towards the adoption of certain system.

In discussion of perceived ease of use of mobile technology, few standards are used. The perceived ease of use of smartphones are measures in general as the antecedent of customers main objectives to accept smartphones are in learning (Sek, Lau, Teoh, Law & Paruma, 2011), mobile banking (Yoon & Occeña, 2014), retailing (Cho & Sagynov, 2015) and purchasement of ancillary airline service (Morosan, 2014).

2.5.2 Perceived usefulness

According to Mathwick, Malhotra and Rigdon (2002), perceived usefulness is the degree to which a person assumes the use of a particular system enable his or her in boosting the job performance. Moronsan (2011) stated as the potential usefulness of a particular technology becoming higher, the possibilities on adoption of the technology will become more likely.

Many researchers have determined the relationship between the intention to use and perceived usefulness by applying the technology acceptance model (TAM). Based on Taherdoost (2018), TAM consist of elements such as perceived usefulness, perceived ease of use, attitude towards using and external variables that might affect the user in adopting the technology.

Study from Venkatesh (2000) concluded that there will be significant or insignificant relationship on perceived usefulness and the intention to use such technology or system brought by perceived ease of use. While others studies claim that there are direct relationships between the perceived usefulness with intent to use. (Hsu & Chiu, 2004) Based on the research done by Zhang (2019), perceived usefulness is the major element that affects directly on the user's willfulness in using facial recognition payment.

2.5.3 Awareness

Awareness is a term in the settings of cooperative which is used to describe that the knowledge gain between the interaction of an agent and its environment. (Gutwin & Greenberg, 2002) Besides, Gafoor (2012) stated that awareness means, knowledgeable being conscious; cognizant, informed alert. Awareness also defined as the ability or state to recognized, to feel or to be conscious of objects, events or even sensory patterns. (Gafoor, 2012)

According to Asfaw (2006), awareness is important in terms of accessibility. As people access the technology frequently, it able to encourage the use and adoption of biometric technology. Nwatu (2011) mentioned that a high level of awareness may not convert into the adoption and usability of biometric, but it is considered a significant element on long run as its function to impact acceptance.

2.5.4 Security Risk

Security is a term that considered as free from danger or threat. (Collins English Dictionary and Thesaurus, 1992) Based on Fisher and Green (2004), security provides a safe environment for any individuals or groups without having feeling of harms or threaten, fear and any other disturbance or injury.

In traditionally, security is considered as an arrangement of private services in protecting the people, information and assets for personal's safety or community

welfare. (Craighead, 2003) While, Jahangir and Begum (2008) claim that security is a significant concern especially for individuals. Security is important in the way of secure identity and prevent self-deception to avoid risk. The users will have positive mind towards the system once they have enough awareness on security and reliability in the use of technology. (Nwatu, 2011)

According to Brooks (2007), some may think that security can prevent crime from happening, while in technology, the term security stands for the prevention of loss or management of risk. In the other hand, Davidson (2005) stated that different people may describe security in a different meaning in terms of place, time and context.

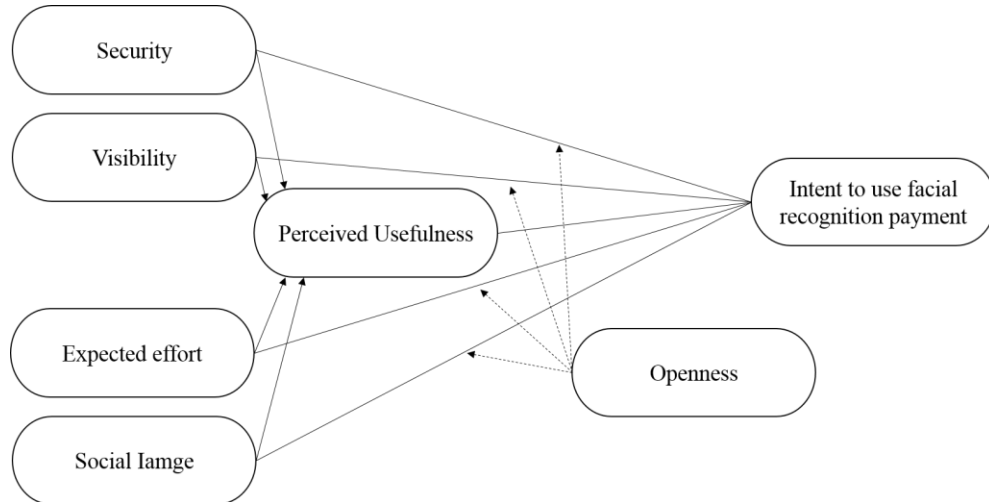
2.5.5 Adoption of Facial recognition

Adoption theory has the purpose to study the way of choice making and reaction by people when encountering something new and innovative and the decision to either accept it or reject it. (Starub, 2009) While in the research done by Sahin (2006), he mentioned that in the review of Roger's theory, adoption refers to the choice making of using the new invention. In contrast, he claims that the rejection from the crowd means that the innovation failed to be adopted by the crowd. In other words, rejection is the opposite of adoption.

According to Vinay et al. (2018), facial recognition technology is different from the traditional QR code payment and credit card payment in the way that facial recognition technology can scan features vectors. Zhang (2019) had done a research on factors that affect the user in using facial recognition payment by collecting vital data from the respondents from different ages through survey questionnaire.

2.6 Review of Relevant Theoretical Models

Figure 2.2: Theoretical Framework



Source: Zhang, W. K. (2019). Factors Affecting the Use of Facial-Recognition. Payment: An example of Chinese Consumers. *IEEE Access*. Digital Object Identifier 10.1109/ACCESS.2017.

Zhang (2019) investigated that the elements that might affect the use of facial technology among users in different age categories. In his study, the researchers had determined security, visibility, perceived usefulness, expected effort and social image as the factors that influences the users' intention to use facial recognition payment. The result was obtained from individuals from different categories of age.

The researcher found out that the consumers' intention to proceed payment via facial recognition are greatly affected by security factor. It is considered a significant factor because public are concerned about their personal information being leaked during the payment process. Thus, security is directly affect the consumer's confidence to make payment via facial recognition technology.

Besides that, the intention of consumer to use facial recognition as method of payment are also greatly affected by visibility. The researcher believes that the visibility of user especially in the intention of making payment via facial recognition technology are affected by the involvement of product, conversation that involve product, the condition of consumption and usage.

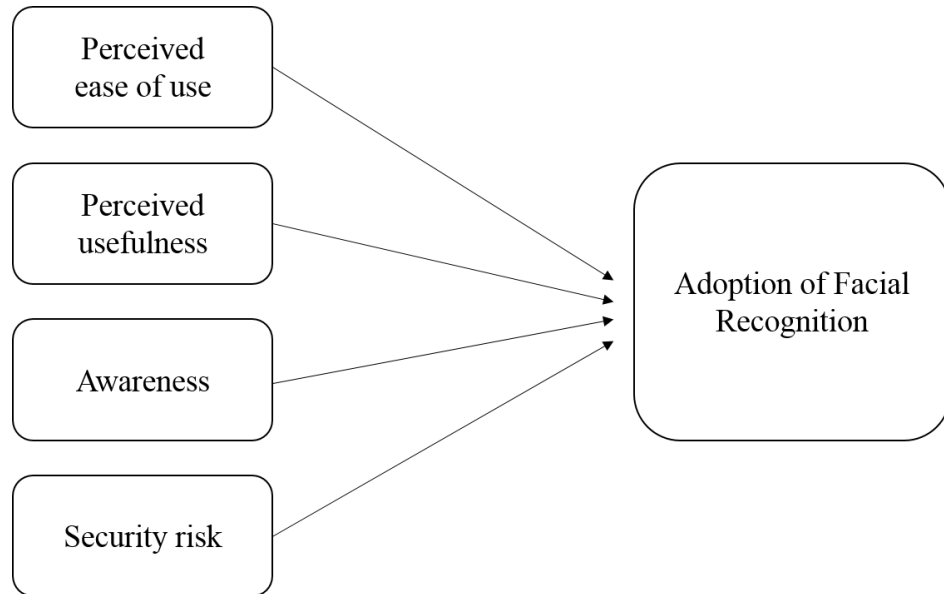
Moreover, results also found that the consumer's intention to complete payment by facial recognition are influenced by expected effort. From the study, the researcher found out that the expected effort is directly affected by the consumers' self-efficacy. The consumer will be encouraged only when they rewarded from their effort with positive results. Also, the consumer's expected judgement on facial recognition will instantly affect the way of payment to be executed.

In addition, consumer's intention to use facial recognition payment is also caused by social image factor. This could be explained in a way that the consumer was influenced by information or evaluation they received and impression leave from people around them. It could be clearly seen that the outside world may affect the consumers' intent to use the facial recognition payment.

Furthermore, the mediation effect which is the perceived usefulness results in positive factors that alter consumers' intent to use facial recognition payment. The researcher found out that application facial recognition payment is considered a new service among the consumers and they might need time to adapt to this facial recognition technology. Thus, perceived usefulness may affect the consumer in the way they accept towards the facial recognition payment.

2.7 Proposed Theoretical/ Conceptual Framework

Figure 2.3: Theoretical Framework



Source: Developed for the research

Based on the Zhang (2019) study, Malaysian will be influenced by the independent variables on adoption of facial recognition in any industries in Malaysia were included as proposed model in his research.

2.8 Hypotheses Development

2.8.1 Perceived ease of use

H₀: There is no significant relationship between perceived ease of use and adoption of facial recognition.

H₁: There is a significant relationship between perceived ease of use and adoption of facial recognition.

Previous studies from Jahangir and Begum (2008) had introduced a theoretical framework that mentioned perceived usefulness and perceived ease of use are the significant factors which influence the user to accept and adopt to electronic banking services. Besides, research done by Kaasinen (2007) stated that few factors that will influence the user in accepting the mobile Internet services. The important factors are the perceived value, ease of use, trust and ease of adoption.

2.8.2 Perceived usefulness

H₀: There is no significant relationship between perceived usefulness and adoption of facial recognition.

H₂: There is a significant relationship between perceived usefulness and adoption of facial recognition.

According to Tassabehji and Kamala (2009), the researchers used the perceived usefulness in the TAM model which was related to the adoption of Biometrics in banks in their study. Besides, Chan (2008) stated that perceived usefulness is considered a variable that affect Malaysian on the adoption of biometric technology as it makes the user to login easier and more quickly. Therefore, perceived usefulness is suitable to be applied in this research.

2.8.3 Awareness

H₀: There is no significant relationship between awareness and adoption of facial recognition.

H₃: There is a significant relationship between awareness and adoption of facial recognition.

Based on Nwatu's study, awareness brings a positive relationship towards the acceptance of biometric technology. (Nwatu, 2011) This could be explained when consumer aware of biometrics technology, their behavior and attitude on accepting the biometric technology will be changed. According to Harris and Yen (2002), they stated that awareness is an important element in order to facilitate the adoption of biometric technology.

2.8.4 Security Risk

H₀: There is no significant relationship between security and adoption of facial recognition.

H₄: There is a significant relationship between security and adoption of facial recognition.

According to Nwatu (2011), security is considered as the third variable out of perceived ease of use and perceived usefulness that influence the adoption of biometrics system. Researchers Shin (2009) and Fang et al. (2005) stated that perceived security as the main variable that affect the intentions to use new technologies. Besides, Moronsan (2012) stated that security is important as it may enhance the customers' perception in adopting the biometric systems.

2.9 Conclusion

In Chapter 2, past studies been discussed and were conducted by other researchers about how independent variables affect the dependent variable in terms of conceptual framework and hypothesis while the methodology for this research will be further discuss in the following chapter.

CHAPTER 3: METHODOLOGY

3.0 Introduction

Research methodology is a system of method that analyze the objectives that proposed in the first chapter. In this chapter, the way of collecting data, the target respondent, the sampling design, the process and the method to analyze the statistical models through the instrument used in this research.

3.1 Research Design

The research study can be built up by the combination of all important element under a structure of a study is called research design. Research design is also important in the aspect of information collection from relevant respondents which enabling the investigation of problems and ways to resolve it.

In the process of doing this research, quantitative methods are being used to collect the data and analyze data statistically. According to Wright et al. (2016), they used quantitative methods in their research in order to confirm their research and hypothesis with theory and to propose a conclusion. Quantitative methods enable to study the relationship between variables in the way of analysis that portrays the relationship in numerical and mathematically. (Center for Innovation in Research and Teaching, 2018).

According to Zikmund (2003), descriptive design means the respondents who participated in the research characteristics or attributes. According to University of Southern California Libraries, descriptive design could generate more useful data and details that might become significant suggestion in current or future research. (University of Southern California Libraries, 2016).

3.2 Data collection method

Data collection is gathering, analyzing and interpreting the data as to calculate the outcome of the data received. According to Zikmund (2003), two main sources of data which are the primary data and secondary data.

3.2.1 Primary Data

According to Bowling (2005), survey questionnaire is one of the methods to collect data which may involve a large target population. All the respondents will code with a set of standardized questions and answers categories. The information received not available and obtained by others, so primary data is considered trustable compared to secondary data. In this research, primary data was conducted by distribution of survey questionnaire.

3.2.2 Secondary Data

According to Johnston (2014), secondary data is refer to the data accumulate by the past researcher for another primary purpose. It is considered the simplest and the cost saving ways then primary data as the data could be obtained from the internet, library and journal articles. In this research, the secondary data are from the internet, journals, textbooks and information offered by UTAR library.

3.3 Sampling design

3.3.1 Target Population

A group of participants who are targeted in the research for result generating purpose is called target population. In this research, Malaysian are the target population. The main reason for choosing Malaysian as respondents is to identify whether facial recognition technology is well known among them. Besides, through the cooperation given by the target respondent, researchers are able to discover details information.

3.3.2 Sampling Frame

Sampling frame is explain as a group of items and individuals that form a population. (Särndal, Swensson, & Wretman, 2003) The target respondents in

this research study is the Malaysian. Through the responses of the target audience, the location and the range of age of the respondents who support the usage of facial recognition technology. In order to collect responses, survey was conducted through online and through hard copy.

3.3.3 Sampling Elements

In conducting this research, 350 questionnaires were distributed to the citizens in Malaysia. The people who uses smartphone and use facial recognition technology currently or in the coming future are considered as target respondents.

3.3.4 Sampling Technique

Sampling techniques categories into two groups, the probability and non-probability sampling. In this research, non-probability was chosen. According on Sekaran and Bougie (2010), they stated that there are 4 kinds of non-probability sampling which are convenience sampling, quota sampling, snowball sampling and judgmental sampling. Throughout the research, convenience sampling is the best techniques to be used because of the limited time and budget.

3.3.5 Sampling Size

Based to Malhotra, Kim and Patil (2006), sample size refers to the total number of target respondents to be studied in the research study. They also stated that the most appropriate sample size for majority research papers is in the range of 30 to 500. In this study, 350 sets questionnaire were allocate among the Malaysian. Besides, before the actual distribution of survey, the pilot test samples will be tested first.

3.4 Research Instrument

The way to collect information for the result for this research study is through distribution of surveys which involves several questions that are related to the topic and based on each of the independent variables. In this research study, self-administered questionnaire is being used as the research tools. Self-administered questionnaire refers to a group of questions that are aim to collect data and preference from respondents without involvement of the researcher. (Zikmund et al., 2013) In other words, self-administered questionnaire is considered a challenge for the research because they depend on the written words on the questionnaire rather than on interviewing.

3.4.1 Questionnaire Design

There are total 31 questions in this questionnaire and it was divided into three major section. For the first part (Section A), the questions were set based on the

general information about facial recognition while in the second part (Section B), the questions set were focused on demographic profile including gender, age and origin state of respondent. Besides, in the last part (Section C), there are 25 questions whereas 5 questions were asked to test the degree of adoption of facial recognition while the remaining questions were related to those 4 independent variables.

3.4.2 Pilot Test

A pilot test is very crucial and it is needed to be done before collecting data in the study. (Hassan, Schattber, & Mazza, 2006) According to Van et al. (2001), pilot test refers to the identification of practical problems in the research procedure. While Baker (1994) stated that pilot test act as pre-testing tools.

During the research, the distribution of 30 sets survey among the target respondent is mainly for the purpose of pilot test. After the process of collecting data, all relevant information will be inserted into the Software Package for the Social Sciences (SPSS) to run the reliability test. Lastly, based on the pilot test results, the questionnaire will be readjusted and distributed for the real study if any problems were found.

In this study, the researcher achieved overall result of 0.916 which indicate the variables are reliable and consistent.

Table 3.1: Cronbach's Alpha of Pilot Test

Variables	Cronbach's Alpha	No. of items
Adoption of facial recognition	0.886	5
Perceived ease of use	0.890	5
Perceived usefulness	0.864	5
Awareness	0.927	5
Security risk	0.909	5
Overall	0.916	5

Source: Developed for the research

3.5 Construct Measurement

3.5.1 Nominal Scale

A nominal scale is usually used in the quantitative variables which will be distributed into 2 categories. Sekaran (2003) stated that the variable which involves two categories are mutually exclusive and collectively exhaustive which able to generate the results. In this research study, the researcher used the nominal scale to categorize the gender into male and female. In section B of the survey, it determines the demographic profile for each respondent. The examples of variables that measured with nominal scale in this questionnaire are the respondents' gender, age and origin states.

3.5.2 Interval Scale

According to Zikmund et al. (2003), interval scale capture the differences between scale values. In other words, the comparison between the stimuli based on the differences in term of scale values can be done through interval scales. In the interval scale, central tendency can be measured by using the mean, median, mode and standard deviation.

Besides, likert scale are also another scales that are commonly used in most of the researches. The Likert scale contain 5 points scaling which involves strongly disagree, disagree, neutral, agree, and strongly agree that ranges from 1 until 5 respectively. Likert is designed to examine the degree of statement are agree or disagree. In this research study, Likert scale had been applied in this questionnaire to evaluate the item in each question for the Section C.

3.6 Data Processing

Data processing is providing an instruction for researchers to manage data that consist of checking questionnaire, editing the data and code the data.

3.6.1 Questionnaire Checking

Before distributing the survey questionnaire to the target respondents, questionnaire checking is an important procedure to ensure the questionnaire is free from errors. Errors such as grammar mistakes, possibility of misunderstanding or incomplete information. Thus, it will greatly affect the overall research's objective and may prevent misunderstanding arise from the readers and target audience. With the process of questionnaire checking, the researcher is able to identify problems and make correction on the survey questionnaire before distributing to the target respondent, in order to ensure good research quality.

3.6.2 Data Editing

Editing refers to the process that consists of data checking and adjusting for omissions, consistency and legibility. (Zikmund et al., 2003) Gathered data from the target respondent should be edited to ensure it is accurate, complete, consistent and free from bias before it being recognized as the primary source. Data editing is important as it can prevent inaccurate data sources that might mislead the research outcome.

3.6.3 Data Coding

Based on Malhotra (2006), data coding assists the researcher in arranging the item in the questionnaire in the way of assigning code or number to represent the likely response to each response (question). In other words, researcher set a series number to categorize all data in the questionnaire. In Section C of the questionnaire, 1 represent strong disagree, 2 for disagree, 3 for neutral, 4 for agree and 5 for strongly agree. This enables the researcher to handle data entry process more easily and quickly.

3.7 Data Analysis

Data analysis is used to evaluate the appropriate and accurate results which able to avoid mislead. (Shepard, 2002) In this research, 350 sets of survey questionnaires were distributed and all data were compiled and entered into SPSS for reliability purpose.

3.7.1 Descriptive Analysis

According to Loeb et al. (2017), descriptive analysis refers to the identification of patterns in data that answer that questions about who, what, where, when and what extent in order to characterize the world or a phenomenon. Data performed in this research which includes the individual dynamics and people interaction can be described and analysed through descriptive analysis so that the data become more understandable and clear. (Wasserman and Faust, 1994)

In this research, table and graph are used to organize the data that collected from the questionnaire. Graphical analysis also is used as the quantitative analysis for the data in this research. The results were described clearly through Chapter 4.

3.7.1.1 Reliability test

Reliability act as an important tool when it comes to the evaluation of measurement in research. Shekhar Singh (2014) stated that with the reliability test, the transparency will be expanded and the opportunities involvement of bias in research will be reduced. The result is considered reliable if the results are always constant as time passes and the study was carried out based on right representation. (Golafshani, 2003) Besides that, the research approach is reliable if the outcome of a research can be reproduced under the same method. (Golafshani, 2003)

3.7.1.2 Cronbach's Alpha

For the reliability test, the use of Cronbach's Alpha is to determine the reliability of the variables which are perceived ease of use, perceived usefulness, awareness, security risk and adoption of facial recognition. The range of the value for Cronbach's Alpha which based on Zikmund et al. (2010) are shown below.

Table 3.2: Range of Cronbach's Alpha value

Cronbach Coefficient alpha (α)	Indication
α value < 0.60	Poor reliability
α value between 0.61 and 0.70	Fair reliability
α value between 0.71 and 0.80	Good reliability
α value between 0.81 and 0.95	Very good reliability

Source: Zikmund, W. G., Babin, B. J., Carr, J. C., & Griffin, M. (2010). *Business research methods* (8th Ed.). Ohio: South-Western Pub.

3.7.2 Inferential Analysis

Burns and Bush (2006) stated that inferential refers to the conclusion produced from the target population characteristics which based on sample data. Multiple Regression Analysis are used to analyze the significant value.

3.7.2.1 Multiple Linear Regression

According to Zikmund et al. (2003), multiple regression analysis that involve two or more independent variables on a single dependent variable which is an extension of simple regression analysis. While Hair et al (2006) stated that multiple is a good statistical technique when it comes to estimating the

coefficient of a straight line equation. Based on Allison (1977), he claimed that the equation below can be used as a model for multiple regression.

Figure 3.1: Equation of multiple regression

$$\hat{y} = b_0 + b_1x_1 + b_3x_1x_2$$

Source: Allison, P. D. (1997). Testing for interaction in Multiple Regression. *The American Journal of Sociology*, Vol. 83, No. 1, p. 145-153.

While another general expression for a regression equation which involve a multiplicative interaction effect is shown below:

Figure 3.2: Equation of multiple linear regression

$$y_i = y_0 + y_1x_1 + y_2z_i + y_3x_iz_i + \varepsilon_i$$

Source: Preacher, K.J., Curran, P.J. & Bauer, D.J. (2006). Computational tools for probing interactions in multiple linear regression, multilevel modeling and latent curve analysis. *Journal of Educational and Behavioral Statistics*, Vol. 31, No. 4, p. 437-448.

For $i = n$ observation, where:

y_i is the dependent variable, x_i are the explanatory variables.

y_0 is the y-intercept (constant term), y_1 ; y_2 ; y_3 are the slope coefficients for each explanatory variable.

ε_i is the model's error term (also known as the residual)

Based on both equations above, this research had form a multiple linear equation below:

$$\text{Adoption of facial recognition} = b_0 + b_1(\text{Perceived ease of use}) + b_2(\text{Perceived usefulness}) + b_3(\text{Awareness}) + b_4(\text{Security Risk}) + e$$

3.8 Conclusion

Chapter 3 has provided methods to identify ‘who, what, where, when and how’ to collect the data and result via methodology. In this chapter, to generate result from the data collected, SPSS software had been used.

CHAPTER 4: DATA ANALYSIS AND PRESENTATION OF THE FINDINGS

4.0 Introduction

The results analyzed obtain from the survey were collected and hypothesis will be further discussed in this chapter. By using the SPSS software, data will be analyzed and summarized with outcomes. At the end of this chapter will consist of descriptive analysis, central tendencies measurement of constructs, scale measurement inferential analysis and conclusion.

4.1 Descriptive analysis

350 sets of survey questionnaires are being distributed and all of the respondent have fulfill the requirements of the research.

4.1.1 Respondent general questions

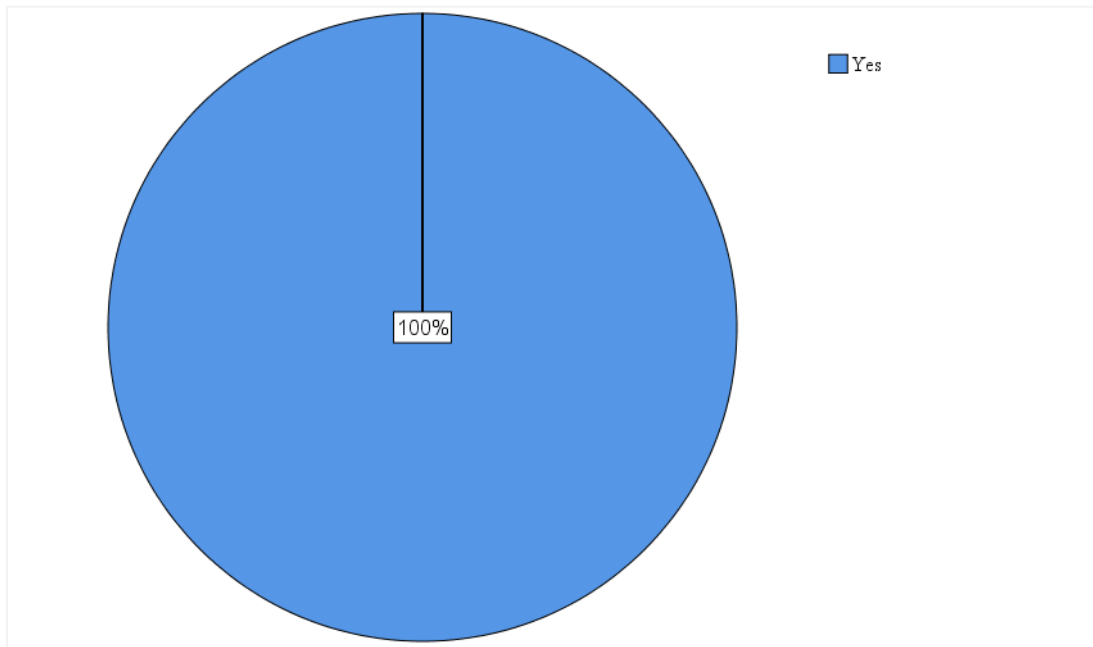
There were three questions under general questions and the respondents are required to complete.

Table 4.1: Are you using a smartphone?

		Frequency	Percent (%)	Valid Percent (%)	Cumulative Percent (%)
Valid	Yes	350	100	100	100

Source: Developed for the research

Figure 4.1: Are you using a smartphone?



Source: Developed for the research

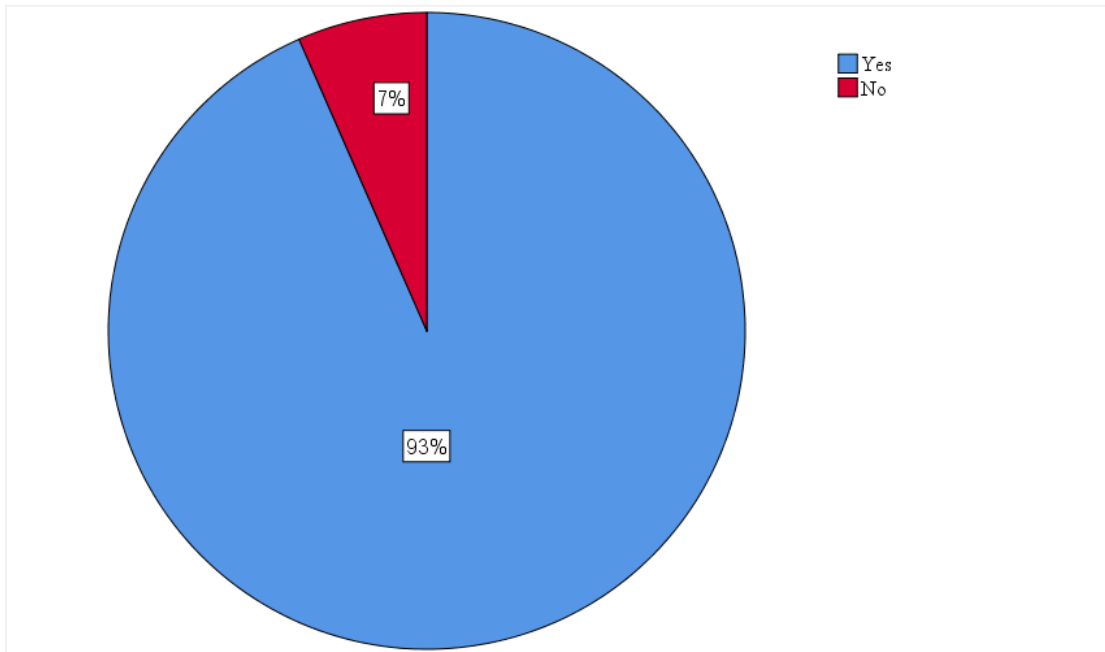
Based on Table 4.1 and Figure 4.1, it clearly shown that 350 respondents are using smartphone.

Table 4.2: Do you know about the facial recognition technology?

		Frequency	Percent (%)	Valid Percent (%)	Cumulative Percent (%)
Valid	Yes	327	93	93	93
	No	23	7	7	100
	Total	350	100	100	

Source: Developed for the research

Figure 4.2: Do you know about the facial recognition technology?



Source: Developed for the research

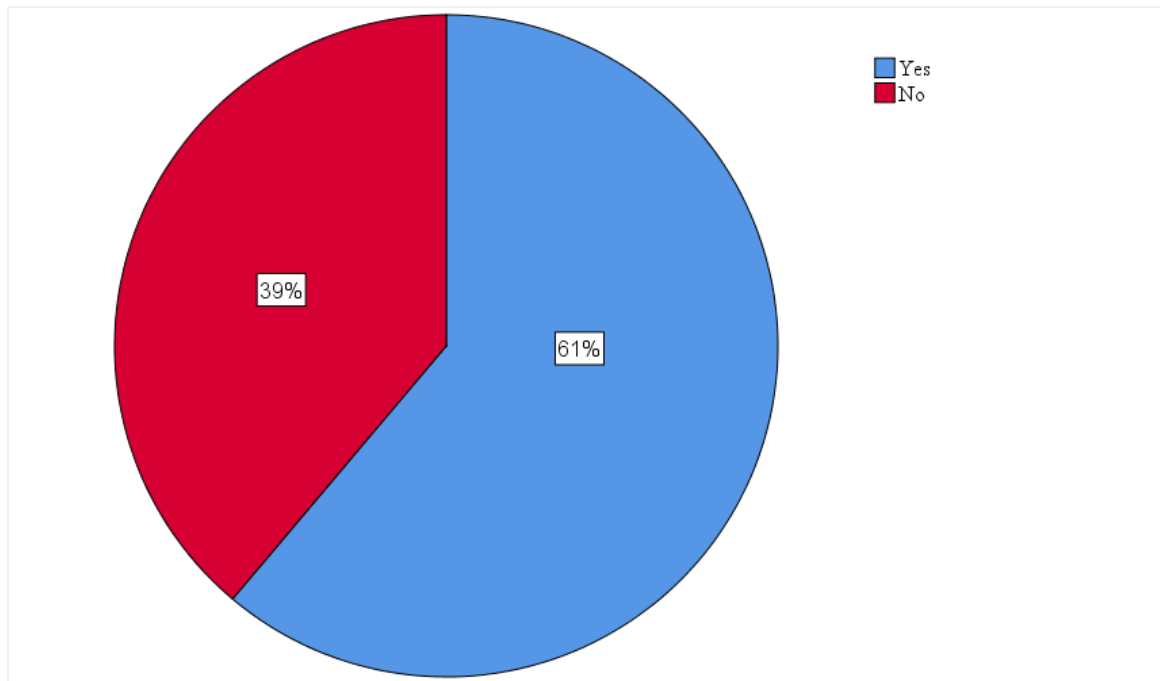
According to Table 4.2 and Figure 4.2, the researcher discovered that more than half of respondents who answered the survey questionnaires heard about facial recognition which is 327 out of 350 (93%) and minority of the respondents have no idea on the facial recognition which is only 23 people (12%).

Table 4.3: Do you consider using facial recognition in banking industry in the future?

		Frequency	Percent (%)	Valid Percent (%)	Cumulative Percent (%)
Valid	Yes	214	61	61	61
	No	136	39	39	100
	Total	350	100	100	

Source: Developed for the research

Figure 4.3: Do you consider using facial recognition in banking industry in the future?



Source: Developed for the research

From the Table 4.3 and pie chart above, the researcher discovered that 61% of respondents are supporting the adoption of facial recognition technology in banking while 39% of respondents are not supporting the adoption.

4.1.2 Respondent demographic profile

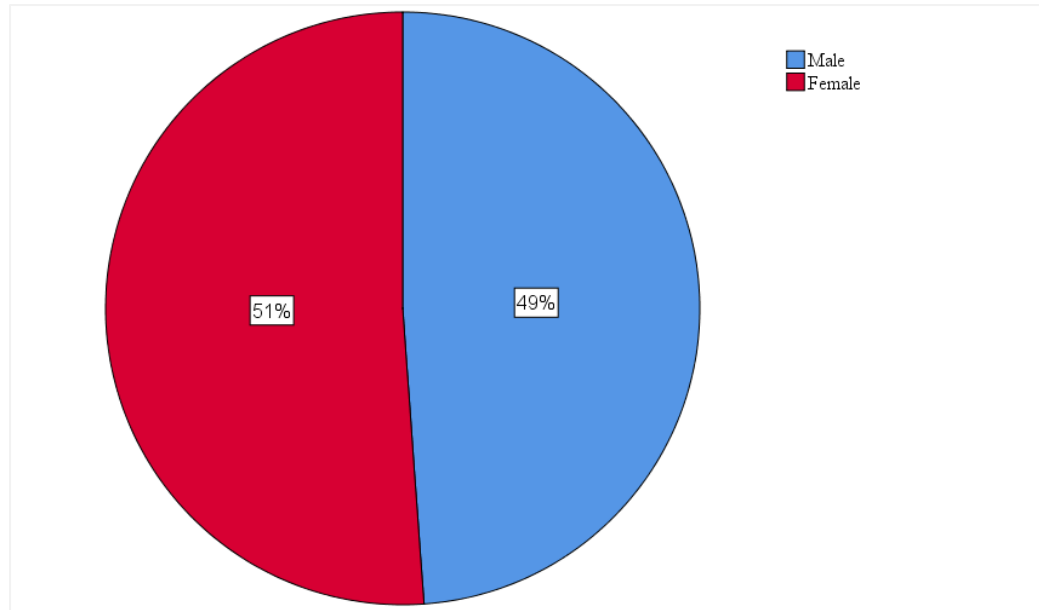
In this study, three questions are set under demographic section which are gender, age and state.

Table 4.4: Gender

		Frequency	Percent (%)	Valid Percent (%)	Cumulative Percent (%)
Valid	Male	171	49	49	49
	Female	179	51	51	100
	Total	350	100	100	

Source: Developed for the research

Figure 4.4: Gender



Source: Developed for the research

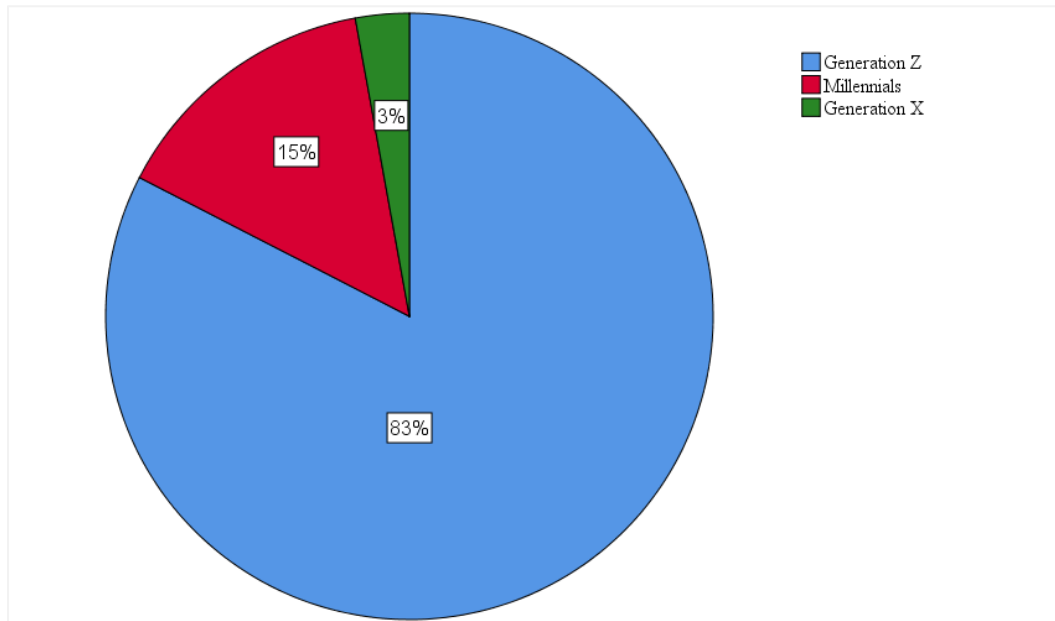
Based on Table 4.4 and Figure 4.4, there are 171 of the respondents are male (49%) and 179 of the respondents are female (51%) have participated in the survey questionnaires.

Table 4.5: Age

		Frequency	Percent (%)	Valid Percent (%)	Cumulative Percent (%)
Valid	Generation Z	289	83	83	83
	Millennials	51	15	15	98
	Generation X	10	3	3	100
	Total	350	100	100	

Source: Developed for the research

Figure 4.5: Age



Source: Developed for the research

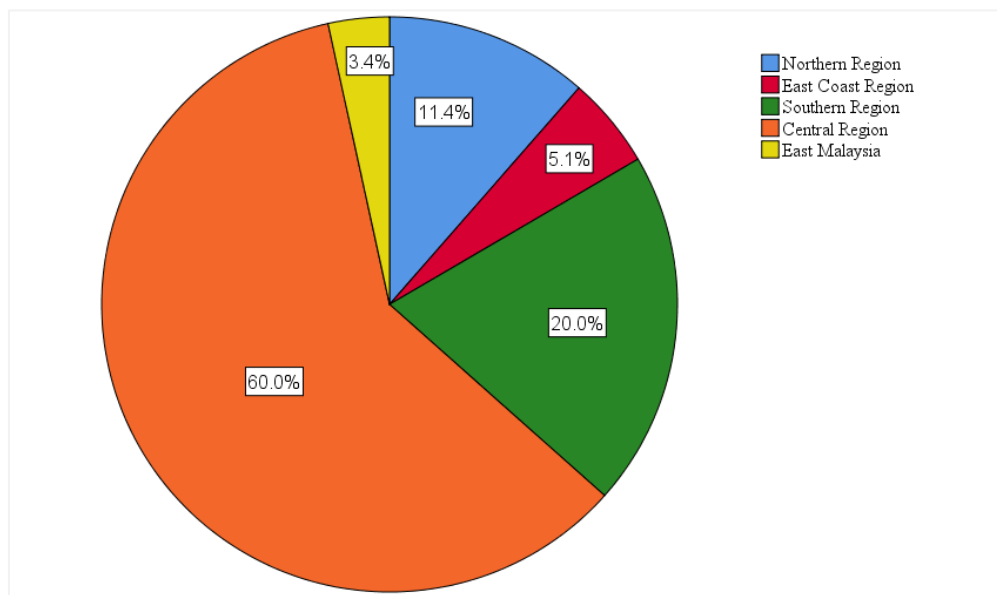
According to Table 4.5 and Figure 4.5, it just only focusing on 3 aging. The highest proportion of age range is generation Z (7-22 years old) which has 63%. The second highest proportion, 15% will be Millennials (23-38 years old) and followed by the lowest 3% for generation X (39-54 years old).

Table 4.6: State

		Frequency	Percent (%)	Valid Percent (%)	Cumulative Percent (%)
Valid	Northern Region	40	11.4	11.4	11.4
	East Coast Region	18	5.1	5.1	16.6
	Southern Region	70	20.0	20.0	36.6
	Central Region	210	60.0	60.0	96.6
	East Malaysia	12	3.4	3.4	100.0
	Total	350	100.0	100.0	

Source: Developed for the research

Figure 4.6: State



Source: Developed for the research

From Table 4.6 and Figure 4.6, 60% are come from Central Region (Selangor, Kuala Lumpur and Pahang) which consist of 210 respondents. The second largest which is the Southern Region (Negeri Sembilan, Melaka and Johor) consists of 70 respondents (20%). Next, Northern Region (Perlis, Kedah, Penang and Perak) consists 40 respondents (11.4%). While for East Coast

Region (Kelantan and Terengganu) and East Malaysia (Sabah and Sarawak) consists of 18 (5.1%) and 12 (3.4%) respondents respectively.

4.2 Central Tendency

Table 4.7: Central tendencies measurement of adoption of facial recognition

	Statement	SD	D	N	A	SA	Mean	Standard Deviation
AD1	I enjoy when using facial recognition technology	2.3	17.1	42.6	29.1	8.9	3.25	0.921
AD2	I feel confident when using facial recognition technology	4.9	12.3	49.1	25.7	8.0	3.20	0.926
AD3	Using facial recognition technology is beneficial	3.1	7.7	35.7	43.1	10.3	3.50	0.895
AD4	Using facial recognition technology able to substitute the cash based payment method	6.3	16.9	34.6	33.4	8.9	3.22	1.032
AD5	Facial recognition can improve the quality of banking industry	6.0	14.9	41.7	28.0	9.4	3.20	1.004

Source: Developed for the research

SD= Strongly Disagree, D=Disagree, N= Neutral, A= Agree, SA= Strongly Agree

Table 4.7 showed the descriptive analysis, including mean score, standard deviation and percentage score of adoption of facial recognition. The highest mean was scored under the statement “Using facial recognition technology is beneficial” with 3.50. The lowest mean score was the statement “I feel confident when using facial recognition technology” and “Facial recognition can improve the quality of banking industry” with 3.20. From the analysis Table 4.7, 43.1% of respondents agreed on the statement that

“Using facial recognition is beneficial”. Overall, the majority of the respondents stand neutral with the statement above.

Table 4.8: Central tendencies measurement of perceived ease of use

	Statement	SD	D	N	A	SA	Mean	Standard Deviation
PE1	I find the facial recognition technology is easy to use	3.1	8.6	24.3	46.0	18.0	3.67	0.971
PE2	I find that facial recognition technology is easy to learn	3.1	3.4	20.6	52.0	20.9	3.84	0.901
PE3	I would feel comfortable using facial recognition technology	2.3	14.6	42.6	29.4	10.9	3.32	0.930
PE4	I would like to use facial recognition technology if it is not difficult	4.9	7.7	23.1	42.3	22.0	3.69	1.050
PE5	I would like instruction to be provided on how to use facial recognition technology	2.9	11.1	28.9	41.1	16.0	3.56	0.981

Source: Developed for the research

SD= Strongly Disagree, D=Disagree, N= Neutral, A= Agree, SA= Strongly Agree

Table 4.8 showed the descriptive analysis, including mean score, standard deviation and percentage score of perceived ease of use. The highest mean was scored under the statement “I find that facial recognition technology is easy to learn” with 3.84. The lowest mean score was the statement “I would feel comfortable using facial recognition technology” with 3.32.

From the analysis Table 4.8, 42.6% of respondents stand neutral with the statement of “I would feel comfortable using facial recognition technology”. While, the majority of the respondents agreed which 46% for the statement “I find the facial recognition technology is easy to use”, 52% for the statement “I find that facial recognition

technology is easy to learn”, 42.3% for the statement “I would like to use facial recognition technology if it is not difficult” and 41.1% for the statement “I would like instruction to be provided on how to use facial recognition technology”.

Table 4.9: Central tendencies measurement of perceived usefulness

	Statement	SD	D	N	A	SA	Mean	Standard Deviation
PU1	Using facial recognition technology to verify identity is a good idea	4.0	9.7	33.1	40.9	12.3	3.48	0.965
PU2	Using facial recognition technology to prevent identity fraud is a clever idea	5.1	14.3	31.1	38.6	10.9	3.36	1.022
PU3	I would prefer to use facial recognition technology for identification	4.0	15.7	30.0	39.7	10.6	3.37	1.001
PU4	The use of facial recognition technology would help me to save time	3.7	6.3	26.9	41.1	22.0	3.71	0.998
PU5	The use of facial recognition technology would be useful in performing in daily life	4.0	7.1	33.1	41.7	14.0	3.55	0.956

Source: Developed for the research

SD= Strongly Disagree, D=Disagree, N= Neutral, A= Agree, SA= Strongly Agree

Table 4.9 showed the descriptive analysis, including mean score, standard deviation and percentage score of perceived usefulness. The highest mean was scored under the statement “The use of facial recognition technology would help me to save time” with 3.71. The lowest mean score was the statement “Using facial recognition technology to prevent identity fraud is a clever idea” with 3.36.

From the analysis Table 4.9, majority respondents agreed towards all the statement which 40.9% for the statement “Using facial recognition technology to verify identity is a good idea”, 38.6% for the statement “Using facial recognition technology to prevent identity fraud is a clever idea”, 39.7% for the statement “I would prefer to use facial recognition technology for identification”, 41.1% for the statement “The use of facial recognition technology would help me to save time” and 41.7% for the statement “The use of facial recognition technology would be useful in performing in daily life”.

Table 4.10: Central tendencies measurement of awareness

	Statement	SD	D	N	A	SA	Mean	Standard Deviation
AW1	I have seen, heard or read about facial recognition technology	3.1	6.6	22.6	46.6	21.1	3.76	0.963
AW2	I have been exposed to facial recognition technology	3.4	13.1	25.7	40.3	17.4	3.55	1.033
AW3	I am aware of the facial recognition technology	4.6	5.7	30.6	43.4	15.7	3.60	0.972
AW4	I know how facial recognition could be used in banking industry	4.9	22.0	42.6	22.6	8.0	3.07	0.979
AW5	I know how facial recognition could be used in daily life	5.1	10.9	33.7	38.6	11.7	3.41	1.002

Source: Developed for the research

SD= Strongly Disagree, D=Disagree, N= Neutral, A= Agree, SA= Strongly Agree

Table 4.10 showed the descriptive analysis, including mean score, standard deviation and percentage score of awareness. The highest mean was scored under the statement “I have seen, heard or read about facial recognition technology” with 3.76. The lowest mean score was the statement “I know how facial recognition could be used in banking industry” with 3.07.

From the analysis Table 4.10, 42.6% of respondents stand neutral with the statement of “I know how facial recognition could be used in banking industry”. While, the majority of the respondents agreed which 46.6% for the statement “I have seen, heard or read about facial recognition technology”, 40.3% for the statement “I have been exposed to facial recognition technology”, 43.4% for the statement “I am aware of the facial recognition technology” and 38.6% for the statement “I know how facial recognition could be used in daily life”.

Table 4.11: Central tendencies measurement of security risk

	Statement	SD	D	N	A	SA	Mean	Standard Deviation
SR1	I feel secure when using facial recognition technology	6.3	21.4	46.3	22.3	3.7	2.96	0.915
SR2	I would use facial recognition technology to protect sensitivity information. (E.g. personal data)	11.4	22.0	36.6	24.6	5.4	2.91	1.065
SR3	Facial recognition technology is more reliable than the existing IT security methods	7.7	18.0	44.9	23.7	5.7	3.02	0.978
SR4	Facial recognition technology is trustworthy with its' security risk feature	5.7	15.4	48.6	24.6	5.7	3.09	0.923
SR5	I would use facial recognition technology in prevention of sensitive information leakage	9.4	17.4	41.7	24.3	7.1	3.02	1.040

Source: Developed for the research

SD= Strongly Disagree, D=Disagree, N= Neutral, A= Agree, SA= Strongly Agree

Table 4.11 showed the descriptive analysis, including mean score, standard deviation and percentage score of awareness. The highest mean was scored under the statement

“Facial recognition technology is trustworthy with it’s’ security risk feature” with 3.09. The lowest mean score was the statement “I would use facial recognition technology to protect sensitivity information” with 2.91.

From the analysis Table 4.11, majority respondents stand neutral towards all the statement which 46.3% for the statement “I feel secure when using facial recognition technology”, 36.6% for the statement “I would use facial recognition technology to protect sensitivity information”, 44.9% for the statement “Facial recognition technology is more reliable than the existing IT security methods”, 48.6% for the statement “Facial recognition technology is trustworthy with its’ security risk feature” and 41.7% for the statement “I would use facial recognition technology in prevention of sensitive information leakage”.

Table 4.12: Central tendencies measurement for all variables

		AD	PE	PU	AW	SR
N	Valid	350	350	350	350	350
	Missing	0	0	0	0	0
Mean		3.27	3.6166	3.49	3.48	3.00
Std. Deviation		.710	.72267	.772	.697	.809

Note. *Five-points scale: 1=Strongly Disagree; 5=Strongly Agree

Source: Developed for the research

Table 4.12 presents the summary of means and standard deviations for all the variables in this research. For adoption of facial recognition (mean=3.27, standard deviation=0.710), the respondents stay neutral as the respondents believe that the adoption of this technology would beneficial them. Besides, the respondents agreed that they are familiar with the facial recognition technology with mean of 3.6366 and

standard deviation of 0.72267. The respondent also agreed that they find facial recognition technology is easy to use with mean of 3.49 and standard deviation of 0.772. Moreover, the respondents agreed that they are aware of the existing of facial recognition technology with the mean of 3.48 and standard deviation of 0.697. For security risk (mean=3, standard deviation=0.809), the respondents stay neutral as they think security is the less or more likely to affect them in using the facial recognition technology.

4.3 Scale measurement

4.3.1 Reliability Test

Table 4.13: Summary of Reliability Test

No.	Variables	Cronbach's Alpha	No. of items
1	Adoption of facial recognition	0.794	5
2	Perceived ease of use	0.774	5
3	Perceived usefulness	0.758	5
4	Awareness	0.846	5
5	Security risk	0.834	5
Overall		0.836	5

Source: Developed for the research

The Cronbach's Alpha was analyzed and the results for overall items is 0.836 which is a very good reliability. Also, all the result of all variables are more than 0.71 which is recognized as reliable and consistent. According to Zikmund et al. (2010), Cronbach Alpha fell under the range of 0.6 to 0.95 is good. Thus, acceptance of all variables as they are reliable in this study.

4.4 Inferential Analysis

4.4.1 Multiple Linear Regression

Table 4.14: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.695 ^a	.482	.476	.514

a. Predictors: (Constant), SR, AW, PE, PU

Source: Developed for the research

Based on Table 4.14, it indicated that the independent variables (security risk, awareness, perceived ease of use and perceived usefulness) is a positive influence the dependent variable (adoption of facial recognition) with the R-value of 0.695. Besides, it also shows the value for adjusted R Square is 0.482 which means that the 48.2% of adoption of facial recognition was explained by the four independent variables. The remaining 51.8% variation do not explain in this study as they are influenced by other factors. Thus, there are other undetermined factors will affect the adoption of facial recognition.

Table 4.15: ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	84.959	4	21.240	80.386	.000 ^b
	Residual	91.157	345	.264		
	Total	176.117	349			

a. Dependent Variable: AD

b. Predictors: (Constant), SR, AW, PE, PU

Source: Developed for the research

From Table 4.15 above, the F-test value of 80.386 is significant at P=0.000 (P< 0.05). Thus, the fitness of the model is identified. The overall regression model with four independent variables (security risk, awareness, perceived ease of use and perceived usefulness) correctly sums up the explanation in the variation of the adoption of facial recognition.

Table 4.16: Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.634	.168		3.783	.000
	PE	.355	.058	.361	6.179	.000
	PU	.204	.058	.222	3.503	.001
	AW	.020	.047	.020	.428	.669
	SR	.190	.041	.216	4.587	.000

a. Dependent Variable: AD

Source: Developed for the research

Based on the output from Table 4.16, the linear equation is formed as below:

$$Y = 0.634 + 0.355(PE) + 0.204(PU) + 0.020(AW) + 0.190(SR)$$

Where,

Y=Adoption of facial recognition

PE= Perceived ease of use

PU= Perceived usefulness

AW= Awareness

SR= Security risk

Table 4.16 illustrate that perceived ease of use, perceived usefulness and security risk have p-value which is lower than 0.05. This results that they have positive relationship with adoption of facial recognition. For the another independent variable that is the awareness shown insignificance relationship towards adoption of facial recognition as their p-value is more than 0.05, which is 0.669.

From the equation formed in this study, it can explained as such. When one unit increase in the perceived ease of use, it will increase 0.355 unit in the adoption of facial recognition while other prediction remain constant. If there is one unit extra added in perceived usefulness, it will increase 0.204 unit in the adoption of facial recognition and other prediction remain unchanged. Moreover, by adding one unit to awareness, the adoption of facial recognition will be extra 0.020 units with all the prediction remain constant. If there is extra one unit added in security risk, it will give an extra 0.190 towards the adoption of facial recognition with the condition that all the predictors remain unchanged.

On the other hand, Table 4.16 shows that perceived ease of use is the most important predictor that influencing the adoption of facial recognition as it have the highest standardized coefficients beta value of 0.361 in this research.

4.4.2 Hypothesis Testing

In this study, there are 4 hypothesis had been developed to examine in this study and the suggested hypothesis are shown below:

H₁: There is a significant relationship between perceived ease of use and adoption of facial recognition.

H₂: There is a significant relationship between perceived usefulness and adoption of facial recognition.

H₃: There is no significant relationship between awareness and adoption of facial recognition.

H₄: There is a significant relationship between security risk and adoption of facial recognition.

CHAPTER 5: DISCUSSION, IMPLICATION AND CONCLUSION

5.0 Introduction

In this chapter, it will be discussing and measuring the results that had generated from the previous chapter. Besides, the implications, managerial implications and the limitations of this research are being indicated. Last, it will ended by providing with the recommendations for the future and future researchers.

5.1 Summary of statistical analysis

From the research, the researcher could summarize that from 350 respondents, 179 respondents are female while the rest 171 respondents are male. Besides, the researcher found that among 350 respondents, the majority are the generation Z which lies between the ages of 7 to 22 years old which involves 289 respondents. As for Millennials (23 to 38 years old) stands 15% which represent 51 respondents, while the minority are the generation X (39 to 54 years old) which involves 10 respondents. The survey questionnaires were distributed equally among Malaysian who come from different states. Based on the results, majority of the target respondents are from the central region which is Selangor, Kuala Lumpur and Pahang.

For general questions, the researchers discovered that 350 respondents are using smartphone but there is still 7% which is 23 respondents that do not know and familiar on the facial recognition technology. This also means that these 23 respondents do not aware that the existent of facial recognition technology. Furthermore, the results of the

survey questionnaires reflects that 214 respondents are willing to use the facial recognition especially in banking industry in the future while 39% which is 136 respondents do not support the use of facial recognition in the future.

The following are the central tendency for the summary of means and standard deviation for all the variables in this research. Means for all the variables fell within 3.0 to 3.6 which means average for all of the respondents answers on “neutral” and “agree” choices in the research questions and the standard deviation also in a range of 0.7 to 0.8, it indicates that the data is well spread to the mean and proved that most of the respondents stay neutral and agreed with the statements in survey questionnaires.

Furthermore, reliability test also conducted by the researcher on each variables. The Cronbach’s Alpha was analysed and the results for overall shown 0.836. As Zikmund (2013) stated that that when the Cronbach’s Alpha shows 0.6 above means the variables are fair reliable. Based on the reliability test done, the Cronbach’s Alpha is 0.836 which indicates the variables are reliable and acceptable in this study.

On the other hand, the coefficient of determination value (R^2) for the adoption of facial recognition is 0.482. This indicates that 48.2% of adoption of facial recognition was explained by the four independent variables. Therefore, our result shows that there is considered a weak linear relationship between independent variables and dependent variables.

Moreover, F-test was used in ANOVA to test the equality of means. Based on Table 4.15, F value was 80.386 with a p-value of 0.000. Thus, the result showed a significant relationship between all independent variables with the adoption of facial recognition as significant value is less than 0.05.

5.2 Discussions of Major Findings

5.2.1 Relationship between perceived ease of use and adoption of facial recognition

According to the significance level analysis, the results showed p-value is 0.000 which is less than 0.05. In other words, there is a significant relationship between perceived ease of use and adoption of facial recognition. Thus, H1 is accepted.

Based on Nwatu (2011), this researcher claims that perceived ease of use is a factors influencing the adoption of biometric technology. The researcher found that when a technology is easy to use, the user will develop a depth interest on such technology. Thus, the outcome from the study is acceptable and the perceived ease of use have significant relationship with adoption of facial recognition.

5.2.2 Relationship between perceived usefulness and adoption of facial recognition

According to the significance level analysis, the results showed p-value is 0.001 as p-value < 0.05. In other words, there is a significant relationship between perceived usefulness and adoption of facial recognition. Thus, H2 is accepted.

From the research of Zhang and Kang (2019), they discovered perceived usefulness will directly impact on the adoption of facial recognition. If the facilities are not fully equipped, consumers may find difficulty in adapting the

technology and it is time consuming. Thus, the outcome from the study is acceptable and the perceived usefulness have significant relationship with adoption of facial recognition.

5.2.3 Relationship between awareness and adoption of facial recognition

According to the significance level analysis, the results showed p-value is 0.669 as p-value is more than 0.05. In other words, there is insignificant relationship between awareness and adoption of facial recognition. Thus, H3 is not accepted.

Based on Mageswari (2019), Malaysia is slowly entering the e-wallet industry and making conversion towards going cashless. However, Malaysians are not aware of the existent of facial recognition technology as e-wallet is entering its adolescent stage. Thus, the outcome from the study have shown the awareness do not have significant relationship with adoption of facial recognition.

5.2.4 Relationship between security risk and adoption of facial recognition

According to the significance level analysis, the results showed p-value is 0.000 as p-value < 0.05. In other words, there is a significant relationship between security risk and adoption of facial recognition. Thus, H4 is accepted.

From the research of Alhussain and Omar (2012), the researcher also concluded that the consumers are concerned about the security issue. They are worried about the risk of disclosure of sensitive information had a high percentage in preferring the biometric method as an authentication method.

5.3 Implications of study

The results of the study are emphasis on the elements that affects the adoption of facial recognition. Therefore, the facial recognition technology might able to provide conveniences to the society, banking industry and also researchers that would like to conduct further study on such topic.

5.3.1 Managerial implications

Moreover, this research are able to help the banking industry in the market. The adoption of facial recognition technology in banking industry is important when it comes to the public. With the technology like facial recognition, bank able to enhance the method of payment for the consumers in the market especially in term of transaction speed and conveniences for transaction. With the confidence provided by the banks, consumer might be more interested in facial recognition technology and feel more secure while using it. Thus, the level of adoption of facial recognition in Malaysia might be able to grow.

Last but not least, the researchers who wish to investigate on the factors that affect facial recognition in the future may be benefited from this study as well. They can adopt the variables from this study and applied them as a reference.

Based on the study, the variables like perceived ease of use, perceived usefulness and security risk are important. Nevertheless, the other variable which is awareness has less affect towards the adoption of facial recognition. Thus, the future researches might eliminate the term awareness as the variable or reconsider other variables that might affect the facial recognition adoption in their future study. In addition, facial recognition is considered as a new topic among the existing technology such as e-wallet in Malaysia and the number of research about such topic are limited. Therefore, this study can benefits other researchers as benchmark of future research.

5.4 Limitations of the study

The researcher discover that there was lack of sufficient past journals and information to provide a in depth study on the quantitative study on the adoption of facial recognition via smartphone in banking industry among Malaysia. With the limited materials from past studies, some studies have reflected similar limitations in the current study in determining the relation between perceived ease of use, perceived usefulness, awareness and security risk towards the adoption of facial recognition. Thus, the lacking of the supporting documents for conducting current research project.

Moreover, the research acknowledge that were limited time given to conduct this study. With the limited time, the researcher only uses the quantitative method for this research project. Due to the limited time, it is sufficient for the researcher to collect data from 350 respondents.

5.5 Recommendations

For the future researchers, it is recommended to have an in depth study in the adoption of facial recognition and voice recognition. Especially in the case of plastic surgery which due to cosmetic reasons or even facial damages. The researchers should also venture into new areas of focus yet to be discovered in the current research project.

Since the target industry is only focus on banking industry, it is also suggested that the future researchers able to apply such technology in other industries. For instance, retail industry. With the used of facial recognition technology, it able to identify and fulfil the needs and wants of the consumers in the market. In the way that the retailers obtain the information through consumers' profile.

Besides, time constraint was also one of the limitation affecting this research project. With a longer duration to pursue this research project given to the researchers, they should able to conduct the research in the other method which is qualitative method in order to achieve a much more extensive and possibly accurate data for the study.

5.6 Conclusion

The researcher have summarized all the analyses and findings in previous chapter and according on the discussion in this chapter, all the independents (perceived ease of use, perceived usefulness and security risk) are directly related with the dependent variable (adoption of facial recognition) and related with some previous study. However, independent variable which is awareness have insignificant relationship towards the adoption of facial recognition. Besides, the researcher have the opportunity to generate

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the managerial implication for the society, institutions and future researchers to imitate the points mentioned in the study. Lastly, recommendations and platforms were provided for the future researchers.

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UNIVERSITI TUNKU ABDUL RAHMAN

Faculty of Accountancy and Management

**BACHELOR OF INTERNATIONAL
BUSINESS (HONS)**

FINAL YEAR PROJECT

**A QUANTITATIVE STUDY ON THE GLOBAL ADOPTION OF FACIAL
RECOGNITION VIA SMARTPHONE IN BANKING INDUSTRY, A
MALAYSIAN PERSPECTIVE**

Survey Questionnaire

Dear respondent,

I am a final year undergraduate student of Bachelor of International Business (Hons), from Universiti Tunku Abdul Rahman (UTAR). The main objective of this survey is to conduct a research to investigate the factors that affect the adoption of facial recognition via smartphone in banking industry in Malaysia.

Kindly fill up all the questions to the best of your knowledge. There are no absolute answers or wrong responses to any of these statements. I guarantee that all responses will be kept completely confidential.

Thank you for your participation.

Instructions:

1. There are **THREE (3)** sections in this questionnaire. Please answer **ALL** questions.
2. Completion of this form will take you approximately 5 to 10 minutes.
3. Please feel free to share your comments in the space provided. The contents of this questionnaire will be kept **strictly confidential**.

Section A: General Questions

Please tick (√) the following answer box for each question.

1. Are you using a smartphone?

- Yes
- No

2. Do you know about the facial recognition technology?

- Yes
- No

3. Do you consider using facial recognition in banking industry in the future?

- Yes
- No

Section B: Demographic Profile

Please tick (√) the following answer box for each question.

1. Gender

- Male
- Female

2. Current Age

- Generation Z (7-22 years old)
- Millennials (23-38 years old)
- Generation X (39-54 years old)
- Boomers (55-73 years old)
- Silent (74-91 years old)

3. State

- Northern Region (Perlis, Kedah, Penang, Perak)
- East Coast Region (Kelantan, Terengganu)
- Southern Region (Negeri Sembilan, Melaka, Johor)
- Central Region (Selangor, Kuala Lumpur, Pahang)
- East Malaysia (Sabah, Sarawak)

Section C

Please indicate your degree of agreement on the following statements by circling the numbers given ranging from:

Strongly Disagree = 1, Disagree = 2, Neutral = 3, Agree = 4, Strongly Agree = 5

Dependent Variable: Adoption of facial recognition

	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
AD1	I enjoy when using facial recognition technology.	1	2	3	4	5
AD2	I feel confident when using facial recognition technology.	1	2	3	4	5
AD3	Using facial recognition technology is beneficial.	1	2	3	4	5
AD4	Using facial recognition technology able to substitute the cash based payment method.	1	2	3	4	5
AD5	Facial recognition can improve the quality of banking industry.	1	2	3	4	5

Independent Variable:

(i) Perceived ease of use

	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
PE1	I find that facial recognition technology is easy to use.	1	2	3	4	5
PE2	I find that facial recognition technology is easy to learn.	1	2	3	4	5
PE3	I would feel comfortable using facial recognition technology.	1	2	3	4	5
PE4	I would like to use facial recognition technology if it is not difficult.	1	2	3	4	5
PE5	I would like instruction to be provided on how to use facial recognition technology.	1	2	3	4	5

(ii) Perceived usefulness

	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
PU1	Using facial recognition technology to verify identity is a good idea.	1	2	3	4	5
PU2	Using facial recognition technology to prevent identity fraud is a clever idea.	1	2	3	4	5
PU3	I would prefer to use facial recognition technology for identification.	1	2	3	4	5
PU4	The use of facial recognition technology would help me to save time.	1	2	3	4	5
PU5	The use of facial recognition technology would be useful in performing in daily life.	1	2	3	4	5

(iii) Awareness

	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
AW1	I have seen, heard or read about facial recognition technology.	1	2	3	4	5
AW2	I have been exposed to facial recognition technology.	1	2	3	4	5
AW3	I am aware of the facial recognition technology.	1	2	3	4	5
AW4	I know how facial recognition could be used in banking industry.	1	2	3	4	5
AW5	I know how facial recognition could be used in daily life.	1	2	3	4	5

(iv) Security Risk

	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
SC1	I feel secure when using facial recognition technology.	1	2	3	4	5
SC2	I would use facial recognition technology to protect sensitivity information. (E.g. personal data)	1	2	3	4	5
SC3	Facial recognition technology is more reliable than the existing IT security methods.	1	2	3	4	5
SC4	Facial recognition technology is trustworthy with its' security risk feature.	1	2	3	4	5
SC5	I would use facial recognition technology in prevention of sensitive information leakage.	1	2	3	4	5

Thank you for your time, opinion and comments

- The End -