DETERMINANTS OF SMARTPHONE ADOPTION AMONG OLDER ADULTS IN MALAYSIA

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DECLARATION

I hereby declare that:

(1) This MKMA 29906 Research Project 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 research project 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.

(3) The word count of this research report is 22,758.

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To my family in Korea,

To Jee EunKyung,

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To Park SunIl.

Thank you for your love, prayers and support.

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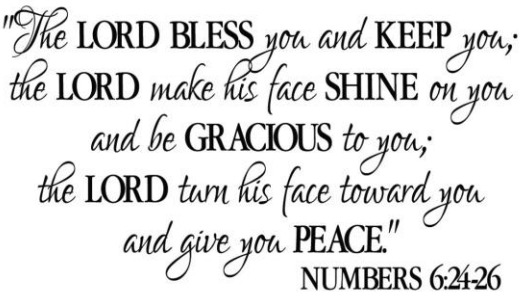

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ABSTRACT

Smartphone is an innovation with multifunctional capabilities that provides immense benefits and convenience to users. The typical smartphone combines telephone, computer, Internet browser, calendar, alarm clock, music player, video player, camera and video camera into one compact device. Motivated by the significance of smartphones and their extraordinary adoption, the purpose of this study was to investigate the motivational factors of smartphone adoption among older adults aged 50 and above. The Technology Acceptance Model (TAM) and Innovation Diffusion Theory (IDT) were adapted to examine the relationship between independent variables of perceived usefulness (PU), perceived ease of use (PEOU), perceived enjoyment (PE), social influences (SI), compatibility (COM), observability (OBS), and trialability (TRI), and their effect on the dependent variable behaviour intention to use smartphone (BI). This quantitative study utilized judgemental and snowball sampling method, and the survey questionnaire was distributed to 300 older adults. The final study sample consisted of 200 older adults from Selangor and Kuala Lumpur in Malaysia. Multiple linear regression analysis was conducted and the results showed that COM, PE, OBS, and TRI were significant determinants of smartphone adoption among older adults in Malaysia. The proposed model explained 54.5 percent of the variance in intention to adopt smartphone, which is higher than the 40 percent variance found in typical TAM studies. The beta value for compatibility ($\beta = 0.384$, $p < 0.05$) indicated that compatibility was the most important determinant of smartphone adoption among older adults. The second most important determinant was perceived enjoyment ($\beta = 0.170$, $p < 0.05$). It had been expected that PE, PEOU, and SI would have positive impact on BI, but these three hypotheses were not supported in this study. This study adds to the existing body of literature for smartphone adoption among older adults, which is still in its infancy. Overall, the study highlighted a fresh understanding of smartphone adoption among older adults, while previous studies focused mostly on students or working adults.

Keywords: smartphone adoption, older adults, TAM, IDT

CHAPTER 1

INTRODUCTION

1.0 Introduction

This chapter provides a basic introduction to the research project. It proposes a research that will add to an understanding of the older adult motivations toward adopting the smartphone. Specifically, the study aims to examine seven relational factors; perceived usefulness, perceived ease of use, perceived enjoyment, social influences, compatibility, observability, and trialability on smartphone adoption among older adults. It defines the background, problem statement, research objectives, research questions, hypotheses, and significance associated with the project.

1.1 Background of the Study

Since the first iPhone was introduced in June 29, 2007 (Honan, 2007), smartphones have been widely adopted all over the world and become one of the fastest spreading technologies of mankind (DeGusta, 2012).With the iPhone, Steve Jobs redefined the definition of smartphone as the phone is not only smarter but also easier to use by everyone. Five years later, Nielsen (2013) reported that 48 percent of mobile subscribers in the United States (US) are using smartphone and predicted soon it will be the most popular device. In December 2015, smartphone adoption in the US has skyrocketed to 80 percent, demonstrating just how prevalent these devices have become in daily lives (comScore, 2016).

The growth and adoption of smartphone technology has been dramatic. It has outpaced the PC, Internet, and social networking boom (Mlot, 2012). Miller (2014) asserted that it is the fourth screen, after the innovation of cinema, television, and computer. In 2011, the number of smartphone users surpassed 1 billion, and in 2014 there were over 1.75 billion smartphone users globally. The number of smartphone users worldwide will surpass 2 billion in 2016 representing over a quarter of the global population. Market research forecasts that by 2018, more than 2.56 billion people, or a third of the world's population, will use smartphones (eMarketer, 2014).

In the Asia-Pacific region, known as the fastest growing economic region in the world; smartphone adoption moved rapidly with more than 1 billion smartphone users in 2015. The widespread adoption of smartphones are led by China, India, and Indonesia. By 2019, smartphone users in the region will number 1.48 billion (eMarketer, 2015).

Smartphone has changed the way people access information and entertainment. Smartphone owners used their phone beyond making calls and text messaging; to get directions and recommendations, shop and bank online, listen to online radio and music, watch movies and TV, send photos and video via text (Anderson, 2016; Ofcom, 2015). Whilst smartphones are impacting societies, not all age groups are accepting and using them. In the US, just 18% of the older adult population has adopted the smartphone (Smith, 2014). In a newly conducted survey, Pew Research Center reported significant smartphone adoption gap exists between the younger and older generation in forty advanced and developing countries, such as Germany, Russia, Japan, China, and Malaysia (Poushter, 2016).

The world is ageing rapidly. Population ageing results from declining fertility and increasing longevity. In 2015, about 12% of the world's population (901 million) was over 60 years old. By 2050, the number of persons aged 60 and above will double to 22% (2.1 billion) and is expected to outnumber children under the age of 15 (United Nations [UN], 2015). The 2015 Revision confirmed that life expectancy is

projected to increase in developed and developing countries. Globally, it is projected to rise from 70 years in 2010-2015 to 77 years in 2045-2050 (UN, 2015). Likewise, the life expectancy of Malaysians is also on the rise; 72 and 77 years for men and women respectively (Rahim, 2016).

The demographic shift presents major opportunities and challenges to businesses and societies. One major implication is the emergence and constant growth of the "silver market". This term refers to the market segment of people aged 50 and older. Increasing in number and share of the total population while at the same time being relatively well-off, this market segment is a lucrative untapped market. Deloitte (2014), one of the Big Four professional services firm predicted that the 55+ will be the age group experiencing the fastest year on year rises in smartphone penetration across developed markets. The over-55s has unique characteristics. They are an economy's wealth holders, wealth creators and have the highest disposable income (Bank of America Merrill Lynch, 2014; Cohen, 2014; Schlesinger & Martin, 2015).

As stated above, smartphones can provide many benefits to users. However, within the older population, the rate of adoption of this innovative technology is still low. This research recognizes the importance of both smartphones and older people, and the need to reduce the existing research gap between older people and smartphone adoption and use. Thus, the aim of this study is to examine and identify the determinants of smartphone adoption among older adults in Malaysia.

1.2 Problem Statement

A review of the literature on smartphone adoption in Chapter 2 indicated that most previous studies focused on students or working adults. Only few studies have been conducted on older adults. For example, Williams (2012) conducted a qualitative study in the United States on how older adults perceived iPhones by interviewing 12 Americans over the age of 60. In the United Kingdom, Choudrie,

Pheeraphuttharangkoon, Zamani, and Giaglis (2014) examined the adoption and use of smartphones of older adults 50 years old and above via online survey. However, the sample size in their study was quite small; only 30 older adults.

In Malaysia, there were 11 million smartphone users, 64% of whom were under 30 years old (The Star, 2016). Past studies have generally focused on smartphone dependency (Liew, 2012; Ting, Lim, Patanmacia, Low & Ker, 2011), and addiction (Ching et al., 2015) among university students. A study on smartphone trend and usage with a large sample size of 1,814 respondents, involved 96% youth and young adults. Less than 1% were older adults above 57 years old (Osman, Talib, Sanusi, Tan, & Alwi, 2012).

Research on smartphone adoption among older adults is still in its infancy, and thus far, is insufficient. The present study will fill in the gap in the literature by examining and identifying the determinants of behaviour intention to use smartphone among older adults.

1.3 Research Objectives

With the above problem statement in mind, the objectives of this research are as follows:

1.3.1 General Objective

This research study aims to investigate and identify the determinants of smartphone adoption in the older adult population in Malaysia by combining the Technology Acceptance Model (TAM) and Innovation Diffusion Theory (IDT). There is a preference to combine two major adoption theories to improve explanatory power, and provide a stronger model (Gao, Yang, & Krogstie, 2015; Park & Chen, 2007; Putzer & Park, 2012; Wu & Wang, 2005).

1.3.2 Specific Objectives

The specific objectives are derived from the general objective above. Subsequently, the specific objectives of the study are as follows:

(a) Research Objective 1: To examine the relationship between perceived usefulness and smartphone adoption among older adults.
(b) Research Objective 2: To examine the relationship between perceived ease of use and smartphone adoption among older adults.
(c) Research Objective 3: To examine the relationship between perceived enjoyment and smartphone adoption among older adults.
(d) Research Objective 4: To examine the relationship between social influences and smartphone adoption among older adults.
(e) Research Objective 5: To examine the relationship between compatibility and smartphone adoption among older adults.
(f) Research Objective 6: To examine the relationship between observability and smartphone adoption among older adults.
(g) Research Objective 7: To examine the relationship between trialability and smartphone adoption among older adults.

1.4 Research Questions

After identifying the research objectives, the research questions to be answered from this research are:

(a) How does perceived usefulness influence behavioural intention to use smartphone among older adults?
(b) How does perceived ease of use influence behavioural intention to use smartphone among older adults?

(c) How does perceived enjoyment influence behavioural intention to use smartphone among older adults?
(d) How does social influences influence behavioural intention to use smartphone among older adults?
(e) How does compatibility influence behavioural intention to use smartphone among older adults?
(f) How does observability influence behavioural intention to use smartphone among older adults?
(g) How does trialability influence behavioural intention to use smartphone among older adults?

1.5 Hypotheses of the Study

The hypotheses that are corresponding to the research questions are developed as follow:

First Hypothesis

H_1: There is a significant positive relationship between perceived usefulness and behavioural intention to use smartphone.

Second Hypothesis

H_2: There is a significant positive relationship between perceived ease of use and behavioural intention to use smartphone.

Third Hypothesis

H_3: There is a significant positive relationship between perceived enjoyment and behavioural intention to use smartphone.

Fourth Hypothesis

H_4: There is a significant positive relationship between social influences and behavioural intention to use smartphone.

Fifth Hypothesis

H_5: There is a significant positive relationship between compatibility and behavioural intention to use smartphone.

Sixth Hypothesis

H_6: There is a significant positive relationship between observability and behavioural intention to use smartphone.

Seventh Hypothesis

H_7: There is a significant positive relationship between trialability and behavioural intention to use smartphone.

1.6 Significance of the Study

The study will be of significance to academia, industry, and smartphone users. Firstly, this research will expand the body of literature on smartphone adoption among older adults which is still in its infancy. Specifically, it extends and enhances the understanding of adoption and use of innovative smartphone within Malaysia's older adult population.

Older adults today are healthier, living longer, wealthier, are better educated, and have more experience with technology (de Barros, Leitão, & Ribeiro, 2014). For practitioners such as smartphone manufacturers, retailers, and applications developers,

it is important to know the factors that influence adoption, in order to tailor their products, services, and business strategies accordingly. This knowledge of motivational factors can help optimize smartphone technology for older adults.

Smartphones can improve the quality of life for older people and assist in their daily employment or businesses. Older adults are remaining in the workforce longer, either delaying retirement, starting a second career, or working on a volunteer basis (Mitzner et al., 2010). To remain active, competitive, and useful in the workforce, older adults must use and learn to use new technologies, such as smartphone.

The growth of the silver market will make older adults one of the most powerful consumer groups. It offers many industries with a gold mine of opportunities since many older adults have the time and money. This market segment is still very underdeveloped in terms of product and service offerings. Companies need to recognize the importance of these older wealthier consumers, and tailor their products and services to cater to this market; such as senior tourism, home reconstruction, healthcare and nutrition, departmental stores, and transportation.

1.7 Chapter Layout

This research study encompasses Chapters 1 through 5.

Chapter 1: Introduction

This introductory chapter presents background of the study, statement of the problem, research objectives and questions, hypotheses, significance of the research for the proposed study.

Chapter 2: Literature Review

Chapter two provides a comprehensive review of relevant literature review of smartphone, aging, theoretical framework and determinants of innovation adoption. It is lastly followed by conceptual framework and hypothesis development.

Chapter 3: Research Methodology

This chapter illustrates the research design, data collection and instrument, constructs measurement, data processing, and method of data analysis adopted in this study.

Chapter 4: Research Results

This chapter reports the overall research findings and analysis of the result by using SPSS version 20.

Chapter 5: Discussion and Conclusion

The last chapter discusses the results of the major findings in relation to the research objectives, implications and limitations of the study, and recommendations for future research.

1.8 Conclusion

Chapter 1 is the foundation for the research project. It frames the background of the study, statement of the problem, research questions, research hypotheses, and the significance of the study.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

The purpose of this chapter is to review the scholarly literature that contributes to smartphone adoption and older adults. The chapter begins by examining background information regarding smartphone, older adult, and the digital divide. Aging and its impact on technology adoption will also be explored. This is then followed by a comprehensive review of the theoretical framework, determinants of smartphone adoption, and the proposed conceptual framework. Seven hypotheses of this study are presented in in the last part of this chapter.

2.1 Smartphone and Applications

The first smartphone, the IBM Simon was invented in 1992 and released to the market in 1994. The smartphone revolution started to grow in 2002 with the introduction of BlackBerry smartphone, and took off in 2007 with Apple's revolutionary iPhone (Grush, 2012; Reed, 2010). There has been a rapid diffusion of smartphone technology in society. Marc Andreessen, founder of Netscape and technology expert states that more people have access to smartphones than running water (Thompson, 2012).

The use of smartphones is widespread and rapidly increasing because of the capabilities and convenience of smartphones. A national survey conducted by Pew Internet Project (Rainie & Fox, 2012) found that 86% of smartphone owners used their phone for just-in-time information to organise meetings or social gatherings, solve unexpected problems, or get driving directions. For smartphone users, their phone is the first thing they look at in the morning, and the last thing they look at before going to sleep (Lee, Chang, Lin, & Cheng, 2014).

Smartphones are mobile phones that have capabilities of a computer. It is a device that offers more advanced computing and communication capability than traditional mobile phones; for example Internet access, geo-positioning systems, management tools, high quality cameras and recording devices (Boulos, Wheeler, Tavares, & Jones, 2011; Charlesworth, 2009). The latest generation of smartphones are increasingly viewed as handheld computers rather than as phones, due to their powerful computing capability and large memory.

As smartphones became more powerful, the ability to run feature-rich applications (called "apps") on these devices became a reality. Google Play and Apple App Store (iTunes) are the leading online application stores. Google Play Store has around 1.3 million apps for Android users, while Apple App Store has around 1.2 million iOS apps available for free and paid downloads (Sims, 2015). There is now an app, free and paid for just about every social, entertainment and educational requirement (Boulos et al., 2011). In addition, the usability of diverse apps enables smartphones to replace many existing devices such as personal computers, digital cameras, video recorders, GPS navigators, watches, alarm clocks, and calculators (Miller 2012).

Small screen size is a distinctive feature of smartphones. The screen size is limited on the smartphone, so less content is visible at one time. Rauch (2011) noted that small screen size adds to the difficulty of understanding content, especially when trying to read large amounts of data via a smartphone. There is a distinct difference when users read from a smartphone compared with when content is read on a desktop computer.

The small screen size and even smaller keyboard make smartphones less suitable for tasks such as spreadsheet analysis and word processing (Bredican & Vigar-Ellis, 2014). It is sometimes difficult to correct errors or typos when writing emails on the smartphone (Shull, 2012).

Kim and Sundar (2014) studied the effects of screen size on 130 undergraduates aged 18 to 27 and found that screen size significantly contribute to shaping user perception and acceptance of smartphones. The study indicated that a large screen, compared to a small screen, is likely to lead to higher smartphone adoption. In addition, the utilitarian and hedonic qualities of smartphones increase with higher quality and quantity of information shown on large screen.

Users need to have digital skills to use a smartphone. The most basic skill is operational skill, which is the capacities to work with hardware and software (Van Dijk, 2002, 2006). Jung, Chan-Olmsted, and Kim (2013) introduced the concept of smartphone consumption skills. A smartphone will not be “smart” if its user does not have the skills to utilize its “smart” features. They added that lack of consumption skills may hinder older people from the benefits of using the smartphones and the diverse apps.

2.2 Definition of Older Adult

There is no standard answer nor agreement by researchers over the definition of an older, senior, or elderly person. In Britain, since 1875, the Friendly Societies Act, enacted the definition of old age as, "any age after 50" (Roebuck, 1979). The American Association of Retired Persons (AARP) in the US starts at age 50 and gives lots of senior discounts for the fifty and above age group (Gellman, 2013). The on-going debate led to several age groups to define the older adult: over 50 years, beyond age 55, 60 years or older, and between 65 and 74 years (Alen, Losada, & Domínguez, 2012).

Studies associated with the Internet and smartphones have defined older adults as those aged 50 and above (Calak, 2013; Choudrie et al., 2014; Morris, Goodman, & Brading, 2007; Lian & Yen, 2014; Moschis, Lee, & Mathur, 1997; Ziefle & Bay, 2005). Therefore, the working definition of older adults in this research is adults aged 50 and above. Furthermore, this demographic group encompasses both employed and retired individuals; thereby providing a broader perspective to this research study.

2.3 Digital Divide

The term digital divide refers to the gap between those who have access to computers and the Internet, and those who do not. The term had been broadened to include other ICTs such the telephone, television, and mobile phones. This divide can take on many forms including income, education, ethnicity, age, gender, and country of residence (Oxford Dictionaries, 2016; WhatIs.com, 2016).

One particular component of this digital divide is age. Findings confirm that a "grey" digital divide exists, with many older people missing out on the benefits that computers, the Internet and other ICTs can provide. The older adults reported less experience with computers and the Internet and less use of technology in general (Charness & Boot, 2009; McMurtrey, McGaughey, & Downey, 2008; Millward, 2003; Morris et al., 2007; Peacock & Künemund, 2007).

Older adults' adoption of new technologies has consistently lagged behind the younger generation (Charness & Boot, 2009). In a large scale survey with a sample of 1204 participants from age 18 to 91, Czaja et al. (2006) examined the general patterns of technology use of older adults. They found that older adults reported less use of computers, the Internet, mobile phone, and automated teller machine than younger adults. Their findings were similar to recent reports by Pew Internet Project researchers (Smith, 2014; Zickuhr & Smith, 2012).

2.4 Aging and Technology Adoption

Aging involves a general slowing of physical and cognitive abilities that are essential to learn and use new technologies (Huber & Watson, 2014). Common age-related changes have negative effects on vision, hearing, memory, and motor control. Many age-related changes are experienced as early as forty-five years old. By fifty, adults enter into the first stage of aging (Gurian, 2013).

When it comes to technology adoption, seniors generally lag behind their younger counterparts (Anderson, 2015). Lower adoption rates of new technologies are related to unique barriers and challenges older adults face (Smith, 2014). The unique challenges that make it difficult for older adults to adopt and use new technologies include vision challenges, cognitive challenges, computer anxiety and technophobia.

2.4.1 Vision Challenges

Many people in middle age begin to experience difficulty with their vision. The American Optometric Association (2015) lists the common age-related vision changes are problems with near vision (presbyopia), glare, lighting, and colour perception. Presbyopia (which literally means "aging eye") is an age-related eye condition, usually starting around the age of 40-45 years (American Academy of Ophthalmology, 2016; Torricelli, Junior, Santhiago, & Bechara, 2012). Decreased near vision makes it more difficult for older adults to focus on near objects; such as reading at close range, seeing the mobile phone numbers, or doing close work.

Haigh's study shows (as cited in Calak, 2013) that adults over the age of 40 often have problems with glare, the ability to differentiate detail reduces after the age of 50, and an adult over the age of 60 requires on average three times more light than a 20 year old to see the same level of detail.

2.4.2 Cognitive Challenges

Cognitive abilities are essential to learning how to use and maintain complex technology products (Charness & Boot, 2009). Czaja et al.'s study (2006) with a large diverse sample of 1,204 Americans found that fluid and crystallized intelligence (cognitive abilities) are important predictors of technology adoption. Aging bring about decreased memory capacity, attentional control, and difficulty in goal maintenance (Charness & Boot, 2015). These changes can slow down performance and result in a greater number of errors as older adults interact with technology that was not designed with their capabilities in mind.

Older adults took twice as long to learn a new word processor than younger adults, whether they were beginners or experienced with another word processor (Charness, Kelley, Bosman, & Mottram, 2001). Older mobile phone users reported they had problems with the complex hierarchical menu system (Ziefle & Bay, 2005), small sized screen and buttons (Kurniawan, 2008). Barnard, Bradley, Hodgson, and Lloyd (2013) examined the types of errors made by older users (aged 58-78) in task performance of touchscreen tablet. Majority of the participants struggled and made errors in entering password, sending an email, using the keyboard, searching on the Internet, and setting the alarm.

2.4.3 Computer Anxiety and Technophobia

Computer anxiety and technophobia are major barriers of computer and Internet access, especially among seniors. Computer anxiety is a feeling of discomfort, stress, or fear experienced when confronting computers. Technophobia is a fear of technology in general and a distrust in its beneficial effects (Van Dijk, 2006). Older adults experienced fear of consequence of use in new technology such as mobile phones (Kurniawan, 2008) and the Internet (Ellis & Allaire, 1999). Van Dijk added that these phenomena do not completely disappear with a rise in computer experience.

2.5 Theoretical Framework

Theories and models in Information and Communication Technology (ICT) focus on people's behavioural intention to adopt and use ICT as a major theoretical foundation. The main theories applied in ICT adoption studies are the Technology Acceptance Model (Davis, 1989), Innovation Diffusion Theory (Rogers, 2003), Unified Theory of Acceptance and Use of Technology (Venkatesh, Morris, Davis, & Davis, 2003), and Theory of Reasoned Action (Fishbein & Ajzen, 1975). There are several similarities between the constructs used to explain individual users' technology adoption and use. Table 2.1 shows how the constructs in TRA, TAM, Extended TAM, IDT, and UTAUT are related to each other.

Table 2.1 Summary of Theories and Models in ICT Adoption Research

TRA	TAM	Extended TAM	IDT	UTAUT
Beliefs, Attitude	Perceived Usefulness	Perceived Usefulness	Relative Advantage	Performance Expectancy
	Perceived Ease of Use	Perceived Ease of Use	Complexity	Effort Expectancy
Subjective Norm		Social Influences		Social Influences
		Perceived Enjoyment		Facilitating Conditions
			Compatibility, Observability, Trialability	

Note. Adapted from Kim, Y., & Crowston, K. (2011). Technology adoption and use theory review for studying scientists' continued use of cyber-infrastructure. *Proceedings of the American Society for Information Science and Technology*, *48*(1), p. 5.

2.5.1 Technology Acceptance Model (TAM)

The TAM is a well-known theory explaining user acceptance and behaviour related to new technologies. Davis (1989) developed the Technology Acceptance Model (TAM) to explain the potential user's behavioural intention to use a technological innovation. The model is an adaptation of the Theory of Reasoned Action (TRA) proposed by Fishbein and Ajzen (1975). TAM involved two primary predictors including perceived ease of use and perceived usefulness and the dependent variable behavioral intention.

Originally aimed at computer adoption, the model has been applied in a wide variety of technologies. Many ICT adoption and use studies have used the TAM and extended TAM as their theoretical framework. Lee, Kozar and Larsen (2003) stated that it is the most widely applied model in information systems. Overall, TAM has empirically proven successful in predicting about 40% of a system's use (Legris, Ingham, & Collerette, 2003). TAM is a parsimonious, powerful and robust predictive model as supported by meta-analyses (King & He, 2006; Legris et al., 2003). It has emerged as a gold standard (Holden & Karsh, 2010); a leading model of users acceptance of a wide range of technologies within diverse organizational and cultural contexts (Yousafzai, Foxall, & Pallister, 2007).

2.5.2 Innovation Diffusion Theory (IDT)

Innovation Diffusion Theory (IDT) seeks to explain how new ideas or innovations such as personal computer, the Internet and mobile telephone are adopted. Rogers (2003) defined innovation as an idea, a practice, or an object perceived as new by an individual or other unit of adoption (Rogers, 2003). The smartphone is a powerful and multifunctional device with more advanced features than a feature phone. It is regarded as an innovation and consequently IDT is applied to this study.

According to Rogers (2003), an innovation has five general attributes that influence adoption: relative advantage, compatibility, complexity, trialability, and observability. In general, the adoption rate of an innovation increases when it is perceived as having greater relative advantage, highly compatible, less complexity, able to be trialed, and results are easily observed. The categories of adopters are innovators, early adopters, early majority, late majority, and laggards (Rogers, 2003).

IDT is a robust theory with a long history of conceptual and empirical study (Dearing, 2009) in many fields of study such as agriculture, sociology, education, marketing and management, and communication (Rellinger, 2014). Over the years, the original five adoption determinants have been extended and combined with theories such as TAM and UTAUT. Tornatzky and Klein's (1982) seminal meta-analysis of 75 articles related to innovation characteristics suggest that three innovation characteristics; compatibility, relative advantage, and complexity provide the most consistently significant relationships with innovation adoption. Relative advantage is similar to perceived usefulness, whereas complexity is similar to perceived ease of use in the TAM.

Weigel, Hazen, Cegielski, and Hall (2014) extended and updated the earlier research of Tornatzky and Klein to present a comprehensive review of the various characteristics affecting innovation adoption. Findings of their meta-analysis of the innovation literature of the past thirty years were even more positive and supported Tornatzky and Klein's findings. Weigel et al. (2014) found that all five innovation characteristics proposed in IDT were significantly related to innovation adoption behaviour.

2.6 Determinants of Smartphone Adoption

Smartphone is a relatively new technology, and therefore there is still a lack of research that explores and confirms the determinants of behaviour intention for smartphone adoption (Ma, Chan, & Chen, 2016). An examination of the current literature revealed that few studies have investigated smartphone adoption and even fewer studies have empirically tested the smartphone adoption behaviours of older adults.

Due to these limitations, previous literature related to the adoption of new technology, such as computers, the Internet, mobile phones, and mobile commerce are included to provide the foundation to identify the determinants for this study. The determinants proposed by previous researchers are discussed in this section.

2.6.1 Perceived Usefulness (PU)

The TAM claimed that perceived usefulness is a strong primary determinant of usage intention. Perceived usefulness is defined as a potential user's subjective assessment that using a specific technology would improve job performance (Davis, 1989; Davis, Bagozzi, & Warshaw, 1989). There are three elements to perceived usefulness, including tasks effectiveness, productivity and time savings, and useful to one's life. Davis (1989) emphasized that perceived usefulness refers to perception of usefulness, and does not necessarily reflect objective reality. Thus, even if a technology (or innovation) would objectively improve performance, if a potential user does not perceive it as useful, it will not be adopted.

Past researchers in ICT provides many empirical evidences that there is strong positive relationship between perceived usefulness and use of technology. An early study on computer adoption conducted by Igbaria, Iivari, and Maragahh (1995) in Finland reported that perceived usefulness was a major determinant in workplace. A

similar study was conducted in the United States with a total sample of 471 managers and professionals. The results indicated that perceived usefulness had the strongest effect on computer usage (Igbaria, Parasuraman, & Baroudi, 1996). The findings indicated that managers and professionals used computer technology because they perceived computers as useful tools to improve their job performance and productivity.

In the context of Internet, Teo, Lim, and Lai (1999) examined the impact of perceived usefulness, perceived enjoyment, and perceived ease of use on the usage of Internet in Singapore. Most of the respondents were male (89%), aged between 16-30 years old. The study found that perceived usefulness had a more significant and stronger relationship with Internet usage than other variables. The results indicated that users engaged in a greater variety of tasks on the Internet because they perceived the Internet to be useful.

In the context of mobile commerce, Lu and Su (2009) conducted an empirical investigation with a sample that included 369 college students and professionals. The results confirmed that perceived usefulness had a significant positive effect on behavioural intention to use mobile shopping. In addition, it was the second strongest determinant on adoption intention. Earlier, Wu and Wang (2004) had found that perceived usefulness significantly influenced and was the second strongest predictor on behavioural intention to use mobile commerce.

TAM-based research on smartphone adoption has been conducted by Park and Chen (2007) in the healthcare sector. The researchers investigated 133 medical doctors' and nurses' intention of smartphone use in a local hospital in Midwest USA. The study confirmed the results of TAM. Perceived usefulness had significant effects on behavioural intention to use smartphone, and was the second most powerful predictor. The findings implied that perceived usefulness played a leading role in medical professionals' intention to use the smartphone.

Jongepier (2011) employed an extended version of the TAM (TAM2) to examine the determinants of smartphone adoption by young people. The sample consisted of 73 young people aged 18-30 in the Netherlands. The research results found that perceived usefulness had a significant impact on usage intention and it was the most important determinant among the tested factors of perceived ease of use, perceived entertainment, social pressure, and apprehensiveness.

South Korea is one of the leading countries in the adoption and use of new communication technologies. More than 4 in 5 South Koreans own a smartphone. The adoption rate of 83 percent made it the fourth highest smartphone adoption country in the world (Korea Times, 2015). The smartphone era began in Korea in late 2009 with the introduction of Apple's iPhone 3GS (third generation iPhone). As of end 2011, most people involved in economic activities were using a smartphone (Reuters, 2011). Commuters using their smartphones on crowded subways is a most common sight in Korea (BusinessKorea, 2014). Therefore, studies on South Korean smartphone users would contribute to determining the factors affecting smartphones adoption and usage.

Chun, Lee and Kim (2012) conducted a web-based survey among undergraduates in several universities in South Korea and gathered a total of 239 responses. The results showed that perceived usefulness had a positive effect on smartphone adoption intention. Another study with 200 undergraduate and graduate students in Seoul and Gyeonggi, South Korea also found perceived usefulness affected smartphone adoption (Kang, Cho, & Lee, 2011).

Park, Kim, Shon and Shim (2013) investigated the factors influencing smartphone adoption with a large sample of 852 Koreans aged from 17 to 49. The findings showed that perceived usefulness was an important factor of behavioural intention to use smartphones. Additionally, Joo and Sang's study (2013) with 491 iPhone users aged 20-59 concluded that perceived usefulness was the strongest predictor on smartphone adoption.

Most past studies consistently found perceived usefulness a significant predictor in TAM. A careful review of existing TAM literature, however, revealed a number of inconsistencies on the effects of perceived usefulness on intention to use a new technology. For instance, in their analysis of online games adoption, Hsu and Lu (2004) found perceived usefulness was not a predictor and had no significant impact on intention to use, while Park (2009) found perceived usefulness had no significant effect on intention to adopt e-learning.

Moreover, Wong, Yeung, Ho, Tse, and Lam (2012) concluded that perceived usefulness was not a significant predictor of Internet adoption among older adults in Hong Kong. In a study of determinants of smartphone adoption among American college students, perceived usefulness did not show a significant impact (Kim, Chun, & Lee, 2014). Similarly, Ma, Chan, and Chen (2016) concluded that perceived usefulness showed no significant impact on smartphone adoption among older adults in China.

2.6.2 Perceived Ease of Use (PEOU)

Perceived ease of use refers to the degree a potential adopter views usage of a technology to be relatively free of effort (Davis et al., 1989). Technologies that are perceived to be easier to use and less complex have a higher likelihood of being accepted and used by potential users. There are three elements to perceived ease of use; including physical effort, mental effort and how easy to learn a system (Davis, 1989). TAM claimed that perceived ease of use is a secondary determinant of usage intention. Additionally, perceived ease of use will depend on individual's expertise, with more experienced users finding a technology easier to use than a novice (Wang, Lin, & Luarn, 2006).

A number of empirical studies in ICTs have found that ease of use is an important determinant in the adoption and usage of a new technologies. A study conducted in Taiwan on consumer intention to use mobile services found that perceived ease of use had a significant positive effect on behavioural intention (Wang et al., 2006). The researchers emphasized that mobile service systems need to be both easy to learn and easy to use to prevent under-utilization problem. Another study conducted in Norway also found that perceived ease of use was a significant determinant in intention to use mobile services (Nysveen, Pedersen, & Thorbjørnsen, 2005).

A recent study on 3G mobile services in Singapore (Cho, 2011) found that perceived ease of use and perceived usefulness were the main predictors of the intention to use new communication technologies. This showed that individuals were more likely to use new mobile services when the services were perceived to be useful and to needed moderate cognitive effort to use.

Li (2014) examined the intention to adopt three new types of computer technologies: tablets, netbooks, and smartphones. The three devices have the basic functions of computers, but differ in size, design and main functionalities. She conducted the telephone survey with 1,100 participants aged 15-50 in Taiwan. The study found that perceived ease of use was a significant predictor for intention to adopt smartphones, tablets, and netbooks. Furthermore, it was the strongest predictor for intention to adopt smartphones and tablets, and the second strongest predictor for netbook adoption.

Studies that applied the TAM showed seemingly inconsistent results on the effects of perceived ease of use on new technology adoption. Perceived ease of use has been found to be significant in some studies and not significant in others due to cultures, situational contexts, adopter types, and technologies (Legris et al., 2003; Yousafzai et al., 2007). Koenig-Lewis, Palmer and Moll (2010) employed the TAM and IDT to predict intention to use mobile banking services among young people in Germany. They hypothesized that perceived ease of use would lead to higher behavioural

intention to use mobile banking. However, the results showed that perceived ease of use had no significant effect on behavioural intention.

In their analysis of smartphone adoption in South Korea, Park et al. (2013) and Kang et al. (2011) found that perceived ease of use did not affect adoption intention. Also, Jongepier (2011) found perceived ease of use showed no significant impact on smartphone adoption intention among young people in the Netherlands. Ma, Chan, and Chen (2016) explored factors that influenced older adults' smartphone acceptance in China. A total of 120 older adults aged above 55 from four senior centres in Tianjin participated in this study. Similarly, perceived ease of use showed no significant impact on smartphone adoption among older adults in China.

2.6.3 Perceived Enjoyment (PE)

Most TAM-based research focused on the perceived usefulness of a new technology and ignored the role of enjoyment in the adoption process. Addressing this limitation, Davis, Bagozzi and Warshaw (1992) introduced the concept of perceived enjoyment to the TAM to complement perceived usefulness and perceived ease of use. Perceived enjoyment is defined as the degree 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 expected (Davis et al., 1992). They explained that perceived usefulness is an extrinsic motivator, while perceived enjoyment is an intrinsic motivator. They found that enjoyment was a significant determinant subordinate to perceived usefulness in behavioural intention to use computers.

Early studies of technology adoption have indicated that the contribution of perceived enjoyment to technology adoption was substantially lower than perceived usefulness. Igbaria et al. (1996) examined the effects of perceived fun/enjoyment on the adoption and usage of computers by managers and professionals. The findings showed that perceived usefulness was the dominant motivator and had the strongest effect on

computer adoption. Perceived fun/enjoyment was an additional motivator, but the contribution of perceived fun/enjoyment was substantially lower.

Teo et al. (1999) adapted Igbaria's motivational model of computer adoption to examine the impact of intrinsic and extrinsic motivations on Internet adoption in Singapore. Consistent with previous research, they found that perceived usefulness played a more significant and stronger role than perceived enjoyment in the adoption of Internet in Singapore. Results indicated that Internet users perceived the Internet to be more useful to their job tasks and secondarily because it is enjoyable to use.

Some researchers argued that perceived enjoyment is in fact the most dominant predictor in the context of hedonic systems. The term hedonic comes from hedonism, signifies the pursuit of pleasure or happiness is the most important goal in life (Oxford Dictionaries, 2016). Van der Heijden (2004) proposed that for hedonic systems such as games, and systems used in the home and leisure environment, perceived enjoyment is the dominant predictor. The study conducted with 1,144 users of a Dutch movie website found that perceived enjoyment was the stronger determinant of intention to use than perceived usefulness. Specifically in the context of hedonic system, perceived usefulness lost its dominant predictive value in favour perceived enjoyment.

In the context of e-commerce, Yu, Ha, Choi, and Rho (2005) concluded that perceived enjoyment was the most important factor affecting behavioural intention toward television-commerce. Their online study was conducted on 886 experienced users and 115 inexperienced users aged 15-39 years old in South Korea. They explained that perceived enjoyment was the most important determinant because television gives pleasure and entertainment.

Lu and Su (2009) investigated mobile shopping intention with a sample of 369 participants aged from 16-55 in Taiwan. The results revealed that perceived enjoyment had a significant impact on behavioural intention to use mobile shopping websites, and was the strongest determinant among six significant determinants. They explained that mobile shopping users experienced immediate fun, excitement, and happiness when searching for their products and services due to product descriptions, images, background music, and videos on their mobile phones.

Several recent studies in the context of smartphone have found that perceived enjoyment has a significant influence on intention to adopt. Chun et al. (2012) proposed an extended TAM for smartphone adoption and hypothesized that intention to use were jointly influenced by hedonic enjoyment and utilitarian usefulness. They claimed that the smartphone is a task-oriented device for productivity and also an entertainment-oriented device designed for pleasure. The results showed that hedonic enjoyment and utilitarian usefulness had a positive effect on adoption intention among 239 undergraduates in South Korea. The findings indicated that smartphone is a convergent device that appealed to adopter's task-oriented and entertainment-oriented motivations.

These findings were consistent with a study conducted in the Netherlands by Jongepier (2011); where perceived entertainment/enjoyment and perceived usefulness had significant effects on smartphone adoption. Smartphones enable users to install and use new apps based on their needs and interests. However, smartphone users do not automatically use all the available apps. A study conducted with 579 smartphone users in Finland (Verkasalo, López-Nicolás, Molina-Castillo, & Bouwman, 2010) found that perceived enjoyment had positive effects on the adoption of games, Internet, and maps.

Kobayashi et al. (2011) conducted a series of experiments on touchscreen smartphones with twenty elderly Japanese in their 60s and 70s and discovered that enjoyability was one of the most important factors in using the smartphones. Similarly, Williams's qualitative study (2012) with twelve adults above age 60 found that entertainment was a main motivational factor for older adults to adopt and use iPhones.

In China, the speed of population ageing has exceeded the rate of population ageing for the rest of the world since 2000. Currently, China has a larger number of older people than any other countries in the world (Ma et al., 2016). Gao et al. (2015) investigated the smartphone adoption of older adults in China with a sample of 121 participants aged above 45. They found that perceived enjoyment was the most important determinant suggesting that older adults are more likely to adopt the smartphone if it is fun to use.

2.6.4 Social Influences (SI)

Venkatesh and Davis (2000) introduced TAM2, a millennium version of the original TAM by adding social influences processes (subjective norm, voluntariness, and image) to predict the adoption of a technology. They found in four longitudinal studies that subjective norm significantly influenced technology adoption in work environments. Subjective norm is defined as the degree to which individuals perceive that important others, such as family, friends, and colleagues believe they should use a new technology (Fishbein & Ajzen, 1975). They also found that the effect of subjective norm on intentions may subside over time, and diminish to non-significance with increased experience with a technology (Venkatesh & Davis, 2000; Venkatesh & Morris, 2000).

Early studies of innovative technology adoption hypothesized the effects of subjective norm on behavioural intention. Igbaria et al. (1996) reported subjective norm was positively related to computer usage when computer technology was still a novelty, while Kwon and Chidambaram (2000) found that social status (image) was an important motivation for individuals to adopt mobile phones to gain higher social status.

Hsu and Lu (2004) applied TAM2 to predict online games acceptance in Taiwan. The results indicated that social influences was an important predictor and had a positive impact on the adoption of online games. The researchers explained that online game is an entertainment technology and users participated because they want to belong to a community.

In the context e-commerce, Yu et al. (2005) reported that subjective norm was a determinant of behavioural intention to adopt television-commerce. The researchers reasoned that users strongly considered the opinions of family, friends, and important others because television-commerce was used in the home environment. Majority (92%) of the respondents was from 15-39 years old.

Wei (2006) examined the adoption of new Internet technologies in the workplace with a total sample of 268 employees of a public university in Taiwan. The results found that social influences from family members and colleagues using wireless Internet were significant predictors of wireless Internet adoption.

Chun et al. (2012) proposed that social influences and self-image would be strongly significant in determining the adoption of smartphone due to the influence of Korea's strong collectivistic culture. The researchers found that social influences and positive self-image had significant but weak effects on smartphone adoption.

Following, Lee (2014) examined the factors that influenced smartphone adoption with 151 university students from a large Midwestern university in the US. The results found that normative peer influence and familial influence had strong positive effects on students' smartphone adoption. Furthermore, familial influence had a larger impact than peer influence possibly because students are financially dependent on their parents. These results indicated that students conformed to the expectations of their friends and family members to enhance affiliation and image.

Pan and Jordan-Marsh (2010) proposed an extended TAM to examine Internet adoption behaviours among the older adults in China. A total of 374 participants aged 50 to 81 from fourteen residential communities in Beijing took part in the study. The findings showed that subjective norm had a significant positive effect on Internet adoption. This suggested that the expectations of others and external pressures to use the Internet had a strong effect on Internet use behaviour.

Lian and Yen (2014) investigated online shopping behaviour among older adults aged 50 and above in Taiwan and found that social influences positively affected older adults' intention to shop online. The findings showed that for older adults, the major online shopping driving factor was social influence from peers and family members.

2.6.5 Compatibility (COM)

Compatibility as defined by Rogers (2003) is the degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters. An innovation that is more compatible, fits more closely with the individual's daily life. The perceived compatibility of an innovation is positively related to its rate of adoption.

Agarwal and Prasad (1997) examined user acceptance of the innovation represented by World Wide Web when the technology was emerging. The sample was 73 MBA students in the US. The researchers found that the innovation characteristics of compatibility, observability, and trialability had significant effects on adoption intention. Also, compatibility appeared to be the most important determinant of behaviour intention to use the Web.

Internet adoption study reported similar results. Wei (2006) employed IDT to examine the adoption of new Internet technologies in the workplace. The total sample was 268 employees of a public university in Taiwan. The results found that compatibility was the strongest predictor highlighting the importance of compatibility in the adoption of wireless Internet technologies. Wei added that higher perceptions of compatibility of wireless Internet led to a greater likelihood of adoption.

Wu and Wang (2005) investigated the acceptance and usage of mobile commerce by integrating IDT into the TAM. In their study, mobile commerce refers to any transactions with monetary value executed via mobile devices. The transactions included online banking, shopping, investing, shopping, and online services. The subjects of their study was users and potential adopters of m-commerce in Taiwan. The results indicated that compatibility positively influenced behavioural intention to use. Additionally, compatibility was the most important determinant for behavioural intention to use m-commerce.

Koenig-Lewis et al. (2010) conducted an online survey of 263 young people aged 18 to 35 in Germany to investigate adoption of mobile phone banking. Mobile banking enables customers to access their bank accounts through mobile devices to check their balance or to conduct financial transactions. Their findings indicated that compatibility had a significant effect on the adoption of mobile banking services. Moreover, compatibility had the strongest positive influence on intention to adopt m-banking. This study showed that young consumers in Germany perceived mobile banking services to be compatible their values, lifestyle, and needs.

Recent studies on smartphone adoption among healthcare professionals have found that compatibility was a significant predictor. Putzer and Park (2010) investigated the decision to adopt a smartphone among 74 nurses in two community hospitals in the United States. The beta value for compatibility showed that compatibility had the strongest relationship with smartphone adoption among nurses. The nurses perceived smartphones as having broad compatibility with other technologies in the hospital.

In another study, Putzer and Park (2012) examined behavioural intention to use smartphone adoption among physicians with seven innovation factors: compatibility, observability, job relevance, personal demographics, personal experience, the internal environment, and the external environment. The sample consisted of 87 physicians from community hospitals and academic medical centres. Similarly, the beta value for compatibility indicated that it had the strongest impact on smartphone adoption among physicians.

In their investigation of smartphone adoption among older adults in China, Gao et al. (2015) found that compatibility had a significant positive impact and was the second most important determinant. The findings suggest that older adults believed that using the smartphone was consistent with their lifestyle and work habits.

2.6.6 Observability (OBS)

Observability refers to how visible the results of an innovation are to potential adopters and others. IDT states that perceived observability has a positive relationship with adoption decision. When potential adopters perceive the new technology as visible, they are more likely to adopt the innovation (Rogers, 2003). The innovation of mobile phones was first offered to American consumers in 1983. Rogers (2003) attributed the rapid adoption of this innovative device to observability because mobile phones were highly visible in companies, restaurants, and other public places.

In the context of the World Wide Web, Agarwal and Prasad (1997) found that observability had a significant impact on adoption intention. They explained that the high visibility of the WWW stimulated curiosity and influenced potential adopters. They added that potential adopters also need to be able to view the technology being utilized, in addition to the physical presence of the new technology.

In the context of e-learning, Lee, Hsieh, & Hsu (2011) combined IDT with TAM and investigated the determinants of e-learning adoption among 552 business employees in Taiwan. The findings revealed that observability was a significant determinant in the adoption of e-learning. Previous study found that observability was a significant determinant for Internet adoption as a teaching tool (Martins et al., 2004). The researchers added that when the results and benefits of an innovation are visible to potential adopters, the innovation will be quickly adopted.

Studies in the context of smartphone adoption among healthcare professionals also reported that observability was a significant predictor. Park & Chen (2007) hypothesized the positive effects of compatibility, observability and trialability on adoption. They found only observability was positively related with medical doctors' and nurses' adoption decisions. Recent studies reported that observability was significant among nurses (Putzer & Park, 2010), and physicians (Putzer & Park, 2012). The researchers explained that observation of colleagues using smartphones positively impacted the medical professionals about the relevance of smartphone. In addition, observability was found to be an important determinant of smartphone adoption among older adults in China (Gao et al., 2015).

2.6.7 Trialability (TRI)

Trialability as defined by Rogers (2003) refers to the degree to which an innovation may be tested on a limited basis prior to making an adoption commitment. The opportunity to try an innovation gives potential users an opportunity to see how it works under their own terms and conditions. It also reduce uncertainty about the new product or service. Potential adopters who are allowed to experiment with an innovation will feel more comfortable with the innovation and are more likely to adopt it.

Previous researchers have documented trialability as one of the significant variables influencing new technology adoption. When Internet banking was relatively new in Singapore, Tan and Teo (2000) examined the factors influencing the adoption of Internet banking. The total sample comprised of 454 respondents. The results indicated that the most significant factor to influence adoption of Internet banking was trialability. The support for trialability was consistent with Rogers' argument that potential adopters who were able to experiment with an innovation were more likely to adopt the innovation.

Educators worldwide are increasingly using the Internet as a teaching tool. Martins, Steil, and Todesco (2004) employed IDT to determine the factors that influenced the acceptance of the Internet as a teaching tool. They conducted a mail survey with 92 foreign language schools in Southern Brazil. The researchers discovered that trialability was the most significant predictor for Internet adoption as a teaching tool. The results also indicated that respondents who received more than 6 hours of training in the use of the Internet have adopted the Internet suggesting the role of training in adoption. A study conducted among lecturers in Malaysia also found that trialability was a significant factor influencing e-learning adoption (Hsbollah & Idris, 2009). These findings suggests that potential users need to be given the opportunity to pre-test the innovative technology prior to implementation.

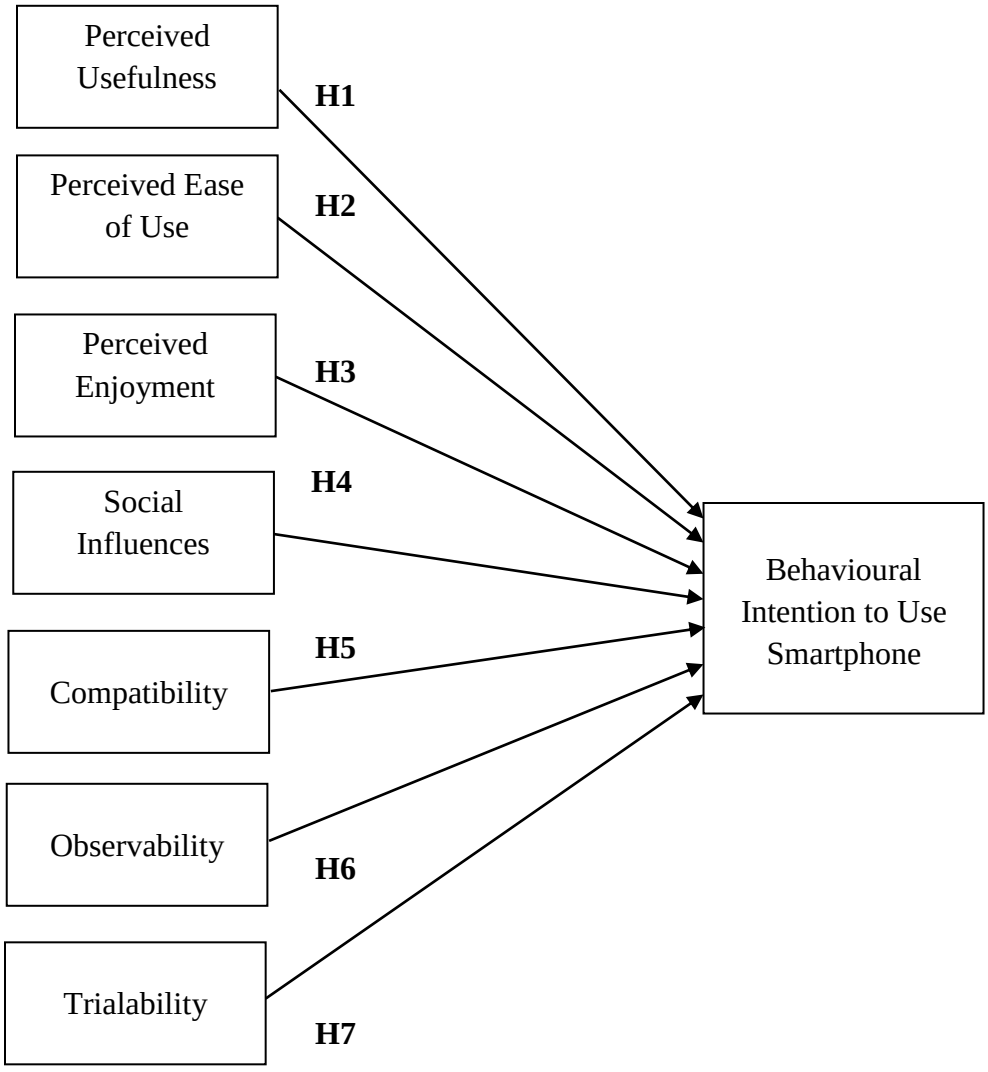
In the online gaming industry, massively multiplayer online games (MMOGs) are currently the most popular online game in Asia and North America. Wang (2014) examined the factors influencing intention to play new online games. A total of 411 undergraduates, 57% male and 43% female with MMOGs experience participated in this study. The findings revealed a significant positive relationship between trialability and intention to play new MMOG. Trialability was also a more significant determinant of intention to play new MMOGs for female players than male players.

Rellinger (2014) examined the adoption of smartphones and tablets by faculty members and students at a private university in Midwestern US. The mean age for faculty was 46, while the mean age for students was 20. The findings indicated that trialability was a significant predictor for students but not significant among faculty.

2.7 Conceptual Framework

The research framework for this study is based on the TAM and IDT. The framework proposed that the dependent variable of this research, behavioural intention to use smartphone is determined initially by perceived usefulness, perceived ease of use, perceived enjoyment and social influences from TAM. The second group of variables include compatibility, observability and trialability from IDT. The researcher has developed seven hypotheses based on the research framework. Figure 2.1 shows the proposed model for the adoption of smartphone among older adults.

Figure 2.1: Proposed Conceptual Framework



Source: Developed for the research.

2.8 Hypotheses Development

2.8.1 Perceived Usefulness

In this study, perceived usefulness refers to the perceptions of older adults in terms of how the smartphone can help them to improve performance, increase productivity, and overall a useful device in their lives. If the older adults recognize the potential benefits that a smartphone provides, then they are more likely to adopt and use a smartphone. Higher perceived usefulness will lead to higher likelihood of adoption. Past researchers provided many empirical evidences that there is strong positive relationship between perceived usefulness and new technology adoption. Therefore, the following hypothesis is proposed.

H_1: There is a significant positive relationship between perceived usefulness and behavioural intention to use smartphone.

2.8.2 Perceived Ease of Use

In this study, perceived ease of use refers to the perceptions of older adults that using a smartphone will be easy and free of physical and mental effort. If a smartphone is seen as easy to learn and use, and to become skillful, older adults are more likely to adopt it. Higher perceived ease of use therefore increases the likelihood of adoption. Perceived ease of use has been found to be a significant determinant of new technology adoption. However, there are a number of inconsistencies in the literature that makes it worthwhile to take a closer look at the impact of perceived ease of use on smartphone adoption among older adults. In order to further analyze this relationship, this study proposed that:

H_2: There is a significant positive relationship between perceived ease of use and behavioural intention to use smartphone.

2.8.3 Perceived Enjoyment

Perceived enjoyment refers to the degree the older adults perceive smartphone use to be exciting, pleasant and fun through activities such as taking photos, playing games, instant messaging on WhatsApps, and social networking on Facebook. Higher perceived enjoyment will positively affect their intention to adopt the device. Since various researchers have reported perceived enjoyment to be a strong determinant, it is included in this research. Therefore, the following hypothesis is proposed.

H_3: There is a significant positive relationship between perceived enjoyment and behavioural intention to use smartphone.

2.8.4 Social Influences

In this study, social influences refers to the degree the older adults perceive that important others believe they should use a smartphone. They are more likely to be socially pressured into using a smartphone if their friends, family or colleagues already have smartphones or will have one in the near future. The stronger the influence of significant referents, the higher the likelihood of adopting a smartphone. Previous research studies also indicated that social influences is a significant determinant. Therefore, the following hypothesis is proposed.

H_4: There is a significant positive relationship between social influences and behavioural intention to use smartphone.

2.8.5 Compatibility

In this study, compatibility is the degree which smartphone is well-suited with the lifestyle of older adults. High compatibility will lead to greater likelihood of adoption. Previous researchers have demonstrated the importance of compatibility to the adoption of new technologies. Therefore, the following hypothesis is proposed.

H_5: There is a significant positive relationship between compatibility and behavioural intention to use smartphone.

2.8.6 Observability

Observability is defined as the degree smartphones are visible to the older adults. A higher level of observability increases the likelihood of adoption. Previous studies related to smartphone adoption reported that observability is a significant predictor. Therefore, the following hypothesis is proposed.

H_6: There is a significant positive relationship between observability and behavioural intention to use smartphone.

2.8.7 Trialability

In this study, trialability refers to whether or not a smartphone can tested prior to adoption. New innovations require the older adults to invest time, energy and resources. More opportunities to test the smartphone therefore increases the likelihood of adoption. Previous studies have reported trialability is a significant determinant of intention to adopt new innovations. Therefore, the following hypothesis is proposed.

H_7: There is a significant positive relationship between trialability and behavioural intention to use smartphone.

2.9 Conclusion

This chapter has examined literature related to smartphone, older adults and aging, and ICT adoption theories to provide a comprehensive view and further understanding to the study. Based on the literature review from previous research, a research model with seven hypotheses has been developed by combining the TAM with IDT. In the next chapter, the proposed hypotheses will be tested on respondents in a local context with appropriate research method.

CHAPTER 3

RESEARCH METHODOLOGY

3.0 Introduction

In previous chapter, which is Chapter 2, the literature review, conceptual framework and hypotheses are highlighted. These provide the foundation for this chapter to proceed. The focus of this chapter is on the detailed methodology used to collect needed data in order to test the hypotheses in the previous chapter. The chapter begins by describing the research design, data collection methods, sampling design and research instrument. Operational definitions of constructs, data preparation, and methods of data analysis are explained in the last part of this chapter.

3.1 Research Design

According to Burns and Bush (2010, p. 143), research design is defined as a set of advance decisions that make up the master plan specifying the methods and procedures for collecting and analysing the needed information. Hence, in order to gain accurate and reliable results, it is vital to have a blueprint to show the progression of carrying out the research in an appropriate and systematic mode.

Broadly, there are two types of research designs: exploratory and conclusive (Malhotra, Birks & Wills, 2012, pg. 86). Exploratory research uses small sample size, thus inhibits making conclusions about the findings and the findings are not

generalizable to the population at large. Conclusive research seeks to describe specific phenomena, test specific hypotheses and examine specific relationships (Malhotra et al., 2012, p. 89). Thus, this study uses conclusive research to gain information on older adults' opinions, usage patterns, demographic profile and adoption intention towards the smartphone.

In addition, conclusive research comprise of descriptive research and causal research. Descriptive research is used to describe the characteristics of a population or phenomena, and to obtain answers to questions of who, what, where, when, and how (Burns & Bush, 2010, p. 149). Causal research tests whether a change in one event brings about a corresponding change in another event (Hair, Money, Samouel, & Page, 2007, p. 160). This study is interested in testing whether the independent variables causes the dependent variable (smartphone adoption intention). The independent variables are perceived usefulness, perceived ease of use, perceived enjoyment, social influences, compatibility, observability, and trialability.

3.2 Data Collection Methods

Data collection is a pivotal stage in a research and it is recognized that a research project is no better than the data collected in the field (Zikmund, Babin, Carr & Griffin, 2010). It is very important to select the correct method because it can influence the results of a study. In this research, both primary data and secondary data are used to answer the hypotheses and research questions.

3.2.1 Primary Data

Malhotra, Hall, Shaw & Oppenheim (2002, p. 157) defined primary data as the data originated by the researcher for the specific purpose of addressing the problem at hand. Primary data are original works of research study or raw data without

interpretation that represent an official opinion or position. Hence, primary data are always the most authoritative because the information has not been filtered or interpreted by any second party (Cooper & Schindler, 2014, p. 96).

In this research, primary data are collected from questionnaire survey because it provides standardization in which all respondents are answering the same question and are exposed to the same response options for each question, and finally lead to ease of administration and analysis (Burns & Bush, 2010, p. 267).

The survey used multiple data collection modes comprising of self-administered and person-administered survey. In self-administered survey, the respondents complete the questionnaire on their own without the researcher present. The advantages are wider access and better coverage, provides anonymity, relatively low cost and respondents complete the questionnaire at own pace (Hair et al. 2007, p. 205).

Person-administered survey is whereby an interviewer reads the questions to the respondent and records the answers (Burns & Bush, 2010, p. 271). It was used to overcome illiteracy and poor reading ability among certain older adults.

3.2.2 Secondary Data

Secondary data is the data that have been already collected by and readily available from other sources. Such data are cheaper and more quickly obtainable than the primary data. In addition, secondary data can help the researcher to identify problem, better define problem, and formulate an appropriate research design such as by identifying the key variable (Malhotra et al., 2002, p. 157).

Useful secondary data information can be obtained through the Internet or relevant websites with academic journals which are consistent with the research study. The

secondary data should be carefully evaluated to make sure that it is relevant, accurate, current and impartial (Kotler, Brown, Adam & Armstrong (2004, p. 220).

3.3 Sampling Design

The objective of most research is to acquire information about the characteristics of a population by conducting either a census or a sample. Using a sample is preferred due to budget and time limits, large population size and small variance in the characteristic of interest (Malhotra et al., 2012, p. 495). Sampling design involves determining the target population, sampling frame, sampling technique, sample size and executing the sampling process.

3.3.1 Target Population

Sampling design begins with defining the target population precisely. The target population is the collection of elements or objects that researcher seeks to acquire information and about which inferences are to be made (Malhotra et al., 2012, p. 496). The main objective of this research is to analyse the determinants of smartphone adoption among the older adults in Malaysia. The eligibility criteria for this research is adults age 50 years old and above. A person below 50 years old is ineligible and will be excluded. Hence, the target population of this study will be adults aged 50 years old and above, both male and female.

3.3.2 Sampling Frame and Sampling Location

A sampling frame is a representation of the elements of the target population, which is a master list of all the sample units for identifying the target population (Malhotra et al., 2012, p. 497). The sampling locations selected are Selangor and Kuala Lumpur.

Population distribution by state indicated that Selangor is the most populous state with 5.46 million people and Kuala Lumpur has 1.67 million people (Department of Statistics, Malaysia, 2011). Kuala Lumpur and Selangor also have the highest mobile phone penetration rate in Malaysia at 220.8% and 156.1%, respectively (Malaysian Communications and Multimedia Commission [MCMC], 2015). Thus, the decision to distribute the questionnaire to respondents in Selangor and Kuala Lumpur would likely be more relevant and significant.

The survey was conducted from 13th August to 20th September, 2015. Three hundred questionnaires were distributed to eligible respondents in companies, schools, universities, public libraries, line-dance groups, senior citizens groups and households (i.e. neighbours) located in Kuala Lumpur, Klang, Petaling Jaya, Shah Alam and Subang Jaya.

3.3.3 Sampling Elements

An element is person about which or from which the information is desired (Malhotra et al., 2012, p. 496). This research was conducted in Selangor and Kuala Lumpur. The target respondents selected were adults age 50 and above, who were using or not using a smartphone. They include working adults, non-working adults and retirees. They were targeted because they can provide the relevant information on smartphone adoption based on their personal opinions, knowledge and experiences.

3.3.4 Sampling Technique

The sampling technique selected for this research is non-probability sampling. Non-probability sampling refers to a sampling technique in which units of the sample are selected on the basis of personal judgment or convenience and the probability of any particular member of the population being chosen is unknown (Zikmund et al., 2010).

Among the non-probability sampling techniques, judgemental sampling and snowball sampling were used in this study. Judgemental sampling is inexpensive, convenient and quick (Malhotra et al., 2012, p. 504). In snowball sampling, an initial group of participants who are known to possess the desired characteristics of the target population is selected. Subsequent participants are selected based on the referrals provided by the initial participants (Malhotra et al., 2012, p. 506).

The 300 questionnaires were randomly distributed by hand in two batches. The first 200 forms were distributed directly to participants age 50 and above. The remaining 100 were handed to 15 initial participants to be distributed to their social networks. Follow-up reminders were sent to non-respondents to encourage participation. Reminder message was sent after one week and again in two weeks. A third reminder message was sent four weeks after the initial survey invitation.

3.3.5 Sampling Size

Sample size refers to the number of elements to be included in a study. Determining the sample size is complex and challenging due to factors such as the nature of the research, the number of variables, the nature of the analysis, completion rates and resource constraints (Malhotra et al., 2012, p. 499).

Roscoe (1975) cited in Sekaran and Bougie (2013, p. 269) proposes the following rules of thumb for determining sample size:

(1) Sample sizes larger than 30 and less than 500 are appropriate for most research.
(2) Where samples are to be broken into subsamples (male/female, etc.), a minimum sample size of 30 for each category is needed.
(3) In multiple regression analyses, the sample size should be preferably ten times or more as large as the number of variables in the study.

Green (1991) provides a comprehensive overview of the procedures used to determine regression sample sizes. Green's formula cited in Tabachnick & Fidell (2014, p. 159) suggests $N \geq 50 + 8m$ (where m = number of independent variables) for multiple regression and $N \geq 104 + m$ for testing individual predictors.

Based on the rules of thumb, the minimum regression sample size with seven independent variables would be:

a) 106 participants for multiple regression ($N = 50 + 8(7)$.
b) 111 participants for testing individual predictors ($N = 104 + 7$).

Table 3.1 provides an overview of the sample size rules of thumb based on the nature of the research. The researcher has decided on a sample size of 300 participants after taking into consideration the nature of the research, incidence rates, completion rates, budget and time constraints.

Table 3.1: Sample size rules of thumb

Type of research	**Minimum size**	**Typical range**
Problem identification	500	1,000-2,500
Problem-solving research	200	300-500
Product tests	200	300-500
Test marketing studies	200	300-500

Note. Adapted from Malhotra, N. K., Birks, D. F., and Wills, P. (2012). *Marketing research: An applied approach* (4th ed.), p. 500. Essex, England: Pearson Education.

3.4 Research Instrument

The research instrument used in this study is questionnaire. A questionnaire is a preformulated written set of questions used by respondents to record their answers, usually within closely defined alternatives (Sekaran & Bougie, 2013, p. 147). The questionnaire was developed based on the literature reviewed.

3.4.1 Questionnaire Design

The questionnaire was written in English because it is the international language and suitable for communication with the respondents. It is divided into three main sections, which are Section A (Personal Opinion about the Smartphone), Section B (Smartphone Usage) and Section C (Demographic Profile).

In Section A, the questions were designed to gather data from the respondents about opinions towards smartphones that consist of questions relating to the measurement of the independent variables; perceived usefulness, perceived ease of use, perceived enjoyment, social influences, compatibility, observability, and trialability. Respondents were also asked to give their opinions on the dependent variable which is their intention to adopt the smartphone.

All the questions were close-ended questions designed in five-point Likert scale and semantic-differential scale. Close-ended questions can help the respondents to make quick decisions among a set of alternatives and the researcher to code the information easily for subsequent analysis (Sekaran & Bougie, 2013, p. 150). The attitudes of the respondents will be indicated by checking how strongly they agree or disagree with the questions that range from very positive to very negative toward the attitudinal object. Positively and negatively worded (reverse-coded) questions were interspersed to minimise mechanical circling towards one end of the scale and help respondents remain alert while answering the questions.

Section B was directed to individuals who made the decision to adopt the smartphone and are presently using one in their daily life. In Section B, open-ended and close-ended questions were used to gather information on smartphone usage. Current users were asked questions about: 1) How long they have been using the smartphone, 2) How they acquired the device, 3) Their daily smartphone usage, 4) Top 5 activities, and 5) Top 3 applications on their smartphones.

In Section C, questions were designed to gather respondent's personal information which consists of gender, age, employment status, education level, and computer experience. Some respondents may find close-ended questions restrictive and might want the opportunity to make additional comments. This is the reason the questionnaire end with a final open-ended question that invites respondents to add comments or suggestions. The questionnaire is enclosed in Appendix A.

3.4.2 Pilot Test

According to Schwab (2005, p. 47), it is necessary to pilot test the questionnaire on individuals similar to those who will eventually complete the survey. A pilot test is conducted to refine and to assess the validity and reliability of the questionnaire (Saunders, Lewis & Thornhill, 2012, p. 451). Pilot test will most likely lead to changes in the design of the questionnaire. These changes may increase response rate, reduce missing data, and obtain more valid responses on the final questionnaire (Shwab, 2005, p. 47). The sample size of the pilot test can range from 15 to 30 subjects (Malhotra et al., 2012, p. 477).

The questionnaire was piloted with fifteen people age 50 and above, from 25th July to 1st August, 2015. Following this a number of changes were made to the questionnaire which were: (1) clearer instructions on how to answer the questions in each section, (2) bigger font sizes for better readability, and (3) included a comments section at the end of the questionnaire.

3.5 Construct Measurement

The sources of the construct measurements used in this research project are adapted from previous studies.

3.5.1 Origin of Construct

The dependent variable is behavioural intention to use smartphone. Four items were used to measure this variable which was adapted from Park and Chen (2007). Table 3.2 indicates the items for the construct of behavioural intention which includes: (1) Assuming that I have a smartphone, I intend to use it, (2) Whenever possible, I intend to use the smartphone, (3) To the extent possible, I would use the smartphone to do different things, (4) I intend to increase my use of the smartphone in the future. The reliability of the scale was confirmed by Cronbach's alpha (α=0.95).

Table 3.2: Behavioural Intention to Use the Smartphone Construct and Measurement Items

Construct	Sample measurement items	Cronbach's Alpha	Sources
Behavioural Intention to use smartphone (BI) 4 items	1. Assuming that I have a smartphone, I intend to use it. 2. Whenever possible, I intend to use the smartphone. 3. To the extent possible, I would use the smartphone to do different things. 4. I intend to increase my use of the smartphone in the future.	0.95	Park and Chen (2007)

Source: Developed for the research

Table 3.3 indicates the items for the construct of perceived usefulness. There are six items used to measure this attitude: (1) Using the smartphone would enable me to accomplish tasks more quickly, (2) Using the smartphone would improve my performance, (3) Using the smartphone would increase my productivity, (4) Using the smartphone saves me time, (5) Using the smartphone would make it easier to do my tasks, (6) Overall, I would find the smartphone useful. The six items are adapted from Park and Chen (2007), and Davis (1989).

Table 3.3: Perceived Usefulness Construct and Measurement Items

Construct	Sample measurement items	Cronbach's Alpha	Sources
Perceived Usefulness (PU) 6 items	1. Using the smartphone would enable me to accomplish tasks more quickly. 2. Using the smartphone would improve my performance. 3. Using the smartphone would increase my productivity. 4. Using the smartphone saves me time. 5. Using the smartphone would make it easier to do my tasks. 6. Overall, I would find the smartphone useful.	0.97	Park and Chen (2007), Davis (1989)

Source: Developed for the research

Table 3.4 indicates the items for the construct of perceived ease of use. There are six items used to measure this attitude: (1) Learning to operate the smartphone would be easy for me, (2) I would find it easy to get the smartphone to do what I want it to do, (3) My interaction with the smartphone would be clear and understandable, (4) I would find the smartphone to be flexible to interact with, (5) It would be easy for me

to become skillful at using the smartphone, (6) I would find the smartphone easy to use. The six items are adapted from Park and Chen (2007), and Davis (1989).

Table 3.4: Perceived Ease of Use Construct and Measurement Items

Construct	Sample measurement items	Cronbach's Alpha	Sources
Perceived Ease of Use (PEOU) 6 items	1. Learning to operate the smartphone would be easy for me. 2. I would find it easy to get the smartphone to do what I want it to do. 3. My interaction with the smartphone would be clear and understandable. 4. I would find the smartphone to be flexible to interact with. 5. It would be easy for me to become skillful at using the smartphone. 6. I would find the smartphone easy to use.	0.95	Park and Chen (2007), Davis (1989)

Source: Developed for the research

Table 3.5 indicates the items for the construct of perceived enjoyment. There are six semantic differential scales used to measure how the respondents feel about using the smartphone: (1) fun-frustrating, (2) pleasant-unpleasant, (3) negative-positive, (4) pleasurable-painful, (5) exciting-dull, and (6) enjoyable-unenjoyable. These six pair items are adapted from Teo et al. (1999), Igbaria et al. (1995), and Davis et al. (1992).

Table 3.5: Perceived Enjoyment Construct and Measurement Items

Construct	Sample measurement items	Cronbach's Alpha	Sources
Perceived Enjoyment (PE) 6 pair items	Using the smartphone is: 1. Fun- Frustrating 2. Pleasant-Unpleasant 3. Negative-Positive 4. Pleasurable-Painful 5. Exciting-Dull 6. Enjoyable-Unenjoyable	0.90	Teo et al. (1999), Igbaria et al. (1995), Davis et al. (1992)

Source: Developed for the research

Table 3.6 indicates the items for the construct of social influences. There are six items used to measure this attitude: (1) Most people around me (friends, family, colleagues) think one should have a smartphone, (2) People who are important to me think that I should use the smartphone, (3) Those who are important to me owned a smartphone already or will have one soon, (4) Majority of my friends and family have a smartphone or will have one in near future, (5) People who influence my behaviour think that I should use the smartphone, (6) I want to use the smartphone because my friends and family do so. The six items are adapted from Chun et al. (2012), Verkasalo et al. (2010), Hsu and Lu (2004), and Venkatesh and Davis (2000).

Table 3.6: Social Influences Construct and Measurement Items

Construct	Sample measurement items	Cronbach's Alpha	Sources
Social Influences (SI) 6 items	1. Most people around me (friends, family, colleagues) think one should have a smartphone. 2. People who are important to me think that I should use the smartphone. 3. Those who are important to me owned a smartphone already or will have one soon. 4. Majority of my friends and family have a smartphone or will have one in near future. 5. People who influence my behaviour think that I should use the smartphone. 6. I want to use the smartphone because my friends and family do so.	0.91	Chun et al. (2012), Verkasalo et al. (2010), Hsu and Lu (2004), Venkatesh and Davis (2000)

Source: Developed for the research

Table 3.7 indicates the items for the construct of compatibility. There are four items used to measure this attitudes: (1) Using the smartphone is compatible with all aspects of my work or life, (2) Using the smartphone is completely compatible with my current situation, (3) I think that using the smartphone fits well with the way I like to work or live, (4) Using the smartphone fits into my lifestyle. The four items are adapted from Park and Chen (2007), and Moore and Benbasat (1991).

Table 3.7: Compatibility Construct and Measurement Items

Construct	Sample measurement items	Cronbach's Alpha	Sources
Compatibility (COM) 4 items	1. Using the smartphone is compatible with all aspects of my work or life. 2. Using the smartphone is completely compatible with my current situation. 3. I think that using the smartphone fits well with the way I like to work or live. 4. Using the smartphone fits into my lifestyle.	0.94	Park and Chen (2007), Moore and Benbasat (1991)

Source: Developed for the research

Table 3.8 indicates the items for the construct of observability. There are four items used to measure this attitude: (1) I have seen what others do using their smartphone, (2) The smartphone is not very visible in my surroundings and/or workplace, (3) It is easy for me to observe others using the smartphone, (4) I have had a lot of opportunity to see the smartphone being used. The four items are adapted from Park and Chen (2007), and Moore and Benbasat (1991).

Table 3.8: Observability Construct and Measurement Items

Construct	Sample measurement items	Cronbach's Alpha	Sources
Observability (OBS) 4 items	1. I have seen what others do using their smartphone. 2. The smartphone is not very visible in my surroundings and/or workplace. 3. It is easy for me to observe others using the smartphone. 4. I have had a lot of opportunity to see the smartphone being used.	0.75	Park and Chen (2007), Moore and Benbasat (1991)

Source: Developed for the research

Table 3.9 indicates the items for the construct of trialability. There are five items used to measure this attitude: (1) The smartphone would help me to feel acceptable, (2) The smartphone would improve the way I am perceived, (3) The smartphone would make a good impression on other people, (4) The smartphone would give its owner social approval. The five items are adapted from Park and Chen (2007), and Moore and Benbasat (1991).

Table 3.9: Trialability Construct and Measurement Items

Construct	Sample measurement items	Cronbach's Alpha	Sources
Trialability (TRI) 5 items	1. I have had a great deal of opportunity to try various smartphone applications. 2. I know where I can go to satisfactorily try out various uses of the smartphone. 3. Before deciding on whether or not to adopt the smartphone, I would need to properly try it out. 4. I would be permitted to use the smartphone on a trial basis long enough to see what it could do. 5. Being able to try out the smartphone was important in my decision to use it.	0.85	Park and Chen (2007), Moore and Benbasat (1991)

Source: Developed for the research

3.5.2 Data Scale of Measurement

Measurement involves assigning numbers to a variable according to certain predefined rules (Sekaran & Bougie, 2013, p. 211). The assigned numbers must reflect the characteristics of phenomenon being measured. A scale is a tool or mechanism in which an intended characteristic of an item can be measured There are four types of scales, which are nominal scale, ordinal scale, interval scale, and ratio scale.

The questionnaire of this study is divided into three main sections; Section A, (Personal Opinion about the Smartphone), Section B (Smartphone Usage) and Section C (Demographic Profile).

Section A consists of forty-two questions. All questions used the interval scale to measure respondents' opinions except question 42 which used the nominal scale. Items for variables include opinions toward the smartphone, perceived usefulness, perceived ease of use, perceived enjoyment, social influences, compatibility, observability, and trialability were measured using a five-point Likert scale ranging from (1) Strongly Disagree to (5) Strongly Agree. Perceived enjoyment was measured using a five-point semantic differential scale. The Likert scale is designed to examine how strongly respondents agree or disagree with statements on a five-point scale. Table 3.10 shows the summary of the Likert scale and the semantic differential scale used to measure the variables in this study.

Section B consists of six questions. The questions are designed with a combination of nominal scale, ordinal scale and ranking scale. Nominal and ordinal scale are used to obtain information on the smartphone usage of respondents. Question 47 and 48 used the ranking scale to draw out older adults' preferences over the top 5 activities and top 3 applications on their smartphone respectively. The ranking scale enables respondents to rank items relative to one another, among the alternatives given (Sekaran & Bougie, 2013, p. 223).

Section C, the final part of the questionnaire consists of six questions. The questions are designed with nominal, ordinal and ratio scale. Gender, employment status, education level, and computer expertise level are measured on the nominal and ordinal scale. Question 50 and 53 used the ratio scale to measure the respondent's age and the number years using computers in general. The personal information of respondents will assist in analysing the responses in Section A and B.

Table 3.10: Summary of Likert Scale and Semantic Differential Scale Used to Measure Variables

Variables	Measurement Scales
Dependent Variable: Behavioural Intention to use Smartphone Independent Variables: Perceived Usefulness Perceived Ease of Use Social Influences Compatibility Observability Trialability Perceived Enjoyment	**Likert Scale** 1=Strongly Disagree 2=Disagree 3=Neutral 4=Agree 5= Strongly Agree **Semantic Differential Scale** Fun-Frustrating Pleasant-Unpleasant Negative-Positive Pleasurable-Painful Exciting-Dull Enjoyable-Unenjoyable

Source: Developed for the research

3.6 Data Preparation

Data preparation begins with checking for acceptable questionnaires, followed by editing, coding, transcribing the data. Finally the data are cleaned and a treatment for missing responses is prescribed (Malhotra et al., 2012, p. 586). This process ensures the accuracy of the data and their conversion from raw form to reduced and classified forms that are more appropriate for analysis (Cooper & Schindler, 2014, p. 376).

3.6.1 Questionnaire Checking

The initial step in questionnaire checking involves a check of all questionnaires for completeness and interviewing quality while field work is still underway (Malhotra et al., 2012, p. 586). A questionnaire may be unacceptable for reasons such as substantial number of questions have been left unanswered, the questionnaire is answered by someone who doesn't qualify for participation, and the questionnaire is received after the deadline (Malhotra et al., 2012, p. 588).

3.6.2 Editing

According to Malhotra et al. (2012, p. 588), editing is the review of questionnaire with the objective of increasing accuracy and precision. It consists of screening questionnaires to identify illegible, incomplete, inconsistent, or ambiguous responses. In this study, the returned questionnaires were checked and questionnaires that were answered by someone below 50 years old, received after the deadline or with excessive missing data were not included in the data set for analysis.

3.6.3 Coding

Coding means assigning a code, usually a number, to each possible answer to each question (Malhotra et al., 2012, p. 590). The coding of close-ended questions is relatively simple because the options are predetermined. Most close-ended questions in the questionnaire had five possible answers and were assigned codes 1 to 5. The coding process of open-ended questions is more complex, whereby the researcher list all the responses, and then develop and assign codes to these responses.

3.6.4 Transcribing

Transcribing data involves keying the coded data from the returned questionnaires into the computer (Malhotra et al., 2012, p. 595). In this research project, Statistical Package for the Social Sciences (SPSS) version 20 was used for transcribing data.

3.6.5 Data Cleaning

Data cleaning includes consistency checks and treatment of missing responses which are more thorough and extensive (Malhotra et al., 2012, p. 597). Consistency checks identify data that are out of range, logically inconsistent or have extreme values which are inadmissible and must be corrected. Missing responses represent values of a variable that are unknown; either because respondents provide ambiguous answers or their answers were not properly recorded (Malhotra et al., 2012, p. 598). Missing values were coded “9”or “99” in this study.

3.7 Data Analysis

According to Cooper and Schindler (2014, p. 86), data analysis involves reducing accumulated data to a manageable size, developing summaries, examining patterns, and applying statistical techniques for hypotheses testing. The data were analysed using SPSS version 20.

3.7.1 Descriptive Analysis

Descriptive analysis is the preliminary step in all data analysis and becomes foundation for subsequent analysis. It is performed with measures of central tendency and variability. Measures of central tendency report the most typical or frequent

response to a question using the mode, the median, and the mean (Burns & Bush, 2010, p. 464). Measures of variability such as frequency distribution, range, and standard deviation reveal the diversity of respondents.

It is important to look beyond numerical summaries into visual summary and gain insight into the patterns of the data. Data visualization is an integral element in the data analysis process and as a necessary step prior to hypothesis testing (Cooper & Schindler, 2014, p. 406). In this study, bar charts, histograms, or pie charts were used to display the data.

3.7.2 Reliability Analysis

The next analysis is to test the goodness of the data by checking the reliability of the multi-items measures. Reliable measures obtain identical or very similar answers to identical or near-identical question from the same respondent (Burns & Bush, 2010, p. 319). Cronbach's alpha is a reliability coefficient to examine the reliability of the measurement scale. Most researchers generally agreed an alpha value of 0.70 as the acceptable level of reliability, and over 0.8 as good (Hair, Black, Babin & Anderson, 2010, p. 125; Heppner & Heppner, 2004, p. 118; Sekaran & Bougie, 2010, p. 293).

In this research, Cronbach's alpha was used to test the reliability for the eight variables: (1) perceived usefulness, (2) perceived ease of use, (3) perceived enjoyment, (4) social influences, (5) compatibility, (6) observability, (7) trialability, and (8) behavioural intention.

3.7.3 Inferential Analysis

Inferential analysis is used to generate conclusions about the population's characteristics based on the sample data (Burns & Bush, 2010, p. 463). Regression analysis is commonly used to analyse the relationship between a single dependent

variable and several independent variables (predictor). The objective of multiple regression analysis is to predict the changes in the dependent variable in response to changes in the independent variables (Hair et al., 2010, p. 161).

The equation in multiple regression has the following form:

$$y = a + b_1x_1 + b_2x_2 + b_3x_3 + \ldots + b_mx_m$$

where

y = the dependent variable

x_i = independent variable i

a = the intercept

b_i = the slope for independent variable i

m = the number of independent variables in the equation.

Multiple Linear Regression (MLR) is a very powerful tool because it reveals what factors are related to the dependent variable, which way (the sign) each factor influences the dependent variable, and how much (the size of b_i) each factor influences it (Burns & Bush, 2010, p. 613).

The purpose of this research is to determine which factors affect the intention to adopt the smartphone among older adults. MLR was adopted to assess the impact of the seven independent variables: (1) perceived usefulness, (2) perceived ease of use, (3) perceived enjoyment, (4) social influences, (5) compatibility, (6) observability, and (7) trialability on the dependent variable behaviour intention to use smartphone.

The multiple regression equation formed is:

$$BI = a + b_1PU + b_2PEOU + b_3PE + b_4SI + b_5COM + b_6OBS + b_7TRI$$

Where

BI = Behaviour Intention

PU = Perceived Usefulness

PEOU = Perceived Ease of Use

PE = Perceived Enjoyment

SI = Social Influences

COM = Compatibility

OBS = Observability

TRI = Trialability

The measure of predictive accuracy for the multiple regression model is the coefficient of determination (R^2). It represents the combined effects of all the independent variables in predicting the dependent variable (Hair et al., 2010, p. 164). With multiple regression, the underlying conceptual model specifics that several independent variable are to be used, and it is necessary to determine which one are significant (Burns & Bush, 2006, p. 588). It helps researcher to clearly identify which independent variables have great impact on the dependent variable.

3.8 Conclusion

This chapter described research design, data collection methods, sampling design, research instrument and construct measurement adopted in this study. Chapter 3 provide a linkage to chapter 4, they are interrelated. Chapter 4 will report on the results of the statistical analysis which are relevant to the research questions and hypotheses using SPSS version 20.

CHAPTER 4

RESEARCH RESULTS

4.0 Introduction

This chapter reports the research results of the smartphone survey that was conducted on the older adults in the Klang Valley, Malaysia. The population sampled in this research consisted of 200 individuals with varied age, education, and employment background. Their experiences with the smartphones are presented in descriptive analysis and multiple regression analysis using the Statistical Package for Social Sciences (SPSS) version 20. This chapter begins with descriptive analysis comprising of the demographic profile of the respondents, their smartphone usage behaviour, and means and standard deviations for each variables. Multiple regression analysis was used to test the hypotheses proposed in Chapter 2. Tables and graphs are used to show patterns and relationships, and to present the results in a more effective manner.

4.1 Demographic Profile

A total of 300 questionnaires were distributed by hand to senior citizens groups, line-dance groups, households, companies, schools, universities, and public libraries, located in the Klang Valley. Out of the 210 responses received, ten were discarded due to substantial number of items left unanswered and ineligible participants below fifty years old. The response rate of 70% was deemed sufficiently complete to be usable for this study.

Section C was designed to gather respondent's personal information which consists of gender, age, employment status, education level, and computer experience. The demographic profile of the respondents (N = 200) is presented in Table 4.1.

Table 4.1: Demographic Profile

Characteristics	**Frequency**	**Percent (%)**	**Cumulative Percent (%)**
Gender			
Male	90	45.0	45.0
Female	110	55.0	100.0
Age group			
50-59 years old	81	40.5	40.5
60-69 years old	98	49.0	89.5
70-79 years old	21	10.5	100.0
Highest education level completed			
Primary	1	0.5	0.5
Secondary	62	31.0	31.5
Diploma	39	19.5	51.0
Bachelor degree	72	36.0	87.0
Master degree	23	11.5	98.5
Doctorate	3	1.5	100.0
Employment status			
Working full-time	73	36.5	36.5
Working part-time	25	12.5	49.0
Retired	94	47.0	96.0
Volunteering	8	4.0	100.0
Level of computer experience			
None	10	5.0	5.0
Low	20	10.0	15.0
Medium	48	24.0	39.0
High	122	61.0	100.0

On gender, there were slightly more female respondents (55%) compared to males (45%). Majority of respondents were between 60-69 years old (49%), followed by 50-59 years old (40.5%), and 70-79 years old (10.5%), with a mean age of 61.52 years. Figure 4.1 and 4.2 depict the respondents' gender and age group graphically.

Figure 4.1: Gender

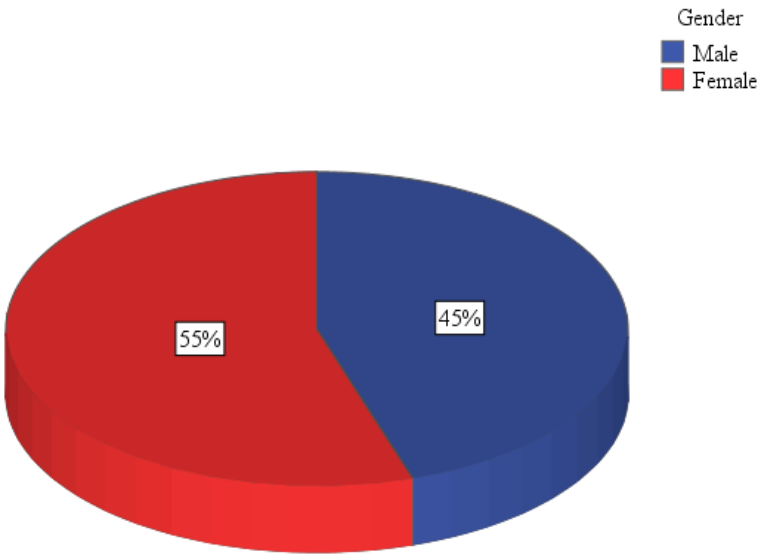


Figure 4.2: Age Group

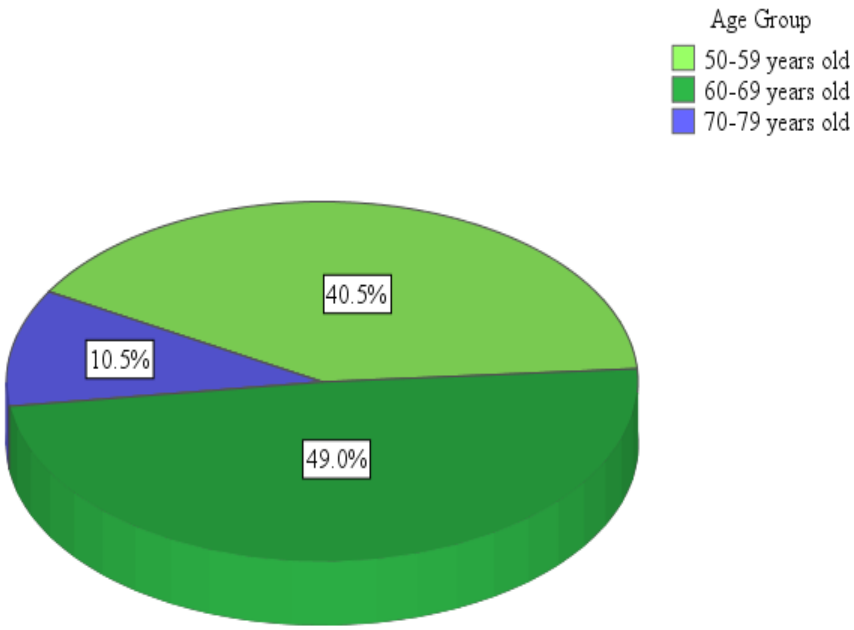
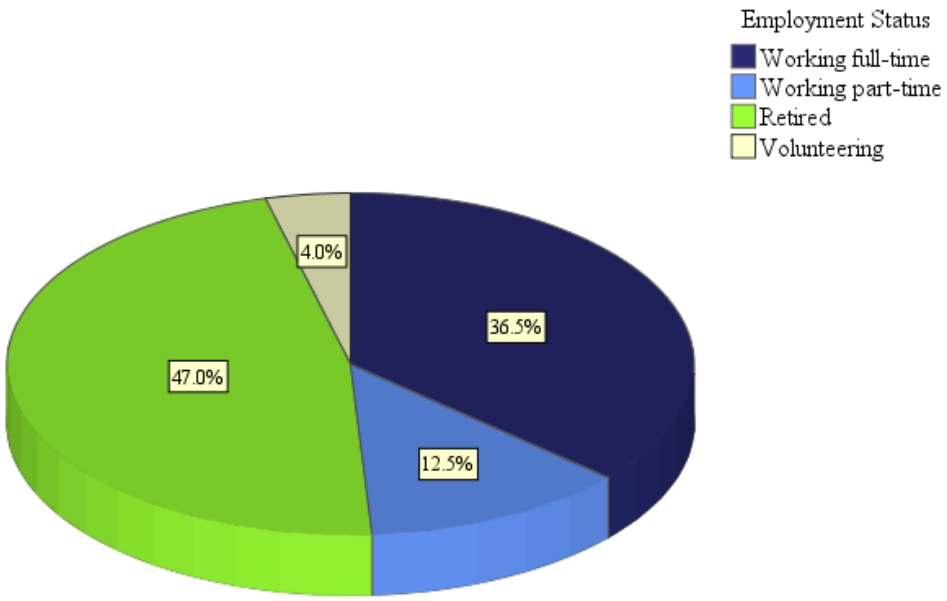


Figure 4.3 displays that 47% of the respondents were retired, followed by 36.5% working full-time, 12.5% working part-time, and 4% involved in volunteering In terms of education, 55.5% of the respondents had completed either a bachelor degree or diploma, followed by secondary school (31%), master degree (11.5%), and doctorate (1.5%). Only 0.5% of the respondents reported having a primary school education.

Figure 4.3: Employment Status



4.2 Smartphone Usage Behaviour

Section B was directed to individuals who made the decision to adopt the smartphone and are presently using one in their daily lives. Current users were asked five questions about: 1) duration of smartphone ownership, 2) how they acquired the device, 3) their daily usage patterns, 4) the top 5 activities they do on their smartphone, and 5) the top 3 applications they use most on their smartphone. Of the 200 participants, 95.5% (191 respondents) were using a smartphone and 4.5% (9 respondents) were using a non-smartphone (i.e. feature phone). Among the nine non-smartphone users, six indicated a possible consideration for smartphone adoption. The details of their smartphone usage are illustrated in Table 4.2.

Table 4.2: Smartphone Usage Behaviour

	Frequency	Valid Percent (%)	Cumulative Percent (%)
Current mobile phone			
Smartphone	191	95.5	95.5
Non-smartphone	9	4.5	100.0
Duration of smartphone ownership			
Less than 6 months	9	4.7	4.7
6 months-< 1 year	7	3.7	8.4
1- < 2 years	50	26.2	34.6
2- ≤ 5 years	80	41.9	76.4
More than 5 years	45	23.6	100.0
Modes of acquisition			
Self-purchased	100	52.4	52.4
Purchased new from family member	54	28.3	80.6
Passed on	27	14.1	94.8
Given by employer	10	5.2	100.0
Daily smartphone usage			
Never/Almost never	2	1.0	1.0
Less than 1/2 hour	11	5.8	6.8
1/2-1 hour	28	14.7	21.5
1-2 hours	59	30.9	52.4
2-3 hours	37	19.4	71.7
More than 3 hours	54	28.3	100.0

Duration of smartphone ownership varied from a few months to five years or more. The most common (mode) response was 2 to 5 years (41.9%). The remaining responses were almost evenly distributed, 1 to 2 years (26.2%) and more than five years (23.6%). Figure 4.4 shows that majority of the respondents (86.9%) had adopted the smartphone for more than 1 year.

Half of the respondents (52.4%) reported that they purchased their smartphone. Another quarter (28.3%) stated it was purchase new by a family member for them. About 15% were given cast-off phones from family members, and 5.2% got their smartphones from their employers. Figure 4.5 depicts this clearer.

Figure 4.4: Smartphone Ownership

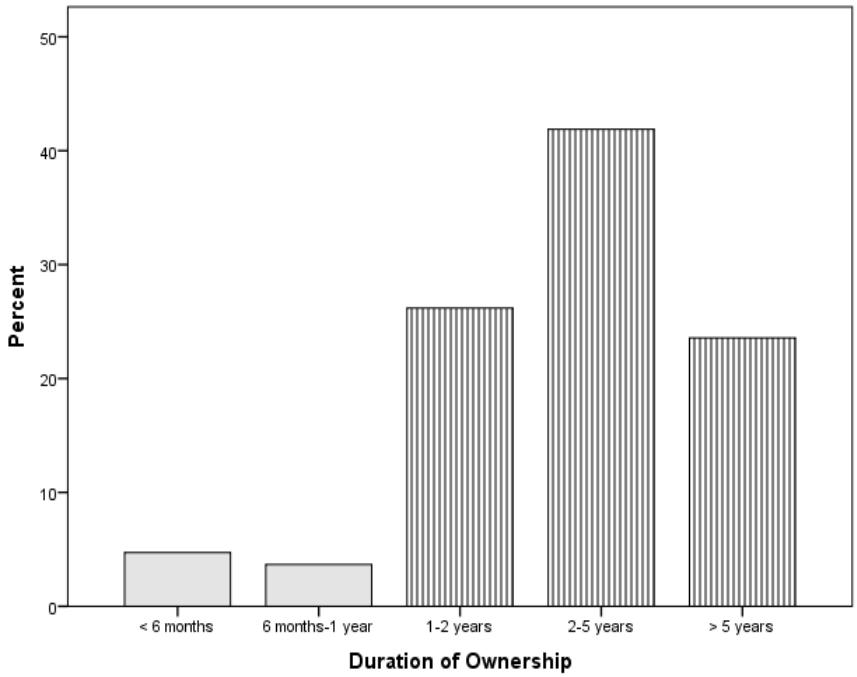
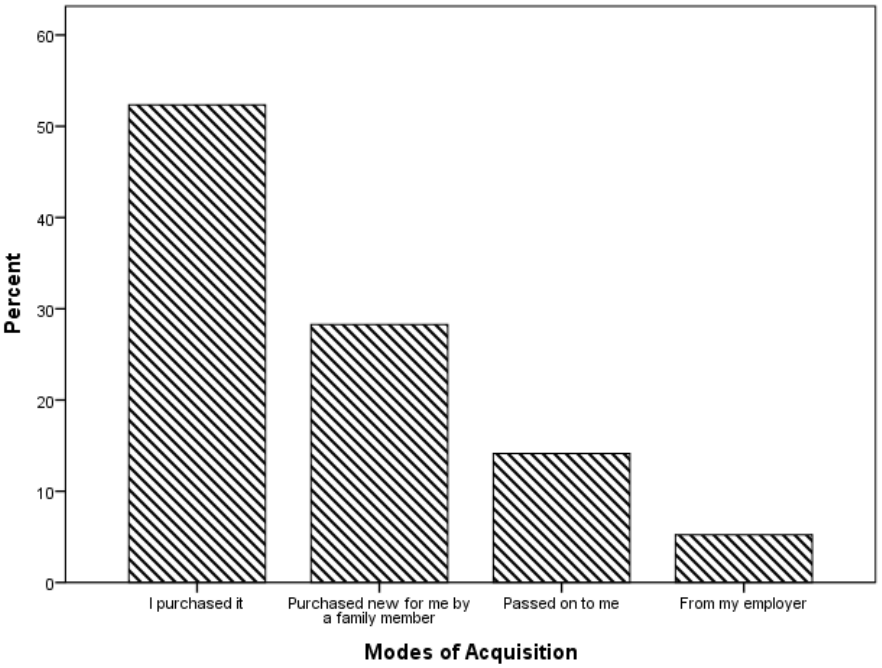
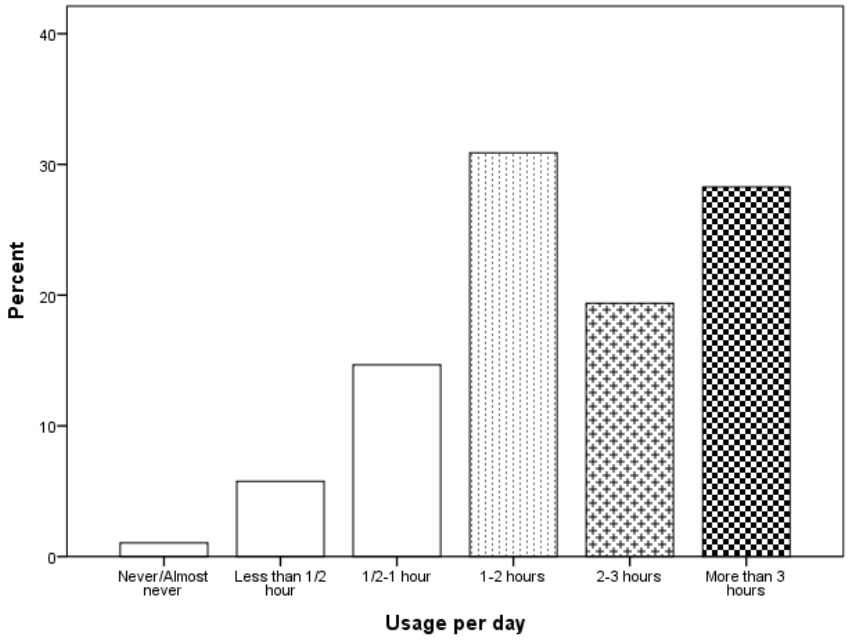


Figure 4.5: Modes of Acquisition



In terms of daily smartphone usage, majority of respondents spent more than 1 hour per day on their devices with 78.5% spending either 1-2 hours, 2-3 hours or more than 3 hours. Only 14.5% of the respondents reported ½-1 hour, less than ½ hour (5.4%) and never/almost never (1%) usage per day. The findings as depicted visually in Figure 4.6 suggests that smartphone users cannot seem to put their phone down.

Figure 4.6: Daily Smartphone Usage



Appendix B and C provide some insights into what smartphone users are doing on their devices. The respondents were asked to rank their top 5 activities and their top 3 applications when using their smartphone. The respondents indicated that making calls was the Top 1 activity on the smartphone (45.5%), ahead of text messaging (33%). The Top 2 activity was text messaging (31.9%). Taking photos was the Top 3, Top 4, and Top 5 activity ranked by the respondents. Others activities that were ranked as important were access e-mail, access social network, read news articles, and look up directions. The activities least carried out on the smartphone were playing games and listening to music. This results suggest that communication was the most important activity and entertainment the least important activity for older smartphone users.

Every smartphone comes with built-in apps, some may be useful and some are not required by regular usage. Some of the built-in apps are calendar, camera, clock, calculator, and maps. Smartphones also allow users to download and use apps based on their interests. Majority of the respondents selected WhatsApp as the Top 1 application (74.3%, 142 respondents). Top 2 application was camera (32.5%), followed by Facebook in Top 3. The smartphone usage behaviour of older adults will be discussed further in Chapter 5.

Thirty seven respondents (18.5%) gave additional comments on the smartphone. An analysis was conducted and four main themes emerged; compatibility, perceived enjoyment, lack of perceived ease of use, and perceived usefulness (see Appendix D). Themes that emerged focus on the motivational reasons for adoption. Some of the comments will be used to support the discussion in Chapter 5.

4.3 Means and Standard Deviation

The mean and standard deviation for constructs measuring each independent and dependent variable in this study are included in Appendix E. The results showed that all the variables scored higher than 3.0. The highest mean was social influences and behavioural intention (M = 4.01), while the lowest mean was perceived ease of use (M = 3.55) and trialability (M = 3.21) on a scale of 1 to 5.

Respondents rated the smartphone marginally positive for all constructs, except for perceived ease of use and trialability. Perceived ease of use and trialability received the lowest scores, indicating that respondents perceived the smartphone to be difficult to use and they didn't have the opportunity to try it out before adoption.

The mean scores of 6 individual items under the perceived ease of use construct were examined. Figure 4.7 indicates that majority of the respondents faced difficulties in learning to use (M = 3.48), to operate (M = 3.46), and to become skilful at using the

smartphone (*M* = 3.57). Trialability was measured using 5 individual items. Figure 4.8 shows that majority of the respondents did not have the opportunity to try out the smartphone prior to adoption (*M* = 2.96), to try out the various smartphone applications (*M* = 3.04), and they did not know where to go to try out the smartphone (*M* = 3.28). These challenges will be discussed in Chapter 5.

Figure 4.7: Mean Scores of individual Perceived Ease of Use items

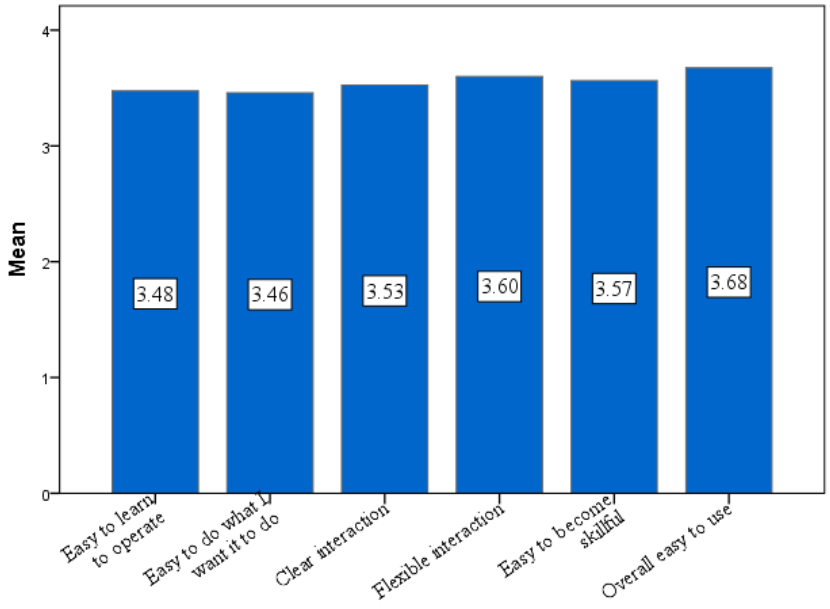
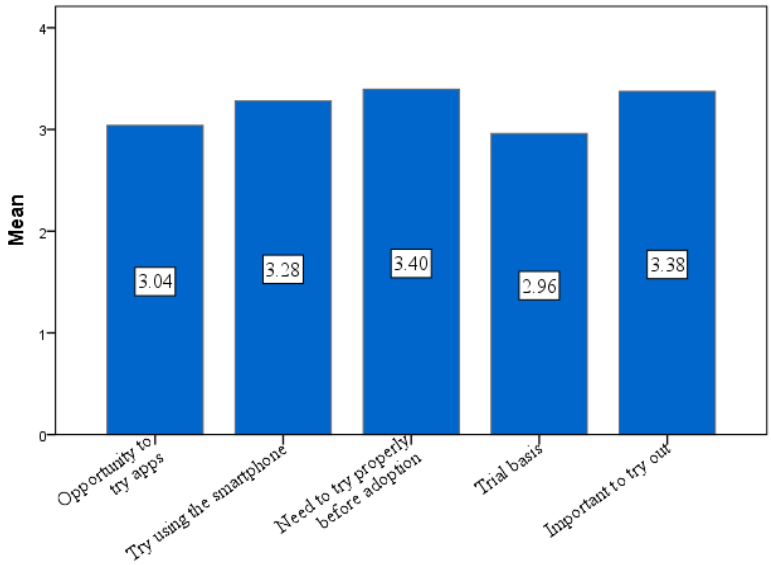
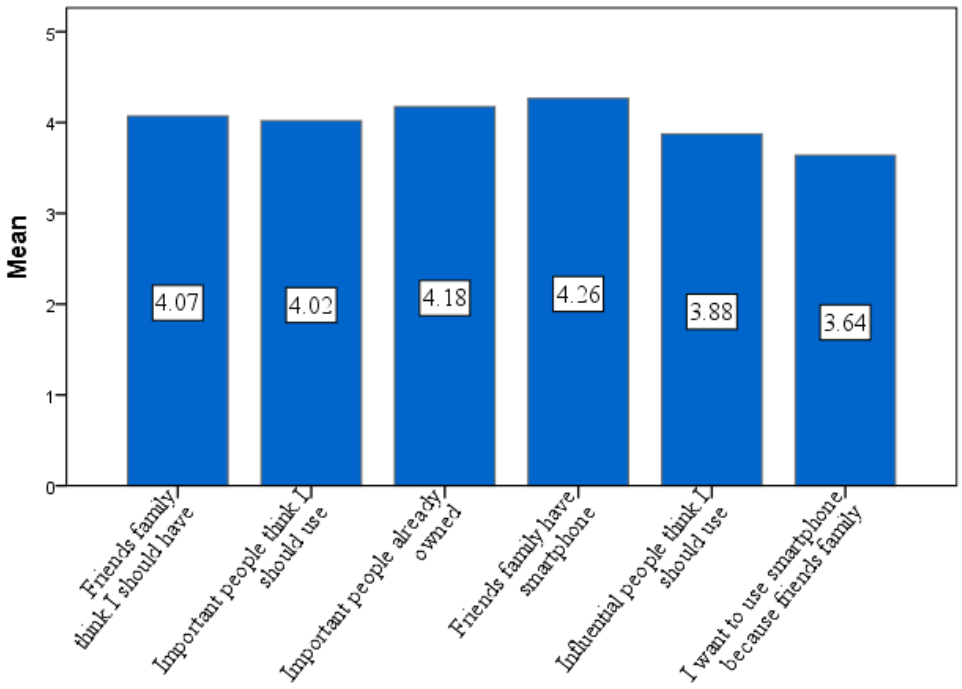


Figure 4.8: Mean Scores of individual Trialability items



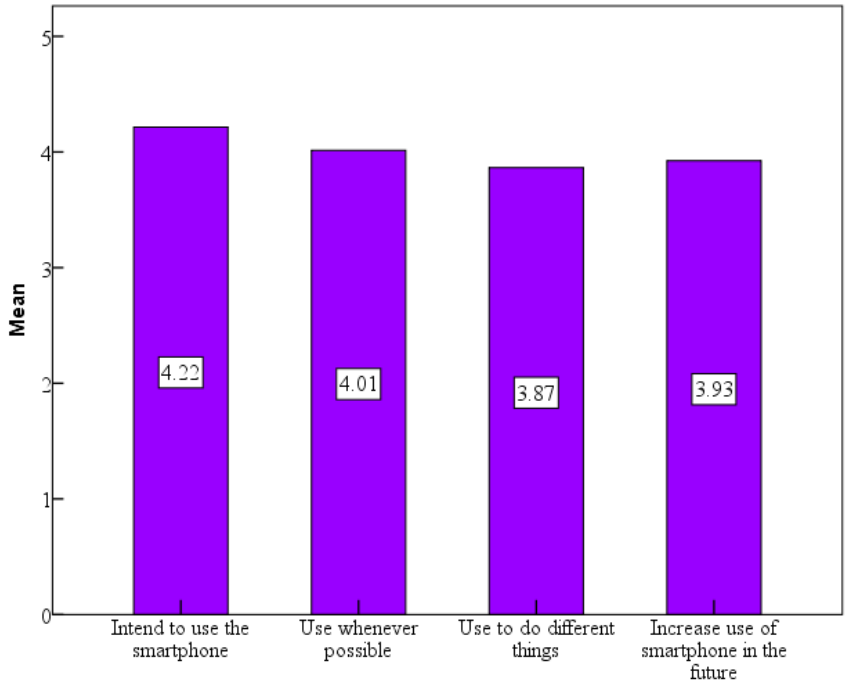
Social influences was measured with 6 items as illustrated in Figure 4.9. Four items consistently showed high mean scores indicating that friends, family, and important people to the older adults have smartphones (*M* = 4.26, *M* = 4.18); and think that the respondents should have and use smartphone too (*M* = 4.07, *M* = 4.02).

Figure 4.9: Mean Scores of individual Social Influences items



Behavioural intention to use smartphone was measured with 4 individual items. The high mean scores as depicted in Figure 4.10 indicate that the respondents were interested in using the smartphone. There was a clear consensus that they intend to use the smartphone (*M* = 4.26), to use the smartphone whenever possible (*M* = 4.01), to use the smartphone to do different things (*M* = 3.87), and to increase their usage of the smartphone in the future (*M* = 3.93).

Figure 4.10: Mean Scores of individual Behavioural Intention items



4.4 Reliability Analysis

The reliability of each of the composite constructs were examined using Cronbach's Alpha. The rate of 0.70 or higher is considered acceptable. As shown in Table 4.7, construct reliabilities ranged from 0.715 to 0.927, and thus exceeded the threshold of 0.70 indicating the internal consistency and the precision of the measurement instrument (Hair et al., 2006). Thus, this instrument provides a valid representation of the sample, and the constructs satisfy both adequacy and reliability.

Table 4.3: Reliability Analysis of Constructs

Construct	Number of Items	Cronbach's Alpha
Perceived Usefulness (PU)	6	0.898
Perceived Ease of Use (PEOU)	6	0.927
Perceived Enjoyment (PE)	6	0.922
Social Influences (SI)	6	0.831
Compatibility (COM)	4	0.929
Observability (OBS)	4	0.766
Trialability (TRI)	5	0.715
Behavioural Intention to Use (BI)	4	0.861

4.5 Assumptions Testing for Multiple Linear Regression

The assumptions of normality, linearity, homoscedasticity and independence of residuals are prerequisites for the use of regression analysis. These assumptions can be checked by inspecting the normal probability plot and residuals scatterplot.

In the normal probability plot, each observed value is paired with its expected value from the normal distribution. If the sample is from a normal distribution, then the cases fall more or less in a straight line (Coakes, 2013, p. 42). Figure 4.11 shows the normal plot of regression standardised residuals for the dependent variable is in a reasonably straight diagonal line from bottom left to top right. This indicates a relatively normal distribution.

Residuals scatterplot is depicted in Figure 4.12. The scatterplot is roughly rectangular shaped, with most of the scores concentrated in the centre (along the 0 point). From the scatterplot of residuals against predicted values, there is no clear relationship between the residuals and the predicted values, consistent with the assumptions of linearity and homoscedasticity.

Figure 4.11: Normal Probability Plot of Regression Standardised Residual

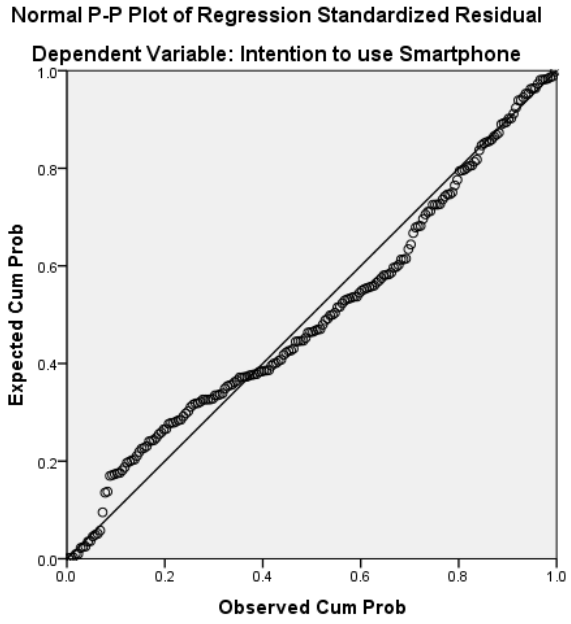
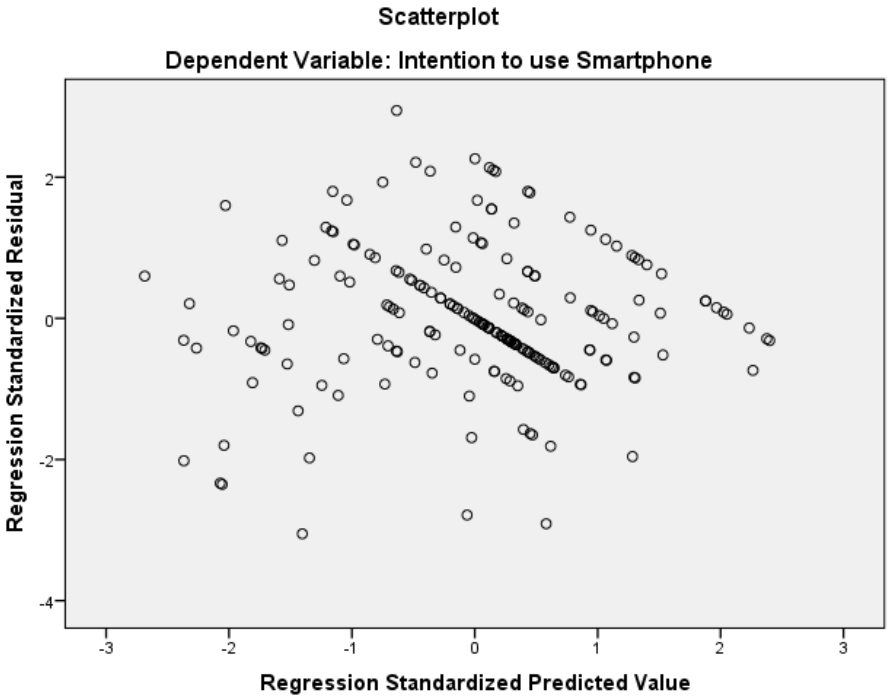


Figure 4.12: Residuals Scatterplot



Multiple regression is very sensitive to outliers (very high or very low scores). Outliers can be checked by inspecting the Mahalanobis' distance that are presented in the data file as an extra variable at the end of the data file (Mah_1). To identify which cases are outliers the critical chi-square value must be determined by using the number of independent variables. There are 7 independent variables in the regression model. Therefore, the critical value is 24.32 as depicted in Table 4.8.

Table 4.4: Chi-square Distribution Table

Number of Independent Variables	Critical Value	Number of Independent Variables	Critical Value
2	13.82	6	22.46
3	16.27	7	24.32
4	18.47	8	26.13
5	20.52	9	27.88

Note. Adapted from Pallant, J. (2005). *SPSS survival manual* (2nd ed.), p. 151. Crows Nest NSW, Australia: Allen & Unwin.

Upon checking the Mah_1 column in the data file, the researcher found only one outlying case (case 55, with a value of 28.36). The decision to remove outliers from the data set must be made with care because their deletion often results in the generation of further outlying cases (Coakes, 2013, p. 140). The outlier was not removed.

SPSS performed collinearity diagnostics to pick up on problems with multicollinearity. The commonly used cut-off points for determining the presence of multicollinearity are tolerance value of less than 0.10, or a VIF (Variance Inflation Factor) value of above 10 (Pallant, 2005, p. 150). The results of collinearity statistics in Table 4.9 showed that there was no multicollinearity because tolerance value for all the independent variables in the model were more than 0.10, ranging from 0.450 to 0.697. Furthermore, all VIFs were less than 10, ranging from 1.435 to 2.222.

Table 4.5: Multicollinearity Analysis

Model		Collinearity Statistics	
		Tolerance	**VIF**
1	(Constant)		
	Perceived Usefulness	0.569	1.758
	Perceived Ease of Use	0.623	1.606
	Perceived Enjoyment	0.634	1.578
	Social Influences	0.614	1.627
	Compatibility	0.450	2.222
	Observability	0.630	1.587
	Trialability	0.697	1.435

4.6 Regression Model

The regression model in Table 4.10 displays the list of independent variables and dependent variable entered in the model. The method of analysis was Enter method. Behavioural intention to use smartphone regressed on the seven independent variables: perceived usefulness, perceived ease of use, perceived enjoyment, social influences, compatibility, observability, and trialability.

Table 4.6: List of Variables[a] Entered

Model	Independent Variables Entered	Method
1	Trialability, Social Influences, Perceived Enjoyment, Perceived Ease of Use, Observability, Perceived Usefulness, Compatibility[b]	Enter

a. Dependent Variable: Behavioural Intention to use smartphone

b. All requested variables entered.

The model summary in Table 4.11 shows that the value of R Square (R^2) for the proposed regression model is 0.545. This means that 54.5% of the variance in behavioural intention to use smartphone can be explained by the variance of the seven independent variables. The high percentage signifies that the model is relatively well in predicting smartphone adoption among older adults. Rules of thumb is more than 50% is considered a good model.

Table 4.7: Model Summary[b]

Model	Method	R	R Square	Adjusted R Square
1	Enter	.738[a]	.545	.528

a. Predictors: (Constant), Trialability, Social Influences, Perceived Enjoyment, Perceived Ease of Use, Observability, Perceived Usefulness, Compatibility

b. Dependent Variable: Behavioural Intention to use smartphone

The Analysis of Variance (ANOVA) as depicted in Table 4.12 shows that the regression model is significant at $p < 0.05$.

Table 4.8: The ANOVA[a] for Regression

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	44.385	7	6.341	32.806	.000[b]
	Residual	37.110	192	.193		
	Total	81.495	199			

a. Dependent Variable: Behavioural Intention to use smartphone

b. Predictors: (Constant), Trialability, Social Influences, Perceived Enjoyment, Perceived Ease of Use, Observability, Perceived Usefulness, Compatibility

Table 4.13 shows the results of regression model with unstandardized coefficient, standardized coefficients, and significance (Sig.). The value in the column marked Sig. shows whether the independent variable is making a statistically significant unique contribution to the regression equation. If the Sig. value is less than 0. 05, then

the variable is making a significant unique contribution to the prediction of the dependent variable. If greater than 0.05, then that variable is not making a significant unique contribution to the prediction of the dependent variable. The results showed that compatibility, perceived enjoyment, observability, and trialability made statistically significant unique contribution to the regression equation (Sig. value < 0.05).

Table 4.9: The Regression Equation and Associated Statistics

Model		**Unstandardized Coefficients**		**Standardized Coefficients**	**Sig.**
		B	**Std. Error**	**Beta**	
1	(Constant)	0.659	0.281		0.020
	Perceived Usefulness	0.048	0.069	0.045	0.487
	Perceived Ease of Use	-0.013	0.057	-0.014	0.822
	Perceived Enjoyment	0.159	0.057	0.170	0.006
	Social Influences	0.096	0.071	0.084	0.177
	Compatibility	0.324	0.061	0.384	0.000
	Observability	0.154	0.064	0.147	0.018
	Trialability	0.131	0.053	0.144	0.015

The regression equation is formed using the unstandardized coefficient values listed as B depicted in Table 4.13. The regression equation for Behavioural Intention to use Smartphone among older adults is as follows:

$$BI = 0.659 + 0.324COM + 0.159PE + 0.154OBS + 0.131TRI$$

Where

BI = Behaviour Intention to use Smartphone

PE = Perceived Enjoyment

COM = Compatibility

OBS = Observability

TRI = Trialability

Beta values provide further insight into the importance of a predictor in the model. A high beta value with respect to an independent variable indicates a stronger unique contribution to explaining the dependent variable. Based on the magnitude of standardized coefficients (Beta) in Table 4.13, the largest beta coefficient is 0.384. This means compatibility is the strongest predictor of behaviour intention to use smartphone. The second strongest predictor is perceived enjoyment ($\beta = 0.170$). The third strongest predictor is observability ($\beta = 0.147$), and the fourth is trialability ($\beta = 0.144$). This conclusion is made at the significant level, $\alpha = 0.05$ (5%) or confidence level (95%).

4.7 Hypotheses Testing

Hypotheses testing is based on multiple regression analysis using SPSS v. 20. Table 4.14 presents the results of hypotheses testing with standard coefficient and significant (p) value.

Perceived enjoyment had a significant positive impact on behavioural intention toward using smartphone, supporting H_3 ($p = 0.006$). Compatibility had a significant positive impact on behavioural intention to use smartphone, supporting H_5 ($p = 0.000$). Observability was found to have a significant effect on behavioural intention to use smartphone, supporting H_6 ($p = 0.018$). Supporting H_7, trialability had a significant positive impact on behavioural intention to use smartphone ($p = 0.015$).

Three hypotheses were not supported. H_1, testing the impact of perceived usefulness on behavioural intention toward using smartphone received no support ($p = 0.487 > 0.05$). H_2 for testing the impact of perceived ease of use on behavioural intention received no support ($p = 0.822 > 0.05$). Social influences was not found to have a significant effect on behavioural intention toward using smartphone ($p = 0.177 > 0.05$).

Table 4.10: Hypotheses Testing

Hypothesis	Relationship	Standardized Coefficient	Result
H_1	PU → BI	0.045	Not supported (p = 0.487)
H_2	PEOU → BI	-0.014	Not supported (p = 0.822)
H_3	PE → BI	0.170	Supported (p = 0.006)
H_4	SI → BI	0.084	Not supported (p = 0.177)
H_5	COM → BI	0.384	Supported (p = 0.000)
H_6	OBS → BI	0.147	Supported (p = 0.018)
H_7	TRI → BI	0.144	Supported (p = 0.015)

Notes: BI – Behavioural Intention; PU – Perceived Usefulness; PEOU - Perceived Ease of Use; PE - Perceived Enjoyment; SI - Social Influences; COM – Compatibility; OBS – Observability; TRI – Trialability

First Hypothesis

H_1: There is a significant positive relationship between perceived usefulness and behavioural intention to use smartphone.

According to Table 4.14, the p-value for perceived usefulness is 0.487. This value is more than 0.05. Therefore, H_1 is rejected. So, there is no significant relationship between perceived usefulness and behavioural intention to use smartphone.

Second Hypothesis

H_2: There is a significant positive relationship between perceived ease of use and behavioural intention to use smartphone.

Based on Table 4.14, the p-value for perceived ease of use is 0.822. This value is more than 0.05. Therefore, H_2 is rejected. So, there is no significant relationship between perceived ease of use and behavioural intention to use smartphone.

Third Hypothesis

H_3: There is a significant positive relationship between perceived enjoyment and behavioural intention to use smartphone.

Based on Table 4.14, the p-value for perceived enjoyment is 0.006, which is less than 0.05. Therefore, H_3 is supported which proves that perceived enjoyment has a significant positive impact on behavioural intention to use smartphone.

Fourth Hypothesis

H_4: There is a significant positive relationship between social influences and behavioural intention to use smartphone.

Based on Table 4.14, the p-value for social influences is 0.177. This value is more than 0.05. Therefore, H_4 is rejected. So, there is no significant relationship between social influences and behavioural intention to use smartphone.

Fifth Hypothesis

H_5: There is a significant positive relationship between compatibility and behavioural intention to use smartphone.

Based on Table 4.14, the p-value for compatibility is 0.000, which is less than 0.05. Therefore, H_5 is supported which proves that compatibility has a significant positive impact on behavioural intention to use smartphone.

Sixth Hypothesis

H_6: There is a significant positive relationship between observability and behavioural intention to use smartphone.

Based on Table 4.14, the p-value for observability is 0.018, which is less than 0.05. Therefore, H_6 is supported which proves that observability has a significant positive impact on behavioural intention to use smartphone.

Seventh Hypothesis

H_7: There is a significant positive relationship between trialability and behavioural intention to use smartphone.

Based on Table 4.14, the p-value for trialability is 0.015, which is less than 0.05. Therefore, H_7 is supported which proves that trialability has a significant positive impact on behavioural intention to use smartphone.

4.8 Conclusion

This chapter reported the results which are relevant to the research questions and hypotheses. Seven hypotheses were tested and four were supported through the study. The results indicated that compatibility, perceived enjoyment, observability, and trialability were significant factors for the adoption of smartphone among older adults. Compatibility had the strongest positive impact on behavioural intention to adopt smartphone, followed by perceived enjoyment. A regression equation was successfully formed from the statistical output of Multiple Linear Regression. The next chapter will discuss the main findings of the research, identify possible reasons for the findings, and suggest some recommendations for future study.

CHAPTER 5

DISCUSSION AND CONCLUSION

5.0 Introduction

This chapter begins with a summary and an in-depth discussion of the research findings. The discussion will be linked to the research objectives in Chapter 1. Next, the implications of the study for scholars and practitioners, limitations and recommendations for additional research are discussed.

5.1 Summary of Results

The study consisted of 200 participants, age 50 to 78 years. Of the 200 older adults, 191 were smartphone users, and 9 were non-smartphone users. Questionnaires distributed by hand facilitated the data collection. The data were analysed using descriptive and inferential statistical analysis.

Demographic statistics were analysed and revealed that 55% of the participants were female and 45% were male. The largest age group of respondents was 60-69 years old, which was 49% of the participants; followed by 50-59 years old (40.5%). The mean age was 61.52 years. Employment status showed that 49% of the respondents were working either full-time or part-time, while another 47% had retired. In terms of education, 68.5% had completed either a bachelor degree, diploma, master degree or doctorate. Sixty-one percent of the respondents reported they have high level of computer experience. The mean years of experience in using computers was 17.37 years.

Among the older adult smartphone users, Samsung (48.2%) was the most popular brand, followed by Apple iPhone (20.4%). Half (52.4%) had purchased their smartphone, while another quarter (28.3%) reported it was purchased new by a family member for them. A large majority (86.9%) had more than 1 year experience using the smartphone. In terms of smartphone usage, the Top 5 activities were: making calls, text messaging, taking photos, accessing e-mail and accessing a social network. The Top 3 applications for older adults were WhatsApp, the camera, and Facebook. The humble alarm clock came in fourth; 3 in 10 older adults used the alarm app on their smartphone.

Multiple linear regression was conducted and the results suggest half of the proposed factors influenced behavioural intention. Specifically, compatibility, perceived enjoyment, observability, and trialability proved to be important determinants for the older adults. Discussion of the results will be presented in the next section.

5.2 Discussion of Major Findings

5.2.1 Research Objective 1: To examine the relationship between perceived usefulness and smartphone adoption among older adults.

H_1: There is a significant positive relationship between perceived usefulness and behavioural intention to use smartphone.

Inconsistent with previous TAM research (Chun et al., 2012; Jongepier, 2011; Kang et al., 2011; Park & Chen, 2007; Wu & Wang, 2005), perceived usefulness was not a significant predictor of behavioural intention of smartphone adoption in the present study. A possible explanation for this finding is that most of the studies were conducted on younger demographic groups; students and working adults aged below 50 that lived more active and busy lifestyles. In this study, the respondents were older adults aged 50 and above. With almost half of the respondents (47%) in retirement,

using the smartphone to increase work productivity would be minimal. This suggests that older adults in Malaysia do not perceive the smartphone as a task-oriented device for utilitarian usefulness. They do not use the smartphone to increase work productivity and accomplish specific tasks and goals quickly.

Moreover, a large majority of the older adults (85%) owned one or more computers. Their reported mean years of computer experience was 17.35 years. Thus, they would be more familiar and comfortable doing productivity tasks with the computer, which has a larger screen than a smartphone. In contrast, smartphones only became widespread in 2007. Table 4.2 showed that less than a quarter of the respondents (23.6%) have used the smartphone for more than 5 years.

This study found that older adults owned a smartphone primarily for communication. They perceived the smartphone as essentially a phone rather than a handheld computer with powerful capabilities. Hence, they carried out limited activities on the smartphone. Based on Appendix B, their top activities on their smartphone were making calls, texting, and taking photos. Other features such as listening to music, playing games, and watching videos were not their main activities. These findings indicate that older smartphone users under-utilized the comprehensive features and functions of the smartphone. Participant 19, a smartphone user for 1-2 years explained her smartphone usage:

> *"I use my smartphone to WhatsApp, check if I have missed calls, and send messages. I'm a minimalist. When the phone came, there was not manual. I haven't sat down to explore what it can do. The smartphone takes a lot of time – time wasting."*

Participant 35 commented:

> "Being retired, I have smartphone but not keen to use much."

Participant 32 expressed the negative effects of using the smartphone.

> *"Using the smartphone without control, can be a distraction and a waste of valuable time for other healthy activities."*

Similarly, Participant 33 commented:

> *"It's a waste of time to clear WhatsApp messages. The smartphone is not useful!"*

These findings are consistent with previous studies on mobile phone usage among older adults (Kubik, 2009; Kurniawan, 2008; Lee, 2007; Renaud & Biljon, 2008). The researchers found that older adults used fewer mobile phone features and were not interested in additional features beyond communication features. This phenomenon can be explained by the Socioemotional Selectivity Theory (Carstensen, Isaacowitz, & Charles, 1999). This theory suggests that people prioritize their goals relative to their age and perception of time. Young people see time as open-ended. With increasing age, older adults view their future as limited and they do not have "all the time in the world" left to pursue their goals. Hence, they use their time and energy selectively. Also, they are reluctant to spend their time and energy with learning a new device/technology unless they are convinced of additional benefits above costs (Melenhorst, Rogers, & Caylor, 2001).

5.2.2 Research Objective 2: To examine the relationship between perceived ease of use and smartphone adoption among older adults.

H_2: There is a significant positive relationship between perceived ease of use and behavioural intention to use smartphone.

Perceived ease of use was proposed as a determinant of smartphone adoption among older adults. The results of this study indicated that perceived ease of use has no significant effect on behavioural intention to use. This finding is in agreement with the results of Ma et al. (2016), Park et al. (2013), Kang et al. (2011), and Jongepier (2011) who found that perceived ease of use was not a significant determinant in their studies.

On a five-point Likert scale, the mean score for perceived ease of use was 3.55 indicating that older adults perceived smartphone to be difficult to use. The smartphone is not free of mental, physical, and learning effort for older adults in Malaysia. Figure 4.7 depicted the low PEOU. The first element of PEOU is learning to operate the smartphone. A small majority (56.5%) of the respondents perceived it easy to learn to operate the smartphone. The other 43.5% of the respondents perceived it was not easy to learn to operate the smartphone. Another dimension of PEOU is to become skilful in using the smartphone. Again, a small majority (61.5%) agreed that it would be easy for them to become skilful, while more than one third (38.5%) perceived that it would not be easy for them to be skilful at using their smartphone.

Several older adults commented that they found it difficult to learn and to use the smartphone, and they have limited skill in using the smartphone. Participant 15, a smartphone user for 2-5 years stated:

> *"Shelf life of smartphones are usually short (obsolescence and breakdown). Frustrating due to the need to learn new operations and loss of data while migrating to a newer model."*

Participant 16, a user for 1-2 year mentioned:

> *"My knowledge of smartphone is minimal. The phone is smarter than me."*

Participant 22 observed:

> *"I have a small circle of friends. Several do not own a smartphone. Those who have told me they have problems using theirs. I communicate with my friends & relatives using a simple mobile which I have been using for 6 years."*

Two participants expressed difficulty with reading on the smartphone due to the small screen size and aging related issues. Participant 20 remarked:

> *"I bought my Samsung Galaxy 5S just before the GST. The 5-inch screen is too small, I cannot see without reading glasses. I should have bought the bigger 5.5 inches phone. Updates are challenging and I don't download apps."*

Participant 21 explained:

> *"When I send e-mails, I must check a few times because of typing errors. I use reading glasses when reading on my phone, cannot see without the glasses."*

Overall, this study revealed that older adults in Malaysia perceived their smartphones as difficult to use. These findings are in line with the literature on aging and technology adoption as reviewed in section 2.4. Older adults face problems with declines in vision, cognitive abilities, and motor control; therefore making it very challenging for them to operate and maintain the smartphone. According to Williams (2012), perceived ease of use is critical for older adults. A device seen as too complex or small would discourage adoption and use. Leung et al. (2012) reported that learning new skills for new technologies such as smartphones is more difficult for older adults than younger adults. As Jung et al. (2013) put in explicitly, smartphone is only easy to use when a one has the skills, specifically smartphone consumption skills.

5.2.3 Research Objective 3: To examine the relationship between perceived enjoyment and smartphone adoption among older adults.

H_3: There is a significant positive relationship between perceived enjoyment and behavioural intention to use smartphone.

This study found that perceived enjoyment has a significant positive impact on behavioural intention to use smartphone as proposed in TAM. In addition, the beta value for perceived enjoyment ($\beta = 0.170$, $p < 0.05$) indicates that perceived enjoyment is the second most important determinant for smartphone adoption among older adults. This finding is supported by Gao et al. (2015), Chun et al. (2012), Jongepier (2011), Lu and Su (2009), Yu et al. (2005), and Van de Heijden (2004).

The results in this study showed that, using the smartphone is pleasant, positive, fun, exciting, and enjoyable for older adults in Malaysia as revealed in their smartphone usage. Ninety-nine percent of the respondents reported interacting with their smartphone every day. More than 5 in 10 older adults are spending more than 2 hours on their smartphone each day. Also, the overall mean score of perceived enjoyment ($M = 3.81$) is relatively high (see Appendix E).

Making calls on the smartphone is the most important activity; since that is the basic communication feature of a phone. Besides that, they are using the smartphone for fun and enjoyable activities such as taking photos, texting, accessing WhatsApp and Facebook, and watching videos. The smartphone proved to be a great source of entertainment for the older adults.

Several respondents stated how much enjoyment they gained from using their smartphone (see Appendix D). For example, Participant 7 actively take photos with her smartphone and later showed photos of her dogs and family holiday trips to her friends and relatives.

Participant 8, a grandmother expressed how much she enjoyed using the smartphone after she purchased one less than six months ago:

> *"It took me a few days learning how to use the smartphone from my grandchildren but I have not looked back. I enjoy using it. I wanted to use it out of curiosity because everyone else was using it so I don't want to be left behind."*

Participant 13 commented on the positive aspect of using the smartphone:

> *"Smartphone activate your thinking & usage of our brains to work and stretch further."*

Three participants commented on WhatsApp, the Top 1 application for this study. Participant 9 stated that he only used the smartphone for WhatsApp and Internet browsing. Participant 10 explained that she has many WhatsApp group chats according to the type of relationships and activities; for her immediate family, extended family members, old classmates, formers colleagues, volunteering group, cell group, and so forth. Participant 11 remarked that WhatsApp is very good because it is free.

Participant 14, expressed her regret because she could not play more on her smartphone due to her full-time work:

> *"Wish I have more time to play with my smartphone – too busy working."*

Finally, Participant 12 commented:

> *"I love it (smartphone)."*

These three words, “I love it” expressed by Participant 12, a smartphone user for more than 5 years with > 3 hours daily usage succinctly captured the emotions of happiness and exhilaration derived from using the smartphone. These new findings confirm that older adults are interested in the new technology culture accessible on smartphones emphasizing entertainment and considered smartphones to possess hedonic enjoyment in line with the literature review.

5.2.4 Research Objective 4: To examine the relationship between social influences and smartphone adoption among older adults.

H_4: There is a significant positive relationship between social influences and behavioural intention to use smartphone.

It had been expected that social influences would have an effect on behavioural intention, but this hypothesis was not supported in this study. A possible explanation for the lack of support for this hypothesis is that a large majority of the older adults (86.9%) had adopted and used the smartphone for more than 1 year as depicted in Table 4.2 and Figure 4.4. This suggests that with increased experience using the smartphone, the influence of their family, friends or colleagues became not significant for the older adults in Malaysia. Further evidence is one third of the respondents (34%) disagreed with the statement, “I want to use the smartphone because my friends and family do so”. The mean score for this item was 3.64 as shown in Figure 4.9. This is consistent with the findings of Venkatesh and Davis (2000), and Venkatesh and Morris (2000); that the effect of social influences may subside over time, and diminish to non-significance with increased experience with a technology.

Another possible reason is that the older adults in this study are well-educated (68.5% has a diploma or higher) and gainfully employed (49%). With higher education, financial independence, and maturity, older adults are less likely to be influenced by

their friends, family, and colleagues compared to students and young adults. Lee (2014) asserted that students who adopted smartphones are more susceptible to social influences because they are financially dependent on their parents, and conform to the expectations of friends to enhance affiliation and image.

5.2.5 Research Objective 5: To examine the relationship between compatibility and smartphone adoption among older adults.

H_5: There is a significant positive relationship between compatibility and behavioural intention to use smartphone.

This study found that compatibility has a significant positive impact on behavioural intention to use smartphone as proposed in IDT. In addition, the beta value for compatibility ($\beta = 0.384$, $p < 0.05$) indicated that compatibility is the most important determinant for smartphone adoption among older adults in Malaysia. This is consistent with the findings of Putzer and Park (2012, 2010), Koenig-Lewis et al. (2010), Lu and Su (2009), Wei (2006), and Wu and Wang (2005) who also found compatibility was the most important determinant in their study.

Compatibility had the strongest positive influence on behavioural intention because the use of this innovative device is perceived to be consistent with their values, past experiences, needs, working habits, and lifestyle. Majority of the sampled older adults agreed that using smartphone fits well with their work or lifestyle. The mean score was 3.81 and 3.78 respectively (see Appendix E). Six respondents commented on the importance of smartphone in their daily lives (see Appendix D). Participant 1, a retiree, stated that smartphone has become an essential part of life:

> *"Smartphones have become part and parcel of life. It has become a necessity for many people."*

Participant 2, also a retiree commented:

"Smartphone is a must in my daily life."

Participant 3 added:

"Smartphone has become part of life, without it life is impossible!"

The importance of smartphones was also emphasized by the working older adults. For example, Participant 4 explained:

"Smartphones are an integral part of my life and I believe should be in majority of the people now and more so in future."

Participant 5 commented:

"Owning a smartphone is a necessity these days."

Participant 6, a smartphone user for 2-5 years specified:

"I am using the smartphone for family and work."

Peslak, Shannon, and Ceccucci (2011) concluded that smartphones have become part of daily life. Bajarin (2013) claimed that smartphone is the most indispensable device and the most important digital screen. Smartphone is portable, compact, and can fit easily into the handbag or pocket. Older adults feel their smartphone represents "freedom" and "connecting". Having one in their pocket or handbag is a liberating experience (Anderson, 2015). Despite the unique challenges facing the older adults, majority (78.5%) used the smartphone for more than 1 hour daily, and a quarter

(28.3%) for more than 3 hours daily. In Malaysia, power users are spending more than 3 hours a day on their smartphones (The Star, 2016).

5.2.6 Research Objective 6: To examine the relationship between observability and smartphone adoption among older adults.

H_6: There is a significant positive relationship between observability and behavioural intention to use smartphone.

This study found that observability has a significant positive impact on behavioural intention to use smartphone, consistent with previous research findings (Gao et al., 2015; Lee et al., 2011; Martins et al., 2004; Park & Chen, 2007; Putzer & Park, 2010, 2012; Rogers, 2003). The mean score for observability was 3.79 based on Appendix E. It indicates that smartphones are very visible in the surroundings of older adults. The high visibility of the innovative device stimulated their curiosity and influenced their adoption decision. Also, they had many opportunities to see the innovation in action. The observation of friends, family, and colleagues, using smartphones positively impacted the older adults about the relevance of smartphone.

5.2.7 Research Objective 7: To examine the relationship between trialability and smartphone adoption among older adults.

H_7: There is a significant positive relationship between trialability and behavioural intention to use smartphone.

This study found that trialability has a significant positive impact on behavioural intention to use smartphone. This is consistent with the findings of Rellinger (2014), Wang (2014), Hsbollah and Idris (2009), Martins et al. (2004), and Tan and Teo (2000). Trialability received the lowest mean score (*M = 3.21*), indicating that

majority of the respondents didn't have the opportunity to try out the smartphone and various apps before adoption. These findings suggests that opportunity to experiment with the smartphone is important for older adults in Malaysia. They need to be given more opportunities to pre-test the smartphone technology prior to adoption to reduce uncertainty and technophobia.

5.3 Implications of the Study

The findings of this study have implications for researchers and practitioners as follows:

5.3.1 Theoretical Implications

Smartphone adoption by older adults has received less attention in academic research. In terms of theoretical contribution, the proposed model explains 54.5 percent of the variance in intention to adopt smartphone which is higher than the value of 40 percent found in typical TAM studies (Venkatesh & Davis, 2000). Compatibility has the strongest positive influence on older adults' intention to adopt smartphone, followed by perceived enjoyment. Other significant determinants were observability and trialability. Also, these findings can contribute to other research on innovative technology such tablets and smartwatches.

5.3.2 Business and Managerial Implications

There are a number of implications for stakeholders in the smartphone industry. The results showed that older adults were willing to use smartphones and majority of the older adults had positive attitudes toward smartphones. With population ageing, higher education level and income, the silver market is an attractive consumer group most likely to adopt smartphone. Logically, to increase smartphone adoption among

older adults, smartphone manufacturers should design more devices with large screen sizes, fonts, and menus that older adults find easy to use.

Compatibility and perceived enjoyment were found to be strong primary and secondary determinants of intention to use smartphone. Older adults in Malaysia expect smartphones to be compatible with their everyday life. Stakeholders have to emphasize that smartphone fits with older adults' lifestyles. Managers need to gain detailed understanding of the lifestyles of older adults through lifestyle studies – activities, interests, and opinions (AIO).

Also, industry players should pay close attention to aspects of enjoyment such as excitement and fun when designing/developing smartphones and apps, and provide pleasant services to older adults. With more than 2 million apps, few have been designed for older people (Deloitte, 2014). Therefore, app developers need to develop more senior-friendly smartphone apps.

This study also highlighted the importance of observability and trialability for smartphone adoption. Emphasizing advertising, promotions and training programs may increase smartphone adoption. Marketing communications targeted at older adults can help explain the features and advantages of various smartphone models. Managers may increase trialability and reduce uncertainty by conducting Question and Answer sessions, and training programs for older adults. Organizing inexpensive education and training courses can increase familiarity and improve positive ease of use in smartphone.

Older adults have reported a preference for instruction manuals and specific training. In this study, three respondents commented on the need for smartphone instruction manual and training. Participant 17 remarked: *"Should have printed instructions on usage of smartphone."* Participant 19 conveyed her surprise: *"When the phone came, there was not manual!"* Participant 18 indicated: *If you run any course to upgrade "Smartphone Skills"- I'm an eager & ready participant."*

Leung et al. (2011) studied the preferred methods of learning to use smartphones for older adults. Their study found that older adults prefer instruction manuals with step-by-step instructions over trial and error method, and they would attend training classes if available. Thus, smartphone manufacturers and retailers need to provide printed step-by-step instruction manuals for older customers.

Older adults require more support to try out features, functions, and tasks on the smartphone. Smartphone retailers and service providers should deliver friendly customer services to older adults. Sales persons should provide knowledge in an easy and understandable way for older adults. For example, smartphone retailers could, pre-set the smartphone with basic settings and the customer's phone numbers as a service to an older customer. Gurian (2013) conducted over one hundred studies on cognitive brain health in older adults. For maximum brain health, he recommends older adults to play games, listen to music, and exercise daily. Sales persons can educate older adults to experiment and use music, games and fitness apps on the smartphone.

5.4 Limitations of the Study

Although this study provided interesting insights into the factors affecting the intention to use smartphone, it has some limitations. First, the researcher only tested the research model and hypotheses with older adults from the Klang Valley in Malaysia. This sample might not be fully representative of the older adult population in Malaysia. Second, due to the nature of quantitative research, this research might not capture additional views apart from the proposed factors. In addition, this study rely on self- reports based on subjective perception which may be biased. Lastly, the findings of this study may be limited due to the relatively small sample size.

5.5 Recommendations

Corresponding with the limitations, future research is recommended with larger samples of older adults across different geographical regions, including East Malaysia. Second, the study could be extended by identifying and adding additional variables such as personal innovativeness, self-efficacy and perceived price value to improve the predictive power of the model. The perceptions of smartphone adoption in this study are based on a one time survey. For better reliability a longitudinal study to show the measurement of attitudes will be recommended. Lastly, a qualitative study could be conducted to follow this quantitative research. A qualitative study would allow the researcher to gain a thorough understanding of the actual user experience from the user's perspective.

5.6 Conclusion

This research provides new insights into the adoption and usage of smartphone among the older adult population of Malaysia. This study provides empirical evidence that compatibility and perceived enjoyment are strong primary and secondary determinants. Observability and trialability of smartphones also affect user adoption positively. The results indicate that older adults adopt smartphone because it is compatible with their values, lifestyle, and needs. In addition, they use the smartphone for leisure activities and enjoyment. Being able to observe others using the smartphone is also a contributing factor. Trialability prior to adoption is a determining factor for older adults too.

This study indicates that smartphone is not just for students and young adults, older adults in their 50s, 60s and 70s are also strongly embracing the use of smartphone. The importance of the segment formed by older people will continue to increase because of the ageing population. The silver market will continue to be one of the fastest growing market segment with more disposable income and leisure time.

Stakeholders, including smartphone manufacturers, service providers, developers, and designers should understand the special needs of older adults. They must adapt and meet the expectations of this large and prosperous silver market. Based on the study findings, compatibility, perceived enjoyment, observability, and trialability are significant determinants and will increase the likelihood of smartphone adoption among older adults.

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APPENDIX A

SURVEY QUESTIONNAIRE

FACULTY OF CCOUNTANCY AND MANAGEMENT

Dear Participant,

I am currently enrolled in the Master of Business Administration at Universiti Tunku Abdul Rahman in Sungai Long Campus, Selangor, and am in the process of writing my Master's research project. I would like to invite you to participate in a research titled, "*Determinants of smartphone adoption among older adults in Malaysia*".

The enclosed questionnaire has been designed to collect information on human motivations affecting smartphone adoption from **adults age 50 and above**. **You do not need to currently have a smartphone to participate in this study.** The questionnaire will require approximately 10-15 minutes to complete. Please would you send the completed questionnaire back within 7 days. Your responses will remain confidential and anonymous.

IF YOU DO NOT WISH TO PARTICIPATE, SIMPLY DISCARD THE QUESTIONNAIRE. COMPLETING AND RETURNING THE QUESTIONNAIRE CONSTITUTES YOUR CONSENT TO PARTICIPATE. KEEP THIS LETTER FOR YOUR RECORDS. IF YOU HAVE ANY QUESTIONS REGARDING THE RESEARCH, CONTACT HUI KAM YONG AT +60104336979 OR CHIN WAI YIN, SUPERVISOR AT FACULTY OF ACCOUNTANCY AND MANAGEMENT, UNIVERSITI TUNKU ABDUL RAHMAN (UTAR) LOT PT 21144, JALAN SUNGAI LONG, BANDAR SUNGAI LONG, 43000 KAJANG, SELANGOR. IF YOU HAVE ANY QUESTIONS REGARDING YOUR RIGHTS AS A RESEARCH PARTICIPANT, PLEASE CONTACT THE INSTITUTIONAL REVIEW BOARD OFFICE AT UTAR.

Thank you for taking the time to assist me in my educational endeavours.

Yours sincerely,
Hui Kam Yong

INSTRUCTIONS:

Please circle (O) your answer or complete the statement.
There is no right or wrong answer.

Section A: Your Personal Opinion about the Smartphone

Please indicate your agreement or disagreement with the following statements:

Choose ONE and only one answer.

Perceived Usefulness	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1. Using the smartphone would enable me to accomplish tasks more quickly.	1	2	3	4	5
2. Using the smartphone would improve my performance.	1	2	3	4	5
3. Using the smartphone would increase my productivity.	1	2	3	4	5
4. Using the smartphone saves me time.	1	2	3	4	5
5. Using the smartphone would make it easier to do my tasks.	1	2	3	4	5
6. Overall, I would find the smartphone useful.	1	2	3	4	5
Perceived Ease of Use	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
7. Learning to operate the smartphone would be easy for me.	1	2	3	4	5
8. I would find it easy to get the smartphone to do what I want it to do.	1	2	3	4	5
9. My interaction with the smartphone would be clear and understandable.	1	2	3	4	5
10. I would find the smartphone to be flexible to interact with.	1	2	3	4	5
11. It would be easy for me to become skillful at using the smartphone.	1	2	3	4	5
12. Overall, I would find the smartphone easy to use.	1	2	3	4	5

Perceived Enjoyment

Please rate the scales below according to how you feel about using the smartphone.

Using the smartphone is:

13.	Fun	1	2	3	4	5	Frustrating
14.	Pleasant	1	2	3	4	5	Unpleasant
15.	Negative	1	2	3	4	5	Positive
16.	Pleasurable	1	2	3	4	5	Painful
17.	Exciting	1	2	3	4	5	Dull
18.	Enjoyable	1	2	3	4	5	Unenjoyable

Social Influences	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
19. Most people around me (friends, family, colleagues) think one should have a smartphone.	1	2	3	4	5
20. People who are important to me think that I should use the smartphone.	1	2	3	4	5
21. Those who are important to me owned a smartphone already or will have one soon.	1	2	3	4	5
22. Majority of my friends and family have a smartphone or will have one in near future.	1	2	3	4	5
23. People who influence my behaviour think that I should use the smartphone.	1	2	3	4	5
24. I want to use the smartphone because my friends and family do so.	1	2	3	4	5
Compatibility	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
25. Using the smartphone is compatible with all aspects of my work or life.	1	2	3	4	5
26. Using the smartphone is completely compatible with my current situation.	1	2	3	4	5
27. I think that using the smartphone fits well with the way I like to work or live.	1	2	3	4	5
28. Using the smartphone fits into my lifestyle.	1	2	3	4	5

Observability	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
29. I have seen what others do using their smartphone.	1	2	3	4	5
30. The smartphone is not very visible in my surroundings and/or workplace.	1	2	3	4	5
31. It is easy for me to observe others using the smartphone.	1	2	3	4	5
32. I have had a lot of opportunity to see the smartphone being used.	1	2	3	4	5
Trialability	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
33. I have had a great deal of opportunity to try various smartphone applications.	1	2	3	4	5
34. I know where I can go to satisfactorily try out various uses of the smartphone.	1	2	3	4	5
35. Before deciding on whether or not to adopt the smartphone, I would need to properly try it out.	1	2	3	4	5
36. I would be permitted to use the smartphone on a trial basis long enough to see what it could do.	1	2	3	4	5
37. Being able to try out the smartphone was important in my decision to use it.	1	2	3	4	5
Behavioural Intention	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
38. Assuming that I have a smartphone, I intend to use it.	1	2	3	4	5
39. Whenever possible, I intend to use the smartphone.	1	2	3	4	5
40. To the extent possible, I would use the smartphone to do different things.	1	2	3	4	5
41. I intend to increase my use of the smartphone in the future.	1	2	3	4	5

42. Please choose the statement that best describes your use and knowledge of smartphones.
    1) I currently have and use a smartphone.
    2) I am curious about what a smartphone can do for me and have considered getting one.
    3) I have looked into getting a smartphone but have decided against it.
    4) I know little or nothing about smartphones and their features.

Section B: Smartphone Usage

43. What mobile phone are you using now? 1) Smartphone 2) Non smartphone (Feature phone)
    Brand (please specify): _____

If you are not using a smartphone, please go directly to Section C.

44. How long have you been using the smartphone? 1) < 6 months 2) 6 months-1 year
    3) 1-2 years 4) 2-5 years 5) > 5 years

45. How did you acquire your smartphone?
    1) I purchased it. 2) It was purchased new for me by a member of my family.
    3) It was passed on to me. 4) My employer got it for me.

46. Approximately how many hours per day do you use your smartphone?
    1) Never/Almost never 2) Less than ½ hour 3) ½ -1 hours
    4) 1-2 hours 5) 2-3 hours 6) More than 3 hours

47. **Rank the TOP 5** activities you do on your smartphone **(1=Most Important, 5=5th Important)**.

a. Make calls	_____	g. Play games	_____
b. Access email	_____	h. Take photos	_____
c. Access a social network	_____	i. Listen to music	_____
d. Text messaging	_____	j. Watch videos	_____
e. Read news articles	_____	k. Browse the Internet	_____
f. Get information from the Internet	_____	l. Look up directions	_____

48. **Rank the TOP 3** applications you use most on your smartphone
    (1=Most Important, 3= 3rd Important).

a. Alarm	_____	b. Camera	_____	c. WhatsApp	_____
d. Games	_____	e. YouTube	_____	f. Facebook	_____
g. Health/Fitness	_____	i. Others (please specify):	_____		

Section C: Demographic Profile

49. Gender: 1) Male 2) Female

50. What is your age this year? _____ years

51. Employment status: 1) Working full-time 2) Working part-time
3) Retired 4) Volunteering

52. Highest education level completed: 1) Primary 2) Secondary 3) Diploma
4) Bachelor degree 5) Master degree 6) Doctorate
7) Others (please specify): _____

53. How many years of experience do you have using computers in general? _____ years

54. How would you describe your general level of computer experience?
    1) None – I have never used a computer.
    2) Low – I have used a computer belonging to someone else.
    3) Medium – I own a computer but I am not comfortable using it.
    4) High – I own one or more computers and I am comfortable using them.

Please add any additional comments or suggestions:

_____

_____

_____

Thank you for taking the time to complete the questionnaire.
Kindly return the questionnaire within 7 days.

APPENDIX B

TOP 5 ACTIVITIES ON THE SMARTPHONE

Types of Activities		**Top 1**	**Top 2**	**Top 3**	**Top 4**	**Top 5**	**Total**
Make calls	Frequency	87	30	23	8	16	164
	Percent (%)	45.5	15.7	12.0	4.2	8.4	85.8
Text messaging	Frequency	63	61	23	14	3	164
	Percent (%)	33.0	31.9	12.0	7.3	1.6	85.8
Take photos	Frequency	4	16	38	38	28	124
	Percent (%)	2.1	8.4	19.9	19.9	14.7	65.0
Access email	Frequency	5	29	25	23	16	98
	Percent (%)	2.6	15.2	13.1	12.0	8.4	51.3
Access social network	Frequency	16	25	23	17	13	94
	Percent (%)	8.4	13.1	12.0	8.9	6.8	49.2
Read news articles	Frequency	6	8	24	16	21	75
	Percent (%)	3.1	4.2	12.6	8.4	11.0	39.3
Information from Internet	Frequency	3	6	12	19	25	65
	Percent (%)	1.6	3.1	6.3	9.9	13.1	34.0
Look up directions	Frequency	1	2	4	11	24	42
	Percent (%)	0.5	1.0	2.1	5.8	12.6	22.0
Watch videos	Frequency	2	2	6	12	13	35
	Percent (%)	1.0	1.0	3.1	6.3	6.8	18.2
Internet browsing	Frequency	1	2	3	11	18	35
	Percent (%)	0.5	1.0	1.6	5.8	9.4	18.2
Play games	Frequency	2	6	7	9	6	30
	Percent (%)	1.0	3.1	3.7	4.7	3.1	15.6
Listen to music	Frequency	0	4	3	13	7	27
	Percent (%)	0	2.1	1.6	6.8	3.7	14.2

APPENDIX C

TOP 3 APPLICATIONS ON THE SMARTPHONE

Applications		**Top 1**	**Top 2**	**Top 3**	**Total**
WhatsApp	Frequency Percent (%)	142 74.3	25 13.1	14 7.3	181 94.7
Camera	Frequency Percent (%)	17 8.9	62 32.5	72 37.7	151 79.1
Facebook	Frequency Percent (%)	7 3.7	47 24.6	20 10.5	74 38.8
Alarm	Frequency Percent (%)	15 7.9	24 12.6	30 15.7	69 36.2
YouTube	Frequency Percent (%)	4 2.1	20 10.5	30 15.7	54 28.3
Health/Fitness	Frequency Percent (%)	2 1.0	7 3.7	12 6.3	21 11.0
Games	Frequency Percent (%)	4 2.1	6 3.1	10 5.2	20 10.4

APPENDIX D

ADDITIONAL COMMENTS ON SMARTPHONE

Subject	Gender	Age	Working Status	Themes
Participant 1	Female	69	Retired	Compatibility
Participant 2	Female	73	Retired	(6 comments)
Participant 3	Female	62	Retired	
Participant 4	Male	61	Working full-time	
Participant 5	Female	55	Working full-time	
Participant 6	Female	60	Working full-time	
Participant 7	Female	62	Retired	Perceived Enjoyment
Participant 8	Female	76	Retired	(8 comments)
Participant 9	Male	66	Retired	
Participant 10	Female	65	Retired	
Participant 11	Female	70	Retired	
Participant 12	Female	60	Retired	
Participant 13	Male	62	Working full-time	
Participant 14	Female	58	Working full-time	
Participant 15	Male	59	Working full-time	Lack of Perceived Ease of
Participant 16	Female	59	Working full-time	Use
Participant 17	Male	63	Working full-time	(8 comments)
Participant 18	Female	59	Retired	
Participant 19	Female	64	Retired	
Participant 20	Male	68	Retired	
Participant 21	Male	66	Retired	
Participant 22	Female	66	Retired	
Participant 23	Male	52	Working full-time	Perceived Usefulness
Participant 24	Female	54	Working full-time	(9 comments)
Participant 25	Female	55	Working full-time	
Participant 26	Male	62	Working full-time	
Participant 27	Male	65	Working part-time	
Participant 28	Female	61	Retired	
Participant 29	Female	70	Retired	
Participant 30	Female	54	Retired	
Participant 31	Female	69	Retired	
Participant 32	Female	61	Retired	Lack of Perceived
Participant 33	Female	62	Retired	Usefulness
Participant 34	Male	61	Retired	(7 comments)
Participant 19	Female	64	Retired	
Participant 35	Female	65	Retired	
Participant 36	Female	67	Working part-time	
Participant 37	Male	67	Volunteering	

APPENDIX E

MEAN AND STANDARD DEVIATION

Variables	Mean (*M*)	Standard Deviation
Perceived Usefulness	**3.98**	**0.598**
1. Using the smartphone would enable me to accomplish tasks more quickly.	4.04	0.736
2. Using the smartphone would improve my performance.	3.75	0.821
3. Using the smartphone would increase my productivity.	3.77	0.789
4. Using the smartphone saves me time.	4.08	0.732
5. Using the smartphone would make it easier to do my tasks.	4.03	0.690
6. Overall, I would find the smartphone useful.	4.22	0.625
Perceived Ease of Use	**3.55**	**0.696**
1. Learning to operate the smartphone would be easy for me.	3.48	0.832
2. I would find it easy to get the smartphone to do what I want it to do.	3.46	0.879
3. My interaction with the smartphone would be clear and understandable.	3.53	0.820
4. I would find the smartphone to be flexible to interact with.	3.60	0.757
5. It would be easy for me to become skilful at using the smartphone.	3.57	0.812
6. Overall, I would find the smartphone easy to use.	3.68	0.770
Perceived Enjoyment	**3.81**	**0.685**
Using the smartphone is:		
1. Fun-Frustrating	3.70	0.880
2. Pleasant-Unpleasant	3.83	0.784
3. Positive-Negative	3.95	0.807
4. Pleasurable-Painful	3.80	0.802
5. Exciting-Dull	3.74	0.791
6. Enjoyable-Unenjoyable	3.84	0.782
Social Influences	**4.01**	**0.561**
1. Most people around me (friends, family, colleagues) think one should have a smartphone.	4.07	0.720
2. People who are important to me think that I should use the smartphone.	4.02	0.736
3. Those who are important to me owned a smartphone already or will have one soon.	4.18	0.719
4. Majority of my friends and family have a smartphone or will have one in near future.	4.27	0.562
5. People who influence my behaviour think that I should use the	3.88	0.826

smartphone. 6. I want to use the smartphone because my friends and family do so.	3.64	0.951
Compatibility	**3.72**	**0.759**
1. Using the smartphone is compatible with all aspects of my work or life.	3.61	0.878
2. Using the smartphone is completely compatible with my current situation.	3.70	0.839
3. I think that using the smartphone fits well with the way I like to work or live.	3.81	0.811
4. Using the smartphone fits into my lifestyle.	3.78	0.811
Observability	**3.79**	**0.610**
1. I have seen what others do using their smartphone.	3.83	0.733
2. The smartphone is very visible in my surroundings and/or workplace.	3.87	0.766
3. It is easy for me to observe others using the smartphone.	3.62	0.842
4. I have had a lot of opportunity to see the smartphone being used.	3.84	0.835
Trialability	**3.21**	**0.703**
1. I have had a great deal of opportunity to try various smartphone applications.	3.04	1.031
2. I know where I can go to satisfactorily try out various uses of the smartphone.	3.28	0.993
3. Before deciding on whether or not to adopt the smartphone, I would need to properly try it out.	3.40	1.007
4. I would be permitted to use the smartphone on a trial basis long enough to see what it could do.	2.96	1.060
5. Being able to try out the smartphone was important in my decision to use it.	3.38	1.049
Behavioural Intention to Use	**4.01**	**0.640**
1. Assuming that I have a smartphone, I intend to use it.	4.22	0.617
2. Whenever possible, I intend to use the smartphone.	4.02	0.792
3. To the extent possible, I would use the smartphone to do different things.	3.87	0.768
4. I intend to increase my use of the smartphone in the future.	3.93	0.850

APPENDIX F

ETHICAL APPROVAL LETTER

UNIVERSITI TUNKU ABDUL RAHMAN
Wholly Owned by UTAR Education Foundation (Company No. 578227-M)

Re: U/SERC/45/2015

14 September 2015

Ms Chin Wai Yin
Department of International Business
Faculty of Accountancy and Management
Universiti Tunku Abdul Rahman
Jalan Sungai Long
Bandar Sungai Long
43000 Kajang
Selangor

Dear Ms Chin,

Ethical Approval For Research Project/Protocol

We refer to your application dated 30 July 2015 for ethical approval for your research project (Master's candidate project) and are pleased to inform you that your application has been approved under expedited review.

The details of your research project are as follows:

Research Title	Determinants of Smartphone Adoption Among Older Adults in Malaysia
Investigator(s)	Ms Chin Wai Yin (PI) Ms Hui Kam Yong (UTAR Postgraduate Student)
Research Area	Social Sciences
Research Location	Klang Valley
No of Participants	150 - 200 participants (Age: 50 - 100)
Research Costs	Self-funded
Approval Validity	2015 - 2016

We take note that the above research project has already been started at the time of application for ethical approval. In future, please ensure that any application for ethical approval is submitted before a research project is initiated as all research requiring ethical review must obtain approval before the research is initiated.

The conduct of this research is subject to the following:

(1) The participants' informed consent be obtained prior to the commencement of the research;

(2) Confidentiality of participants' personal data must be maintained; and

(3) Compliance with procedures set out in related policies of UTAR such as the UTAR Research Ethics and Code of Conduct, Code of Practice for Research Involving Humans and other related policies/guidelines.

Address: Jalan Sg. Long, Bandar Sg. Long, Cheras, 43000 Kajang, Selangor D.E. **Postal Address:** P O Box 11384, 50744 Kuala Lumpur, Malaysia
Tel: (603) 9086 0288 **Fax:** (603) 9019 8868 **Homepage:** http://www.utar.edu.my

Should you collect personal data of participants in your study, please have the participants sign the attached Personal Data Protection Statement for your records.

The University wishes you all the best in your research.

Thank you.

Yours sincerely,

Professor Ir Dr Lee Sze Wei
Chairman
UTAR Scientific and Ethical Review Committee

c.c Dean, Faculty of Accountancy and Management
Director, Institute of Postgraduate Studies and Research