The Adoption, Use and Diffusion of Smartphones among Adults over Fifty in the UK

A Thesis Submitted to the University of Hertfordshire in Partial Fulfilment of the Requirements for the Degree of Doctor of Philosophy

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Abstract

Smartphones are innovations that currently provide immense benefits and convenience to users in society. However, not all the users of society are accepting and using smart phones, more specifically, for this research study older adults (50+) are a demographic group displaying such an attitude. Currently, there is minimal knowledge of the reasons that older adults adopt and use smartphones. Bearing this in mind, this research study *aimed to identify, examine and explain the adoption and usage of smartphones in the UK within the 50 years old and above population.* For this purpose, a conceptual framework, a Model of Smartphone Adoption (MOSA) was formed drawing factors from the theories of Unified theory of Acceptance and Use of Technology (UTAUT), the Diffusion of Innovations theory (DoI) and Technology Acceptance Model 3 (TAM3). Seven variables from the theories were brought to consideration, which were Observability, Social influence, Compatibility, Effort expectancy, Facilitation conditions, Performance expectancy and Perceived enjoyment.

For the research method, a quantitative approach was selected to examine and apply MOSA that involved the data collection method of an online questionnaire survey that resulted in 204 completed replies during the pilot phase of this research and 984 in the final phase. The collected data was analysed using SEM-PLS where the results found that six of the eight formed hypotheses were supported, and the factors of Compatibility, Effort expectancy, Facilitation condition, Performance expectancy and Perceived enjoyment were important for the adoption of smartphones. From these results, it was understood that older adults used smartphones because they have enough knowledge, time and money to use. They also think that smartphones are easy to use, provide benefits including enjoyment and are compatible with their lifestyles. In terms of usage, older adults frequently used the basic features of smartphones such as making a phone call, SMS, email, and browsing. Older adults are also likely to use their devices for seeking information about their health and for appointments with their doctors; however, from this research it was found that more than half of the 50 years old and above adults did not use smartphones for health and well-being purposes.

The contributions of this research are viewed to be the identification and understanding of the factors that encourage or inhibit smartphones use within the older adult population. Secondly, this research can inform smartphone manufacturers and developers of factors pertinent for the design of computing devices and applications specific to silver surfers. Finally, this research can enlighten policy makers when forming decisions that encourage the adoption and use of smartphones within the older adult population. Regarding limitations, these existed in the form of finance and time. To overcome the limitations, this research recommends further studies that apply qualitative research and/or to provide a comparison between western and eastern countries.

Keywords: Smartphones, Mobile phones, Adoption, Usage, Diffusion, Silver-surfers, Older adults, UK.

Dedication

I Dedicate This Thesis to My Parents,

Mr. Krailak and Mrs. Somsuk Pheeraphuttharangkoon, and

My Sister, Miss Nuttaporn Pheeraphuttharangkoon

Thank you.

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This thesis has been one of the most difficult tasks of my life; therefore, without the help of certain people I could not have completed it.

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List of Abbreviations

DoI	Diffusion of Innovation
ICTs	Information Communication Technologies
IS	Information Systems
IT	Information Technology
PLS	Partial Least Squares
SEM	Structural Equation Modelling
TAM	Technology Acceptance Model
UTAUT	Unified Theory of Acceptance and Use of Technology
Ofcom	The Office of Communication (UK)
OxIS	Oxford Internet Surveys- University of Oxford
WOM	Word of Mouth
PDA	Personal Digital Assistant
3G	The third generation of mobile phone standards
4G	The fourth generation of mobile phone standards
4G LTE	The fourth generation of mobile phone standards, Long Term Evolution

WiFi	Wireless connection technology under IEEE 802.11 standard
GPS	Global Positioning System

Publications

- Choudrie, J., **Pheeraphuttharangkoon, S**., Zamani, E., and Giaglis, G (2014). “Investigating the Adoption and Use of Smartphones in the UK: A Silver-Surfers Perspective”. *ECIS 2014, Tel Aviv, Israel.*
- **Pheeraphuttharangkoon, S**. and Choudrie. C (2012) “Silver Surfers adoption, use and diffusion of smartphones: an SME perspective”. *International Conference on Information Resource Management Conf-IRM 2012 Proceedings.*

Chapter 1 Introduction

1.1 Introduction

This chapter provides an introduction to this research study, where Section 1.2 provides a background of the research and the research problem. Included in this section is also a description of the current situation of smartphones penetration, and the situation with older adults and Information Communication Technologies (ICTs). Section 1.3 then presents the aims, objectives and research questions surrounding this research. Thereafter, the research scope and research approach are provided in section 1.4. Next, a research contribution is proffered in section 1.5. In section 1.6, a brief description of the research approach pursued is given. To familiarise the readers with the contents and format of this research, a dissertation outline, and a Thesis Structure Flow is specified in section 1.7. Finally, a summary of this chapter is in section 1.8.

1.2 Research Problem and Background

In the last decade, Information and Communication Technologies (ICT) have significantly developed and proliferated society and organizations alike. For those unfamiliar to the term, the United Nations Development Programme (UNDP) (2003) defined ICT as: “ICTs are basically information-handling tools – a varied set of goods, application and services that are used to produce, store, process, distribute and exchange information”. Rouse (2005) suggested that ICT is an umbrella term that includes any communication devices or applications. The term ICT also covers mobile phones, computers, tablet devices, and network hardware and software. The development of ICT has provided benefits for many sectors of society such as in business, education and personal life (Condie & Munro, 2007; Galloway et al., 2004; Line et al., 2011; Selwyn et al., 2003). These technologies provide benefits to users in the form of accessibility and management of information in a faster and easier manner. Having introduced the main device of interest to this dissertation, the following section will explain the research background that led to the research problem and motivation of this research. The following sub-section will initially explain and understand the role of older adults when adopting and using ICTs, mobile phones and smartphones.

1.2.1 Older Adults (50+)

Older population, older adults, 50+ adults or Silver Surfer are the terms frequently used in this research. The term older adult in this research refers to individuals age 50 years and older (Netlingo, 2010). There are many other terms that have been used to refer to this demographic group of society such as, senior citizen, the young-old, older adults, pre-seniors or pre-retirees. The different words present the variance when employing this term. For example, individuals who are 50-64 years old are referred to as pre-seniors or pre-retirees, while the young-old are those who are aged 65-74 years old (Lee et al., 2011). Note: This research will focus on older adults aged 50+ adults who are also known as silver surfers. As the Cambridge Dictionary Online (2015) states: “A silver surfer is a person aged over about 50 who uses the internet”.

It has been found that, due to advances in medicine and improvements to the quality of life and well-being, countries around the globe are facing the prospect of an ageing population (UN DESA, 2009). In the UK, currently more than 16.4% of the population is aged 65 years old and above and around 40% is older than 45 years old (Office for National Statistics, 2012a; The Telegraph, 2012). Therefore, regarding the size and the trends of this older generation, this group should be considered as one of the important research areas.

Moreover, this demographic group is not only approximately 30% of the overall population in the UK, but also a wealth holding group and a group that is viewed to be more affluent than the younger individuals of society (Censky, 2011). Soule et al (2005) reported that the sources of older adults income are different from those of the younger generation. Over 80 % of 50-59 older adults’ income is from employment and self-employment, while for the 70+ adults, 80% of their income is from both state and private pensions. Therefore, for those who are aged more than 70 years old, income may be considered as a limitation (Soule et al., 2005).

Contrastingly, due to the improvements in the quality of life, economic conditions within families, some older adults are still working or becoming entrepreneurs; thereby owning and managing their own enterprises (Meyer, 2013). A report from AgeUK found that one in six people of 50 to 55 years is in employment (Soule et al., 2005). On the other hand, due to an increase in life expectancy and increases in income, older adults can enjoy their later life by partaking in a range of leisure and travel activities (Soule et al., 2005).

However, as adults age, they may face physical or cognition difficulties. Older adults may have disorders such as diabetes, loss of muscle mass, osteoarthritis, poor vision, sciatica and stroke (Medicinenet, 2014; Besdine, 2013). Further details on these disorders can be found in chapter 2. Due to the physical ailments, older adults may face difficulties in their work place such as, negative attitudes from managers and colleagues on an inability to adapt to new technologies or resistance to change (Tishman et al., 2012). Moreover, older people may have mental illnesses, loneliness and social isolation (NHS, 2013a).

Due to the physical ailments and mental illnesses such as worsening vision, loss of muscle mass and Parkinson’s disease, older adults may face difficulty using some technologies such as mobile phones (Kurniawan, 2008). However, mobile phones could help older adults in many ways such as providing them with a sense of security because they could seek assistance in cases of emergency, or reduced isolation by connecting them to their friends and family (Kurniawan et al., 2006). Older adults could also use ICT such as laptop or desktop to access information that they require. For example, ICT could provide information about older adult health disorders.

Having identified that ICT can provide benefits to older adults and older adults' health, cognition and/or mental wellbeing which can deteriorate as ageing occurs, the next section assesses the situation with regards to ICT and older adults.

1.2.2 Older Adults and ICT

Having explained the increase in older adults and their importance in society, this section will understand the importance older adults have in the ICT sector.

When considering the numbers of older adults using ICTs, it has been found that there are fewer older adults, particularly the 65 years old and above adults who have access to the internet than the younger generations. However, their numbers are rapidly increasing (Age UK, 2011). In the United Kingdom (UK), the Office of National Statistics (ONS) (2012b), estimated that 36% of single 65+ and 69% of older couples (where at least one person is aged 65+) have internet access (Green & Rossall, 2013). Having such disparities, this leads to the question, why or what are the reasons for there being fewer older adults in comparison to the younger generations?

Green and Rossall (2013) listed the influencing factors of internet adoption among older adults (65+) as being age, income, household composition, self-perceived health status, gender, mobility, Asian ethnicity, memory or ability to concentrate. Additionally, it has been found that older adults do not accept new ICT due to the obstacles such as, cost of the devices, a lacking of user friendly of the devices, unfamiliarity of the new devices, and, resistance to change facing the new technology (Age UK, 2011). Green and Rossall (2013) also provided reasons for not using the internet such as, perceived lack of need, lack of awareness, negative experience with computer, skill and training, practicality and concerns about privacy and security.

Therefore, it can be seen that older people may need assistance when attempting an ICT for the first time, but some may require help continuously or reassurance when accepting or using new technologies (Age UK, 2011).

In the UK, there are several projects that are seeking to ensure that older adults do accept and utilise ICT (Age UK, 2011). Examples and campaigns emphasised on older adults and ICT are as follows:

- **Digital United's Silver Surfer day**: National Adults Learners' week and Age UK's ITea and biscuits and my friend's online weeks from Age UK.

- **The Moose in the Hoose Project** from Age Concern Edinburgh
- **EverybodyOnline Programme** from Citizens Online with 23 sub-projects
- **Connecting Milton Keynes** project by Milton Keynes Council and Microsoft
- **Keeping IT in the Family** in Birmingham
- **British Telecom (BT) Internet Rangers** that support young people to help older generation to get online
- **Digital Mentor Programme** from UK Government by Media Trust

The above projects aim to encourage and help older adults to use more technology and they also illustrate that UK is a country that is seeking to address the problems of ageing and is actively pursuing initiatives to close the digital gap between older and younger generations. However, as explained earlier, some older adults are still not using ICT. The next issue is about how older adults are using the technology and what the benefits are.

A recent study showed that the main functions of mobile phones for older adults are to enable them to connect cheaply, to their friends and family (Age UK, 2011). Other functions are sending/receiving emails, finding information and using services for travel and accommodation (Age UK, 2011). In other word, technology is being used to reduce loneliness and isolation in older adults. Other benefits offered are, providing health and well-being information and accessing public services (Green & Rossall, 2013).

At the beginning of this section, it was suggested that firstly, older people are lagging behind in terms of new technologies usage. Secondly, 50+ adults could require assistance when starting to use a new technology. Thirdly, the UK has provided several projects and campaigns to encourage and support older adults to use ICT. Finally, this section explained that ICT can benefit older adults in many ways and how some older adults are using ICT. Having assessed the older adult and ICT situation, the next section will explain the second element of this research study, which is the device of concern, smartphone devices.

1.2.3 Smartphones and Mobile Phones

For this research study, the device of emphasis is the smartphone. However, before delving into any descriptions of the devices, an introduction to their functionality and background is provided.

Before the smartphone era, mobile phones were important for communication. **Mobile phones** are devices that could be used wirelessly in wide areas by providing connections to cellular systems via radio waves (Chang et al., 2009; Oxford Dictionaries, 2014). The basic features of mobile phones are voice communication and simple services such as Short Message Service (Min et al., 2009; Patel et al., 2011). Mobile phones have continuously been developed by increasing capacity and ability. Mobile phones are the predecessors of smartphones, which is the technology focused on in this research.

A Smartphone is defined as a mobile device or mobile phone that allows users to make telephone calls, sends and receives emails, downloads files, provides an internet connection and uses applications. It usually has a touchscreen interface, and an operating system capable of running downloaded apps (Verkasalo et al., 2010; Aldhaban, 2012; Yuan, 2005; MobileSQUARED, 2010; PCMag.com, 2013; Oxford Dictionaries, 2013a; Park & Chen, 2007; Osmana et al., 1814). Current examples of smartphone brands are the Apple iPhone, Samsung Galaxy phones, that proffer operating systems such as, Windows Phone or Android Operating Systems (Verkasalo et al., 2010).

Currently, a smartphone is one of the expedited developing novel technologies, which was initially introduced to individuals in 1996, and since then has proliferated daily life. Smartphones can benefit users by providing instantaneously and in a real time environment, information and knowledge on entertainment, travel, finance, healthcare, lifestyle, photography and social networks (Xu et al., 2011). Since their introduction, there are an estimated one billion smartphones in the consumer market, with an expected rate of penetration to reach two billion in 2015 (Rushton, 2012). As shown in figure 1.1, in the United Kingdom (UK), the numbers of smartphone owners have been increasing continuously from 39% in 2012 to 61% in 2014. What is also indicated is that there are gaps between the older adults and adults in general. In 2014, 14% of the 65+ population owned smartphones compared with 39% of 55-64 and 72% of 35-54 age groups (Ofcom, 2014). The gaps were slightly larger in 2012 and 2013. It has also been suggested that the direction of smartphones growth is increasing and not declining around the globe (IDC, 2013). This leads to the question: Why are older adults adopting fewer smartphones compared with other groups and what are the reasons for some older adults using smartphones, and not others?

A global study during 2008-2009 found that users using different mobile operating systems have varying usage differences (Verkasalo, 2010). The overall services provided by smartphones are shown in figure 1.2. When considering the brand types of smartphones and their uses, Blackberry users seem to use more email service than others. Symbian S60 is preferred due to its being a better device when employing multimedia. Android users spend more time browsing the mobile internet. In terms of the adoption gaps of email and map services, it was found that there are wide variations. What was also discovered is that gaming, video, instant messaging and VoIP obtained a low level of usage. When considering the satisfaction of users it was found that the longer time a user spent on using email services, the greater the dissatisfaction. This was attributed to a poor keypad function, small screens and the push mail facility-rapidly transmitted emails (PC Mag, 2014).

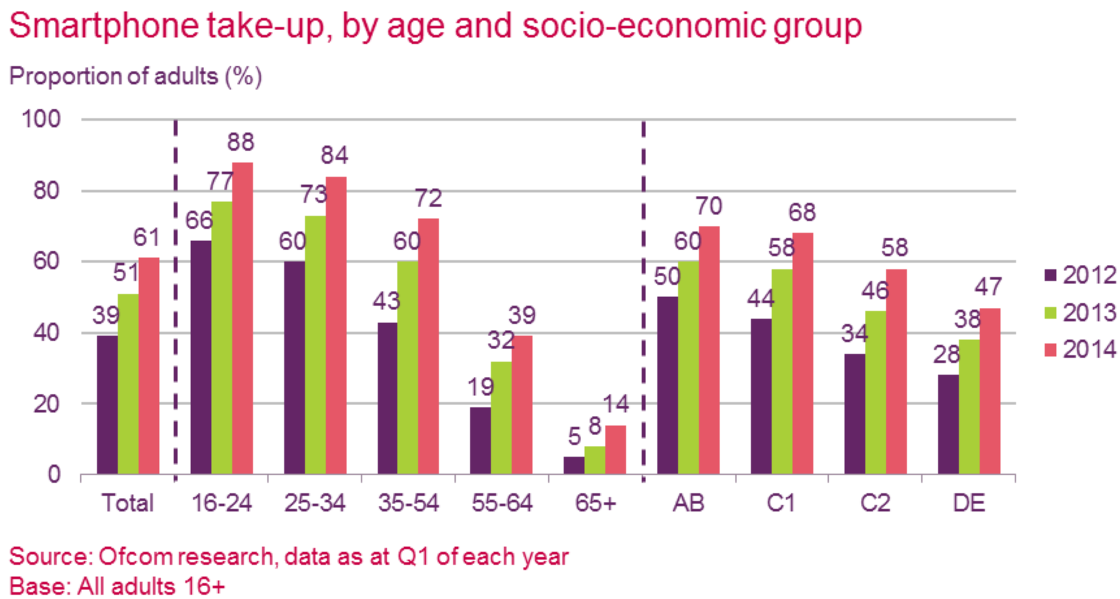

Figure 1.1 Number of smartphone owners from 2012 – 2014 (Ofcom, 2014)

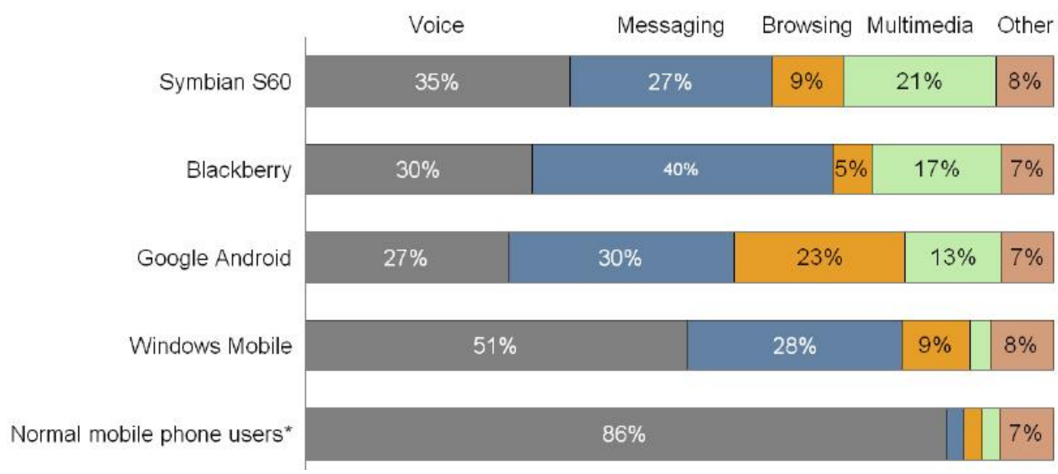

Figure 1.2 Distribution of face time across device platforms (Verkasalo, 2010)

When considering the usage of the operating systems of smartphones Android and Windows , it was found that that there are diversities in many ways such as, hours per day, time between using sessions and using patterns (Falaki et al., 2010). A popular smartphone brand type, Apple iPhone and socio economic status were also studied and it was found that there is a positive influence on usage patterns (Rahmati et al., 2012). From the previously mentioned research and reports, it can be seen that smartphone usage is diversified. The usage pattern can be influenced by many factors such as, smartphones brands, or age of users. It can also be implied that other factors such as, time, money, knowledge and experience can also influence a smartphone usage. Therefore, the question that motivated and encouraged this research was the question: *What are the factors that influence older adults to use their smartphones?*

From previous explanations, it can be learnt that smartphones with advanced technology have played an important role in assisting older adults in operating their businesses or assisting their daily livelihoods (Is4profit, 2010). Moreover, smartphones are viewed to assist business owners, including the older population to increase their quality of life (Kurniawan, 2006). , Smartphones as an ICT can help older adults to reduce loneliness and isolation, and to improve their health and well-being (Green & Rossall, 2013). These reasons further encouraged this researcher to pursue this research study.

Having ascertained that due to a better quality of life, advances in medicine and benefits of technology for health and wellbeing becoming emphasised, there is an older adult population that is increasing; however, not all the older adults are accepting and using the ICT, a research gap was identified and motivated this researcher. In the next section, the aim and objectives of this research study are provided.

1.3 Research Aim, Objectives and Research Questions

Having identified that older adults are not readily accepting smartphones and that there are reasons for this, a gap of research and a motivation to reduce or eliminate it was formed. This led to the formation of an aim. The **aim** of this research was formed to be: *To identify, examine and explain the adoption and usage of smartphones in the UK within the 50 years old and above population.*

To fulfil the aim, the following **objectives** were developed:

1. A comprehensive and detailed literature review of smartphones, silver surfers, technology adoption and usage was completed in order to gain an understanding of these areas. The knowledge also led to confirming the existence of a research gap.

2. After gaining the theoretical knowledge, a theoretical and conceptual framework was developed. The knowledge from the literature review on technology adoption including IS theories in the field helped in identifying the factors that are likely applicable to this research. Thereafter, the hypotheses and conceptual framework were formed.

3. The literature review also assisted in identifying an appropriate research methodology. The questions in the form of constructs were drawn and adapted from the previous studies. However, to ensure that the theoretical constructs could be employed to real life situations, the questions were validated by an expert panel consisting of specialists in the related fields.

4. The expert panel approved questions were used in the pilot phase within a small sample population. The pilot group included all ages in order to confirm that diverse age groups display different behaviours when using smartphones.

5. Following the recommendations and errors detected in the pilot phase, an improvement was made to the conceptual framework and the questionnaire utilised for the final phase. The final phase was conducted within only on the silver surfers group in order to gain an understanding of specifically, this demographic group and to fulfil the research aim.

6. The obtained results were then assessed in terms of validity and reliability. After that they were interpreted to derive the novel knowledge. The results were also compared with the research from other institutes or organizations in order to identify its novelty and to confirm the results.

7. The last objective was to offer a conclusion based on the end results of the final phase. Moreover, the implications, contributions, limitations and future direction were provided.

Research Questions

To further understand this research, several research questions were formed:

Research Question 1: What attitudinal, normative and control factors significantly affect silver suffers when adopting smartphones?

Research Question 2: What are the features of smartphones that silver surfers used and their frequency?

Research Question 3: What are the channels of communication that influence the diffusion of smartphones within silver surfers?

1.4 Research Scope

Before considering the research scope, a reminder to the reader is made of the research areas of this research study, which are Smartphones and older adults (50+). This suggests that the final results will emphasis only the 50+ adults who DO use or DO NOT use smartphones. Thus, both the social and technical factors affecting adoption and usage will be investigated. However, the questions for this study will avoid using technical questions associated with smartphones, adoption, and use behaviour's. Furthermore, this research will not focus upon commercial or marketing issues.

In terms of the context of this research, this research study is based upon the United Kingdom (UK). For those unfamiliar to the area of the country, or its population, the UK has a total area of 244, 820 km^2, and consisting of several countries including, England, Wales, Scotland (Great Britain) and Northern Ireland. The UK has a population of 61.7 million people. In terms of economic strength, the UK is one of the largest economies of the EU, where most of its wealth is accumulating from increasingly services provided in the economy, although it also maintains industrial capacity in the high-technology and other sectors.

The City of London, which is the capital of England, is a world centre for financial services (Europe.eu, 2014). Since the UK is an important nation of consideration and the researcher is based in the UK, this research study was undertaken in the UK, more importantly, in the Northern part of the city of London.

1.5 Research Contributions

Although smartphones or their features have been studied in several research studies as found from the literature review of chapter 2, this research also provides unique contributions, which are as follows:

1) For academia, more novel theory focused on the adoption and usage of smartphones, but within an under-researched age group, the silversurfers will be produced. Academic contributions will also be achieved from the conceptual model.

2) This research will also benefit industry-the smartphone providers and manufacturers as they will understand the needs and requirements of older adults, or silversurfers in a better manner. For example, the results may lead to special requirements in terms of software, hardware and operating systems. The results may also lead to certain applications that are needed by the older adult population and will eventually benefit software developers.

3) For government or policy makers, the findings can be used as a policy guideline to support and help UK the needs and requirements of the older adult population.

1.6 Research Approach

Based on the descriptions of the aim and objectives, this research developed knowledge based on the Information System (IS) existing researches and theories. This implies that the researcher believes in the Positivist philosophy, which is that the smartphone adoption factors and usage can be observed in this world. Moreover, this research intends to generalise the smartphone adoption phenomenal among older adults. When considering the research approaches, the deductive approach is being used. A deductive approach includes developing a theory and testing the developed theory (Saunders et al., 2009) in order to fulfil the aim of this research. Therefore, this research will initially gain an understanding of the smartphone phenomenon using a literature review and then create a conceptual framework. The benefit of the framework is viewed to be formed from the explanations that are available from the diagrammatic format with illustrations of the key factors, constructs, variables and the relationships among them (Miles & Huberman, 1994a). The factors were derived from IS theories that were identified in the literature review chapter.

The data that was obtained for this research was quantitative (based on numbers) in nature and acquired using a survey strategy. The strategy was used because of the benefits of, convenience, cost, less time consuming and accessibility (Gilbert, 2001). The survey was completed manually and online in order to gain the maximum numbers of responses. After collecting the data, it was analysed using the software, SmartPLS and the technique, Partial Least Squares Structural Equation Modelling (PLS-SEM). The PLS-SEM technique was applied because the technique provides a complete result in one analysis phase and it is a popular technique within the subject of business studies (Hair et al., 2011).

1.7 Dissertation Outline

Having described this research study aims, its contributions and research method, this section informs readers by providing an overview in textual terms, which is detailed in Table 1 below.

Table 1.1 Dissertation Outline

Chapter	Content
1. Introduction	This first chapter provides an overview of this dissertation. It begins with an introduction of the chapter and a background of this research that illustrates the important of this study. Next, the aims and objective, research questions and Scope of Study are provided. Then, to inform readers of how the research was achieved, the Research Approach is explained. The Research contributions then follow where the benefits of this research are provided. Finally, the research outline and summary of this chapter are provided to in

	order to familiarise readers to this research.
2. Literature Review and Conceptual Model	The second chapter provides a literature review that includes reviews of previous older adults, smartphones, and the digital divide studies. The chapter also assesses the theoretical foundations for the conceptual framework that is built on the theories of Diffusion of Innovation, Technology Acceptance Model and Unified theory of acceptance and use of technology. Other previous relevant research is also reviewed in this section. Then, the conceptual model of this study is illustrated and explained.
3. Research Methodology	The third chapter explains the relevant aspects of the research methodology of this research study. The reasons for selecting the research philosophy, approach, strategy, time horizon, techniques and procedures are provided.
4. Development of Instrument and Pilot Study	This chapter describes the constructs, analysis and findings of the pilot phase or exploratory phase. This phase assisted in improving the final questionnaire.
5. Research Findings	The fifth chapter presents the main and final finding from a large scale questionnaire conducted in the North of London area. The chapter includes the results in terms of the theories of adoption and usage. The hypothesis are also tested and discussed in this chapter. This is followed by other important findings.
6. Evaluation and Discussions	This chapter provides an evaluation and discussion of the research findings. The first half of this chapter uses national datasets obtained from two sources in order to evaluate the research finding. This assists in illustrating some of the conditions that are evident within the national datasets when impacting older adults. The second half of this chapter discusses the research findings of this research by comparing them with the existing works that were obtained in the literature review.
7. Conclusions	This last chapter provides summaries of the research findings. Then, it provides a conclusion to this research as well as the research contributions, and implications of this research. The chapter also discusses the research limitations and recommendations, and offers future directions in the field of the older adults' smartphones and technology adoption research.

To illustrate the text above, the following summary map is provided.

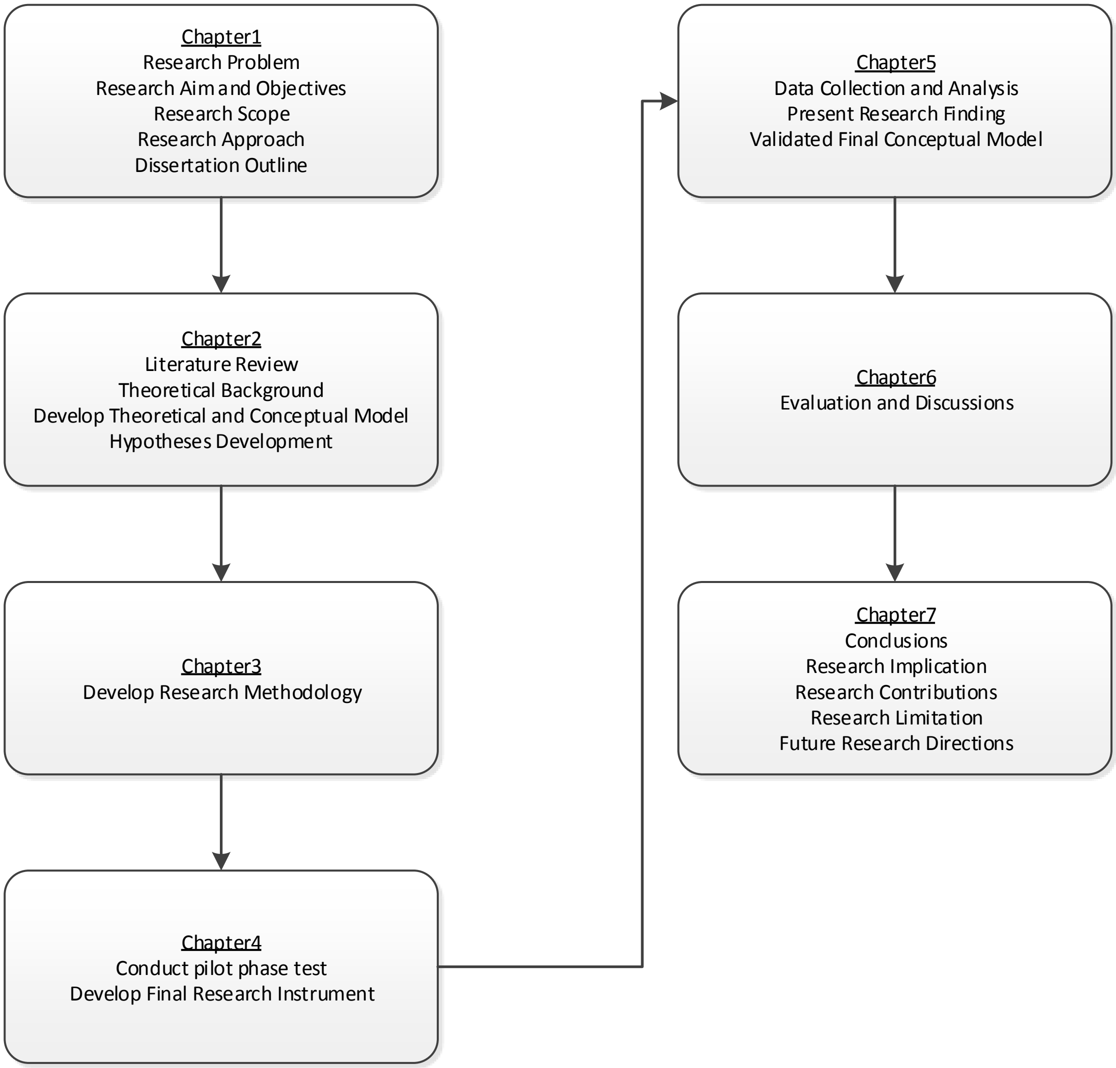

Figure 1.3 Thesis Structure Flow Diagram

1.8 Chapter Summary

Having introduced the main concepts and ideas associated with this research study, this chapter draws to a close. However, to summarise, this introductory chapter initially provided the background of this research, including the research motivation and problems. The aims, objectives and scope of this research were then explained. The overview of the pursued research approach was also proffered. The research outline then explained the structure and contents of this research.

In the objectives of this research, a literature review was mentioned, which the next chapter provides. The next chapter also provides reviews of the previous literature studies that are related with this research. The selected IS theories that assisted in developing the conceptual framework are also provided in the same chapter. This is then followed by a description and illustration of the conceptual framework and hypothesis.

Chapter 2- Literature review & Conceptual Theoretical Development

2.1 Introduction

In this chapter, the literature review & conceptual theoretical development will provide further definitions of terminology used in this research and provide a critique to the literature related to the main elements of this research: older people, technology adoption, technology diffusion, technology usage, and smartphones.

Reviewing the relevant theories and previous research on the main elements of this research leads to a further understanding of adoption, use and diffusion and to select the best possible theories to form the conceptual framework applied to this research. A literature review can also help in terms of determining a suitable research methodology for this research. To familiarise readers to the structure of this chapter the following is provided. In section 2.2, a literature review on smartphone technologies, a history of smartphones, smartphone features and usage, older adult and technologies, and digital divide and older people is presented. Section 2.3 reviews the theories of technology adoption associated with this research. In section 2.4, the theoretical and conceptual framework of this research is provided. Section 2.5 is a summary of this chapter.

2.2 Literature Review

When considering the theoretical foundations of older adults and smartphones, gaps that exist within the older generation research, the digital divide, mobile phones and smartphones were initially identified. This was then followed by considering the theoretical foundations of the conceptual framework that was developed for this research study.

Searching carefully across academic journals, conference publications, technology websites and books, this research discovered that over 150 related articles were associated with the terms (See appendix 2-1). The main elements that will be reviewed in this section are smartphones technology, older adults, the digital divide and technology adoption. The explanations for the process followed to provide the literature search are provided in chapter 3 section 3.7. Also included in chapter 3, section 3.7 is details about the keywords, databases, search engines, and duration of articles.

2.2.1 Smartphone Technology

As the main device of interest to this study is the smartphone, which was described in chapter 1 as an advanced form of a mobile phone, the following discussion on its background is provided. A mobile phone (Oxford Dictionaries, 2014) is a telephone without a physical connection to the network; therefore, it can be used over a wide area. When considering the mobile phone, it can be learnt that **the history of mobile telephony** dates back to the 1920s (Dunnewijk & Hultén, 2007). The first cellular phone system was introduced in 1979 and commercialized in 1983 (Agar, 2013). When considering the development of mobile phones, the first period of mobile phone development refers to mobile phones developed for cars in Boston and New York (Agar, 2013).

In the previous paragraph, mobile phone development was explained in the North American continent context. In Europe, Sweden was one of the first countries to adopt mobile systems, but when considering Sweden, it can also be noted that for its mobile phone development, also developed was a standard named the Nordic Mobile Telephone. The standard allowed the possibility for roaming, and the ability for a cellular customer to automatically use his/her mobile phone outside the home network, and since 1982, in other European countries such as, Finland, Sweden, Norway, Denmark and Iceland (Dunnewijk & Hultén, 2007).

When considering mobile phone development, standards also need to be considered, which are explained hereafter. In the United Kingdom (UK), which is the context of this research, a mobile network was initially developed in 1985 when the government licensed two national operators, Cellnet and Racal-Vodafone to provide radio services (Ofcom, 2011c). At that time, several countries developed their own mobile standards such as, Nippon Telephone and Telegraph (NTT) by Japan; a C450 standard in Germany, and in the United States of America (USA), an American standard Advanced Mobile Phone system (AMPS) (Dunnewijk & Hultén, 2007).

To prevent problems across various countries and to prevent further confusion, in 1982, a Global System for Mobile Telecommunications (GSM) was introduced to standardize the mobile telephone technology in Europe (Pelkmans, 2011). In 1987, thirteen European countries signed a memorandum to initialize the GSM network. This GSM network along with mobile phone manufacturers such as, Motorola, Ericsson, Nokia, Siemens and Alcatel provided great contributions to mobile phone systems sector; thereby leading to more advanced technology (Dunnewijk & Hultén, 2007).

When studying mobile telephones the term and device, smartphone also need to be drawn into the conversation. The standard that supported smartphones was **the third generation of mobile phone standards (3G)**. The benefits of the 3G standards were that they enabled some features of smartphones. Examples include, downloading of applications, or connecting to social media platforms and services that need a rapid and reliable data connection. This technology can be referred to as the Universal Mobile Telecommunication System that is based on the GSM Standards. A 3G network provided a significant increase in the capacity for data and voice communications compared to the previous 2G network capabilities (Dunnewijk & Hultén, 2007). This meant that more users could connect to a network with expedited data connections (Tan et al., 2007). In the UK, Italy and Sweden, the pioneering company that introduced 3rd Generation networks was Hutchinson Whampoa. Therefore, the company was the first for 3G service provider in the UK.

As mentioned earlier, a term that is presently widely used is the smartphone. The evolution of smartphones began in 1992 when IBM developed the Simon phone (Mccarty, 2014). In 1996, Nokia provided a Nokia 9000 Communicator that had additional features such as, email, web browsing, word processing and spreadsheets. In 1997, Ericsson launched a GS 88 with touch screen and stylus capabilities (Martin, 2014). In the early 2000s, many more manufacturers emerged within the smartphone development sector and provided many more handsets such as, Nokia providing Nokia N and E series with Symbian operating system, a leader in the business and entrepreneurial sector, BlackBerry and a Windows mobile is known as Pocket PC (Martin, 2014). However, smartphones were not adopted in large numbers by the consumer and retail market until the arrival of the Apple iPhone. In 2007, the first iPhone from Apple was introduced that featured products and services beyond emails. The Apple iPhone offered a finger-friendly design, large colour display, advanced web browser, multimedia functions and application market.

About November 2007, Google also lunched a free Android mobile operating system that allowed mobile manufacturers to install an operating system on their devices. In 2008, HTC was the first manufacturer who provided a smartphone with an Android Operating System (OS). Currently, Android – a mobile operating system developed by Google, has been used by several phone providers such as Samsung, LG, and Motorola (Mccarty, 2014; Martin, 2014; Arthur, 2012).

Whilst the previous paragraphs have explained the novel standards that led to smartphone development, it was found that the smartphones attributes are also different from their predecessors, the mobile phone, in three ways: physical, software and connection. Currently, smartphones have larger screens and usually, a touch finger capability that offers a full QWERTY keypad, the common keyboard layout.

They also usually have powerful processors compared to their predecessors. The powerful processors result in such as faster application opening, faster web page loads, and better games. In terms of software, smartphones have two main operating systems. These are the Android system from Google or iOS from Apple. The difference between both the operating system can be found in Table 2.1 below.

Table 2.1 Differences between Android and IOS source (Diffen, 2013; Digitaltrends, 2014)

Category	Android	iOS
Owner/Developer	Google	Apple Inc.
Customisability	Customisable	Limited
Initial release	September 2008	July 2007
App store	Google Play – around million apps available	Apple app store – around million apps available
Device manufacturer	Google, LG, Samsung, HTC, Sony, Motorola, and many more	Apple Inc.
Website	Android.com	Apple.com
Affordability (price)	Price are variety from low cost handset to luxury such as Vertu brand (Vertu, 2015)	Does not have budget devices
Interface	Material Design – minimalist look with simple animations.	Bright and modern-feeling, easy to understand.
Battery and Battery life	Android device come with big battery. Some manufacturers provide battery saving feature.	iOS optimized the battery usage but the battery can be consider as poor

Smartphones with their operating system can download and install other applications on top of their operating systems. In terms of the network abilities and the smartphones being able to connect to them, currently smartphones have the ability to connect to 3G or 4G networks and a high speed internet connection (Bridges et al., 2010). Therefore, it can be seen that smartphones and their mobile technologies provide many benefits for users that will be explained further in the following sections.

2.2.2 Smartphone Features and Services

In chapter one, the aim of this research was also identified to be a consideration of smartphone usage. For this purpose, this research needs to determine and understand the features and services of smartphones. This can then lead to investigating the older adults' usage. Without the knowledge and information on the products and services of smartphones, it is very difficult to understand smartphone usage.

In terms of novel features and services, a smartphone offers many. For example, research on individuals' life styles and mobile phones identified that smartphones provided services such as, communication, information search, learning, the provision of office tools, and entertainment services (Gao et al., 2012). Other features include, a multi-talking operating system, powerful processors, full QWERTY keyboard functions, large displays with high screen resolution, fast internet access, synchronization capability, Wi-Fi and Bluetooth connections, cameras, file management, Global Positioning System (GPS), Radio Frequency Identification (RFID), storage expansion, or biometric information (Chang et al., 2009). Currently, an increased number of smartphones are equipped with more advanced sensors such as, Accelerometer, Gyroscope, Digital Compass, fingerprint ID, and, Barometer (Phonearena, 2015).

As mentioned smartphones consist of a GPS system, which receives information from at least three satellites to determine a current location position, time and velocity (GSMarena, 2014a). The applications using GPS include, location searching, searches, mobile social networks, and navigation (Liu, 2013). Location search allows a user to include his or her current location in the search that the results will only bring things nearer to the user. An example of a location search is a restaurant location search where only a restaurant near the user's location will be shown.

A smartphone also has gyroscope capabilities that have been used to detect the orientation of a device, while the accelerometer measures linear acceleration of movement. A digital Compass ability allows the smartphone to determine directions such as, what is the Northern direction, that helps in map applications (GSMarena, 2014b). Therefore, a smartphone will identify whether it has been moved or not, which implies the movement of a user. These features can be applied to health and well-being by tracking a users' activities, as well as to encourage users to increase exercise (Liu, 2013).

It is undeniable that smartphone apps or applications are the main features that enable smartphones to be useful devices and enhancements or extensions of mobile phones. There are many applications that are being provided in smartphones, but for the readers' information, the following important applications are identified. Xu et al (2011) classified the categories of applications into books, business, education, entertainment, finance, games, healthcare, lifestyle, medical, music, navigation, news, photography, productivity, reference, social network, sports, travel, utilities, weathers and others. Some applications implement a user's current location from sensors such as GPS that are considered as local services, which provide local information for users such as news, weather, or traffic based on a user’s current location (Xu et al., 2011).

While the previous discussions have explained the usefulness of smartphones in daily life and in the context of a consumer, smartphones are also useful for businesses and the working life. Amongst the foremost benefits, research on mobile emails revealed that the email feature of smartphones can help in promoting collaboration between colleagues. The collaboration is assisted largely due to the acceleration of work processes and keeping a team’s members informed on the progress of the work (Beurer-Zuellig & Meckel, 2008a). Smartphones with personal organizer features such as, contact list and automatic reminders assist users in becoming more organized (Is4profit, 2010). Smartphone also offer instant information to users due to their instant connections. Additionally, Smartphone users can access information such as maps, satirize navigator, news, weather reports, traffic information, stock price or currency price from their devices (Is4profit, 2010). Smartphones are also beneficial as they proffer camera functions and text and voice communications abilities that can allow the sharing of photographs or using a video call function that can provide a better experience for business in terms of communication (Is4profit, 2010).

Of the other uses of a smartphone, the entertainment element of the device is also well known. A smartphone can be used online and off line to listen to music and to watch videos. Music, movies or video files can also be copied and stored in smartphones and these files can be played on the devices due to large storage, displaying and powerful processing abilities within the smartphone. In addition, due to the faster internet connections applications such as, YouTube, Google Play Movie or Netflix proffer users the choice to watch videos online. Within the entertainment context, games can be played on smartphones, which can be adventurous, in arcade format, board games, card forms, educational, puzzle, sport and strategy. For entertainment purposes, smartphones also allow users to connect to online social networks such as, Facebook or Twitter.

The healthcare sector also views smartphones as being important (Smallman, 2014). Smartphones can be used by healthcare professionals to develop their skills and knowledge, or to provide convenience to their work. Comparatively, smartphones can be tailored to the patients individual health needs and requirements (Smallman, 2014). For the professionals, smartphones offerings range from providing a doctor’s basic information about the medication and patient’s dosages, observe portable heart monitors, view a patient's x-ray’s and other images, and as a reference source for doctors, all in a mobile environment (Whalen, 2013). For members of the public, applications for smartphones range from trackers to monitor the distance and Global Positioning System (GPS) tracker, fitness applications, and diet and weight management tracking facilities (Altena, 2012).

The previous discussions have highlighted and explained the benefits of a smartphone. To inform readers and to summarise the benefits, a list has been developed and provided in Table 2.2.

Table 2.2 Features of smartphones

Smartphone Built-in services	• Taking a photo, video • Record voice
Communication services	• Phone call, text messaging (SMS) • Instant messaging tools such as WhatsApp, Facebook Messenger • Email communication • Voice over IP and video communication such as Skype
Information search services	• Search engine query • Read news though a browser
Transaction / banking services	• Mobile trading service such as m-commerce, m-payment • Financial services such as stock trading, accounting • Mobile banking
Learning / office tools services	• Office software such as MS word, PDF • Learning tools such as dictionaries, formula conversion • Note taking, calendar, organizer • Tracking items or packages being delivered
Entertainment services	• Online entertainment service such as online game, music streaming, video streaming • Download content such as game, music, and movie
Social network services	• Social network services such as Facebook, Linkedin
Navigating / transportation services	• Mapping such as Google Maps • Navigating such as TomTom, Copilot • Bus, Train time table, Flight time
Health services	• Distance and GPS tracking • Fitness application • Diet and Weight Management applications • Sleep management
Security services	• Password Management • Antivirus • Accessing security systems such as using watching CCTV, unlock a car or home with a smartphone

Government services	• Using government authority's applications such as NHS, Jobcentreplus

Finally, smartphones offer flexibility in the manner that smartphones can be connected to other devices such as, televisions (Y. Chen et al., 2009), they can be used to log activities (Zeni et al., 2014), cars (Kun et al., 2013), electronic devices in apartments (Suyuti et al., 2013), and, smart watch, mobile ultrasound, Cell Scope and Electrocardiogram for healthcare segment (Swan, 2012). Therefore, it can be concluded that smartphones offer immense benefits to users. Having identified the usage of smartphones, the next section will now understand the adoption of smartphones.

2.2.3 Adoption and Smartphone Development

As previously explained, smartphones have been developed since 1990s, but the device became widespread from 2007. Amongst the first studies of smartphone adoption, a study of adoption within doctors and nurses was conducted by Park and Chen (2007) where findings revealed that perceived usefulness and perceived ease of use can determine smartphone adoption. The researchers also found that in 2007, only 10% of the participants used any type of smartphone, with approximately half of the respondents considering using a smartphone (Park & Chen, 2007).

The use of a smartphone in terms of fashion was then explained In 2008, where the impact of the smartphone design on emotional reaction was studied and it was concluded that a smartphone is not only a communication tool, but also a fashion accessory (Nanda et al., 2008). In 2008 studies on the design of the smartphone also began to emerge where it was learned that users can navigate a smartphone user interface, with or without a touch screen capability (Kim et al, 2008). Research on the usage of smartphones found that entrepreneurial individuals had begun to adopt smartphones in their work processes, where the email facility was identified as a popular feature due to its providing improvements to and accelerations in the working processes (Beurer-Zuellig & Meckel, 2008a).

Smartphone adoption studies then began to take a different direction where the case study approach on multiple case studies (5) was used to identify whether delivery service companies would adopt smartphones. It was suggested that the logistics industry needed instant information sharing that can assist in supply chain management and decision making, which was proffered by the smartphone. Therefore smartphones were considered to be viable solutions for delivery service facilities. The research found that testing, an organizational and environmental factors performed an important role in the adoption of smartphones in the businesses (J. Chen et al., 2009). Chen et al (2009) also identified the smartphone's recent features and characteristics where the reviewed smartphone brands were, the first iPhone, which was a smartphone using the Windows mobile operating system, Blackberry, and Nokia.

The adoption of three smartphone services, the internet, maps and gaming were then considered where findings revealed that perceived enjoyment and usefulness linked to intention were the services that were most useful (Verkasalo, 2010). A study by the same researcher in 2010 on user behaviour using the tracking software installed on smartphones led to an interesting discovery that user behaviour depended on the smartphone operating systems, with users tending to use the voice and SMS features immensely, followed by calendar browsing and email, and then more advanced features. In this study, Verkasalo (2010) also provided ideas and the software that can be used to capture smartphone usage.

In 2011 smartphone devices had begun proliferating society, which was further supported by official reports such as, the UK government regulation report reporting that the UK population had become addicted to smartphones (Ofcom, 2011a). In academic studies this pattern was also evident. For example, a comparative study from South Korea becoming more precise about the factors that university students consider when purchasing smartphones compared to the normal mobile phone (Kang et al., 2011). The classic adoption theories began to emerge where a study from Thailand used UTAUT with perceived Value to study the adoption of an iPhone and Blackberry (Pitchayadejanant, 2011). A Taiwanese study used TAM to study smartphone acceptance within a major delivery service company (Chen et al., 2011). A South Korea study used TAM, DoI, switching costs, and emotional attachment to study the factors impacting both the adoption and post-adoption of smartphones (You et al., 2011).

As Japan has been facing an ageing population for several years, research studies from Japan considered how smartphones with touch screen capabilities impacted elderly users (60+). The results found that after a week, older adults could improve their skills of using touch screens. This study also became more precise and explained and understood problems such as, how older adults were often confused due to unclear instructions, the problem with a software keyboard, and the mode of applications (Kobayashi et al., 2011). Whilst the Japanese study emphasised the users' aspect, studies of the application designs also began to emerge where researchers reviewed the opinions of application developers when creating applications in mobile platforms (Holzer & Ondrus, 2011).

As adoption studies were increasing, a review of the literature reviews and studies of smartphone adoption was provided by Aldhaban (2012). In the reviewed study, it was found that in 2000 there were six articles related to the adoption of smartphones, but the numbers of research studies emphasising smartphone's adoption began to increase from 2006 where a number of 11 articles were founded and by 2011, there were 27 articles. What was concluded from this study was that as advances and familiarity with smartphone technology continued, research findings were also continuously emerging (Aldhaban, 2012).

In 2012 smartphone and adoption studies from South Korea found that within Korean students, hedonic enjoyment and utilitarian usefulness were both important factors of consideration (Chun et al., 2012). Rahmati et al (2012) studied the factors from a socioeconomic perspective among iPhone users and found that people with low socioeconomic status surprisingly spend more money on purchasing mobile applications. A comparative study of US and Korean cultures, usability and aesthetics on smartphones acceptance using interviews and focus group revealed that both usability and aesthetic values were important; however, users in both countries differed in their ways of thinking about usability and aesthetic values (Shin, 2012).

Adoption studies of smartphone features and service also begun to take off. Lee et al (2012) UTAUT was employed to study the factors influencing the use of smartphones application where it was found that performance expectancy and effort expectancy had positive effects on usage intention when using smartphone applications (Lee et al., 2012). Persaud and Azhar (2012) found the reasons to adopt mobile marketing via smartphones which were shopping style, brand trust and value.

Smartphone adoption studies also began to diversify by becoming more precise about the applications on smartphones. For instance, Wac (2012) studied the use of smartphones for personal health information services and found that using smartphones in this manner was limiting. A study of the Thai patients in Thailand used UTAUT to study the adoption of smartphones for e-Health services and found that Effort Expectancy, Facilitating conditions and Perceived value significantly affect Behavioural Intention to use older adults use of smartphones (Boontarig et al., 2012).

Studies also emerged within the mobile gaming and marketing sectors and in general about the various theories of adoption. An explanation of smartphone design effecting use was provided by applying TAM and DoI, where it was found that design varieties had a very positive effect on perceived usefulness and the perceived ease of use of smartphone usage. Moreover, the attribute of relative advantage, from DOI, immensely affected usage attitudes (Tsai, 2013). In terms of the mobile games sector, TAM, connection quality, content quality, flow – great enjoyment, social influence and usage cost were applied to study mobile gaming adoption (Zhou, 2013). The results found that flow, social influence and usage cost effect usage intention and perceived ease of use, connection quality and content quality effect flow (Zhou, 2013). This research also revealed that the UK had the second highest of ratio of mobile game adopters.

In the marketing arena, Watson et al (2013) studied smartphone use within marketers using functions such as the text message service, mobile website content, and QR code (a two-dimensional barcode) where it was found that QR adoption in smartphones was possible due to the ease of use, utility and incentives for using the code factors. Smartphone adoption preventive factors were identified by the study, which existed in the form of lacking knowledge on how to scan the code, or the benefits of a QR code (Watson et al., 2013).

Literature was again reviewed, but this time for older adults and using mobile phones for health purposes. From a literature review of 21 documents between 1965 and 2012, emphasising the 60+ adult population and mobile phones, it was learnt that mobile phones were used for diabetes care, chronic obstructive pulmonary disease, Alzheimer's care, and osteoarthritis. This study also confirmed that smartphones can benefit older people, particularly those who suffer from ageing ailments (Joe & Demiris, 2013).

Therefore, from this review of adoption studies, it can be deduced that during the last decade, research on smartphones has been completed in several topics and fields of studies. Additionally, smartphones have played significant roles in many sectors such as healthcare, gaming, commercial and marketing. As older adults are the demographic population of interest in this research, the next section will explain the ageing problems that older adults face and the role of ICT, including mobile technology.

2.2.4 Older Adults and the Challenges of Ageing

"Aging is a complex process of accumulation of damage, and it is the major risk factor for predominant killer diseases in developed countries" (Partridge, 2010:1). When ageing occurs, older adults could face different health, emotional and mental problems. Moreover, ageing also causes challenges for society and governments alike. Therefore, this section will address the potential problems that older adults may face and challenges for society and the government.

Whilst ageing, older adults are likely to face some ailments known as the term Geriatrics syndromes. The ailments are identified and described in Table 2.3 below.

Table 2.3 Some ailments that affect mainly older people. Source: (Medicinenet, 2014; Besdine, 2013)	
Ailment	***Description***
Alzheimer Disease	Memory and other mental function are progressively lost
Diabetes	The body does not respond to the insulin it produces.
Glaucoma	The optic nerve is damaged because pressure in a part of the eye is elevated. Vision is progressively reduced, and blindness can result
Hearing impairment	Difficulty hearing other people clearly and misunderstanding what they say
High blood cholesterol	Increasing the risk of heart attack, narrowing of the arteries, and stroke
Loss of muscle mass	Loss of strength and mobility
Osteoarthritis	The cartilage that lines the joints degenerates, which causes pain
Osteoporosis	Bones become less dense and more fragile.
Parkinson disease	Nerve cells in the brain degenerate slowly and progressively; thereby, causing tremor, stiff muscles and difficulty moving and maintaining balance.
Poor vision	The loss of sharpness of vision and the inability to see fine details
Pressure sores	The skin breaks down because prolonged pressure reduces the blood flow to the affected area
Prostate cancer	Cancer develops in the prostate gland and eventually interferes with the flow of urine
Sciatica	Pain, weakness, numbness or tingling of lower back and leg
Stroke	A blood vessel in the brain is blocked or ruptures.

Besides the ailments listed in Table 2.3 above, older adults could face health problems that are caused by hormonal problems such as, menopause, poor kidney function, hair loss, skin problems, urinary problems, oral and dental problems (Medicinenet, 2014). Some statistics on some of the ailments are provided to illustrate the challenges of the geriatrics syndromes.

The first ailment in the list is Alzheimers. By 2015, there will be 850,000 people with dementia in the UK, with one in six people aged 80 and over having dementia (Alzheimer’s Society, 2013). Dementia is a term for a set of symptoms including, impaired thinking and memory. Approximately 50-70% of Alzheimer's disease leads to Dementia (Alzheimers.net, 2013).

In the UK in 2010, there were 1.3 million older adults (60-70 years old) who had diabetes, which means that more than half of the UK's individuals are aged over 60 years old. Diabetes care is expensive, with an estimated 10% of European healthcare budgets (80 billion Euro) being spent on it (IDOP, 2011).

Heart strokes are another major health problem within older adults in the UK. Annually, around 110,000 individuals suffer from strokes in England. Strokes are the third largest cause of death, following heart disease and cancer. Strokes are more likely to occur in older adults. One in every four people suffering from strokes die. Survivors of strokes often face a brain injury (NHS, 2013b). From the statistics, it can be learnt that older adults are very vulnerable, where besides the ailments; older adults could face mental difficulties.

A serious social problem of an ageing society is loneliness and social isolation. About half of the 75+ adults live alone and 5 million older adults cite television as being their source of company. Social isolation can lead to depression and a serious decline in physical health and well-being. Causes of social isolation including, ageing, weakness, no longer being the hub of one's family, a disability or illness, or the deaths of spouse and friends (NHS, 2013a). Due to this factor, older adults could also face difficulties in their work place.

Whilst the above was a social problem, organizations perceptions of the older workers could also impact the older adult workers. Organizations adopting a positive perspective cite benefits from higher level managers in the form of, increasing knowledge of work habits, commitment to quality, loyalty, punctuality and respect for authority (Tishman et al., 2012). Moreover, older workers can be considered to be a valuable resource for all organizations due to their reliability, experience, expertise and knowledge (Okunribido et al., 2010). However, older workers are considered a drawback because they are considered to be inflexible, unwilling or unable to adapt to new technologies, lack of aggression, resistance to change, complacency and a presence of physical limitations that lead to an increase in the cost of health insurance (Tishman et al., 2012).

Challenges that older adults could face in life are as follows. Ageing brings about illness and disease where older adults could endure a loss of cognitive capacity. Moreover, older workers have less physical strength and endurance. Older adults may have poorer sensory abilities such as, sight and hearing. Older workers may have difficulty adapting to change and to learn new skills. Lastly, older people are less productive. Therefore, in the work place, older adults could pose to be a challenge for the organization and government (Benjamin & Wilson, 2005).

In terms of Government spending on older adults, presently, 65% of the UK's Department for Work and Pensions benefits expenditure is devoted to older adults, which is an estimated £100 billion in 2010/11. Additionally, due to an ageing population there is an increase in the allocated costs and budgets for providing UK's health care service known as, the National Health Service (National Health Service, NHS). In 2007/08 the average value of NHS services for retired households was £5,200 compared with £2,800 for non-retired (Cracknell, 2010).

From the previous discussions, it has been found that older adults could face both physical and mental challenges that could impact the older adults working life. Moreover, an ageing population is challenging for the government and society in many ways. Nevertheless, Benjamin and Wilson (2005) suggest that some problems, such as health problems, can be prevented or improved by a change of lifestyle by making small adjustments to the amounts of exercise taken and to nutrition. New technologies such as smartphone are also viewed to be a means of improving the well-being and health of older people (Boontarig et al., 2012).

This section has discussed and identified the benefits and drawbacks of an ageing population and also the ailments that are likely to be faced as an individual ages. ICT is the devices of interest in this research, which the next section addresses by considering research that has been completed with older adults and ICT.

2.2.5 Older Adults and Technology (ICT, mobile phone, smartphones); Are older adults Accepting the Technology?

As explained in chapter 1, a group of people that this research focused on is the older adult group, or the silver surfers. This group was selected due to their not experiencing the Internet or advanced technologies in their adult lifetimes (Hill et al., 2008). In comparison to younger generations, older adults will probably not have experienced innovative technologies; therefore, they are also likely to be excluded from technology use, knowledge and information (Hill et al., 2008). To support this view, statistics obtained from the Oxford Internet Institute Survey identify the numbers of older adult internet users who are fewer in number of the younger generations (Dutton et al., 2013). In terms of the mobile devices of this research, -the smartphone, at the beginning of 2011, 55+ Adults in the UK used only 7% of smartphones, compared with 50% from 16-24 year old age groups (Ofcom, 2011b). Data from the Ofcom report shows that the adoption trend began from the younger generation, which meant that the 55+ years older users were fewer. Previous research also found that technology, particularly ICT is important for older adults to reconnect with, to improve their connections with society and improve their quality of life (Irizany & Downing, 1997; White et al., 1999). Therefore, some countries such as the UK and USA recognise that there are benefits of technology for older adults. However, the question formed at the beginning of this millennium is how to encourage older people to use ICT (Selwyn et al., 2003).

In terms of the positive attitude, Nimrod (2011) studied the fun culture within seniors (50+) online communities in the USA and Canada. From 50,000 posts on six online communities, it was found that the content seniors were posting were online social games, jokes and funny stories. The games can be categorised as cognitive, associative and creative games. The jokes and funny stories can be classified as stories about gender, ageing, grand parenting, faith, politics and alcohol. Nimrod (2011) suggested that online communities should encourage social engagement and well-being and successful ageing. This research suggests that enjoyment can be a positive effect on technology adoption for older people.

In other ways, considering the high number of older people and ageing population, senior portals, websites that focus on older people have been introduced. Moreover, senior portals were predicted to be popular within the ageing population. Yoon et al (2011) studied the older adults portals in terms of appropriate content for older adults in South Korea and found that the content preferences were dependent on the older adults' characteristics. For instance, some older adults preferred entertainment and sought content that was entertaining. However, generally older adults preferred to view content on health/medical terminology, banking, travel, current terminology, and real estate (Yoon et al., 2011). Drawing from this research, appropriate contents for older adults such as content about health could lead to technology adoption.

Technology usage within older adults (65+) and their attitude towards technology were studied by Mitzner et al (2010). The technology utilised in this research included, computers, blood glucose and blood pressure monitors, microwaves, mobile phones fax, telephone, television and telephone. Older adults reported positive attitudes over the negative attitude. The positive attitude related to technology support activities, enhanced convenience and useful features while the negative attitude linked to inconvenience, unhelpful features, security concern and unreliability of some technology. This research also confirmed that the perceived benefits of use and ease of use led to technology adoption within older adults (Mitzner et al., 2010). From this research, an attitude about technology from older adults is important for technology adoption.

In terms of literature, Wagner et al (2010) reviewed existing research on computer usage within older adults and provided a historic view of the field by using the Social Cognitive Theory. This led to 151 articles from 1990-2008 from related fields such as, business, information technology, social sciences, and education. This research found that the number of articles related to older adult research increased continuously. Other results included a summary of the most commonly computer use for older adults, the barriers to computer use, variables affected personal behaviour

(Wagner et al., 2010). Wagner et al (2010) concluded that the barriers preventing older adults from using computers were the factors of a perceived lack of benefit, lack of interest or motivation, lack of knowledge, lack of access, cost and perceived barriers due to physical limitations. In addition, most of the common computer uses within older adults were communication and social support, leisure and entertainment, information seeking for health and education, and productivity.

The internet and mobile phone were found to be similar in terms of adoption and usage (Rice & Katz, 2003). Before the arrival of iPhone in 2007, Kurniawan (2006) considered mobile phone designs that were suitable for older adults and built from the older adults' perspective. The suggestions included a large test and the backlight under the screen, a flip phone with antenna which would be easy for older adults when attending to a call, the birth colour that older people can spot easily, and, a dedicated button for emergency. The same research also suggested that older adults adopting mobile phones were greater in number to those adopting the internet.

After the arrival of smartphones, Kurniawan (2008) studied older adults 60+ adults use of mobile phones and found that older adults were inactive with mobile phones and feared using unfamiliar technologies. The study also found that older adults believed that mobile phones were not essential for them. This research implied that older adults may take some time before adopting smartphones.

In 2011, a study of health and caregiving within the 50 years old and above older adult population identified that 79% of the silver surfers owned mobile phones, but only 7% adopted smartphones (Barrett, 2011). It was also learnt that within this age group, approximately half of the 50 years old and above groups used or intended to use mobile technology for health related matters. When considering technology use for only health purposes, 11% of the sample population used the technologies for basic health matters such as weight, blood sugar and blood pressure measurements (Barrett, 2011). Such research studies assisted this research team to identify the benefits of smartphones for the older population and identified the existing gaps in adoption studies associated with older adults.

Plaza et al (2011) addressed the issue of the ageing population in Europe, USA and Japan and the benefits of mobile phones that improve the quality of life for the elderly. This paper also presented a review of the status of mobile functions and applications that can fulfil the needs of older adults and the quality of life. From a literature review which considered the needs of older adults and provided a basis for researchers, designers, and mobile phone service providers , the existing needs of developing trends, the existing opportunities and mobile applications were also taken into account(Plaza et al., 2011).

In 2012, smartphones features that could assist with e-health services were studied within an older adult population in Thailand (Boontarig et al., 2012). The results showed that Effort Expectancy, Facilitating conditions and Perceived value significantly affect the Behavioural Intention to use within older adults using smartphones. An exploratory study of older (50+) women's perceptions of accessing health information via a mobile phone was studied in Singapore (Xue et al., 2012). Xue et al (2012) found that perceived usefulness, perceived ease of use, compatibility and subjective norm affected the usage intention of health information via a mobile phone.

It can be seen that ICT, mobile and smartphones can benefit older people in many ways. However, the numbers of older adults using ICT are fewer than the younger generation. These differences are emphasised within the digital divide, which is discussed next.

2.2.6 The Digital Divide and Silver Surfers (50+ adults)

The differences that exist in the ways that individuals use and accept their ICT, and innovative technologies are associated with characterizations that are widely referred to as 'the digital divide'(Tsatsou, 2011).

There are various forms of the digital divide that have been discussed in academic literature, where non-government funding agencies such as, the OECD (Oecd, 2008) have noted:

"Despite progress in broadband usage and access, certain divides are evident. Household use is often related to income, education levels, gender (males having more access), the number of children (households with children having more access), age, and, disability. As data for 2006-2007 from Australia shows, use is significantly higher in the age group 15 to 17; people from households in the top two income quintiles; people with higher levels of educational attainment; and the employed (Australian Bureau of Statistics, 2007).

As explained above, there are various levels of the digital divide. The top level definition of the digital divide follows Norris (2001). Norris conceptualized the digital divide as operating at three levels:

- The global divide refers to the divergence of internet access between industrialised and developing countries;
- The social divide concerns the gap between information rich and information poor in each nation;
- The democratic divide signifies the difference between those who do, and those who do not, use the panoply of digital resources to engage, mobilise, and participate in public life.

A basic strategy for overcoming the digital divide has been to provide physical access to computers; but, as Warschauer (2004) clarifies, there are additionally three further aspects with regard to resources: Digital resources (material made available online); Human resources (in particular literacy and education) and Social resources (the community, institutional and societal structures that support access to IT). The aspects that Warschauer (2004) identified as important formed the basis of this research when evaluating and identifying the non-technical and technical factors that lead to the adoption and usage of technology by silver surfers.

For this research, the digital divide is defined as the divide between "those who have access to a particular technology and those who do not" (Curwen and Whalley, 2010:210). It is also posited that "the digital divide (or the global digital divide) is generally referred to as the 'uneven diffusion' or 'gap' or 'disparities' between different socio-economic levels or across countries or between developed and developing nations in terms of 'access' and 'use (usage)' in ICTs"(Hwang, 2006:19). When considering "the digital divide" it was also found that 'typically' this means Internet access, but the term has been broadened to include other ICTs (Anheire & Toepler, 2010).

The digital divide often referred to as the "information gap" or "information inequality" has promoted immense debates that have resulted in the digital divide being considered in a variety of contexts, including socio-economic status, gender, age, racial, region or geography (Tsatsou, 2011).

One significant component of the digital divide is age (Selwyn et al., 2003). Having lived many years in the world without the internet older adults tends to perceive the internet as a 'non-essential'. Additionally, age related problems such as declining eyesight and arthritis pose to be major challenges to overcome when viewing computer monitors and co-ordinating mouse interaction. This has resulted in a significant age-based divide between young and old with internet use declining in every advancing age group (Greengard, 2009).

In the last decade, older adults applications of and benefits of novel technologies have been examined by many researchers. When considering this issue, several diverse aspects have emerged. These have included the digital divide where the gap between individuals who have used ICT and those who have not used ICTs has been examined.

Several research studies have attempted to study this issue and identify the factors leading to the age related digital divide. These factors are viewed to be in theoretical terms the factors, perceived lack of benefits (Mann et al., 2005; Melenhorst et al., 2006), lack of interest or motivation (Carpenter & Buday, 2007; Selwyn et al., 2003), lack of knowledge (Peacock &

Künemund, 2007), lack of access (Peacock & Künemund, 2007), cost (Mann et al., 2005; Carpenter & Buday, 2007), and physical limitation (Saunders, 2004; Carpenter & Buday, 2007).

When considering the use of the internet in the 55 years old and above population of Finland, it was found that an estimated one-third of the respondents do not use the Internet (Vuori & Holmlund-Rytkönen, 2005). In Australia, within the 50 years old and above individuals it was found that the internet is used five times less than the under 30s age group (Willis, 2006).

In the Netherlands, socio-demographic variables were studied to find the relationship of Internet use and the type of Internet usage. Research found that in terms of the user numbers, there were more younger adults than older adults, and age was an important factor to predict internet usage. In terms of the patterns of usage, the younger generation used the internet as communication and entertainment tools while older adults used the internet for buying products online, email, and searching for health related (van Deursen & van Dijk, 2013).

The digital divide was studied across Europe in terms of countries by Cruz-Jesus et al (2012) where an analysis of the digital divide in 27 European members was conducted and the causes of the digital divide were explored. This study used several variables such as, percentage of households having access to the internet, percentage of the population regularly using the internet, using mobile devices, email, e-banking services, or seeking for health information, the percentage of government services available online, and percentage of enterprise selling online. The results were that the 27 members were divided into five groups. The UK, Germany, Austria, Ireland, Belgium, Portugal, Slovakia, Spain and Malta were in the digital followers groups. The best groups were the digital leaders - Denmark, Finland, Luxembourg, the Netherlands and Sweden where the numbers of the population adopting the internet were higher and the costs were lower (Cruz-Jesus et al., 2012). A similar study of European members was also performed from 2001 to 2009 by Kyriakidou et al (2011) and in 2008 by Vicente and López (2011) where the digital divide among the EU members was identified.

Brandtzæg et al (2011) also studied the digital divide in five Europe countries, Norway, Sweden, Austria, the UK and Spain. To identify the digital divide, Brandtzæg et al (2011) categorised 12,666 European to five groups which were, non-users, sporadic users, instrumental users, entertainment users and advanced users. The research found that in the UK, Spain and Austria, gender, age, and household members were dependent variables to predict type of usage patterns. The research found that over 80% of 65+ adults, around 60% of 55-64 adults and around 50% of 45-54 adults were in the non-user catalogue (Brandtzæg et al., 2011).

The digital divide was also studied from a global perspective. Doong and Ho (2012) collected secondary data from 136 countries from 2000 and 2008 to examine global ICT development. The variables in the research were Gross national income (GNI), Mobile penetration, Internet user penetration, Capital investment in telecom, and Total telecom revenue. The study found that countries with Higher GNI tended to invest more in the ICT infrastructure (Doong & Ho, 2012). The research found that countries with difference GNI levels have different ICT development paths. The study also found that the arrival of mobile phones had led to a narrower digital divide gap (Doong & Ho, 2012). Globally, mobile internet the infrastructure has been developed continuously where technology can substitute the wired infrastructure (Srinuan et al., 2012). Individuals who cannot access the internet via fixed telephone lines can use mobile internet (Srinuan et al., 2012).

In April 2012, 59% of American older adults (65+) used the internet in comparison to 86% of all the adult population in the USA. In terms of mobile phones, 77% of older adults used mobile phones compared to 91% of all the adults (Smith, 2014). In September 2013, 55% of the American adults used smartphones while only 18% of the older adults (65+) used smartphones (Smith, 2014). This shows that a digital divide exists in terms of the internet, mobile phones and smartphones.

Friemel (2014) who studied older adults (65 years old and above) Internet usage in Switzerland found several reasons for older adults not using the Internet. The main reasons were the difficulties or complications of technology, immense efforts when learning how to use the technology, safety concerns and lack of support and assistants. Some other health problems were memory problems and limited eyesight and hearing. The research also found that older adults preferred to have support from the family and friends at home, having the support of younger individuals in the form of coaches, or peer-mentoring among seniors and class. Also found was that older adults were less active with self-learning (Friemel, 2014).

Within the older adult population, health is an important issue of consideration. Health literacy is the degree of the ability to obtain, process and understanding basic health information and services needed to make an appropriate decision on health problems or issues (Health.gov, 2010). Levy et al (2014) studied health literacy and the digital divide among older Americans (65 years old and above). The research found that health literacy was a factor predicting internet use for obtaining health information. Around 9.7% of older adults with low health literacy used the internet to gain health information compared to 31.9% in terms of those who had the knowledge (Levy et al., 2014).

Apart from physical health problems, some older adults could face mental issues such as depression, social isolation, decreased social contact or lack of emotional support. Cotton et al (2012) examined the link between depression and internet use within Americans aged 50 years old and above. The results indicated a positive correlation between Internet use and mental well-being of retired older adults. Internet use was found to reduce the probability of a depression categorisation for older participants by about 20–28% (Cotten et al., 2012). Therefore, using smartphones connected wirelessly to the internet could assist older adults to reduce their depression as well as increase their familiarity and knowledge of the internet.

A recent study has found that there exists a digital divide and the gap is not likely to close in the near future (Kim, 2011). When delving deeper, it was found that older adults face difficulties when adopting novel technologies (Lee et al., 2011). However, from such studies above it was confirmed that a digital divide exists and recognised by many researchers around the world.

From the aforementioned reviews, this research was motivated to explore further the smartphones and older adult's adoption, use and diffusion issues as addressed in Chapter1. Therefore, the following section will focus on the technology adoption theories being employed by this research study.

2.3 Theoretical Background

When considering adoption, researchers tend to apply mostly the theories of Theory of Reasoned Action (TRA), Technology Acceptance Model (TAM), Theory of Planned Behaviour (TPB), Diffusion of Innovation Theory (DOI), Decomposed Theory of Planned Behaviour (DTPB), Technology Acceptance Model 2 (TAM2), and, Unified Theory of Acceptance and Use of Technology (UTAUT). This section will now review these theories.

Technology adoption theories have been continuously developed and employed since the 1960s with the pioneering and classic theories of adoption being TRA and TAM. The first two theories were applied in the 1990s when mobile phones initially took off. TPB, DTPB DOI were then used in the next wave of mobile phone development. In the 2000s when smartphones emerged, TAM2, TAM3 and UTAUT were employed and finally, the UTAUT theory was enhanced and employed, which is also reviewed in this section.

2.3.1 Theory of Reasoned Action (TRA)

The pioneering theory of adoption, TRA was used to explain individual behaviour and developed in the social psychology field. At the time, researchers were trying to understand an individual's behaviour due to the impact of attitude (Fishbein & Ajzen, 1975). This theory explained that individuals form behaviour based decisions based on behavioural intentions. Behavioural intentions are based on attitude and subjective norms.

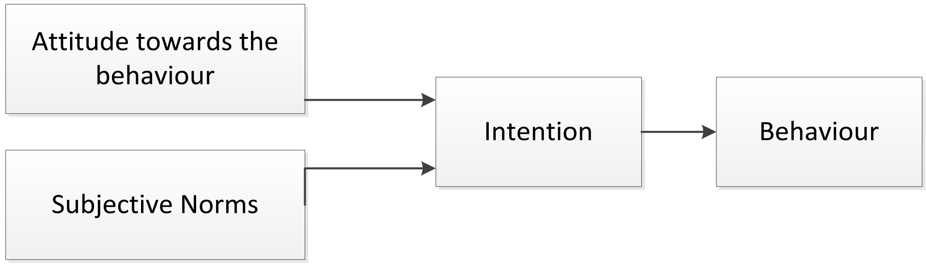

Figure 2.1 Factors determine individuals’ behaviour in TRA

The factors of the TRA model are as follows:

Attitude towards the Behaviour is the degree to which performance of the behaviour is positively or negatively valued.

Subjective Norms is the influence of a social environment on behaviour. It can be defined as the individuals’ perceptions of the majority people who are important to him or her think that he/she should or should not perform the behaviour.

Intention is an indicator of individual’s readiness to perform certain behaviours.

However, there are limitations to this theory, including personality-related factors, cultural factors and demographic variables. The theory can explain only planned behaviours; hence this theory cannot explain immediate decisions, habitual actions or unconscious decision (Sheppard et al., 1988), which explains the reasons for not applying this theory to this research study.

2.3.2 Technology Acceptance Model (TAM)

TAM was introduced by Davis (1986) to explain the acceptance of information technology. The model is composed of two components, which are Perceived usefulness (PU) and Perceived ease of use (PEOU).

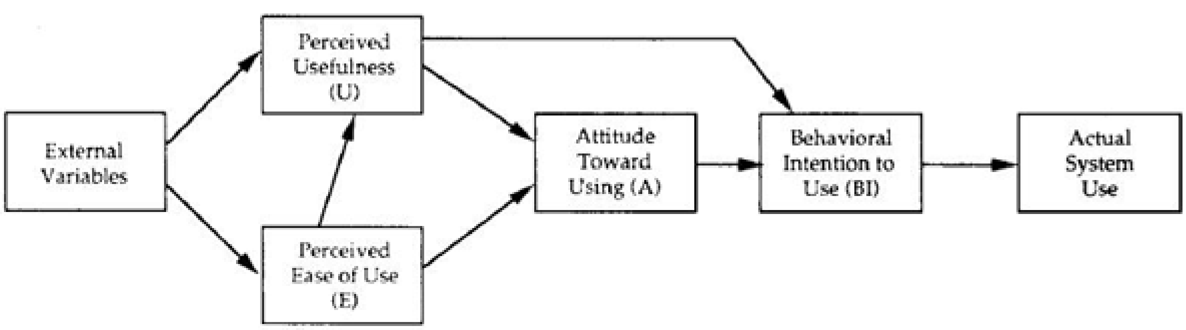

Figure 2.2 Technology Acceptance Model

PU can be defined as the degree to which a person believes that using the particular technology would improve his or her job performance. PEOU refer to the degree to which a person believes that using the particular technology would be free from effort (Davis, 1986). Referring to the original research, the external variables were identified as, objective system design characteristics, training, computer self-efficacy, user involvement in design and the nature of the implementation process (Davis & Venkatesh, 1996). Others articles applied different external variables such as system quality, compatibility, computer anxiety, enjoyment, computer support and experience (Lee et al., 2003).

To illustrate the relationship between TAM's variables Figure 2-2 is provided. Figure 2.2 shows how the external variables affect PU and PEOU and both the main factors influence the attitude towards use, the behavioural intention to use and actual use. Moreover, PEOU affects PU while PU affects Behavioural Intention to use. However, compare with TRA, TAM does not integrate Subjective Norm in the model. Finally, it can be learnt that the definition of perceived ease of use and perceived usefulness are equal to effort expectancy and performance expectancy respectively (Venkatesh, 2012). TAM has been further developed to introduce the theories of TAM 2 and TAM 3 in 2000 and 2008.

Table 2.4 Related literature using TAM

Literature	An area of research	Methods used	Research purpose/Research finding
Park & Chen (2007)	Smartphone adoption	A survey of 820 US doctors and nurses	To investigate human motivations affecting an adoption decision for smartphone among medical doctors and nurses. The results found behavioural intention to use smartphones was affected by PU and attitude, and PEOU affects attitude.
Bouwman et al. (2007)	Mobile services	A survey of 484 Finish Consumers	This research studied 6 mobile services- mobile travel service, GPRS, mobile surveillance, traditional and advance entertainment and m-commerce service bundles, where both the barriers (physical, cognitive, security and economic) and benefits (perceived entertainment value and perceived flexibility) of mobile services in Finland were identified. The research found that different services have different adoption factors.
Shin (2009)	Mobile Payment	A survey of 296	This study validated a comprehensive model of consumer acceptance in the context of mobile

		Consumers in Korea	payment, where the results found that Perceived Usefulness, Perceived Ease of Use, Perceived Security, and Trust affect a consumer's intention when using mobile payments.
Chen et al. (2009)	Smartphone adoption in Logistic companies	A survey of 274 workers from 5 Taiwan logistic companies	To study acceptance and diffusion of smartphones using the case study approach in a delivery service company of logistics. The result found that self-efficacy strongly affected behavioural intention. This study showed that the different models can be used to study the same technology. Further, a combination of theories could better explain the phenomenon.
Chen et al. (2011)	Smartphone in delivery service industry	A survey of 215 Employees in Taiwan	To study smartphone acceptance in a major delivery service company in Taiwan. TAM with Self-Efficacy can explain smartphone adoption in delivery service.
Chtourou & Souiden (2010)	Smartphone adoption-browsing the internet	Survey 367 mobile users in France	To examine the effect of the fun aspect of consumers' adoption of technological products. This research used TAM with the Fun factors of enjoyment or playfulness. The results found that fun is an important factor affecting attitude toward using mobile device for browsing internet.
Kim (2008)	Smartphone adoption	A survey of 286 working adults in South Korea	To study adoption of mobile internet in smartphones with TAM and other factors. The results found that Job Relevance, Perceived Cost Savings, PU, PEOU, Company willingness to fund, Experience affect behavioural intention to use mobile internet.
Koenig-Lewis et al. (2010)	Mobile banking	A survey of 263 Young people in Germany	To study the barriers for adopting mobile banking services The results found that compatibility, perceived usefulness and risk significantly influence mobile banking adoption.
Shin (2007)	Mobile internet	A survey of 515	TAM was used, where Perceived availability, Perceived quality, Perceived Enjoyment and Social

		Consumers in South Korea	pressure examined the adoption of mobile internet. The results showed that the variables significantly affected attitude. However, Perceived usefulness and Perceived enjoyment of use did not significantly affect Intention.
Verkasalo et al.(2010)	Mobile application	A survey of 579 panellists in Finland	This study examined the adoption of new mobile application, game, internet and map. The research found that perceived technological barriers negatively affect behavioural control, perceived usefulness was linked to behavioural control except for gaming, and perceived enjoyment and usefulness significantly affected the intention to use applications
Wu & Wang (2005)	Mobile commerce	A survey of 310 m-commerce users in Taiwan	To study mobile commerce using TAM, DOI, perceived risk and cost factors. The results found that Perceived risk, Cost, Compatibility and Perceived usefulness significantly affected behavioural intention to use mobile commerce.
Chong, Chan, et al.(2012)	Mobile commerce	A survey of 394 consumers in Malaysia (172) and China (222)	To examine the adoption of mobile commerce in Malaysia and China. This research found that apart from variables from TAM, Trust, Cost, Social influence and variety of services can influence mobile commerce. Culture can also affect the adoption.
Kang et al.(2011)	Smartphone adoption and their features	A survey of 100 students in South Korea	TAM was used to investigate factors affecting the adoption of smartphone and features of the smartphones. The research found that around half of responses used smartphones. Wireless internet, design, multimedia, application, after service, and, interface were important for adoptions. Perceived usefulness and Perceived ease of use also affect Behaviour Intention

			to use smartphones.
Kim & Garrison (2008)	Mobile internet	A survey of 58 graduate students in Korea	To use TAM as a core theory with other factors to examine Mobile wireless adoption such as cellular and PDA. This study found that the model can explain 58.7% of the behavioural intention. And confirm that TAM can still be used to explain mobile wireless technology.
Nysveen et al.(2005)	Mobile messaging services	A survey of 684 mobile chat service users in Norway	To investigate the moderating effects of gender in explaining the intention to use mobile chat services. This research found that social norms and intrinsic motives such as enjoyment were important for female users, while extrinsic motives such as usefulness and expressiveness were important for males. The model could explain 71% of the intention to use the service in females and 68.2% of intention to use the service in males.
Mallat et al. (2006)	Mobile ticketing	A survey of 47 business school students in Finland	To study mobile ticketing service adoption in public transportation. The research found that compatibility is a major factor. Others variable such as trust, mobility, social influence also important for the adoption. The model can explain around 56% of intention to use the mobile ticket.

Table 2.5 Related literature using TAM and 50+ adults			
Xue et al. (2012)	Health informatics via a mobile	A survey of 700 older adult women (50+) in Singapore	To examine the perceived attitudes and readiness of women aged 50 years and above on adopting a mobile phone-based intervention. The research found that perceived usefulness and perceived ease of use, compatibility and subjective norm can be used to predict the adoption intention of the technology. The model could explain 88% of the intention to use a mobile phone-based intervention.
Nayak et al. (2010)	Internet usage	A survey of 592	Used TAM and demographic variables to understand the factors that influence internet usage among older

		older adults (60-88) in UK	adult (60-80) The research found that attitude towards using the internet and good health status could predict the level of internet usage. Moreover, attitude, usefulness, good health and gender (males) could affect internet activity. The model could predict 20.5% of internet usage (time in hours) and 24.2% of Internet usage (activity level)

Form Tables 2.4 and 2.5 it can be seen that TAM is one of the most popular theory used to understand technology adoption research. However, this research study considered employing a new theory to explain smartphone adoption.

2.3.3 Theory of Planned Behaviour (TPB)

The Theory of Planned Behaviour was developed based on TRA to reduce the limitation of TRA (Ajzen, 1991). TPB is viewed to be an extension of TRA by maintaining the central factors, and the behavioural intention to perform certain behaviour. TPB differs from TRA due to the addition of the factor, perceived behavioural control (PBC) - the brown box in the below figure. The component responds to a situation when individuals have incomplete control over some behaviour. From the hyphenated line, for some situation, PBC with behavioural intention can be used to predict behaviour (Armitage & Conner, 2001).

The definitions of the components of TPB are shown as follows:

Behavioural Beliefs are the subjective probability that the behaviour will produce a given outcome. This factor also influences Attitude towards the behaviour.

Normative Beliefs are the perceived behavioural expectations from important referent individuals or groups such as partner, family, friends, teacher, doctor, supervisor, and co-workers. Normative beliefs from a variety of sources form Subjective norm.

Control beliefs are the perception of the factors that may encourage or impede the performance of behaviour. Control beliefs influence Perceived Behavioural Control.

Perceived Behavioural Control is an individual's perception of his or her ability to perform a given behaviour.

Actual Behavioural Control is the extent to which an individual has the skills, resources, and other prerequisites needed to perform a given behaviour. This factor also influences Perceived Behavioural control. Together with intention, this factor can directly predict behaviour.

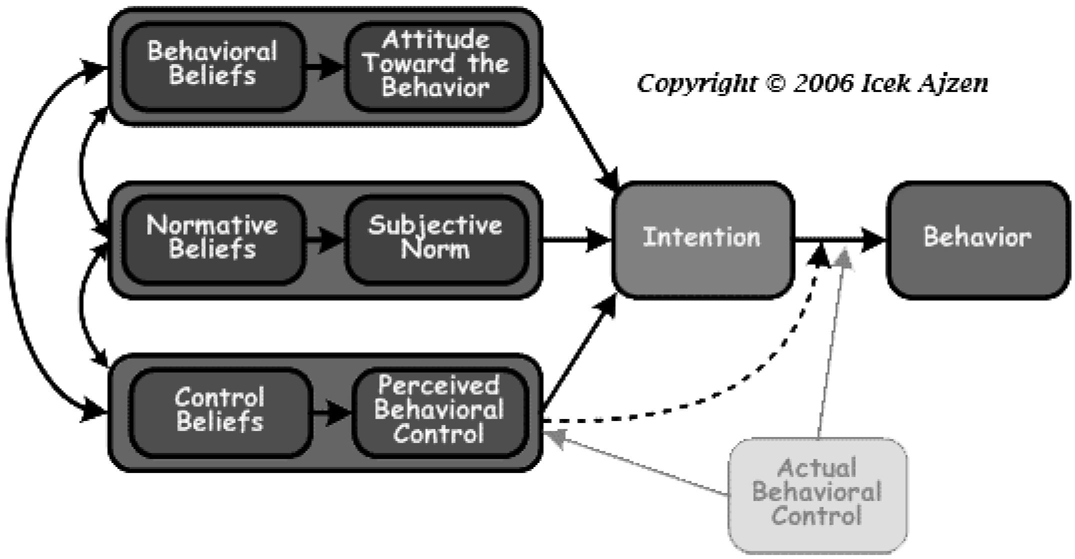

Figure 2.3 Theory of Planned Behaviour (Ajzen, 2006)

Although this theory can be viewed to be a very broad framework, it may not be practical in specific fields such as, consumer or technology adoption behaviour (Benbasat & Zmud, 1999; Taylor & Todd, 1995a).

2.3.4 Diffusion of Innovation Theory (DOI)

Smartphones are viewed to be current times innovations. An innovation is defined to be a new idea, method or product (Oxford Dictionaries, 2013b). For DOI, an innovation is perceived to be a new item by an individual. Diffusion is a process that an innovation is communicated through certain channels over time among member of a social system (Rogers, 2003). Rogers highlighted four elements of diffusion, which are innovation, time, communication channels and social systems.

2.3.4.1 Innovation Decision Process

The Innovation decision process is the process that an individual or group of decision making unit pass from first knowledge about the innovation to formulating an attitude, to decision regarding adoption or reject the innovation, to implementation of the innovation and to confirmation of the decision. The process is composed office steps.

1. A Knowledge stage represents the period when an individual or decision unit discover an innovation and gain more understanding of the innovation. The knowledge can be categorised as Awareness-knowledge, How-to-knowledge and Principles-knowledge. **Awareness-knowledge** is the first knowledge on the existing of an innovation which can be received by mass media. An individual is motivated by this knowledge to pursue the second and third knowledge types. **How-to-knowledge** is a basic knowledge to use an innovation which can be acquired from sale persons or agents. **Principles-Knowledge** is further information on how an innovation works. In some cases, adoption may occur without principles-knowledge, but this may lead to the misuse of an innovation, which may lead to it being discontinued.

2. Persuasion stage represents when the individual forms a positive attitude toward an innovation and seeks further information in order to reduce uncertainty about an innovation.

3. Decision stage is when an individual engages in the activities that lead to the choices of adoption, or rejection of an innovation. In some cases, an individual may prefer to attempt a small scale of an innovation first. The rejection of the innovation may occur at any stage of this process. It could also happen after a prior decision to adopt the innovation.

4. Implementation stage is when the individual actually uses the innovation. At this stage, some problem from complexity and difficulty of the innovation may occur during the implementation stage. Therefore, the original idea may be changed. In a positive case, the change may benefit the adopters when reducing possible mistakes, seeking further learning when understanding the innovation or customising the innovation to fit the adopters. However, for negative case, the problem may lead to the rejection of an innovation.

5. Confirmation stage is when the individual seeks reinforcement for the decision to adopt the innovation. The individual may find a conflict idea and make some changes including, replacing the adopted innovation with a better innovation or rejecting the adopted innovation.

2.3.4.2 Attributes of the Innovation

When considering innovation and diffusion, Rogers (2003) also focused on the innovation and identified the attributes of the innovation. More than half of the time, the perception of the innovation attributes can explain innovation adoption. The five attributes are as follows:

1. Relative advantage is the degree to which an innovation is perceived as better than what it supersedes.

2. Compatibility is the degree to which an innovation is perceived as consistent with existing values, past experiences, and the needs of potential adopters.

3. Complexity is the degree to which an innovation is perceived as relatively difficult to understand and use.

4. Trialability is the degree to which an innovation may be experimented with, but on a limited basis.

5. Observability is the degree to which the results of an innovation are visible to others.

Apart from the attributes other factors also affect adoption, which are the type of innovation (optional, collective or authoritative), communication channel, the nature of social systems, and the extent of a change agent's promotion effort. Further variations affecting adoption are the numbers of people involved in a decision, where impacts are made due to the larger the number and the more times requests are made.

2.3.4.3 Characteristics of Innovators

In DOI, individuals can be categorised in terms of speed of their adoption. **Innovators** (2.5%) are happy to spend their resources on an innovation. They also have an ability to understand, apply complex knowledge and cope with the high uncertainty of an innovation. These types of individuals have an important role when launching an innovation in a social system. **Early Adopters** (13.5%) can be considered to be the social leaders with resources. These groups of individuals can provide advice about the innovation. Therefore, an innovation should be approved by this group before diffusing to a wider group. The **Early Majority** (34%) adopts an innovation before the average members of the social system. With enough resources, this group can be seen as deliberate. They may take some time before completely adapting to the innovation. The early majority from the link in the diffusion process are the early adopters and late majority. **Late Majority** (34%)

2.3.4.4 The Limitations of DoI

Although the DOI Theory provides explanations about the decision process, adoption proportion and adoption categories, this theory does not explain how attitude is involved in the adoption procedure and how innovation characteristics are applied to the adoption process (Karahanna et al., 1999; Chen et al., 2002). To overcome such weaknesses, further developments of the model and theory were made.

2.3.5 Decomposed Theory of Planned Behaviour (DTPB)

The DTPB model was further developed based on the TPB, DOI and TAM. Further, there are at least two versions of DTPB. The first model applies DOI's characteristics- Relative Advantage, Complexity and Compatibility to the Attitude component, where the Normative Influences and Subjective Norms components are maintained. For the Perceived Behavioural Control component, Efficacy and Facilitating Conditions link to the component. The previous research illustrated that the DTPB is more efficient than TPB (Taylor & Todd, 1995a). The first version of DTPB is depicted in Figure 2-4.

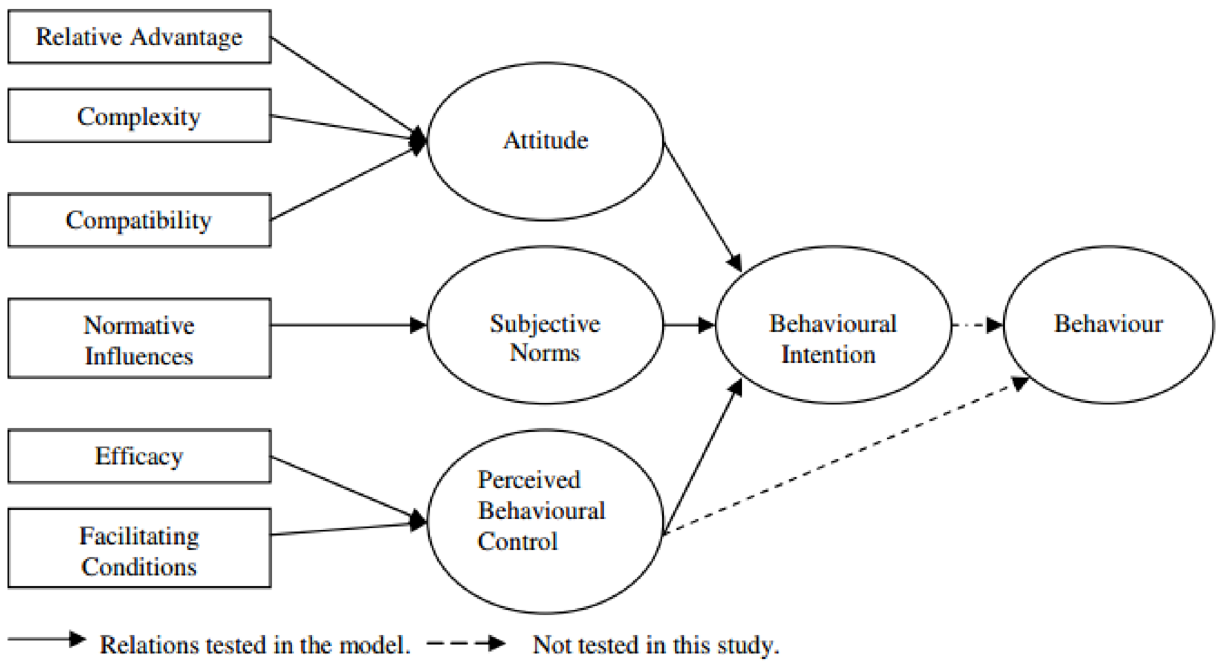

Figure 2.4 Decomposed Theory of Planned Behaviour version 1

The second version of DTPB was also proposed in the same year (Taylor & Todd, 1995b). In this version, PU and Ease of Use from TAM and the Compatibility to Attitude component were combined. For the Subjective Norms components, Peer Influence and Superior's Influences were used. The Perceived Behavioural Control factor is affected by Self Efficacy, Resource Facilitating Conditions and Technology Facilitating Conditions.

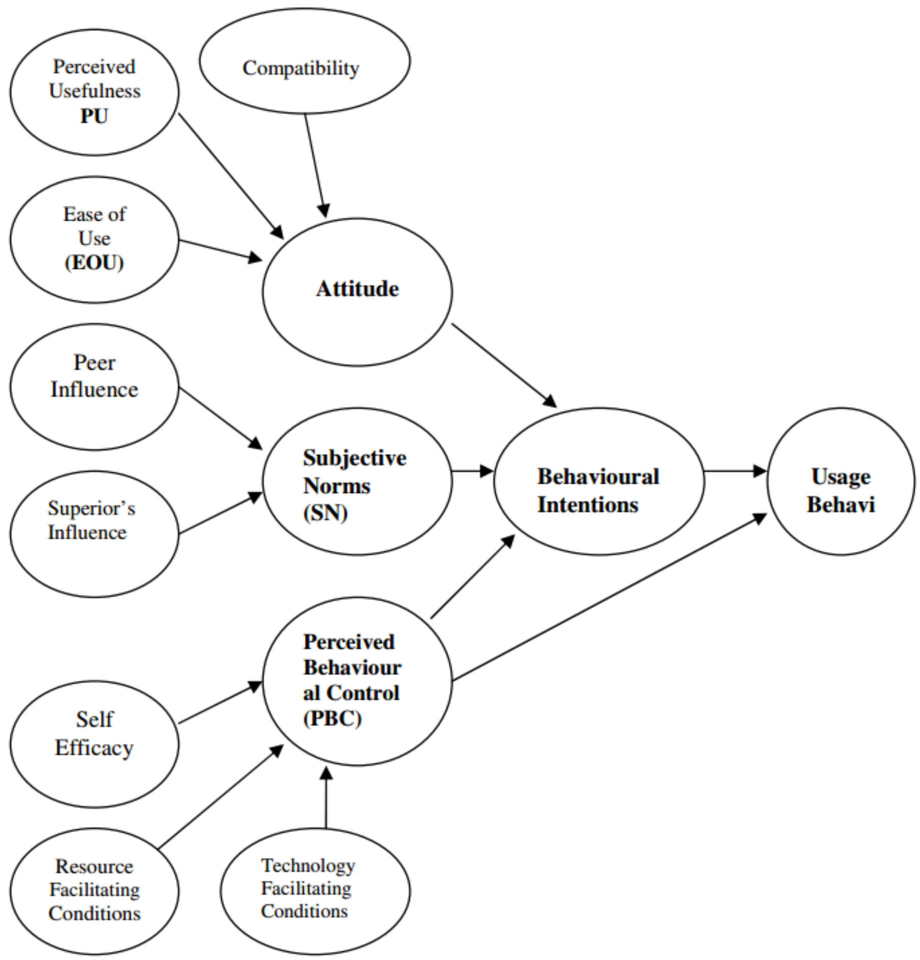

Figure 2.5 Decomposed Theory of Planned Behaviour versions 2

It can be seen that in the two versions there are similarities except for the decomposed part. Attitude is influenced by relative advantage, compatibility and complexity while the second version using TAM is affected by perceived usefulness and perceived ease of use. Moreover, the second version is more focused on Subjective Norms and Facilitating Conditions. However, the two models still have gaps in terms of moderated variables, demographic variables, enjoyment, or experience.

2.3.6 Technology Acceptance Model 2 (TAM 2)

In 2000 the original TAM was improved by introducing more factors. Experience and Voluntariness were the moderated variables, while Image, Job Relevance Output Quality and Results Demonstrability were the independent variables as shown in Figure 2.6 (Venkatesh & Davis, 2000). This model was termed as the extended TAM. The definition of extended variables is as follows (Venkatesh, 2012).

Voluntariness can be defined as the extent to which potential adopters perceive the adoption decision to be non-mandatory.

Image can be defined as the degree to which use of an innovation is perceived to enhance one's status in one's social system.

Job Relevance is the reference to an individual's perception regarding the degree to which the target system is relevant to his or her job.

Output Quality is the degree to which an individual believes that the system performs his or her work tasks well.

Subjective norm is a person's perception that most people who are important to him think he should or should not perform the behaviour in question.

Result demonstrability is the Tangibility of the results of using the innovation.

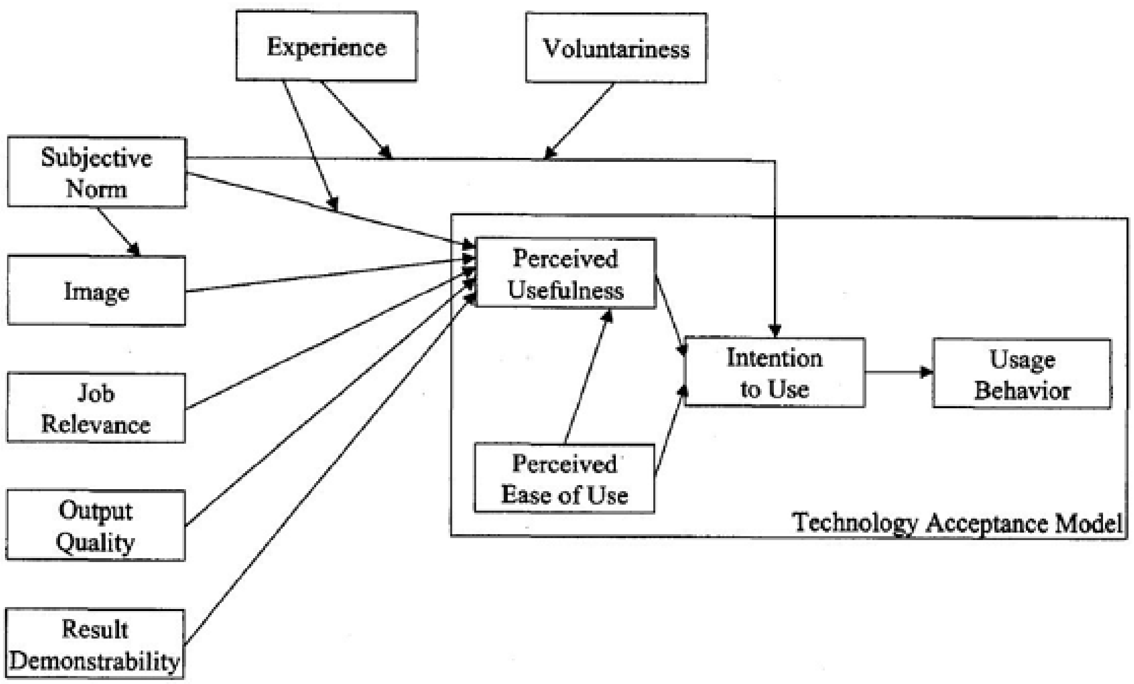

Figure 2.6 Technology Acceptance Model 2

TAM 2 was tested on Information technology and received a 34%- 52% when predicting the usage intentions. Therefore, this model improved the understanding of user adoption behaviour (Venkatesh & Davis, 2000).

Several research studies used TAM2 or the extended TAM to investigate technology related to smartphones. Lu et al (2005) studied wireless internet service via mobile technolgy and found that social influences and personal innovativenss influence usefulness and ease of use. Further, usefulness and ease of use influence the adoption intention. Rouibah et al (2011) studied in the Arab world, the adoption of a camera-mobile phone before e-shopping and found that subjective norms, ease of use and camera usefulness affect camera mobile phone adoption before e-shopping. Ducey (2013) studied tablet devices adoption and found that perceived usefulness, perceived ease of use, subjective norm, compatibility and reliability of tablets influences the intention to adopt tablets in a medical practice. Trakulmaykee and Benrit (2014) studied mobile tourism guide in a Thai national park and found that perceived usefulness, perceived ease of use, mobile content quality and mobile appearance quality effect intention to use mobile tourism guide.

The main difference between TAM and TAM2 is the additional factor of Subjective norm. However, the model does not explain demographic variables such as, age, which is a factor of importance to this research study. Further, some older adult research addresses the entertainment or joyfulness aspects as factors leading to adoption (Yoon et al., 2011). Therefore, TAM 2 is not appropriate to smartphone adoption within older adult research.

2.3.7 Unified Theory of Acceptance and Use of Technology (UTAUT)

Introduced in 2003, UTAUT was developed based on TAM, TPB and DoI (Venkatesh, Morris, Hall, et al., 2003). The improved factors are Performance Expectancy, Effort Expectancy, Social Influence and Facilitating Conditions that impact independent variables. For moderator variables, UTAUT presents Gender, Age, Experience and Voluntariness of Use. UTAUT attempted to combine all the possible previous research models to predict the acceptance and use of technology. It was found that UTAUT can also predict approximately 70% of acceptance and use (R-square = 0.7) (Venkatesh, Morris, Hall, et al., 2003).

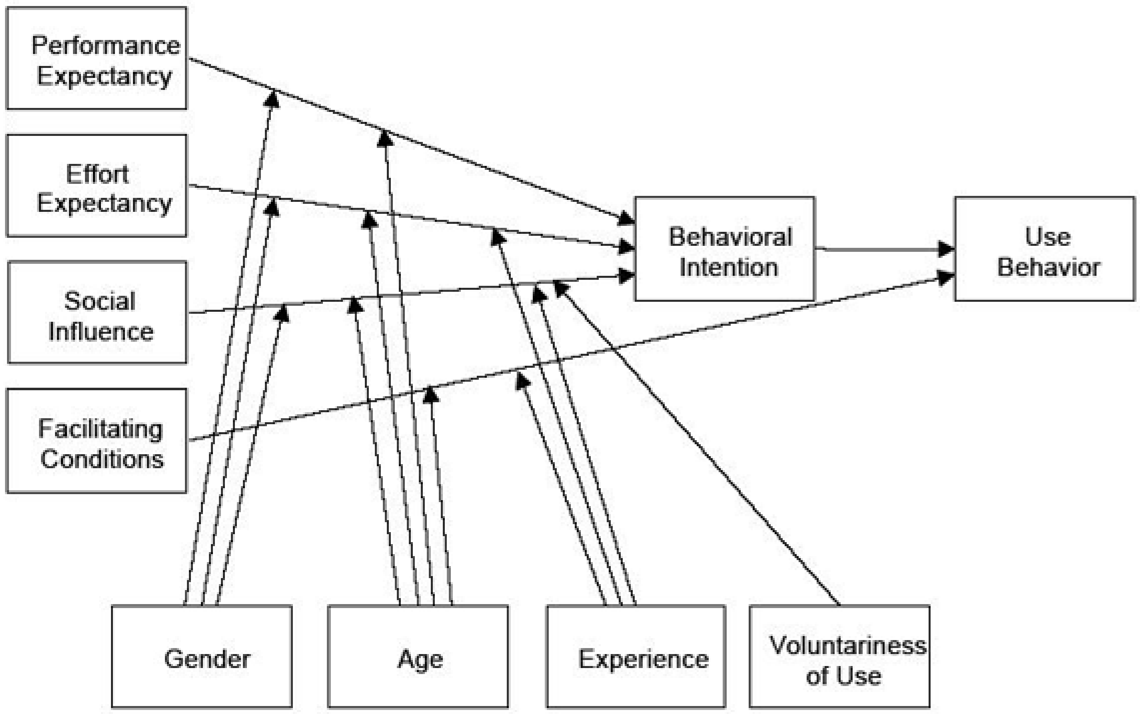

Figure 2.7 Unified Theory of Acceptance and Use of Technology

The definitions of UTAUT's variables are as follows (Venkatesh, 2012).

Performance Expectancy is the degree to which an individual believes that using the system will help him or her to attain gains in job performance. This factor matches the perceived usefulness variable from TAM and relative advantage from DOI. From figure 2.7 above, the relationship between Performance Expectancy and Behavioural Intention can be moderated by gender and age.

Effort Expectancy is the degree of ease associated with the use of the system. This factor is similar to ease of use from TAM and complexity from DoI. From the original research, the relationship between Effort Expectancy and Behavioural Intention is moderated by gender, age and experiences.

Social Influence is the degree to which an individual perceives the important others believe he or she should use the new system. This factor is similar to the subjective norm from TRA, TAM, TPB and DTPB and image from DoI. Furthermore, the link between Social Influence and Behavioural Intention is moderated by gender, age, voluntariness and experience.

Facilitating Conditions is the degree to which an individual believes that an organizational and technical infrastructure exists to support the use of the system. This variable is similar to perceived behavioural control from TPB and DTPB and compatibility from DoI. Moreover, the relationship between Facilitating Conditions and Use Behaviour is moderated by Age and Experience.

Table 2.6 Related literatures used UTAUT			
Literature	An area of research	Methods used	Research purpose/Research finding
Lee et al (2012)	Smartphone Applications	A survey of 215 college students and office workers in Korea	This research used UTAUT, credibility and personalization to investigate smartphone application adoption. The results found that personalization influenced performance expectancy. This research also investigated the user behaviour on smartphone applications and the length of application usage.
Venkatesh et al (2012)	Mobile Internet	A survey of 1,512 mobile internet consumers in Hong Kong	This used UTAUT2 to study acceptance and use of technology in a consumer context. This research showed that UTAUT2's Performance expectancy, Effort expectancy, Social Influence, Facilitating Conditions, Hedonic Motivation, Price Value, and Habit affect mobile internet acceptance. Following adjustment, the model could explain 74 % of behavioural intention.
Alkhunaizan & Love (2012)	Mobile Commerce	A survey of 547 smartphone users in Saudi Arabia	This examined factors affecting m-commerce in Saudi Arabia This research found that cost, effort expectancy and performance expectancy influence intention to use mobile commerce. The model explained 38 % of m-commerce usage intention
Pitchayadejanant (2011)	Compare adoption between iPhone and Blackberry	A survey of 408 smartphone users in Thailand	This study used UTAUT to identify the use of smartphones - iPhone and Black Berry in Thailand This research found that Facilitating Conditions and Perceived Values affected

			behavioural intention to use smartphones.
Zhou et al.(2010)	Mobile Banking	A survey of 250 phone users and students in China	This research from China explained mobile banking adoption. This research was important as it emphasized the use of a smartphone feature The study found that Task technology fit, Performance expectancy, and Social influence intention, drawn from UTAUT use mobile banking. The model can explain 57.5% or user adoption of mobile banking.
Song & Han (2009)	Smartphone applications	A survey of 570 consumers in South Korea	This study from South Korea, examined the adoption of smartphone applications The results showed that the quality of content of application influenced user performance expectancy through enjoyment.
Kijsanayotin et al.(2009)	Using IT in Health	A survey of 1323 patients in Thailand	This study from Thailand studied factors influencing health IT adoption in the community health centres This research found that adoption is influenced by UTAUT's performance expectancy, effort expectancy, social influence and voluntariness. The actual use is influenced by intention to use, facilitating conditions and IT experiences. The model can explain 27% of the IT usage and 54% of intention to use the IT.
Shi (2009)	Mobile Application	A survey of 653 application users in China	This study from China used UTAUT to examine smartphone software adoption The research found that UTAUT's Performance Expectancy, Effort Expectancy and Facilitating Conditions affect behavioural intention. Moreover, Perceived Enjoyment influence Performance Expectancy.

Zhou (2008)	Mobile Commerce	A survey of 250 phone users and students in China	This study again from China studied UTAUT's significant factors influencing user acceptance of mobile commerce The result found that UTAUT's performance expectancy, facilitating conditions, social influence and contextual offer significantly affected the user acceptance of mobile commerce intention. The model can explain 76.2% of intention to use the m-commerce
Park et al (2007)	Mobile communication Technology	A survey of 221 online panellists in China	This was a Chinese study of mobile communication technology adoption This research found that UTAUT's Performance Expectancy, Effort Expectancy and Social Influence affect the attitude to use the technology. Moreover, gender and education levels significantly moderated the UTAUT factors.
Carlsson et al.(2006)	Adoption of smartphone both devices and services	A survey of 157 mobile consumers in Finland	This Finnish study examined mobile device adoption using UTAUT in organizations The results found that performance expectancy and effort expectancy affect behavioural intention.
He & Lu (2007)	Mobile Advertisement	A survey of 243 individuals in China	This Chinese study explored the consumer's perceptions and acceptance of mobile advertising in the SMS The research found that performance expectations, social influence, and user's permission had significant effects on behavioural intention. Facilitating conditions and behavioural intention also had significant effects on user behaviour. The models can explain up to 66.3 % of m-advertising intention and 45% of actual usage

Table 2.7 Related literature used UTAUT and 50+ adults			
Boontarig et al. (2012)	Smartphone adoption of e-health service	A survey of 31 elderly adults in Thailand	This examined the factors that influenced the Thai older adults' population's intention to use smartphones as tools for e-Health services. Of the UTAUT, the results showed that Effort Expectancy, Facilitating conditions and Perceived value significantly affects Behavioural Intention to use smartphones.

It can be seen that the UTAUT model is widely employed by numerous researchers around the globe. Compared to other models, UTAUT predicts technology intention of use up to 70 % (Venkatesh, Morris, Hall, et al., 2003) while TAM2 predicts about 50%. In addition, this model was published in the smartphone era. Therefore, this model was considered to be an important model. However, this model is still weak in terms of determining entertainment or playfulness, which led to the next model TAM3.

2.3.8 Technology Acceptance Model 3 (TAM 3)

In 2008 TAM 3 was formed to be an enhanced version of TAM 2 that consisted of additional factors such as Computer Self efficacy, Perception of External Control, Computer Anxiety, Computer Playfulness, Perceived Enjoyment and Objective Usability (Venkatesh & Bala, 2008). The model was used to examine IT adoption in the workplace and could predict 53% of the behavioural intention and 31-36% of actual use factors. The TAM 3 model is shown in figure 2.8.

The definition of the TAM 3's additional variables can be found below.

Computer Self-Efficacy is the degree to which an individual believes that he or she has the ability to perform a specific task/job using the computer.

Perception of External Control is the degree to which an individual believes that organizational and technical resources exist to support the use of the computer system.

Computer Anxiety can be defined as the degree of an individual's apprehension or even fear, when he or she is faced with the possibility of using computers.

Computer Playfulness is the degree of cognitive spontaneity in microcomputer interactions.

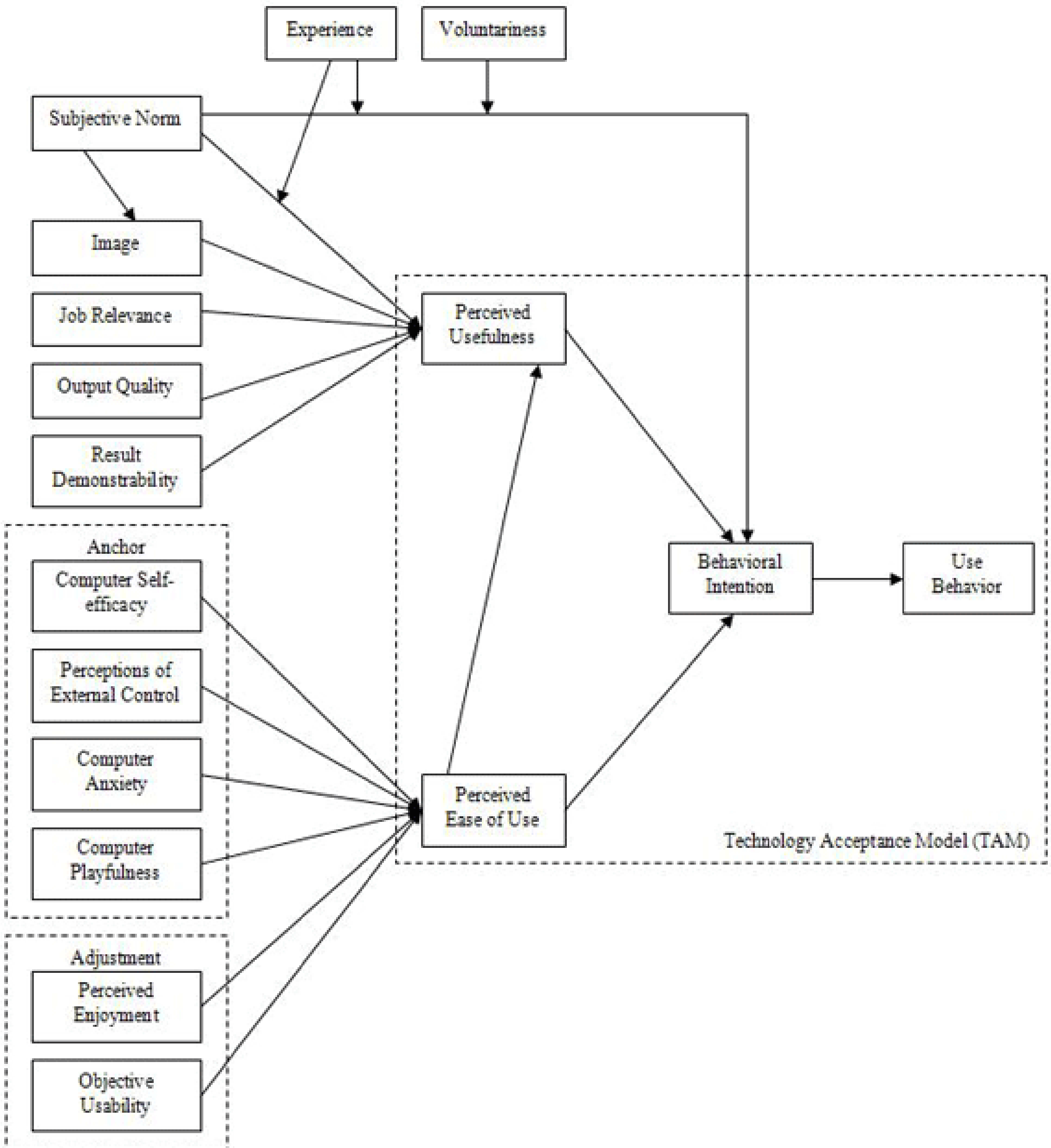

Figure 2.8 Technology Acceptance Model 3

Perceived Enjoyment is the extent to which the activity of using a specific system is perceived to be enjoyable in its own right, aside from any performance consequences resulting from system use.

Objective Usability can be defined as a comparison of systems based on the actual level (rather than perceptions) of effort required to complete specific tasks.

TAM 3 has been used in some research studies such as, studies of behavioural intention when using mobile entertainment (Leong et al., 2013), mobile payment services (Jaradat & Al-Mashaqba, 2014), mobile technology in hedonic scenarios (Abad et al., 2010) and mobile commerce technology (Faqih & Jaradat, 2015).

TAM 3 can predict 53% of intention to use and 31-36% of actual use (Venkatesh & Bala, 2008) while UTAUT can forecast adoption intention up to 70% (Venkatesh, Morris, Hall, et al., 2003). However, the new factors such as Playfulness and Enjoyment were included to the new TAM. This research believes that Enjoyment may affect smartphone adoption for older adults; therefore, Perceived Enjoyment will be used in our research model.

2.3.9 Unified Theory of Acceptance and Use of Technology 2

In 2012, UTAUT 1 was updated by the same research team. The model was present with new variables such as, Hedonic Motivation, Price Value and Habit. Moreover, the voluntariness of use as a moderator variable was removed. The study examined the model with mobile internet. The model as shown in Figure 2.9 could predict 56-74% of behavioural intention and 40-52% of technology use (Venkatesh et al., 2012). The additional variables can be explained below.

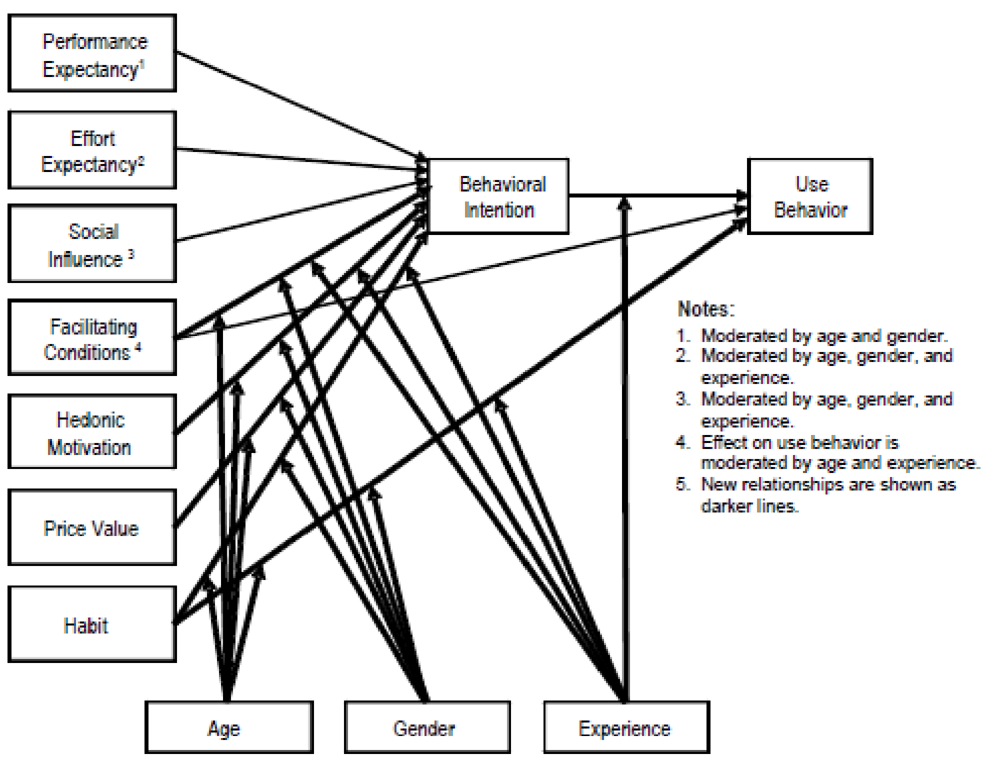

Figure 2.9 Unified Theory of Acceptance and Use of Technology 2

Hedonic motivation can be defined as the fun or pleasure derived from using a technology. This factor affect behavioural intention and the relationship can be modified by age, gender and experience.

Price Value was applied to this model since the model was used to explain consumer behaviour. The price value affects behavioural intention and the link can be modified by age and gender.

Habit can be defined as the extent to which people tend to perform behaviours automatically because of learning. The factor affects both behavioural intention and use behaviour. Moreover, the relationships can be moderated by age, gender and experience.

UTAUT 2 was introduced in 2012. Therefore, few articles are presented and some of them are in progress which mean some research studies aim to study technologies with UTAUT2 but have not finished at the time this chapter was written. Vongjaturapat and Chaveesuk (2013) presented working in progress article on mobile technology Acceptance for library information services by using UTAUT2 and technology characteristics (weight - of the mobile devices, user interface - of the OS in the mobile devices, and form factor- size of the mobile devices) and task characteristics (Information Retrieval and Document creation) . Ally and Gardiner (2012) presented working in progress that they plan to use UTAUT2 and TAM to study smartphone mobile devices. The factors that Ally and Gardiner propose were Perceived Usefulness, Perceived ease of use, attitude, behavioural Intention, hedonic motivation, price value, habit, facilitating conditions, social influence and social demographics. In Korea, UTAUT2 is used to study Mobile learning among 305 university students that can explain 45% of behavioural intention (Kang et al., 2015). UTAUT 2 is considered to be a new model that may be widely adopted in research studies.

However, this research study decided to use UTAUT 1 as a base of the conceptual framework. It is because firstly, UTAUT2 was published after the conceptual framework was established. Then, the research value the established than change to UTAUT2. Secondly, the UTAUT2 is very new compare with UTAUT which is mature in terms of researches.

Having considered the classic theories of adoption and the main topics of interest to this research study, the next section will explain the conceptual framework of this research, the reasons for selecting particular components from the three technology adoption models that formed this research study's model, the explanation hypothesis and the definitions of factors in the research model.

2.4 Theoretical and Conceptual Framework

As stated in the aim, adoption and use are imperative for this research. In terms of the Information Systems (IS) discipline and adoption research, it was identified that research in this area has matured, but studies related to adoption are still developing. The main theories applied in adoption studies are the Diffusion of Innovation (DoI) theory (Rogers, 2003); Unified Theory for the Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2012; Venkatesh, Morris, Davis, et al., 2003); Technology Acceptance Model (TAM) (Davis, 1989) and Theory of Reasoned Action (TRA) (Ajzen & Fishbein, 1980). In addition to these theories, the factor of Enjoyment was used in the previous research studies and applied to examine and understand the adoption and use of smartphones for this study.

To determine the combination of the theories, a review of the main and combined theories of adoption in IS was conducted in the previous sections. It was found that TAM is the most popular, followed by UTAUT and TRA (Aldhaban, 2012). However, there was also a preference towards combining two or more classic IS adoption and use theories for research. For instance, DoI and TAM were combined to explain the adoption of smartphones in the logistics industry (J. Chen et al., 2009). This combination was also applied to research the adoption of smartphones within medical practitioners, doctors and nurses (Park & Chen, 2007). UTAUT and Enjoyment were combined to examine the importance of Enjoyment in mobile services (Song & Han, 2009). Using this as reasoning, it was decided to combine more than two classic adoption and use theories to provide a better understanding of the adoption of smartphones in the Silver surfer population of the UK. Moreover, from this point the model that was developed for this research study will be termed the Model of Smartphone Acceptance (MOSA). The following section will explain the definition of components and the origin of the components.

2.4.1 Conceptual Framework

A conceptual Framework is one of the most important parts of a research study. There are several ways to define this term. Miles and Huberman (1994) defined the term as “A conceptual framework explains, either graphically or in narrative form, the main things to be studied - the key factors, concepts, or variables and the presumed relationships among them. The framework can be rudimentary or elaborate, theory-driven or commonsensical, descriptive or causal” (p. 18). Conceptual Frameworks can help researchers in several ways. They can be used as a guide line and they can also link the research objective and research questions (Saunders et al., 2009).

A conceptual framework can be built from experiential knowledge, existing theory and research, pilot and exploratory research, and thought experiments (Maxwell, 2013). Oppong (2013) supported the idea that a conceptual framework can be created from the reviewed literature. For quantitative research, a conceptual framework provides the content for the study based on a literature review or a researcher's experience. For qualitative research, a framework is developed based on the results of a study (Saunders et al., 2009).

This research developed a conceptual framework to study the adoption of smartphones within older adults based on UTAUT, TAM3 and DOI. Please note that a conceptual framework may be also termed as a research framework or conceptual model. The following section will explain hypothesis to form MOSA conceptual framework.

2.4.2 MOSA Construct Definition

Having explained the nature of a conceptual framework, this section now provides the definitions of the selected components of the framework and concepts drawn from the reviewed theories.

Table 2.8 MOSA Construction Definition

Factor/Components	Original Theory	Definitions
Observability	DOI (Rogers, 2003)	Observability is defined as the degree which smartphones are visible to 50+adults.
Compatibility	DOI (Rogers, 2003)	Compatibility can be defined as the degree which smartphone is compatible with 50+adults' lifestyles.
Social Influence	UTAUT (Venkatesh, Morris, Hall, et al., 2003)	Social Influence be defined as the degree to which an individual perceives that other individuals important to the individual, such as, family, friends or other close peers believes that he or she should use the new system such as a smartphone.
Facilitating Conditions	UTAUT (Venkatesh, Morris, Hall, et al., 2003)	Facilitating Conditions can be defined as the degree to which an individual believes that an organizational and technical infrastructure exists to support the use of a smartphone.
Performance Expectancy	UTAUT (Venkatesh, Morris, Hall, et al., 2003)	Performance Expectancy is defined as the degree to which an individual believes that using the system will help him or her to achieve their jobs or tasks.
Effort Expectancy	UTAUT (Venkatesh, Morris, Hall, et al., 2003)	Effort Expectancy can be defined as the degree of ease associated with the use of a system.

Perceived Enjoyment	TAM 3 (Venkatesh & Bala, 2008)	Perceived enjoyment can be defined as the extent to which the activity of using a specific system is perceived to be enjoyable in its own right, aside from any performance consequences resulting from system use.
Behavioural Intention	UTAUT (Venkatesh, Morris, Hall, et al., 2003)	Behavioural Intention is the level to which a person has formulated a conscious plan to further use a device in the future.

These definitions of the components are important and critical for the research as these allow the development of the hypotheses and provide the basis of the research questions.

2.4.3 MOSA Hypotheses Development

After completing the literature review, the next step is to form a conceptual framework and hypotheses. “A hypothesis is a statement of the relationship between two variables that can be tested empirically” (Gratton & Jones, 2010:26).

The proposed conceptual framework assumed that the dependent variable of this research, the behavioural intention to use and the adoption of smartphones of silver surfers is influenced initially by Observability and Compatibility that have been drawn from the DoI (Rogers, 2003). The second group of constructs include, social influence, facilitating conditions, performance expectancy and effort expectancy that are drawn from UTAUT (Venkatesh et al., 2012; Venkatesh, Morris, Davis, et al., 2003) Third, Perceived Enjoyment (Song & Han, 2009; Chtourou & Souiden, 2010) is also integrated into the model. Finally, the dependent variable Actual use is influenced by the intention to use smartphones.

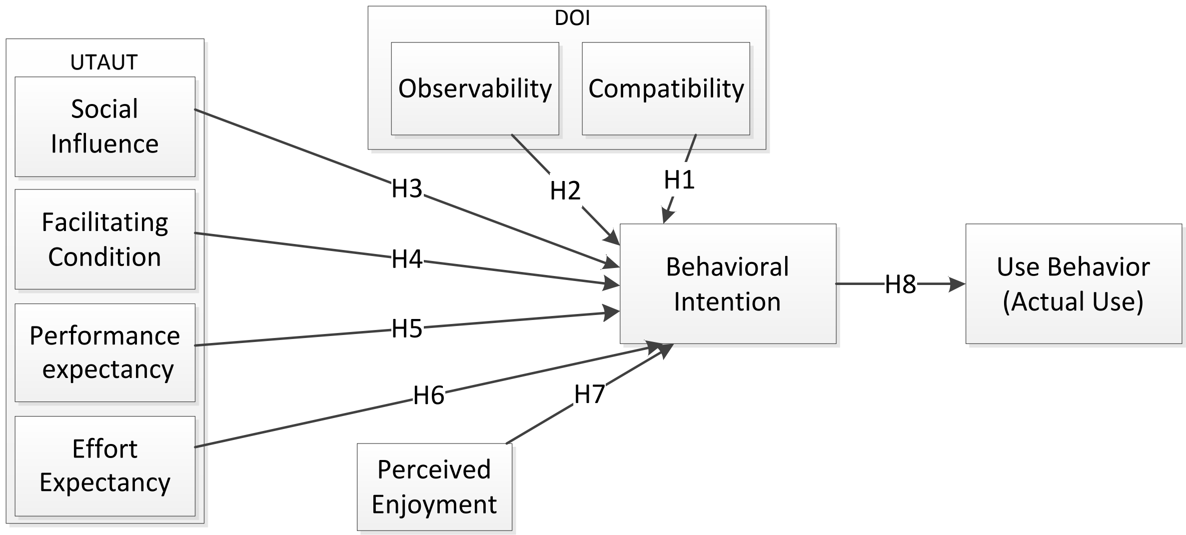

Figure 2.10 Proposed conceptual framework - Model of Smartphone Acceptance (MOSA)

DoI: Observability

An innovative product is defined as a new product where the features are novel or improved significantly from the predecessors. The contemporary features may be developed using innovative technologies and knowledge or materials currently available (Rogers, 1998). Smartphones, therefore, can be considered to be an innovative product because firstly, they were introduced in 2007 with advanced designs and sophisticated technologies such as an iPhone (Honan, 2007). Secondly, they had applications and immense advanced features compared to a feature phone. Therefore, Rogers's DoI is applied to this framework.

Observability is defined as the degree that smartphones are visible to silver surfers. Previous research studies related to smartphones also identify that Observability is important for technology adoption. Observability was applied and confirmed in the study of smartphone adoption among doctors and nurses (Park & Chen, 2007) in Midwest, USA. Observability also applied to study smartphone adoption among nurses in community hospitals in southeastern USA (Putzer & Park, 2010). Observability also influenced the mobile commerce adoption within graduate degree students (Khalifa & Cheng, 2002) and in mobile banking (Al-Jabri & Sohail, 2012). The variable was also studied and confirmed in the mobile internet context in China (Liu & Li, 2010).

In real life situations, Observability can emerge in instances where older adults who are in employment, are likely to observe smartphones being used by their younger co-workers. Older adults may also see smartphone being used by their children. Smartphone providers also widely advertise their products on several channels including traditional ones such as TV, newspapers and magazines. Therefore, it can be assumed that older adults would have a chance to observe smartphones being used.

Therefore, from DoI, this research posits that there is more a likelihood of silver surfers adopting smart phones when they see a smartphone being used. Thus the following hypothesis is proposed.

H1: Observability has a positive influence on the behavioural intention of smartphone adoption within silver surfers.

DoI: Compatibility

Compatibility that is also drawn from DoI, is defined as the degree that a smartphone is compatible with a silver surfers' lifestyles (Rogers, 1998). This variable has been studied in several research studies. Teo and Pok (2003) from Singapore studied WAP-enabled mobile phones within internet users and confirmed that Compatibility can influence attitude and user behaviour. Compatibility was also confirmed in mobile commerce adoption (Wu & Wang, 2005) and mobile banking (Lin, 2011) studies conducted in Taiwan. In the health care industry, compatibility was integrated and confirmed in healthcare systems using mobile devices (J.-H. Wu et al., 2007). Xue et al (2012) applied compatibility to study accessing health informatics via a smartphone and confirmed that compatibility influence intention to use among 50+ women in Singapore.

In a traditional perspective, smartphones or mobile phones are compatible with business person's lifestyle. From their benefits that are explained earlier on, smartphones can be used by every individual, including older adults. Smartphones can be used as communication tools to operate a business and to contact friends and family. As addressed earlier, smartphones can assist older adults in monitoring their health. A Personal digital assistant feature of smartphones can help those who are facing memory loss problems. With a Bluetooth connection to an application monitoring tool used to monitor health problems such as blood pressure, sugar or hearth rate monitor, older adults can regularly check their health status. Therefore, it can be seen that smartphones can be compatible with an older adult's lifestyle, which led to the proposal of the following hypothesis.

H2: Compatibility has a positive influence on the behavioural intention of smartphone adoption within silver surfers.

UTAUT: Social Influence

Social influence, one of the factors drawn from UTAUT can be defined as the degree to which an individual perceives that others important to them such as family, friends or other close peers, believe that they should use the new system, such as a smartphone (Venkatesh, 2012). It has been learnt that when the silver surfers adopt new technologies, they are normally influenced by other individuals, particularly those who are close to them; for instance, their family and good friends. The influencing individuals can introduce smartphones to older adults, explain the features of and the benefits of smartphones to silver surfers.

Previous research studies associated with smartphones also show that social influence is important for technology. Examples of studies that have used social influence include a study of 3G adoption in China (Chong, Ooi, et al., 2012), mobile coupons (Chong, Ooi, et al., 2012), mobile phone adoption within older adults (Chong, Ooi, et al., 2012), online applications on smartphones (Shi, 2009), Smartphone Application Acceptance (Lee et al., 2012), 3G mobile technology (Song & Han, 2009), Analysis of users and non-users of smartphone applications (Verkasalo et al., 2010), the Thai older adults intention to use smartphone for e-Health services (Boontarig et al., 2012), and smartphone adoption in Bangkok (Pitchayadejanant, 2011). Therefore, the following hypothesis is proposed.

H3: Social Influence has a positive influence on the behavioural intention of smartphone adoption within silver surfers.

UTAUT: Facilitating Conditions

Facilitating conditions drawn from UTAUT can be defined as the degree to which an individual believes that an organizational and technical infrastructure exists to support the use of a smartphone (Venkatesh, 2012). This factor can be explained by older adults having the necessary resources such as knowledge, time and money to adopt smartphones (Zhou, 2008; Venkatesh, Morris, Hall, et al., 2003). However, as with any novel technology, users who want to adopt a smartphone will need to have some understanding of using the new device. This is because the newer technologies are different in some way from the old ones. Therefore, the users may need to learn how to use a new device.

Additionally, the costs of using a smartphone a handset and the monthly fee are also included within this factor. Therefore, if the cost for using a smartphone is affordable and viewed as more beneficial to the silver surfers, than a positive attitude may occur. This means then that the users can use the technology and is within the budget that an older adult has allocated to use a smartphone.

From previous research studies on mobile acceptance, the construct facilitating conditions are viewed to be one of the main factors leading to acceptance; in other words, adoption (Zhou et al., 2010; Zhou, 2008). The previous research studies integrate Facilitating Conditions such as acceptance of smartphone online application software in China (Shi, 2009), smartphone application acceptance in Singapore (Lee et al., 2012), intention to use smartphones in Bangkok (Pitchayadejanant, 2011), Chinese mobile banking (Zhou et al., 2010), mobile technology acceptance (Zhou, 2008), and mobile device and services (Carlsson et al., 2006). Therefore, based on this reasoning, the following hypothesis is proposed.

H4: Facilitating Condition has a positive influence on the behavioural intention of smartphone adoption within silver surfers.

UTAUT: Performance Expectancy

Performance Expectancy, which is also drawn from UTAUT, is defined as the degree to which an individual believes that using the system will help him or her to achieve completion of their jobs or tasks (Venkatesh, 2012). Theory also reveals that performance is also one of the factors that affects user behavioural intention (Venkatesh, 2012). UTAUT identifies a user’s perception of the smartphone benefits being mobility, internet connection and an application that can assist older adults in many ways as addressed in the reviewed literature. If older users recognise the potential benefits that a smartphone can provide, then they are likely to adopt and use a smartphone.

Yu (2012) used Performance Expectancy to study mobile banking in Taiwan and found that the variable was significant. He and Lu (2007) also applied the variable to study consumers perceptions and acceptances of mobile advertising in China. In terms of mobile gaming, Performance Expectancy also be confirmed by Chen (2011) in Taiwan. Carlsson et al (2006) from Finland applied Performance Expectancy to study mobile device and services such as Multimedia Message, Search service and Ring tones. Park et al (2007) also applied Performance Expectancy to study mobile technologies including mobile phone and personal digital assistance in China, and found that the variable was significant. In terms of using smartphones for health services, Boontarig et al (2012) applied Performance Expectancy to study among older adults (65+) in Thailand. Therefore, the following hypothesis is proposed.

H5: Performance expectancy has a positive influence on the behavioural intention of smartphone adoption within silver surfers.

UTAUT: Effort Expectancy

Another factor taken from UTAUT is effort expectancy, which is defined as the degree of ease associated with the use of a system (Venkatesh, 2012). Effort expectancy reflects the perceived effort construct when users adopt a new system; in this case, a smartphone. This factor is compared to the perceived ease-of use construct of TAM and the complexity construct from the DoI (Venkatesh, Morris, Hall, et al., 2003). It explains a user's perception of the difficulty associated with using a smartphone; that is, whether using a smartphone is a difficult or easy task. However, in the past few years, smartphone providers and developers have simplified the operations and functions of smartphones. Therefore, some older adults may find smartphones easy to accept and use.

Effort expectancy was integrated to study smartphone for health services adoption among Thai older adults (Boontarig et al., 2012) and the resulted was confirmed this variable. Kijsanayotin et al (Kijsanayotin et al., 2009) included Effort Expectancy to study Information system with health centres, the research also confirmed that Effort Expectancy was significant for Information system and health. Im et al (2011) applied Effort Expectancy to study music player and mobile banking in Korea and USA. Im et al (2011) confirmed that Effort Expectancy was important for technology adoption. For mobile gaming, Chen (2011) applied the variable to study mobile gaming in China. Alkhunaizan and Love (2012) also applied Effort Expectancy to studies mobile commerce in Saudi Arabia. Therefore, the following hypothesis is proposed.

H6: Effort Expectancy has a positive influence on the behavioural intention of smartphone adoption within silver surfers.

TAM3: Perceived Enjoyment

TAM 3 provided perceived enjoyment that is defined as the extent to which the activity of using a specific system is perceived to be enjoyable in its own right, aside from any performance consequences resulting from system use (Venkatesh, 2012). A smartphone, which has additional capacities such as connecting older adults with friends and family, playing music, watching videos, installing and playing games and surfing some entertaining content, can be a device that provides enjoyment for older adults. Perceived enjoyment was found to significantly affect the intended use of new technology (Davis, et al, 1992).

Verkasolo et al (2010) suggested that for some features of smartphones such as mobile internet services and mobile gaming, enjoyment was significant affected by the adoption. Nimrod (2011) reviewed online forums and found that senior citizens also considered enjoyment when using new technologies such as, an online community. This factor was also studied in both the contexts of using software in smartphones (Song & Han, 2009; Verkasalo et al., 2010) and using mobile Internet (Shin, 2007). Moreover, UTAUT2 (Venkatesh et al., 2012) also included Hedonic motivation - defined as fun or pleasure derived from using a technology. Thus, this research believes that older people may find smartphones enjoyable in many aspects. Therefore, the following hypothesis is proposed.

H7: Perceived Enjoyment has a positive influence on the behavioural intention of smartphone adoption within silver surfers.

Behavioural Intention/ Use Behaviour

The final factor drawn from UTAUT (Venkatesh, 2012) is Behavioural Intention, which is the level to which a person has formulated a conscious plan to further use a device in the future. It is also the middle factor between the dependent variables and Use behaviour.

In this research study, Behavioural Intention is considered to influence further or continue use of the smartphones. It is because this research study believe that with appropriate time and environments older adults can learn how to use smartphones (Chaffin & Harlow, 2005) as well as younger generations. This research expected that, with the benefits and features as address above in section 2.2.2 and benefits for older adults who are facing health problems such as in the research by Joe and Demiris (2013), older adults will continue to use smartphones and perhaps increase a frequency of usage. Moreover, some previous research studies based on UTAUT display the strong relationship between the dependent variables and Behavioural Intention such as the study of information technology in six organizations by Venkatesh et al (2003), and, mobile advertising by He and Lu (2007).

Therefore, the following hypothesis is proposed.

H8: Behavioural intention has a positive influence on the smartphone usage of silver surfers.

To illustrate and understand the combined factors, their relationships and the formed hypotheses, a structural model was formed that is shown in Figure 2.10.

This research also realizes the usage of demographic variable such as age, gender, experience and voluntariness as in Venkatesh (2012) research. Therefore, the demographic variable will be explained in the next section.

2.4.4 Demographic Variables

Besides the main factors identified above, socioeconomic variables such as age, gender, education, occupation and health can provide further information on the characteristics of the research population (Burgess, 1986). Wagner et al (2010) concluded that independents variables such as age, gender, health and education could affect personal behaviour; therefore, this research recognised these variables and included them for further consideration. The demographic variables such as age, gender and education will be analysed both as independent variables and moderator variables. In the following section more explanations on age are provided.

2.4.4.1 Demographic Variables as Independent Variables

When including demographic variables in a research study generally, the researchers present and interpret their findings in terms of demographic variables.

Age, which is a demographic variable used in this study can be used as a factor to explain a specified social group or collective behaviour (Finch, 1986). For technology adoption research, the younger age group is likely to adopt a new technology compared with the older age group (Rogers, 1995). For example, younger users are likely to use a Personal Digital Assistant well (Arning & Ziefle, 2007), while the younger users are likely to use WAP services (Hung et al., 2003). Karim et al (2009) also found that 20-30 age groups were far more adapted to mobile phones. For mobile commerce, Chong et al (2012) found that the younger generation (16-28) use more mobile commerce. The actual use of mobile commerce was affected by age (Alkhunaizan & Love, 2012).

Reasons why younger users are likely to adopt new technology more than the older adults

A strong reason for younger individuals to adopt new technologies is likely due to their attitude toward technology. Younger users view new technologies as useful tools and important for their lifestyles. Younger users also have a positive view of themselves when determining the capability to use the new technologies (Broady et al., 2010; Bovée et al., 2007; Teo, 2006; Pektaş & Erkip, 2006). Further, factors such as the level of confidence of younger users to use new technologies (Gardner et al., 1994), or technology exposure, or experience with technology also influence the younger users to adopt new technologies (Levine & Donitsa-Schmidt, 1998; Bovée et al., 2007). From the above reasons, it is expected that older adults (50-59) are likely to adopt smartphones more than 60+ adults.

Gender is also an important variable in social sciences research that can be used as both a descriptive and explanatory variable (Morgan, 1986). From several research studies, males are more likely to adopt innovative technology in comparison to females (Rogers, 1995). For example, males are more likely to adopt mobile phones than females (Karim et al., 2009). However, some research has found that the differences in numerical terms between male and female smartphone owners may not be significant (Su & Li, 2010). Nevertheless, for the 50+ adults the numbers may be varied.

Education is a less popular variable that is used in research studies, particularly when compared to age and gender. Further, studies using the education variable are still limited in technology adoption studies (Teo, 2001). However, educational level has been used in some studies of innovational adoption (Rogers, 1995). For example, people with higher educational levels are more likely to adopt 3G (Chong, Ooi, et al., 2012), and mobile commerce (Alkhunaizan & Love, 2012). It is expected that people with higher education levels are likely to adopt and use smartphones.

Occupation is considered in this research because some of the 50+ adults may still be in employment, which could lead to them using smartphones. There have been previous research studies of mobile phones linked with occupation in the technology adoption arena, university students, working class and teenagers are more likely to use mobile phones compared to retired individuals both in the UK and China (Su & Li, 2010). This variable can provide a contribution to link smartphone adoption to occupation.

As older adults are the demographic group of interest to this study, and as ageing occurs, disabilities, ailments and health issues emerge, which is likely to affect technology use; hence the health variable was included in this study. Kurniawan (2008) found that older women facing haptic (touch) problems while men have perceptual problems when using mobile phones. The health or ailing problems may be classified as cognitive functions or memory, vision, auditory and haptic (touch) (Kurniawan, 2008). Other diseases such as Parkinson's disease could lead to problems associated with the smartphone touch screen.

In some specific research studies, demographic variables can also form a hypothesis. For example, in the research study of 3G technology the demographic variables of age, education and gender were the independent variables used to predict the intention to adopt 3G technology (Chong, Ooi, et al., 2012). The hypotheses in the 3G adoption research were that users who are in lower age groups are more likely to adopt 3G, while users who have higher educational levels are more likely to adopt 3G and males are likely to adopt 3G than females.

Further examples of using demographic variables as independent variables in the hypotheses are the research study on mobile commerce using TAM (Yang, 2005). The hypotheses were that age negatively influences perceived usefulness and the ease of use of mobile commerce. Gender influences perceived usefulness and the ease of use of mobile commerce. However, the hypotheses about gender supporting the perceived usefulness was dropped.

2.4.4.2 Demographic Variable as Moderator Variables

A demographic variable can also be used as a moderator variable in research studies such as the research study on mobile internet by Venkatesh (2012). In the UTAUT study, the moderator variables with regards to demographics are age, gender, experience and Voluntariness of use. The UTAUT model (Venkatesh, Morris, Hall, et al., 2003) was suggested as follows.

- The Effect of performance expectancy on the behavioural intention is stronger for men and younger users.
- The Effect of effort expectancy on the behavioural intention is stronger for women older users and those with limited experience.
- The Effect of social influence on behavioural intention is stronger for women, older users, under condition of mandatory use, and with limited experience.
- The Effect of facilitating condition of usage is stronger for older users with increasing experience.

Other research studies that have utilised demographics as moderator variables in the context of smartphones are identified below in the table below.

Table 2.9 Related literature used demographic variable as moderator variables

Literature	An area of research	Methods used	Main Theories/ Moderator variables/Research finding
(He & Lu, 2007)	Mobile advertisement	A survey of 243 individuals in China	UTAUT was applied where Age, Gender, Experience, and Voluntariness were used. The effect of social influence was moderated by age, gender and voluntariness of the use of mobile advertising.
(Park et al., 2007)	Mobile technologies	A survey 221 online panel in China	UTAUT was implemented with Gender, Education, and Experience. The effect of performance expectancy and effort expectancy was moderated by gender and education on the use of mobile technology. Moreover, the effect of social influence was moderated by education.
(Shin, 2009)	Mobile Wallet	A survey 296 website visitors in Korea	TAM was applied where Age, Gender and Income were used. The effect of security and trust was moderated by income. The effect of perceived ease of use, self-efficacy, social influence and intention to use mobile wallet was moderated by age.
(Ha et al., 2007)	Mobile game	A survey 1169	TAM was applied where Age and Gender were used. The effect of Perceived ease of

		website visitors in Korea	use was moderated by age and gender.
(Yu, 2012)	Mobile Technology for Chinese Consumers	Survey 221 users in Taiwan	UTAUT was implemented with Age and Gender. The effect of performance expectancy and perceived financial cost was moderated by gender. The effect of facilitating condition and perceive self-efficacy was modified by age.

From the above table, it can be seen that demographic variables as moderator variables can provide more of an understanding of the research model. Therefore, this research will apply the demographic variables in both ways.

However, with regards to UTAUT, The voluntariness of using the technology will be removed from this research. The definition is "the degree to which use of the innovation is perceived as being voluntary, or of free will" (Moore and Benbasat 1991:195). Unlike organizations, this research is focused on general users where the users have a freedom to use or not to use their smartphones; therefore, the voluntariness of use was omitted.

2.5 Chapter Summary

This chapter began with a background story of the smartphone in terms of statistics and literature where it was learnt that the smartphone is a successor of the mobile phone that was developed in 1992 and the proliferation of smartphones began to occur in 2007. The key smartphone brands are Apple, Samsung, LG, Sony and Motorola. Smartphones can provide many benefits as shown in Table 2.1. Then, a review of the earlier studies on smartphone adoption was proffered where the emphasis was more on the user design interface, smartphone usage and smartphone adoption and the population that was utilised included, organizations, students, or the population in general. Therefore, from the literature review, it was found that there is a gap in research on older adults and smartphones.

Section 2.3 the provided discussion of the theories in technology adoption studies in IS. The reviewed theories are TRA, TAM, TPB, DOI, DTPB, TAM2, UTAUT, TAM3 and UTAUT2. Using the reviewed theories and selected constructs, Section 2.4 provided the conceptual framework of this study, along with the eight hypotheses and an explanation of the demographic variables as moderators were afforded.

The following chapter 3 will now offer a discussion of the chosen research methodology.

Chapter 3 Research Methodology

3.1 Introduction

From the previous chapter, the conceptual model was formed to evaluate the factors that influence the decisions of 50+ adults when adopting and using smartphones.

This chapter will now present the research methodology of this research study where the operations and structures are influenced by the research process onion, in Figure 3.1. The process is mainly divided into five sub topics which are Research Philosophy, Research Approaches, Research Strategies, Time Horizons, Data collection Methods.

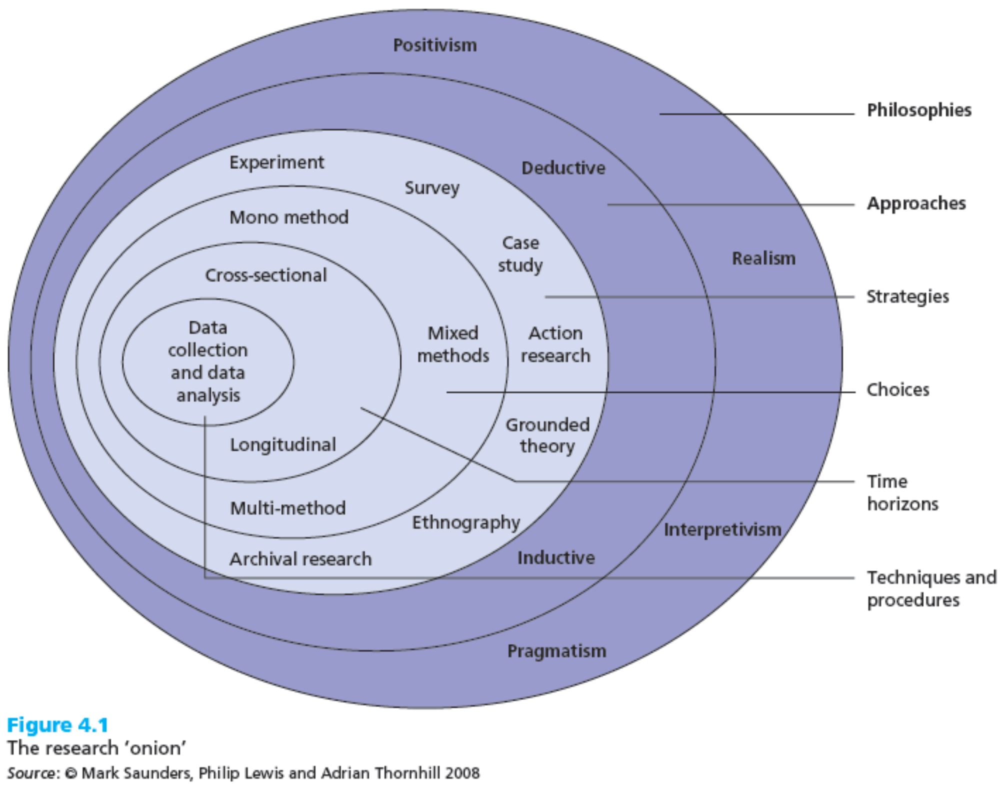

Figure 3.1 Research Process 'Onion' (Saunders et al., 2009)

Saunders et al (2009) suggests that researchers should consider the outer layers of the onion as well as the core of the onion. Moreover, researchers should start with the outsider layer to the centre. Therefore, this chapter is informed by following the Research Process Onion and aims to describe the research methodology pursued for this study using the research onion.

3.1.1 Overview of the Research Process

The following outline is provided to illustrate the research process that was pursued in this research study.

Phase 1: Research Instrument Development & Pilot Testing

- Literature review to develop the pilot questionnaire
- Content Validation
- Collect 200 responses from all age groups
- Analyse the received data using SEM-PLS
- Provide results
- Develop final survey

Phase 2: Final Survey

- Pre-test final survey
- Collect 1,000 responses
- Analyse the data using SEM-PLS
- Measurement Reliability and validity
- Provide final results

Phase 3 Evaluations.

- Acquire nationwide dataset/s
- Using Probit regression to analyse the dataset
- Compare analysed national wide result with the final research result
- Test research hypothesis with national wide result

To inform readers, this chapter is structured as follows: In the following section, 3.2 the research philosophy is provided. This is followed by the research approaches section in 3.3. The research strategy, which was pursued by this research study is proffered in section 3.4, which is followed by a discussion of the research choices in 3.5. There were some time horizons to be considered that are identified and explained in section 3.6. The data collection process and analysis techniques are identified and explained in section 3.7, which leads to the conclusion to this chapter in section 3.8.

3.2 Research Philosophy

Researchers should understand the research philosophy and be aware of the importance of a research philosophy, which is defined as the development of knowledge and the nature of knowledge (Saunders, Lewis, & Thornhill, 2009). The components of a research philosophy are, Epistemology, Ontology, and, Methodology.

Pursuing the suggestions of the research onion, research philosophies that researchers can apply can be grouped into Positivism, Realism, Interpretivism and Pragmatism.

3.2.1 Positivism

Positivism is the idea of objectivism where a researcher is independent of, neither affects and nor is affected by the subject of the research (Remenyi, 1998). Positivism is used to describe an approach to research based on the assumption that knowledge can be discovered by collecting data through observation, measurement and analysing it to establish truths (Somekh & Lewin, 2005). “Positivist studies are premised on the existence of *a priori* fixed relationships within phenomena, which are typically investigated with structured instrumentation. Such studies serve primarily to test theory, in an attempt to increase predictive understanding of phenomena” (Baroudi & Orlikowski, 1990:5).

Generally, Positivism aims to discover social phenomenal by beginning with a set of hypotheses. This type of philosophy normally uses designed experiments, measurement techniques, and verification analysis. The outcome can be seen as causality (Easterby-Smith et al., 2006). A positivist philosophy usually applies quantitative research and a deductive approach (Saunders et al., 2009). Other philosophies that are based on positivism are Neo-positivism and Post-positivism.

For this research, the researcher believes that he is not related to, or affected the subjects of this research, 50+ adults. The researcher does not personally know all the 50+ adults in the research sites. Secondly, the researcher believes that knowledge can be collected utilizing measurements, although this is not entirely accurate (100 percent correct). Third, the researcher has a background in engineering; therefore, the researcher felt more comfortable to work with structured instrumentation or data collection method and analysis, which are associated more with positivism.

Baroudi and Orlikowski (1991) have also suggested that Positivism is used to test theory in an attempt to increase the predictive understanding of phenomena, in this case adoption of smartphones among older adults. Since this research did form hypotheses and a conceptual framework in chapter 2 and intended to examine smartphones adoption it is believed that this research study did apply a positivist standpoint.

3.3 Research Approaches - Deductive

The next layer of the onion refers to the research approaches, which are deductive and inductive.

3.3.1 Deductive

A deductive approach is mostly performed in the natural sciences where laws can present, explain and predict the phenomenon. A deductive approach is applicable for quantitative data with large sample sizes in order to explain the relationship between variables. Further, a deductive research approach is more generally associated with positivist and quantitative research. It involves the development of an idea, or hypothesis, from existing theory which can then be tested through the collection of data” (Gratton & Jones, 2010:26). Therefore this research utilised a deductive approach.

3.4 Research Strategies

As suggested by the research onion process, the strategies layer is the next layer, which consists of an Experiment, Survey, Case study, Action research, Ground theory, Ethnography and Archival research. A research strategy offers an overall direction to the research, including a process of how research should be conducted and enabled such that researchers can systematically perform the study (Remenyi, 1998). The strategies can be considered as a general plan for researchers to perform their research study with, and to answer their research question (Saunders et al., 2009). The factors that help the researchers to select an appropriate research strategy are research objectives, research questions, existing information, time and other resources as well as the selected research philosophy.

The terms research strategies and research methodology are often used interchangeably. A research methodology can be defined as the theory of how research should be undertaken, including the theoretical and philosophical assumptions upon which research is based and the implications of these methods adopted (Saunders et al., 2009). This has already been discussed earlier in the chapter. Both research strategies and research methodology are closely linked to methods. Method refers to the techniques and procedures used to collect and analyse research data such as questionnaires, observations, interviews and statistical and non-statistical techniques (Saunders et al., 2009). A research methodology or research strategy employs research methods such as a survey strategy that uses a questionnaire technique. Additionally, methods such as questionnaires can also be referred to as a research instrument (Cooper & Schindler, 2013). This research study applied a survey instrument that is discussed later on in the chapter.

3.4.1 Survey – Research Strategy

A Survey consists of gathering data using questionnaires (Chen & Hirschheim, 2004). A Survey is also a common strategy for business and management studies and is associated with the deductive approach. Surveys assist in answering ‘who, what, where, how much and how many’ questions. A survey is also commonly used because it can economically collect large amounts of data (Saunders et al., 2009). From the Chen and Hirschheim (2004) study, a survey was used in 41% of the articles submitted to eight major IS publications during 1991 to 2001. Please note: A survey is a research strategy while the questionnaire is a research tool that employs questions to gather data.

The data collected by a survey strategy can be analysed using both descriptive and inferential statistics. This means that a survey is used to provide the reasons for particular relationships between variables to create models to illustrate a relationship and to allow more control over the research process (Saunders et al., 2009).

A questionnaire can be defined as a set of carefully designed questions related to the research topic of interest and given in exactly the same form to a group of people when collecting data (Jupp, 2006). However, deviations are the medium of a questionnaire and how questionnaires are answered. There are several types of questionnaires, according to the methods of a survey strategy; for example, a paper-based, postal or online questionnaire. Moreover, questionnaires can be classified as delivery and collection questionnaires, interviewer-administered questionnaires, and self-administered questionnaires (Saunders et al., 2009). A questionnaire usually provides an inexpensive and effective way to obtain data and in a structured and manageable way. The questionnaire was the selected research instrument for this research.

For this research, a **self-administered internet and intranet mediated questionnaire (online questionnaire) was** administered via email or website (Hewson, 2003). In the next section, more explanations of a self-administered questionnaire are provided.

3.4.1.1 Internet and Intranet Mediated Questionnaire - Method

The internet and intranet mediated questionnaire are suitable for a population that can access the internet or an intranet. The strength of this type of questionnaire is coping with a large geographic area and a large sample size. However, the response rate is around 30% within an organizational environment and around 11% using the internet. In this instance, researchers should provide fewer questions, the questions should be closed question and not complicated. Researchers should allow 2-6 weeks for distribution and the financial resource can be spent on web design or software.

The advantage of this type of questionnaire in comparison to the paper based, postal and delivery, collection questionnaire are reducing both the times, costs of printing, distributing the questionnaire, where the data collated is likely to be prepared for analysis due to the statistical software. An online questionnaire also allows vast and diverse groups of potential research participants to be reached (Hewson, 2003). In the case of this research study, the academic institution that the researcher is completing his studies at, provide the software and a website subscription for the researchers. Therefore, this research adopted the internet and intranet mediated questionnaire.

The advantage of the survey strategy when using a questionnaire are first, the postal or online questionnaire allows researchers to collect data from a geographically dispersed sample group with a lower cost in comparison to interview. Secondly, questionnaires are likely to provide structured quantitative data that is easier to analyse. Thirdly, respondents can complete the self-administered questionnaire at their convenience (Gratton & Jones, 2010).

This strategy was applied to this research study because this strategy allowed more control over the process of research and was achievable given the limited financial resources that the research team had.

3.5 Research Choices

When considering research choices several options exist including the mono method, mixed methods and multi-method. Research choices include selecting between, or with both, the Quantitative and Qualitative approach and data. For this research, quantitative data was sought, which is described in the next section.

3.5.1 Quantitative and Qualitative Data

The terms quantitative and qualitative data are used to explain research data characteristics. **Quantitative data** is "Predominantly used as a synonym for any data collection technique such as, a questionnaire or data analysis procedures such as, graphs or statistics that generate or use numerical data" (Saunders et al., 2009:151). The quantitative data's key concept is quantity and numbers. Consequently, quantitative data is information about the data in the form of numbers (Punch, 2013). This type of data does not occur naturally. Thus, researchers convert data into numbers that can be measured and analysed (Punch, 2009).

Comparatively, **Qualitative data** is "used predominantly as a synonym for any data collection technique such as, an interview or data analysis procedure such as categorising data that generates or use non-numerical data" (Saunders et al., 2009:151). This type of data is appearing in, for instance, interview transcripts, recordings and notes, observational records and notes, documents and products and records of material culture, audio-visual materials and personal experience materials (Punch, 2013).

For this research study that is on smartphones and older adults, the data was collected in surveys that were then converted into numbers; therefore, quantitative data was considered to be appropriate for this research.

3.5.2 Quantitative and Qualitative approach

As mentioned earlier, there are epistemologies that also exist, which is also the case for the research data characteristics. Quantitative research is typically associated with a positivist and objectivist stance, while qualitative research is associated with Interpretivism and constructionism (Alasuutari et al., 2008).

This research applied a quantitative approach because firstly, the data that was obtained was in numerical format, which is quantitative data. Secondly, the selected strategy and research philosophy conformed to the research aims. The aim which is to understand the adoption of smartphone using IS theories needs the quantitative data similar to the previous research in this field (Venkatesh, 2012).

3.6 Time Horizons

Research studies and the research onion consist of a time dimension where there are two types of time horizons, which are Longitudinal and Cross-sectional research.

Longitudinal Studies are repeated over an extended period, which allows researchers to track changes over time (Cooper & Schindler, 2013). This type of time horizon is suitable for testing and developing theories on human development and answers (Saunders et al., 2009).

Cross-sectional Studies are "carried out once and represent a snapshot of one point in time"(Cooper & Schindler, 2013:128). Cross-sectional studies are likely to have a large sample using questionnaires and the survey technique (Easterby-Smith et al., 2006). This time horizon is suitable for studies where a particular phenomenon is considered at a specific time (Saunders et al., 2009).

Regarding this research's aim and questions there was an attempt to explore a smartphone phenomenon within a limited timed period, where a cross-sectional time horizon was considered most appropriate. Further, the cross-sectional time horizon was compatible with this research philosophy and selected survey strategy.

3.7 Data Collection and Data Analysis

Having considered the research onion, the philosophies and research strategies were considered. Now, this section will explain the Primary and secondary data used in this research, the literature review sources, the research site decision, instrument validation, sampling Frames and sample size, and finally, the sample and analysis methods.

3.7.1 Primary and Secondary Data

Primary data is data collected specifically for an undertaken research study (Saunders et al., 2009). The Primary data can be collected using methods such as surveys or observations (Zikmund et al., 2009).

Secondary data are the data that have already been collected by other researchers and for some other purpose. Secondary data is raw data and in the form of, for example, published summaries (Saunders et al., 2009). Secondary data can be acquired faster and is less expensive than primary data (Zikmund et al., 2009). Published documents prepared by other researchers are secondary data sources (Cooper & Schindler, 2013).

Due to the aim and research questions of this study, this research needed to acquire primary data. However, secondary data was also required; for instance, for literature reviews when forming the initial understanding and conceptual framework. In this research secondary data such as journal articles and conference publications are used for problem definition, literature review, conceptual development, method development, and discussion phases. Statistical documents and secondary quantitative data sets also helped in developing the problem definition and evaluation phases. Further, research books were also used for the research method development phase.

3.7.2 Sources and Management of Literature Review

When obtaining secondary data, search engines and databases were employed, which were Google Scholar by Google Inc., Web of Science by Thomson Reuters, Scopus and ScienceDirect by Elsevier, Wiley Online Library, Palgrave Journals, IEEE Xplore Digital Library, Association for Computing Machinery (ACM) Digital Library, AIS Electronic Library (AISeL), and, the Institute for Operation Research and the Management Sciences (INFORMS).

Of the above identified search engines and databases, the Web of Science, Scopus, and Google Scholar were mainly used. The reasoning for this is that Google Scholar is well known due to its wide coverage of most journals from the Google universe. Google Scholar provided full-text searches of journal articles and books (Jacsó, 2008). In terms of conference proceedings, Google scholar offered a better comparison to the Web of Science (Franceschet, 2009) and Scopus (Bar-Ilan, 2010). Moreover, Google is convenient as it is easily accessible from anywhere and at any time. When employing Google Scholar, the researcher was aware that since Google Scholar is widespread, low quality or irrelevant articles are also presented, which was found to be more time consuming.

Web of Science and Scopus were also used to gather articles as both the databases provide better results compared with Google scholar. Also, using both databases could achieve better coverage

(Vieira & Gomes, 2009; Bar-Ilan, 2010). Besides these three main databases, other databases were considered because initially, older adults and smartphone adoption use and diffusion is novel; therefore, the researcher sought to provide a comprehensive list of reviews. Second, this research wanted to cover the most possible, high quality journals that are provided by the Association of Business Schools' (ABS) listing(Morris et al., 2009).

For the smartphone technology search, the keywords that were used were: smartphones, smartphones, mobile phones, mobile phones adoption and, acceptance. For older people and technologies searches, the keywords were: older adults, older people, 50+ people, senior citizens, technologies, silver surfers, and mobile. The time frames that were used for the literature reviews were from 2000 to 2013. The main journals used for this research study are as follows.

- MIS Quarterly
- Computer Standards & Interfaces
- European Journal of Marketing
- Industrial Management & Data Systems
- Information & Management
- Information Economics and Policy
- Intern Journal of Research in Marketing
- International Journal of Forecasting
- International Journal of Industrial Organization
- International Journal of Information Management
- Journal of Business Research
- Journal of Consumer Marketing
- Journal of Interactive Marketing
- Telecommunications Policy
- Telematics and Informatics

The main Journals used for older people and technology studies were:

- Computers in Human Behaviour
- Information & Management
- International Journal of Human-Computer Studies
- Interacting with Computers
- Journal of Aging Studies
- Journal of Business Research
- Poetics
- Journal of Systems and Software

To reduce human errors for citations and to increase the efficiency of managing referenced articles, this research used reference management software (Henning & Reichelt, 2008), which were: EndNote from Thomson Reuters, and Mendeley. EndNote is one of the most popular commercial reference management software that offers many features such as full text search, online storage, large numbers of citation styles and collaborative community (EndNote, 2014). However, Endnote costs users an amount of around 100 USD for license.

The articles from the searches were stored and managed using Mendeley, from www.mendeley.com. Mendeley is a free reference and Portable Document Format (PDF) manager and academic social network (Mendeley, 2014). Mendeley also provided large enough cloud storage that allows users and researchers to automatically synchronize their PDF files. Therefore, the researchers can access the files anytime, anywhere from various devices and platforms.

3.7.3 Research Instruments

This research study also applied research Instruments that range from, questionnaires, interviews, content analysis, focus groups, and observations. They can be defined as devices for obtaining information (Wilkinson & Birmingham, 2003). When completing research studies, researchers need to understand research instruments and select appropriate instruments for data capture the data that can lead to answers to the research questions.

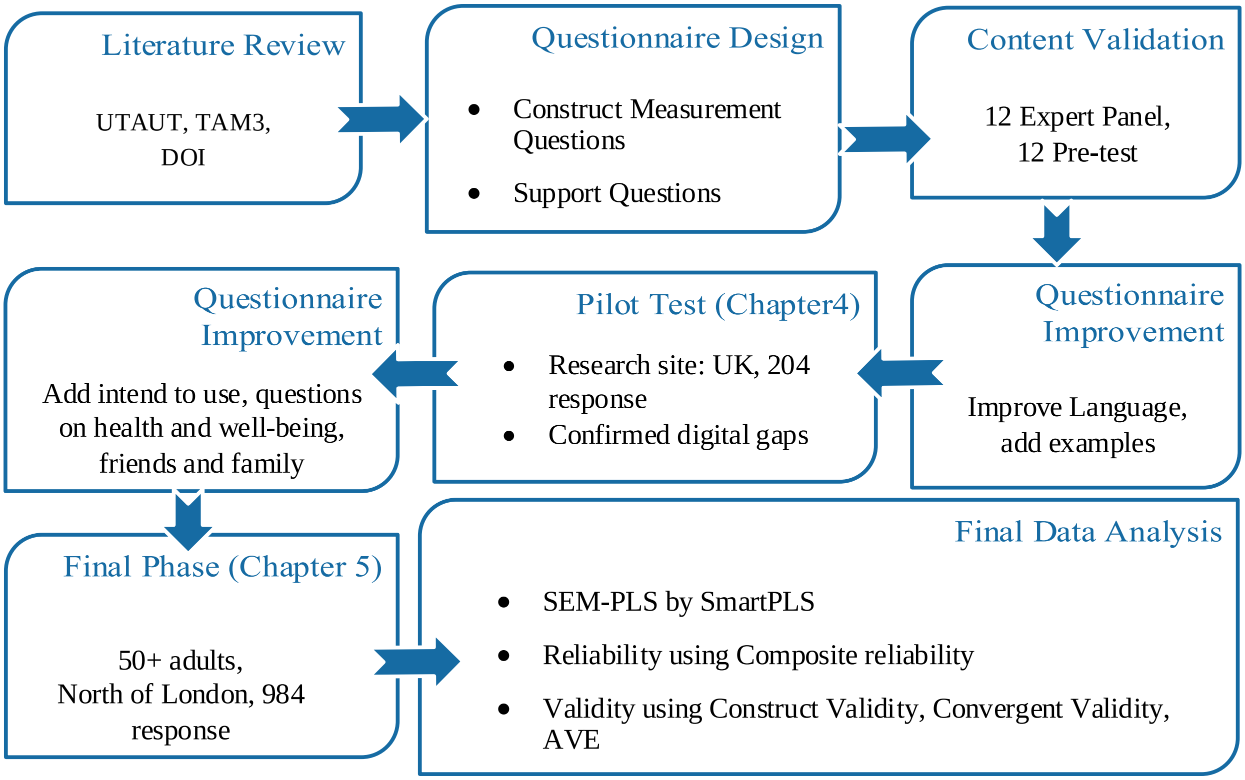

Figure 3.2 Flow Chart of Questionnaire Design to Final Data Analysis

The above flow chart illustrates the process that was utilised from the literature review stage to the final data analysis that was used in this research.

3.7.4 Questionnaire construction

Having decided upon the survey as a strategy and the questionnaire as the instrument, the next step was survey construction.

3.7.4.1 Designing Individual Questions

Individual questions can be developed by adopting questions used in other research studies, adapting questions used in other questionnaires, and developing one's own questions (Saunders et al., 2009). Schrauf and Navarro (2005) provided guidelines for selecting, evaluating, using and adapting former questions.

3.7.4.2 Type of Questions

Question types that can be utilized in research include, open-ended, close- ended, and partially open-ended questions (Jackson, 2011). **Open- ended questions** are questions where participants formulate their own responses. Respondents need to provide answers in their own ways (Jackson, 2011). These types of questions are widely used for in-depth and semi-structured interviews and also for exploratory research. However, open-ended questions are not recommended for large population samples (Saunders et al., 2009). Therefore, open- ended questions were not utilised for this research.

Closed questions or close-ended questions are the questions where participants select answers from a limited number of options that are provided by the researchers (Jackson, 2011). For participants, the close- ended questions are quicker and easier to answer. Moreover, responses can be easily interpreted and analysed. Close-ended questions can be further expanded as lists, categories, ranking, rating, quantity, and matrix questions (Saunders et al., 2009). For this research, a rating method was used, which led to the inclusion of close-ended questions.

Another type of question is the partially open-ended question that is a combination of open-ended and close- ended questions. There is also the close- ended question with an open-ended question at the end (Jackson, 2011). This type of question was also used in this research. This type of question was used in the validation phase that asked the Expert Panel to review and provide further comments on the questionnaire.

List and Category questions provide lists of possible answers to the respondents. However, for category questions, only one answer is required for replies. Respondents can select more than one choice in a list of questions (Saunders et al., 2009). For these types of question researchers should provide all possible choices to the respondents. These types of question were included in this research as the questionnaire needed information such as the background information of respondents.

Ranking questions seek respondents to place items in rank order. These types of questions can be used to gain an understanding of the variable ranking. However, the numbers of factors that need ranking should be no more than seven items due to a limitation in the form of human being memory capability (Saunders et al., 2009).

Rating scale questions are questions where respondents reply with numbers that indicate their direction and strength (Jackson, 2011). These kinds of questions are suitable for collecting respondents' opinions (Saunders et al., 2009). Rating scale frequencies use Likert-style rating scales that ask respondents on how strongly the individual agrees or disagrees with a statement or series of statements. The scale normally ranges from a rating scale from four to seven. An even number of points such as four or six are normally not recommended as this forces respondents to select their views and opinions, which can cause unnecessary stress within respondents (Saunders et al., 2009). Using a number of possible responses such as seven scales, provides more flexibility to the respondents and offers better details (Wilkinson & Birmingham, 2003).

This research applied an odd number of scales such as five and seven, which were considered to be less stressful. In the pilot phase, five scales were used, but in the final phase, a seven point Likert scale was used. The five scales were used in the pilot because at the time the researcher was concerned about the simplicity of the research. Moreover, five scales are used more often in general questionnaires (Wilkinson & Birmingham, 2003). However, for the final phase, the scale was increased to seven because the seven Likert scale is “a better approximation of a normal response curve and extraction of more variability among respondents” (Cooper & Schindler, 2013:278).

Quantity questions expect participants to reply with numbers such as the participant’s year of birth. Quantity questions are also more suitable to collect attribute data. In this research, to collect background information, quantity questions were employed (Saunders et al., 2009).

Matrix or grid questions allow researchers to present similar questions simultaneously, where the questions are listed on the left-hand side of a page and the replies are listed across the top. These types of questions assist in saving space (Saunders et al., 2009). Matrix or grid questions are similar to groups of rating scale questions. This research used grouped rating scale questions as matrix questions.

3.7.4.3 Questionnaire Types

Having explained how the questions for the questionnaire were developed, this section now discusses the questionnaire design and development.

Paper questionnaire – validating and pretest

After the questions were selected and developed from previous research studies, the questionnaire needed to be validated. For this purpose, the researcher printed the online questionnaire and using instructed interviews or a delivery and collection process, sought replies from an expert panel. Thereafter, content validity was pursued, where the understanding and language of the questions from the expert panel was achieved. Before disseminating the content validity questionnaire to respondents, approval was obtained from the supervisory team. The entire content validity form is provided in appendix 3-1, but for the reader’s current perusal, an example is provided in Figure 3.3.

Section 0 Example

Question	Your suggestion
0. Please state your gender a. Male b. Female	This question is ☒ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:

Figure 3.3 The example of question in Content Validation of the Questionnaire form

Following validation, some improvements were made to the questionnaire. Some of the expert panel members provided answers using the hard (paper) format, whilst others employed the email and online questionnaire channels.

Online questionnaire – websites for pilot and final phase

As previously explained, an online questionnaire was selected as the research strategy. However, to ensure that a large success rate could be achieved a suitable application service provider had to be identified. This section discusses how this research selected a particular website when hosting the questionnaire.

When considering the online questionnaire hosting providers there were four candidates: Qualtrics, Google Form, SurveyGizmo and Surveymonkey. **Qualtrics** is one of the best research tools that has a good reputation and support service, and is used by more than 5,000 customers and 97 top business schools. The website and created questionnaire are easy to use with Qualtrics providing analytical and survey building tools. However, the website has a high subscription cost; therefore Qualtrics was considered to be inappropriate (Qualtrics, 2015).

Google Form was the next choice as it is very simple to use. Nevertheless, the website is not appropriate to the questions because Google Form is too simple, lacking appropriate survey builder tools, and does not provide suitable analytical tools (Google, 2015).

SurveyGizmo was viewed as easy to use and a user-friendly site that offered cartoons alongside the questionnaire. However, this website was limited to a trial period of 14 days and was an expensive service to utilise; therefore, it was also removed as an option (SurveyGizmo, 2015).

The fourth and final website to be considered was Surveymonkey. Surveymonkey was founded in 1999 and is a pioneer and popular provider for online questionnaires. Surveymonkey is used by millions of users and provides an easy to use survey platform (Marra & Bogue, 2006; Survey-reviews.net, 2012). The website also proffered, important features that were needed for this research which are, Page and Question Logic. The features allow survey developers to route respondents to particular questions (SurveyMonkey, 2013). Surveymonkey also provides graphs and charts that are useful for presenting results and allows users to export the findings in a variety of formats including Microsoft excel (Marra & Bogue, 2006). The data format can also be imported into several analytical programmes such as SPSS and SmartPLS.

3.7.4.4 Cover Letter, Ethical Issues, Closing Page, Invitation Letter.

Following consideration of an appropriate questionnaire hosting website, the next stage was to compose a covering letter (details in Appendix 5-2). **The covering letter** is the first part of the questionnaire that contains an introduction to the researcher, research purpose and university. The letter also contains details of the ethics number, instructions for completing the questionnaire, the duration for completing the questionnaire, assuring the participants of anonymity, results use and the researcher's contact details (Saunders et al., 2009).

The questionnaire also contained a **closing page** that was at the end of the questionnaire (Example in Appendix 5-3). This document contained a note of appreciation to the respondent and the contact details of the researcher once again and was the format that was recommended by (Saunders et al., 2009).

An important prerequisite for researchers is the Ethical issue where the privacy of possible and actual participants, the voluntary nature of participation and the right to withdraw partially or completely from the research process, consent of participants, maintenance of the confidentiality of data provided by respondents, are provided. In brief, a research study and the researcher should not harm both possible and actual participants and measures to ensure these aspects need to be provided. In the researcher's university, prior consent to ethics is required and the form to be completed is provided in Appendices 5-4 and 5-5.

Finally, the online questionnaire contained an invitation letter that was used in the final phase. The letter contains an introduction of the researcher, the team and university, the aims and introduction of the research, the instruction of this questionnaire, linked to questionnaire on Surveymonkey, and the contact details. The letter can be found in appendix 5-7. The letters were printed out and distributed over the research area. The respondents can follow the link printed on the letter in response to the questionnaire.

3.7.5 Instrument Validation

Validity is a characteristic of measurement and involves testing the extent that a researcher wishes to measure; and the differences found with a measurement tool. These reflect the true differences amongst participants drawn from a population (Cooper & Schindler, 2013). Instrument validation is a vital step for researchers to ensure the generation of scientifically valid knowledge (Kim, 2009). Kim (2009) also suggests the scope of validity that begins from Content validity. The second stage of validity involves a Pre-Test, Pilot test, and Manipulation validity. The final and third stages are Reliability and Construct validity.

From Boudreau et al (2001) it was found that following a review of 143 articles from five IS publications: Information & Management, Information System Research, MIS Quarterly, Journal of Management Information System, and, Management Science, 63% applied a reliability test, 47% used a pre-test or pilot test, 42% utilised the previous instrument, 37% had Construct Validity, and 23% had Content Validity (Boudreau et al., 2001). Therefore, it can be suggested that validation is very important for IS research and was the reasoning applied to this research. Please note that details and contents about construction, validity and reliability can be found in the analysis section.

3.7.5.1 Content Validity or Face Validity

Content validity is the extent to which measurement scales provide adequate coverage of the investigative questions (Cooper & Schindler, 2013). It can also be defined as the argument that a question, scale, or measure appears to be logical to reflect accurately what was intended to be measured (Saunders et al., 2009). There are several ways to justify adequate coverage. One is using a discussion of the reviewed literature. Another is to use a panel of individuals to assess whether each measurement question in the questionnaire is essential, useful but not essential or not necessary (Saunders et al., 2009). In other words, validation examines whether a questionnaire appears to make sense.

Bell (2005) recommends that a test to discover issues such as, the duration, the clarity of instructions, layout clarity and attractiveness, any missing topics and any other comments should be considered during validity. Following the questionnaire design, the questionnaire was submitted to the first 12 panel participants for content validity. Four of the twelve participants were drawn from the IS field and were academics, whilst the remaining were from other academic fields (Details shown in Table 3.1).

Table 3.1 Content Validation – Expert Panel

	Participant	Area of Expertise
Academia Researcher related on IS or older people	A	Researcher on IS
	B	Researcher on IS
	C	Researcher on IS
	D	Researcher of old people and

		technology
Other Academia reviewers or related fields	E	Retired Lecturer in Engineering
	F	Researcher of Engineering
	G	Researcher on Marketing
	H	Translator
	I	Master Degree Student on marketing
	J	Master Degree students on business
	K	Master Degree Student
	L	Graduated Student

In this process, the researcher applied both the delivery and collect, and instructed interview methods in order to ensure a response from the panel. The content validation form and results can be found in Appendices 3-1 and 3-2. This research applied the content validation method provided by Lawshe (1975) and the results are provided in chapter4.

Lawshe (1975) provided a guideline that involved using the Content Validity Ratio (CVR) for each question. The formula is shown below.

$$CVR = \frac{n_e - \frac{N}{2}}{\frac{N}{2}}$$

n_e is the number of panelists indicated as essential.

N is the total number of panelists.

From this formula the following results are possible. A positive scenario is that more than half of the panel agrees with the essential elements, which suggests that the CVR is positive. However, if more than half of the panel does not agree with the essential, then the CVR is negative. Lawshe (1975) also suggested that the minimum value of CVR should be more than 0.62 for 10 panelists. For 12 Panelists, then the CVR should be more than 0.56. The results of the CVR obtained by this research can be found in appendix 3-2. However, the results will be discussed again in chapter 4.

3.7.5.2 Pre - Testing

After the first improvement, the next step for this research was the Pre-testing stage. Pretesting is the assessment of questions and instruments prior to commencing a study; an established practice for discovering errors in questions, question sequencing, instruction, or skip directions (Cooper & Schindler, 2013). For this process, a questionnaire was created on Surveymonkey, the survey website. At this juncture, for some of the pre-test panellists, a paper based questionnaire was used. However, the researcher used mainly the email facility where a link to the online questionnaire website was sent and comments for improvements were received by email or telephone. The list of pre-test panellists is shown in Table 3-2.

Table 3.2 Survey Pretest Validation Panel

	Participant	Area of Expertise
Academic Professionals	Dr. V	Lecturer of IS
	Dr. Ma	Lecturer of IT
Industry Professional	Ms. Pi	Diplomatic officer (40+)
	Ms. Ta	Diplomatic officer (40+)
	Mr. Ti	Diplomatic officer, older adult (50+)
	Mr. Me	Older adults CEO (50+)
	Ms. Se	Business woman (40+)
	Mr. Hu	Older business owner (50+)
	Ms. Ro	Older adults Hair Dresser (50+)
	Ms. Fa	Accountant (40+)
	Ms. Na	Older Lady (60+)
	Mr. Ki	Very Old House Agent (65+)

For Pre-testing, it can be seen that this research focused more on Industry Professionals and older adults by using a personal network of contacts. The pre-test results can be found in the appendix 3-2.

3.7.5.3 Pilot Testing

This research also used a pilot test. A pilot test is a trial collection of data that is used to detect weaknesses in the design, instrumentation and provision of proxy data for the selection of a probability sample (Cooper & Schindler, 2013). A pilot test is also defined as a small-scale study that tests questionnaire in order to minimise the likelihood of respondents having problems with the questions and processes. This can also help with the question validity and reliability (Saunders et al., 2009). A Pilot not only enables a researcher to review a questionnaire used mainly for distribution, but it also allows the researcher to test the analysis methods and the framework (Bell, 2005). A pilot can assist in determining the response rate, and to understand the questionnaire more and is useful for gathering replies to open-end questions (Dillman, 2011).

When determining the sample size for the pilot phase, there is reliance on the research questions, objectives, final sample size, time and resources, and how well questionnaire was designed (Saunders et al., 2009). A recommended number for a pilot are between 100 and 200 responses (Dillman, 2011).

For the pilot phase, this research used an online questionnaire that was diffused via the social media platform, Facebook. The process that was followed is that initially, the researcher posted the link to the questionnaire in several Facebook pages, and placed an advertisement advertising the questionnaire on Facebook. Any shortfall in numbers was overcome using the personal connection networks and a snowball sampling method that led to 201 responses from the United Kingdom (UK). Further details on the pilot are available in chapter4.

3.7.6 Sampling

Sampling is the process of selecting elements from a population to represent the overall population(Cooper & Schindler, 2013). The reasons to use sampling are lower costs compared to a census, and rapid data collection speed. The sampling process followed by this research included, defining a relevant population, selecting the sample type, selecting a sampling technique, identifying and evaluating sampling frames, selecting sampling frames and drawing samples (Cooper & Schindler, 2013). The following section now discusses the nature of a population.

3.7.6.1 Population

A population is defined as the complete set of cases or group members (Saunders et al., 2009). Since this research is interested in the older adults of the UK, it was found that there are around 22.7 million people aged 50 years old and above, which is an estimated third of the UK population (Office for National Statistics, 2014). From the previous Census in 2011, the UK population was around 63.18 million, where the 50+ population was 21.89 million, around 34.65 % (BBC, 2012). The UK population is ageing and it is predicted to continue ageing over the next few decades due to the number of births after World War 2 (Office for National Statistics, 2012c). Compared to other EU countries, in 2010, the numbers of members of the population aged 65+ rose to 17% as the second highest demographic group to have such an increase (Office for National Statistics, 2012c). Moreover, there were several research studies such as research on mobile phones and older people using focus groups (Kurniawan, 2008), research on adoption and usage of social media and older adults (Vyas, 2013), and research on internet access, e-public services and older people (Sourbati, 2009) that were completed on the UK population. For the aforementioned reasons, it was decided that the UK is an appropriate country to conduct such a study.

However, the size of the entire population in the UK is immense and access to the entire country is impossible, which led to this research study concentrating upon a smaller area of the UK. Details of the research site and the reasoning for selecting it are provided in the next section.

3.7.6.2 Research Site

The research site for this research study is North London. There are several ways to define the north of London; however, for this research, the areas that the study encompassed included Barnet, Brent, Camden, Enfield, Haringey, Islington and Westminster. In 2011, north London had a population of 1,880,852 with 474,873 older adults of 50 years old and above, where the 50 years old and above adults were 25.25% of the overall population (Office for National Statistics, 2011). The full list of north London areas can be found in appendix 5-6.

North London was also chosen for this study due to the well-developed mobile coverage infrastructure offered in the vicinity compared to other areas around the UK (Ofcom, 2013) and since this research study emphasises smartphones, this factor was also important.

Figure 3.4 Map of London, England, the UK

Table 3.3 Population of London, North London and Hertfordshire source: (Office for National Statistics, 2013)						
Area	Total population	50-59	60-69	70-79	Over 80	Over 50
London	8,173,941	833,226	599,362	393,117	254,860	2,080,565
North of London	1,880,852	189,273	138,404	90,572	56,624	474,873
Hertfordshire	1,116,062	136,865	110,464	74,423	51,507	373,259

Other reasons for choosing north London is that north London is next to Hertfordshire where the University of Hertfordshire and the researcher are located; hence accessibility was easier than other areas. Then, previous research on technology and older adults has been completed in Hertfordshire (Vyas, 2013), which suggested that vicinities surrounding Hertfordshire could provide some future comparative studies. To draw some comparisons, Table 3.3 has been developed to show the differences in the population numbers of London, North of London and Hertfordshire. What is also apparent is that the numbers of 50+ adults of North of London outnumber the Hertfordshire older adult population numbers.

Secondly, as mentioned earlier, the University of Hertfordshire Business School has completed some research on older adults and innovative ICT, which allowed the research team to display some credence in the research area. Thirdly, convenience in terms of the questionnaire distribution area/s was possible by deciding upon north London. That is, when disseminating questionnaires, the researcher could utilise public transport to deliver the questionnaires. Finally, the principal researcher resides in north London, so familiarity with the area was a major factor for selecting north London as the research site of this study. Having explained the reasoning for choosing north London, the next section provides reasons for the sampling frame.

3.7.6.3 Sampling Frames

When considering the sample size of any research study, the term sampling frame is frequented upon. The sampling frame is a list of elements in the population from which the sample is actually drawn (Cooper & Schindler, 2013). The list includes details such as the names of employees in a company (Saunders et al., 2009). However, for this research, it is impractical to access the list of older adults who live in north of London. Therefore, this research used the list of 164 districts in the north of London. For example, Camden area is composed of districts such as Agar Town, Belsize Park, Bloomsbury, Camden Town, Chalk Farm, Covent Garden, Dartmouth, and Hampstead (Geographers' A-Z Map Company, 2008). The complete list can be found in appendix 5-6.

3.7.6.4 Sample Size

The term sample is also one that emerges before considering any sample size, or sample frame. A sample is a group of cases, participants, events, or records consisting of a portion of the target population, which is carefully selected to represent the population (Cooper & Schindler, 2013). For Content Validation that was undertaken in this research, the recommended sample size or expert panel size is five (Lawshe, 1975). This research obtained 12 responses from the pre-test; whilst the pilot phase of this research gained 201 replies.

In general, the larger a sample size, the lower the likely the error exists for generalising the population. Therefore, probability sampling is a compromise between the accuracy of a finding and the amounts of resources in collecting, checking and analysing the data. A sample size can be calculated statistically. For example, for a population of one million to ten million, 384 samples can provide a 95 confidence level with a 5% margin of error. For the same population, 1067 samples can provide a 95 confidence level with a 3% margin of error (Saunders et al., 2009). Therefore, in this research, the target response rate was viewed to be 1000. However, after the data collection, the numbers of completed response rates were at 1030. Nevertheless, after re-examining the questionnaires, only 984 were useable, which led the researcher to conclude that 984 is very close to the targeted number of 1000 and more than the requested minimum number.

3.7.6.5 Sampling Types

When determining sampling, it can be learnt that there are two categories, which are Probability and Non-probability. For **Probability sampling**, all the units in the population have an equal chance of being selected. Contrarily, when the probability of all the units in the population are not equal, **Non-probability sampling** occurs (Cooper & Schindler, 2013). **The probability sampling** or representative sample is normally related to a survey-based research strategy (Saunders et al., 2009) where the processes begin with identifying an appropriate sampling frame and sample size with regards to the research questions and objectives. Thereafter, the appropriate sampling techniques and the sample need to be selected, which leads to this process requiring a recheck on whether the sample represents the population. **The Non-Probability sampling** or non-random sampling is applicable for the exploratory stage of research such as, for a pilot survey (Saunders et al., 2009). Therefore, this research used Probability sampling for the final phase and non-probability sampling in the pilot phase. In the next section, explanations about the sampling techniques are provided.

3.7.6.6 Sampling Technique

The techniques of Probability types that are available are: Simple random, Systematic, Stratified random, Cluster, and multi stage. The techniques from Non-probability types are: Quota, Purposive, Snowball, Self-selection, and Convenience (Saunders et al., 2009).

Probability sampling techniques

Simple Random Sampling is the selection of a sample from the sampling frame using random numbers from sources such as random tables or using random function software. This technique allows researchers to select a sample without bias. Additionally, a selected sample can represent the overall population. A simple random sampling technique is best used when the sampling frame can be obtained from the entire population. However, this technique is not suitable for large geographical area population (Saunders et al., 2009). Since this research study cannot obtain the list of entire 50+ adults in the north of London there for this sampling type is not applicable.

Multi-stage or Multi-Stage Cluster Sampling was used in this study. This technique is normally used to overcome problems associated with a geographically dispersed population when face-to-face contact is requested or when it is expensive and time consuming to construct a sampling frame for a large geographical area. This research examined north London as the research site, where there is a large, diverse population. This means that the sample frame cannot acquire individual 50+ adults' instances. Therefore, the sample frame for this research was considered to be a list of districts in north London. Due to the limitation of accessing the lists of all individual cases, and the large area; the Cluster Sampling technique was considered to be the main sampling technique for the final phase.

This research study also applied the non-probability sampling techniques for Content Validity, the pre and Pilot test. For Content Validity and the Pre-Test, Purposive Sampling was selected because the researcher wanted to select particular persons for these phases. For the pilot phase, both the snowball and Self-selection sampling approaches were used. After the pre-test and the questionnaire improved, the link to the questionnaire was posted to the online social network, Facebook. To increase the numbers, the link to the online questionnaire was sent as an email to friends and family.

3.7.6.7 Sample Process

For content Validity which used purposive sampling, the researcher selected 12 panelists, where the majority were academics. Therefore, for the Pre-Test, the panelists were largely from industry. In all three phases, the researcher used his personal connections.

Sampling process for final phase

In the previous section, it was explained that the Cluster Sampling technique was used in the final phase. Saunders et al (2009) suggested that such sampling can be undertaken in three stages. The first stage is choosing the cluster grouping for the sampling frame. The second stage is the identification, which involves numbering each of the clusters with a unique number. The third stage is to use a simple random technique to select the sample.

With regards to this research, initially, the seven areas of the London borough were further divided in districts using the map as the main reference (Geographers' A-Z Map Company, 2008). A list of 164 districts was created using Microsoft Excel 2010 and used as the sample frame (shown in appendix 5-6). The next step involved using a simple random technique in order to select the sample from the sampling frame. In this case, sampling involved naming the area, and not each individual case. Therefore, the sampling size needed to be defined.

	Margin of error			
Population	**5%**	**3%**	**2%**	**1%**
50	44	48	49	50
100	79	91	96	99
150	108	132	141	148
200	132	168	185	196
250	151	203	226	244
300	168	234	267	291
400	196	291	343	384
500	217	340	414	475
750	254	440	571	696
1 000	278	516	706	906
2 000	322	696	1091	1655
5 000	357	879	1622	3288
10 000	370	964	1936	4899
100 000	383	1056	2345	8762
1 000 000	384	1066	2395	9513
10 000 000	384	1067	2400	9595

Figure 3.5 Sample sizes for different sizes of population at a 95 confidence level, source: (Saunders et al., 2009)

For the sample size, Table 3.3 was used as a guideline. For the population of the 164 districts, 108 was selected for an estimated 5% margin of error at a 95 % confidence level. The random selection of the 108 districts was completed using Microsoft Excel, where the function RANDBETWEEN (0,163) was used to generate the random numbers shown in Table 3.4.

Table 3.4 The random numbers from MS Excel							
120	68	152	40	64	24	139	52
7	110	89	23	38	139	110	15
63	31	104	48	56	111	26	89

132	46	131	113	68	93	39	55
140	89	84	17	50	16	131	110
86	57	88	24	123	162	48	161
78	54	136	19	44	140	85	34
88	2	152	127	128	20	109	14
153	33	87	69	110	129	47	151
31	53	136	128	97	48	4	86
72	17	121	115	151	65	125	92
73	143	28	96	138	154	152	19
144	22	99	58	55	141	83	106
107	147	81	27	110	81	72	110
112	150	121	151	19	155	71	148
105	127	7	50	39	151	131	35
98	46	27	59	148	61	76	78
108	28	68	147	6	27	12	159
146	73	62	106	114	70	41	66
13	161	62	108	124	14	107	48

The numbers in Table 3.4 need to match the assigned number, where the selected areas (shown in appendix 5-6) were highlighted. As explained earlier, invitation letters for participants were printed and distributed to the selected area (Invitation letter shown in appendix 5-7).

Please note that the 108 areas used for Cluster Sampling were essential for selecting the areas that the invitation letters were distributed. In Table 3.3, it can be learnt that the population of 50+ adults in the north of London was 2,080,565, which is the research population. From figure 3.4, it can be seen that for population numbers up to ten million, 384 samples can provide a 95 confidence level with a 5% margin of error. For the same population number, 1067 samples can provide a 95 confidence level with 3% margin of error (Saunders et al., 2009). Therefore, the target sample of individual cases was established in 1000. After the data collection, 1030 completed questionnaires were received, but 984 questionnaires were usable. Further details on the final questionnaire can be found in chapter 5.

3.7.6.8 Questionnaire Distribution Method

For final phase, after the research site selection, an estimated 20,000 cover letter were printed. The letters were distributed by hand.

3.7.6.9 Sampling Methods Summary

Having explained the sampling process, terms that are of importance and the various techniques for sampling, Table 3.5 provides a summary of the sampling process utilized for this research.

Table 3.5 Selected Sample Methods and Sizes

Phases	Sampling Technique	Target Sample	Actual Sample	Sampling Frame
Content Validity	Purposive Sampling	12	12	England
Pre-Test	Purposive Sampling	12	12	England
Pilot Test	Snowball and Self-Selection Sampling	200	201	UK
Final Survey	Cluster Sampling	1000	1030 (984 usable)	North London

From Table 3.5 it can be learnt that the target samples and actual size samples of each phase are satisfied and the actual response number was greater than the recommended figures (Saunders et al., 2009; Lawshe, 1975; Dillman, 2011). For the content validity and Pre-Test phases, some respondents were located in Hertfordshire or London. In those instances, the Sampling frame was England. For the pilot phase, which used a Self-Selection Sampling process, the link was posted on the Internet, which allowed individuals from across the UK to access the link. The pilot phase also utilised the sampling frame of the UK.

3.7.7 Analysis Methods

Once the data was collected, analysis was required, which is reliant on the research questions and objectives. Considering the measurement in research, Jupp (2006) concluded that there are four ways of measurement which are 1) nominal- using numbers to represent categories such as 1= men; 2= women, 2) ordinal – ranking of the categories such as scale 1-7 from strongly disagree to strongly agree, 3) interval such as number of year, and 4) ratio such as income scale. Jupp also suggested that nominal and ordinal measurement is non-metric while interval and ratio measurement are metric. “Parametric statistics assume that the data are metric; to use such statistics on non-metric statistics are incorrect” (Jupp, 2006 p 168). As addressed in question type section, the rating scale questions (Likert-style) were applied for capture older adults’ opinion or attitude of using smartphones, please also refer to chapter 4 pilot where the construct questions were developed. From this point of view, the data that used this research to test the conceptual model are **non-parametric**.

The normality test is the test for normally distributed (or bell-shaped). "In statistical analysis, parametric tests can be done only the data is in normally distributed" (Jupp, 2006 p 214) However, since this research applied **non-parametric tests,** the normality test is not requisite.

From the above guideline the following section will discusses the available analysis methods and the method selected for this research. A point to note is that the data analysis techniques can be grouped as first and second generations.

3.7.7.1 First Generation Data Analysis Techniques

The first generation data analysis techniques include linear regression, LOGIT, ANOVA and MANOVA. These techniques allow researchers to analyse the item loadings on the latent variables and the linkage of the independent variables (Gefen et al., 2000). *Please note that the justification of this first generation data analysis techniques can be found at the end of this section.*

Regression Analysis uses simple and multiple predictions to predict Y from X values (Cooper & Schindler, 2013). The Y value can be termed as the outcome, dependent or endogenous variable. Y is dependent on X that is referred to as the predictor, independent, explanatory or exogenous variable (Gefen et al., 2000; Urbach & Ahlemann, 2010). Regression analysis is the process of calculating a regression coefficient and regression equation using one independent variable and one dependent variable (Saunders et al., 2009). The analysis uses regression equations to predict the values of dependent variables. The equation that is used are examples such as a straight line, parabola, normal equation and ordinary least squares. The regression coefficient is the result from an analysis that shows the strength of the relationship between a dependent variable and independent variable (Saunders et al., 2009).

Multiple Regression is a statistical tool used to develop a self-weighting estimating equation that predicts values for a dependent variable from the values of independent variables, controls confounding variables to better evaluate the contribution of other variables, tests and explains a causal theory (Cooper & Schindler, 2013). Multiple regression analysis is the process of calculating a coefficient of multiple determination and regression equations using more than two independent variables and one dependent variable (Saunders et al., 2009). Multivariate analysis is a statistical technique that focuses upon and emphasises the structure of simultaneous relationships among three or more phenomena (Cooper & Schindler, 2013).

Analysis of Variance (ANOVA) is a statistical technique that estimates the probability that the values of a data variable for three or more independent samples or groups are different. This test assesses the probability of any difference between the groups occurring by chance alone (Saunders et al., 2009).

Multi-variance Analysis of Variance (MANOVA) is a statistical technique that can be implemented to study the relationship between several categorical independent variables and two or more metric dependent variables. ANOVA can analyse only dependent variables while MANOVA can cope with multiple dependent variables. This technique is often used to test differences among related samples (Cooper & Schindler, 2013).

LOGIT (Log-odds) and **PROBIT** (Probability + Unit) is also a first-generation regression technique, which is non-linear regression in nature. In this case, a dependent variable can be only two values or dichotomous (binary) variables such as yes or no, like or don't like, and enrol or not enrol (William J. Wales et al., 2013). The model is used more in the Economics discipline (Ai & Norton, 2003). Note: Although both PROBIT and LOGIT have different formulas, they are similar (Gunderson, 1974). Gunderson (1974) suggested that a linear probability function is enough for testing hypotheses. However, PROBIT and LOGIT are more accurate. The PROBIT and LOGIT models have been used more than 10% in Strategic Management Journal in 1990s and 2000s (Shook et al., 2003).

PROBIT and LOGIT can be employed using software packages such as, STATA, NLOGIT, SPSS and EViews (Greene, 2010). **This research considered using PROBIT with STATA in chapter 6 to analyse the external data when comparing the collected data for validation purposes.** This method follows Ai and Norton (2003).

The first generation techniques offers "limited modeling capabilities, particularly in terms of causal modeling" (Lowry & Gaskin, 2014: 123). In contrast, the second generation that will be explained in the following section, "offer extensive, scalable and flexible causal-modeling capability" (Lowry & Gaskin, 2014: 123). The secondary generation technique also appropriate with complex causal modeling that was used in behavioural research (Lowry & Gaskin, 2014). Since this is considered to be a behavioural research the first generation technique is considered less appropriate for this research.

3.7.7.2 Second Generation Data Analysis Techniques

The second generation technique is Structural Equation Modelling (SEM). This technique allows researchers to explore a set of interrelated research questions in a single, systematic and comprehensive analysis by modelling the relationships among multiple independent and dependent constructs simultaneously (Gefen et al., 2000).

Structural Equation Modelling (SEM)

SEM has been used in literature since the 1980s (Hair et al., 2011), but in the last decade, SEM have been widely used in IS research studies. SEM can be can be categorised into Covariance-based SEM (CB-SEM) and Partial least squares SEM (PLS-SEM). PLS-SEM is a causal modelling approach aimed at explaining the variance of the dependent latent constructs. On the other hand, CB-SEM focuses on reproducing the theoretical covariance matrix without explaining the variances (Hair et al., 2011).

Several researchers in IS have used CB-SEM and PLS-SEM for testing their research models in the last decade. Urbach and Ahlemann (2010) examined 728 articles from two IS Journals, Information Systems Research (ISR) and Management Information System Quarterly (MISQ), between 1994 and 2008 where their findings revealed that 19.78% of the articles used SEM. In more details 10.71% of the 728 articles applied PLS-SEM while 9.07% used CB-SEM and the numbers of articles utilising SEM have been widely accepted by researchers.

There are several advantages of PLS-SEM. Firstly, PLS-SEM is appropriate for prediction. Secondly, it requires a smaller sample size in comparison to other analysis methods. Thirdly, PLS-SEM can be used to explain complex structural equation models with a large number of constructs. Fourthly, PLS-SEM is better for theory development. And finally, PLS-SEM can cope with both reflective and formative constructs (Urbach & Ahlemann, 2010). Hair et al (2011) also suggested that “PLS-SEM does not presume that the data are normally distributed” Thus, PLS applies non-parametric bootstrapping. Consequently, PLS-SEM can be used with non-parametric data. From the above benefits, this research selected PLS-SEM as the main technique for analyse data in the final phase.

Please note Linear regression, ANOVA, MANOVA, variance, covariance will not be used in this research because the PLS-SEM will provide comprehensive results and enough for testing the hypothesis. Moreover, the main research study, the study of consumer acceptance and use of Information technology from Venkatesh et al (2012) was applied SEM-PLS.

Having selected the analysis technique, the next section provides the explanations and justification for the software that support PLS-SEM.

Software Used with SEM

There are several software packages that can be utilised for SEM such as, AMOS from SPSS, WebSEM, EQS, LISREL, PLS-GUI, STATA SEM and SmartPLS. Nevertheless, for this research, the chosen software was one that supports PLS-SEM, PLS-Graph (Chin, 2001), VisualPLS (Fu, 2006), AMOS from SPSS and SmartPLS (Ringle et al., 2005). They are popular due to their provision of diagrams in the form of graphs.

3.7.7.3 Reliability

Reliability refers to the extent to which the data collection techniques or analysis process will yield consistent findings (M Saunders et al., 2009). Reliability is a characteristic of measurement concerned with accuracy, precision, and consistency and is a necessary, but not sufficient condition for validity. Therefore, if a measure is unreliable, it cannot be valid (Cooper & Schindler, 2013).

There are three types of reliability estimates available. These are, Test-Retest, Parallel Forms and Split-Half, KR20 or Cronbach's Alpha. The details of reliability for each type, can be found in Table 3.6.

Table 3.6 Summary of Reliability Estimates Source: Cooper & Schindler, 2013 pp 260

Type	Coefficient	What is Measured	Methods
Test-Retest	Stability	Reliability of a test or instrument inferred from examinee scores; same test is administered twice to the same subjects over an interval of less than six months	Correlation
Parallel Forms	Equivalence	Degree to which alternative forms of the same measure produce same or similar results; administered simultaneously or with a delay. Interrater estimates of the similarity of judges' observations or scores.	Correlation
Split-Half, KR20, Cronbach's Alpha	Internal Consistency	Degree to which Instrument items are homogenous and reflect the same underling construct(s)	Specialized correlational formulas

For this research, the Split–Half type of Reliability was selected as a reliability estimation where the process applies only one administration of a test to assess the internal consistency among the collected data (Cooper & Schindler, 2013).

Cronbach's Alpha is a classic tool that measures internal consistency in order to show how well different research items complement each other when measuring the same concept and from a single scale (Jupp, 2006). The interpretation of Cronbach's Alpha value can be found in Table 3.7. A data value will be considered as homogenous if an index is larger than 0.7 for confirmatory studies (Vinzi et al., 2010).

Table 3.7 Interpretation of Cronbach's Alpha (α)

Cronbach's Alpha (α)	Internal Consistency

More than 0.9	Excellent
0.8 to 0.9	Good
0.7 to 0.8	Acceptable
Lower than 0.5	Unacceptable

However, when applying SEM-PLS a Cronbach alpha can be viewed as a traditional tool because the Cronbach alpha assumes that all the indicators are equally reliable (Hair et al., 2011). Therefore, an appropriate tool such as **Composite Reliability** (CR) is used for such a PLS study. Similar to Cronbach alpha, the data can be considered as homogeneous, if a CR is larger than 0.7 (Vinzi et al., 2010).

An Indicator Reliability can be examined using outer loading where all the loadings should more than 0.7 in order to ensure reliability (Vinzi et al., 2010). However, weak loading can be found frequently in empirical research, particularly when new developed frameworks are used. In this case, when the indicators with their loading are lower than 0.4, they need to be removed from the models (Hulland, 1999).

Low loading can occur due to poorly worded questions in a questionnaire (item), an inappropriate item, and improper transfer of an item from one context to another (Hulland, 1999). The summary of Reliability checks can be found in Table 3.8.

Table 3.8 Reliability Check from PLS-SEM technique (Wong, 2013)

Reliability	SmartPLS	Threshold
Indicator Reliability	Outer loading numbers	Square each of the outer loadings to find the indicator reliability value 0.7 or higher is preferred. If it is an exploratory research, 0.4 or higher is acceptable (Hulland, 1999).
Internal Consistency Reliability	Reliability number, Composite reliability	Composite reliability is 0.7 or Higher. If it is an exploratory research, 0.6 or higher is acceptable (Bagozzi & Yi, 1988).

In SmartPLS, an overview report is automatically generated, where the composite reliability and Cronbach Alpha scores can be found in the report (Lowry & Gaskin, 2014). The Indicator Reliability, outer loading can be found under the Outer Loading report in SmartPLS following the PLS calculation.

3.7.7.4 Validity in PLS-SEM Technique

When determining validity, PLS-SEM provides several methods for evaluating validity. Convergent Validity and Discriminant Validity are two main important validation measures in PLS-SEM that lead to Construct Validity.

Construct Validity is the degree to which a research instrument is able to provide evidence based on the theory (Cooper & Schindler, 2013), or the constructs that researchers aim to measure (Saunders et al., 2009). In other words, this validation examines whether the questions represent the factors in a conceptual framework. Schrauf and Navarro (2005) suggest that it is possible to use or adopt existing scales or the scales that have been used in previous research studies. Using this as support, this research also adopted some questions from previous research (Venkatesh, Morris, Hall, et al., 2003; Venkatesh et al., 2012). To validate the questions for this research, and to form the constructs, convergent and discriminant validity were determined.

Convergent validity is defined as “the degree to which scores on one scale correlate with scores on other scales designed to assess the same construct” (Cooper & Schindler, 2013:259). Measures of convergent validity are important to ensure that variations in one indicator are consistent with variations in the other reflective indicators of the same latent construct (Lowry & Gaskin, 2014). In short, convergent validity presents how well the questions from a factor linked.

In the PLS-SEM technique, Convergent validity can be evaluated using the **Average Variance Extracted (AVE)**. The AVE values must be greater than 0.5 for convergent validity to be acceptable. This means that the latent variables explain more than half of the indicators. In the software SmartPLS, the data to demonstrate the convergent validity are found in the outer loadings section of the default report following Bootstrapping. The low t-values of each items show a lack of convergent validity on the factor.

Please note that Bootstrapping is “a way of computing sampling error and generating t-values by using the available data as a distribution” (Lowry & Gaskin, 2014:131).

Discriminant validity is defined as “the degree to which scores on a scale do not correlate with scores from scores designed to measure different constructs” (Cooper & Schindler, 2013:259). Discriminant validity indicates the extent to which a given construct is different to other latent constructs (Vinzi et al., 2010).

Fornell and Larcker (1981) recommended that the square root of AVE of each latent variable should be greater than the correlations amongst the latent variables. The other method to determine Discriminant validity is an indicator's loading that should be higher than all of its cross loadings (Hair et al., 2011).

Table 3.9 Validity Check from PLS-SEM technique Source: Wong, 2013

Validity	SmartPLS	Threshold
Convergent validity	AVE number	AVE is 0.5 or Higher (Bagozzi & Yi, 1988)
Discriminant validity	AVE number and Latent Variable Correlations	The square root of AVE of each latent variable should be greater than the correlations among the latent variables (Fornell & Larcker, 1981)

In SmartPLS, the Latent Variable Correlation can be found in a default report where a new table with the square root of AVE is manually created and written in bold on the diagonal of the table. The Latent Variable Correlation is placed in the lower, left triangle of the table before the comparison (Wong, 2013).

For this research, the factor analysis that leads to ensuring that the validity of the research model was determined by pursuing both the validations that have been performed in chapters 4 and 5. Further verification that the appropriate results had been obtained was determined by referring to the guidelines from Hair et al (2011), Wong (2013) and the SmartPLS official website.

3.8 Chapter Summary

In chapter 2 a conceptual model was developed to investigate smartphone adoption, use and diffusion within older adults. To ensure that the framework is applicable in practice, a research method and methodology were required which are explained and discussed in this chapter 3. To provide content of importance and to provide a structure to this chapter, the research onion developed by Saunders et al., (2009) was referred to. From this chapter, it can be learnt that the researcher believes in Positivism and applied a deductive and quantitative approach along with a Survey Strategy. Due to the survey strategy, an online, internet based questionnaire located at the website Surveymonkey, structured interviews and paper questionnaires were employed. In terms of data, both primary and secondary data were utilised. Prior to commencing the questionnaire, an invitation and Cover Letters were initially provided, which if the respondents agreed to the content, led to the start of the questionnaire. Following the dissemination of the questionnaire, Instrument and Content Validity tests were performed. The chapter also provided details about the research site, sample size sampling type and sampling technique. For the analysis Structured Equation Modelling (SEM-PLS) with SmartPLS were used where reasoning for using it was provided, and finally, a summary of the chapter was provided. To inform readers, the next chapter explains and discusses how the pilot test was conducted.

Chapter 4 Pilot Test & Final Survey Development

4.1 Introduction

Having provided reasons and explanations of the research methodology pursued by this research, this chapter aims to provide details of how the survey instrument used for the pilot test was developed and the outcomes of the instrument's applications. As a summary, section 4.3, explains the reasoning for the construct measurement questions and how they were developed. Section 4.4 explains how the content validation and pre-test occurred, which is then followed by descriptions of the data collection process for the pilot, the sampling method utilszed, the questionnaire used for the pilot and how the questionnaire was disseminated in section 4.5. Section 4.6 presents the findings of the collated data, which is followed by a discussion of the pilot's results and section 4.9 provides a discussion of the limitations and further improvements to the pilot survey. Finally, section 4.10 provides the summary and conclusions to the chapter.

4.2 The Pilot Study

As mentioned in chapter 3, a pilot test is also vital to the research process. In this section, more details of the pilot with regards to this research are provided.

4.2.1 Aims of the Pilot test

The recommended purpose of a pilot test is to test a questionnaire's wording, sequencing and layout, gaining familiarity of the sample groups, testing response rates and testing the analysis processes (Ticehurst & Veal, 2000). Therefore, the aims of this research's pilot test are as follows.

1. To examine the questions in the questionnaire.
2. For data collection, analysis and coding.
3. The pilot will be evaluated to determine the final phase of this research.
4. To gain preliminary results for smartphone adoption and usage and to examine the construct variables.
5. To identify the constructs that are statically significant and lead to an adjustment of the research framework.

6. To explore whether 50 years old and above adults have different adoption factors for the younger generation.

Before conducting the pilot test, a survey questionnaire instrument was required as a tool to gather the necessary data. An explanation of how the pilot survey was developed is described in the following section.

4.2.2 Pilot Survey Questionnaire Development

"A pilot study is a small-scale research project that collects data from respondents similar to those that will be used in the full study (Zikmund et al. 2009 p65)". Therefore, the pilot was developed for this research study as follows.

1. To design questions and for the survey layout, including construct measurement questions;
2. To validate the pilot questionnaire;
3. To design the questionnaire's distribution method;
4. To collect the pilot data;
5. To analyse the collected data;
6. To present the results from the analysis; and
7. To provide feedback to improve the research method, the conceptual framework and the final questionnaire.

Consequently, the next section will describe how the construct measurements were developed for the pilot.

4.3 Development of Construct Measurement Questions in the Pilot

The proposed conceptual framework (MOSA) as shown in chapter 2 assumed that the dependent variable-usage intention-of smartphone adoption is influenced by Observability, Compatibility, Social influence, Facilitating Conditions, Performance Expectancy, Effort Expectancy, and Perceived Enjoyment. Moreover, the dependent variable Actual use is influenced by the usage intention variable.

The construct measurement questions were developed by adopting questions used in other research studies, and developing own questions (Saunders et al., 2009). This pilot process was applied by referring to previous studies that found of 42% of 143 articles obtained from five IS publications: Information Systems Research, MIS Quarterly, Journal of Management Information Systems, Information & Management, and, Management Science the previous instrument was utilised (Boudreau et al, 2001).

By adapting previous research studies questions to this research study, the constructed questions amounted to 34 questions where the questions sought respondents assistance with rating the statements using a five-point scale, 1 is strongly disagree and 5 is strongly agree. The questions that were formed for this research are shown below together with the reference that they were taken from. Please refer to Appendix 4-1 for original construct measures.

Intention to use / adapt (IN)

1. I intend to use a smartphone as much as possible (Venkatesh et al., 2012).
2. I intend to continue using a smartphone in the future (Venkatesh et al., 2012).
3. Whenever possible, I intend to use a smartphone in my job (Park & Chen, 2007).
4. I intend to increase my use of a smartphone in the future (Park & Chen, 2007).

Social Influence (SOC)

1. People important to me think I should use a smartphone. (For example, friends and family) (Shin, 2007).
2. People who influence my behaviour think that I should use a smartphone (Venkatesh et al., 2012).
3. It is expected that people like me use smartphones. (For example, similar age or position people) (Shin, 2007).
4. I want to use a smartphone because my friends do so (Verkasalo et al., 2010).

Observability (OB)

1. I have had a lot of opportunity to see smartphones being used (Park & Chen, 2007).
2. It is easy for me to observe others using smartphones. (For example, I saw my friends use smartphones) (Park & Chen, 2007).

Compatibility (COM)

1. I believe that using the smartphone is suitable for me (Koenig-Lewis et al., 2010).
2. I believe that using the smartphone will fit my lifestyle (Koenig-Lewis et al., 2010).
3. I think that using the smartphone fits well with the way I like to work (Park & Chen, 2007).
4. Using the smartphone fits into my work style (Park & Chen, 2007).

Facilitating Condition (FC)

1. I have the resources necessary to use the smartphone. (Venkatesh et al., 2012).
2. I have the knowledge necessary to use the smartphone (Venkatesh et al., 2012).
3. The operation costs of a smartphone do not prevent the use of it (such as price of smartphone or monthly fee) (Qurashi, 2012).
4. I have a person available to assist me in using my smartphone (Gu et al., 2009).

Performance Expectancy (PE)

1. I feel a smartphone is useful (Zhou et al., 2010).
2. Using a smartphone enables me to finish tasks more quickly (Zhou et al., 2010).
3. Using a smartphone increases my productivity (Venkatesh et al., 2012).

Effort Expectancy (EE)

1. I find that using the smartphone is easy (Zhou et al., 2010).
2. Learning how to use a smartphone is easy for me (Venkatesh et al., 2012).

Enjoyment (ENJ)

1. I find a smartphone fun (I had fun using a smartphone) (Shin, 2007).
2. I think it is fun to use a smartphone (Verkasalo et al., 2010).

In order to measure the actual use of smartphones, this research followed Venkatesh (2012) where the use aspect was tested by seeking the frequency of use ranging in time from never to many times per day. The list was adapted from Thinkmobile by Google (2011) and through discussions with the supervisory team. The ranges used for usage were from 1 (never) to 5 (many times per day) for 9 of the smartphone's features. The scales were adopted from Venkatesh et al (2012) research findings on page 178. The list of the features that will be used to represent actual use (ACU) is provided below.

- ACU1 - Making a phone call
- ACU2 - SMS, text messaging
- ACU3 - E-mail
- ACU4 - Browsing- surfing website(s)
- ACU5 - Downloading applications (app)
- ACU6 - Using social networks such as, Facebook, twitter, LinkedIn, Foursquare, Google Plus
- ACU7 - Using voice over internet protocol (VoIP) such as, Facetime, Skype, Oovoo, Google Talk, Viber, Fring
- ACU8 - Taking a photo- photography
- ACU9 - Playing games

The list above represents ACU1 to ACU9 and includes features that silver surfers are expected to use. Questions regarding smartphone usage and other supported questions will be explained in the following section.

4.4 Developing Support Questions for the Pilot Study

Having explained the development of the construct measurement questions, this section will now explain the development of the other supported questions.

In this pilot, the researcher divided the participants into two groups: those using smartphones and those who do not. Due to this two path system, the questionnaire was designed to take two paths. At the start of the questionnaire, both groups of participants were asked the same questions about their demographics, state of health and ailments associated with ageing. Following these questions, the questionnaire was then divided into those using smartphones and those not using smartphones. Note: This research's questionnaire included questions on health and ailments because this research emphasises older adults. From previous research studies in literature review chapter, it was found that older adults do suffer from some form of health ailment, which led to the inclusion of such questions. The layout of the pilot survey is shown in Figure 4.1 below.

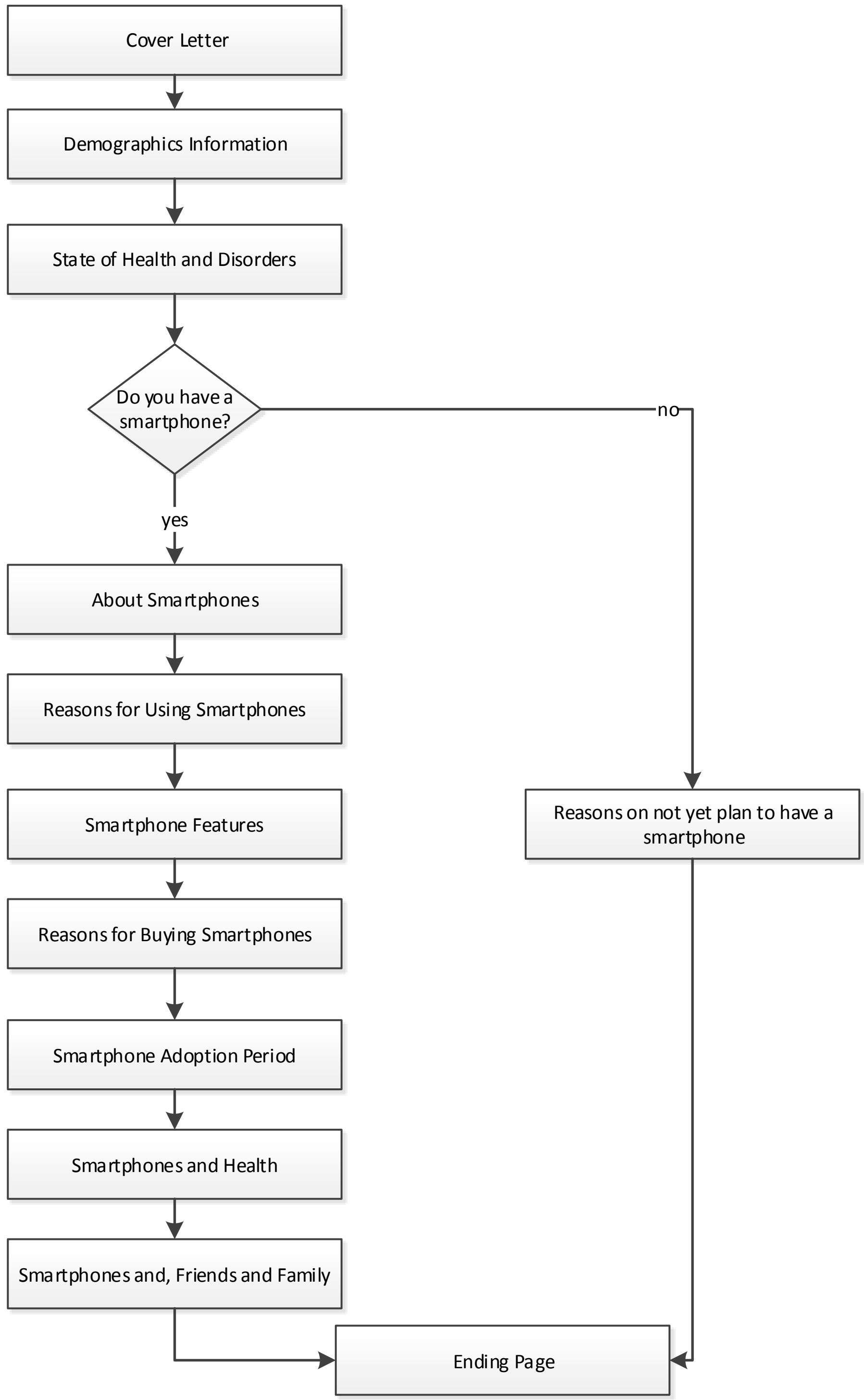

Figure 4.1 Pilot questionnaire Layout

Having provided a brief summary of the layout of the questionnaire, this section will provide more details of the survey. For full details and an example of the survey, please refer to appendix 5-1 section.

4.4.1 The cover Letter was the first part of the questionnaire that contained an introduction to the researcher and the university, the purpose of the research, the ethics number, the instructions for completing the questionnaire, the duration, the confidentiality of this research, use of the results and finally, the contact details (Saunders et al., 2009). These details were required by the researcher's university, and a means of informing the respondents about the questionnaire's details.

4.4.2 This was followed by the Demographic Information section that consisted of seven questions, which sought information about the participants' age, gender, ethnicity, educational background, the current location, employment status, and occupation. This data was vital to allow the researcher to compare the responses from the sub-groups. Information from the demographic factors were also important as they could allow a review of some additional factors besides those determined from the conceptual framework that could, in turn, influence smartphone adoption and usage.

As the demographic group being addressed in this research was the older adults, a section sought self-assessed information from the participants about their health and any disorders. The options that were provided were excellent, good and poor. Participants were also asked questions about any ailments that they suffer from as a result of the ageing process.

4.4.3 The next section was Using Smartphones where the initial question provided explanations about the nature of a smartphone. Thereafter, participants were asked to choose between them being users, or not being users of smartphones. For those who were users, the path leading to questions about the uses of smartphones was selected. For those who were non-users, a diverse section seeking information about the reasons for not using a smartphone were sought.

4.4.4 Reasons for not Using Smartphones

This section was applicable to respondents who did not have smartphones where options for not using a smartphone were provided. The options that were utilised included, the cost of using a smartphone, use in terms of the design of the smartphones; for example, maybe feeling uncomfortable when using smartphones, the small screens of smartphones and keyboards; lacking knowledge, and the lifestyle of an individual. Moreover, this question provided an option box so that respondents could supply their other reasons. This question expected to capture the reasons on why older people don't use smartphones and this data was used in the discussion chapter.

4.4.5 About The Smartphones

The section began asking respondents about the durations that they had a smartphone for, followed by questions such as: the smartphone brand, the smartphone network provider, and the cost for using the smartphone. In essence, this section allowed the researcher to provide a review of the current smartphone situation in the UK. Finally, the question regarding the monthly cost for using smartphones was used to support the hypothesis: the Facilitating conditions for using smartphones.

4.4.6 The reason for Using Smartphones was the core section used when determining the smartphones adoption, where this section also presented the construct measurement questions.

4.4.7 Smartphone's Features

This section was included to satisfy the aim of this research on determining how older adults are using smartphones; in this case, the smartphones features. The smartphone features were also gathered from previous research studies and computer trade magazines such as, PC Mag (2012) as explained in chapter 2. After gathering the smartphones features data from all sources, the list was simplified by the research team, which led to the inclusion of smartphone features such as, making a phone call, text messaging, e-mailing, browsing, downloading applications, mapping, online shopping, online banking, reading news, social media, instant messenger, taking a photo, filming a video, playing online games, using for health monitoring and care, using for transportation and travel, and use for contacting government authorities. To ensure some focus to the question, participants were asked to select one or more options.

The next question in this section regarded the usage frequency of some smartphone features as described in the Development of Construct Measurement Questions section in this chapter where the purpose of the questions was to measure the actual smartphones use.

4.4.8 To understand the reasons for the older adult's purchases of a smartphone, the section Reasons to buy smartphones was formed. Answers included smartphone appearance, brand, price, operating systems, screen size, screen resolution, weight, battery life, size of memory, and the numbers of applications available to download. This question was pertinent for collating data that informed researchers about the reasons for purchasing smartphones.

The next question in this section was about the communication channel that respondents used to gather knowledge and information from, about their smartphones. The provided options were classics such as, word of mouth provided by friend and family; the media – TV, radio, newspapers, magazines; online social networks, and professional technology review websites. This question was pertinent to understand the communication channels that older adults used prior to adopting new technology. For different stakeholders this is important as it identifies efficient ways of promoting communication with older adults and encouraging them to use the new technology.

To understand the duration that it takes older adults to get comfortable or familiar with the novel devices (smartphones), a question regarding the **4.4.9 Smartphone adoption period was asked.** The question provided choices in the form of a time period that was, less than a day, one day to one week, one week totwo2 weeks, two weeks to one months, one month to three months, and more than three months.

4.4.10 Smartphones and Health

In chapter 2 it was mentioned that as ageing occurs, health problems are also apparent, which led to the inclusion of two questions that examined smartphones and health. The first question asked whether a smartphone assists a respondent with well-being or health, where a multiple choice option in the form of yes, or no was provided. If the respondent replied that there was an impact-yes, then the participant/s proceeded to the next question, where the emphasis was on how respondent/s used the smartphone to improve their health and well-being. The provided options were choices in the form of: seeking health related information, managing exercise, managing with sleep, weight management, monitoring blood pressure and helping in controlling smoking. An option in the form of ‘other’ was provided where respondents could provide their own information if required.

4.4.11 Smartphones and friends and family

Smartphones are viewed to be beneficial in connecting older adults with friends and family; thereby reducing problems such as, social isolation. By doing so, mental ailments that could also affect health problems could be reduced. For this reason a question sought to ascertain whether smartphones helped participants in connecting with their friends and family, which was followed by a question about how the smartphone helped. Options for this included, making phone calls to friend and family, sharing photos and videos, using instant messenger, video telephony, using social media to follow friends and family, and playing games with friends and family.

Finally, the questionnaire had a page that thanked participants for spending their valuable time on completing the questionnaire.

Having described the questionnaire, the next step was to analyse the findings, which was possible using content validation. This process and the results are provided in the next section.

4.5 Content Validation

Following the pilot questionnaire's implementation, the next step was to provide content validation. Content validity is the extent to which measurement scales provide adequate coverage of the investigative questions (Cooper & Schindler, 2013). Bell (2005) recommends this test in order to discover issues that a developer could miss, such as the time taken for a participant to complete the questionnaire; the instructions clarity; layout clarity and attractiveness; absence of any topics; and any other comments.

This research also followed the suggestions from Lawshe (1975) for using a Content Validity Radio (CVR). The validation form was initially provided to 12 panelists who were mostly from academia (the research team) and another eight individuals from various diverse backgrounds. The validation forms were largely delivered and collected from the panel members (Results in Appendix 3-2).

The feedback received sought altering some technical terms, punctuation, spelling mistakes, and removing questions on income. Moreover, examples on unclear or technical words such as media, review websites, social media, or online magazine need to be provided as much as possible to deliver a better understanding of the questions.

Content Validity Radios (CVR) were also the results from Content Validations that can be found in the appendix 3-2. Lawshe (1975) suggested that the questions with CVR lower than 0.56 need to be removed. However, after consulting with the research team, some questions with the low CVR need to be kept to follow the previous research study. Moreover, the research team expected different results from content validation. Therefore, it is worthy to keep those questions.

<table>
<tr><th colspan="3">Table 4.1 Content Validation – Expert Panel</th></tr>
<tr><td></td><td>Participant</td><td>Area of Expertise</td></tr>
<tr><td rowspan="4">Academic Researcher related to IS or older people</td><td>A</td><td>Researcher of IS</td></tr>
<tr><td>B</td><td>Researcher of IS</td></tr>
<tr><td>C</td><td>Researcher of IS</td></tr>
<tr><td>D</td><td>Researcher of old people and technology</td></tr>
<tr><td rowspan="2">Other Academia reviewers or related fields</td><td>E</td><td>Retired Lecturer on Engineering</td></tr>
<tr><td>F</td><td>Researcher on Engineering</td></tr>
</table>

	G	Researcher on Marketing
	H	Translator
	I	Master Degree Student on marketing
	J	Master Degree students on business
	K	Master Degree Student
	L	Graduated Student

After content validation, the pilot questionnaire was improved prior to the Pre-test phase. 12 panel members mostly from industry professional were helped in this phase as shown in Table 4.2 below.

Table 4.2 Survey Pretest Validation Panel		
	Participant	Area of Expertise
Academic Professionals	Dr. V	Lecturer on IS
	Dr. Ma	Lecturer on IT
Industry Professionals	Ms. Pi	Diplomatic officer (40+)
	Ms. Ta	Diplomatic officer (40+)
	Mr. Ti	Diplomatic officer, older adult (50+)
	Mr. Me	Older adults CEO (50+)
	Ms. Se	Business woman (40+)
	Mr. Hu	Older business owner (50+)
	Ms. Ro	Older adults Hair Dresser (50+)
	Ms. Fa	Accountant (40+)
	Ms. Na	Older Lady (60+)
	Mr. Ki	Very Old House Agent (65+)

In the Pre-test phase, it can be seen that the panel member selection was focused on adults and older adults. These would help in fine tuning the pilot survey, particularly in terms of wording in the questionnaire.

4.6 Pilot Data Collection

After completing the Content validation and Pre-test, the next step is to provide a sample for the pilot phase, which this section will explain and discuss.

4.6.1 Sampling and Sample Size

For the pilot, this research study applied non-probability, or non-random sampling, as this form of sampling is recommended by Saunders (2009) for an exploratory stage, which is the purpose of the pilot phase. Prior to utilising this method, both the snowball and Self-selection sampling methods were considered and used.

To emphasise the importance of this research which was focusing on older adults, the adoption gap needs to be illustrated. Therefore, this research selected all age groups as the target sample of the pilot phase. The results expected to show and confirm the adoption gap, the usage frequency, and the usage pattern. The results in the pilot will support rationality to focus the study on older adults in the final phase.

The United Kingdom was selected because, firstly, the numbers of smartphone used in the UK. The numbers were increased from 39% in 2012 to 61% in 2014. Secondly, the numbers of older adults, In the UK, currently more than 16.4% of the population is aged 65 years old and above and around 40% is older than 45 years old (Office for National Statistics, 2012a; The Telegraph, 2012). Moreover, the UK is a country that cares for the elderly. There were several organizations and associations that found for older adults such as Age UK, 50 connect, Alzheimer's society, the care directory, Ceartas Advocacy, and Citizens Online (Contact-the-elderly.org.uk, 2015). In terms of mobile technology, Ofcom (2013) reported the significant investment on telecommunication technology including 4G mobile broadband networks and superfast broadband. In additional, the world leaders mobile operators such as Vodafone by Vodafone Groups, O2 by Telefónica, and EE by Orange group (Gillet, 2014). In academic terms, the United Kingdom was selected as the research site following suggestions made by previous research studies from Venkatesh et al (2012) where Hong Kong was used, Carlsson et al (2006) used Finland, and Alkhunaizan and Love (2012) used Saudi Arabia. Therefore, this research selected UK as the research site for the pilot phase.

For a pilot sample size, Cooper and Schindler (1998) recommended that the size of a pilot test should be around 25 to 100 subjects, which was the reasoning that this study followed.

4.6.2 Online Questionnaire

In order to reach all the age groups and to provide a detailed overview of the UK, this research considered applying internet mediated questionnaires or an online survey. An online survey can be disseminated using two methods, which are by email or to provide links or to develop a website (Hewson et al., 2003). For the online questionnaire, four commercially and advanced forms of applications were considered, which were Qualtrics, Google Form, SurveyGizmo and Surveymonkey. Qualtrics is one of the best research tools with a trustworthy and reliable reputation and strong supporting team. However, the drawback is that use of the application involves a high subscription amount that large organizations are prepared to, and do pay; hence led to the dismissal of Qualtronics. The next choice was Google Form, which is very simple to use, but was not designed and developed to a level that the questions applied to this research study required. Next, SurveyGizmo was considered, but it was not easy to use and involves a trial period of free use that was limited to 14 days, which was not enough for the pilot duration; hence discounted.

Finally, the Surveymonkey website was viewed to be suitable as it provides important features needed for this pilot, which are Page and Question Logic. These features allow surveys to route respondents to particular questions, specific to the answers that are provided (SurveyMonkey, 2013). Surveymonkey also provides graphs and charts which are useful for illustrating the results. Finally, the website allows users to export the findings to a variety of formats including, Microsoft excel (Marra & Bogue, 2006). The format can be also be imported to several analytic programs such as, SPSS and SmartPLS. Further, Surveymonkey is amongst the oldest and pioneering of the online questionnaire providers, which meant that there is a reliability and trust, in turn, which has led to its popularity.

4.6.3 Pilot Questionnaire Distribution

Following a check of the questionnaire, which led to content validation and pre-test by 24 specialists including, university lecturers, postgraduate students (PhD and Master’s degree) students, older adult professionals and adult smartphone users, the month of November 2012 was spent on improving the questionnaire and ensuring that the questionnaire functioned as required. The final important review was completed in the middle of January 2013.

The online pilot questionnaire was distributed using two ways. Initially, a link to the questionnaire link was posted on at least three Facebook pages, which a majority of the Thai community who live in the UK use for transferring money and a wholesale jewellery company’s websites were used. The link was posted three times on the pages. The second way of dissemination was to send emails where the link was emailed to the network of the researcher that contained entrepreneurs, university officers, academics, translators and office workers. After sending the email to a number of people, their assistance in the form of forwarding an email link to the questionnaire was sought. The link was opened for three weeks and closed on 7 February 2013.

4.7 Pilot Findings

Following the survey link's closure, the data were reviewed using the Surveymonkey analysis tools. The data were divided into four groups, demographics and background, how respondents use smartphones, why they use smartphones and why they do not use it. The data on the reasons for using the smartphones was analysed. The next section presents the results of the pilot phase.

4.7.1 Demographics and Background

This pilot research followed the general questions on Demographic and background. The questions contain age, gender, education, area, employment and occupation. The data are shown in table 4.3. There were 65 responses from male and 139 response from the female, which is an overall 204 replies. In terms of the age groups, 86 (42.2%) were 20-29 year old, 60 (29.4%) were from 30-39 year old. 40-49 and 50-59 age groups were 22 (10.8%) and 21 (10.3%) respectively. That can be grouped at 174 (85.3%) were from younger than 50 years old and 30 (14.7%) were from 50 years old and above. The age groups illustrated that Higher Degree, 1st degree and BTEC/College Diploma educational qualifications dominated the results. In terms of location, it was found that over half of the replies were from the London area.

Table 4.3: The profile of Respondents: gender, age group, education and area. (n= 204)

Category		Number of respondents	Percentage (%)
Gender	Male	65	31.9
	Female	139	68.1
	Total	**204**	**100**
Age	Under 20	6	2.9
	20-29	86	42.2
	30-39	60	29.4
	40-49	22	10.8
	50-59	21	10.3
	60-69	5	2.5
	70-79	2	1.0
	80-89	0	0
	Over 90	2	1.0
	Total	**204**	**100**
Education	Higher Degree Postgraduate	92	46.0
	1st Degree	60	30.0
	HND/ HNC/ Teaching	3	1.5

	A-Level	11	5.5
	BTEC/ College Diploma	26	13.0
	GCSE/O Level	8	4.0
	Others	4	2.0
	Total	**204**	**100**
Area	Channel Islands	1	0.5
	East of England	4	2.0
	Isle of Man	1	0.5
	London	137	67.2
	Midlands East	2	1.0
	Midlands West	7	3.4
	North East and Cumbria	5	2.5
	North West of England	5	2.5
	Northern Ireland	1	0.5
	Scotland	2	1.0
	South East of England	12	5.9
	South of England	4	2.0
	South West of England	7	3.4
	Wales	4	2.0
	West of England	2	1.0
	Yorkshire and Lincolnshire	6	2.9
	Others	4	2.0
	Total	**204**	**100**

Table 4.4: The profile of Respondents: Employment status and occupation (n= 204)

Category		Number of respondents	Percentage (%)
Employment status	Pensioner 65+	7	3.4
	Retired (under 65 years old)	1	0.5
	Employed full time	53	26.0
	Employed part time	18	8.8
	Self-employed	22	10.8
	Entrepreneur	22	10.8
	Unemployed (for less than 6 months)	4	2.0

	Unemployed (for medical reasons)	0	0
	Unemployed (for more than 6 months)	6	2.9
	Student (part-time)	7	3.4
	Student (full-time)	64	31.4
	Total	**207**	**100**
Occupation	Academic/Teacher	6	2.9
	Agricultural/Forestry/Fishery	0	0.0
	Clerk	9	4.4
	Craft/Trade	4	2.0
	Freelance	19	9.3
	Legislator/Manager	18	8.8
	Plant/Machine Operator	2	1.0
	Services/Sales	40	19.6
	Students	74	36.3
	Others	32	15.7
	Total	**207**	**100**

In terms of occupations, it can be seen that the survey replies were received from both employed and working individuals and students as shown in Table 4.4. In terms of student numbers, it can be seen that 74 (34.8%) responses were from both full and part time students. In terms of part and full-time employment, there were 71 (34%) responses. There were an equal number of entrepreneurs and self-employed individuals at 22 (10.8%) responses. Further categories of the occupations revealed that the largest numbers of replies were received from 74 (36.3%) students. There were 40 (19.6%) responses from service and sales individuals, Freelancers were at 19 (9.3%) responses, and 18 (8.8%) from legislator or managers.

4.7.2 Smartphone, Networks, Fee

This section explains whether the respondents used or did not use smartphones, the duration of possessing, the brand of, the provider of, the types of subscriptions and amounts paid for the smartphones.

In Table 4.5, most of the respondents had smartphones 180 (88.2%). For those who are below 50 years old, 161 (93.1%) used a smartphone. However, 19 (61.3%) responses were from the 50 years old and above group that used smartphones and 12 (38.7%) responses of the 50 years old and above still did not adopt smartphones.

In terms of the duration that individuals had smartphones, more than half of the respondents had used smartphones for over three years, which was the same amount within the over 50 years old age group. What was noticeable is that in the over 50 years old age group, 5 (21%) responses had begun using smartphones since 2012, compared to 10 (7.1%) responses from the below 50 year old age group. This outcome also confirmed that the 50 years old and above age group is slower at adopting new technologies.

In terms of the smartphone brand, Apple (iPhone) is the most popular one, followed by Blackberry, Samsung and HTC. It was also found that within the older adults group Apple iPhone usage was lower than the younger population. However, within the older age group there were more Samsung and Blackberry users than in the younger age groups.

With regards the network providers, O_2 is the most popular provider, followed by 3UK, Vodafone, Orange, Giffgaff and Lebara. What was interesting is that the 50 years and younger adult numbers using O_2 and 3UK were outstanding compared to the 50 years old and above age groups.

Table 4.5: The profile of smartphone, network and fee used and pay by respondents

Category		Below 50 years old		Over 50 years old		Overall	
		Number	(%)	Number	(%)	Number	(%)
Having smartphone (n=204)	Yes	161	93.1	19	61.3	180	88.2
	No	12	6.9	12	38.7	24	11.8
Length of using smartphone	Less than 6 months	4	2.8	2	10.5	6	3.8
	6 months to 1 year	6	4.3	3	10.5	9	5.6
	1 year to 2 years	21	14.9	1	5.3	22	13.8
	2 years to 3 years	36	25.5	3	15.8	39	24.4
	Over 3 years	74	52.5	10	52.6	84	52.5
Brand of Smartphone	iPhone (Apple)	109	77.3	7	36.8	116	72.5
	Blackberry	27	19.1	5	26.3	32	20.0

	HTC	9	6.4	1	5.3	10	6.3
	Samsung	24	17.0	6	31.6	30	18.8
	Nokia	7	5.0	1	5.3	8	5.0
	Motorola	3	2.1	0	0	3	1.9
	Sony	7	5.0	1	5.3	8	5.0
	LG	5	3.5	0	0	5	3.1
Network provider	3 (Three UK)	48	34.8	3	15.8	51	32.5
	EE	5	3.6	2	10.5	7	4.5
	Giffgaff	8	5.8	1	5.3	9	5.7
	Lebara	8	5.8	1	5.3	9	5.7
	O2	56	40.6	6	31.6	62	39.5
	Orange	10	7.2	5	26.3	15	9.6
	T-mobile	7	5.1	3	15.8	10	6.4
	Talk mobile	1	0.7	0	0	1	0.6
	Virgin	3	2.2	1	5.3	4	2.5
	Vodafone	21	15.2	7	36.8	28	17.8
	Other	3	2.2	0	0	3	1.8
Payment	Pay as you go	44	31.2	4	21.1	48	30.0
	Pay on a monthly basis (contract)	105	74.5	15	78.9	120	75.0
Pay per month	Free - £10	13	9.2	1	5.3	14	8.8
	£10.01 - £30.00	66	46.8	9	47.4	75	46.9
	£30.01 - £50.00	56	39.7	3	15.8	59	36.9
	£50.01 - £70.00	7	5.0	4	21.1	11	6.9
	£70.01 - £90.00	2	1.4	1	5.3	3	1.9
	> £ 90.00	2	1.4	1	5.3	3	1.9

In payment terms, 120 (75%) responses of the subscribers are on a monthly (contract) agreement, where 105 (74.5%) responses were in the below 50 years old group, 15 (78.9%) responses in the over 50 years old. Overall, 75 (46.9%) respondents paid an estimated £10.01 - £30.00 per month, followed by 59 (36.9%) responses who was paying between £30.01 and £50.00 per month. This trend was apparent in both the age groups.

4.7.3 Features of Smartphones Used

In terms of the use of smartphones, this pilot questionnaire followed the recommendations of UTAUT and mobile internet (Venkatesh et al., 2012) where the questions were drawn from previous research studies and the type of applications in the application markets such as the Android market. The options are shown in table 4.6. Respondents could select more than one feature that was used on their smartphone. The top ten uses were making a phone call, taking a photo, text messaging, emailing, browsing the website, using social networking, downloading apps, mapping and navigator, playing games, and using the smartphone for public transport timetabling. Figure 4.2 illustrates how the smartphones are used by all the age groups. When considering only the below 50 year old age group, figure 4.3 was formed where the timetabling of public transport issues was removed and replaced by using the Voice over IP facilities such as Facetime or Skype. For the over 50 years old group, figure 4.4 was formed where filming a video was in the top ten instead of using for public transport timetabling.

Interestingly, for the 50 years old and above group, the numbers of respondents using smartphones for making a phone call, SMS, emailing, taking a photo, and browsing the website (the top five) were very high. However, the sixth to the tenth- filming a video, playing games, mapping downloading app, and using social media were far less than the first five. Filming a video was more popular in the above 50 years old than in the below 50 years old. Comparatively, in the above 50 years old age group there were fewer individuals making use of the downloading apps and using social media features. Additionally, in the above 50 years old group there were more game players.

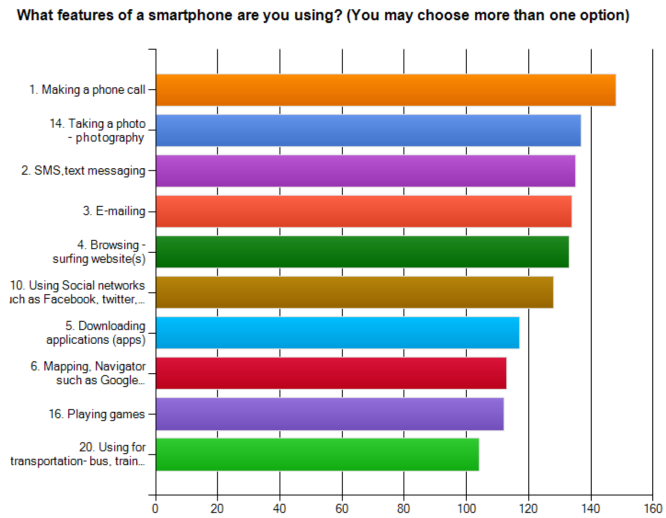

Figure 4.2 Feature used by respondents, overall

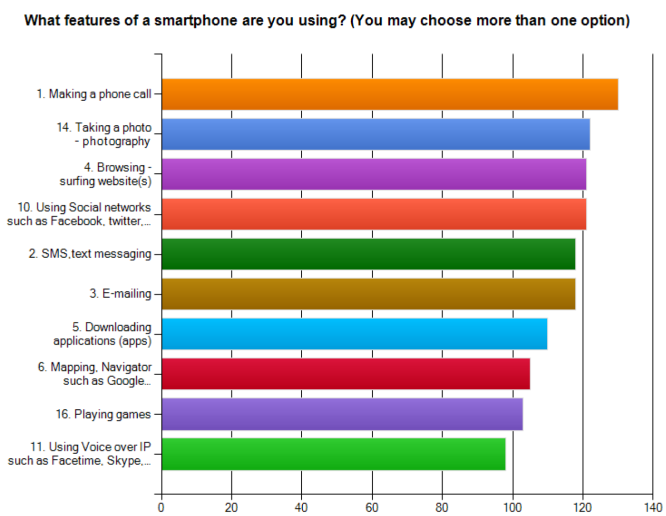

Figure 4.3 Feature used by respondents, under 50 year old group

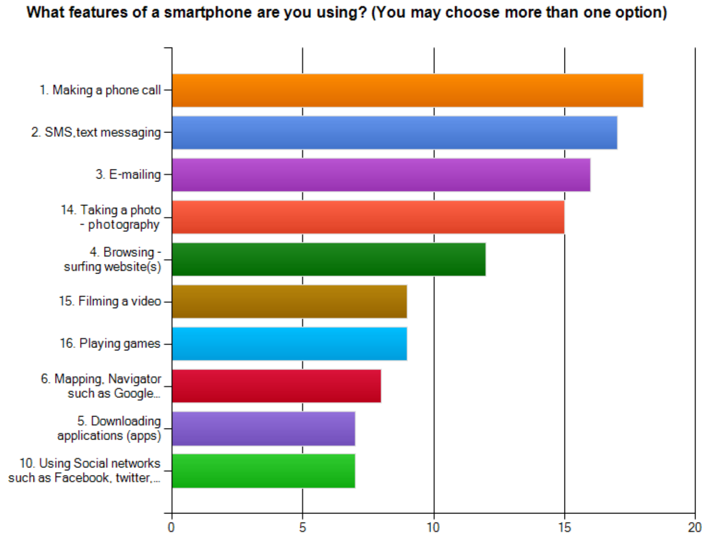

Figure 4.4 Feature used by respondents, over 50 year old group

Table 4.6: Features of a smartphone used by respondents

Features of a smartphone	Below 50 years old		Over 50 years old		Overall (n=159)	
	Number (n=141)	(%)	Number	(%)	Number	(%)
Making a phone call	130	92.2	18	100	148	93.1
SMS, Text messaging	118	83.7	17	94.4	135	84.9
E-mailing	118	83.7	16	88.9	134	84.3
Browsing-surfing website(s)	121	85.8	12	66.7	133	83.6
Downloading applications	110	78.0	7	38.9	117	73.6
Mapping, Navigator such as Google Map, Tom-Tom, Copilot	105	74.5	8	44.4	113	71.1
Online shopping such as eBay Amazon, Shopper, Groupon, Amazon Mobile, Newegg Mobile	69	48.9	2	11.1	71	44.7
Online Banking	81	57.4	5	27.8	86	54.1
Reading online News and online Magazines	82	58.2	3	16.7	85	53.5
Using social network such as Facebook, Twitter	121	85.8	7	38.9	128	80.5
Using voice over IP such as Facetime, Skype, oovoo, Google	98	69.5	3	16.7	101	63.5

Talk, Viber, Fring						
Using Instant messenger such as Blackberry Messenger, Live Messenger iMessenger, Whatsapp	91	64.5	5	27.8	96	60.4
Tracking items or package using such as Royal Mail, DHL UPS	40	28.4	4	22.2	44	27.7
Taking a photo	122	86.5	15	83.3	137	86.2
Filming a video	66	46.8	9	50.0	75	47.2
Playing games	103	73.0	9	50.0	112	70.4
Using password management such as Keeper	23	16.3	2	11.1	25	15.7
Using Finance application, stock market or currency exchange application	34	24.1	2	11.1	36	22.6
Using for health fitness or medicine	32	22.7	3	16.7	35	22.0
Using for transportation bus, train or tube checker	98	69.5	6	33.3	104	65.4
Using to contact government authorities NHS, Jobcentreplus, UKBA	26	18.4	1	5.6	27	17.0

From the above figures and table, it can be seen that the patterns of smartphone usage of older adults in the 50+ and younger generations were different.

4.7.3.1 Factors Affecting Smartphone Purchase

The next question explored the factors that drive the smartphone purchases as shown in table 4.7. The top ten considering factors were brand, price, appearance, camera, screen size, operating system, battery life, size of memory, weight, and quality of applications. However, in the above 50 years old age group there were fewer considerations in terms of price and operating systems. There were more concerns about the camera, weight, screen size, and screen resolution.

Table 4.7: Factors that consider when buying a smartphone						
Consideration in buying a smartphone	Below 50 years old		Over 50 years old		Overall (n=159)	
	Number (n=140)	(%)	Number	(%)	Number	(%)
Appearance such as colour material	83	59.3	9	47.4	92	57.9
Brand such as Apple, Samsung, Nokia, Blackberry	123	87.9	13	68.4	136	85.5
Price of the smartphone	90	64.3	8	42.1	98	61.6
Camera	74	52.9	10	52.6	84	52.8
Operating System such as iOS, Android or Windows8	66	47.1	4	21.1	70	44.0
Operating Speed	55	39.3	4	21.1	59	37.1
Voice Clarity	15	10.7	1	5.3	16	10.1
Screen Size	65	46.4	9	47.4	74	46.5
Screen Resolution	49	35.0	5	26.3	54	34.0
Weight	52	37.1	10	52.6	62	39.0
Battery life	61	43.6	7	36.8	68	42.8
Size of Memory in the phone to store files	57	40.7	7	36.8	64	40.3
Quality of application	59	42.1	3	15.8	62	39.0
Price of applications	20	14.3	2	10.5	22	13.8
Number of application available in app market	30	21.4	2	10.5	32	20.1
Support LTE 4G	15	10.7	0	0	15	9.4

It can be seen that older adults were concerned with smartphone screen size and weight that supported the idea that older adults may have poor vision or weak muscles as explained in chapter 2.

4.7.3.2 Source of Information about Smartphones

In order to understand the reasons that led to the smartphone purchase, questions regarding the influencing factors were sought as shown in Table 4.8.

Table 4.8: Source of information about a smartphone						
Where do you get information about a smartphone	Below 50 years old		Over 50 years old		Overall (n=157)	
	Number (n=138)	(%)	Number	(%)	Number	(%)
1. Word of mouth by friends and family	91	65.9	17	89.5	108	68.8
2. High street stores	33	23.9	6	31.6	39	24.8
3. Media- TV, Radio and Newspapers	72	52.2	6	31.6	78	49.7
4. Magazines	30	21.7	3	15.8	33	21.0
5. Online social network	71	51.4	0	0	71	45.2
6. Professional technology review website such as CNET.co.uk, Trustedreviews.com	36	26.1	1	5.3	37	23.6
7. Peer technology review such as unboxing video on YouTube	29	21.0	0	0	29	18.5

Overall, as shown in Table 4.8 smartphones were purchased due to the recommendations provided by the word of mouth, i.e. friends and family, the media (TV, Radio and Newspapers), online social networks, high street stores, professional technology review websites, magazines and Peer technology reviews respectively. Within the below 50 years old, purchases were made due to the word of mouth, media and online social networks. Contrastingly, in the over 50 years old respondents, there was more reliance on the classic communication channel of the word of mouth, with less reliance on online social networks, the more popular, recent communication channel. This reliance on the classic communication channel could also be a factor that could explain the slow adoption of novel technologies as the transmission speed of the word of mouth is much slower than an online social network, or other forms of media.

4.7.3.3 Using Smartphones for Health and Well-being, and, Connecting Friends and Family Purpose

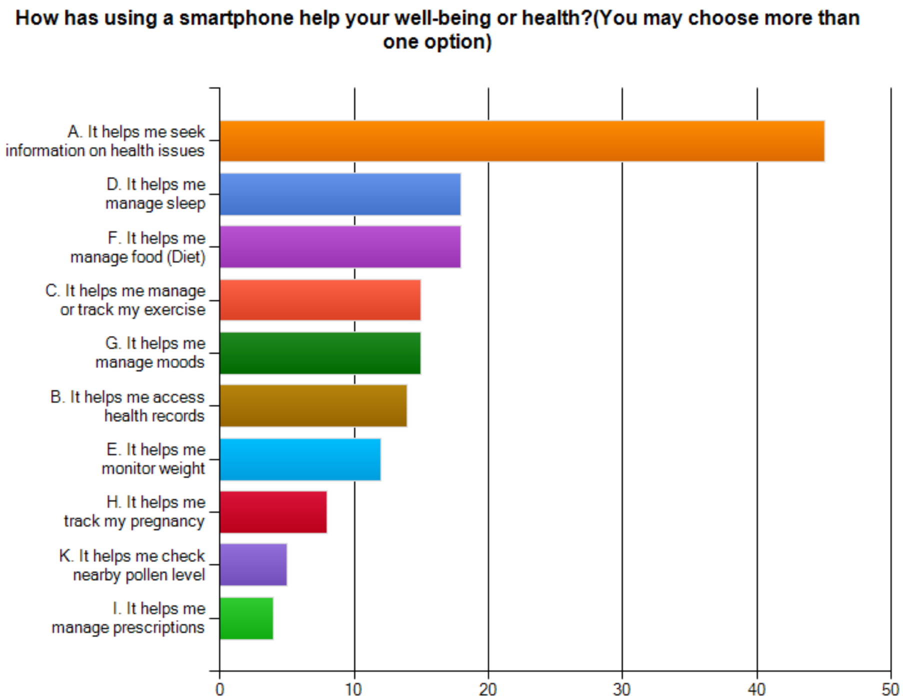

Figure 4.5 How smartphones help with well-being or health, overall.

Another benefit of a smartphone is to assist with wellbeing or health care as shown in figure 4.5. 65 respondents or 40.6% agreed that they used their smartphones for their health and well-being. The options for this question sought information such as seeking information on health, accessing health records, tracking exercises, managing sleep, monitoring weight, managing food, managing moods, tracking pregnancy, managing prescriptions, managing blood pressure, checking pollen levels, and controlling cigarette smoking.

Of the overall responses, 45 respondents had used smartphone to seek information about health issues. The next two popular benefits that 18 respondents agreed with were helping with managing sleep and managing food. For the 50 years old and above age group, only four of 50+ adults who used smartphones had used their smartphone for health and well-being purposes. There were only three features used which were seeking information, managing or tracking physical exercise and managing food. Therefore, this result shows that this benefit was not widely recognised by smartphone users, particularly, the older adults who could benefit immensely from this feature.

Another benefit of smartphone is to bring friends and family closer. In figure 4.6, it is shown that 140 respondents agreed that smartphones could help with this issue, with around 126 (90%) of the respondents from the under 50 year old age group supporting this view and 12 of the above 50 years old age group supporting this view. In the older age groups, it was found that there was less use of online social networks and more email being used to contact friends and family. Comparatively, in the below 50 age group there was more online social networks use and less of email. Location sharing with friends and family was also used more in the younger adults compared to the older adults.

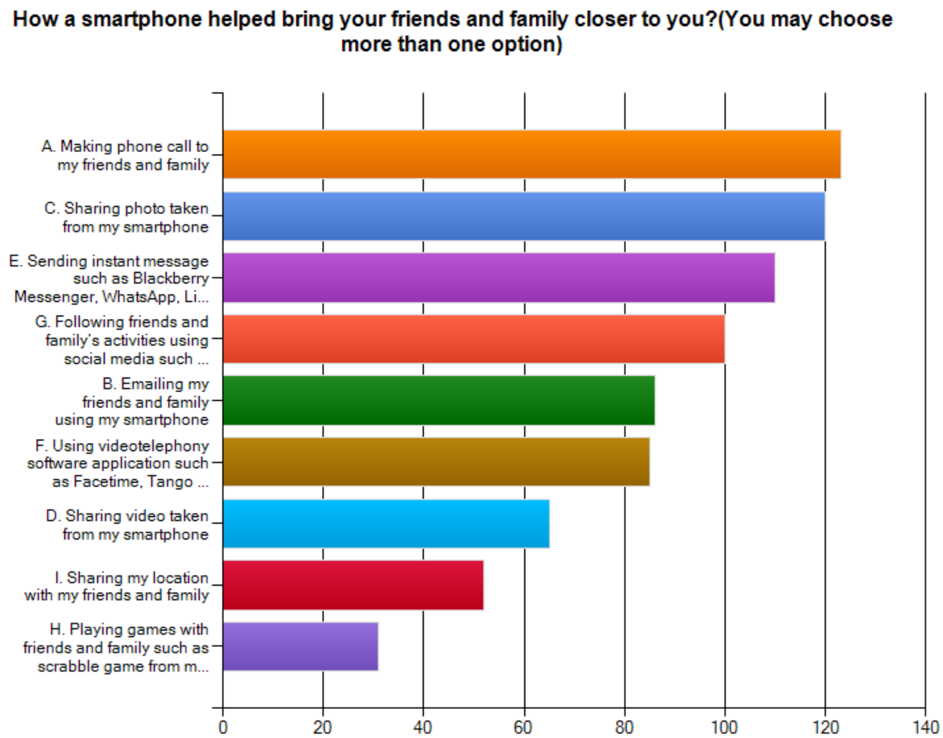

Figure 4.6 How smartphones help with bring friends and family closer, overall.

As addressed in chapter 2, new technologies can be used as a means of improving the well-being and health of older adults (Boontarig et al., 2012). The results in this section indicate that smartphones can help with well-being, health and loneliness. However, within the older adults, these features are not widely adopted.

4.7.4 Reasons for Non-Adoption

Whilst the previous section understood the reasons for adoption, a question also attempted to understand the reasons for some respondents not using smartphones. The top cited reason is the availability of alternative devices such as laptops, netbooks or desktops, which was followed by the cost of using a smartphone followed by discomfort when using the mobile devices small screens and keyboards. Although not very significant results, it was discovered that private time, knowledge and lifestyle were also factors of non-adoption.

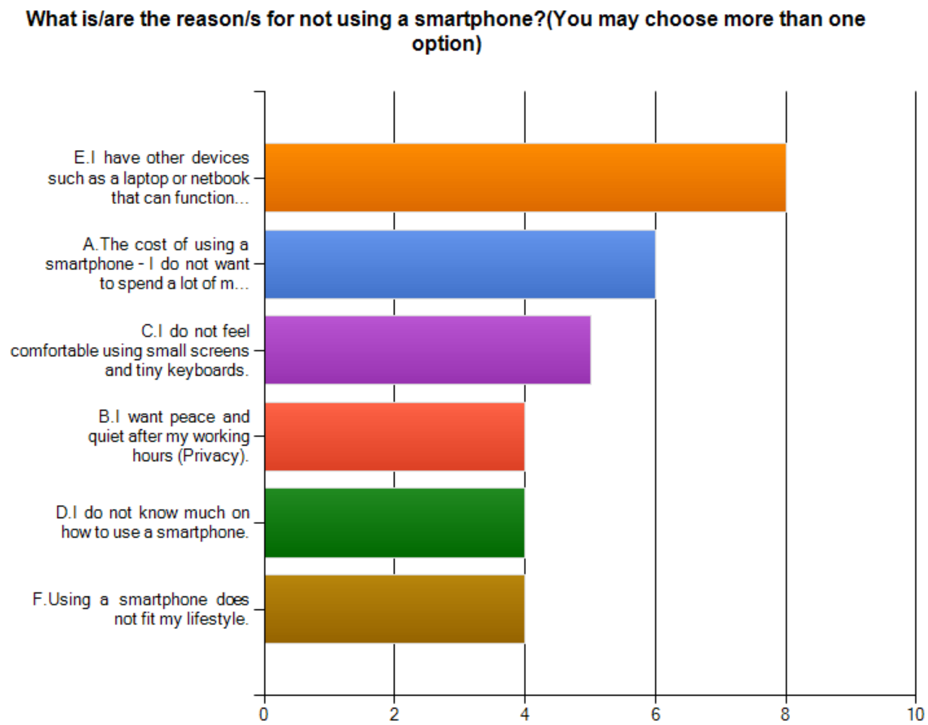

Figure 4.7 Reasons for not using smartphones, overall.

Having explained the reasons for not using a smartphone, the next issue was to improve and identify the factors that may encourage non-users to use smartphones in the future, which is explained in the next section.

4.7.5 Analysis Technique

Data analysis was performed using the component-based approach to structural equation modelling (SEM) and the associated statistics for validity and reliability. Specifically, this pilot used the Partial Least Square (PLS) technique with the help of the SmartPLS version 2.0M3 (Ringle et al., 2005).

For data analysis, there are two generations of data analysis techniques. The first generation can analyse the model, which has only one layer of connections at a time between the independent and dependent variables. The tools in this generation include regression methods such as, ANOVA and MANOVA. For the second generation, SEM can analyse simultaneously relationships amongst many independent and dependent constructs and provide a comprehensive result at the end. The second generation techniques include, Linear Structural Relations (LISREL) or PLS (Gefen et al., 2000).

Although, LISREL and PLS are second generation techniques, they are different in many aspects (Gefen et al., 2000). First, the objective of variance analysis is different. LISREL explains an overall model while PLS explains the variance details. Second, LISREL requires a theory base and supports only confirmatory research; while, PLS does not need a theory base and supports both exploratory and confirmatory research. Third, refers to the minimal sample size. LISREL requires at least 100-150 cases; whereas, PLS needs at least 10 times the number of factors in the most complex model.

During the last few years, the PLS technique has become increasingly popular in information systems, marketing and management research. The research on the numbers of PLS used in Management Information Systems Quarterly (MISQ) and Information System Research (ISR) is increasing. In 2006, 23.19% or 16 articles, from 53 articles, in MISQ and ISR used PLS (Urbach & Ahlemann, 2010). This pilot used PLS by SmartPLS for data analysis, not only due to the popularity of the technique, but also, due to the compatibility of the research framework and the nature of adoption research, which is normally related to more than one layer of the links between independent and dependent variables.

4.7.6 Analysis Results

Following distribution of the link to the online questionnaire, 205 replies were received, of which 181 were complete responses. However, the responses that could be analysed amounted to 160. Although 160 is a relatively small sample size, it is sufficient enough to gain a reliable understanding from the PLS results. This is due to the replies being 10 times more of the formative factors (numbers of factors in the conceptual framework) (Chin, 1998). In this study the numbers of formative factors are eight. Therefore, the minimum numbers of responses required are 80 respondents.

During the analysis processes, some questions, formative indicators, were removed because the questions did not provide good results for the factors. The removed questions were as follows:

SOC3: it is expected that people like me use a smartphone (for example, similar age or position people).

SOC4: I want to use a smartphone because my friends do so.

FC3: The operation costs of a smartphone do not prevent the use of it (such as, price of smartphones or monthly fee).

FC4: I have a person available to assist me in using my smartphone.

Removing these questions helped improve the overall results. What was also found is that in this pilot phase reflective indicators, ACU3, ACU4, ACU6, ACU7, ACU8, and, ACU9 were selected for analysis, but ACU1 and ACU2 were removed because they were not present when using smartphones. Both are just simple features. ACU5 and ACU9 did not perform quite as well in the analysis, so they were removed.

4.7.6.1 Reliability

Reliability is the first area to consider when analysing data, which is normally referred to as internal consistency reliability and indicator reliability. The internal consistency reliability can be tested using Cronbach's Alpha or Composite Reliability. Cronbach's Alpha is the reliability indicators that assume that all items or questions are equally reliable. However, Composite Reliability considers the different items loading to the factor. The requirement value should above 0.7 in both indicators (Henseler et al., 2009). Table 4.9 shows all Composite Reliability of all age groups are more than 0.8 which mean the data is in good scale.

Table 4.9: Overview of all age groups

	AVE	Composite Reliability	R Square	Cronbachs Alpha
ACU	0.4663	0.8375	0.1512	0.7678
COM	0.7953	0.9395	0.0000	0.9142
EE	0.9153	0.9558	0.0000	0.9075
FC	0.8399	0.9130	0.0000	0.8095
FUN	0.8910	0.9423	0.0000	0.8776
IN	0.6577	0.8848	0.6228	0.8270
OB	0.7307	0.8439	0.0000	0.6406
PE	0.7236	0.8869	0.0000	0.8094
SOC	0.8726	0.9320	0.0000	0.8543

The indicator reliability related to the manifest variables (questions) loadings should not be less than 0.707 (Chin, 1998; Gefen et al., 2000). Figure 4.8 illustrates that all the indicators' magnitude is greater than 0.707. Therefore, from both the reliabilities tests, the model for all the age groups is reliable.

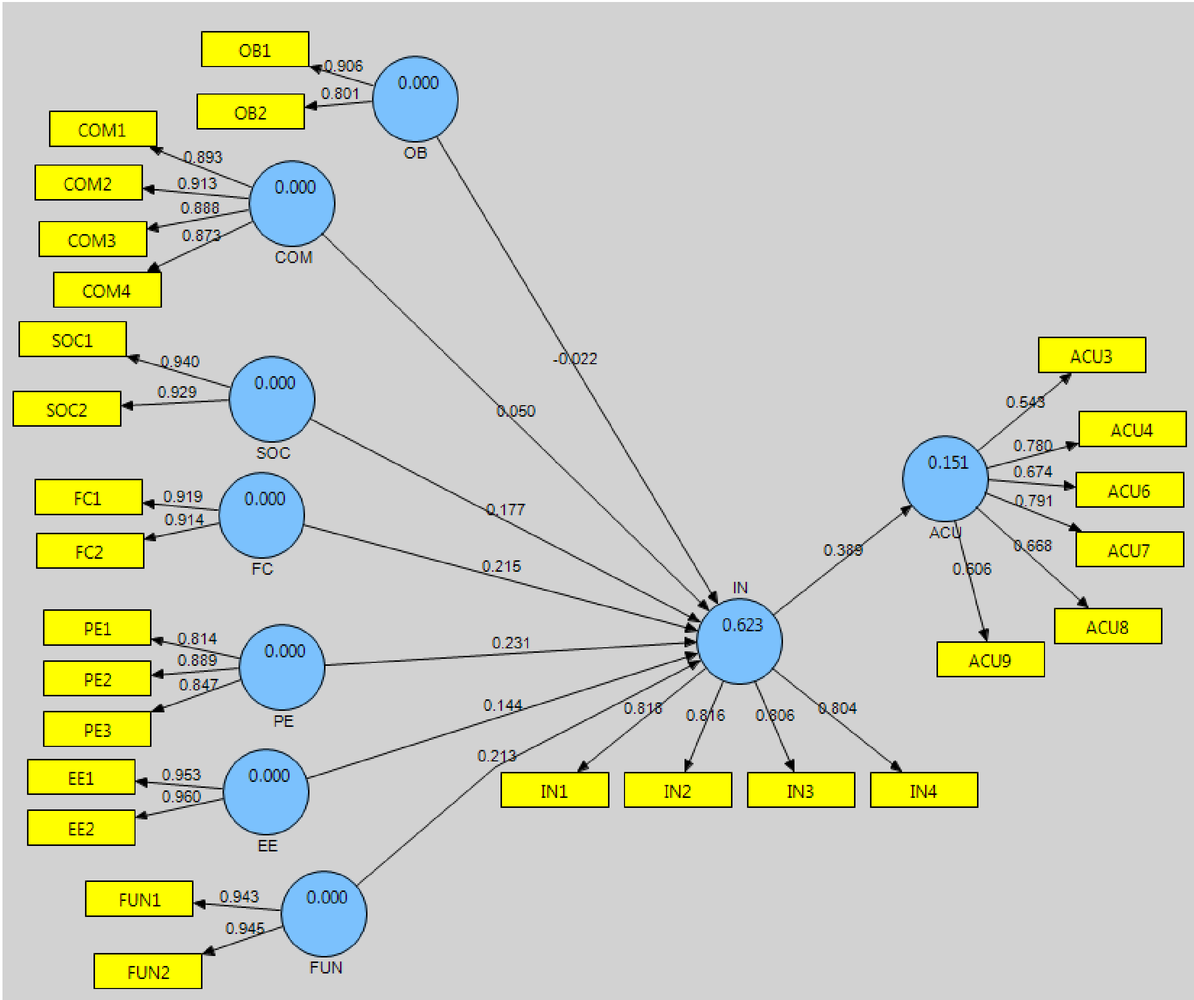

Figure 4.8: PLS Results of Measurement and Structural Models of all age groups

4.7.6.2 Validity: Convergent and Discriminant Validity

The convergent validity and the discriminant validity are normally used to check the validity. **Convergent validity** is defined as "the degree to which scores on one scale correlate with scores on other scales designed to assess the same construct" (Cooper & Schindler, 2013:259). Convergent validity can be examined using Average Variance Extracted (AVE). **Discriminant validity** indicates the extent to which a given construct is different from other latent constructs (Vinzi et al., 2010). The square root of AVE of each latent variable should be greater than the correlations among the latent variables (Fornell & Larcker, 1981). The further detail on convergent and discriminant validity can be found in chapter 3, section 3.7.7.4.

The first column in table 4.9 shows that the Average Variance Extracted (AVE) for all the constructs is higher than 0.5, except for ACU. This indicates that there is sufficient convergent validity, and implies that each latent variable on average explains that more than 50% of their indicator variance (Hair et al., 2011). Discriminant validity refers to the appropriate patterns of inter-indicators of a construct and other constructs. The variance of a construct should be assigned a value greater than its own indicators rather than to other constructs (Hair et al., 2011).

Table 4.10: Cross Loading of all age groups

	ACU	COM	EE	FC	FUN	IN	OB	PE	SOC
ACU3	0.5429	0.5222	0.2677	0.4134	0.2054	0.3046	0.3007	0.3727	0.1902
ACU4	0.7805	0.3722	0.4203	0.4008	0.4360	0.3265	0.3307	0.3349	0.2119
ACU6	0.6738	0.1491	0.2779	0.1727	0.3638	0.1790	0.2105	0.1216	0.0504
ACU7	0.7912	0.2716	0.2423	0.2183	0.2869	0.2440	0.1927	0.1823	0.1225
ACU8	0.6679	0.1674	0.1522	0.1581	0.2546	0.2272	0.0852	0.1457	0.1497
ACU9	0.6064	0.1073	0.2228	0.1832	0.2760	0.2432	0.0879	0.0988	0.1388
COM1	0.3548	**0.8927**	0.5943	0.7040	0.5010	0.6060	0.5243	0.6826	0.3487
COM2	0.3611	**0.9133**	0.5681	0.7409	0.5921	0.5858	0.5381	0.6728	0.3040
COM3	0.3968	**0.8876**	0.5336	0.7469	0.4520	0.5787	0.4225	0.6750	0.1836
COM4	0.4027	**0.8731**	0.4844	0.7177	0.4394	0.5283	0.4146	0.6456	0.1943
EE1	0.3922	0.5919	**0.9534**	0.6724	0.5592	0.5833	0.3662	0.6092	0.2251
EE2	0.3795	0.5819	**0.9599**	0.6887	0.6416	0.6280	0.4413	0.5598	0.2153
FC1	0.3717	0.7787	0.5745	**0.9191**	0.5183	0.6495	0.4139	0.7113	0.2471
FC2	0.3761	0.7147	0.7323	**0.9138**	0.6388	0.6301	0.4794	0.6218	0.2533
FUN1	0.4168	0.5274	0.5760	0.5986	**0.9427**	0.5902	0.4356	0.5222	0.2556
FUN2	0.4328	0.5259	0.6113	0.5913	**0.9451**	0.6028	0.4948	0.5224	0.2550
IN1	0.3558	0.4579	0.4850	0.5624	0.5224	**0.8183**	0.3532	0.4761	0.3804
IN2	0.2717	0.5961	0.5965	0.5605	0.5727	**0.8159**	0.3485	0.6192	0.3219
IN3	0.3899	0.5759	0.5664	0.6398	0.4867	**0.8057**	0.4440	0.5867	0.2181
IN4	0.2288	0.4486	0.3831	0.4871	0.4602	**0.8039**	0.2241	0.4625	0.3766
OB1	0.2916	0.5376	0.4371	0.4952	0.4416	0.4213	**0.9056**	0.5009	0.1835
OB2	0.2425	0.3527	0.2634	0.3131	0.4021	0.2984	**0.8009**	0.2794	0.2655
PE1	0.1526	0.6416	0.5928	0.6172	0.5886	0.6252	0.4577	**0.8140**	0.1701
PE2	0.3329	0.6205	0.4610	0.6071	0.4202	0.5446	0.3620	**0.8888**	0.2307
PE3	0.3931	0.6482	0.4856	0.6294	0.3766	0.5142	0.3784	**0.8473**	0.2674
SOC1	0.1803	0.2855	0.1971	0.2712	0.2232	0.3836	0.2461	0.2700	**0.9396**
SOC2	0.2452	0.2585	0.2342	0.2374	0.2846	0.3542	0.2245	0.2110	**0.9287**

From Table 4.10, it can be seen that an indicator's loading is higher than all of its cross loadings. For example, EE1 is the question that expected to support EE (Effort Expectancy) construction. The indicators such as EE1 should provide at least 0.8 loading value to its construct EE. From the table 4.10, the EE1 provided loading 0.9534 to EE that was very strong. Moreover, the loading of EE1 to other constructs (ACU, COM, FC, FUN, IN, OB, PE, and SOC) should smaller than to EE.

From the table 4.10, indicator COM1-COM4 provide 0.8927, 0.9133, 0.8876, and, 0.8731 loading to COM; moreover, COM1-4 did not provide loading to other variables more than their own variable (COM). Similarly EE1-2 offered 0.9534 and 0.9599 to EE, FC1-2 provided 0.9191 and 0.9138 to FC, FUN1-2 provided 0.9427 and 0.9451 to FUN, IN1-4 provided 0.8183, 0.8159, 0.8057 and 0.8039 to IN, OB1-2 provide 0.9056 and 0.8099 to OB, PE1-3 provided 0.8140, 0.8888, and 0.8473 to PE, and, SOC1-2 provided 0.9396 and 0.9287 to SOC.

Table 4.11: Construct Cross-Correlation Matrix and AVE analyses

AVE		ACU	COM	EE	FC	FUN	IN	OB	PE	SOC
0.4663	ACU	**0.6829**								
0.7953	COM	0.4237	**0.8918**							
0.9153	EE	0.4030	0.6132	**0.9567**						
0.8399	FC	0.4079	0.8153	0.7116	**0.9165**					
0.8910	FUN	0.4501	0.5579	0.6291	0.6303	**0.9439**				
0.6577	IN	0.3888	0.6458	0.6338	0.6982	0.6320	**0.8110**			
0.7307	OB	0.3146	0.5346	0.4234	0.4868	0.4932	0.4295	**0.8548**		
0.7236	PE	0.3351	0.7506	0.6099	0.7280	0.5533	0.6662	0.4745	**0.8506**	
0.8726	SOC	0.2264	0.2917	0.2300	0.2729	0.2705	0.3954	0.2523	0.2586	**0.9341**

Discriminant validity can be examined by the square root of AVE of each latent variable should be greater than the correlations among the latent variables (Fornell & Larcker, 1981). From table 4.11, the square root of AVE of each latent variable was written in bold. For example, The COM's AVE was 0.7953 therefore, the square root of it was 0.8918. The EE's AVE was 0.9153, then the square root of it was 0.9567. For Discriminant validity testing, for example, COM's AVE, 0.8918 need to compare with construct cross-correlation which were 0.6132 from EE, 0.8153 from FC, 0.5579 from FUN, 0.6458 from IN, 0.5346 from OB, 0.7506 from PE, and 0.2917 from SOC. Then, when consider other variables' AVE compare with cross-correlation, the AVE were greater than the correlations. Therefore, the results satisfied Discriminant validity.

4.6.6.2.1 Assessment of the Structural Model

In order to explain and predict the developed conceptual framework for this research, the methods and suggestions provided by previous PLS literature were used (Chin, 1998; Gefen et al., 2000; Henseler et al., 2009).

4.6.6.2.2 Explanatory Power

Figure 4.7 shows an overview of the evaluation of the modified conceptual framework for all the age groups. The number in the blue circle shows the R-squared value that explains the variance. In Figure 4.7 the model explains 62.3% of the intention to use a smartphone and 15.1% of the actual smartphones use is explained.

4.6.6.2.3 Predictive power

SmartPLS was used to run bootstrapping where the t-values illustrated the line linked between the variables (shown in Figure 4.8). The Critical t-values for the two-tailed test is 1.65 that provide a significant level of less than 10% or 0.10; 1.96 provided a significance level of less than 5% or 0.05, and 2.58 provided a significance level of less than 10% or 0.1 (Hair et al., 2011). A graphical result of the conceptual model evaluation is shown in figure 4.9. For all the age models, this pilot found that Observability (H1) and Compatibility (H2) do not have a significant effect on the intention to use smartphones. Social Influence (H3 supported with coefficient = 0.177) and Performance expectancy (H5 supported with coefficient = 0.231) are positively influenced towards the behavioural intention of smartphone adoption at a significant level of less than 0.01. Enjoyment (H7 supported with coefficient = 0.213) positively influenced the behavioural intention towards smartphone adoption with a significant level of less than 0.05. The facilitating Condition (H4 supported with coefficient = 0.215) and Effort Expectancy (H6 supported with coefficient = 0.144) positively influenced the behavioural intention towards smartphone adoption with a significant level of less than 0.10. Further, behavioural intention (H8 supported with coefficient = 0.389) had a positive influence on smartphone use at a significant level of less than 0.01. The conclusions of these hypothesis tests for all the age groups are shown in Table 4.12.

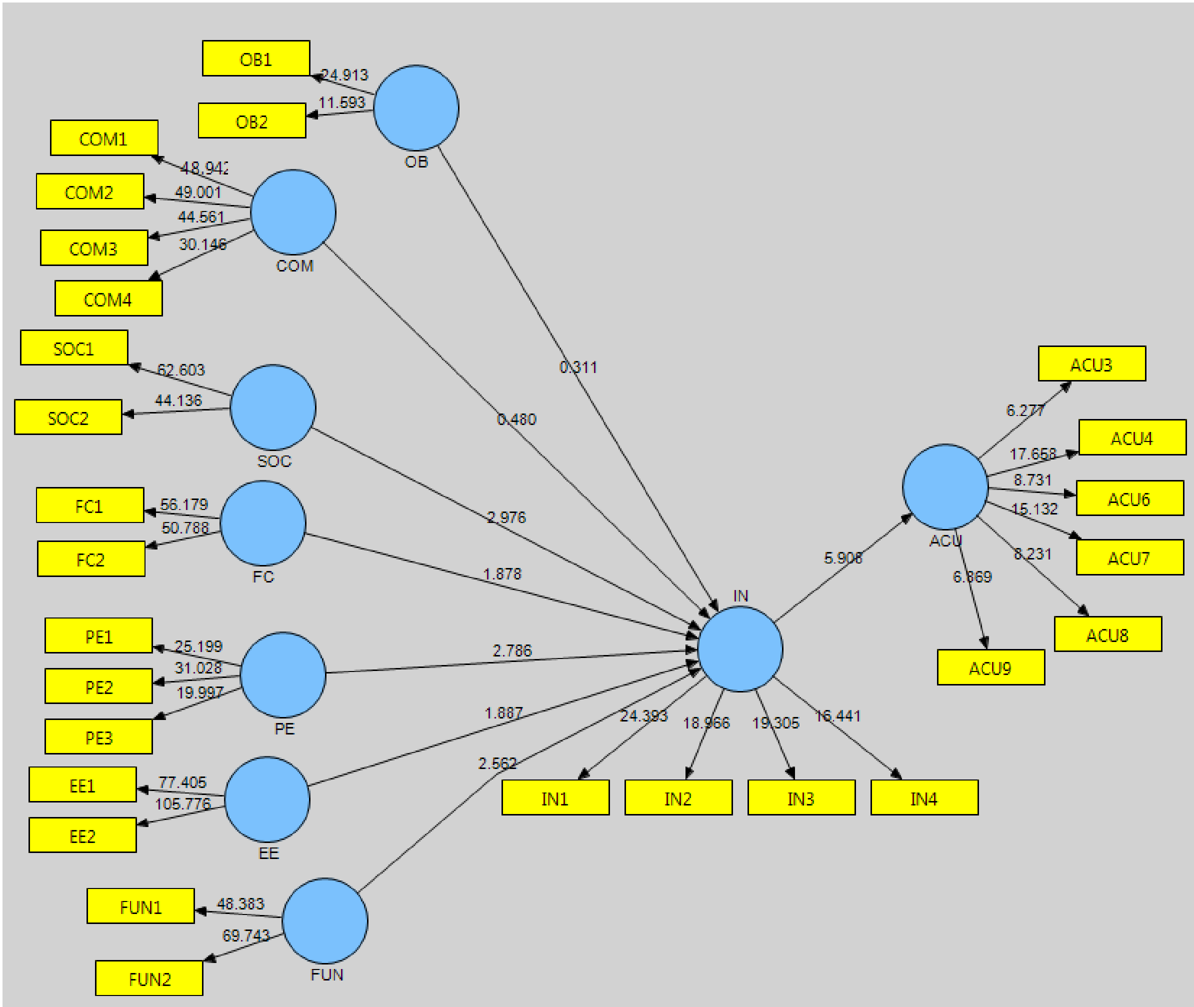

Figure 4.9: Bootstrap Results of the Measurement and Structural Models of all age groups

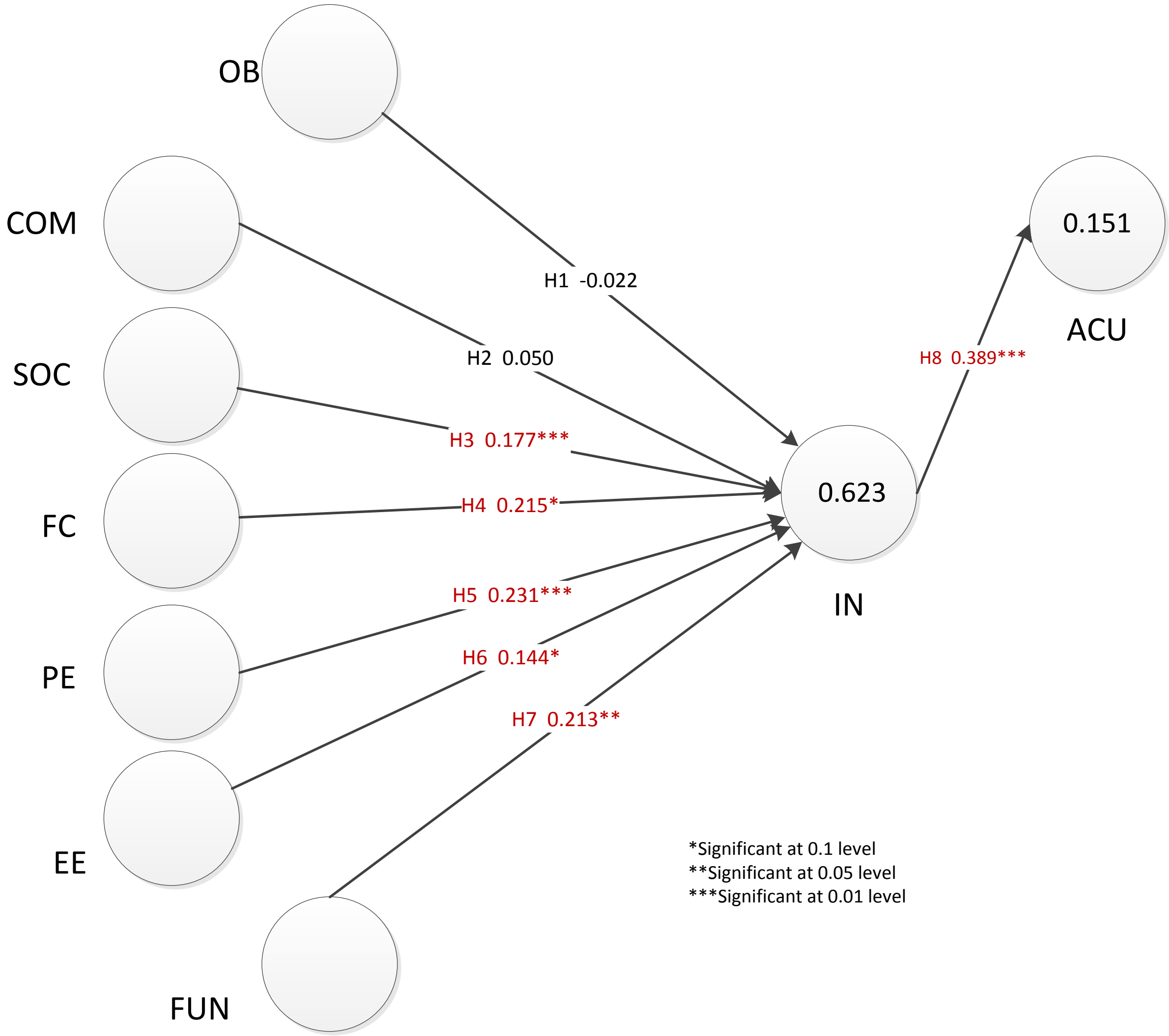

Figure4.10: Evaluation of Structural Model of all age groups

Table 4.12 : Conclusion of the Hypothesis tests of all age groups		
Hypothesis	Outcome	Values
Hypothesis 1 : Observability has a positive influence on the behavioural intention towards smartphone adoption.	Not Supported	
Hypothesis 2 : Compatibility has a positive influence on the behavioural intention towards smartphone adoption.	Not Supported	
Hypothesis 3 : Social Influence has a positive influence on the behavioural intention towards smartphone adoption.	Supported	0.177
Hypothesis 4 : Facilitating Condition has a positive influence on the behavioural intention towards smartphone adoption.	Supported	0.215
Hypothesis 5 : Performance expectancy has a positive influence on the behavioural intention towards smartphone adoption.	Supported	0.231
Hypothesis 6 : Effort Expectancy has a positive influence on the behavioural intention towards smartphone adoption.	Supported	0.144
Hypothesis 7 : Enjoyment has a positive influence on the behavioural intention towards smartphone adoption.	Supported	0.213
Hypothesis 8 : Behavioural intention has a positive influence on the smartphone usage.	Supported	0.389

4.7.7 The Analysis Results of the Above 50 Years Old Adults

To obtain information specific to the 50 years old and above age groups, the data from the 50 years old responses were analysed using SmartPLS in the same way as overall age groups, where the conclusions are illustrated in figure 4.11 and table 4.13.

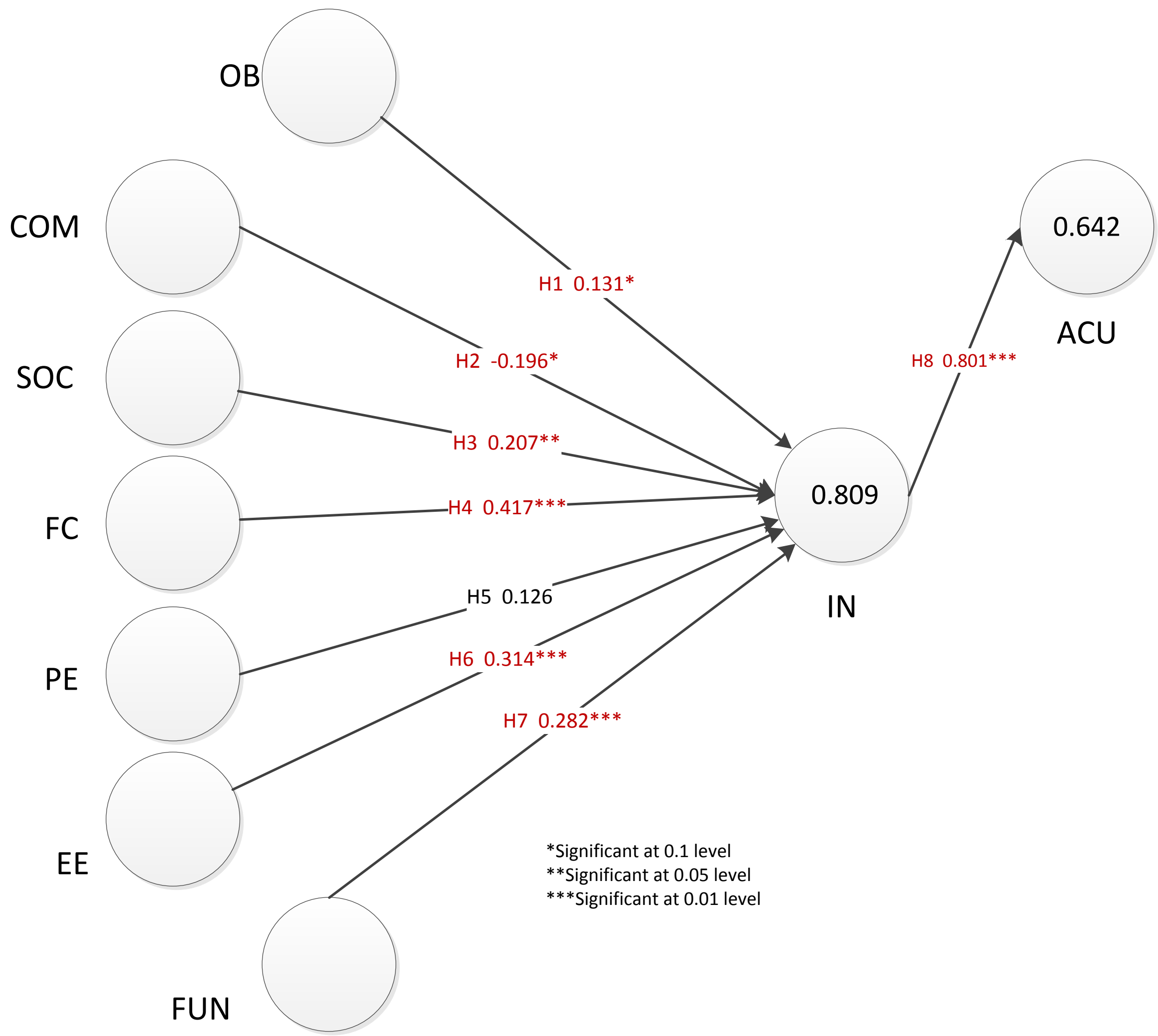

Figure4.11 Evaluation of the Structural Model for the over 50 age groups

From the analysis, it was found that there are three hypotheses that are supported. These are Facilitating Conditions (H4), Effort Expectancy (H6) and Enjoyment (H7) that have strong significance levels (less than 0.01) with coefficients = 0.417, 0.314 and 0.282 respectively. Social Influence (H3) was supported by the coefficient 0.207 with a significance level at less than 0.05. Observability (H1) was also supported with a coefficient of 0.131 with a significance level less than 0.10. Further, intention (H8) was also strongly supported by a coefficient of 0.801 at a significance level of less than 0.01. Comparatively, Compatibility (H2) had an opposite result with a coefficient of -0.196 at a significant level less than 0.1. Performance expectancy was not supported by this model for the over 50 age groups.

When considering the explanatory power of both intention to continue using smartphone and smartphone actual use using the R-squared for the particular age groups, the intention and usage were at 80.9 % and 64.2% explained respectively. Both values are quite strong. However, the R-squared values of 0.67, 0.33 or 0.19 for the endogenous latent variables were substantially moderate or weak respectively (Hair et al., 2011). This implies that the model has a strong explanatory power when explaining the adoption of smartphones within the above 50 years old and above adults.

Table 4.13 Conclusion of Hypothesis test of over 50 age groups

Hypothesis	Outcome	Values
Hypothesis 1 : Observability has a positive influence on the behavioural intention towards smartphone adoption.	Supported	0.131
Hypothesis 2 : Compatibility has a positive influence on the behavioural intention towards smartphone adoption.	Supported	0.196
Hypothesis 3 : Social Influence has a positive influence on the behavioural intention towards smartphone adoption.	Supported	0.207
Hypothesis 4 : Facilitating Condition has a positive influence on the behavioural intention towards smartphone adoption.	Supported	0.417
Hypothesis 5 : Performance expectancy has a positive influence on the behavioural intention towards smartphone adoption.	Not Supported	
Hypothesis 6 : Effort Expectancy has a positive influence on the behavioural intention towards smartphone adoption.	Supported	0.314
Hypothesis 7 : Enjoyment has a positive influence on the behavioural intention towards smartphone adoption.	Supported	0.282
Hypothesis 8 : Behavioural intention has a positive influence on the smartphone usage.	Supported	0.801

4.7.8 Analysis Results for the Below 50 Years Old

As the 50 years old and above demographic data were analysed, the data from below the 50 years old group was analysed in SmartPLS. The results are shown respectively in figure 4.12 and Table 4.14. Performance expectancy (H5) and Enjoyment (H7) were positively influenced towards the behavioural intention with a coefficient of 0.242 and 0.209 at a significance level less than 0.01. Social Influence (H3) was supported with the coefficient, 0.154 and a significance level of less than 0.05. Facilitating Condition (H4) was also supported by the coefficient, 0.188 and a significance level of less than 0.10. Further, intention (H8) was supported by the coefficient = 0.320 and a significance level of less than 0.01. However, Compatibility (H2) and Effort Expectancy (H6) were not supported. Further, Observability (H1) has a negative influence by not being statically important.

This model with this particular group can predict 61.5% of the intention to use a smartphone and 10.3% of actual use.

Table 4.14 Conclusion of Hypothesis test of below 50 age groups		
Hypothesis	Outcome	Values
Hypothesis 1 : Observability has a positive influence on the behavioural intention towards smartphone adoption.	Not Supported	
Hypothesis 2 : Compatibility has a positive influence on the behavioural intention towards smartphone adoption.	Not Supported	
Hypothesis 3 : Social Influence has a positive influence on the behavioural intention towards smartphone adoption.	Supported	0.154
Hypothesis 4 : Facilitating Condition has a positive influence on the behavioural intention towards smartphone adoption.	Supported	0.188
Hypothesis 5 : Performance expectancy has a positive influence on the behavioural intention towards smartphone adoption.	Supported	0.242
Hypothesis 6 : Effort Expectancy has a positive influence on the behavioural intention towards smartphone adoption.	Not Supported	
Hypothesis 7 : Enjoyment has a positive influence on the behavioural intention towards smartphone adoption.	Supported	0.209
Hypothesis 8 : Behavioral intention has a positive influence on the smartphone usage.	Supported	0.320

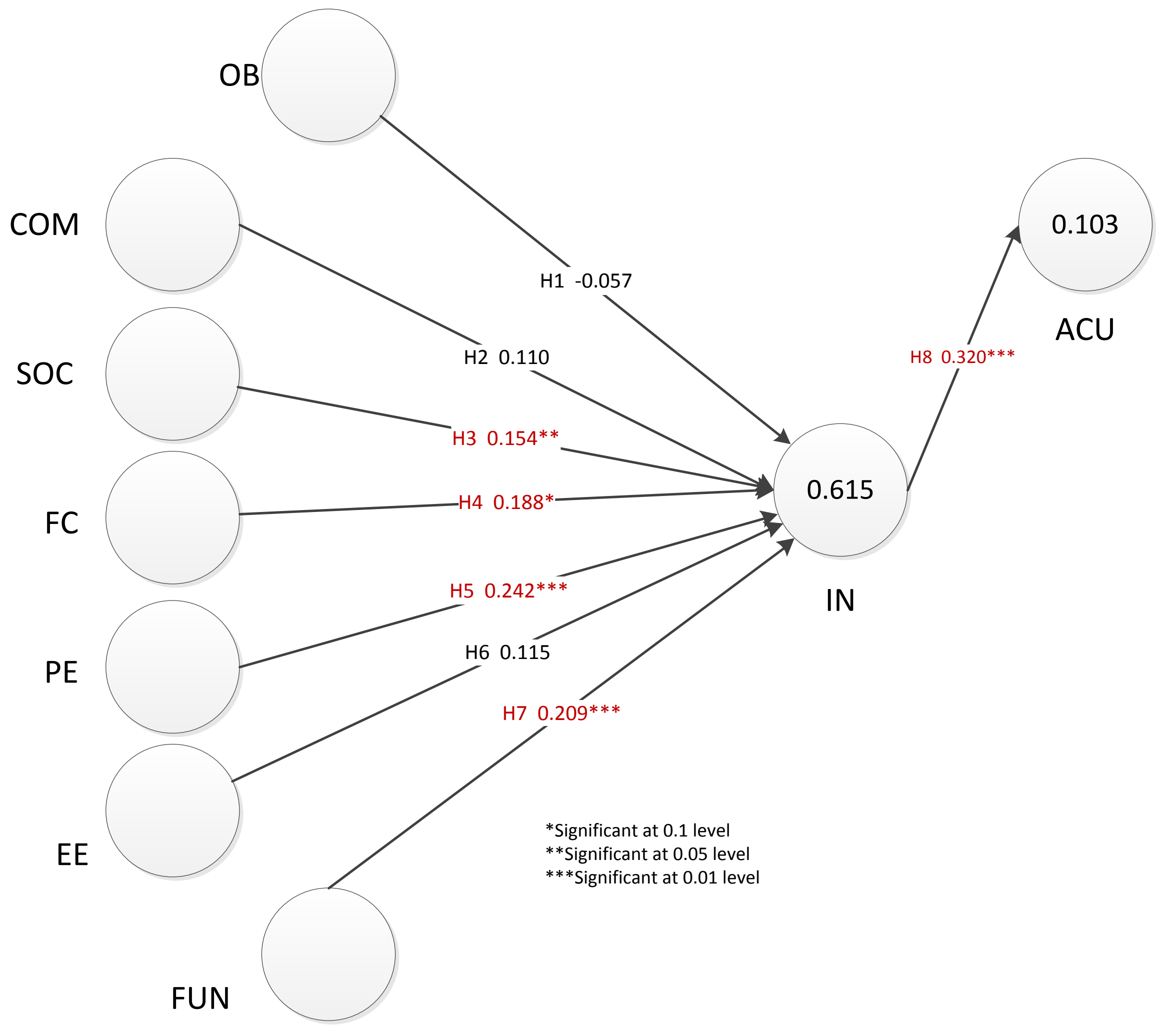

Figure4.12 Evaluation of Structural Model of below 50 age groups

Table 4.15 Comparison of the Hypothesis between the Over 50 and Below 50 age groups

Hypothesis	Outcome value		
	All age	Over 50	Below 50
1. Observability -> Behavioural intention		0.131	
2. Compatibility -> Behavioural intention		0.196	
3. Social Influence -> Behavioural intention	0.177	0.207	0.154
4. Facilitating -> Behavioural intention	0.215	0.417	0.188
5. Performance expectancy -> Behavioural intention	0.231		0.242
6. Effort Expectancy -> Behavioural intention	0.144	0.314	
7. Enjoyment -> Behavioural intention	0.213	0.282	0.209
8. Behavioural intention -> smartphone usage	0.389	0.801	0.320

The results from the conceptual framework with different age groups can be compared as shown in Table 4.15. For all the age groups and the below 50 year old age group, Observability (H1) and Compatibility (H2) are not supported in the framework. However, they positively influence the behavioural intention for the over 50 years old age group. Performance expectancy (H5) is positively influenced on the overall results and the below 50 age groups but it did not influence the 50 years old and above age group. Lastly, Effort Expectancy (H6) does not affect the below 50 years old age groups.

In terms of explanation, the model can explain 62.3% of behavioural intention and 15.1% of actual use of all the age groups. This same model can explain 80.9% of behavioural intention and 64.2% of actual use. However, the framework can describe only 61.5% of behavioural intention and only 10.3% of actual use in the below 50 years old age group.

4.8 Pilot Discussion

Having explained the pilot data collection results, the next section will discuss the results.

4.8.1 How People Use Smartphones

From the pilot results, the numbers of people who do not currently use smartphones is 88.7%, which means that 11.3% of the resulting population has not yet adopted smartphones. However, if the 50 years old and above group are considered, then the numbers of people who are not presently using smartphones is 36.7%. However, from anecdotal evidence, this number is expected to be greater than 36.7%. This is due to the approach that was applied at this pilot phase that employed largely the internet as a distribution channel and sought participants using emails and Facebook. Therefore a population number that does not have the internet has been missed. However, despite the controversial channel, it is interesting to learn that the numbers of individuals using smartphone in this pilot are the same number as the Ofcom report that suggests that in 2011 59 % of the UK population own smartphones (Ofcom, 2011a).

In the case of both the under and over 50 years old adult groups, more than 52% of the groups have used smartphones for more than three years. For the over 50 years old group, 21% have just begun using them in the last year compared to only 7.1% of those who are under 50 years old. Therefore, it seems that the 50 years old and above adults are slowly adopting smartphones. However, from the pilot 36.7% are still not yet using smartphones.

In terms of using the smartphone features, the features that are frequently used include, making a phone call, taking a photo, SMS, email, browsing, social media, downloading apps, mapping, playing games, filming, Voice over IP and checking for public transportation. There are similar trends evident in both the below and over 50 year old age groups. However, the numbers of those using the features reveal differences between the over and below 50 year old individuals. Other interesting differences are that online shopping using a Smartphone is a new trend, which has led to some online stores designing their websites in a manner that allows their website to support small screen devices. In this pilot, online shopping usage is around 48.9%. Research from Nielsen Mobile Consumer studies show that 26% of UK smartphone users have been using their smartphones for bricks and mortar (real life) shopping purposes in the last 30 days (Moth, 2013). However, research from Google reviews show that 79% of smartphone users' use the phone to partake in activities related with real life shopping such as comparing prices or searching for store locations. Further, during shopping, 70% of the users use their phones in stores. More importantly, 74% of smartphone users purchase products as a result of using smartphones. Nevertheless, only 27% buy products using their smartphone (Google, 2011). Therefore, currently smartphones provide a fast and easy way to find information.

Around 50% of the participants displayed features such as mobile banking or reading news and magazine being moderately popular, which is similar to previous research from Google (2011) that found that 56% individuals read news and articles on their research (Google, 2011). Mobile banking is also getting increasingly popular. The reasons for using m-banking include, easier access or more control over the money. Traditionally, to access internet banking products and services, individuals needed computers and the internet, which was limited in some cases. However, with smartphones, access to mobile banking is easier since mobile connections are available almost everywhere. Moreover, mobile banking applications provided by banks are increasing users' confidence when using mobile banking (Gustke, 2010). Therefore, in the UK, increasingly, individuals are using mobile banking.

Health, fitness and medicines are other areas that are significantly benefiting users. From this pilot, only 22.0% of all age respondents and only 16.7% in the over 50 year old age group showed an interest or use of these areas. This shows that fewer people are aware of this value. Research in the USA shows that in 2012, only 10% of smartphone users have health-related apps in their smartphones (Castillo, 2012). This kind of feature cannot replace the service provided by human doctors, but can significantly impact individual health and wellbeing. It is believed that the above 50 years old age group individuals should be informed of the benefits and how to use this type of feature that can help them understand their health ailments and disorders.

From the results, there are similar directions in the way that both the over and below 50 years old use smartphones such as using email, taking a photo, browsing, filming, playing games, mapping or downloading apps. However, the over 50 age group still lags behind the below 50 year old group.

4.8.2 Why People Adopt Smartphone

In terms of smartphone adoption, this pilot discloses the difference between above and below 50 year old age group in order to adopt smartphones. Half of the proposed factors influencing behavioural intention are similar in both groups. The same factors in both groups are Social Influence (H3), Facilitating (H4) and Enjoyment (H7). However, Observability (H1), Compatibility (H2) and Effort Expectancy (H6) are supported only among over 50 year old age group. Furthermore, Performance expectancy (H5) is supported only among below 50 year old age group.

4.8.2.1 Factors Supported by Both Groups

Social Influence (H3) shows that friends and family can influence decisions when adopting and using smartphones, as shown in the conceptual model and the question in table 4.8. Further, 68% of the respondents said word of mouth messages from friends and family is an information source about smartphones adoption and use. Other research related to smartphone such as research on mobile banking also discovered that Social Influence positively affects user adoption of mobile banking (Zhou et al., 2010). Moreover, previous research on mobile technology in China also supported this hypothesis (Park et al., 2007). This factor was studied qualitatively in mobile applications' downloads and showed a strong influence in Japan (Katagiri & Etoh, 2011). However, Social Influence was not found to be significant when older people had higher education and had retried using smartphones for their health purposes in Thailand (Boontarig et al., 2012).

Facilitating (H4), resource such as knowledge, time and money, is necessary for using smartphones. Unlike feature phones, smartphones consist of hi-technology and many features as shown in table 4.6. In order to use smartphone, users need to have a certain level of knowledge. To gain knowledge, users may need some learning time. Within the older adults' age group results it was found that older adults require more time to get comfortable or familiar with the basic functionality of smartphones compared to the young adult group. The subscription fee to use or the costs of smartphones are more expensive than feature phones. Previous research on mobile banking and mobile commerce also supported that Facilitating resource conditions are important (Zhou, 2008; Zhou et al., 2010). Facilitating Conditions are also important when older people adopt smartphones for their health as shown in a study from Thailand (Boontarig et al., 2012). Therefore, to use smartphones, individuals need to have knowledge, time and money.

Enjoyment (H7) is the last common feature between both the young and old groups. From table 4.6, 70% of respondents played games. This feature implies an obvious form of enjoyment. To achieve enjoyment, users can also use their smartphone to listen to music, watch videos or follow others using social networks. These advantages are provided by smartphones that in turn lead to smartphone usage. Previous research also supported this hypothesis (Shin, 2007; Song & Han, 2009; Verkasalo et al., 2010; Chtourou & Souiden, 2010).

4.8.2.2 The Factors Supported Only 50+ Adults

However, Observability (H1), Compatibility (H2) and Effort Expectancy (H6) affected only the over 50 year old age group. As addressed above in table 4.3, 36.7% of over 50 year old group do not use smartphone and 21.0% started using smartphones last year. Therefore, older age groups began to use and adopt smartphones after their friends or family did, in comparison to younger groups that are likely to see their friends use smartphones or closely follow the mass and social media, which then leads to their adoption and use. Additionally, Observability (H1) was studied in specific social groups such as in hospitals where the researchers found significant results for smartphone adoption (Park & Chen, 2007; Putzer & Park, 2010). Therefore, Observability may not be significant if the technology can be observed too easily. However, for specific features of smartphones, Observability still has an important role in adoption.

Compatibility (H2) is the factor that can be considered to be both positive and negative, due to the 50 years old age group contains individuals who are both in employment and retired. Therefore, for those who are in employment, smartphones may be compatible with their work or their personal lifestyles. In older, retired adults, there may not be interested in such a complicated technology and may not adopt smartphones.

Nevertheless, Compatibility (H2) has been studied in smartphones for features such as mobile payment (Mallat, 2007), within nurses in community hospitals (Putzer & Park, 2010), mobile commerce (Wu & Wang, 2005) and mobile banking among young people (Koenig-Lewis et al., 2010). Moreover, the results of these research studies found Compatibility is supported in mobile technologies.

Effort Expectancy (H6) or the ease of use is quite important for the 50 year old and above age group. Generally, older adults do not like complicated systems. Previous research on comparing iPhone 5 and galaxy S3 found that iPhone 5, is an easy to use smartphone, and is more popular within older adults (Nerney, 2013).

From a sample population that consisted of 97% of individuals below 45 years old, it was found that Effort Expectancy does not directly affect behaviour intention when using smartphones in Bangkok (Pitchayadejanant, 2011). The research found that Effort Expectancy indirectly influences behaviour intention via Perceived Value. Further, the researcher explained that the users were not concerned with Effort Expectancy but more with the value of their money when using smartphones (Pitchayadejanant, 2011). Therefore, smartphone providers should provide easy to use smartphones with reasonable subscription prices for older and younger people.

4.8.2.3 The Factors Supported Only in the Below 50 Years Old Age Group

Performance Expectancy (H5) is not supported in the 50 and above age group due to this age group containing both working and retired people. Questions in this section sought answers about productivity, usefulness and completing tasks. Therefore, this factor may not be applicable to those who are retired. Additionally, older adults may not know about the performance of smartphones. Therefore, this factor is not supported in the 50 year old and above age group.

However, this factor is supported in the below 50 year old age group where studies on smartphone application acceptance (Lee et al., 2012), mobile banking (Zhou et al., 2010), mobile devices and services (Carlsson et al., 2006) and mobile communication using 3G (Y. Wu et al., 2007) shows that Performance Expectancy is supported.

From the pilot, the 50 year old and above adults could have different reasons for adopting smartphones when compared to the younger adult group. This can be attributed to the different lifestyles, time management and the ability to learn, with training also being important for the older adult smartphone adoption.

4.9 Limitations and Future Improvement

Having presented the pilot results, the next step is to analyse the pilot questionnaire to determine the existing limitations that could be improved upon in the final questionnaire. These were identified to be the distribution channels, the low response rate, the length of the questionnaire, and, the clarity of the questions in the questionnaire. Furthermore, some questions had to be removed.

4.9.1 Distribution and Length of the Questionnaire

As addressed above, this pilot employs only an online version using emails and social network. This meant that the target group was limited to those who are members of a particular social network. Therefore, in the next round, the questionnaire should be provided in a hard copy format or using other approaches that will lead to a high response rate within the sample population.

Although this pilot required a few one hundred responses, the researcher felt that the response rate was not suitable enough for an understanding. Therefore, for the next phase, the researcher will seek to improve the survey reply rates by printing on colored paper, telephone pre-notification, incentives and/or a follow-up-mailing protocol (Newby et al., 2003).

The length of the questionnaire is also a problem, which could account for the incomplete replies. The changed conceptual framework and analysis should lead to an improvement in the length of the questionnaire.

In terms of the research site, this research on smartphones and older adults will focus on particular area rather than nationwide. It is because this research wants to receive the final results from the area which the mobile infrastructure has been well established within the same level. Moreover, this research on adoption focused on older adults who have used smartphones; therefore, this research considered the area such as London, where most of the pilot results received, as in table 4.3.

4.9.2 Final Questionnaire Layout

Following the pilot, some changes were made in the next phase, which is shown in Figure 4.12 below. This layout added a path for planning to purchase a smartphone. The respondents who plan to have a smartphone will be asked questions about reasons for planning to have a smartphone, what are the factors considered when buying a smartphone and sources of information on smartphones. For those who do not plan to have a smartphones, questions on factors that may encourage smartphone use were added.

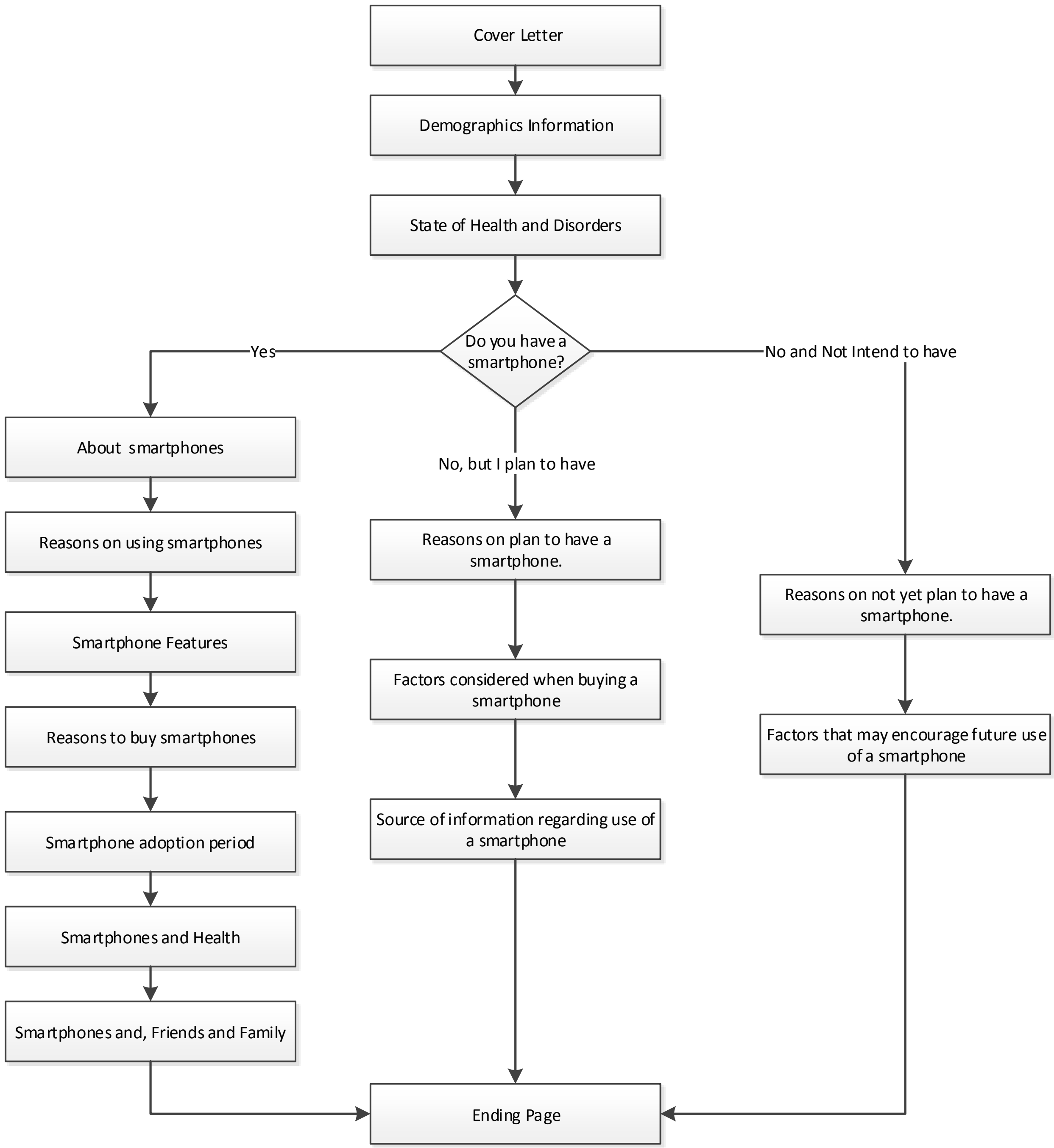

Figure4.12 Final Questionnaire Layout

4.9.3 Construct Measurement Questions

As addressed in the analysis result section, questions SOC3, SOC4, FC3 and FC4 that represented social influence and facility conditions performed poorly in SEM-PLS. In the analysis, SOC3, SOC4, FC3 and FC4 needed to be removed before the analysis. However, after discussions with the research team, the four questions still remained in the final questionnaire.

The reason for this is that by including them, there could be the possibility to provide useful data for the final phase. For example, FC4 which is "I have a person available to assist me in using my smartphone (Gu et al., 2009)", can link to the results that older adults need support to learn new technologies (Age UK, 2011). However, two questions were dropped while some questions were improved in order to provide more details and examples, as shown in Table 4.16 below.

Table 4.16 Construct Measurement Questions on Pilot and Final

Question	Pilot	Final
SOC1	People important to me think I should use a smartphone. (For example, friends and family).	People important to me think I should use a smartphone (For example, friends and family).
SOC2	People who influence my behaviour think that I should use a smartphone.	People who influence my behaviour think that I should use a smartphone.
SOC3	It is expected that people like me use smartphones. (For example, similar age or position people).	It is expected that people like me will use smartphones (For example, similar age or position people).
SOC4	I want to use a smartphone because my friends do so.	I want to use a smartphone because my friends do so.
OB1	I have had a lot of opportunity to see smartphones being used.	I have had many opportunities to see smartphones being used.
OB2	It is easy for me to observe others using smartphones. (For example, I saw my friends use smartphones).	It is easy for me to observe others using smartphones. (For example, I saw my friends use smartphones).
COM1	I believe that using the smartphone is suitable for me.	I believe that using the smartphone is suitable for me.
COM2	I believe that using the smartphone will fit my lifestyle.	I believe that using the smartphone will fit my lifestyle.
COM3	I think that using the smartphone fits well with the way I like to work.	I think that using the smartphone fits well with my lifestyle or my work.
COM4	Using the smartphone fits into my work style.	DROPPED
FC1	I have the resources necessary to use the smartphone. (For example, time and money).	I have the resources necessary to use the smartphone. (For example, time and money).
FC2	I have the knowledge necessary to use the smartphone.	I have the knowledge necessary to use the smartphone.

FC3	The operation costs of a smartphone do not prevent the use of it (such as price of smartphone or monthly fee).	The operation costs of a smartphone do not prevent the use of it (such as, price of a smartphone or monthly fee).
FC4	I have a person available to assist me in using my smartphone.	I have a person available to assist me when using my smartphone.
PE1	I feel a smartphone is useful.	I feel a smartphone is useful. (e.g. with my lifestyle, my daily routine and my work)
PE2	Using a smartphone enables me to finish tasks more quickly.	Using a smartphone enables me to finish my personal tasks or work more quickly.
PE3	Using a smartphone increases my productivity.	Using a smartphone increases my productivity (e.g. to receive or reply emails faster).
EE1	I find that using the smartphone is easy.	I find that using the smartphone is easy.
EE2	Learning how to use a smartphone is easy for me.	Learning how to use a smartphone is easy for me.
ENJ1	I find a smartphone fun (I had fun using a smartphone).	I think it is fun to use a smartphone.
ENJ2	I think it is fun to use a smartphone.	I find a smartphone fun (I had fun using a smartphone).
IN1	I intend to use a smartphone as much as possible.	I intend to use a smartphone as much as possible.
IN2	I intend to continue using a smartphone in the future.	I intend to continue using a smartphone in the future.
IN3	Whenever possible, I intend to use a smartphone in my job.	Whenever possible, I intend to use a smartphone in my daily lifestyle or job.
IN4	I intend to increase my use of a smartphone in the future.	DROPPED

Two questions have been dropped, which are COM4 and IN4. The first reason is to reduce the numbers of questions. Then, COM4 was removed because the question is specifically associated with work activities. For older adults, particularly the above 65 years old age group, which is also a target research group, this question may not be appropriate. IN4 was excluded because the wording was too specific on increasing smartphone use. Due to the suggestion of the research team, it was felt that this question may be inappropriate for older adults. Therefore, for the constructions measurements COM4 and IN4 were removed for the final phase questionnaire. Additionally, the Likert scale was changed from 5 to 7, a strategy similar to Venkatesh (2012).

4.9.4 Improvement to Supported Questions

Having improved the construct measurement questions, the next step was to improve the overall questionnaire and supported questions. The following steps were followed.

1. The question on ailments was removed.
2. The question of location was replaced with the list of locations in North London.
3. The options in questions about smartphone brands and providers were updated.
4. A question on frequency of smartphone usage was added.
5. Questions on smartphone features were upgraded to seven Likert scales.
6. The two questions on health and well-being were combined as well as the question on using smartphones to connect to friends and family.
7. All choices were presented in at least two columns to virtually reduce the length of the final questionnaire.

4.10 Chapter Summary

This chapter presented the process followed to develop the survey instrument that was used to test smartphone adoption in this research. This process involved developing questions, validating the questions using 24 specialists, improving the questions, creating the questionnaire in an online environment, distributing the link to the questionnaire in the target group using email and social media, validating the results and the instrument, analysing the result using SmartPLS and improving the questions and the questionnaire layout for the final data collection. The results from the pilot phase, which confirmed that smartphone usage is the difference between the older adults (50+) and younger generations (lower than 50). Moreover, the technology adoption factors between the groups are also different as seen in table 4.15.

The next chapter will present and analyse the results of the final data collection, which will be conducted in specific areas of North London, UK.

Chapter 5 Research Findings

5.1 Introduction

The questionnaire from the pilot phase that was presented in the previous chapter was improved after the feedback and analysis outcomes. To ensure that the newly formed conceptual framework is applicable and suitable for this research, a final phase was pursued for which the amended questionnaire was utilised. This chapter reveals the findings from the amended survey along with explanations about the sample size, the sampling process, the research site and the questionnaire distribution method. The demographics results are presented in section 5.3, followed by section 5.4, where the instrument validity is discussed. The hypotheses testing and comparisons between the sub-groups are described in section 5.6, which is then followed by section 5.7 where the effect of the moderated variables is discussed. Section 5.8 then explains the descriptive statistics of the construct measurements, after which section 5.9 explains the analysis outcomes of smartphone use, including health and connections with friends and family. Section 5.10 then reveals the results of the sources of information leading to smartphone adoption. Section 5.11 explains the results from older adults 50 years old and above who planned to use smartphones. For older adults who not use smartphones, the findings are described in section 5.12, which then draws the chapter to a close with a summary that is provided in section 5.13.

5.2 Sample Size and Sampling

For this phase, the selected research site was north London. North London was selected because London is not only the capital city of England and the United Kingdom but also advanced in terms of technologies.

Figure 5.1 Map of London, England, the UK

London was also chosen due to the well-developed mobile coverage infrastructure offered in the vicinity compared to other areas of the UK (Ofcom, 2013). In 2013 London was also one of the pioneering cities that UK major providers launched 4G services in. Therefore, London was an appropriate city due to an advanced and mature form of mobile signal coverage area, which would help in determining smartphone adoption and use. North London was also selected because the vicinity is closer in distance terms to the university; hence residents of north London are likely to be familiar with, and recognise the name, which could lead to more assistance with completing the questionnaire. The north London areas that were covered by this research were Barnet, Brent, Camden, Enfield, Haringey, Islington and Westminster. A final generic reason for selecting north London is due to the researcher being a resident of the area; thus being familiar with the area and having links with entrepreneurs in the area, which assisted in the distribution of the questionnaire letter (shown in Appendix 5-6).

In terms of the selection criteria used for the areas, the 108 districts were selected as explained in chapter 3’s description of the sample selection process. The data collection was achieved by the researcher and a team of two other individuals (a delivery man) who were delivery. The data collection period began from 1st November 2013 and ended on 12th February 2014, with a break of 76 days during the Christmas and New Year period (19th December 2013 to 14th January 2014).

Table 5.1 Population of sample area in North of London Source: Office for National Statistics (2011)			
Area	All age populations	50+ population	Percent of 50+ (%)
Barnet	356,386	102,741	28.83
Brent	311,215	77,860	25.02
Camden	220,338	53,552	24.30
Enfield	312,466	86,442	27.66
Haringey	254,926	55,641	21.83
Islington	206,125	43,338	21.03
Westminster	219,396	55,299	25.21
Total	1,880,852	474,873	25.25

Since this research is focused on 50 years old and above, the population of North London that matched the age ranges was identified to be 474,873 individuals as shown in Table 5.1. Before commencing the target population and appropriate sample size, the researcher established a target sample size after dissemination and collection to be at 1,000 individuals. The reasons of setting up the target at 1,000 responses were firstly from table 2.4 and table 2.6 that the average numbers of sample of the previous research studies were approximately 460. Secondly , Krejcie and Morgan (1970) suggested the sample of 384 can represent 1,000,000. Thirdly, to be ambitious, this research wanted to make sure that the sample size can present the population of older adults in north of London area. Therefore, this research doubled the recommended and rounded it to 1,000 responses.

To achieve, 1000 completed replies, 19760 questionnaire cover letters were randomly distributed during the earlier stated time periods that led to 1030 complete responses. The completed replies were inspected and cleansed which led to 984 usable responses. In terms of complete responses, it was found that the results received 3% more than the anticipated target. However, if the 984 usable responses were considered, it could be seen that this amount is less than the 1000 target, which leads to a reduced amount of 1.6%.

Since the researcher could not contact the overall possible populations, probability sampling as explained by Saunders et al (2009) was applied. The technique and the reasoning were earlier explained in chapter 3. From figure 3.5 in chapter 3, the guide of the minimum sample size was provided where it was learnt that with a sample size of 984 and a population of 474,873, was at a 95 % confidence level and a 5 % margin of error.

5.3 Calculating the Response Rate

The response rate is a number that can explain the situation and bias in a research (Saunders et al., 2009). The response can be calculated using the formula below.

$$response\ rate = \frac{number\ of\ responses}{number\ in\ sample}$$

$$response\ rate = \frac{1{,}030}{19{,}760} = 0.0521\ or\ 5.21\%$$

The response rate can be interpreted to represent the problems when collecting the data. Non-response rates can be caused by a refusal to respond, ineligibility to respond, inability to locate respondent/s and respondents being located, but unable to make contact (Saunders et al., 2009). Considering the 5.21% in this research, the number is quite low. However, when considering the real-life situation where a random sample population that the researcher could not find within the 50 years old and above group implies that the rate of 5.21% is reasonable.

5.4 Demographics

As explained in chapters 3 and 4, the questionnaire sought answers from the respondents in terms of the demographics, which this section now provides. The results of the socioeconomic characteristics are shown in Table 5.2. From the 984 complete replies, there were 702 replies within the adopters, 134 replies for the planned to have smartphones and 148 answers did not plan to have smartphones. In terms of gender, the results showed that there were 514 (52.24%) from the male and 470 (47.76%) from the female population. It can be deduced that the numbers of male respondents outnumbered the females, whilst the planned to have and did not have smartphones category showed that there were more females than male responses.

In terms of age, the majority of the respondents 553 (56.20%) were from the 50-59 age groups, 339 (34.45%) were from the 60-69 age group, 74 (7.52%) from the 70-79 age group, 16 (1.63%) from the 80-89 age group and 2 (0.2%) from the over 90 years old. Within the adopters' category, the majority was from the 450 (64.10%) 50-59 age group and 211 (30.06%) was from the 60-69 age group. The majority of the replies in the do not plan to have a smartphone 73 (49.32%) were from the 60-69 age group.

Table5.2 Socio-demographic Summary – Gender, Age, Education, and Area (n= 984)									
Category		Adopted		Plan to have		Do plan to have		Total	
		Respondents	%	Respondents	%	Respondents	%	Respondents	%
Gender	Male	382	54.42	59	44.03	73	49.32	514	52.24
	Female	320	45.58	75	55.97	75	50.68	470	47.76
	Total	702		134		148		984	
Age	50-59	450	64.10	64	47.76	39	26.35	553	56.20
	60-69	211	30.06	55	41.04	73	49.32	339	34.45
	70-79	39	5.56	12	8.95	23	15.54	74	7.52
	80-89	2	0.28	3	2.24	11	7.43	16	1.63
	Over 90	0	0	0	0	2	1.36	2	0.20
		702		134		148		984	
Education	Higher Degree Postgraduate	95	13.53	11	8.21	12	8.11	118	11.99
	1st Degree	187	26.64	41	30.59	42	28.38	270	27.44
	HND/ HNC/ Teaching	48	6.84	9	6.72	14	9.46	71	7.22
	A-Level	104	14.81	21	15.67	27	18.24	152	15.45
	BTEC/ College Diploma	77	10.97	9	6.72	14	9.46	100	10.16
	GCSE/O Level	176	25.07	41	30.60	37	25.00	254	25.81
	Others	15	2.14	2	1.49	2	1.35	19	1.93
		702		134		148		984	
Area	Barnet	95	13.53	12	8.95	25	16.89	132	13.41
	Brent	42	5.98	11	8.21	8	5.41	61	6.20
	Camden	158	22.51	35	26.12	42	28.38	235	23.88
	Enfield	99	14.10	25	18.66	22	14.86	146	14.84
	Haringey	108	15.39	19	14.18	22	14.86	149	15.15
	Islington	90	12.82	12	8.96	16	10.81	118	11.99
	Westminster	110	15.67	20	14.92	13	8.79	143	14.53
		702		**134**		**148**		**984**	

For education the results were diversified with 118 (11.99%) of the respondents being highly educated, or from a postgraduate level. 270 (27.44%) of the respondents had undergraduate (1st) Degrees. 71 (7.22%) had educational backgrounds of HND/HNC/Teaching. 152 (15.45%) had A-level qualifications, 100 (10.16%) had BTEC or college Diploma qualifications and 25.81% had GCSE/ O level educational qualifications.

When considering the localities of north London, 13.41% of respondents were from Barnet, 6.2% of respondents hailed from Brent, 23.88% were from Camden, 14.84% were from Enfield, 15.15% from Haringey, 11.99% were from Islington. 14.53% were from Westminster. It can be seen that in the Westminster area, which is in the centre and heart of London, the percentage of people who adopted smartphones are greater than those who plan to have smartphones. In turn, individuals who plan to adopt and use smartphones outnumber those who do not plan to have a smartphone. Contrastingly, areas that are in the outskirts of central London, such as in Barnet, reveal that those who do not plan to adopt and use smartphones are larger than the adopters, which suggests that the area with a good or strong mobile phone coverage or facility may affect the numbers of people that adopt smartphones.

As the UK is a multi-cultural and diverse country, ethnicity was also considered by this research where 804 (81.71%) of the respondents were White British, 91 (9.25%) of respondents were other White Backgrounds, 23 (2.34%) of replies were from Black/Brit African and finally, other Ethnicities were Mixed white and black African, Mixed white and Asian, Other mixed background, Asia/Brit Indian, Asian/Brit Pakistani, Chinese, Japanese, Other Asian background, Black/Brit African, and others that the details can be found in Table 5.3

With regards to employment status, 323 (32.83%) of respondents were full time employees, 193 (19.61%) were pensioners at 65 years and above, 124 (12.60%) were self-employed respondents. Both the Retired (under 65 years old) and part time respondents were at 107 (10.87%) equally. There were 64 (6.5%) unemployed respondents, 31 (3.15%) entrepreneurs, 11 (1.12%) of the respondents were disabled and 8 (0.81%) were homemakers.

Table5.3 Socio-demographic Summary-Ethnicity, Employment and Occupation (n= 984)

Category		Adopted		Plan to have		Do not plan to have		Total	
		Respondents	%	Respondents	%	Respondents	%	Respondents	%
Ethnicity	White British	577	82.19	104	77.61	123	83.11	804	81.71
	Other white background	54	7.69	20	14.93	17	11.49	91	9.25
	Mixed White & Black African	8	1.14	1	0.75	2	1.35	11	1.12
	Mixed White and Asian	3	0.43	2	1.49	2	1.35	7	0.71
	Other mixed background	10	1.42	3	2.24	0	0.00	13	1.32
	Asian/Brit Indian	12	1.71	0	0.00	0	0.00	12	1.22
	Asian/Brit Pakistani	3	0.43	0	0.00	0	0.00	3	0.30
	Chinese	4	0.57	0	0.00	0	0.00	4	0.41
	Japanese	0	0.00	1	0.75	0	0.00	1	0.10
	Other Asian background	11	1.57	1	0.75	2	1.35	14	1.42
	Black/Brit African	19	2.71	2	1.49	2	1.35	23	2.34
	Others	1	0.14	0	0.00	0	0.00	1	0.10
		702		134		148		984	
Employment status	Pensioner 65+	102	14.53	26	19.40	65	43.92	193	19.61
	Retired (Under 65 Years	71	10.11	20	14.93	16	10.81	107	10.87

	Old)								
	Employed full time	262	37.32	41	30.60	20	13.51	323	32.83
	Employed part time	80	11.40	12	8.96	15	10.14	107	10.87
	Self-employed	87	12.39	17	12.69	20	13.51	124	12.60
	Own my own business	25	3.56	3	2.24	3	2.03	31	3.15
	Unemployed	51	7.26	7	5.22	6	4.05	64	6.50
	Disable	7	1.00	4	2.99	0	0.00	11	1.12
	Housewife	8	1.14	0	0.00	0	0.00	8	0.81
	Others	9	1.28	4	2.99	3	2.03	16	1.63
		702		134		148		984	
Occupation	Academic/Teacher	41	5.84	14	10.45	16	10.81	71	7.22
	Agricultural/Forestry/Fishery	4	0.57	1	0.75	0	0.00	5	0.51
	Clerk	102	14.53	20	14.93	29	19.59	151	15.35
	Craft/Trade	39	5.56	8	5.97	9	6.08	56	5.69
	Freelance	59	8.40	14	10.45	10	6.76	83	8.43
	Legislator/Manager	119	16.95	16	11.94	21	14.19	156	15.85
	Services/Sales	136	19.37	33	24.63	35	23.65	204	20.73
	Plant/Machine Operator	8	1.14	2	1.49	3	2.03	13	1.32
	Others	194	27.64	26	19.40	25	16.89	245	24.90
		702		134		148		984	

With respect to the occupation of the respondents, 204 (20.73%) of respondents were services or sales personnel; 156 (15.85%) of respondents were legislators or managers; 151 (15.35%) were clerks; 83 (8.43%) were freelancers; 71 (7.22%) were academics or teachers; 56 (5.69%) were craft or trades people; 13 (1.32%) were plant or machine operators; 5 (0.51%) were agricultural, forestry or fishery individuals. It was also found that 245 (24.90%) of the respondents stated other occupations such as being drivers, insurance related personnel, nurses, army, HM forces, builders, programmers, system engineers, paramedics, book keepers, funeral arrangers, helicopter pilot instructors and postmen.

In terms of employment status, 102 (14.53%) of the adopters were pensioners at 65 years and above; 26 (19.40%) planned to have smartphones and 65 (43.92%) did not plan to adopt smartphones, which implied to the researcher that pensioners, i.e. Individuals aged 65 years and above were less interested in adopting smartphones. Contrastingly, individuals in full time employment displayed 262 (37.32%) adopters, 41 (30.60%) planning to adopt smartphones and 20 (13.51%) not planning to adopt smartphones. These results suggest that employment status can affect smartphone adoption.

Table 5.4 Socio-demographic Summary – Health status (n= 984)								
Category	Adopted		Plan to have		Do not plan to have		Total	
	respondents	%	respondents	%	respondents	%	respondents	%
Health Excellent	147	20.94	25	18.66	27	18.24	199	20.22
Health Good	473	67.38	94	70.15	98	66.22	665	67.58
Health Poor	82	11.68	15	11.19	23	15.54	120	12.20
	702	**100.00**	**134**	**100.00**	**148**	**100.00**	**984**	**100.00**

Finally, as suggested in chapter 2 as adult age, health concerns emerge. This research sought respondents to self-diagnose their health. The majority at 665 (67.58%) of the respondents believed that their health was good. 199 (20.22%) identified their health as excellent. However, 120 (12.20%) of the respondents assessed their health as poor.

5.5 Instrument Validation

Having explained the demographics of the questionnaire, the next step was to conduct a validation test before analysing the data further. It is very important to demonstrate that the collected data is valid and meets statistical standards. The tools to validate in this research study began with a sampling adequacy that applied Kaiser-Meyer-Olkin and Bartlett's Test. The measurement model was validated using reflective measurements that included internal consistency reliability using Composite reliability, indicator reliability using Indicator loadings, Convergent validity using Average Variance Extracted (AVE), and Discriminant validity using the Fornell and Larcker (1981) methods. Those validation results will be explained in the following section.

5.5.1 Sampling Adequacy- Kaiser-Meyer-OlKin and Bartlett's Test

The Kaiser-Meyer-Olkin (KMO) is the first factor test to examine the collected data and to measure the sampling adequacy. A KMO value ranges from 0 to 1, and a value greater than 0.6 displays satisfaction. (Brace et al., 2003; Hinton et al., 2004). The data from the adopted group (n=702) was used for this test as it was only in this group that the data was brought to Path Analysis. The data was analysed using SPSS version 21 that resulted in a value of 0.928, as shown in table 5.5. This result suggests that this dataset is worthy to further analyse for providing a conceptual model.

Table 5.5 KMO and Bartlett's Results

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.928
Bartlett's Test of Sphericity	Approx. Chi-Square	13848.159
	Df	276
	Sig.	.000

Bartlett's sphericity test is the second test that was conducted and examined whether there is a relationship between the variables. A p-value less than 0.05 displays satisfaction (Hinton et al., 2004) and was used as the guiding measure. Table 5.5 shows that for the collected data the p-value is less than 0.001, which suggested that it is appropriate to conduct further analysis.

5.5.2 Reflective Measurement Model

In a reflective measurement model, indicators are functions of a hypothesised factor and error terms, where empirical meaning can be said to be local. That is, the inferred parameters linking each indicator to the construct are in principle particular to the nature of the relationships amongst all the indicators of the construct alone and the residual for each indicator reflects errors. Such measurements models can stand on their own (Bagozzi, 2011). This measurement consists of internal consistency reliability, indicator reliability, convergent validity and discriminant validity. For **Internal consistency reliability**, composite reliability is considered where a satisfactory value should be higher than 0.70 (Hair et al., 2011). For this, the data was imported into SmartPLS to perform several tests with the results displayed in table 5.6. From table 5.6, the overall **composite reliability** values are greater than 0.7; therefore, this data satisfies the internal consistency reliability test.

Table 5.6 Cross-correlations, Item loadings, Average variance Extracted (AVE), Composite Reliability (CR), R-squared and Cronbach's Alpha (CA) of the research model. The diagonal elements in bold in the cross-correlations matrix are the square root of the AVE

	Cross-correlations								**Item loadings**	**AVE > 0.50**	**CR > 0.70**	**R^2**	**CA > 0.70**
	COM	**EE**	**FC**	**ENJ**	**IN**	**OB**	**PE**	**SOC**					
COM	**0.9353**								0.9212-0.9544	0.8747	0.9544		0.9283
EE	0.6057	**0.9664**							0.9640-0.9688	0.9339	0.9658		0.9293
ENJ	0.6551	0.6499	**0.9817**						0.9814-0.9820	0.9637	0.9815		0.9624
FC	0.7301	0.6638	0.5379	**0.8626**					0.8452-0.8869	0.7441	0.8971		0.828
INT	0.7707	0.6625	0.7765	0.6585	**0.8843**				0.8435-0.9079	0.7819	0.9149	0.7596	0.8602
OBS	0.5493	0.3629	0.3269	0.5535	0.4181	**0.9513**			0.9472-0.9554	0.9049	0.9501		0.8951
PE	0.7474	0.5656	0.6148	0.6121	0.7393	0.4304	**0.8798**		0.8497-0.8954	0.774	0.9113		0.8543
SOC	0.4494	0.1988	0.3616	0.3174	0.3667	0.3769	0.4215	**0.9393**	0.9328-0.9458	0.8823	0.9374		0.8669
ACU									-			0.2078	

The second test for this model is **Convergent validity**, where emphasis is upon the **Average Variance Extracted (AVE) that should achieve a** value higher than 0.50 for satisfaction (Hair et al., 2011). As seen in table 5.6, the minimum AVE value is 0.7441; hence the data has satisfied convergent validity.

The third test is **Indicator reliability** that considers the **factor loading** from each indicator. In the case of the indicators, the loadings should be higher than 0.70 (Hair et al., 2011). In table 5.7 it can be seen that the loading factors of items FC4, SOC3 and SOC4 were less than 0.8, although this researcher does acknowledge that the results should be higher than 0.7. Due to the previously mentioned items being less than 0.8 there were removed and only the significant indicators were kept. The indicators that were kept in this research and known as items are listed in Table 5.8.

Table 5.7 Factor loadings table

	COM	EE	ENJ	FC	INT	OBS	PE	SOC	ACU
ACU	0.4447	0.334	0.3454	0.3749	0.4558	0.2301	0.4251	0.2056	**1**
COM1	**0.9212**	0.6144	0.6209	0.7212	0.7362	0.5284	0.6718	0.4299	0.4188
COM2	**0.9544**	0.5556	0.6194	0.6737	0.7305	0.5036	0.7011	0.5163	0.4074
COM3	**0.9299**	0.527	0.5967	0.6579	0.6943	0.5089	0.7255	0.5129	0.4217
EE1	0.619	**0.9688**	0.632	0.6425	0.6623	0.3528	0.5805	0.2532	0.3504
EE2	0.5493	**0.964**	0.624	0.6324	0.6166	0.3486	0.5103	0.2446	0.2932
ENJ1	0.6684	0.6442	**0.982**	0.5338	0.7679	0.3344	0.6101	0.4012	0.3295
ENJ2	0.6174	0.6317	**0.9814**	0.5241	0.7566	0.3072	0.5969	0.3711	0.3488
FC1	0.674	0.5059	0.439	**0.8877**	0.5583	0.5377	0.574	0.3837	0.3393
FC2	0.6297	0.7363	0.5409	**0.8516**	0.6017	0.4752	0.5047	0.2928	0.3015
FC3	0.5838	0.4589	0.4039	**0.8461**	0.5403	0.4174	0.5062	0.3131	0.3331
FC4	0.1224	-0.0349	0.0744	**0.117**	0.061	0.219	0.0906	0.2458	0.0182
IN1	0.672	0.5939	0.8093	0.5309	**0.9**	0.3289	0.672	0.406	0.446
IN2	0.6811	0.6297	0.6093	0.657	**0.8435**	0.4092	0.5699	0.3125	0.3533
IN3	0.6941	0.5373	0.6277	0.5693	**0.9079**	0.378	0.7144	0.4032	0.4042
OB1	0.5255	0.3739	0.3081	0.5359	0.4136	**0.9554**	0.4131	0.4108	0.2253
OB2	0.5196	0.3142	0.3142	0.5302	0.3808	**0.9472**	0.4056	0.4568	0.212
PE1	0.7571	0.5796	0.6022	0.6249	0.7119	0.4271	**0.8497**	0.4048	0.3872
PE2	0.5898	0.4374	0.4973	0.4908	0.6094	0.3535	**0.8954**	0.4699	0.3388
PE3	0.6052	0.4591	0.5098	0.486	0.6158	0.3452	**0.8935**	0.4516	0.3911
SOC1	0.4337	0.2106	0.3668	0.3093	0.3615	0.3607	0.3955	**0.8564**	0.14
SOC2	0.4095	0.1604	0.3097	0.3039	0.3257	0.3468	0.3967	**0.8711**	0.1495
SOC3	0.5005	0.3252	0.3369	0.4253	0.4043	0.4494	0.4939	**0.7994**	0.2297
SOC4	0.2648	0.0634	0.2157	0.1432	0.2283	0.2596	0.271	**0.6489**	0.117

Table 5.8 List of items or indicators

Construct Measure	Mean	SD	Construct Measure Definition
Social Influence (SOC1)	4.43	1.95	1. People important to me think I should use a smartphone (For example, friends and family)
Social Influence (SOC2)	3.81	1.95	2. People who influence my behaviour think that I should use a smartphone
Social Influence (SOC3)	4.60	1.88	3. It is expected that people like me will use smartphones (For example, similar age or position people).
Social Influence (SOC4)	3.00	1.90	4. I want to use a smartphone because my friends do so.
Observability (OB1)	5.51	1.64	5. I have had many opportunities to see smartphones being used.
Observability (OB2)	5.39	1.68	6. It is easy for me to observe others using smartphones. (For example, I saw my friends use smartphones)
Compatibility (COM1)	5.91	1.37	7. I believe that using the smartphone is suitable for me.
Compatibility (COM2)	5.61	1.60	8. I believe that using the smartphone will fit my lifestyle.
Compatibility (COM3)	5.59	1.66	9. I think that using the smartphone fits well with my lifestyle or my work.
Facilitating Condition (FC1)	5.79	1.43	10. I have the resources necessary to use the smartphone. (For example, time and money)
Facilitating Condition (FC2)	5.86	1.35	11. I have the knowledge necessary to use the smartphone.
Facilitating Condition (FC3)	5.66	1.51	12. The operation costs of a smartphone do not prevent the use of it (such as, price of a smartphone or monthly fee).
Facilitating Condition (FC4)	3.63	2.20	13. I have a person available to assist me when using my smartphone.
Performance expectancy (PE1)	5.77	1.45	14. I feel a smartphone is useful. (e.g. with my lifestyle, my daily routine and my work)
Performance expectancy (PE2)	4.69	1.92	15. Using a smartphone enables me to finish my personal tasks or work more quickly.
Performance expectancy (PE3)	4.99	1.92	16. Using a smartphone increases my productivity (e.g. to receive or reply emails faster).
Effort Expectancy (EE1)	5.67	1.41	17. I find that using the smartphone is easy.
Effort Expectancy (EE2)	5.54	1.46	18. Learning how to use a smartphone is easy for me.
Enjoyment (ENJ1)	5.37	1.62	19. I think it is fun to use a smartphone.
Enjoyment (ENJ2)	5.20	1.73	20. I find a smartphone fun (I had fun using a smartphone).
Behavioural intention (IN1)	5.28	1.69	21. I intend to use a smartphone as much as possible.
Behavioural intention (IN2)	6.18	1.23	22. I intend to continue using a smartphone in the future.
Behavioural intention (IN3)	5.53	1.61	23. Whenever possible, I intend to use a smartphone in my daily lifestyle or job.
Actual use (ACU)	5.87	1.49	Usage frequency of your smartphone
n=702	The question used likert scale 1-7(1=strongly disagree, 7 =strongly agree)		

The last test in this group is **Discriminant validity**. Firstly, an indicator's loadings should be greater than all of its cross loadings (Hair et al., 2011). As can be seen in factor loading table, table 5.7, apart from the removed items, each indicator's loadings was higher than all its cross loading. Secondly, the AVE of each latent construct should greater than the construct's highest squared correlation with any other latent construct (Fornell & Larcker, 1981). In another word, the square root of the AVE should be compared with the correlations between the latent constructs. Moreover, the square root of the AVE should more than cross-correlations both horizontal and vertical. In Cross-correlations table, table 5.6, the square root of AVE was presented in bold. Each value is bigger than any other latent cross-correlations. Therefore, this model satisfied the Reflective Measurement test.

5.5.3 Formative Measurement

Having completed the Reflective Measurement test, the next step was to conduct a Formative Measurement test where the indicator's weight and loading were examined. In the formative measurement model indicators have no errors directly associated with them (Bogozzi, 2011). For this model, bootstrapping was employed to estimate the indicator's significance. The further details on bootstrapping can be found at section 3.7.7.4. As shown in the earlier explanations, this research followed the recommendations from Hair et al (2011). This research also set the number of bootstrap samples to 5,000 times that the SmartPLS randomly select the samples from 702 case 5,000 times before providing report that can be seen in figure 5.2 and Table 5.9.

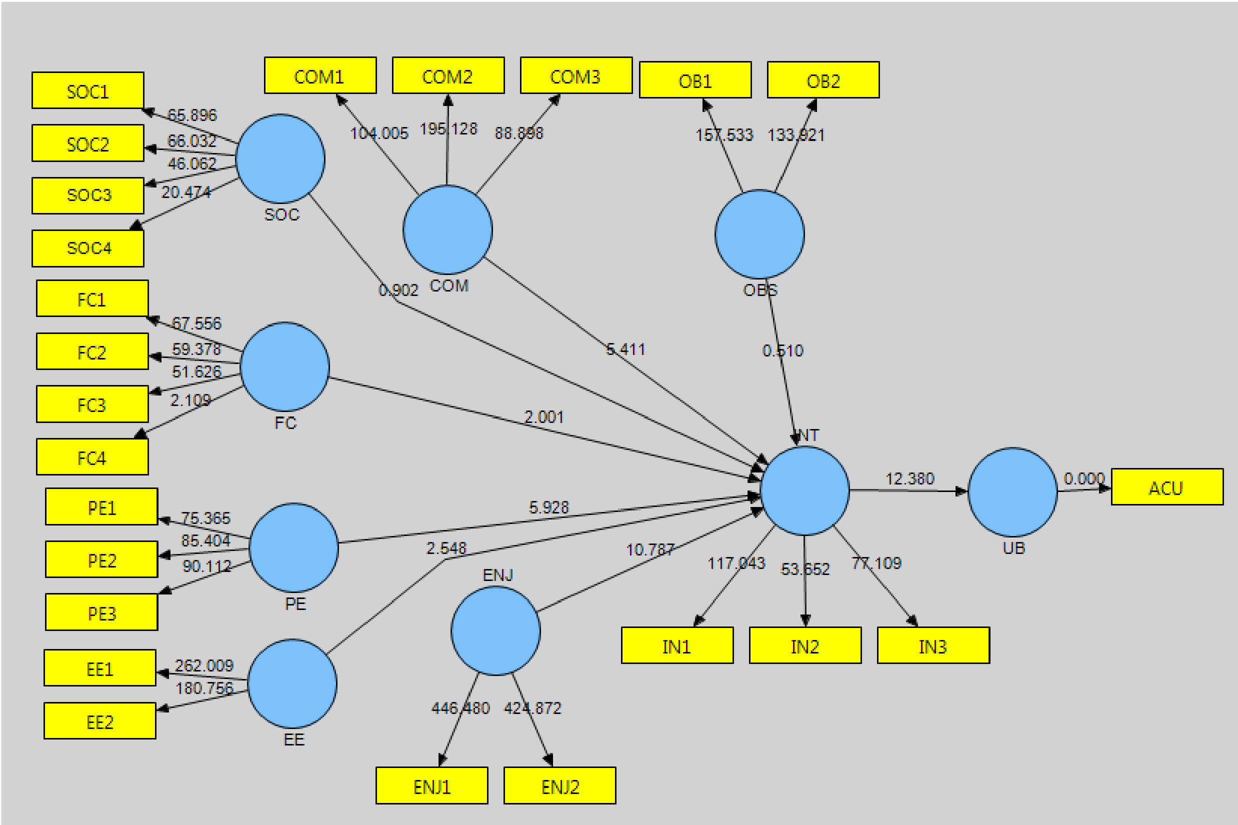

Figure 5.2 Bootstrap results from SmartPLS

Table 5.9 Hypothesis, Path coefficients, t-value, Significant and hypothesis support

Hypothesis	**Path coefficients (β)**	**t-value**	**Significant (p)**	**Supported: Yes/No**
1. Observability -> Behavioural intention	0.015	0.510	-	NO
2. Compatibility -> Behavioural intention	0.251	5.411	<0.01	YES
3. Social Influence -> Behavioural intention	0.020	0.902	-	NO
4. Facilitating -> Behavioural intention	0.089	2.001	<0.05	YES
5. Performance expectancy -> Behavioural intention	0.232	5.928	<0.01	YES
6. Effort Expectancy -> Behavioural intention	0.083	2.548	<0.01	YES
7. Enjoyment -> Behavioural intention	0.380	10.787	<0.01	YES
8. Behavioural intention -> smartphone usage	0.456	12.380	<0.01	YES

The indicator’s weight is known as t-value and can be obtained from the numbers on the lines between the indicators in the figure of the results from bootstrapping above. A t-value can be interpreted to show the significance (p) of the paths. As a rule, the critical t-values for a two-tailed test is 1.65 equal to significance level = 10 % or 0.10, 1.96 equal to significance level = 5 % or 0.05, and 2.58 equal to significance level = 1 % or 0.01 (Hair et al., 2011). Note: In most IS research, significance levels of less than 0.05 are considered as significant and support a hypothesis.

5.5.4 A Structural Model

In this section, the R-square (R^2) value, that represents the ability of a model to explain a phenomenon, can be viewed in Table 5.9. In this research's instance, the model can explain 75.96% of the 50 years and above adults' intention to use smartphones and 20.78% of the 50 years old and above adults' actual use of smartphones. In terms of the R-squared measurements, the values of 0.75, 0.50 and 0.25 can be described as substantial, moderate or weak, respectively (Hair et al., 2011). Hence, for this research the R-square of 0.7596 or 75.96% was substantial for the intention to use smartphones. However, for actual use, the R-squared was 0.2078 or 20.78%, which can be considered as weak. Nonetheless, when comparing smartphone use in terms of consumer behaviours, the R-square of 0.2080 or 20.78% can be considered as significant (Hair et al., 2011).

5.6 Hypotheses Testing and Comparison

In chapter 2 some hypothesis were formed that were also tested in the pilot and now, for this final phase. The results from applying SmartPLS showed that the model's R squared 75.96% shows that the variance in Behavioural Intention's values is explained and 20.78% of the results revealed the Actual Use of smart phones as shown in Table 5.8.

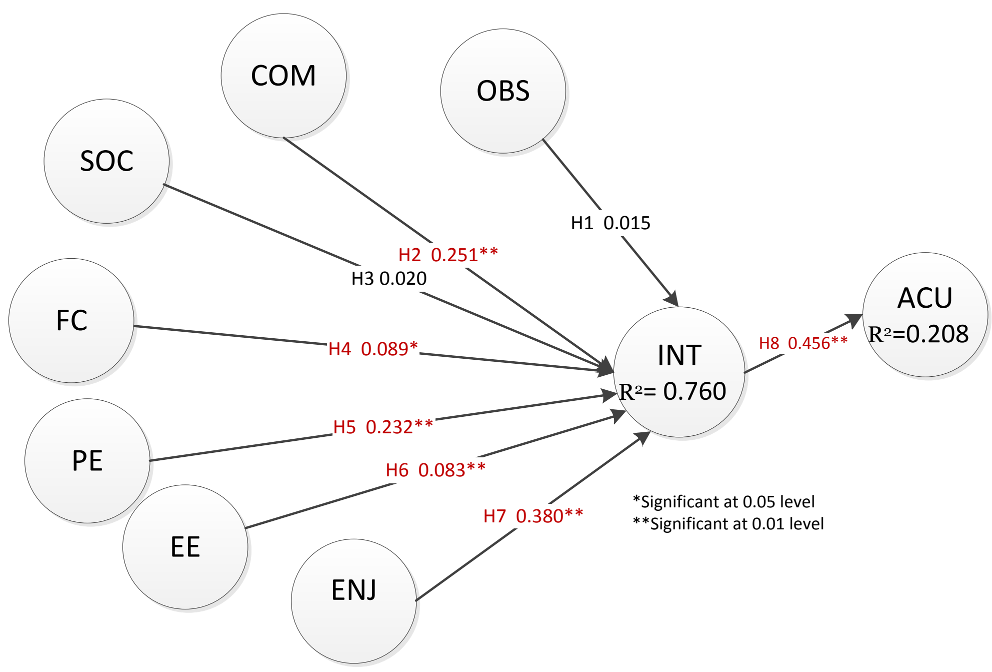

Figure 5.3 Conclusion of the Hypothesis on Research Model

The path coefficients (β) and t-value of the bootstrap and PLS algorithms were also applied to explain the hypothesis (Hair et al., 2011; Urbach & Ahlemann, 2010). Enjoyment (H7) had the strongest factor influencing the Behavioural intention to use smartphones within the 50 years old and above older adults obtaining a β=0.380, t-value= 10.787 and a significance level of (p) < 0.01. Compatibility (H2) and Performance expectancy (H5) were strong factors with $p < 0.01$, and β=0.251, t-value= 5.411 and β=0.232, t-value= 5.928 respectively. Facilitating Conditions (H4) was considered significant ($p < 0.05$) with β=0.089, t-value= 2.001. Effort Expectancy (H6) was considered significant ($p < 0.01$) with β=0.083, t-value= 2.548. More importantly, Behavioural intention for the total sample appears to have an important effect on actual use (β=0.456, t-value= 12.380 and $p< 0.01$). However, Observability (H1) and social influence (H3) were considered as not significant with the t-value=0.510 and 0.902 respectively. Therefore, of eight hypotheses, six were supported (results shown in Table 5.10).

Following the overall results from the 50 years old and above age groups, the data was categorised in terms of gender (Male and Female), age groups (50-59, 60-69 and 70-79), and education levels (Higher Degree, First Degree, A Level and O Level) for further comparison of the results. After entering the data in SmartPLS an analysis of each demographic group was completed, which is located in Appendices 5-10 and 5-11. The final results are illustrated in Table 5.10, below and a comparison of each hypothesis is also provided hereafter.

Table 5.10 Hypotheses testing results: Comparison

Hypothesis	**Adopted (50+)**	**Male**	**Female**	**50-59**	**60-69**	**70-79**	**Higher Degree**	**First Degree**	**A Level**	**O Level**
1. Observability H1										
2. Compatibility H2	Y	Y	Y	Y	Y		Y	Y	Y	Y
3. Social Influence H3										
4. Facilitating H4	Y						Y	Y	Y	Y
5. Performance expectancy H5	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
6. Effort Expectancy H6	Y		Y	Y						
7. Enjoyment H7	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
8. Behavioural intention H8	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Hypothesis 1: Observability has a positive influence on the behavioural intention towards smartphone adoption – Not Supported

For this hypothesis it was expected that the more chances older adults have of viewing a smartphone, the more they intend to use the technology. From the obtained results this hypothesis was not significant for the older adults. Therefore, it can be implied that older adults have already viewed smartphones for a while; hence not displaying any further interest in the device.

Hypothesis 2: Compatibility has a positive influence on the behavioural intention towards smartphone adoption – Supported

This hypothesis predicted that the more smartphones are compatible with the users' lifestyle, the more they intend to use their smartphone. Table 5.10 above shows that this hypothesis was supported by all categories except for within the 70-79 years old age group. Generally, smartphones can provide many benefits to users and are compatible with most of their lifestyles. However, for the 70-79 age group, smartphones may not yet be compatible. Moreover, from the above results, age can be a moderating factor for this hypothesis. That means for 60+ adults, smartphones were likely to be less compatible with their lifestyle, therefore, the 60+ people may be less likely to adopt smartphones. In other words, the effect of compatibility on smartphone intention would be stronger for a younger age group, in this case 50-59 adults.

Hypothesis 3: Social Influence has a positive influence on the behavioural intention towards smartphone adoption - Not Supported

The third hypothesis expects that social Influence positively affects the intention to use smartphones. However, this hypothesis was not supported by any category as shown in Table 5.10 above. Therefore, older adults are less influenced by society.

Hypothesis 4: Facilitating Condition has a positive influence on the behavioural intention towards smartphone adoption – Supported

This hypothesis predicted that facilitating conditions positively influences the intention to use the devices. This was supported by the overall results and all the levels of education. However, for particular age groups or genders this hypothesis was not supported. Please note that the t-value of both the genders and the 50-59 age groups for this hypothesis was very near the level of significance.

Hypothesis 5: Performance expectancy has a positive influence on the behavioural intention towards smartphone adoption – Supported

Performance expectancy, the fifth hypotheses, was believed to positively increase the intention to use smartphones. From Table 5.10 above, this hypothesis was supported in every category.

Hypothesis 6: Effort Expectancy has a positive influence on the behavioural intention towards smartphone adoption – Supported

Hypothesis 6 predicted that Effort Expectancy will positively influence technology usage intention. This hypothesis was supported in the overall results, within the female population and 50-59 age groups. This hypothesis was not supported in the 60-69, 70-79, higher Degree, First Degree, A level or O level groups.

Hypothesis 7: Enjoyment has a positive influence on the behavioural intention towards smartphone adoption – Supported

This hypothesis expected that Perceived Enjoyment has a positive effect on the intention to use smartphones. The results showed that this hypothesis was supported in every category.

Hypothesis 8: Behavioural intention has a positive influence on the smartphone usage – Supported

This hypothesis predicted that the actual use of technology was positively influenced by the intention to use smartphones. This hypothesis was supported in every category.

From these descriptions, it can be learnt that six of the overall eight hypotheses were supported. It was also found that the strongest variable for smartphone adoption was Perceived Enjoyment. What is also known is that the structural model can predict up to 75.96% of the intention to continue to use smartphones, which can be considered as substantial. For actual usage, the model can predict around 20.78%. After analysing the overall results, the data were categorised by the demographic variables - age, gender and education. Having explained the differences between the categories, the next section will further investigate the demographic variables as moderator variables.

5.7 The effect of Demographic Variables as Moderated Variables

Having identified the results of the hypothesis, the next step in this study was to further analyse the demographic factors that can be used to determine moderator variables. To study demographic variables as a moderated variable, this study further investigated the sub categories of demographic variables within 50+ adults.

From UTAUT, it was found that moderator variables affect relationships between the independent and the dependent variables (Venkatesh, Morris, Hall, et al., 2003). The original moderator variables taken from UTAUT are gender, age, experience, and voluntariness of use. Experience for this research was defined as experienced at using a smartphone. Further, since this research relates to older adults, health is selected as a moderator variable. Education is also often another variable that is often used as a moderator variable in technology adoption research (Park et al., 2007). This research study examined five moderators to smartphone adoption that are gender, age, experience, health, and education with the supported hypothesis similar to Dabholkar and Bagozzi (2002) and Park et al (2007).

The data collected in the final phase questionnaire was analysed following the process from Lowry and Gaskin (2014) and using a formula from Chin (2000). The process began by dividing the data into two main groups that are dependent on moderators. For **gender**, the dataset was divided into male and female. In terms of age, the dataset was separated in terms of the age groups of 50-59 and 60-79 years old. The **experience** of users was divided to under two years and more than two years of using smartphones. The two years in the past (2011 to 2012) were the years that Ofcom (2011) report 59% of the UK had smartphones. There was a significant increase in smartphone usage. Moreover, this research would like to investigate whether two year experience with smartphone could affect smartphone adoption.

Health was a self-assessed question that provided three choices that were available to respondents, which were poor, good and excellent. For the moderator analysis, the expressions of good and excellent were grouped against the poor. This is because this research wanted to further investigate whether poor heath could affect smartphone adoption.

For the **education levels**, there were Higher and First Degrees against the Diploma, A level, and O level. The sub-groups were analysed using SmartPLS in order to determine the t or significant values.

An example of calculating moderator variables has been adapted from the formulas provided by Lowry and Gaskin (2014) and Chin (2000). The formula to calculate the t-values between two subgroups is shown below.

$$t = \frac{Path_{sample\_1} - Path_{sample\_2}}{\left[\sqrt{\frac{(m-1)^2}{(m+n-2)} * S.E.^2_{sample1} + \frac{(n-1)^2}{(m+n-2)} * S.E.^2_{sample2}}\right] * \left[\sqrt{\frac{1}{m} + \frac{1}{n}}\right]}$$

Multi-Group analysis with PLS equation source: Chin (2000)

Where

M = number of responses in case 1 such as number of females

N = number of responses in case 2 such as number of males

Path sample1 = Mean of case 1 or Regression Weight which similar to Path coefficients of case 1

Path sample2 = Mean of case 2 or Regression Weight which similar to Path coefficients or case 2

S.E. = Standard Error. Or STERR

From the analysis and the formula, 5 tables from each demographic variable were created, as can be seen in appendix 5-11. The only important rows from the 5 tables, t- value >1.50, were selected to create Table 5.11. This is providing convenience for readers.

Table 5.11 Significant moderator variables

Moderating Model- Health										
	Poor(n=82)				Good and Excellent(n=620)				Compare	
Hypothesis	β	t-value	Mean	STERR	β	t-value	Mean	STERR	t-value	p-value
INT->ACU	0.611	6.476	0.6121	0.0943	0.427	10.828	0.4263	0.0395	1.633	0.103
Moderating Model-Experience										
	Less than 2 years (n=238)				More than 2 years (n=464)				Compare	
Hypothesis	β	t-value	Mean	STERR	β	t-value	Mean	STERR	t-value	p-value
INT->ACU	0.525	9.342	0.5232	0.0562	0.352	7.079	0.3502	0.0497	2.159	0.031
Moderating Model-Education										
	Low(n=405)				High(n=282)				Compare	
Hypothesis	β	t-value	Mean	STERR	β	t-value	Mean	STERR	t-value	p-value
FC->INT	0.199	3.687	0.1997	0.054	-0.088	1.320	-0.087	0.0666	3.366	0.001
INT->ACU	0.404	7.923	0.4027	0.051	0.523	9.847	0.5233	0.0531	1.600	0.110
Moderating Model-Age										
	Older Adult (50-59) (n=450)				60+ Adult (60-79) (n=250)				Compare	
Hypothesis	β	t-value	Mean	STERR	β	t-value	Mean	STERR	t-value	p-value
ENJ->INT	0.342	8.043	0.3408	0.0426	0.457	7.090	0.4571	0.0644	1.561	0.119

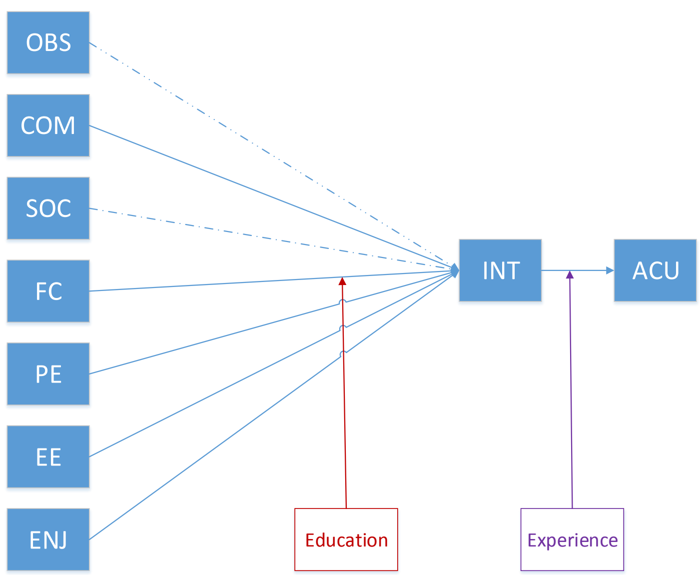

Figure 5.4 Conceptual framework with moderated variables – education and experience

The results of the moderated variables disclosed that education moderated the relationship between FC and INT while Experience moderated the link between INT and ACU significantly ($p<0.05$). This means that the effect of facilitating conditions will be stronger for those who have higher education. It can also be implied that for those who have a higher education, there are more resources such as time, money and knowledge in order to use their smartphones.

It was also discovered that the effect of intention to continue using smartphones will be stronger for those who are more experienced at adopting and using their smartphones. This means that the more experienced individuals (more than two years) will spend increasing times on their smartphones.

Others moderator variables that are almost significant ($p<0.15$) were Age that provided the link between ENJ and INT; Health and education between INT and ACU. The implications of these results are that individuals with higher education and good health are likely to use smartphones more than those who have health problems and lower education. Further, the effect of perceived enjoyment will be stronger for those adults who are 60 years old and above.

5.8 Adoption: Smartphone – Descriptive Statistics of Construct Measurements

This section reviews the results from the construct questions or indicator items that were used for analysing the research model. Further, some questions represent interesting details of smartphone adoption patterns. Please note that from this point onwards, the questions or indicator items will be called statements.

Table 5.12 Construct Measurement Results

Questions	1 strongly disagree	2	3	4	5	6	7 strongly agree	Avg
1.People important to me think I should use a smartphone (For example, friends and family)	11.40	8.83	7.83	**23.79**	14.10	13.82	20.23	4.43
2.People who influence my behaviour think that I should use a smartphone	17.66	12.39	10.97	**24.36**	11.82	10.83	11.97	3.81
3. It is expected that people like me will use smartphones (For example, similar age or position people).	8.83	7.41	9.69	**21.23**	15.95	15.81	21.08	4.60
4. I want to use a smartphone because my friends do so.	**31.77**	17.09	12.96	14.96	10.68	5.98	6.55	3.00
5. I have had many opportunities to see smartphones being used.	2.99	3.85	6.55	10.97	15.67	20.94	**39.03**	5.51
6. It is easy for me to observe others using smartphones. (For example, I saw my friends use smartphones)	3.70	4.56	5.98	11.68	19.09	19.23	**35.75**	5.39
7. I believe that using the smartphone is suitable for me.	1.28	1.99	3.42	9.40	13.11	23.65	**47.15**	5.91
8. I believe that using the smartphone will fit my lifestyle.	2.56	3.99	4.13	12.54	14.10	21.23	**41.45**	5.61

9. I think that using the smartphone fits well with my lifestyle or my work.	3.56	3.85	4.70	10.83	13.39	22.22	**41.45**	5.59
10. I have the resources necessary to use the smartphone. (For example, time and money)	1.71	1.85	3.42	12.25	13.11	24.79	**42.88**	5.79
11. I have the knowledge necessary to use the smartphone.	1.14	1.14	5.13	8.55	14.25	26.78	**43.02**	5.86
12. The operation costs of a smartphone do not prevent the use of it (such as, price of a smartphone or monthly fee).	1.85	2.99	4.70	11.40	16.10	22.51	**40.46**	5.66
13. I have a person available to assist me when using my smartphone.	**26.78**	13.68	9.97	11.25	10.83	13.11	14.39	3.63
14. I feel a smartphone is useful. (eg. with my lifestyle, my daily routine and my work)	1.71	1.85	5.41	10.11	12.54	25.93	**42.45**	5.77
15. Using a smartphone enables me to finish my personal tasks or work more quickly.	8.97	7.98	8.55	17.66	16.38	16.95	**23.50**	4.69
16. Using a smartphone increases my productivity (eg. to receive or reply emails faster).	7.55	7.12	7.41	13.82	15.67	17.38	**31.05**	4.99
17. I find that using the smartphone is easy.	1.42	2.71	4.13	10.26	17.38	28.77	**35.33**	5.67
18. Learning how to use a smartphone is easy for me.	1.14	3.56	5.56	11.54	19.23	25.64	**33.33**	5.54
19. I think it is fun to use a smartphone.	3.56	2.71	6.55	15.24	17.52	21.08	**33.33**	5.37
20. I find a smartphone fun (I had fun using a smartphone).	4.70	4.99	6.55	14.53	17.66	21.94	**29.63**	5.20
21. I intend to use a smartphone as much as possible.	4.42	3.85	5.84	16.10	16.81	20.51	**32.48**	5.28
22. I intend to continue using a smartphone in the future.	1.28	0.57	3.28	4.42	10.54	23.65	**56.27**	6.18
23. Whenever possible, I intend to use a smartphone in my daily lifestyle or job.	2.99	3.13	6.13	11.82	16.38	20.80	**38.75**	5.53
Usage frequency of your smartphone	0.71	3.85	6.13	6.70	12.54	19.37	**50.71**	5.87

The first group of statements, statements 1-4, represent Social Influence, and this hypothesis was not supported by this research. The results in Table 5.8 reveal that the average score was quite low compared to the other statements. The third statement (SOC3) which is “It is expected that people like me will use smartphones (for example, similar age or position people)” can lead to the implication that 50 years old and above adults believe that some other older adults in their age group have still not adapted to the smartphone. The fourth statement (SOC4) had the lowest average score at 3.00 with the majority of the respondents strongly disagreeing with the statement. This suggests that the 50 years old and above adults was less dependent on their friends using smartphones or some of their friends not using smartphones.

The fifth and sixth statements were linked to Observability. In this case the hypothesis was rejected in the model, but had quite a high average value and the obtained value was low compared to other statements.

In the next group of statements seven to nine Compatibility was represented in the second hypothesis. The average values of this group were more than 5.5. Moreover, the majority of responses strongly agreed with the statements. It can be observed that for the ninth statement that included the word ‘work’ the average value was slightly dropped. It may cause by retried older adults may not work, which make smartphones less compatible with their lifestyle.

The tenth to thirteenth statements represent Facility Conditions that were supported by this research. The resource in this study included time, money, knowledge, monthly fee and assistance. The time and money was represented by the tenth and twelfth statements. The average values of the responses in both statements were quite high. Interestingly, in the eleventh statement, the average value is the highest in the group. This implies that silver surfers in this research believe that they have enough knowledge to operate the smartphones. On the other hand, it can be seen that smartphones are currently quite easy for older users to adopt and use. Nevertheless, smartphones from time to time may cause some difficulties. The thirteenth statement showed that when 50 years old and above individuals face smartphone related problems, approximately half of the older adults can seek help from someone else. The majority of responses strongly disagreed with the statement with the average value of this statement being only 3.63.

The fourteenth to sixteenth statements represent Performance Expectancy. The fourteenth statement addressed the usefulness of the smartphone and around half of the respondents agreed with this statement. This led the research team to understand that the positive reply respondents already know the benefit of smartphones. The fifteenth statement focused on enabling users to finish their personal tasks or work rapidly. The average value of this statement, which was less than the previous statement, showed that some adopters cannot use their smartphones correctly in order to suit their tasks or their work. The next statement, the sixteenth, also showed a similar trend to the fifteenth statement.

The next two statements, the seventeenth and the eighteenth, represented the hypothesis on Effort Expectancy that showed how 50 years and above adopters think about using their smartphones. Since the average values and majority of the replies, it can be seen that from the silver surfers perspective that smartphones are easy to operate. The nineteenth and twentieth statements focused on the perceived enjoyment from smartphones. It is obvious that for adopters their smartphones are enjoyable and as shown in the previous section these factors are very strong in this research model.

The next three statements addressed the intention to use smartphones. The twenty-first and twenty-third statements compared quite weakly with the twenty-second statements. The twenty-second statement is viewed as a long term one and does not have any pressure for using smartphones compared to the others. Therefore, from the average values and the majority of the three statements, the 50 years and above adopters do not want pressure for using smartphones in their daily life. However in the long term, they will gradually use their smartphones.

The last statement sought smartphone users information regarding the frequency of their smartphone use where the frequency was determined in terms of the values ranging from one never to seven many times per day. From Table 5.12 it can be seen that around half of the respondents used their smartphones many times per day and the average values were quite high at 5.87. However, 0.71% never used their smartphones with 3.85% replying with a one as rarely using their smartphones. Thus, some 50 years and above adults may only have the devices but rarely make use of the smartphones.

5.9 Smartphone Usage

There were also results in terms of smartphone use, length of smartphone use, smartphone brand, network providers, and features of smartphones that are presented in this section. Most of the data in this section is presented in terms of age groups.

Table 5.13 Lengths of using smartphones

Category		50-59		60-69		70-79		80-89		Total	
		Number	(%)	Number	(%)	Number	(%)	Number	(%)	Number	(%)
Length of using smartphone	Less than 6 months	21	4.67	12	5.69	4	10.26	1	50	38	5.41
	6 months to 1 year	41	9.11	28	13.27	5	12.82	0	0	73	10.40
	1 year to 2 years	82	18.22	39	18.48	6	15.38	0	0	127	18.09
	2 years to 3 years	95	21.11	40	18.96	10	25.64	0	0	145	20.66
	Over 3 years	212	47.11	92	43.60	14	35.90	1	50	319	45.44
	Total	450		211		39		2		702	

This research's final phase survey was undertaken at the end of 2013 and the beginning of 2014 where Table 5.13 shows that approximately half of the 50-59 and 60-69 age groups have used smartphones for more than three years. In the 50-59 age groups, 4.67% had smartphones from around mid-2013. Therefore, 13.78% of the group received their smartphones in 2013. For the 60-69 year age groups, 5.96% had smartphones from mid-2013. Therefore, 18.86% of the groups receive their smartphones in 2013. For the 70-79 age groups, 23.08% of the group acquired smartphones in 2013. Note: From anecdotal evidence and personal experience it was anticipated that an increasing number of older adults adopt smartphones and the older age groups are slower at adoption than the younger ones. However, these results can confirm that in this particular area, the north of London, more than half of the 50 years and above adults already adopted smartphones.

Table 5.14: The profile of Smartphone, network and fee used and pay by age groups

Category		50-59		60-69		70-79		80-89		Total	
		Number	(%)	Number	(%)	Number	(%)	Number	(%)	Number	(%)
Brand of Smartphone	iPhone (Apple)	142	28.69	63	28.38	11	26.83	1	25	217	28.48
	Blackberry	61	12.32	22	9.91	0	0.00	0	0	83	10.89
	HTC	41	8.28	15	6.76	3	7.32	0	0	59	7.74
	LG	6	1.21	8	3.60	0	0.00	0	0	14	1.84
	Motorola	10	2.02	6	2.70	1	2.44	1	25	18	2.36
	Nokia	40	8.08	16	7.21	5	12.20	1	25	62	8.14
	Samsung	153	30.91	73	32.88	14	34.15	1	25	241	31.63
	Sony	31	6.26	11	4.95	3	7.32	0	0	45	5.91
	Others	11	2.22	8	3.60	4	9.76	0	0	23	3.02
	Total	495		222		41		4		762	
Network provider	3 (Three UK)	47	9.53	14	6.42	3	10.34	0	0.00	64	8.49
	EE	53	10.75	20	9.17	1	3.45	1	25.00	75	9.95
	Giffgaff	10	2.03	4	1.83	0	0.00	0	0.00	14	1.86
	Orange	46	9.33	24	11.01	3	10.34	2	50.00	75	9.95
	O2	125	25.35	54	24.77	11	37.93	1	25.00	191	25.33
	Lebara	1	0.20	0	0.00	0	0.00	0	0.00	1	0.13
	T-mobile	51	10.34	20	9.17	0	0.00	0	0.00	75	9.95
	Virgin media	41	8.32	25	11.47	4	13.79	0	0.00	69	9.15
	Tesco	15	3.04	9	4.13	3	10.34	0	0.00	26	3.45
	Vodafone	93	18.86	36	16.51	3	10.34	0	0.00	140	18.57
	Other	11	2.23	12	5.50	1	3.45	0	0.00	24	3.18
		493		218		29		4		754	
Payment	Pay as you go	83	18.32	41	19.16	16	40.00	2	66.66	142	20.00
	Pay on a monthly basis (contract)	370	81.68	173	80.84	24	60.00	1	33.33	568	80.00
		453		214		40		3		710	
Pay per month	Free - £10	69	15.33	53	25.12	13	33.33	1	50.00	136	19.37
	£10.01 - £30.00	242	53.78	106	50.24	23	58.97	0	0	371	52.85
	£30.01 - £50.00	117	26.00	43	20.38	3	7.69	1	50.00	164	23.36
	£50.01 -	11	2.44	7	3.32	0	0.00	0	0	18	2.56

	£70.00										
	£70.01 - £90.00	6	1.33	2	0.95	0	0.00	0	0	8	1.14
	> £ 90.00	5	1.11	0	0.00	0	0.00	0	0	5	0.71
		450		211		39		2		702	

There was also a question seeking information about the Smartphone Brand, networks providers and costs. From table 5.14, it can be seen that Samsung, at 241 (31.63%), was the most popular brand followed by the Apple iPhone and Blackberry at around 217 (28.48%) and 83 (10.89%) respectively. This trend was apparent in all the age groups. In Table 5.14 it can be seen that for the network providers, O_2 seems to be a very popular network provider for the 50 years old and above adults at around 191 (25.33%). Vodafone was the second popular at around 140 (18.57%). However, for the 70-79 age groups, Virgin media, Tesco and Orange were popular at the same level as Vodafone. The researcher believes that the reason for Tesco and Virgin media being popular in the 70-79 age groups may be due to the subscription price. EE (Everything Everywhere) that focuses on high-speed mobile internet connections seems very popular only in the 50-59 age groups.

In terms of payments, the majority of the 50 years old and above adopters preferred the pay on a monthly basis subscription known as a contract. Around 142 (20.00%) chose to use the pre-paid system known as Pay as you go. However, for the 70-79 age groups, the percentages of Pay as you go were quite high at around 16 (40%) compared with those at contract terms at around 24 (60%). The next question sought to ascertain the cost of the subscription rates that the 50 years old and above adults spend per month. Around half of the respondents indicated spend of around £10-£30 per month. Around 164 (23.36%) paid around £30-£50 per month followed by 136 (19.37%) paying up to £10 per month. However, the number of 50 years old and above paying up to £10 varied age wise.

Table 5.15 Length of time allows users to familiar with their smartphones

Category		50-59		60-69		70-79		80-89		Total	
		Number	(%)	Number	(%)	Number	(%)	Number	(%)	Number	(%)
How long did it take you to get familiar with using the basic functionalities of your present smartphone?	Less than a day	155	34.44	73	34.60	7	17.95	2	100	237	33.76
	1 day – 1 week	185	41.11	69	32.70	12	30.77	0	0	266	37.89
	1 week – 2 weeks	58	12.89	34	16.11	9	23.08	0	0	101	14.39
	2 weeks – 1 month	29	6.44	16	7.58	6	15.38	0	0	51	7.26
	1month – 3 months	11	2.44	13	6.16	4	10.26	0	0	28	3.99
	More than 3	12	2.67	6	2.84	1	2.56	0	0	19	2.71

	months										
	Total	450		211		39		2		702	100

The next question sought information about the length of time that it took for users to become familiar with the smartphone and could operate their smartphones for basic functions such as making a phone call, sending text messages and emails, or connecting to other devices. Overall, approximately 38% of the silver surfers spent around one day to one week to become familiar with the new smartphones. An estimated 34% of 50 years and above adults spent only a day to become familiar with basic functions of their smartphones. Approximately 10% of the 50 years old and above adopters spent more than two weeks to become familiar with their smartphones. As expected, the duration for the 70-79 age groups was longer than the younger age groups.

Table 5.16 Smartphone usage: Features of smartphones

Features of a smartphone (n=702)	Mean (frequency of use the feature) From 1 to 7, 1 is never and 7 is many times per day.	Total	
		Numbers of people used the feature	%
1. Making a phone call	4.76	687	98.14
2. SMS, Text messaging	5.19	689	98.43
3. E-mailing	4.19	600	85.71
4. Taking a photograph	3.58	647	92.43
5. Filming a video	2.37	454	64.86
6. Browsing-surfing website(s)	4.35	629	89.86
7. Playing games	2.89	420	60.00
8. Watching videos for example YouTube	2.45	426	60.86
9. Mapping, Navigator such as Google Map, Tom-Tom, Copilot	3.21	553	79.00
10. Taking notes such as shopping lists or task that I need to do	2.95	472	67.43
11. Managing my appointment on my calendar	3.52	508	72.57
12. Using social networks such as Facebook, Twitter	3.26	440	62.86
13. Reading online News and online Magazines	3.15	482	68.86
14. Using Facetime, Skype, oovoo, Google Talk, Viber, Fring	2.22	322	46.00
15. Using to contact government authorities – NHS, Jobcentreplus, UKBA	1.80	243	34.71

In terms of the smartphone features uses, 15 Likert scale questions ranging from one to seven where one is never and seven is many times of the day were asked of only those who used a smart phone (n=702). The results are shown in table 5.16

Making a phone call and Short Message Services (SMS) were considered to be the basic functions of a mobile phone. The results showed that 689 (98.43%) of the participants used Short Message Services (SMS) and 687 (98.14%) made calls using smartphones.

647 (92.43%) of the respondents used their smartphones for basic phone functions, while 89.86% used the browser functions of their phone and 600 (85.71%) used the email function of their smartphones. In terms of frequency, browsing was at 4.35, emailing was at 4.19 and taking a photo was at 3.58. Therefore, respondents were browsing more than emailing or taking a photograph.

Mapping or Navigation was the next popular feature, where 553 (79.00%) of the replies displayed use of this feature and the frequency of use was at 3.21. 508 (72.57%) managed appointments and used the calendar with a frequency at 3.52. That means more than 70% of older adults moderately use both mapping and appointments.

Reading online news or magazines was used next at 68.86% with a frequency of 3.15. The other uses included, taking notes, filming a video, using online social networks such as Facebook, watching videos and playing games that were used by more than half of the participants. It was found that the frequency of using social media was at 3.26. Using Voice over Internet Protocol (VoIP) or Video calls using applications such as Facetime, Skype or Viber and using smartphones to contact government authorities such as the National Health Service (NHS) or Job centre plus was used by less than half of the users with low frequencies at 2.22 and 1.80 respectively.

Table 5.17: Features of a smartphone used by respondents

Features of a smartphone	50-59		60-69		70-79		Total	
	number	%	number	%	number	%	number	%
1. Making a phone call	440	97.78	209	99.05	38	97.44	687	98.14
2. SMS, Text messaging	446	99.11	206	97.63	37	94.87	689	98.43
3. Emailing	395	87.78	176	83.41	29	74.36	600	85.71
4. Taking a photo	422	93.78	193	91.47	32	82.05	647	92.43
5. Filming a video	322	71.56	118	55.92	14	35.90	454	64.86
6. Browsing-surfing website(s)	416	92.44	183	86.73	30	76.92	629	89.86
7. Playing games	302	67.11	101	47.87	17	43.59	420	60.00
8. Watching videos for example YouTube	309	68.67	99	46.92	18	46.15	426	60.86
9. Mapping, Navigator such as Google Map, Tom-Tom, Copilot	363	80.67	164	77.73	26	66.67	553	79.00
10. Taking notes such as shopping lists or task that I need to do	321	71.33	128	60.66	23	58.97	472	67.43
11. Managing my appointment on my calendar	342	76.00	146	69.19	20	51.28	508	72.57
12. Using social network such as Facebook, Twitter	311	69.11	109	51.66	20	51.28	440	62.86

13. Reading online News and online Magazines	324	72.00	137	64.93	21	53.85	482	68.86
14. Using Facetime, Skype, oovoo, Google Talk, Viber, Fring	219	48.67	91	43.13	12	30.77	322	46.00
15. Using to contact government authorities – NHS, Jobcentreplus, UKBA	179	39.78	57	27.01	7	17.95	243	34.71
	450	100.00	211	100.00	39	100.00	700	100.00

To further understand usage in each age group, the data was re-arranged as shown in table 5.17. From the same question, table 5.17 shown responses from those who used the feature (answered two or more). Please note that the 80-89 age groups were removed since the numbers were too low.

As seen in Table 5.17, apart from the first feature, making a phone call, the numbers of users in the 60-69 age groups were slightly higher than the numbers from the 50-59 age groups. In turn, the numbers of users in the 50-59 age groups were higher than the 60-69 age groups and the numbers from the 60-69 age groups were greater than the 70-79 age groups. For some basic features such as SMS, Emailing, taking a photo, or, browsing-surfing websites(s), the numbers of responses from the 70-79 age groups slightly dropped compare to the 60-69 and 50-59 age groups. Comparatively, for some advanced features such as filming a video, mapping or navigation, managing appointments, reading news or using video calls, the numbers of respondents from the 70-79 age groups had significantly dropped compared to the other groups.

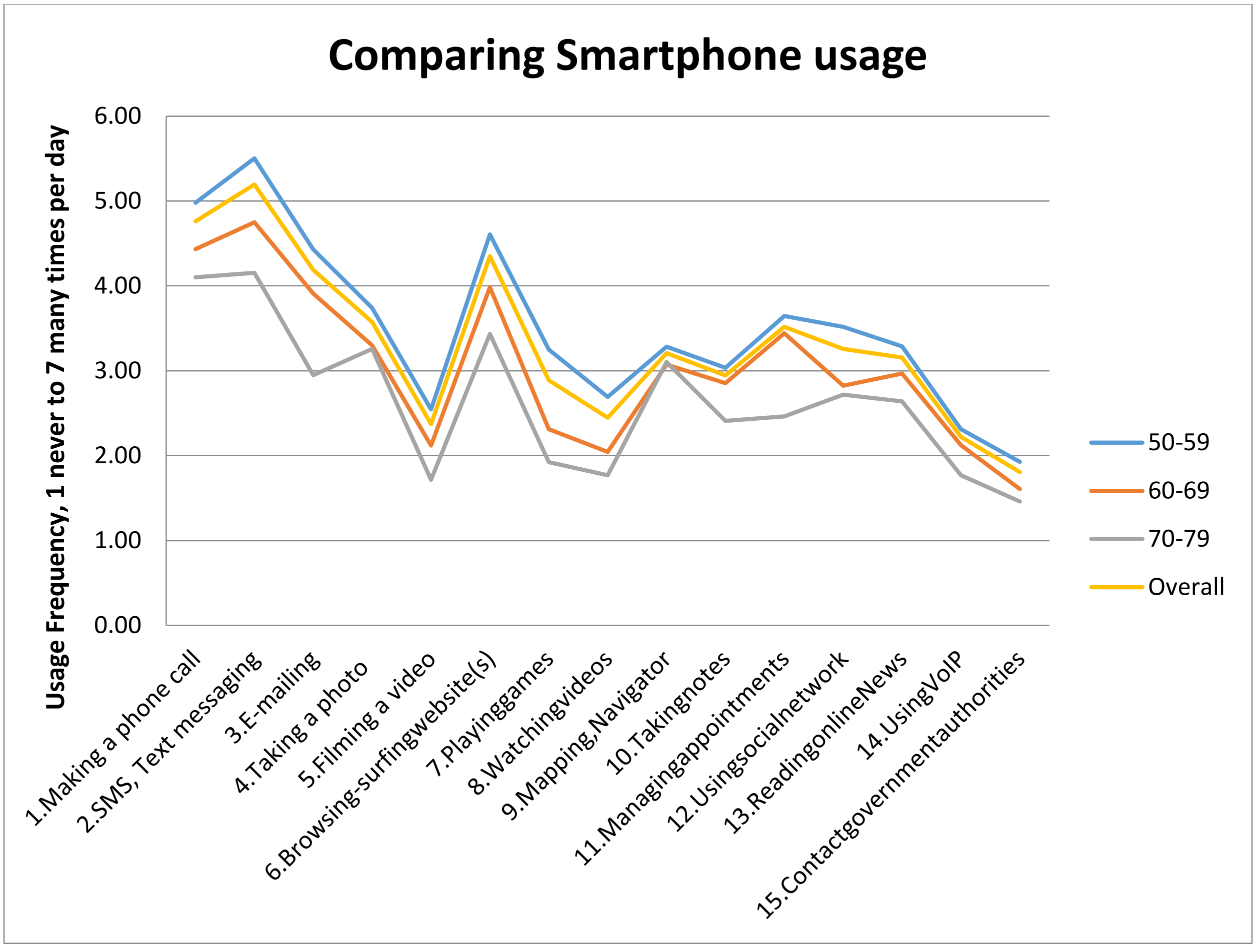

Figure 5.5 Compares the smartphone features use

To illustrate the above explanations, a graph is presented in Figure 5.5 where it can be seen that the line from the 50-59 age groups is higher than other lines, while the line from the 70-79 age groups is the lowest line. The overall line is always lower than the line of the 50-59 age groups line, but higher than the lines of the 60-69 and 70-79 age groups.

5.9.1 Use of Smartphones for Health Purposes

For older adults, health and well-being are important issues of consideration. Smartphones are viewed to be tools that can assist with well-being or health. Therefore, a question associated with smartphone use that was related with health and well-being was also asked in the survey.

Table 5.18 Smartphone on well-being or health usage by age

How has using a smartphone helped your well-being or health?	50-59		60-69		70-79		Total	
	number	%	number	%	number	%	number	%
1. seek information on health issues	114	25.33	22	10.43	8	20.51	144	20.57
2. helps me with my appointment time keeping with doctors	93	20.67	41	19.43	11	28.21	145	20.71

3. helps me manage or track my exercise routine	46	10.22	16	7.58	2	5.13	64	9.14
4. helps me manage my diet	28	6.22	10	4.74	3	7.69	41	5.86
5. helps me monitor my weight	29	6.44	14	6.64	1	2.56	44	6.29
6. helps me access health records	9	2.00	7	3.32	3	7.69	19	2.71
7. helps me manage my moods	14	3.11	2	0.95	1	2.56	17	2.43
8. helps me manage prescriptions	18	4.00	12	5.69	1	2.56	31	4.43
9. helps me monitor blood pressure	7	1.56	9	4.27	2	5.13	18	2.57
10. helps me check nearby pollen levels	8	1.78	5	2.37	2	5.13	15	2.14
11. helps me control my cigarette smoking	4	0.89	3	1.42	0	0.00	7	1.00
12. Smartphone does not help me with my well-being or health	263	58.44	143	67.77	25	64.10	431	61.57
	450		**211**		**39**		**700**	

The results in table 5.18 show that 61.57% or 431 responses had not utilized their smartphone for health and well-being issues. Around 20% or 144 of respondents sought health related information and managed doctors' appointments. Only 64 (9.14%) used smartphones to monitor their exercise routine. The features on monitoring weight and weight management were used by around 44 (6.29%) of respondents, whilst managing prescriptions using the smartphones was used by only 31 (4.43%) of the respondents. Functions such as accessing health records, mood management, blood pressure monitoring, checking nearby pollen levels, and cigarette control were used by less than 3% of respondents.

In terms of age groups, the results found that in general, the 50-59 age groups used their smartphones the most for health and well-being, followed by the 70-79 and 60-69 age groups respectively. An example can be found in the seeking health information and helping in making an appointment with doctors, where the 60-69 age group respondents used the feature even less than the others.

In terms of age, Table 5.19 revealed that both the male and female respondents used their smartphones for health and well-being in equivalent numbers. 71 (18.59%) of the male respondents and 74 (23.05%) of the female respondents sought health information from their smartphones and approximately 20% of both males and females used their smartphones for managing their doctor's appointments.

Table 5.19 Smartphone on well-being or health usage by gender				
How has using a smartphone helped your well-being or health?	Male		Female	
	number	%	number	%
1. seek information on health issues	71	18.59	74	23.05
2. helps me with my appointment time keeping with doctors	80	20.94	66	20.56
3. helps me manage or track my exercise routine	33	8.64	32	9.97
4. helps me manage my diet	16	4.19	25	7.79
5. helps me monitor my weight	20	5.24	24	7.48
6. helps me access health records	14	3.66	6	1.87
7. helps me manage my moods	10	2.62	7	2.18
8. helps me manage prescriptions	20	5.24	12	3.74
9. helps me monitor blood pressure	11	2.88	7	2.18
10. helps me check nearby pollen levels	7	1.83	8	2.49
11. helps me control my cigarette smoking	5	1.31	2	0.62
12. Smartphone does not help me with my well-being or health	241	63.09	191	59.50
	382		320	

A similar question to managing doctor appointments was asked in the eleventh question of table 5.17 where a question was asked about the use of management of appointments using a smartphone calendar. 508 (72.57%) of the respondents used this feature and the amounts are shown to be quite high in Table 5.17. Compared to Table 5.19, there were 20.71% of respondents that used the calendar feature with their health and well-being.

To summarise, this section showed that the survey revealed smartphones can be used by older adults for their health and well-being; however, less than half of the 50 years and above adults adopted this smartphone benefit. Therefore, smartphone stakeholders should encourage 50 years and above adults to use the smartphones for their health benefits.

5.9.2 Usage with Friends and Family

Friends and family are always important for older adults as they can assist in reducing isolation within older adults. This led to the inclusion of a question seeking information about the smartphone and friends and family.

Table 5.20 Using smartphones with friends and family by age group								
How has a smartphone helped bring your friends and family closer to you?	50-59		60-69		70-79		Total	
	number	%	number	%	number	%	number	%
1.Making phone calls to my friends and family	373	82.89	172	81.52	35	89.74	580	82.86
2.Emailing my friends and family using my smartphone	276	61.33	117	55.45	20	51.28	413	59.00
3.Sharing photos taken from my smartphone	307	68.22	110	52.13	22	56.41	439	62.71
4.Sharing videos with from my smartphone	112	24.89	25	11.85	3	7.69	140	20.00
5.Sending instant messages such as Blackberry Messenger, WhatsApp, Line, Facebook messenger	194	43.11	54	25.59	9	23.08	257	36.71
6.Using video telephony software applications such as Facetime, Tango or Skype	88	19.56	31	14.69	6	15.38	125	17.86
7.Following friends' and family's activities using social media such as Facebook, Google+ on my smartphone	172	38.22	58	27.49	5	12.82	235	33.57
8.I do not use a smartphone to contact with my friends or family	20	4.44	13	6.16	2	5.13	35	5.00
	450		211		39		700	

Table 5.20 shows that using a smartphone with friends and family assists in bringing proximity to family and friends. From Table 5.20, 580 (82.86%) made a phone call to their friends and family, a basic function of the smartphones. Emailing is one of the advanced features allowed in a smartphone and 413 (59.00%) of the silver surfers emailed their friends and family. Another popular smartphone function that was used is sharing photos at 439 (62.71%). Sending instant messages using apps such as Blackberry Messenger, WhatsApp or Facebook messenger was the next popular feature at 257 (36.71%). Social media such as Facebook or Google+ is another channel for older people to connect with their friends and families. In this research, 235 (33.57%) of older adults who have smartphones connect to their friends and family using social media. However, it is interesting to compare the data of Table 5.17 with the data from table 5.20 where social media was considered. From table 5.17, 62.86% of the 50 years old and above adults have used social media while in table 5.20 only 33.57% have used social media to connect with friends and family.

Sharing videos was the next feature that 140 (20%) of the respondents used with friends and family, followed by video calling using applications such as Facetime or Skype at 125 (17.86%). Compared with Table 5.17, the number of 50 years and above adults used Facetime or Skype and filming a video was high at 46.00% and 64.86%. Therefore, it can be seen that even though older adults used the feature, they may not use the technology to encourage and improve their relationship with friends or family.

Table 5.21 Using smartphones with friends and family by gender				
How has a smartphone helped bring your friends and family closer to you?	Male (n= 382)		Female (n= 320)	
	number	%	number	%
1. Making phone calls to my friends and family	314	82.20	267	83.18
2. Emailing my friends and family using my smartphone	239	62.57	175	54.52
3. Sharing photos taken from my smartphone	231	60.47	209	65.11
4. Sharing videos with from my smartphone	77	20.16	64	19.94
5. Sending instant messages such as Blackberry Messenger, WhatsApp, Line, Facebook messenger	126	32.98	132	41.12
6. Using video telephony software applications such as Facetime, Tango or Skype	68	17.80	57	17.76
7. Following friends' and family's activities using social media such as Facebook, Google+ on my smartphone	119	31.15	116	36.14
8. I do not use a smartphone to contact with my friends or family	24	6.28	12	3.74

In terms of gender, the data in this section was re-arranged and shown in Table 5.21. Both male and female respondents showed a similar trend in the adoption and use of their smartphones with friends and family. A small difference emerged where males used email slightly more than the females. Comparatively, females shared photos and used social media slightly more than the males.

To summarise, this section found that older adults had adopted smartphones and used some advanced functions of the smartphone. When considering the use of smartphones with friends and family, the 50 years and above adults normally used basic functions such as making phone calls, emailing and sharing photos. In gender terms, both males and females used their smartphones in similar numbers when contacting their friends and family. Therefore, to reduce isolation and to encourage good relationships with friends and family the 50 years and above adults should be encouraged to use smartphones.

5.10 Diffusion: Source of Information about Smartphones

In terms of diffusion and adoption, the questions began with the functions considered when purchasing a smartphone. When investigating the attitudes of the groups, the questions were asked of both the adopted and plan to adopt groups.

Table 5.22 Feature considered when buying a new smartphone						
Consideration in buying a smartphone	Adopted (n=702)		Plan to use (n=134)		Total	
	Number	(%)	Number	(%)	Number	(%)
1. Appearance (such as colour or material)	284	40.46	42	31.34	326	39.00
2. Camera	337	48.01	41	30.60	378	45.22
3. Operating System (Such as iOS, Android or Windows Mobile)	397	56.55	48	35.82	445	53.23
4. Brand (such as Apple, Samsung, Nokia or Blackberry)	432	61.54	78	58.21	510	61.00
5. Price of the smartphone	464	66.10	58	43.28	522	62.44
6. Operating Speed	290	41.31	22	16.42	312	37.32
7. Screen Size	452	64.39	47	35.07	499	59.69
8. Screen Resolution	215	30.63	20	14.93	235	28.11
9. Weight	245	34.90	22	16.42	267	31.94
10. Battery life	452	64.39	52	38.81	504	60.29
11. Size of Memory in the phone to store files	268	38.18	20	14.93	288	34.45
12. Voice Clarity	171	24.36	21	15.67	192	22.97

From Table 5.22, the plan to use group may have less experience with smartphones because they do not own the devices. 78 (58.21%) of the plan to use groups had the highest percentage where there was immense interest in the brand of the smartphone that they intended to purchase. The second and third highest of this group are 58 (43.28%) where interest was expressed in the purchase price of the smartphone, followed by 52 (38.81%) the battery life. Operating systems 48 (35.82%); screen size 47 (35.07%); smartphone appearance 42 (31.34%) and camera functions 41 (30.60%) respectively. The plan to use group was less affected 20% difference by the operating speed, screen resolution, weight, smartphone memory size, and, voice clarity.

Comparatively, the group that adopted smartphones had some diverse experience or knowledge issues. The adopted group at 464 (66.10%) were most interested in the smartphones purchase price, followed by the screen size and the battery life at 452 (64.39%). 432 (61.54%) of the adopted group emphasised the smartphone brand. Next, 397 (56.55%) of the group was interested in the operating system followed by the adopters interested 337 (48.01%), 290 (41.31%) and 284 (40.46%) in the camera, and operating speed functions and finally, the appearance of the smartphones. The adopters were less interested in voice clarity, screen resolution and weight of the smartphones.

From the previous two paragraphs, it can be learnt that both groups had diverse views, with the plan to adopt and use group being most interested in the smartphone brand and the price while the adopted group was most interested in the smartphone purchase price, screen sizes and brand. Further, from the percentage differences between both the groups, it can be seen that after the adopted users smartphone experiences, they were likely to pay more attention to every function of the smartphones.

Table 5.23 Communication channel

Where do you get information about a smartphone	Adopted		Plan to use		Total	
	Number	(%)	Number	(%)	Number	(%)
8. Word of mouth by friends and family	441	62.82	103	76.87	544	65.07
9. High street stores	192	27.35	58	43.28	250	29.90
10. Media- TV, Radio and Newspapers	157	22.36	36	26.87	193	23.09
11. Magazines	85	12.11	20	14.93	105	12.56
12. Online social network	70	9.97	12	8.96	82	9.81
13. Professional technology review website such as CNET.co.uk, Trustedreviews.com	215	30.63	39	29.10	254	30.38
14. Peer technology review such as unboxing video on YouTube	66	9.40	8	5.97	74	8.85
15. Sales Person	153	21.79	31	23.13	184	22.01
	702	**100.00**	**134**	**100.00**	**836**	**100.00**

This research also attempted to identify the various communication channels used for the diffusion of the smartphones. A question provided choices in the form of eight communication channels that were: word of mouth from friends and family; high street stores; media such as TV, radio and newspapers, magazines, online social networks; professional technology review websites; peer technology reviews and sales persons. The question was asked of both the adopted and plans to use groups. Overall, both the groups received information largely from word of mouth from friends and family 544 (65.07%). However, the plan to use groups 103 (76.87%) had a greater reliance on the word of mouth compared to the adopters 441 (62.82%). Next, both groups relied on professional technology review websites and high street stores 254 (30.38%) and 250 (29.90%) respectively. Communication channels that were not so important for both groups were peer technology review such as unboxing and review video on YouTube, online social networks and magazines. The percentages of both groups were similar except for the plan to use group being far more dependent on high street stores compared to the adopters.

5.11 Plan to Use Smartphone

Following feedback from the pilot test, a section on planning to adopt and use smartphones was added to the final survey in order to further explore the reasons for the 50 years and above adults intending to adopt and use smartphones. These questions could explain the decisions for adopting smartphones.

Please note that this section is not included in the conceptual framework (MOSA) because the data was from those who do not yet use the smartphones. Therefore, they may not fully understand the features of smartphones and they cannot answer questions in the adopted section.

Table 5.24 Reason for planning to adopt and use smartphones (n=134)

Reasons for why you plan to use a smartphone (n=134)	50-59		60-69		70-79		80-89		total	
	res	%	res	%	res	%	res	%	res	%
I will get an upgrade from my provider.	13	20.31	12	21.82	1	8.33	0	0.00	26	19.40
I want to have a handy device that can do many things such as making a telephone call, taking a photograph, filming, and surfing the internet.	46	71.88	34	61.82	5	41.67	2	66.67	87	64.93
Most of my friends have used smartphones, and have convinced me to get one.	14	21.88	20	36.36	1	8.33	1	33.33	36	26.87
I want to use a smartphone to contact my friends or family.	17	26.56	11	20.00	1	8.33	0	0.00	29	21.64
My new job or new position requires me to use a smartphone.	3	4.69	0	0.00	1	8.33	0	0.00	4	2.99
I want to use a smartphone to help with my well-being or health.	2	3.13	0	0.00	0	0.00	0	0.00	2	1.49
I travel a lot and the smartphone will help me on my travels.	7	10.94	8	14.55	0	0.00	0	0.00	15	11.19
My new smartphone will help me with my memory.	0	0.00	3	5.45	0	0.00	0	0.00	3	2.24
My new smartphone will have a bigger screen which is easy for me to see and use.	17	26.56	13	23.64	5	41.67	0	0.00	35	26.12
	64	**100.00**	**55**	**100.00**	**12**	**100.00**	**3**	**100.00**	**134**	**100.00**

In Table 5.24 it can be seen that there were approximately 134 older adults planning to adopt and use a smartphone. The analysed results also showed that 87 (64.93%) of the plan to adopt and use a smartphone as they were viewed to be handy devices that could provide many functions such as making a telephone call, taking a photograph, filming and surfing the internet. This first reason was directly linked to the provided smartphone benefits. This also supported the hypothesis that Performance Expectancy and Perceived Enjoyment of a new smartphone is compatible with a respondents' lifestyle and can provide them with enjoyment.

The next reason for the plan to use and adopt smartphones 36 (26.87%) was due to the respondents' friends using smartphones and their encouragement and support convincing respondents to adopt and use smartphones. This reason is linked to the hypothesis of social influence that was not supported by the adopted and uses smartphones results. The screen size of smartphones 35 (26.12%) was the next reason for the planning to adopt and use a smartphone. It is believed that as the literature review suggested older adults suffer from vision problems; hence the screen size being of importance to the older adults. What these results also suggest is that smartphones with large and bright screens are compatible with the older adults population needs.

Using smartphones to contact friends and family was the next motive within the planning to adopt and use a smartphone at 29 (21.64%). This was then followed by the respondents receiving an offer from the mobile phone providers for a smartphone.

Other reasons considered in this study were the benefits of smartphones for travel, well-being and health and lifestyle purposes, a requirement for the respondents' new job, and memory as show in table 5.24.

5.12 Not Using Smartphone

This research also determined the reasons for silver surfers not planning to use and adopt smartphones, which is shown in Table 5.25.

Table 5.25 Reasons on not use smartphones (n=148)

Reasons on not use smartphone	50-59		60-69		70-79		80-89		total	
	res	%	res	%	res	%	res	%	res	%
I am too old for a smartphone	4	10.26	11	15.07	4	17.39	5	45.45	26	17.57
It is too much of an effort to use a smartphone	7	17.95	24	32.88	7	30.43	1	9.09	40	27.03
A smartphone is too complicated and difficult to use.	7	17.95	28	38.36	8	34.78	2	18.18	46	31.08
I do not think a smartphone is useful.	7	17.95	11	15.07	3	13.04	0	0.00	21	14.19
Physical discomfort or accessibility problems	1	2.56	6	8.22	2	8.70	0	0.00	10	6.76
The cost of using a smartphone – I do not want to spend a lot of money when using a smartphone.	13	33.33	36	49.32	8	34.78	2	18.18	59	39.86
I want peace and quiet after my working hours	4	10.26	5	6.85	4	17.39	0	0.00	13	8.78
I do not feel comfortable using small screens and tiny keyboards.	14	35.90	16	21.92	8	34.78	3	27.27	42	28.38
I do not know much about how to use	4	10.26	7	9.59	7	30.43	3	27.27	22	14.86

a smartphone.										
I have other devices such as a laptop or a netbook that can function as well, or better than a smartphone.	19	48.72	29	39.73	8	34.78	3	27.27	59	39.86
Using a smartphone does not fit with my lifestyle.	11	28.21	18	24.66	9	39.13	4	36.36	43	29.05
	39	100.00	73	100.00	23	100.00	11	100.00	148	100.00

Overall, it was found that only 17.57% of the silver surfers thought that they were too old for smartphones. However, the percentage changed from 10.26% in the 50-59 age groups to 15.07% in the 60-69 age groups and 17.39% in the 70-79 age groups. Therefore as ageing occurs and technologies progress, older adults do think that they are too old for technology; in this case, smartphones.

What is also known is that smartphones are not the easiest devices to operate; therefore, the next question determined the placed efforts for adopting and using a smartphone. Approximately 27.03% of the respondents replied that they thought it was too much of an effort to use a smartphone. The percentage increased from 17.95% in the 50-59 age groups to 32.88% and 30.43% from the 60-69 and 70-79 age groups respectively. The next questions asked respondents whether they viewed the smartphone as being too complicated and difficult to use where similar views were expressed at 17.95%, 38.36% and 34.78% respectively.

Table 5.26 Factors may encourage future use of the not use smartphone group (n=148)

Factors that may encourage future use of a smartphone.	50-59		60-69		70-79		80-89		total	
	res	%	res	%	res	%	res	%	res	%
Nothing/ will never use a smartphone in the future	14	35.90	22	30.14	12	52.17	7	63.64	57	38.51
Free training	10	25.64	20	27.40	5	21.74	2	18.18	37	25.00
Reduce cost of a smartphone	19	48.72	35	47.95	9	39.13	3	27.27	66	44.59
Reduce cost of monthly contract	13	33.33	31	42.47	6	26.09	3	27.27	53	35.81
	39	100.00	73	100.00	23	100.00	11	100.00	148	100.00

Factors that may encourage the future use of a smartphone were also sought where the first factor at 44.59% was the cost of a smartphone followed by 35.81% from the cost of a monthly contract or service cost. Free training for using smartphones was also provided as a reason at 25.00%. However, 38.51% of the 50 years and above adults resisted and stated that they will not use a smartphone in the future. In terms of age groups, the 80-89 age groups were the largest group to resist using a smartphone at 63.64% followed by 70-79 at 52.17%.

This study also asked for the reasons that prevented the 50 years and above adults from adopting and using smartphones. The identified issues included security, screen size, complications of smartphone usage, price and touch screen. Some people just wanted to use their current mobile phones. For some 50 years and above Parkinson’s disease sufferers, the touchscreen use was a difficulty due to their trembling hands often touching the smartphone screen more than was needed. For some older adults with visionary (longsighted) problems, using small screen smartphones was not an easy task.

5.13 Chapter Summary

This chapter presented the research findings from the final phase of this study. The chapter began by reporting on the sample size and the numbers of received replies. This was followed by explanations of the validity tests that included descriptions of the reflective measurement, formative measurement, and structural model testing. The data was then further analysed for hypothesis testing where it was found that of the overall eight hypotheses, six were supported. Further, the conceptual model could predict up to 76% of intention to use smartphones and 20.8% of actual usage. Then the effect of demographic variables as moderator variables was discussed.

The next chapter provides an evaluation and discussion section. The evaluation parts will apply primary datasets acquired from the Oxford Internet Survey and The office of National Statistics Omnibus Survey in order to validate the final finding. Then, a discussion from the literature review standpoint will be presented.

Chapter 6 Evaluation & Discussion

6.1 Introduction

The previous chapter presented the research findings, analysis of the research findings, and the results of hypothesis testing. To evaluate, verify and validate the results for generalisations this research used Nationally Representative Datasets (NRDs), which is the data from The Office of National Statistics (ONS) Omnibus survey and the Oxford Internet Survey (OxIS). After evaluating the results, this chapter also discusses and reflects upon the finding of this research from a theoretical perspective by using the literature review of Chapter 2.

6.2 Evaluation for Validation

For research the validation of the results in terms of theories is very important as it confirms the results of research (Panneerselvam, 2004). From the previous chapter, the results of the primary data from the north of London area were obtained that achieved a conceptual model. To ensure that the results of this research can be verified and valid an evaluation process needs to be completed.

The process will start with a definition of evaluation, which is then followed by a description of the process and then the reasons for selecting a particular process. Finally, the nationally results will be presented.

6.2.1 Evaluation Definitions

Evaluation can be defined as the systematic identification and assessment of effects generated by programmes or products (Jupp, 2006). In this case, the results of the final data collection of the previous chapter and the tested hypothesis also within the previous chapter are evaluated. Therefore, the aim of the evaluation is to assess the success of the results of this research study and to obtain the information needed for further development (Rubin & Babbie, 2011).

Evaluation can be classified as summative or formative (Little, 2013). **Summative evaluation is** concerned with the success or outcome of a programme. The results of a summative evaluation convey a sense of finality where reliance on the results imply the success of a programme (Rubin & Babbie, 2011). A summative evaluation purpose is to judge the finished product compared with the potential alternative programmes (Little, 2013). Applying this type of evaluation to this research, this study examined the outcome of this research.

Formative evaluations are not concerned with testing the success of a programme. They focus instead on obtaining information that is helpful in planning the programme and in improving its implementation and performance. (Rubin & Babbie, 2011) A formative evaluation is not fixed but is still in the process of change. The goal of a formative evaluation is to provide feedback to the programme managers with the purpose of improving the programme regarding with is and what is not working well and not to make a final judgment on the relative merits of the programme (Little, 2013). For this research, formative evaluation began from the literature review in chapter 2, selecting the appropriate research method in chapter 3, pilot testing the theoretical constructs of chapter 2 and presenting their results in chapter 4, and finally, presenting the results and analysis in chapter 5.

Having considered evaluation types, this chapter will now apply summative evaluation to evaluate the outcome of this research in order to confirm that the theory that collected the data from north of London can be applied nationwide.

6.3 Evaluation Approach

Trochim and Donnelly (2001) suggest that secondary analysis is an acceptable quantitative method for a summative evaluation. The secondary analysis involves making use of existing sources of data, which is normally quantitative data (Trochim, 2006). The available data for secondary analysis include census bureau data, standardized testing data, economic data, and consumer data.

Therefore, to evaluate the results of this research study, a nationwide quantitative dataset will be selected and utilised to perform secondary analysis. For this this phase, the research team selected two famous secondary data sources, which were available from the Office for National Statistics (ONS) and Oxford Internet Surveys (OxIS). In the following sections the reasons for selecting them are presented.

6.3.1 Office of National Statistics (ONS) Omnibus or Opinions Survey

The Office for National Statistics (ONS) in Great Britain survey collects information on a range of topics from individuals living in private households in the country (Office for National Statistics, 2015). For this purpose, an omnibus survey that is explained as a survey that provides those seeking information about markets and opinions with a means to get quick, relatively low cost answers to their questions without financing and organizing a full market or opinion research survey themselves. The omnibus survey could involve a research company conducting a number of interviews with a target group on a regular basis where the interviews combine a number of standard questions that are always asked - generally including demographic information (age, sex, occupation) or e.g. company classification information for a business survey - with questions effectively sponsored by clients. The answers to these questions are analysed shortly afterwards, cross-referenced with some or all of the classification data, and delivered to the client either as tables or in a report (Duffy and Smith, 2005).

For the ONS, the omnibus survey also known as the Opinions Survey commenced at the beginning of 2008 and became part of the Integrated Household Survey (HIS). In 2012 the survey name was changed once more to the Opinions and Lifestyle Survey (UK Data Service, 2014). The dataset of Omnibus and opinions surveys can be obtained from the Economic and Social Data Service (ESDS) website. This survey was selected due to its reliability and its nationwide coverage.

The ONS Omnibus Surveys of 2010, 2011, 2012, and 2013 provided data for using the internet and technologies in more than 3,000 responses. This continuous data assists in reviewing the adoption data in terms of time. However, the ONS dataset has not directly addressed the word smartphone. ONS used the terms mobile phone. Therefore, this research needed to used further understand the prediction of the mobile phone usage in order to interpret the smartphone usage, such as use mobile phone to access emails or surfing internet.

As addressed in Chapter 3's section on demographic variables, this evaluation phase will include demographic variables such as age, gender, race, education, occupation, health, and income in order to predict smartphone adoption.

6.3.2 The Oxford Internet Surveys (OxIS) Survey

The next data set used for this research study is the Oxford Internet (OxIS) Survey begun in 2003. OxIS is a continuous survey for internet users in Britain. OxIS is the longest-running academic survey of Internet use in Britain operated by the Oxford Institute at the University of Oxford (Surveys Oxford Internet, 2014). OxIS is a multi-stage national probability sample of 2,000 people in Britain.

The survey includes information on internet usage, attitudes toward the internet and technology, demographic information and geographic information. Previous surveys conducted by OxIS have been 2003, 2005, 2007, 2009 and 2011. OxIS uses a face-to-face survey in an interviewee's house where this has led to an increase in the quality of the collected data. This Survey was also selected by this research study due to its coverage and reliability.

The OxIS questionnaire consists of four sections: general questions, questions for internet users, questions for non-internet users and questions for ex-internet users. Further, other internet related technologies such as Cable TV, Digital camera, Portable Mp3, Game consoles, mobile phones are also included in this survey as well as, demographic and geographic information (Surveys Oxford Internet, 2014). A difference when using this dataset to the ONS dataset is that researchers have to seek prior permission by contacting OxIS and then obtain the dataset. Due to some limitations, the OxIS allowed data for the periods 2007, 2009 and 2011.

6.4 Evaluation Analysis Method

Having selected the sources for evaluation, the next step for this phase involved explaining the analysis method. The analysis method aimed to compare the results of both surveys to this research study and second, to evaluate the conceptual framework that is found in chapter 5 by testing the framework with the dataset.

Since both ONS and OxIS are datasets that were not particularly designed for this research study, the previous analysis method of chapter 5 could not be used. Gunderson (1974) suggested that a linear probability function is enough for testing hypotheses. Using this as supporting information, Probit, a non-linear regression method was selected. The Probit and Logit models have been used more than 10% in Strategic Management Journals in the 1990s and 2000s (Shook et al., 2003). Research teams recommend STATA version 12 when applying Probit with the datasets and since this version was also available in this university, the research considered this application.

6.4.1 Variables from ONS

Having selected the datasets, the next step involved selecting variables from these datasets. Demographic variables selected as independent variables for ONS were age, gender, married status, regions, income, educational level, and, employment status. These demographic variables appeared in the ONS surveys of 2010 until 2013.

The dependent variable was obtained from the question on mobile devices that can access the internet. The choice that ONS provided were mobile phone (or smartphone) via GPRS, Mobile phone (or smart phone) via UMTS, HSDPA (3G, 3G+), handheld computer, or Portable computer. Only those who selected the first and the second choices were considered as using smartphones. This question was in the ONS surveys of 2010 to 2013.

Interestingly, in 2012, ONS included further questions on smartphone usage. Choices of smartphone use included email, news, newspaper, e-book, download game, download music, and using social media. Therefore, for ONS 2012, smartphone usage will be included as a dependent variable because downloading games, downloading music or social media can be considered as using smartphones for entertainment purposes, which can then be used to verify the seventh hypothesis on perceived Enjoyment. However, in 2013, ONS removed questions on handheld device usage.

6.4.2 Variables from OxIS

For OxIS 2007, the question that will be considered as dependent variable is the question on mobile phone usage. OxIS sought information in questions using questions such as using mobile phones for sending text messages, playing games, accessing email or the internet, taking pictures, sending photos, or listening to music (Mp3s). The respondents had to provide responses by selecting one of the aforementioned choices in order to be determined as using a smartphone, except using sending a text message. Demographic variables were also used as independent variables.

6.5 Evaluation Findings

Having selected the variables, the datasets were analysed using STATA version 12, a method that was also pursued by Vyas (2013). The following section provides and discusses the findings of the selected variables obtained from the ONS data sets.

6.5.1 ONS findings: Smartphone Usage in the UK Using Probit Analysis

To gain an understanding of smartphones use based on demographics such as age, gender, marital status, education level, employment status, and income, Probit regression analysis was applied to the recent waves of ONS data 2013, 2012, 2011 and 2010. For those unfamiliar with the method, Probit regression is a method of working with categorical dependent variables whose underlying distribution is assumed to be normal. That is, the assumptions of Probit regression are consistent with having a dichotomous dependent variable whose distribution is assumed to be a proxy for a true underlying continuous normal distribution. Probit regression has been extended to cover multinomial dependent variables (more than two nominal categories) and to cover ordinal categorical dependent variables. These extensions are sometimes labelled mlogit and ologit respectively. Probit regression is an umbrella term meaning different things in different contexts, although the common denominator is treating categorical dependent variables assumed to have an underlying normal distribution. When a Probit model is applied, the inverse standard normal distribution of the probability is modelled as a linear combination of the predictors.

Table 6.1 Probit Regression: ONS 2010 Wave

```
Probit regression                              Number of obs   =       4077
                                               LR chi2(    23)   =     828.21
                                               Prob > chi2     =     0.0000
Log likelihood =  -1588.8996                    Pseudo R2       =     0.2067
```

smartphone	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
age25_34	.2670074	.0766483	3.48	0.000	.1167794	.4172353
age35_49	-.1938935	.0714457	-2.71	0.007	-.3339245	-.0538625
age50_65	-.8424524	.0922851	-9.13	0.000	-1.023328	-.6615768
age66plus	-1.382612	.1369544	-10.10	0.000	-1.651037	-1.114186
male	.3279176	.0526196	6.23	0.000	.2247852	.4310501
single	.4070677	.1735576	2.35	0.019	.0669011	.7472342
married_together	.2610322	.1693896	1.54	0.123	-.0709653	.5930297
divoded separate widowed	.3101243	.1770599	1.75	0.080	-.0369067	.6571553
scotland	-.2603967	.102236	-2.55	0.011	-.4607756	-.0600177
wales	-.3264479	.1323901	-2.47	0.014	-.5859277	-.0669681
north	-.2938506	.0843634	-3.48	0.000	-.4591998	-.1285014
midland	-.1207189	.0838813	-1.44	0.150	-.2851232	.0436853
south	-.0684117	.0788131	-0.87	0.385	-.2228825	.0860591
london	.019732	.102561	0.19	0.847	-.1812838	.2207479
sumgross	.0013131	.0009491	1.38	0.167	-.0005471	.0031732
englishwhite	.1008423	.0939157	1.07	0.283	-.0832291	.2849136
irish	.2031966	.1337884	1.52	0.129	-.059024	.4654171
gcse_o_level	.1717645	.0739211	2.32	0.020	.0268819	.3166472
a_level	.3071174	.0935963	3.28	0.001	.123672	.4905628
higher_education	.320268	.0891297	3.59	0.000	.145577	.4949591
degree level	.4848823	.0710891	6.82	0.000	.3455503	.6242143
employed	.2696455	.0697318	3.87	0.000	.1329737	.4063173
unemployed	.1655061	.1185892	1.40	0.163	-.0669246	.3979367
_cons	-1.409814	.2086631	-6.76	0.000	-1.818786	-1.000842

For this research, the first wave to be considered is 2010, which is the time period that is three and a half years after the initial launch of the first iPhone. As shown in Table 6.1 there were 4,077 usable responses in 2010. For the age category, it can be learnt that the probability of older adults using smartphones was meaningfully decreased to -0.842 in the 50 to 65 age groups and -1.382 in the above 66 years old age groups. In terms of education, the higher the education level of an individual there was, it led to a higher probability of using smartphones. Further, employment also affected smartphone usage. However, income (sum gross) did not have a significant effect on smartphone usage in 2010.

Table 6.2 Smartphone adoption by age from the ONS 2010 Wave

Age	**Number of Responses**	**Using smartphones**	**Percent**
14-19	128	50	39.06%
20-29	460	212	46.09%
30-39	671	228	33.98%
40-49	670	166	24.78%
50-59	630	85	13.49%

60-69	749	42	5.61%
70-79	486	6	1.23%
over 80	283	0	0.00%
Total	**4077**	**789**	**19.35%**

From the data set, the data can be grouped by ages as in table 6.2. Table 6.2 shows the responses of those who used smartphones in 2010 where the numbers of 50-59 people using smartphones was quite low at 13.49% or 85 of 670. Moreover, the 60-69 years old age group used smartphone only 5.61% or 42 of 749 responses. Generally, there were 19.35% (789 of 4,077) of the British who used smartphones in 2010. For 50+, the dataset show only 6.12 % (133 of 2,148). The number 133 were from the summary of the smartphone users from 50-59 (85), 60-69(42), 70-79(6) and over 80(0). There were 2,148 replies form the 50 years old adults in the ONS dataset of 2010.

Table 6.3 Probit Regression: ONS 2011 Wave

```
Probit regression                                 Number of obs   =       3307
                                                  LR chi2(   23)     =    1045.85
                                                  Prob > chi2     =     0.0000
Log likelihood =  -1485.1111                       Pseudo R2       =     0.2604
```

smartphone	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
age25_34	.3083532	.0858295	3.59	0.000	.1401306	.4765759
age35_49	-.2028556	.0759518	-2.67	0.008	-.3517184	-.0539929
age50_65	-.8404326	.0919881	-9.14	0.000	-1.020726	-.6601392
age66plus	-1.419158	.1323456	-10.72	0.000	-1.678551	-1.159766
male	.2758287	.0541297	5.10	0.000	.1697364	.3819209
single	.4522442	.1713072	2.64	0.008	.1164882	.7880001
married_together	.2411424	.1651792	1.46	0.144	-.082603	.5648877
divoded_separate_widowed	.2410871	.1751437	1.38	0.169	-.1021884	.5843625
scotland	-.1297096	.1075722	-1.21	0.228	-.3405472	.081128
wales	-.0021374	.1283342	-0.02	0.987	-.2536679	.249393
north	.0328822	.0859783	0.38	0.702	-.1356322	.2013965
midland	-.0060754	.0900634	-0.07	0.946	-.1825964	.1704455
south	.0022776	.0805771	0.03	0.977	-.1556506	.1602057
london	.1633098	.1106165	1.48	0.140	-.0534945	.3801141
sumgross	.0027308	.0009735	2.81	0.005	.0008227	.0046389
englishwhite	.0977084	.0874152	1.12	0.264	-.0736221	.269039
irish	-.4949313	.2964147	-1.67	0.095	-1.075893	.0860309
gcse_o_level	.2081832	.0750511	2.77	0.006	.0610858	.3552806
a_level	.6579967	.096545	6.82	0.000	.4687719	.8472214
higher_education	.5366091	.0956735	5.61	0.000	.3490924	.7241257
degree_level	.6393437	.074342	8.60	0.000	.493636	.7850513
employed	.4113197	.0696064	5.91	0.000	.2748937	.5477457
unemployed	.1525987	.1156869	1.32	0.187	-.0741434	.3793409
_cons	-1.342622	.2100255	-6.39	0.000	-1.754264	-.9309797

From the data set of 2011 the numbers of responses were at 3307. The results showed and confirmed a similar trend to 2010 which was that the 50 years old and above adults had a significant probability of not using smartphones. In terms of income, the numbers of probability increased from 2010 and it was significant. For the education aspect, individuals educated to the A levels and above had had an increased possibility to use smartphones. Therefore, in 2011, individuals who had high education levels and were younger were likely to adopt smartphones as explained in section 5.7 that addressed the issue that 50 years old and above adults with higher education levels were likely to adopt smartphones in 2014.

Table 6.4 Smartphone adoption by age from the ONS 2011 Wave

Age	**Number of Responses**	**Using smartphones**	**Percent**
14-19	123	88	71.54%
20-29	389	258	66.32%
30-39	481	257	53.43%
40-49	580	207	35.69%
50-59	529	97	18.34%
60-69	557	62	11.13%
70-79	412	9	2.18%
over 80	236	0	0.00%
Total	**3307**	**978**	**29.57%**

When the dataset was grouped to show the numbers of people who used smartphones in 2011 it was found that the numbers of 50-59 people using smartphones increased slightly from 13.49% in 2010 to 18.34% (97 of 529) in 2011 (shown in Table 6.2 and 6.4). Similarly, for the 60-69 years old age group, the numbers had increased from 5.61% to 11.13% (62 of 557). Generally, there was 29.57% of the overall British population that used smartphones in 2011, which had increased from 19.35% in 2010. However, for the 50 years old and above adults, there were 9.69% (168 of 1,734) smartphone users in 2011. The percentage increased slightly from 6.12% in 2010. Although the numbers of older adults had increased from 2010, the number was still very low compared to the younger groups.

Table 6.5 Probit Regression: ONS 2012 Wave Test 1

```
Probit regression                                 Number of obs   =       3000
                                                  LR chi2(   23)    =    1325.80
                                                  Prob > chi2     =     0.0000
Log likelihood =  -1393.1703                        Pseudo R2       =     0.3224
```

smartphone_use	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
age25_34	.4814115	.0983848	4.89	0.000	.2885809	.6742422
age35_49	-.088124	.0812322	-1.08	0.278	-.2473362	.0710883
age50_65	-.7875528	.0931412	-8.46	0.000	-.9701062	-.6049995
age66plus	-1.481835	.1179384	-12.56	0.000	-1.71299	-1.25068
male	.1310293	.0561989	2.33	0.020	.0208815	.2411771
single	.6391552	.1510246	4.23	0.000	.3431524	.935158
married_together	.4043177	.1409888	2.87	0.004	.1279848	.6806505
divoded_separate_widowed	.4479382	.1485244	3.02	0.003	.1568356	.7390408
scotland	.0525533	.1108015	0.47	0.635	-.1646137	.2697203
wales	-.0180404	.1415923	-0.13	0.899	-.2955562	.2594754
north	-.0055391	.0916365	-0.06	0.952	-.1851434	.1740651
midland	-.0820423	.0881554	-0.93	0.352	-.2548238	.0907392
south	-.1051026	.0836766	-1.26	0.209	-.2691058	.0589006
london	.0112484	.1136886	0.10	0.921	-.2115772	.2340739
sumgross	.0031805	.0010427	3.05	0.002	.0011369	.0052242
englishwhite	.0435844	.0879714	0.50	0.620	-.1288365	.2160052
irish	-.0613243	.2830254	-0.22	0.828	-.6160439	.4933953
gcse_o_level	.3145172	.0770697	4.08	0.000	.1634633	.4655712
a_level	.5220852	.0980679	5.32	0.000	.3298757	.7142947
higher_education	.4314136	.0968432	4.45	0.000	.2416044	.6212229
degree_level	.7805714	.0753433	10.36	0.000	.6329013	.9282416
employed	.3471516	.0688554	5.04	0.000	.2121976	.4821057
unemployed	.0685934	.1255557	0.55	0.585	-.1774913	.3146781
_cons	-.9018957	.1904862	-4.73	0.000	-1.275242	-.5285497

The 2012 data set from ONS was also analysed where there were 3000 responses as shown in Table 6.5 above. This revealed that there were some changes between 2011 and 2012 and that the probability numbers of using smartphones within the 50 years old and above adults had slightly increased. Educational level was also one of the most important factors in terms of the probability of smartphone usage and it was found that Income (gross sum) had a slightly increased probability when using smartphones.

In addition, the 2012 ONS survey had a question on the use of some features of handheld devices. The uses were sending and/or receiving emails, reading/downloading online news/ newspapers/magazines, reading or downloading online books or e-books, playing or downloading games, images, video or music, using podcast services to receive audio/video files, and, online social networking using websites such as, Facebook or Twitter.

Table 6.6 Probit Regression: ONS 2012 Wave Test 2

```
Probit regression                                 Number of obs   =       3000
                                                  LR chi2(    29)     =    3214.13
                                                  Prob > chi2     =     0.0000
Log likelihood =  -449.00214                       Pseudo R2       =     0.7816
```

smartphone_use	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
age25_34	.2245378	.183343	1.22	0.221	-.1348078	.5838835
age35_49	.2432122	.1457131	1.67	0.095	-.0423802	.5288047
age50_65	.0102065	.1584608	0.06	0.949	-.3003711	.320784
age66plus	-.4194146	.1890636	-2.22	0.027	-.7899725	-.0488568
male	.0884432	.0932484	0.95	0.343	-.0943204	.2712067
single	.5663346	.2393798	2.37	0.018	.0971589	1.03551
married together	.4275764	.2181686	1.96	0.050	-.0000262	.8551791
divoded_separate_widowed	.5348543	.228568	2.34	0.019	.0868693	.9828393
scotland	.0500048	.1819972	0.27	0.784	-.3067032	.4067128
wales	-.0225526	.2316334	-0.10	0.922	-.4765457	.4314404
north	-.003806	.1483426	-0.03	0.980	-.2945521	.2869401
midland	-.1274285	.1418236	-0.90	0.369	-.4053976	.1505406
south	-.0605897	.1367982	-0.44	0.658	-.3287093	.2075298
london	-.3739	.2069729	-1.81	0.071	-.7795594	.0317594
sumgross	.0016558	.001703	0.97	0.331	-.0016819	.0049936
englishwhite	-.2216459	.1524318	-1.45	0.146	-.5204066	.0771149
irish	-.5819727	.5290968	-1.10	0.271	-1.618983	.455038
gcse o level	.182736	.1262546	1.45	0.148	-.0647184	.4301905
a_level	.1068002	.1694771	0.63	0.529	-.2253688	.4389692
higher education	.1966373	.1577726	1.25	0.213	-.1125913	.5058658
degree_level	.3703761	.1267632	2.92	0.003	.1219247	.6188274
employed	.0894404	.1117352	0.80	0.423	-.1295565	.3084374
unemployed	-.1911722	.223651	-0.85	0.393	-.6295202	.2471757
email	2.584138	.1325555	19.49	0.000	2.324334	2.843942
reading_news_magazines	1.633277	.1926686	8.48	0.000	1.255653	2.0109
reading_ebook	-.6844866	.2490523	-2.75	0.006	-1.17262	-.1963531
playing_game	1.947954	.2867937	6.79	0.000	1.385848	2.510059
podcast	-1.819191	.3672171	-4.95	0.000	-2.538923	-1.099459
social_networks	2.271086	.1739442	13.06	0.000	1.930162	2.61201
_cons	-1.970313	.3030784	-6.50	0.000	-2.564336	-1.37629

Due to the presence of such information, these features were included in the second analysis with the outcomes shown in Table 6.6. What was discovered is that the added novel six factors were found significant for smartphone usage. Emailing and social networking showed a high probability at around 2.584 and 2.271, respectively. Playing or downloading games, images, video or music, and reading / downloading online news/ newspapers/ magazines increased with a high possibility at around 1.947 and 1.633 respectively. These revelations are linked with the fifth and the seventh hypothesis, performance expectancy and enjoyment.

Table 6.7 Smartphone adoption by age from the ONS 2012 Wave			
Age	**Number of Responses**	**Using smartphones**	**Percent**
14-19	97	84	86.60%
20-29	320	268	83.75%
30-39	472	373	79.03%
40-49	525	292	55.62%
50-59	460	180	39.13%
60-69	519	99	19.08%
70-79	391	17	4.35%
over 80	216	0	0.00%
Total	**3000**	**1313**	**43.77%**

In terms of the number of users in 2012, the overall number had increased from 29.57% in 2011 to 43.77% (1,313 of 3,000) in 2012. In terms of this research, it was learnt that the percentage of users in the 50-59 age groups and 60-69 age groups had doubly increased from 18.34% to 39.13% and 11.13% to 19.08% in 2012 respectively. However, when combining the numbers of the 50 years old and above responses and the number of 50 years old and above replies of those who used smartphones, the percentage of 50 years old and above adults using smartphones was at 18.66% (296 of 1,586), an increase from 9.69 % in 2012.

Table 6.8 Probit Regression: ONS 2013 Wave

```
Probit regression                               Number of obs   =        2920
                                                LR chi2(    23)     =    1242.51
                                                Prob > chi2     =      0.0000
Log likelihood =  -1380.2379                     Pseudo R2       =      0.3104
```

smartphone	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
age25_34	.420196	.1018954	4.12	0.000	.2204846	.6199073
age35_49	-.1678379	.0825499	-2.03	0.042	-.3296326	-.0060431
age50_65	-.9633084	.0939174	-10.26	0.000	-1.147383	-.7792337
age66plus	-1.461539	.1142382	-12.79	0.000	-1.685441	-1.237636
male	.1688876	.0564196	2.99	0.003	.0583073	.279468
single	.3934787	.1413341	2.78	0.005	.116469	.6704884
married_together	.298056	.1325202	2.25	0.025	.0383212	.5577907
divoded_separate_widowed	.154176	.143578	1.07	0.283	-.1272318	.4355838
scotland	.0133738	.1149457	0.12	0.907	-.2119156	.2386632
wales	-.067694	.1365541	-0.50	0.620	-.3353351	.1999472
north	.0186247	.0908274	0.21	0.838	-.1593937	.1966431
midland	-.0555904	.0938114	-0.59	0.553	-.2394573	.1282765
south	.0332218	.0848569	0.39	0.695	-.1330946	.1995382
london	.2674178	.1118828	2.39	0.017	.0481315	.4867041
sumgross	.0032042	.0010542	3.04	0.002	.0011381	.0052703
englishwhite	.1540729	.0916478	1.68	0.093	-.0255536	.3336994
irish	.0742488	.3346293	0.22	0.824	-.5816126	.7301101
gcse_o_level	.29641	.0771739	3.84	0.000	.1451519	.447668
a_level	.5509865	.1035459	5.32	0.000	.3480403	.7539328
higher_education	.4274574	.0965865	4.43	0.000	.2381514	.6167634
degree_level	.5756392	.0750719	7.67	0.000	.428501	.7227774
employed	.4949312	.0708367	6.99	0.000	.3560938	.6337687
unemployed	.3129288	.1243719	2.52	0.012	.0691644	.5566931
_cons	-.8791808	.1908868	-4.61	0.000	-1.253312	-.5050495

The 2013 data set from OSN was the latest data set available at the time and the results are shown in Table 6.8. In 2013 age was also significant and the latest data still presented similar results, which were that the older adults are unlikely to adopt smartphones. However, the numbers have continuously improved from 2010. The income (gross sum) also shows significance. What was learnt was that the education levels were constantly significant and another significant factor affecting smartphone use was employment.

Table 6.9 Probit Regression: ONS 2013 Wave (50+ only)

```
Probit regression                               Number of obs   =       1554
                                                LR chi2(22)     =     356.83
                                                Prob > chi2     =     0.0000
Log likelihood = -578.24905                     Pseudo R2       =     0.2358
```

smartphone	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
age50_59	1.243977	.2571112	4.84	0.000	.7400483	1.747906
age60_69	.917674	.2464658	3.72	0.000	.43461	1.400738
age70_79	.5037688	.2549421	1.98	0.048	.0040914	1.003446
over80	0	(omitted)				
male	.3893817	.0873232	4.46	0.000	.2182313	.5605321
single	-.137036	.2003523	-0.68	0.494	-.5297194	.2556474
married_together	.1474291	.1568441	0.94	0.347	-.1599796	.4548378
divoded_separate_widowed	.1842458	.1713928	1.07	0.282	-.1516779	.5201694
scotland	.046379	.1808473	0.26	0.798	-.3080752	.4008331
wales	-.0695905	.2036313	-0.34	0.733	-.4687006	.3295196
north	.0664699	.1413662	0.47	0.638	-.2106029	.3435426
midland	-.137021	.14855	-0.92	0.356	-.4281738	.1541317
south	.1340949	.1297075	1.03	0.301	-.120127	.3883169
london	.6532945	.1628435	4.01	0.000	.3341271	.972462
sumgross	.0026701	.0015618	1.71	0.087	-.000391	.0057311
englishwhite	.4351156	.200168	2.17	0.030	.0427936	.8274376
irish	.1326606	.4981753	0.27	0.790	-.843745	1.109066
gcse_o_level	.332129	.1222522	2.72	0.007	.0925191	.5717389
a_level	.6865473	.1576524	4.35	0.000	.3775542	.9955404
higher_education	.4880574	.1437332	3.40	0.001	.2063455	.7697692
degree_level	.6395143	.1115555	5.73	0.000	.4208696	.8581591
employed	.6091943	.1027501	5.93	0.000	.4078078	.8105809
unemployed	.3762844	.2159026	1.74	0.081	-.046877	.7994458
_cons	-3.27578	.3447695	-9.50	0.000	-3.951515	-2.600044

The 2013 data set from OSN was further analysed **by focusing only on the 50+ adults-the demographic group of society of interest to this research study**. For this, the 18-49 years old records were removed, that led to the numbers of responses reducing from 2,920 to 1,554 as shown in table 6.9. It can be seen that the older respondents are less likely to adopt smartphones, which is a result similar to the results of table 6.8. In terms of gender, the male population is likely to adopt smartphones, a result similar to table 6.8. Living in London, income, education levels, and employment showed similarity to the results of table 6.8. However, in terms of marital status, it could not be predicted whether the 50 years old and above adults are likely to adopt smartphones, which is a result different from table 6.8. This implies that the 50 years old and above adults marital status is not significant when considering purchasing smartphones.

Table 6.10 Smartphone adoption by age from the ONS 2013 Wave			
Age	**Number of Responses**	**Using smartphones**	**Percent**
14-19	97	88	90.72%
20-29	293	251	85.67%
30-39	441	337	76.42%
40-49	535	307	57.38%
50-59	451	172	38.14%
60-69	526	98	18.63%
70-79	367	22	5.99%
over 80	210	4	1.90%
Total	**2920**	**1279**	**43.80%**

In terms of the numbers of smartphone users, in 2013, the overall number had grown from 43.77% to 43.80%. In terms of the age groups, there were slightly increases in every age group except for the 30-39 and 60-69 years old age groups. For the over 80 years old and above age groups, it was found that in 2013 the numbers of adopters was at approximately 1.90%. For the 50 years old and above adults, the number of smartphone usage had increased from 18.66% in 2012 to 19.04% (296 of 1,554).

6.5.2 ONS findings: A Longitudinal View

Whilst the previous section has been identifying an annual trend, a longitudinal perspective can also be obtained from the trends (Saunders et al., 2009), which can generally be illustrated visually using line graphs. Using the outcomes of 2010 to 2013 from the ONS data a line graph was drawn to provide Figure 6.1 was drawn.

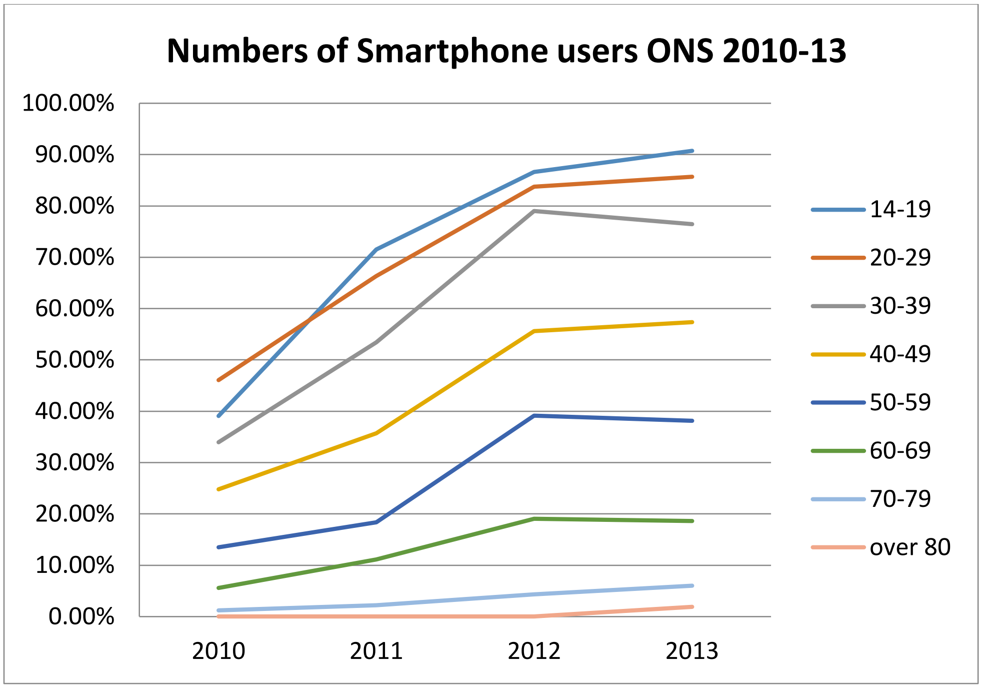

Figure 6.1 Graph, compare number of smartphone users from ONS survey 2010-2013

From the above graph it can be seen that the numbers of 50 years old and above adults adopting smartphones had increased significantly from 2011 to 2012 especially for the 50-59 age groups. In 2010, the 20-29 year age group was the highest smartphone user group at around 48%. The 40-49 age group adopted smartphones at around 25%. Individuals in the 50-59 year old age group used smartphones at around 15%, while the 70-79 year old age group adopted at around 6%. In 2011, smartphones were widely adopted within the younger age groups of 14-19, 20-29, 30-39 and 40-49 years old. Within the younger age groups, the 14-19 years old age group was the highest smartphone adopters group at around 72%. In the 40-49 year old age group, the adopters were at 35%, while the 50-59 age groups of adopters was at around 18% in 2011. In 2012 the numbers of smartphone users had increased significantly from 2011. Besides the younger generations, the below 40 years old age group , which was greater than 75% had adopted smartphones where the 50-59 years old age group had adopted smartphones from 18% in 2011 to 38% in 2012. However, smartphones use within the 60-69 years old age group had increase from 12% in 2011 to 19% in 2012.

In 2013, the overall use had increased slightly. However, in 2013 the gaps between the age groups were wider than the previous years. In 2013, the numbers of 30-39 year old users were around 78%, followed by 68% in the 40-49 years old age group. For the 50 years old and above adults, the numbers of 50-59 users was at around 38%, with the number of 60-69 users being approximately 19%. Therefore, the gap between the 40-49 age groups and 50-59 age groups was at around 20%. Further, the gap between the 50-59 age groups and 60-69 age groups was at around 20%, but the gap seems to be constant in 2013. **Therefore, a digital divide still exists.**

6.5.3 ONS findings: Smartphone Adoption Area

As addressed in chapter 5, the selected area for this final survey was the north of London where the reasons for selection included London being the capital city of the UK and London being important economically. Table 6.11 below that is based on the ONS results of 2013 show that London had more adopters than any other one in the UK.

Table 6.11 Smartphone adoption by area from the ONS 2013 Wave

Area (2013)	Response	Use Smartphone	%
London	279	155	55.56
Scotland	241	113	46.89
Wales	159	58	36.48
North	518	217	41.89
Midland	465	183	39.35
South	693	311	44.88
Yorkshire	279	115	41.22
East England	286	127	44.40

In Table 6.11 the London adopters were at 55.56% compared to the second largest area of Scotland at 46.89% and the South of England in third place at 44.88%. Wales appeared to lesser at 36.48%. Therefore, to study the adoption of smartphones London is an appropriate location where there are a large number of adopters.

These results also confirmed that there is a well-developed, mobile coverage infrastructure in London (Ofcom, 2013), which meant that individuals were more likely to adopt innovative technologies and devices, as in the case of this research, smartphones.

6.5.4 OxIS Findings: Predicting Smartphone Use around the UK- A Probit Analysis and Smartphone Users

Similar to the ONS, to gain an understanding of smartphone usage, the data from OxIS was obtained from the years of 2007, 2009 and 2011 and analysed using Probit.

Table 6.12 Probit Regression: OxIS 2007 Wave

Probit regression		Number of obs =	2350
		LR chi2(23) =	705.48
		Prob > chi2 =	0.0000
Log likelihood =	-1256.9524	Pseudo R2 =	0.2191

smartphone	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
age19_24	.4828592	.1406146	3.43	0.001	.2072597	.7584587
age25_34	.3074935	.10875	2.83	0.005	.0943474	.5206397
age35_49	-.1715395	.0959793	-1.79	0.074	-.3596554	.0165764
age50_65	-.7688222	.1121135	-6.86	0.000	-.9885607	-.5490837
age66plus	-.8287913	.1417737	-5.85	0.000	-1.106663	-.5509199
male	-.0045134	.0637712	-0.07	0.944	-.1295027	.1204758
single	-.7230606	.7217143	-1.00	0.316	-2.137595	.6914734
married_together	-.8717236	.7201524	-1.21	0.226	-2.283196	.539749
divoded_separate_widowed	-1.018926	.7228612	-1.41	0.159	-2.435708	.3978556
scotland	-.0544504	.1231376	-0.44	0.658	-.2957957	.1868949
wales	-.116849	.145352	-0.80	0.421	-.4017336	.1680356
north	-.1243862	.1063965	-1.17	0.242	-.3329195	.084147
midland	.1252546	.1084661	1.15	0.248	-.0873351	.3378442
south	-.0882171	.0957002	-0.92	0.357	-.2757861	.0993518
london	.2104736	.1197795	1.76	0.079	-.0242899	.445237
income	.0687426	.022463	3.06	0.002	.024716	.1127692
white_british	.1255008	.1020661	1.23	0.219	-.0745451	.3255466
other_white	.0882198	.1685239	0.52	0.601	-.242081	.4185206
fulltime	.0046286	.0880938	0.05	0.958	-.1680322	.1772894
parttime	-.2176039	.0997567	-2.18	0.029	-.4131234	-.0220844
retired	-.7900579	.1291226	-6.12	0.000	-1.043134	-.5369822
unemployed	-.4009797	.1342676	-2.99	0.003	-.6641394	-.1378199
health_problem	-.2687161	.101372	-2.65	0.008	-.4674016	-.0700306
_cons	1.203878	.7334923	1.64	0.101	-.2337409	2.641496

In Table 6.12 it can be seen that in 2007, the year that the iPhone was initially launched, age was a significant factor. In comparison to the older age groups, the younger generation was likely to adopt advanced mobile phones. In fact, within the 50 years old and above adults there was a likelihood that there were no smartphone users. Income was another significant factor for determining smartphone adoption. For OxIS, the question about health was apparent and during the analysis this factor was included. It can be seen that health problems were a significant factor where they moderately or negatively affected smartphone adoption. In terms of the regions, in 2007, the significant area was only in London. Therefore, in 2007 London residents were likely to use smartphones compared to other regions.

Table 6.13 Probit Regression: OxIS 2009 Wave

```
Probit regression                          Number of obs   =       2013
                                           LR chi2(   28)     =    818.09
                                           Prob > chi2     =     0.0000
Log likelihood =  -974.97259                Pseudo R2       =     0.2955
```

smartphone	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
age19_24	.4870153	.1589516	3.06	0.002	.1754759	.7985547
age25_34	.5063053	.1348385	3.75	0.000	.2420268	.7705839
age35_49	.0464601	.1119669	0.41	0.678	-.1729909	.2659111
age50_65	-.6968509	.1280062	-5.44	0.000	-.9477384	-.4459634
age66plus	-1.258226	.1634243	-7.70	0.000	-1.578532	-.9379206
male	.0771576	.0719975	1.07	0.284	-.063955	.2182701
single	-.6703925	.8502399	-0.79	0.430	-2.336832	.996047
married_together	-.8569813	.8466295	-1.01	0.311	-2.516345	.802382
divoded_separate_widowed	-1.173056	.8484543	-1.38	0.167	-2.835996	.4898835
scotland	.3889429	.1289782	3.02	0.003	.1361502	.6417356
wales	.468315	.1857897	2.52	0.012	.1041738	.8324562
north	.3843731	.1122431	3.42	0.001	.1643808	.6043655
midland	.1731815	.1112861	1.56	0.120	-.0449353	.3912982
south	.5475869	.1032068	5.31	0.000	.3453052	.7498686
london	.6195465	.1322009	4.69	0.000	.3604374	.8786555
income	.0157577	.0154115	1.02	0.307	-.0144482	.0459636
white_british	.2276441	.1323121	1.72	0.085	-.0316829	.486971
other_white	.7599313	.2819782	2.69	0.007	.2072641	1.312599
olevel	-.0370338	.1244036	-0.30	0.766	-.2808604	.2067928
alevel	.3861372	.1359869	2.84	0.005	.1196077	.6526667
bachelors_degree	.1230381	.1127594	1.09	0.275	-.0979661	.3440424
masters_degree	.349904	.2019318	1.73	0.083	-.045875	.7456829
doctoral_degree	-1.323508	.5267699	-2.51	0.012	-2.355958	-.2910581
fulltime	.0653372	.1032939	0.63	0.527	-.137115	.2677895
parttime	.0328269	.1188616	0.28	0.782	-.2001374	.2657913
retried	-.3560008	.1385612	-2.57	0.010	-.6275758	-.0844258
unemploy	-.1869917	.1396576	-1.34	0.181	-.4607155	.0867321
health_problem	-.1458365	.0961615	-1.52	0.129	-.3343096	.0426367
_cons	.7215761	.8608284	0.84	0.402	-.9656166	2.408769

In 2009, as shown in table 6.13, age was the main factor for predicting smartphone use. Compared to 2007, the probability of younger adults (below 50) to use smartphones had increased. However, the possibility of 50 years old and above adults was very low. In terms of regions, other areas such as Scotland, Wales, North or South of England were significant factors for predicting smartphones adoption in this year. It was found that the educational levels were factors that were not suitable for predicting smartphone use in the year. Combined with the data from figure 6.1, this year was considered to be the beginning of the smartphone adoption lifecycle.

Table 6.14 Probit Regression: OxIS 2011 Wave

Probit regression				Number of obs = 2057		
				LR chi2(28) = 851.98		
				Prob > chi2 = 0.0000		
Log likelihood = -991.2998				Pseudo R2 = 0.3006		

smartphone	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
age19_24	.7609194	.1689389	4.50	0.000	.4298053	1.092034
age25_34	.3851823	.1249772	3.08	0.002	.1402315	.6301331
age35_49	.1055419	.109872	0.96	0.337	-.1098032	.320887
age50_65	-.5279424	.1193294	-4.42	0.000	-.7618237	-.294061
age66plus	-1.126948	.146403	-7.70	0.000	-1.413893	-.8400039
male	-.1363156	.0702936	-1.94	0.052	-.2740884	.0014573
single	.5661929	.4194563	1.35	0.177	-.2559264	1.388312
married_together	.4094362	.4161437	0.98	0.325	-.4061904	1.225063
divoded_separate_widowed	.1753071	.4214508	0.42	0.677	-.6507213	1.001335
scotland	-.4101735	.121189	-3.38	0.001	-.6476996	-.1726473
wales	-.2361359	.1584184	-1.49	0.136	-.5466303	.0743585
north	-.1525455	.1139086	-1.34	0.181	-.3758022	.0707112
midland	-.3646955	.1146217	-3.18	0.001	-.58935	-.1400411
south	-.3471437	.1012461	-3.43	0.001	-.5455825	-.148705
london	-.5429058	.1312043	-4.14	0.000	-.8000614	-.2857502
income	.022626	.0137381	1.65	0.100	-.0043003	.0495523
white_british	.0909254	.1266921	0.72	0.473	-.1573866	.3392375
other_white	.1479567	.2258389	0.66	0.512	-.2946794	.5905929
olevel	.0603279	.1246287	0.48	0.628	-.1839399	.3045957
alevel	.0013933	.1471466	0.01	0.992	-.2870086	.2897953
bachelors_degree	.2342888	.1184308	1.98	0.048	.0021686	.466409
masters_degree	.4535674	.2204199	2.06	0.040	.0215523	.8855826
doctoral_degree	.4139602	.336142	1.23	0.218	-.2448661	1.072786
fulltime	.2636575	.1059657	2.49	0.013	.0559685	.4713465
parttime	.2007084	.1218637	1.65	0.100	-.0381401	.4395569
retried	-.3138332	.1295112	-2.42	0.015	-.5676705	-.0599959
unemploy	-.2824482	.1425175	-1.98	0.047	-.5617774	-.0031189
health_problem	-.2799453	.0931916	-3.00	0.003	-.4625974	-.0972932
_cons	.2026238	.4424304	0.46	0.647	-.664524	1.069772

In 2011, age groups and region were significant and could bring to predict smartphone usage similar to in 2009. However, older adults were still unlikely to use smartphones. Education levels in this year were significant and people who graduated degrees were likely to use smartphones. During this year, the smartphone was widely used among workers. Therefore, full time was significant and full time workers were like to use smartphones in 2011. Health problem was found significant to predict smartphone usage.

As addressed in section 5.7 Effect of Demographic Variable as Moderated Variables, Heath variable is almost significant t-value = 1.633 (t-value need to more than 1.65 to be considered as significant).

6.6 Final Hypotheses Testing

Having reviewed the results of both the ONS and OxIS datasets, this section will discuss how the results validate this research study framework as in chapter 5 and the further explain the smartphone adoption. Please note that it is expected that not all the hypothesis can be applied to the datasets from ONS and OxIS because the both datasets did not designed to examine smartphone adoption among older adults. This is known as secondary data (Saunders et al., 2009).

6.6.1 Evaluation Hypothesis Testing

In chapter 5, the six of eight hypotheses were supported. The supported variables were compatibility, facilitating conditions, performance expectancy, effort expectancy, perceived enjoyment.

From ONS 2012, the year that ONS ask about mobile device usage, the results from Probit as in figure 6.4, reviewed that smartphone usage can be predicted by the factors which are emailing, social networking, playing or downloading games, images, video or music, and reading / downloading online news/ newspapers/ magazines. These usages involved several capability of smartphones, which the owners may expect from smartphone advertisement or word of mouth from friend and family. Therefore, this could verify the supported variable on performance expectancy. Moreover, when consider some activities such as listen to music or playing game, the activities can grouped as entertainment which is bring enjoyment. Thereby, the supported by variable on perceived enjoyment would be verified. Therefore, the fifth and the seventh hypothesis, performance expectancy and enjoyment were tested.

From ONS 2012 and 2013, which were the latest years at the time that final questionnaire was taken. The income (sum gross) shows significant with low attitude as in figure 6.4 and 6.5. The education levels were constantly significant with considerably values. By the definition of supported variable on facilitating conditions which is the users need to have necessary resources – knowledge time and money to support smartphone usage. The results from ONS 2012 and 2013 could verify the fourth hypotheses on facilitating conditions.

Table 6.15 Hypotheses Testing: Evaluation	
Hypotheses	Evaluation
Compatibility -> behavioural intention	Could not be tested
Facilitating conditions -> behavioural intention	Supported
Performance expectancy -> behavioural intention	Supported
Effort expectancy -> behavioural intention	Could not be tested
Perceived enjoyment -> behavioural intention	Supported
Behavioural intention-> smartphone usage	Could not be tested

Therefore, three of six supported hypotheses were supported by nationally represented datasets drawn from the ONS and OxIS.

6.6.2 Discussion on ONS and OxIS Datasets

Having used both datasets to verify the hypothesis in this research study, this section will discuss other potential variables or issues that relate to smartphone adoption that are evident in the ONS and OxIS datasets.

In terms of responses to the final phase questionnaire of this research, there were 984 completed useable responses from the north London area as explained in chapter 5. From the datasets that were used in this chapter, the researcher felt more confident with the completed numbers of replies since the number of nationwide responses in the ONS dataset were an estimated 3,000 and 2,200 from OxIS. Therefore, considering the challenges that this research study endured, it was felt that 984 responses were strong enough to represent the north of London area.

In terms of gender, the dataset from ONS revealed that especially males were likely to adopt smartphones compared to females. This result also confirmed the finding in section 5.4 that this research study found. That is, 54.42% of the 50 years old and above male adult population adopted to smartphones compared to 45.58% of the 50 years old and above female adult population.

As mentioned in the first two chapters as ageing occurs, health problems do emerge that led to the inclusion of health problems in this study, as in the OxIS dataset. The 2011 OxIS data set as shown in Figure 6.9 found that health problems do negatively affect smartphone adoption. This implies that individuals with health problems are less likely to adopt smartphones. Although health is not significant enough to modify the effect of the intention to actual use as explained in section 5.7, it can be said that health problems could negatively affect smartphone usage.

From the datasets, variables such as employment, regions and married status were available, however, due to time restrictions; they were not included within this study.

What has been learnt from this evaluation is that it is very helpful and useful to conduct evaluation studies using secondary data in order to compare and to test the hypothesis between the collated data of this research study and the nationwide collected datasets such as, those of the ONS and OxIS. However, it has to be understood that only some of the results of this study can be partially verified as all the data of chapter 5 is not evident within the datasets; however, evaluation allows a researcher to be confident with the final findings as partial results can still be confirmed and avoid a bias to the research.

6.7 Discussion

Having verified the MOSA using datasets from ONS and OxIS, this section will further discuss this research findings and compare them with existing research studies associated with smartphones. The discussion issues include research site, sample size, research methods, theories, and hypotheses.

6.7.1 Discussion on Research Site, Sample Size and Research methods

The articles on technology adoption using both TAM and UTAUT that were addressed in chapter 2 were compiled and presented in Table 6.16 below. This allows a discussion on the research site and sample size.

Table 6.16 Discussion Research Site and Sample Size to Existing Literatures

Existing Literature	Research Country	Sample Size	Is focus on older adults
Park and Chen (2007)	USA	A survey of 820 US doctors and nurses	NO
Chtourou and Souiden (2010)	France	A Survey 367 mobile users	NO
Kim (2008)	South Korea	A survey of 286 working adults	NO
Koenig-Lewis et al (2010)	Germany	A survey of 263 Young people	NO
Shin (2007)	South Korea	A survey of 515 Consumers	NO
Verkasalo et al (2010)	Finland	A survey of 579 panellists	NO
Wu and Wang (2005)	Taiwan	A survey of 310 m- commerce users	NO

Chong et al (2012)	Malaysia and China	A survey of 394 consumers	NO
Kang et al (2011)	South Korea	A survey of 100 students	NO
Kim and Garrison (2008)	South Korea	A survey of 58 graduate students	NO
Nysveen et al (2005)	Norway	A survey of 684 mobile chat service users	NO
Xue et al (2012)	Singapore	A survey of 700 older adult women (50+)	YES
Nayak et al (2010)	United Kingdom	A survey of 592 older adults (60-88)	YES
Lee et al (2012)	South Korea	A survey of 215 college students and office workers	NO
Venkatesh et al (2012)	Hong Kong	A survey of 1,512 mobile internet consumers	NO
Alkhunaizan and Love (2012)	Saudi Arabia	A survey of 547 smartphone users	NO
Pitchayadejanant (2011)	Thailand	A survey of 408 smartphone users	NO
Zhou et al (2010)	China	A survey of 250 phone users and students	NO
Song and Han (2009)	South Korea	A survey of 570 consumers	NO
Kijsanayotin et al (2009)	Thailand	A survey of 1323 patients	NO
Shi (2009)	China	A survey of 653 application users	NO
Zhou (2008)	China	A survey of 250 phone users and students	NO
Park et al (2007)	China	A survey of 221 online panellists	NO
Carlsson et al (2006)	Finland	A survey of 157 mobile consumer	NO
He and Lu (2007)	China	A survey of 243 individuals	NO
Boontarig et al (2012)	Thailand	A survey of 31 elderly people	YES
Leong et al (2013)	Malaysia	A survey of 572 students	NO
Abad et al (2010)	Spain	A focus group of 79 teenagers	NO

From 28 research studies, when considering the research countries, it can be seen that there is only one research study from the USA, seven research studies from Europe and 20 research studies from Asia. Delving further, it can be seen that there was only one research study from the

UK and six research studies were from South Korea. This implies that European researchers had less emphasis on mobile technology adoption research. Contrastingly, Asian countries such as South Korea, China, Taiwan, Malaysia, and Thailand were more active in this type of research. This supports the fact that the majority of smartphone brands being developed and sold within the consumer market hail from South East Asian manufacturers such as Samsung, Lenovo, LG, Huawei or Sony.

In terms of methodology, most of the research on mobile technology adoption applied a survey strategy. For the sample sizes, the largest size included 1,512 responses and the average sample size of responses was 468. From the above table, only three articles focused on older adults, which as discussed and explained in chapter 2 is an important demographic group of society.

From the above details, this research on smartphone and older adults has quite a strong sample size at 984, twice the size of the average. Secondly, this research provides a contribution by focusing on older adults in the UK. Therefore, this research provides knowledge that can fill the research gap in terms of the country (the UK) and particular demographic group (50+ adults).

6.7.3 Discussing Technology Adoption Theories

Having discussed the methodology, this section will discuss the existing literature in terms of technology adoption theories. Please note that the following table, table 6.17 was designed to be used for 6.7.3 to 6.7.6. Section 6.7.3 will discuss on only the base theory, TAM and UTAUT. Then section 6.7.4 will compare only the technology that the researches focus, NOT the results in terms of adoption or research outcome. Then, the section 6.7.4, will explain on the similarity and difference in terms of hypothesis and adoption variables.

Table 6.17 Discussion Research, Theory and Technology to Existing Literatures

Existing Literature	Supported Variables	Unsupported Variables	Base Theory	Technology
Park and Chen (2007)	PU, PEOU, SE, OB, AT, BI		TAM	Smartphone
Chtourou and Souiden (2010)	Fun-Enjoyment, PEOU, PU		TAM	Mobile devices for surfing the internet
Kim (2008)	Perceived Cost Savings, PU and PEOU EXP moderate effect of company willingness to fund to behavior intention.		TAM	Mobile wireless technology

Koenig-Lewis et al (2010)	PU, PEOU, Credibility, Trust, Risk and COM	Perceived Cost	TAM	Mobile banking
Shin (2007)	Perceived Availability, Perceive quality, Social Pressure, ENJ and PU		TAM	Mobile internet
Verkasalo et al (2010)	Technical, Barriers, Social Norm, ENJ and PU		TAM	Smartphone application
Wu and Wang (2005)	Perceived Risk, Cost, COM, PEOU and PU		TAM	Mobile commerce
Chong et al (2012)	Trust, Cost, SOC, Variety of Services – Malaysian Trust, SOC, Cost – Chinese	PU, PEOU, Trialability – Malaysian PU, PEOU, Trialability, Variety of Services – Chinese	TAM	M-commerce
Kang et al (2011)	Wireless Internet, Design, Multimedia, Application, After service, PEOU and PU		TAM	Smartphones
Kim and Garrison (2008)	Perceived ubiquity, Perceived Reachability, Job relevance, PEOU and PU		TAM	Mobile wireless usage
Nysveen et al (2005)	Perceived Expressiveness, ENJ, PU, PEOU, AT; Normative Pressure in Female	Normative Pressure in Male	TAM	Mobile chat services
Xue et al (2012)	PU, PEOU, COM, and Subjective norm, Technological Anxiety, Perceived User Resource		TAM	Health informatics via a mobile phone-based intervention
Nayak et al (2010)	AT, Usefulness, Good	Education,	TAM	Internet usage

	Health, gender (Males)	Age, PEOU, Relevance		
Leong et al (2013)	PU, PEOU, SOC and ENJ	SE; Gender as moderator variable not moderate any effects.	TAM	mobile entertainment
Abad et al (2010)	PU, PEOU ENJ affected actual use		TAM	Smartphone in hedonic scenarios
Lee et al (2012)	Credibility, Personalisation, PE, EE	SOC, Flow	UTAUT	Smartphone application
Venkatesh et al (2012)	PE, EE, SOC, FC, Hedonic motivation EXP moderate effect of intention to actual use.		UTAUT	mobile internet
Alkhunaizan and Love (2012)	Cost, EE and PE Age can determine m-commerce actual use.	Trust, SOC	UTAUT	mobile commerce
Pitchayadejanant (2011)	FC, Perceived Value, PE, EE, SOC		UTAUT	Smartphones
Zhou et al (2010)	Task technology fit, SOC, PE and FC		UTAUT	mobile banking
Song and Han (2009)	SOC, ENJ, PE and EE		UTAUT	Smartphone application
Kijsanayotin et al (2009)	Knowledge, EXP, FC, PE, EE, SOC		UTAUT	IT in the community health centres
Shi (2009)	ENJ, SOC, PE, EE and FC		UTAUT	Smartphone software adoption
Zhou (2008)	PE, FC and SOC		UTAUT	mobile commerce

Park et al (2007)	PE, EE and SOC Gender and education levels significantly moderated the PE, EE.	FC	UTAUT	mobile communication technology
Carlsson et al (2006)	EE and PE	SOC	UTAUT	mobile devices/services
He and Lu (2007)	PE, FC, SOC	EE	UTAUT	consumers mobile advertising
Boontarig et al (2012)	EE, FC, and Perceived value	SOC, PE	UTAUT	Smartphone for e-Health services
Note: PU= Perceived usefulness; PEOU = Perceived Ease of Use; SOC = Social Influence; ENJ = Perceived Enjoyment; EE = Effort Expectancy; PE = Performance Expectancy; COM = Compatibility ; OB = Observability; SE = Self-efficacy; AT= Attitude; BI = Behavioural Intention; EXP = Experience				

From Table 6.17 above 13 articles applied UTAUT while 15 article used TAM as the base theory. It is very interesting to note that only two theories have been applied to study technology acceptance and these two theories have been developed by the researcher V. Venkatesh. However, both theories are different in several ways. Please refer to Chapter 2 for more details about the theories.

Initially, the theories differ in terms of their names. UTAUT includes the word "use" in the name, but both theories have the construct Use Behaviour. Secondly, UTAUT places greater emphasis on moderator variables such as gender, age, experience, and voluntariness of use in comparison to TAM 3 that includes Experience and Voluntariness. Therefore, UTAUT might more applicable with research studies that aim to study demographic variables such as moderator variables. Thirdly, TAM appears to be a flexible model as other variables can easily be added to the model. Examples of this flexibility include the study from Chong et al (2012) that inserted Trust, Cost, Variety of Service, and Trialability in order to study M-commerce, and Koenig-Lewis et al (2010) that included Credibility, Trust, Risk and Perceived Cost to study mobile-banking.

This discussion was essential to explain why UTAUT was used as the foundation to study smartphone adoption within UK's older adults. Further, from this discussion it can be learnt that this research study emphasises not only adoption, but also study smartphone usage and the demographic variables of health, experience, education and gender were studied as moderator variables, which is similar to UTAUT.

6.7.4 Discussing Smartphone Technology

In terms of technologies in adoption research studies, smartphone technologies can be divided into three main categories: the devices, the connection and the usage of the smartphone for specified purposes. Researchers can focus on the smartphone itself, such as Park and Chen (2007) who studied smartphone adoption within nurses and doctors. Kang et al (2011) studied smartphone adoption in general, and Pitchayadejanant (2011) was interested in iPhone and Blackberry adoption. These studies are similar to this research on smartphones and older adults in UK that focused largely on the adoption of the devices.

Some researchers focused on mobile internet connections where examples include Shin (2007) who focused Wireless Broadband Internet (Wi-Bro), and, Venkatesh et al (2012) who applied UTAUT2 to study mobile Internet consumers. Although smartphones are closely linked to the mobile connection, this research on smartphones and older adults did not focus on the connections. Therefore, this research is different from those that studied the adoption of the connections.

Using smartphones for specified purposes appeared to be the largest category due to a smartphone's ability to install several applications or using internet browsers. Examples of smartphone use include mobile banking, mobile commerce, mobile entertainment, mobile for health, mobile for learning and other applications. Examples of mobile commerce and adoption research include the study of Wu and Wang (2005), Chong et al (2012), and Alkhunaizan and Love (2012). In these studies, Perceived Risk, Cost, and Trust were added to conceptual models when studying mobile commerce. Similarly, mobile banking has also been researched when considering the adoption of the m financing aspect. Examples of mobile banking research include, Koenig-Lewis et al (2010) and Zhou et al (2010) where credibility, Trust, Risk, Perceived Cost, and Task technology fit were added to classic adoption theories in order to research mobile banking.

The previous studies are different from this research where the research did not have an emphasis on the particular purposes of use. This research did not test the conceptual model (MOSA) only by considering the specific use of the smartphones. Instead, MOSA was tested against general use of smart phones. Therefore, this research provided a broader view of use. Nonetheless, this also means MOSA may not be fully compatible with research studies of smartphone use being utilised for specific purposes. However, this research on smartphone and older adults also included smartphone use on health and well-being, and connecting to friends and families.

When considering the applications aspect of smartphones, Nysveen et al (2005) studied mobile chat services where it was found that besides perceived usefulness and ease of use, perceived expressiveness and perceived enjoyment could affect mobile chat service adoption. Further, Nysveen et al (2005) added gender as a moderating variable of the adoption. Other research on the applications have been conducted by Shi (2009) who studied smartphone software, Song and Han (2009) researched smartphone applications, and Xue et al (2012) on health informatics via a mobile phone.

It can be seen that there are several aspects of smartphone technologies that can be explored. Therefore this research on smartphone and older adults should provide a contribution that focuses not only on the device, but also the use aspect including the features of smartphones and the frequency of use. An outcome of such a study is that there should be deeper knowledge. For example, this research provides not only a MOSA conceptual framework, but shows that older adults frequently use basic features of smartphone such as emails and browsing compared to the advanced features such as sharing locations, using video conferencing or watching online videos. Therefore, the strength of this research on smartphone and older adults is providing knowledge for smartphone device adoption, which is the platform of other applications and purposes. Hence this research should be considered as pertinent for studying the adoption of smartphones in a demographic group of society.

6.7.5 Research Hypotheses

Having explained in terms of technology, this section focus on a discussion of the research hypotheses compared to the previous research studies and the implication of the hypotheses.

6.7.5.1 Hypothesis 1 Observability has a positive influence on the behavioural intention towards smartphone adoption – Not Supported

The first hypothesis expected that the more chances that older adults have of viewing smartphones, the more they intend to use the technology. The results in chapter 5 found that this hypothesis was not applicable.

The Observability variable in smartphone devices was studied by Park and Chen (2007) and Putzer and Park (2010) and found that the variable could predict smartphone adoption. Both research studies focused on smartphone adoption within nurses and doctors that included every age group. Further, due to the emphasis on occupations, it is assumed that most likely smartphones were used mainly for work purposes. Additionally the research was published since 2007 and 2010.

Therefore, the results from Park and Chen (2007) and Putzer and Park (2010) may differ to this research study that examined smartphone adoption in 50 years old and above adults because first the target audience is the older adults demographic group, versus nurses and doctors. At the time that the previous research was published, older adults had been seeing the uses of smartphones for a while; and could have lost interest in them.

Implication of Hypothesis 1 Observability

Observability was not supported in this research focused on older adults and smartphones, which means that older adults are not convinced to use smartphones by just observing the phones at use.

6.7.5.2 Hypothesis 2 Compatibility has a positive influence on the behavioural intention towards smartphone adoption – Supported

This hypothesis predicted that the more smartphones are compatible with a users' lifestyle, the more the intention to use a smartphone exists.

There were several research studies that supported this view such as the research of mobile banking from Koenig-Lewis et al (2010), the research of health informatics via a mobile phone-base intervention among 50 years old and above older adult females from Xue et al (2012), and the research of mobile commerce from Wu and Wang (2005).

Implication of Hypothesis 2 Compatibility

From the analysis of this research, it has been found that compatibility is important as older adults will adopt smartphones only if they can use smartphones to perform their daily tasks. This also means that smartphone stakeholders should design smartphones in a manner such that older adults' lifestyles can also be dealt with, rather than only the younger adults' needs and requirements. Smartphones can be viewed to be communication tools for workers, but older adults could value the device more in terms of entertainment as identified by Hypothesis 7, or to utilise the devices for connecting to friends and family. Therefore, to encourage smartphone usage, stakeholders should illustrate that smartphones can be an older adults' companion.

6.7.5.3 Hypothesis 3 Social Influence has a positive influence on the behavioural intention towards smartphone adoption - Not Supported

In hypothesis 3 it is expected that social Influence will positively affect the intention to use smartphones.

There have been several research studies that have tested this hypothesis. For instance, Chong et al (2012) studied mobile commerce between Malaysian and Chinese users of all the age ranges and found the social influence variable could predict mobile commerce adoption. Similarly, Leong et al (2013) who studied mobile entertainment within students also found the social influence variable significant, as did Zhou et al (2010) who studied mobile banking in China.

Contrastingly, smartphone application adoption research in South Korea focused on students and working people found that Social influence was not significant (Lee et al, 2012). Alkhunaizan and Love (2012) who studied mobile internet adoption in Saudi Arabia, and, Carlsson et al (2006) who also studied the adoption of mobile devices and services in Finland found that the hypothesis on Social influence was not supported.

Therefore, it is difficult to explain this variable. However, cultural and age groups could also cause this uncertainty. This is based on the study of Lee et al (2013) who study the impact of cultural differences on technology adoption by compare US and South Korea. Lee et al (2013) found that the mobile users in individualistic cultures such as US tend to rely on themselves. Unlike collectivistic cultures, South Korea, the Korean users tend to listen to others who have already adopted the technology. Therefore, since the American culture is similar to the UK, it can be implied that British people are likely to find information about the technology independently. Therefore the effect of Social Influence was not significant within the 50 years old and above adults in the UK.

Implication of Hypothesis 3 Social influence

Since social influence is not supported by this research it is suggested that older adults will not be influenced by their friends and family. Therefore, it may take time to encourage older adults to adopt new technologies, which implies that smartphone stakeholders and policy makers should allow a longer period of time when considering the adoption of novel technologies within older adults.

6.7.5.4 Hypothesis 4 Facilitating Conditions have a positive influence on the behavioural intention towards smartphone adoption – Supported

This hypothesis predicted that facilitating conditions positively influence the intention to use devices. The facilitating conditions in this case were time, money and knowledge.

To form this hypothesis, previous research that was referred to included, Venkatesh et al (2012) who found that facilitating conditions can predict mobile internet usage, as did Pitchayadejanant (2011) who studied smartphone adoption. In terms of only the facilitating conditions role in the adoption of novel technologies, Zhou et al (2010) and Shi (2009) found that facilitating conditions supported the adoption of mobile banking and smartphone software adoption respectively.

Implication of Hypothesis 4 Facilitating Conditions.

The above supported research studies confirmed that older adults need to have time, money and knowledge in order to adopt smartphones. For money and knowledge, the smartphone manufacturer and developers could encourage older adults to use smartphone by initially, maintaining or reducing the price of smartphones and applications. Secondly, the stakeholders, including policy makers could provide knowledge for older adults in the form of offering short courses or online tutorials.

6.7.5.5 Hypothesis 5 Performance expectancy has a positive influence on the behavioural intention towards smartphone adoption – Supported

Performance expectancy refers to the related benefits of smartphones for older adults in their daily lives or for their work purposes.

There were several research studies that found performance expectancy could predict mobile technologies such as the research on smartphone application adoption (Lee et al, 2012), mobile internet adoption research (Venkatesh et al, 2012), mobile commerce (Alkhunaizan and Love, 2012), and the research on mobile devices and services (Carlsson et al, 2006).

However, for specific research topics such as a smartphone being used for a specific service, e-Health services, Boontarig et al (2012) is a good example, as their research explained that older adults did not realize the benefits of e-Health services; hence not adopting smartphones. Therefore, their research did not fully support this hypothesis.

Implication of Hypothesis Performance Expectancy

From Boontarig et al (2012)’s case, researchers need to evaluate their research sample groups knowledge about a technology before including the factor of performance expectancy. For policy makers and smartphone manufacturers, advertisements or information about novel products and the benefits of the products are very important for adoption and should be considered within their strategies and policies.

6.7.5.6 Hypothesis 6 Effort Expectancy has a positive influence on the behavioural intention towards smartphone adoption – Supported

Effort Expectancy is related to the ease of use of smartphones for older adults.

There were several research studies supporting this hypothesis which included one where it was found that effort expectancy effected mobile communication technology adoption and gender and education levels moderated the effect of effort expectancy on attitudes when using mobile technology (Park et al, 2007). Research has also found that effort expectancy can predict the adoption of mobile devices and services (Carlsson et al, 2006). Finally, Song and Han (2009) and

Alkhunaizan and Love (2012) found that effort expectancy is pertinent for the adoption of smartphone applications and mobile commerce respectively.

Implication of Hypothesis

This hypothesis can lead to an understanding for smartphone developers and application developers in that they should attempt to develop devices and technologies for older adults that are easy to use.

6.7.5.7 Hypothesis 7 Enjoyment has a positive influence on the behavioural intention towards smartphone adoption – Supported

This hypothesis supports the view that Perceived Enjoyment has a positive effect on the intention to use smartphones.

When this research study commenced, a second version of the Unified theory of acceptance and use of technology (UTAUT2) by Venkatesh et al (2012) had been developed where the variable **Hedonic Motivation** was added. It is defined as the *fun or pleasure derived from using a technology*, and it has been shown to have an important role for determining technology acceptance and use. In UTAUT2, Venkatesh et al (2012) referred to the previous research of 2005 and used the Model of Adoption of Technology in Households (MATH) to explain the adoption of personal computers in the household (Brown & Venkatesh, 2005). The MATH model used the word **Application for Fun** as a factor of consideration and application for fun was defined as the pleasure derived from personal computer used.

Brown and Venkatesh's research of 2005 was linked to the earlier research of 2001 that was focused on personal computers. In Brown and Venkatesh (2005) research, **Hedonic Outcomes** was represented by the Applications for fun when using personal computers at homes where a hedonic outcome was defined as the pleasure derived from the consumption, or use of a product.

From these explanations it can be learnt that Fun or perceived enjoyment is important for technology adoption ever since the personal computer era. In terms of smartphone technologies, Song and Han (2009) found perceived enjoyment did impact smartphone application adoption whilst, Shin (2007) Abad et al (2010) and Leong et al (2013) found that fun or perceived enjoyment influenced smartphone adoption in hedonic scenarios, mobile internet and mobile entertainment respectively.

Implications of this Hypothesis

By identifying the importance of this hypothesis academics could benefit by confirming that perceived enjoyment from UTAUT2 is important. For manufacturers and developers, this hypothesis suggests that enjoyments factors should be considered when developing both software and hardware for older adult consumers.

6.7.6 Mobile phone, Smartphone Older Adults

Besides smartphones, this research also focused on older adults. However, the numbers of articles or research studies on smartphones and older adults were limited. Therefore this research emphasised the technology where focus was upon mobile phones, personal computers and internet.

When considering the internet and older adults, in 2005, Vuori and Holmlund-Rytkonen (2005) studied adults who are above the age of 55 years old and used the internet and found that the majority (more than 50%) of respondents used the internet for sending or receiving email, information search, e-banking, browsing, booking trips, and ticketing. The research also found internet features such as e-shopping, entertainment, downloading software, investments, and chat services were used by a minority of the sample group. Earlier, Eastman and Lyer (2004) studied 65-85 year old age group with 171 sample size in the US on the purpose of using the internet and found that 67% (115) of older adults used the internet to remain in contact with friends and relatives, 38% accessed news and events using the internet and around 32% (55) accessed health or medical information. Cotton et al (2012) studied 50 years and older adults in the USA with 7,839 observations and found that the internet can reduce depression within older adults by approximately 26%.

The above research studies provided similar results to this research where older adults that are 50 years and above were likely to use basic smartphone features such as SMS, emailing and surfing internet. Moreover, in terms of purposes, this research also shows that smartphones can assist older adults by connecting them with their friends and families. In addition older adults can use their smartphones for health and well-being purposes.

A diverse perspective was provided by Kurniawan (2006) who proposed a mobile phone design for older adults (65+). The design considerations included a large screen and text. Additionally, Kurniawan (2006) found that older adults feel more confident when going out by themselves due to the functions being tailored more to their purposes. In 2005 older adults used the mobile phone for improving their memory by utilising features such as an address book, diary and alarm clock that were used more than a music player, camera and videophone. Additionally, Kurniawan argued that older adults have a higher mobile phone adoption rate than internet usage and in 2008. Kurniawan (2006) found that older adults feared using unfamiliar technology, in this case a mobile phone (Kurniawan, 2008). Further Kurniawan (2008) emphasised that smartphones had helped in reducing half of the problems that mobile phones gave. The problems that were mentioned were aspects such as the size of the screen, typing or texting and coverage. However, problems such as battery life and customisation by using the phone were problems that were still not resolved by the successor smartphones.

The design of mobile phones was also researched in Germany by comparing between easy and complex phones and by having a usage comparison study of younger and older adults (50-64 years). Ziefle and Bay (2005) found that users can benefit more from the lower complexity of mobile phones. Additionally, older adults need more time in comparison with the younger generation when learning how to use a mobile phone. Kobayashi et al (2011) study on Japan’s elderly (60 years old and above) learnt that there was a positive response to using touch screens as the screens were easier to use. Further, the researchers’ suggested that after a week the elderly can improve their proficiency at using a screen. Therefore, older adults could take more time when learning how to use novel technologies.

In terms of **learning to use new technology**, Eastman and Lyer (2004) found that the 50 years old and above adults learned how to use novel technologies mostly by themselves or with the assistance of relatives. One in five 50 years and above adults managed to seek assistance from other people or by taking a class. However, some adults learnt how to use technology from their workplace. A qualitative study of older adults learning of mobile phones found that older adults experimented using the mobile phones and referred to hard copy manuals when employing a phone. In some cases, some older adults had their own hard copy notes about the use of phones (Tang et al., 2012).

However, some older adults did not express a preference to using new technologies. Research on mobile phone usage within older adults (48-90 year old) found that 104 (39.7%) of 262 took a photograph while 36 (14%) of 258 used their phone to access internet (Hardill & Olphert, 2012). When older adults were asked about the reasons for giving up mobile phones reasons such as complications, costs of the devices and services, and peacefulness were cited. Added reasons for not using mobile phones include a fear of breaking the device, not liking the technology, costs of learning and owning the device, no one being available to learn from about the use of a mobile phone, or having no one to ask a question of (Lee et al., 2011). However, Hardill and Olphert (2012) showed that mobile phones have been gradually integrated in some of the lives of 50 years and older adults.

In terms of **demographic variables**, Choudrie and Dwivedi (2006) study of broadband adoption by considering demographic variables in London found that higher income and education can positively influence broadband adoption. Similarly, Eastman and Lyer (2004) focused on internet usage within the elderly and confirmed that high educational levels and income could encourage internet usage within the 50 years and older adults. In Eastman and Lyer (2004) research on smartphones and older adults, the final results suggested that enough money and knowledge can encourage smartphone adoption. Further, adults 50 years old and above with higher educational levels were more likely to adopt smartphones.

6.7.7 Digital Divide Discussion

This research also considered the Digital divide that is defined as the gap between those who can access the technology versus those who do not (Curwen and Whalley, 2010). The digital divide often referred to as the “information gap” or “information inequality” has promoted immense debates that have resulted in the digital divide being considered in a variety of contexts, including socio-economic status, gender, age, racial, region or geography (Tsatsou, 2011). This section will discuss the digital divide and smartphone technology.

Srinuan et al (2012) found that the mobile internet can assist in narrowing the digital divide in terms of geography or by assisting those living in an area where the telephone network cannot be accessed. They also found that the cost of mobile internet can negatively affect mobile internet usage. Loo and Ngan (2012) also supported the idea that mobile telecommunications can assist in narrowing the digital divide especially within a large developing country such as China. Loo and Ngan (2012) also found that the installation costs for wireless networks was often cheaper than fixed-telephone lines, especially in rural areas.

In developing countries, it is pertinent to narrow the digital divide as this will promote economic growth, health care and education, civic education, governance and social cohesion (West, 2015). Therefore, the arrival of the internet can lead to opportunities, investments and new jobs. It can also assist the economy by reducing poverty by creating jobs and business opportunities. Additionally, the internet allows individuals to access knowledge, such as information about diseases, including how to prevent and cure patients (West, 2015), which can lead to an improvement to the quality of life within individuals.

Although, this research on smartphones and older adults did not directly contribute to a narrowing of the UK’s digital gap, it may indirectly assist policy makers by making them become aware of the current digital divide situation and obtain a guideline that could help in reducing the existing digital divide between the younger and older generation.

6.8 Chapter Summary

This chapter began by explaining the diverse forms of evaluation and identifying their role for this research. For evaluation, the datasets from ONS and OxIS were used to evaluate the MOSA conceptual framework and revealed that three of six hypotheses formed by this research were supported. Then this chapter discussed the similarities and differences between this research study and other research studies. Having completed the evaluation and discussion, the next chapter will conclude this research, discuss the limitations, the overall implications and future directions.

Chapter 7 Conclusions

7.1 Introduction

Having presented the aims and objectives, the literature review, research methodology, pilot findings, final phase findings and the evaluation, this chapter now concludes this research study. The chapter begins with an overview and summaries of this research. Next, the implication of this research in terms of academia, policy makers and industry is discussed, followed by the limitations and future directions, some recommendations of this research and finally the conclusion of this research.

7.2 Thesis Overview & Summary

The first chapter began by introducing the research background, which was emphasised on the smartphone adoption and older adults. For this, the chapter commenced by presenting the evidence of an ageing society, UK older adults and ICTs, and mobile phone adoption in the UK that led to the research aim and questions. The aim of this research was identified as: *To identify, examine and explain the adoption and usage of smartphones in the UK within the 50 years old and above population.* This research also formed the questions on communication channels within older adults while purchasing smartphones and on the features of smartphones used by older adults. Next, a brief description of the research scope, the research contribution and the outline were provided in this chapter.

The second chapter began by providing literature reviews on smartphone technology, smartphone features, older adults and challenge of older adults, older adults and technology, and digital divides. Then this chapter presented the available technology adoption theories which were TRA, TAM, TPB, DOI, DTPB, TAM2, UTAUT, TAM3, and UTAUT2. Following an understanding of the adoption theories, a conceptual framework (MOSA) was formed with variables taken from DOI, TAM3 and UTAUT. For MOSA, the independent variables were identified as Compatibility (COM), Observability (OB), Social Influence (SOC), Facilitating Conditions (FC), Performance Expectancy (PE), Effort Expectancy (EE), and Perceived Enjoyment (ENJ). The key dependent variables were Behavioural Intention (IN) and Actual Use (ACU). All the constructs were interlinked with linear one-way causal paths. The paths represented hypotheses formed for this study that were formed based on previous research, rationalized and related theories. Further, this chapter addressed the demographic variables as moderator variables that would be included in the final phase.

Chapter three offered explanations regarding the research methodology where for an understanding reference was made to the research onion developed by Saunders et al (2009). Before every decision about the research methodology and descriptions related to the onion layers, this chapter provided the possible, available choices. This allowed the researcher to selected Positivism as the research philosophy, a deductive research approach, and a survey as a research strategy. For the data collection, this research utilised an internet based questionnaire that was located at the website Surveymonkey. In terms of data, both primary and secondary data were utilised. Chapter 3 also discussed the Instrument and Content Validity of the questionnaire that this research used for confirming both the pre-test and pilot questions. This chapter also provided reasoning for the utilised research site and the sample sizes of both the pilot and final phase. In terms of the research site and sample sizes, for the pilot this research employed the UK to examine the adoption and use of smartphones within all the age groups and for the final phase north London for the above 50 years old age group. Finally, the chapter explained the reasoning and application of the analysis method of SEM-PLS.

Having identified the literature review, aims and objectives and research methodology of this research, the **fourth chapter** offered explanations about the survey development and outcomes of the pilot test. The chapter commenced by describing the pilot study process, which included examining the pilot’s aims, the development of the construct measurement questions, the development of other related questions, the layout of the pilot questionnaire, and content validation of the pilot. Regarding the conceptual framework (MOSA), the construct measurement questions were adopted from previous research studies, while related questions were based on the research questions. Then, this chapter explained the data collection process for the pilot phase, the sampling and sample size. The pilot questionnaire received 204 completed responses from the UK area where the reviewed results the adoption gap between the below 50 years old and the above 50 years old age groups. Further, the diverse use pattern of the two groups was identified. The chapter also provided analysis and findings that led to an improvement of the final phase questionnaire.

Chapter five then provided the results of the final phase of this research. The chapter started by providing details on the sample size and sampling process. The chapter also revealed that 984 completed responses were obtained from 50 years old and above adults residing in north London. Then the details about the validation were explained before presenting the hypothesis testing results. The SEM-PLS analysis results showed that MOSA can explain 76% of the intention to use smartphones among the 50 years old and above adults and 20.8% of actual use. This chapter also found that after the analysis, six out of the eight hypotheses were supported by the collected data. Compatibility (COM), Observability (OB), Social Influence (SOC), Facilitating Conditions

(FC), Performance Expectancy (PE), Effort Expectancy (EE), and Perceived Enjoyment (ENJ) were all found to be highly significant to explain the intention to use smartphones.

The sixth chapter then examined the evaluation outcomes and placed the results of this research within the obtained literature within the discussion section. The first half of this chapter used datasets from the Oxford Internet Institute and Office of National Statistic to verify the findings of chapter 5. The analysis of both datasets verified and validated some hypothesises of MOSA; hence confirming the possibility of the MOSA to be applied at a wider scale. The second half of this chapter described and explained similarities and differences to the adoption, use, diffusion and digital divide previous research studies. The comparison allowed this research to clearly provide contributions.

Chapter seven is the final chapter of this thesis where the chapter commenced with an overall summary of this research, followed by answering the research aim and questions. Then, the limitations and the future directions of this research were explained.

These explanations draw this section to a close. The next section reflects upon the earlier formed research questions.

7.3 Reflecting on the Research Questions

Having summarised the thesis, this section now focuses on answering the research questions.

Research Question 1: What factors significantly affect silver suffers when adopting smartphones?

To answer the first question, the conceptual framework (MOSA) was developed from classic IS theories and previous research studies. To compose the framework, some possible variables were proposed, which are Compatibility (COM), Observability (OB), Social Influence (SOC), Facilitating Conditions (FC), Performance Expectancy (PE), Effort Expectancy (EE), and Perceived Enjoyment (ENJ). To analyse the results of the primary data, SEM-PLS was used that resulted in COM, EE, FC, PE and ENJ being identified as significant factors affecting the intention to adopt smartphones within older adults. ENJ was the strongest variable followed by COM, PE, FC and EE respectively.

Inclusion of these variables meant that: 1) older adults used smartphones because smartphones are compatible with their lifestyle. 2) Older adults need to have a certain level of knowledge, time and money to use smartphones. 3) The benefits or features of smartphones lead to smartphone adoption among older adults. 4) Smartphone's ease of use encourages smartphone adoption within older adults. 5) The pleasure or enjoyment encourages smartphone use within 50 years old and above adults.

Research Question 2: What are the features of smartphones that silver surfers used and their frequency?

To determine the use of smartphone features 15 Likert scale questions ranging from one to seven where one is never and seven is many times of the day were asked of only those who used a smart phone. The features were making a phone call, SMS, emailing, taking a photograph, filming a video, browsing and surfing websites, playing games, watching videos, mapping and navigation, taking notes, managing appointments, using social networks, reading online news and online magazines, using video calls, and using smartphones to contact government authorities.

The most frequently used features (more than 3.5) were making a phone call, SMS, Emailing, taking a photograph, browsing websites, and, managing appointment. The low frequency usage feature was filming a video, playing games, watching videos, mapping and navigation, taking notes, using social media, reading online news and magazines, using video call, and contract government authorities.

The detailed answers to this question can be found in section 5.9 – Smartphone use.

Research Question 3: What are the channels of communication that influence the diffusion of smartphones within silver surfers?

To determine the diffusion aspects of smartphone adoption, the classic theory of the Diffusion of innovation was considered in this study. The final questionnaire provided choices for the way that older adults were likely to receive information about smartphones in the form of word of mouth, Professional technology review websites, high street shops, and media-TV, Radio and Newspapers. It was learnt that for older adults who had not yet adopted smartphones, but planned to, information regarding the smartphones was obtained from the word of mouth and high street mobile phone shops.

Having ascertained the research questions for this research study, the next section discusses the implications and contributions of this research study.

7.4 Implications and contribution

When considering the implications of this research, three categories were formed, which are, industry, academia and policymaking.

7.4.1 Industry

This research provides practical implications for stakeholders in the smartphone industry, which are the smartphone manufacturers, network providers, and application developers.

Our research found that information and advertising about smartphones is best disseminated using word of mouth, TV, Radio, newspaper and online social networks. This information will benefit smartphone manufacturers and network providers seeking to encourage smartphone adoption within older adults by using the suggested communication channels.

Further, from MOSA it was identified that facilitating and effort expectancy are significant variables. This implies that smartphone providers could use this finding to provide older adult friendly sales representatives as these representatives would be of a similar age group to the older adult consumer; hence would be able to understand the challenges and problems of older adults better than a younger sales representative. The older representatives could provide knowledge in an easy way for older adults. In terms of knowledge, smartphone manufacturers could consider providing short courses on how to use smartphones for older adults that inspires future uses of smartphones.

From the perceived enjoyment, performance expectance, and compatibility variables, smartphone manufacturers and network providers could present the benefits of smartphones, which are tailored more towards older adults lifestyles or situations such as, using a smartphone for video calling older adults' friends and family, using smartphones to encourage and promote health and well-being or to reduce isolation problems, or using smartphones for entertainment purposes.

This research also reviewed the factors that older adults are concerned with when purchasing a new smartphone. Older adults were interested in price, brand, battery life, screen size, operating systems, camera, and appearance. Therefore, to increase smartphone sales, smartphone providers could offer older adults with larger screens, longer battery life and good camera smartphones.

Similar to smartphone providers, application developers could use the results in this research to further develop smartphone applications. Developers could also provide knowledge, including how to use applications and features of the application that can benefit older adults. Furthermore, if older adults are not aware of a smartphone's health features, the developers could provide information and knowledge about this, which can assist in maintaining older adults' well-being; therefore, the application developers and related organizations could provide more information in this regard for the older adults.

7.4.2 Academia

From this research study, for academia, more novel theory focused on the adoption and usage of smart phones, but within an under-researched age group, the silver-surfers is provided. Academic contributions will also be achieved from the conceptual model (MOSA) as the model is emphasised upon a particular age group of society.

From a theoretical perspective, this study has explored the knowledge of the factors influencing smartphone adoption in the UK. In the pilot phase, this research compared younger and older age groups. From these results it was also found that there is a digital divide in smartphone adoption within younger and older generations. The key theoretical contribution of this study is the development of the conceptual framework of smartphone adoption using components from the theories of UTAUT, TAM3 and DOI. This research not only composed MOSA but partially confirmed UTAUT within a particular age group. The variables of UTAUT identified in this research can be used in the future studies examining novel technology adoption in older adults. This research also found that the social influence variable from UTAUT and observaribility from DOI may not be appropriate to study technology adoption among 50+ adults. For perceived enjoyment, this research found that the variable strongly influenced technology adoption; therefore, future studies should consider integrating this variable.

Future research studies could also benefit from this research study’s validated questions that represent variables drawn from MOSA. Additionally, the researchers could use the questionnaires in appendix 4-1 and 4-2 as a guideline to study technology adoption.

From chapter 6, at the time that this research was conducted, the numbers of research studies on smartphone adoption in Europe were limited. By referring to the outcomes of this research, this study can be extended to Europe and provide a comparative aspect to this research.

Lastly, the results can shed light on the research related to the adoption of innovative technology such as are ageing, the knowledge on how the older generation will adopt and use the new technology is very important in order to increase their quality of life and wellbeing. This research could encourage future researchers to study older adult’s adoption of novel technologies and researchers could use MOSA as a reference.

7.4.3 Policy Makers

This research also benefits policy makers of organizations that are aiming to encourage ICT usage within older adults, such as Age UK, as addressed in the first chapter. This research found that smartphones have a potential to prevent or reduce problems such as, loneliness for older adults. By using smartphones to contact friends and family, or using smartphones to monitor or assist with health problems. In health care terms, smartphones could be used for tracking physical and health related activities, for quitting smoking, or for weight monitoring. Therefore, this research could raise the level of awareness of the policymaker that would encourage older adults to use smartphones. Further, this research also provides a guideline for the policymakers when considering adoption as courses are focused more towards older adult needs and requirements or advertisements emphasising to older adults wants and needs could be provided. For policymakers of the government, this research provides evidence that increasing numbers of people are using smartphones. However, an interesting discovery is that only 34.7% of the older adult population have used their phone to contact the government. Therefore, the government could consider providing some assistance or initiating some efforts that increase the level of awareness of smartphones within this population group.

Moreover, policymakers seeking to narrow or eliminate the digital divide could use this research study finding on smartphones as indicators that could prove to be long term solutions. The results could also be used for policy makers of business organizations that aim to apply smartphones for 50 years old and above adult workers by applying the confirmed variables in order to encourage older users. Further, this research will benefit IT consultants aiming to provide appropriate devices and guidance to entrepreneurs 50 years old and above. The consultants could understand what 50+ adults seek when adopting and using smartphones for this research.

7.5 Limitations

"All research studies have their limitation, and the sincere investigator recognises that readers need aid when judging the study's validity" (Cooper & Schindler, 2013:511). Having explained the research contribution, this section discusses this research study's limitations.

Firstly, MOSA is composed of eight variables from classic IS theories as explained earlier. However, from chapter 2, other variables such as image, job relevance, output quality and result demonstrability from TAM2 are also important; therefore future research could consider including these variables. Further, there are several IS theories that were not included in this research, such as a model of adoption of technology in households (MATH) (Brown et al., 2006). In addition, other field's knowledge, such as Marketing can provide some more insights into smartphone adoption, something that this research study could not include due to time availability.

In terms of literature, as explained in chapter 6, several articles and documents used in this research were from Asia which are different to Europe or UK in several perspectives such as, economic conditions or culture. This implied that applying Asia focused papers could lead to limitations in terms of forming hypothesis and conceptual framework. Due to the application of quantitative research, this research may not capture other ideas, apart from the variables included in MOSA and the questions in the final questionnaire. Further, cross-sectional time horizons were applied to this research, so this research could capture just a snapshot of the phenomena. To overcome this shortcoming, this research used secondary analysis with two datasets from ONS and OxIS to provide the trend of smartphone adoption as in chapter 6, which has proven to be a limitation due to the use of secondary data being utilised to verify and validate primary data.

The next limitation is about the research site. This research aimed to present a UK perspective that was based on the participation of residents living in England, which from the pilot phase was viewed to be an impossible task; hence seeking participants from a selected area of London. This meant that only a certain perspective of smartphone adoption was possible with two limitations. Firstly, since the main research site was the North of London, the network exchange and the smartphone network exchanges were viewed to be mature in terms of network infrastructure. As governments are increasing investments in the infrastructure, this means that other areas could also be used to provide a more in-depth perspective of the UK. Further, due to one vicinity being utilized in this research, generalisations about the UK were not possible.

7.6 Future Directions

Having assessed the limitations of this research study, this section will explain the future directions of this research.

Since this research used a quantitative method to study smartphone adoption, the future direction of this study should employ quantitative aspects along with data collections methods that can be utilised for a qualitative study such as, interviews, observations or focus groups. By doing so, there will be a further understanding of the knowledge regarding smartphone adoption and use.

In terms of the research site, since the final phase examined only older adults in north London, the future directions could include examining other parts of the UK such as, in other cities or rural areas. Further, with similar concepts drawn from MOSA there could be testing of MOSA in another part of the world such as in other developed countries or developing countries.

In terms of innovative technology, in this case smartphones, a further study can be completed on other mobile devices such as tablets or iPad, smart watch, or activity trackers. Future research could explore smartphone use in particular, purposes, such as smartphone use for health and well-being, or smartphone use for sporting purposes. Particular applications available in smartphones could be studied further; for instance, social media or messaging services on smartphones.

7.7 Recommendations

For academia, it is recommended that there should be a further extension of the MOSA to study technologies related to smartphone within older adults. This research recommends using variables to predict smartphone usage, such as the price of smartphones, the promotions, social values of using a smartphone, and pressure from society.

Further, this research could not find much research on smartphone adoption from Europe or North America. Contrastingly, there was research from Asia such as from Korea, Taiwan, China, Malaysia and Singapore. Research could also be linked to the origin of the top smartphone brands that most of the older adults use. For example, from Asia Samsung, Lenovo, Huawei, LG or Sony could be considered in the context of older adults. Therefore, this research recommends that European researchers should study mobile technology adoption that may lead to more understanding of mobile device users and may create value in economic terms.

This research also benefits **Smartphone manufacturers, application developers, and network providers as this research shows that the aforementioned stakeholders** should pay more attention to older adult age groups. Regarding the findings of the communication channels used to diffuse smartphones within older adults, TV programs on technologies are more compatible with older adults' needs and requirements. Further, older adults still prefer word of mouth, so more communities should be formed to provide teaching and learning on innovative technologies in order to help older adults to form an understanding such that they may be encouraged to use innovative technology.

For smartphone providers, providing an easy mode or an older adults' mode should be one of the selling features such as providing large screens with larger icons for older adults who face vision impairments as ageing occurs. For very old adults, an emergency button or dedicated online helping centre could add more value to the smartphones. Additionally, an intelligent, personal assistant and knowledge navigator that uses a natural language to answer questions, make recommendations, and performs actions such as Siri from Apple iPhone should be introduced to older adults.

For application and game developers, this research found that games were played by older adults. Therefore, the games that can help older adults to exercise their memory may be a new market for older adults particularly since memory problems are faced as ageing occurs.

Organizations, or Businesses that are associated with older adults, such as the NHS or retail supermarkets should consider providing older adults compatible version applications such as a shopping online application for older adults, or applications that provide information such as health information for older adults.

What has been learnt from this study is that stakeholders should provide not only short courses for older adults on basic smartphone use, but also for using smartphone for an older adult's lifestyle that is different from the younger generations.

7.8 Thesis Conclusions

This research focused on two trends that are currently occurring in society and in the technology and telecommunications sectors-an ageing society and smartphone technology. Smartphones provide advanced telecommunication and mobile phone functions which can provide seamless benefits to the users and, due to medical advances and better quality of life, an ageing society.

From the statistical analysis that was completed by this research it was realized that many individuals are connected globally due to their mobile phones. A smartphone, which is a successor of a mobile phone, has played an important role in providing more connections that have led to changes in the telecommunications, information and communication technologies sectors and provided many diverse benefits to users. However, what was also learnt was that older adults are using the smartphones that are still at a basic level for making a phone call, SMS, email, and browsing. Older adults were also likely to use their smartphones for seeking health related information, as a calendar or diary where the smartphone reminded them of appointments with doctors. What was also surprising was that more than half of the 50 years old and above adults did not use smartphones for health and well-being purposes. It can be concluded that smartphone adoption can offer saturation levels of smartphone adoption and use within younger adults, but there still exists a gap within older adults.

To encourage older adults to use smartphones, stakeholders such as smartphone providers and manufacturers, should provide support for the above 50 years old adults. Furthermore, application developers may need to provide applications specific for this group of society that are also easy to use. This is because this group of society is very important to society and to the economy due to its wealth creating and wealth holding potentials. Therefore, this study on adoption for older adults is important and displays that this demographic group of society requires and warrants attention.

Due to this study and others focused on older adults it is hoped and envisaged that there will be more research on technologies and older adults that can improve older adult's living standards and lifestyles.

Having concluded this research study, this thesis now draws to a close and hopes that it has informed various stakeholders of the adoption, use and diffusion of smartphones within older adults.

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Appendices

2-1 Literature Reviewed

Smartphone Technology Adoption/Usage/Diffusion -Literature Review			
Literature	An area of research	Article Title	Research purpose/Research finding
(Park & Chen, 2007)	Smartphone adoption	Acceptance and adoption of the innovative use of smartphone	A survey of 820 US doctors and nurses to investigate human motivations affecting an adoption decision for smartphone among medical doctors and nurses. The results found behavioural intention to use smartphones was affected by PU and attitude, and PEOU affects attitude.
(Bouwman et al., 2007)	Mobile services	Barriers and drivers in the adoption of current and future mobile services in Finland	A survey of 484 Finish Consumers, this research studied 6 mobile services- mobile travel service, GPRS, mobile surveillance, traditional and advance entertainment and m-commerce service bundles, where both the barriers (physical, cognitive, security and economic) and benefits (perceived entertainment value and perceived flexibility) of mobile services in Finland were identified. The research found that different services have different adoption factors.
(Shin, 2009)	Mobile Payment	Towards an understanding of the consumer acceptance of mobile wallet	A survey of 296 Consumers in Korea, this study validated a comprehensive model of consumer acceptance in the context of mobile payment, where the results found that Perceived Usefulness, Perceived Ease of Use, Perceived Security, and Trust affect a consumer's intention when using mobile payments.
(J. Chen et al.,	Smartphone	The acceptance and	A survey of 274 workers from 5 Taiwan logistic companies, to study

2009)	adoption in Logistic companies	diffusion of the innovative smart phone use: A case study of a delivery service company in logistics	acceptance and diffusion of smartphones using the case study approach in a delivery service company of logistics. The result found that self-efficacy strongly affected behavioural intention. This study showed that the different models can be used to study the same technology. Further, a combination of theories could better explain the phenomenon.
(Chen et al., 2011)	Smartphone in delivery service industry	Dimensions of self-efficacy in the study of smart phone acceptance	A survey of 215 Employees in Taiwan, to study smartphone acceptance in a major delivery service company in Taiwan. TAM with Self-Efficacy can explain smartphone adoption in delivery service.
(Chtourou & Souiden, 2010)	Smartphone adoption-browsing the internet	Rethinking the TAM model: time to consider fun	Survey 367 mobile users in France, to examine the effect of the fun aspect of consumers' adoption of technological products. This research used TAM with the Fun factors of enjoyment or playfulness. The results found that fun is an important factor affecting attitude toward using mobile device for browsing internet.
(Kim, 2008)	Smartphone adoption	Moderating effects of Job Relevance and Experience on mobile wireless technology acceptance: Adoption of a smartphone by individuals	A survey of 286 working adults in South Korea, to study adoption of mobile internet in smartphones with TAM and other factors. The results found that Job Relevance, Perceived Cost Savings, PU, PEOU, Company willingness to fund, Experience affect behavioural intention to use mobile internet.
(Koenig-Lewis et al., 2010)	Mobile banking	Predicting young consumers' take up of mobile banking	A survey of 263 Young people in Germany, to study the barriers for adopting mobile banking services The results found that compatibility, perceived usefulness and risk

		services	significantly influence mobile banking adoption.
(Shin, 2007)	Mobile internet	User acceptance of mobile Internet: Implication for convergence technologies	A survey of 515 Consumers in South Korea, TAM was used, where Perceived availability, Perceived quality, Perceived Enjoyment and Social pressure examined the adoption of mobile internet. The results showed that the variables significantly affected attitude. However, Perceived usefulness and Perceived enjoyment of use did not significantly affect Intention.
(Verkasalo et al., 2010)	Mobile application	Analysis of users and non-users of smartphone applications	A survey of 579 panellists in Finland, this study examined the adoption of new mobile application, game, internet and map. The research found that perceived technological barriers negatively affect behavioural control, perceived usefulness was linked to behavioural control except for gaming, and perceived enjoyment and usefulness significantly affected the intention to use applications
(Wu & Wang, 2005)	Mobile commerce	What drives mobile commerce?	A survey of 310 m- commerce users in Taiwan, to study mobile commerce using TAM, DOI, perceived risk and cost factors. The results found that Perceived risk, Cost, Compatibility and Perceived usefulness significantly affected behavioural intention to use mobile commerce.
(Chong, Chan, et al., 2012)	Mobile commerce	Predicting consumer decisions to adopt mobile commerce: Cross country empirical examination between China and Malaysia	A survey of 394 consumers in Malaysia (172) and China (222), to examine the adoption of mobile commerce in Malaysia and China. This research found that apart from variables from TAM, Trust, Cost, Social influence and variety of services can influence mobile commerce. Culture can also affect the adoption.

(Kang et al., 2011)	Smartphone adoption and their features	Analysis of factors affecting the adoption of smartphones	A survey of 100 students in South Korea, TAM was used to investigate factors affecting the adoption of smartphone and features of the smartphones. The research found that around half of responses used smartphones. Wireless internet, design, multimedia, application, after service, and, interface were important for adoptions. Perceived usefulness and Perceived ease of use also affect Behaviour Intention to use smartphones.
(Kim & Garrison, 2008)	Mobile internet	Investigating mobile wireless technology adoption: An extension of the technology acceptance model	A survey of 58 graduate students in Korea, to use TAM as a core theory with other factors to examine Mobile wireless adoption such as cellular and PDA. This study found that the model can explain 58.7% of the behavioural intention. And confirm that TAM can still be used to explain mobile wireless technology.
(Nysveen et al., 2005)	Mobile messaging services	Explaining intention to use mobile chat services: moderating effects of gender	A survey of 684 mobile chat service users in Norway, to investigate the moderating effects of gender in explaining the intention to use mobile chat services. This research found that social norms and intrinsic motives such as enjoyment were important for female users, while extrinsic motives such as usefulness and expressiveness were important for males. The model could explain 71% of the intention to use the service in females and 68.2% of intention to use the service in males.
(Mallat et al., 2006)	Mobile ticketing	An empirical investigation of mobile ticketing	A survey of 47 business school students in Finland, to study mobile ticketing service adoption in public transportation. The research found that compatibility is a major factor. Others

		service adoption in public transportation	variable such as trust, mobility, social influence also important for the adoption. The model can explain around 56% of intention to use the mobile ticket.
(Lee et al., 2012)	Smartphone Applications	A Study on the Factors Affecting Smart Phone Application Acceptance	A survey of 215 college students and office workers in Korea, this research used UTAUT, credibility and personalization to investigate smartphone application adoption. The results found that personalization influenced performance expectancy. This research also investigated the user behaviour on smartphone applications and the length of application usage.
(Venkatesh et al., 2012)	Mobile Internet	Consumer Acceptance and Use of Information Technology: Extending the Unified Theory of Acceptance and Use of Technology	A survey of 1,512 mobile internet consumers in Hong Kong, this used UTAUT2 to study acceptance and use of technology in a consumer context. This research showed that UTAUT2's Performance expectancy, Effort expectancy, Social Influence, Facilitating Conditions, Hedonic Motivation, Price Value, and Habit affect mobile internet acceptance. Following adjustment, the model could explain 74 % of behavioural intention.
(Alkhunaizan & Love, 2012)	Mobile Commerce	What drives mobile commerce? An empirical evaluation of the revised UTAUT model	A survey of 547 smartphone users in Saudi Arabia, this examined factors affecting m-commerce in Saudi Arabia This research found that cost, effort expectancy and performance expectancy influence intention to use mobile commerce. The model explained 38 % of m-commerce usage intention
(Pitchayadejanant, 2011)	Compare adoption between iPhone	Intention to use of Smart phone in Bangkok Extended	A survey of 408 smartphone users in Thailand, this study used UTAUT to identify the use of smartphones - iPhone and Black Berry in Thailand

	and Blackberry	UTAUT Model by Perceived Value	This research found that Facilitating Conditions and Perceived Values affected behavioural intention to use smartphones.
(Zhou et al., 2010)	Mobile Banking	Integrating TTF and UTAUT to explain mobile banking user adoption	A survey of 250 phone users and students in China, this research from China explained mobile banking adoption. This research was important as it emphasized the use of a smartphone feature The study found that Task technology fit, Performance expectancy, and Social influence intention, drawn from UTAUT use mobile banking. The model can explain 57.5% or user adoption of mobile banking.
(Song & Han, 2009)	Smartphone applications	Is Enjoyment Important? An Empirical Research on the Impact of Perceive Enjoyment on Adoption of New Technology	A survey of 570 consumers in South Korea, this study from South Korea, examined the adoption of smartphone applications The results showed that the quality of content of application influenced user performance expectancy through enjoyment.
(Kijsanayotin et al., 2009)	Using IT in Health	Factors influencing health information technology adoption in Thailand's community health centers: applying the UTAUT model	A survey of 1323 patients in Thailand, this study from Thailand studied factors influencing health IT adoption in the community health centres This research found that adoption is influenced by UTAUT’s performance expectancy, effort expectancy, social influence and voluntariness. The actual use is influenced by intention to use, facilitating conditions and IT experiences. The model can explain 27% of the IT usage and 54% of intention to use the IT.
(Shi, 2009)	Mobile	An Empirical	A survey of 653 application users in China, this study from China

	Application	Research on Users' Acceptance of Smart Phone Online Application Software	used UTAUT to examine smartphone software adoption The research found that UTAUT's Performance Expectancy, Effort Expectancy and Facilitating Conditions affect behavioural intention. Moreover, Perceived Enjoyment influence Performance Expectancy.
(Zhou, 2008)	Mobile Commerce	Exploring Mobile User Acceptance Based on UTAUT and Contextual Offering	A survey of 250 phone users and students in China, this study again from China studied UTAUT's significant factors influencing user acceptance of mobile commerce The result found that UTAUT's performance expectancy, facilitating conditions, social influence and contextual offer significantly affected the user acceptance of mobile commerce intention. The model can explain 76.2% of intention to use the m-commerce
(Park et al., 2007)	Mobile communication Technology	Adoption of mobile technologies for Chinese consumers	A survey of 221 online panellists in China, this was a Chinese study of mobile communication technology adoption This research found that UTAUT's Performance Expectancy, Effort Expectancy and Social Influence affect the attitude to use the technology. Moreover, gender and education levels significantly moderated the UTAUT factors.
(Carlsson et al., 2006)	Adoption of smartphone both devices and services	Adoption of Mobile Devices / Services – Searching for Answers with the UTAUT	A survey of 157 mobile consumers in Finland, this Finnish study examined mobile device adoption using UTAUT in organizations The results found that performance expectancy and effort expectancy affect behavioural intention.
(He & Lu, 2007)	Mobile Advertisement	Consumers perceptions and	A survey of 243 individuals in China, this Chinese study explored the consumer's perceptions and acceptance of mobile advertising in

		acceptances towards mobile advertising: an empirical study in China	the SMS The research found that performance expectations, social influence, and user's permission had significant effects on behavioural intention. Facilitating conditions and behavioural intention also had significant effects on user behaviour. The models can explain up to 66.3 % of m-advertising intention and 45% of actual usage
(Xue et al., 2012)	Health informatics via a mobile	An exploratory study of ageing women's perception on access to health informatics via a mobile phone-based intervention.	A survey of 700 older adult women (50+) in Singapore, To examine the perceived attitudes and readiness of women aged 50 years and above on adopting a mobile phone-based intervention. The research found that perceived usefulness and perceived ease of use, compatibility and subjective norm can be used to predict the adoption intention of the technology. The model could explain 88% of the intention to use a mobile phone-based intervention.
(Nayak et al., 2010)	Internet usage	An application of the technology acceptance model to the level of Internet usage by older adults	A survey of 592 older adults (60-88) in UK, used TAM and demographic variables to understand the factors that influence internet usage among older adult (60-80) The research found that attitude towards using the internet and good health status could predict the level of internet usage. Moreover, attitude, usefulness, good health and gender (males) could affect internet activity. The model could predict 20.5% of internet usage (time in hours) and 24.2% of Internet usage (activity level)
(Boontarig et al., 2012)	Smartphone adoption of e-health service	Factors influencing the Thai elderly intention to use smartphone for e-	A survey of 31 elderly adults in Thailand, this examined the factors that influenced the Thai older adults' population’s intention to use smartphones as tools for e-Health services. Of the UTAUT, the results showed that Effort Expectancy,

		Health services	Facilitating conditions and Perceived value significantly affects Behavioural Intention to use smartphones.
(Aldhaban, 2012)	Smartphone	Exploring the Adoption of Smartphone Technology : Literature Review	This article reviewed literatures related to smartphone adoption and explain how it was studies including the methodology. This review also included theories of adoption of new technology and Information technology. This article also suggests the research gaps and proposed an adoption model.
(Katagiri & Etoh, 2011)	Smartphone	Social Influence Modeling on Smartphone Usage	This research was conducted in Japan on Social Influence modeling on smartphone usage. This research showed the group behavior of university students in using smartphone. Although this paper not strongly related to adoption, this research present that the social influence affect user behavior.
(Mallat, 2007)	Mobile payment	Exploring consumer adoption of mobile payments – A qualitative study	This article explained the adoption of mobile payment which is one of the smartphone features. The studied using diffusion of innovation theory and variable related to payment such as costs, network externalities, critical mass, security and trust. Since this research was conducted in 2007 which payment facilities was not widely available. The results found the further details on how to develop the services. This paper is not directly related to smartphones but it related to features of smartphones. Moreover, the article provided understanding on the challenge adopting new technologies such as smartphones.
(Beiginia et al., 2011)	Mobile banking	Assessing the Mobile Banking Adoption	This article from Iran in 2011 using classic IS theories such as TRA, TPB, and DTPB to investigate mobile banking which is one of the

		Based on the Decomposed Theory of Planned Behaviour	smartphone features. With 425 questionnaires distributed and LISREL 8.8 and SPSS, the research found that the planned behavior model and decomposed theory of the planned behavior model could largely explain the phenomenal. This research provided example of using classical IS theories to investigate one of the features of the smartphone adoption. Moreover, this research provided the list of the questions linked to variables and using SEM to analyze the model.
(Bouwman & Reuver, 2011)	Mobile TV	Mobile TV : The Search for a Holy Grail that Isn’t	Mobile TV, one of the smartphone apps that allow users to watch TV on their smartphones, is one of the features of a smartphone. This article aimed to study Mobile TV adoption and logged user’s behavior to gain understanding. The research based on TAM and adopted variable such as personal innovativeness, alone, social and transit. The log method was tested with 118 respondents and the adoption was examined with 515 survey responses. The results showed that the mobile TV was mainly used for short clips and the users would adopt if they were convinced that the mobile TV would replace the current TV. This article is support the concept to use TAM with external variables. Moreover, this article illustrates one of the benefits of smartphones.
(Gu et al., 2009)	Mobile Banking	Determinants of behavioral intention to mobile banking	This study focused on banking service on smartphones. The aim of this paper was to examine and validate determinants of user’s intention to mobile banking. This research applied social influence, system quality, self-efficacy, facilitating conditions, familiarity with

			bank, situational normality, structural assurances, calculative-based trust, trust, perceived ease of use and perceived usefulness. This research received 910 responses and analyzed with SEM. The results found that self-efficiency was the strongest variable influenced intention. This article benefits chapter 2 in terms of support the idea to combine theories and list of questions.
(Arruda-Filho & Lennon, 2011)	Smartphone	How iPhone innovators changed their consumption in iDay2: Hedonic post or brand devotion	This article focused on iPhone usage by analyzing posts on the iPhone community website. The research found that innovative users adopt and use new technology for hedonic experiences and social positioning. The results found that innovative users preferred really new innovation not the upgrade version. This article provided the example of smartphone adoption and the reasons on adoption.
(Arruda-Filho et al., 2010)	Smartphone	Social behavior and brand devotion among iPhone innovators	This paper aimed to investigate smartphone based on functional or utilitarian needs. This research applied netnographic , analyzing content on websites, as evident on iPhone usage. The results showed that innovators adopt and use new technology because utilitarian and experiential outcomes. Moreover, the utilitarian users also had hedonic and social factors applied in theirs consumption patterns.
(Balocco et al., 2009)	Mobile internet	Mobile internet and SMEs: a focus on the adoption	This article aimed to investigate adoption of mobile internet and application of SMEs under corporate environment and decision-making process. This study received 646 surveys from Italian SMEs and 28 case studies. The results found that the adoption of the application still limited. The solutions suggested were divided into

			connectivity-based and application based. Moreover, the research found the reasons of not adopts the technology which were lacking of knowledge and not perceiving the benefits of the application.
(Bauer & Barnes, 2005)	Mobile marketing	Driving consumer acceptance of mobile marketing: A theoretical framework and empirical study	The purpose of this paper was to investigate the factors that encourage consumers to adopt mobile phone as a means of communicating promotional content. The research applied TRA to explain the phenomenal. With 1,028 responses, the research found that entertainment and information values were the strongest drivers of the acceptance of the mobile phones. This study supported concept to combine two or more theories to explain technology adoption.
(Beurer-Zuellig & Meckel, 2008b)	Smartphone	Smartphones Enabling Mobile Collaboration	This research aimed to assess the impact of smartphones and the incorporated mobile email functionality on the performance of employee and on firm performance. This study received survey results from 16 German companies. The results showed that mobile email influence on performance and attitude towards technology affect perceived performance gains. This research confirmed that smartphone have potential to improve and accelerate work processes. This study illustrated the benefits of smartphones on working environment which 50+ people may receive benefits.
(Bodker et al., 2009)	Smartphone benefits	Smart Phones and Their Substitutes: Task-Medium Fit and Business Models	This article aimed to improve the understanding of the role of substitutes, device content fit issues and implications for businesses of smartphones. This study applied prospect theory, media richness theory and business models to investigate the phenomenal with

			longitudinal study. This research focused on smartphone's features such as email, SMS, Internet Omnipresence, Camera, GPS and MP3. The results found that smartphones are suitable devices for businesses and businesses should be informed on benefits of them.
(You et al., 2011)	Smartphone	Factors Influencing Adoption and Post-Adoption of Smart Phone	This article aimed to develop a research model of smartphones adoption both before and after adoption. The first survey before the adoption was 628 response, the second survey was 286 responses after the adoption. The article applied TAM, DOI, social image, cost and emotion. The results found that relative advantage, aesthetics and social image was positively support intention. The intention is positively to the usage. Switching cost is positively related to continue adoption intention.
(Gilbert & Han, 2005)	Mobile data	Understanding mobile data services adoption: Demography, attitudes or needs?	This longtitudium research started in 2000 aim to study mobile data service. This research divided mobile phone usage into 5 categories, technology, mobile professionals, sophisticates, socialites, and lifestyles. This research applied four small studies. Firstly, SMS and WAP adoption behavior were study use focus group with 20 GSM subscribers and 198 Survey from undergraduate and postgraduate student from Singapore. The second and third focus on mobile entertainment use 45 focus group and 300 mobile users. The fourth study focused on comparison between Singapore and Malaysia wit 290 and 140 surveys.
(Ho et al., 2012)	Mobile data	Investigation of factors influencing the adoption of mobile	This paper investigated factors that affect consumers' intention to use mobile data service. The theoretical framework was composed by technology acceptance and economics perspectives. This study

		data services	applied 310 surveys in late 2010. The results showed that perceived service availability was positively impact ease of use and perceived usefulness of mobile data services. And perceived usefulness of mobile data positively affected intention to use mobile data.
(Hyvönen & Repo, 2005)	Mobile service	The Use of Mobile Services in Finland : Adoption The Use of Mobile Services in Finland : Adoption Challenges	This article focused on mobile services in Finland. With 582 survey response in 2005 from panelist who use mobile phones to access email and internet. The result found that the mobile service does not take place as straightforwardly as the diffusion of innovation proposes. Young people were more likely to use mobile services than older people. The reasons to use mobile service were such as ease of use, convenience, saving time, entertainment, and enjoyment.
(Kargin & Basoglu, 2007)	Mobile service	Factors affecting the adoption of mobile services	This article focused on mobile service adoption by using value added services. This study started from using interview with 12 users- 6 experienced and 6 novice users. The results found that Ease of use and usefulness were perceived as most significant adoption factors in mobile service usage. Other suggested factors were content, social influences, mobility, cost, enjoyment, and, user characteristics.
(Kim et al., 2009)	Mobile service	Factors influencing adoption of Korean 3G mobile services: The role of relative advantages, facilitating condition	This research examined use of 3G service as known as data services using DoI- Facilitating condition, Relative advantages, and, adoption barriers. The survey to 500 Korean users, age between 15 and 49 was applied with SPSS and AMOS. The results show that innovativeness compare with 2G affected both willingness to subscribe and use, handset replacement service affect only willing to

		and adoption barriers	subscribe, and, cost pressure and uncertainty also affected on both willingness to subscribe and use. This article also show how to implement DoI to mobile adoption researches.
(Rui & Lu, 2009)	Mobile commerce	The diffusion and adoption research of mobile commerce-A Review	This paper aimed to review the literature on diffusion and adoption of mobile commerce. From literature review, the paper found the current problems in research, provide a source of idea for the understanding of the key factors for diffusion and adoption of mobile commerce and the whole process from adoption to diffusion of mobile commerce. This paper form a table match which theory was used with which mobile research such as TAM was used with research on handset device, m-commerce adoption, m-internet, and advance mobile service.
(Rui & Lu, 2009)	Smartphone	Importance of positive reputation for Smartphone adoption	This research aimed to investigate the importance of positive reputation from external experience sources for diffusion of a smartphone. This study the reputation source into, personal, expert, consumers, and mass media. With 53 pilot surveys and conjoint analysis from SPSS18.0, the research found that the prior experience of consumer groups was the most importance for purchasing decision and the potential of adoption. Moreover, early adopters and female consumers give more importance on the prior consumers' opinions. The reputation from experts and mass media were quite low compare with that from consumers and personal group.
(Zhang et al., 2012)	Mobile commerce	A meta-analysis of mobile commerce adoption and the	This research aims to explain the factors influencing mobile commerce adoption. This research applied TAM, DOI, Cost, Risk, Trust, and, perceived enjoyment for conceptual model. This article

		moderating effect of culture	also statically relative article in terms of sample size, area, and, culture. With literature review from 53 articles, this research found that the extended TAM model can fit with this research. Perceived cost, perceived risk, trust, and enjoyment were important for mobile commerce adoption.
(Chun et al., 2012)	Smartphone	The integrated model of smartphone adoption: hedonic and utilitarian value perceptions of smartphones among Korean college students.	With 239 Korean college students and survey, this study proposed the adoption model with social influences, perceived technicality, hedonic and utilitarian. This research found that the adoption was highly influenced by social influences and self-image. Moreover, a smartphone can be considered as symbolic product to enhance the group status.

Older Adults/Age Related Studies -Literature Review		
Literature	Article Title	Research purpose/Research finding
(Karavidas et al., 2005)	The effects of computers on older adult users	This research investigate the effects of computer anxiety and computer knowledge on self-efficacy and life satisfaction within the retired older adults (aged 53-88). With 222 questionnaire and path analysis, the research found that computer use helped to reduce computer anxiety and rise self-efficacy, then, increase life satisfaction. Moreover, females reported more computer anxiety and less knowledge than males. This research also provide a guideline for usage section which for older adults they may use the technology on health, news, hobbies, investments and travel. And the computer can be used as email, browsing internet, learning new skills and others.
(Lee et al., 2011)	Age differences in constraints encountered by seniors in their use of computers and the internet	This study aimed to explain older computer users' restrictions at various age stages (the pre-senior, the young-old, and the older-old). With 243 survey response, 50- 93 year old, and one-way analysis, this research found

		that there were four dimensions of constraints, intrapersonal, interpersonal, structural and functional constraints. Moreover, older people may face diverse barriers at different age stages such as the older-old users were face with a much higher level of challenge to start learning and using technology than pre-senior groups. This also show that older adults frequently experienced a high level of personal anxiety or stress and had limited self-confidence in dealing with new technology. This article support the idea of older people may face problem with new technology such as smartphones.
(Selwyn, 2004)	The information aged: A qualitative study of older adults' use of information and communications technology	This paper aimed to study old people on the reason on use or not use ICT, the nature of the use and the support of the use, and the outcomes and life-fit of older adults for ICTs. From 35 interviews from 60+ adults, this research found that older adults were alienated from or unable to use new technologies. Older people with some physiological and psychological reasons such as poor vision, memory, and dexterity were less use new technologies
(Wagner et al., 2010)	Computer use by older adults: A multi-disciplinary review	This article reviews the existing research on computer usage by older adults and provide holistic view on the field by using Social Cognitive Theory. With 151 article from 1990-2008 from related fields such as business, information technology, social sciences, and education, this research found that the number of article related to older adults was increased continuously. In terms of field of study, Human computer interaction was the highest to 33 in 2005-2008, Gerontology was round 12 and IS was around 7 at the same period. Others results include summary on most common computer uses for older adults, barriers to computer use, variables affect personal behavior.
(Dickinson & Gregor, 2006)	Computer use has no demonstrated impact on the well-being of older adults	This interesting article provide that view that computer usage were not directly well-being of older adults. This article reviewed that previous researches on older adults and technology and explain the weak points of the conclusion of those researches.
(Cotten et al., 2012)	Internet use and depression among older adults	The research from US found that the 50+ adults and use technology to reduce depression problems. This can provide another benefit of technology for older adults
(Smith, 2014)	Older adults and technology use:	This recent report from US in 2014 showed that although more and more

	Adoption is increasing but many seniors remain isolated from digital life	old adults used technology but there is the existing gap. The broadband and internet gap was wider than the cell phone gap.
(Joe & Demiris, 2013)	Older adults and mobile phones for health: a review.	This article review the research in health care domain that use mobile phone to help older adults. There were twenty one article address using mobile phone that can be categorize. The groups were such as using phone on diabetes care, Alzhimer's care, and osteoarthritis care.
(Hardill & Olphert, 2012)	Staying connected: Exploring mobile phone use amongst older adults in the UK	This article aims to explore the ways mobile phone were included in everyday life of older people in UK. The usage including connected their friend and family, taking photo, access internet. This article also reviewed the reasons on not to used mobile phone such as too complicated, too expensive and prefer private life.

Digital Divide -Literature Review		
Literature	Article Title	Research purpose/Research finding
(Sly et al., 2014)	The Digital Divide and Health Disparities: a Pilot Study Examining the Use of Short Message Service (SMS) for Colonoscopy Reminders	This research studied on whether the use of SMS appointment reminder could help colonoscopy completion. This research was the pilot phase with 25 case studies. The cases were divided to two groups, received SMS and not received SMS. The results showed that 46.2% participants completed a colonoscopy compared with 72.7% of the SMS group. Therefore, it can be seen that technology divide could affect health care significantly.
(Cruz-Jesus et al., 2012)	Digital divide across the European Union	This article is one of the most referenced on digital divide. This article studied 27 countries in the European Union. The article conclude that a digital gap still exist within the EU countries.
(Vie, 2008)	Digital Divide 2.0: "Generation M" and Online Social Networking Sites in the Composition Classroom	This research is focus on the problem that young students have more technology knowledge than their teachers moreover, the classroom content and facility may not up to date. Currently, there are much more available study material such as online social networking websites, podcasts, audio mash-ups, blogs, and wikis. Therefore, teachers should familiar with the technology to provide more efficiency teaching.
(West, 2015)	Digital divide: Improving Internet access in the developing world through affordable services	This article provide the global view of digital divide and provide benefits guideline of the technology- internet connection, for developing countries. The authors addressed the barrier such as cost of the devices and services,

	and diverse content	reliability of the infrastructure, and the problem in terms of languages. If the government of the developing countries manage to improve the gap, they will received the benefits such as economic growth, improvement in health care and education, and increase in civic education, governance and social cohesion.
(Levy et al., 2014)	Health Literacy and the Digital Divide Among Older Americans	Internet could be the source of information about health, this article focus on health literacy of older adults (65+) and internet usage. This research was the longitudinal survey of 1,584 American older adults. The results found that older adults with low health literacy was less related to use internet for finding health information. This research support that idea that knowledge is one of the main factors that lead to digital divide.
(Goldfarb & Prince, 2008)	Internet adoption and usage patterns are different: Implications for the digital divide	This research studied on internet adoption and usage patterns by focusing on income and education. The results showed that people with high-income, and hi-education were likely to adopt to internet compare with the low-income and less-education. However, the low income and low education groups was like to spend more time on internet.
(Willis, 2006)	Beyond the 'digital divide': Internet diffusion and inequality in Australia	This research from Australia focusing on household income, age, education and occupation. The 5 years period survey data found that more and more Australian adopted to internet. However, older people was the groups that resist to change with difficulty to learn new skill that lead to digital divide.
(Selwyn, 2006)	Digital division or digital decision? A study of non-users and low-users of computers	This paper study using or not using new technology such as computers and Internet. With 1001 adults survey in England and Wales and 100 follow-up in depth interview. This research found that in 2006 around 38.4% or the response never used a computer in life time and 46.7% used a computer at least fairly often. Around 10% have used a computer but not for last 12 months. The results also show that the number of older adult (61+) was very high in non-user section and very low for uses a computer at least fairly often. The reasons on decide to not use the computers were such as no interest/motivation, too old, no need, no skills, no access, and too busy. This paper conclude that digital divide sometime cause by personal decision to not use computers. This paper provided a good list of reason on not use a technology which used in questionnaire.
(Akca et al., 2007)	Challenge of rural people to	This article reviewed theories and guideline to reduce the digital gap among

	reduce digital divide in the globalized world : Theory and practice	countryside people. The paper introduced advantage of ICTs for rural areas such as e-trade, training and knowledge transfer, advertisement of tourism, or Geographic information system for management. The paper suggested the take-off model which targeted groups such as students, youth or women in communities used the places such as schools or women society centers and projects from governments. This paper benefits chapter 1 in terms of illustrating digital gaps and the facts that ICT is less adopted in countryside.
(Stump, 2008)	Exploring the Digital Divide in Mobile-phone Adoption Levels across Countries: Do Population Socioeconomic Traits Operate in the Same Manner as Their Individual-level Demographic Counterparts?	This article used secondary data to study mobile phone adoption using demographic variables age, education and income. This research applied 170 counties and found that mobile phone likely to be adopt in countries with older populations with high education and income. This article provided the idea to use secondary data to examine smartphone adoption.
(van Deursen & van Dijk, 2013)	The digital divide shifts to differences in usage	This research from the Netherlands come with the question that why people with low level education or disables spend more of their time on internet. The general conclusion was when internet mature the usage could reflect the real life society. People will use internet to compensate what their miss.
(Rice & Katz, 2003)	Comparing internet and mobile phone usage: digital divides of usage, adoption, and dropouts	This research compare adoption of technologies which was mobile phone and internet and found that the gap between mobile phone user and non-user was related to income, work status and marital. The gap of continue use and dropout of mobile phone user was related to income.
(Friemel, 2014)	The digital divide has grown old: Determinants of a digital divide among seniors	This research is quite recent on digital divide from Switzerland with 1,105 responses. This research found that the digital divide gap was still exist particularly among old seniors (70+).

Methodology Related Studies – Literature Review				
Publication	Year	Author(s)	Article Title	Aims/Method/Findings
Communications of AIS	2000	Gefen, David Straub, Detmar W.	STRUCTURAL EQUATION MODELING AND	Structured Equation Modeling (SEM) is one of the important analysis techniques using in Information System research. This paper showed the example of how to analyse data using

		Boudreau, Marie-Claude	REGRESSION : GUIDELINES FOR RESEARCH PRACTICE	covariance-based SEM and Partial-Least-Squares-based SEM. The article also discussed and compared linear regression models and provided the guideline on how to select the appropriate techniques. This article provided the very useful information as a guideline and supporting document on how and why PLS was selected.
Journal of Information Technology Theory and Application	2010	Urbach, Nils Ahlemann, Frederik	Structural Equation Modeling in Information Systems Research Using Partial Least Squares	This article presented the study of SEM in terms of fundamental knowledge and statistic of the researches in Information system. This research collected the statistic from two journals, Information Systems Research and Management Information Systems Quarterly (MISQ) during 1994 to 2008 to show the numbers of research using SEM both PLS and CBSEM. The results showed that the numbers of using PLS and SEM have been increased in the last 10 years. This article not only provided knowledge on using SEM and PLS but also supported the method to use PLS to analyze the results in chapter 5.
The Journal of Marketing Theory and Practice	2011	Hair, Joe F. Ringle, Christian M. Sarstedt, Marko	PLS-SEM: Indeed a Silver Bullet	As Structural Equation modeling (SEM) was selected as the main technique to analyse the model. This PLS-SEM: Indeed a silver bullet provided the simple and details way on interpret the information received from PLS software. This article firstly explained the overview of SEM, the algorithm of PLS-SEM, step by step to calculate the algorithm, comparison of PLS-SEM and CB-SEM, Evaluation of measurement model, and the explain on bootstrapping.

				This article shard a very bright light on the PLS-SEM technique and this article were used as a guidebook in chapter 3, 4 and 5.

3-1 Content Validation Form

Content Validation of the Questionnaire

I would like to ask for your co-operation in completing the form below. Your help is required as an expert and not as a consumer or smartphone user. This means that you will be required to provide opinions or your views to questions, choices and statements in this form. For your information, this form contains 27 questions and 23 construct statements. For example in section 0, you have to judge whether the following question is essential, useful but not essential or not necessary. To provide your opinion, please insert a check mark, or cross in the box on your left hand side.

Section 0 Example

Question	**Your suggestion**
0. Please state your gender a. Male b. Female	This question is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:

If any of the questions are confusing and need re-wording, or you are aware of any other improvements that are needed, please provide your comment/s or suggestion/s in the left hand side boxes or free space in the right hand boxes. If you would like to suggest any new question/s please add it/them in the provided space at the end of this form.

Your feedback and critique are much appreciated as this will enable me to improve and validate the content of the questionnaire.

Section 1 Background Information

Question	**Your suggestion**
1. Please state the age group that you belong to a. Under 20 b. 20-29 c. 30-39 d. 40-49 e. 50-59 f. 60-69 g. 70-79 h. 80-89 i. Over 90	This question is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:
2. Please state your gender a. Male b. Female	This question is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:
3. Please select your ethnicity a. White British b. Other white background c. Mixed White & Black African d. Mixed White and Asian e. Other mixed background f. Asian/Brit Indian g. Asian/Brit Pakistani h. Chinese i. Japanese j. Other Asian background k. Black/Brit African l. Other…	This question is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:

4. Please state your highest level of education a. Higher Degree/Postgraduate Degree (MBA, PhD, MD, MA, MSc) b. 1st Degree (BA/ BSc) c. HND/HNC/Teaching d. A-Level e. BTEC/College Diploma f. GCSE/ O Level g. Other…	This question is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:
5. Please indicate where you live in Camden a. Fortune Green b. West Hampstead c. Kilburn d. Frognal and Fitzjohns e. Swiss Cottage f. Hampstead Town g. Belsize h. Highgate i. Gospel Oak j. Haverstock k. Kentish Town l. Camden Town with Primrose Hill m. Cantelowes n. St Pancras and Somers Town o. Regent's Park p. Bloomsbury q. King's Cross r. Holborn and Covent Garden	This question is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:
6. What is your current employment status? a. Pensioner 65+ b. Retired (Under 65 Years Old) c. Employed full time d. Employed part time	This question is ☐ Essential ☐ Useful but not

e. Self-employed f. Own my own business g. Unemployed (for medical reasons) h. Unemployed (Redundant) i. Unemployed (for less than 6 months) j. Unemployed (for more than 6 months) k. Student (Part-time) l. Student (Full-time)	essential ☐ Not necessary Suggestion:
7. Please state your current occupation. If you are of retired/pensioner status, please select the occupation you held for the majority of your working life. a. Academic/Teacher b. Agricultural/Forestry/Fishery c. Clerk d. Craft/Trade e. Freelance f. Legislator/Manager g. Plant/Machine Operator h. Services/Sales i. Student j. Freelance k. Other …	This question is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:
8. Which of the following do you think best describes your state of health? a. Excellent b. Good c. Poor	This question is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:

Section 2 Do you have a smartphone?

Question and explanation of this question	**Your suggestion**
A smartphone is a type of mobile handheld device. It allows you to make telephone calls, send and receive e-mail,	This question is

download and use Applications (Apps), use the internet and Voice Over Internet Protocols (Skype). Examples are Apple iPhone, BlackBerry, HTC phones, Samsung Galaxy phones, Nokia N and E series or mobile phone using Android. 9. Do you have a smartphone? a. Yes b. No, I do not have a smartphone yet, but I plan to have one c. No, and I do not intend to, or plan to have a smartphone	☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:

Section 3 General details regarding the smartphone

Question	**Your suggestion**
10. How long have you been using a smartphone? a. Less than 6 months b. 6 months to 1 year c. 1 year to 2 years d. 2 years to 3 years e. Over 3 years	This question is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:
11. What is the brand of your smartphone(s)? (You may choose more than one option) a. iPhone b. Samsung c. Sony d. HTC e. LG f. Blackberry g. Motorola h. Nokia i. Alcatel j. Huawei k. Asus l. Acer	This question is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:

m. Philips n. Sharp o. Vertu p. ZTE q. Other…	
12. Who is the network provider of your smartphone(s)? (You may choose more than one option) a. 3 (Three UK) b. Bemilo c. EE d. Giffgaff e. Lebara f. Lyca g. O2 h. Orange i. T-Mobile j. Talkmobile k. Tesco Mobile l. Toggle m. Virgin Media n. Vodafone o. Other…	This question is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:
13. How do you pay for your smartphone? a. Pay as you go b. Pay on a monthly basis (Contract)	This question is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:
14. How much do you pay per month for your smartphone? a. Free - £10.00 b. 10.01 - £30.00 c. £30.01 - £50.00 d. £50.01 - £70.00 e. £70.01 - £90.00	This question is ☐ Essential ☐ Useful but not

f. Over £90.00	essential Not necessary Suggestion:

Section 4 Usage of the smartphone and reasons for using the smartphone

Question	**Your suggestion**
15. Please choose your usage frequency of your smartphone. Frequency ranges are between "1 (never)" to "7 (many times per day)".	This question is Essential Useful but not essential Not necessary Suggestion:
16. Please indicate to which extent you agree or disagree with the following statements. Please rate each of the provided following factors on the five-point scale. Note: 1 is Strongly Disagree and 7 is Strongly Agree.	This question is Essential Useful but not essential Not necessary Suggestion:
a. People important to me think I should use a smartphone (For example, friends and family)	This statement is Essential Useful but not essential

	☐ Not necessary Suggestion:
b. People who influence my behaviour think that I should use a smartphone	This statement is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:
c. It is expected that people like me will use smartphones (For example, similar age or position people).	This statement is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:
d. I want to use a smartphone because my friends do so.	This statement is

	☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:
e. I have had many opportunities to see smartphones being used.	This statement is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:
f. It is easy for me to observe others using smartphones. (For example, I saw my friends use smartphones)	This statement is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:
g. I believe that using the smartphone is suitable for me.	This statement is ☐ Essential ☐ Useful but not essential ☐ Not necessary

	Suggestion:
h. I believe that using the smartphone will fit my lifestyle.	This statement is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:
i. I think that using the smartphone fits well with the way that I work or live.	This statement is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:
j. I have the resources necessary to use the smartphone. (For example, time and money).	This statement is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:

k. I have the knowledge necessary to use the smartphone.	This statement is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:
l. The operation costs of a smartphone do not prevent the use of it (such as, price of a smartphone or monthly fee).	This statement is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:
m. I have a person available to assist me when using my smartphone.	This statement is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:
n. I feel a smartphone is useful. (eg. with my work, my lifestyle and my daily routine)	This statement is ☐ Essential

	☐ Useful but not essential ☐ Not necessary Suggestion:
o. Using a smartphone enables me to finish tasks more quickly.	This statement is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:
p. Using a smartphone increases my productivity.	This statement is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:
q. I find that using the smartphone is easy.	This statement is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:

r. Learning how to use a smartphone is easy for me.	This statement is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:
s. I think it is fun to use a smartphone.	This statement is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:
t. I find a smartphone fun (I had fun using a smartphone).	This statement is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:
u. I intend to use a smartphone as much as possible.	This statement is

	☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:
v. I intend to continue using a smartphone in the future.	This statement is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:
w. Whenever possible, I intend to use a smartphone in my job or my daily life.	This statement is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:
Question	**Your suggestion**
17. What features of a smartphone are you using? Please choose your usage frequency form each of the following. Frequency ranges are between "1 (never)" to "7 (many times per day)".	This question is ☐ Essential

If you never use the features please chose 1 as “never”.	☐ Useful but not essential ☐ Not necessary Suggestion:
a. Making a phone call	This feature is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:
b. SMS, text messaging	This feature is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:
c. Taking a photo – photography	This feature is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:

d. Filming a video	This feature is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:
e. Browsing – surfing website(s)	This feature is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:
f. Playing games	This feature is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:
g. Listening to music	This feature is ☐ Essential

	☐ Useful but not essential ☐ Not necessary Suggestion:
h. Watching videos for example YouTube	This feature is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:
i. Mapping, Navigator such as Google Map, TomTom, Copilot	This feature is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:
j. Taking notes such as shopping lists or task that I need to do	This feature is ☐ Essential ☐ Useful but not essential ☐ Not necessary

	Suggestion:
k. Managing my appointment on my calendar such as doctor appointment , business appointment, or meeting with friends	This feature is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:
l. Using a smartphone to downloading applications (apps)	This feature is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:
m. Using Social networks such as Facebook, twitter, LinkedIn, Foursquare, Google+	This feature is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:
n. Online Shopping such as eBay, Google Shopper, Groupon, Amazon Mobile, Newegg Mobile	This feature is ☐ Essential

	☐ Useful but not essential ☐ Not necessary Suggestion:
o. Online Banking such as Lloydstsb Mobile Banking, NatWest Mobile Banking	This feature is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:
p. Reading online News and online Magazines such as BBC, Sky News, Google Currents, Flipboard	This feature is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:
q. Using Voice over IP such as Facetime, Skype, oovoo, Google Talk, Viber, Fring	This feature is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:

r. Using Instant messenger services such as Blackberry Messenger, Live Messenger, iMessenger, WhatsApp	This feature is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:
s. Tracking items or packages using eg. Royal Mail, DHL, UPS	This feature is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:
t. Using Password management such as Keeper, LastPass Password Mgr	This feature is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:
u. Using Finance applications such as stock market applications, currency exchange market applications	This feature is ☐ Essential

	☐ Useful but not essential ☐ Not necessary Suggestion:
v. Using for well-being or health such as track my exercise routine	This feature is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:
w. Using for transport information- bus, train or tube checker	This feature is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:
x. Using to contact government authorities – NHS, Jobcentreplus, UKBA	This feature is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:

Question	Your suggestion
18. What is (are) your consideration(s) when buying a smartphone? (You may choose more than one option) a. Appearance (such as colour or material) b. Brand (such as Apple, Samsung, Nokia or Blackberry) c. Price of the smartphone d. Camera e. Operation System (Such as iOS, Android or Windows Mobile) f. Operating Speed g. Voice Clarity h. Screen Size i. Screen Resolution j. Weight k. Battery life l. Size of Memory in the phone to store files such as (Phones, movies or documents) m. Quality of Applications (apps) n. Price of Applications (apps) o. Number of Applications (apps) available in the app Market p. Support LTE (4G)	This question is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:
19. Where did you get information regarding the use of your smartphone? (You may choose more than one option) a. Word of mouth from friends and family b. High street stores c. Media –TV, Radio and Newspapers d. Magazines e. On-line social networks f. Professional technology review websites such as CNET.co.uk, Trustedreviews.com g. Peer technology review such as unboxing video on YouTube h. Sales person i. Other…	This question is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:

20. How long did it take you to get comfortable or familiar with using the basic functionalities of your present smartphone? Basic functionalities are described as: Making a phone call, using the internet services, using your SMS, or using email. a. Less than a day b. 1 day – 1 week c. 1 week – 2 weeks d. 2 weeks - 1 month e. 1 month – 3 months f. More than 3 months	This question is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:

Section 5 how has a smartphone helped your well-being or health?

Question	**Your suggestion**
21. How has using a smartphone helped your well-being or health? (You may choose more than one option) a. It helps me seek information on health issues b. It helps me with my appointment time keeping with doctors c. It helps me manage or track my exercise routine d. It helps me manage my diet e. It helps me monitor my weight f. It helps me access health records g. It helps me manage my moods h. It helps me manage prescriptions i. It helps me monitor blood pressure j. It helps me check nearby pollen levels k. It helps me control my cigarette smoking l. Smartphone does not help me with my well-being or health m. Other…	This question is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:

Section 6 how a smartphone helped brings your friends and family closer to you?

Question	**Your suggestion**

22. How has a smartphone helped bring your friends and family closer to you? (You may choose more than one option) a. Making phone calls to my friends and family b. Emailing my friends and family using my smartphone c. Sharing photos taken from my smartphone d. Sharing videos with from my smartphone e. Sending instant messages such as Blackberry Messenger, WhatsApp, Line, Facebook messenger f. Using video telephony software applications such as Facetime, Tango or Skype g. Following friends' and family's activities using social media such as Facebook, Google+ on my smartphone h. I do not use a smartphone to contact with my friends or family i. Other…	This question is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:

Section 7 I do plan to get a smartphone

Question	Your suggestion
23. What are the reasons for why you plan to use a smartphone a. I will get an upgrade from my provider. b. I want to have a handy device that can do many things such as making a telephone call, taking a photograph, filming, and surfing the internet. c. Most of my friends have used smartphones, and have convinced me to get one. d. I want to use a smartphone to contact my friends or family. e. My new job or new position requires me to use a smartphone. f. I want to use a smartphone to help with my well-being or health. g. I travel a lot and the smartphone will help me on my travels. h. My new smartphone will help me with my memory. i. My new smartphone will have a bigger screen which is easy for me to see and use. j. Other..	This question is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:
24. What is (are) your consideration(s) when buying a smartphone? (You may choose more than one option)	This question is

a. Appearance (such as colour or material) b. Brand (such as Apple, Samsung, Nokia or Blackberry) c. Price of the smartphone d. Camera e. Operation System (Such as iOS, Android or Windows Mobile) f. Operating Speed g. Voice Clarity h. Screen Size i. Screen Resolution j. Weight k. Battery life l. Size of Memory in the phone to store files such as (Phones, movies or documents) m. Quality of Applications (apps) n. Price of Applications (apps) o. Number of Applications (apps) available in the app Market p. Support LTE (4G)	☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:
25. Where do you get information regarding use of your smartphone? (You may choose more than one option) a. Word of mouth from friends and family b. High street stores c. Media –TV, Radio and Newspapers d. Magazines e. On-line social network f. Professional technology review website such as CNET.co.uk, Trustedreviews.com g. Peer technology review such as unboxing video on YouTube h. Sales person i. Other….	This question is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:

Section 8 I do not plan to get a smartphone

Question	**Your suggestion**
26. What is/are the reasons/s for not getting a smartphone? (You may choose more than one option) a. I am too old for a smartphone b. It is too much of an effort to use a smartphone c. A smartphone is too complicated and difficult to use. d. I do not think a smartphone is useful.	This question is ☐ Essential ☐ Useful but not essential

e. Physical discomfort or accessibility problems f. The cost of using a smartphone – I do not want to spend a lot of money when using a smartphone. g. I want peace and quiet after my working hours h. I do not feel comfortable using small screens and tiny keyboards. i. I do not know much about how to use a smartphone. j. I have other devices such as a laptop or a netbook that can function as well, or better than a smartphone. k. Using a smartphone does not fit with my lifestyle. l. Other…	☐ Not necessary Suggestion:
27. Factors that may encourage future use of a smartphone. a. Nothing/ will never use a smartphone in the future b. Free training c. Reduce cost of a smartphone d. Reduce cost of month contract e. Other…	This question is ☐ Essential ☐ Useful but not essential ☐ Not necessary Suggestion:

1) Can you please suggest any changes that can be made to improve this survey?

2) Are there any questions that you found too intrusive or you thought may discourage people from taking part in this survey?

One again I would like to take this opportunity to thank you for your valuable time and patience in completing this form.

3-2 Content Validation Results

Section 1 Background Information

Question	Suggestion			Note/CVR
	Essential	Useful but not essential	Not necessary	
1. Please state the age group that you belong	12	0	0	
2. Please state your gender	12	0	0	
3. Please select your ethnicity	11	1	0	CVR = 0.83
4. Please state your highest level of education	12	0	0	
5. Please indicate where you live in Camden	12	0	0	
6. What is your current employment status	12	0	0	Too many details in choices
7. Please state your current occupation. If you are of retired/pensioner status, please select the occupation you held for the majority of your working life.	12	0	0	
8. Which of the following do you think best describes your state of health?	11	1	0	CVR = 0.83

Section 2 Do you have a smartphone?

Question	Suggestion			Note/CVR
	Essential	Useful but not essential	Not necessary	
9. Do you have a smartphone?	12	0	0	

Section 3 General details regarding the smartphone

Question	Suggestion			Note/CVR
	Essential	Useful	Not	

		but not essential	necessary	
10. How long have you been using a smartphone?	12	0	0	
11. What is the brand of your smartphone(s)?	12	0	0	
12. Who is the network provider of your smartphone?	12	0	0	
13. How do you pay for your smartphone ?	12	0	0	
14. How much do you pay per month for your smartphone?	11	1	0	CVR = 0.83

Section 4 Usage of the smartphone and reasons for using the smartphone

Question	Suggestion			Note/CVR
	Essential	Useful but not essential	Not necessary	
15. Please choose your usage frequency of your smartphone. Frequency ranges are between “1 (never)” to “7 (many times per day)”.	12	0	0	
16. Please indicate to which extent you agree or disagree with the following statements. Please rate each of the provided following factors on the five-point scale. Note: 1 is Strongly Disagree and 7 is Strongly Agree.	12	0	0	Mistake from five – point scales to seven scales
a. People important to me think I should use a smartphone (For example, friends and family)	12	0	0	
b. People who influence my behaviour think that I should use a smartphone	12	0	0	

c. It is expected that people like me will use smartphones (For example, similar age or position people).	12	0	0	
d. I want to use a smartphone because my friends do so.	12	0	0	
e. I have had many opportunities to see smartphones being used.	12	0	0	
f. It is easy for me to observe others using smartphones. (For example, I saw my friends use smartphones)	12	0	0	
g. I believe that using the smartphone is suitable for me.	12	0	0	
h. I believe that using the smartphone will fit my lifestyle.	12	0	0	
i. I think that using the smartphone fits well with the way that I work or live.	12	0	0	Swap between work or live
j. I have the resources necessary to use the smartphone. (For example, time and money).	12	0	0	
k. I have the knowledge necessary to use the smartphone.	11	1	0	CVR = 0.83
l. The operation costs of a smartphone do not prevent the use of it (such as, price of a smartphone or monthly fee).	12	0	0	
m. I have a person available to assist me when using my smartphone.	8	4	0	CVR = 0.33
n. I feel a smartphone is useful. (eg. with my work, my lifestyle and my daily routine)	12	0	0	Arrange to my daily routine, my lifestyle and with my work

o. Using a smartphone enables me to finish tasks more quickly.	12	0	0	
p. Using a smartphone increases my productivity.	7	5	0	This question is particular for workers CVR = 0.17
q. I find that using the smartphone is easy.	12	0	0	
r. Learning how to use a smartphone is easy for me.	12	0	0	
s. I think it is fun to use a smartphone.	12	0	0	
t. I find a smartphone fun (I had fun using a smartphone).	12	0	0	
u. I intend to use a smartphone as much as possible.	10	2	0	CVR = 0.67
v. I intend to continue using a smartphone in the future.	12	0	0	
w. Whenever possible, I intend to use a smartphone in my job or my daily life.	12	0	0	Swap between my job and my daily life
Question				
17. What features of a smartphone are you using? Please choose your usage frequency form each of the following. Frequency ranges are between “1 (never)” to “7 (many times per day)”. If you never use the features please chose 1 as “never”.	12	0	0	
a. Making a phone call	12	0	0	

b. SMS, text messaging	12	0	0	
c. Taking a photo – photography	12	0	0	
d. Filming a video	12	0	0	
e. Browsing – surfing website(s)	11	1	0	CVR = 0.83
f. Playing games	12	0	0	
g. Listening to music	12	0	0	Add or radio
h. Watching videos for example YouTube	11	1	0	Add or film CVR = 0.83
i. Mapping, Navigator such as Google Map, TomTom, Copilot	9	3	0	CVR = 0.5
j. Taking notes such as shopping lists or task that I need to do	8	3	1	CVR = 0.33
k. Managing my appointment on my calendar such as doctor appointment , business appointment, or meeting with friends	9	3	0	CVR = 0.5
l. Using a smartphone to downloading applications (apps)	9	3	0	CVR = 0.5
m. Using Social networks such as Facebook, twitter, LinkedIn, Foursquare, Google+	9	3	0	CVR = 0.5
n. Online Shopping such as eBay, Google Shopper, Groupon, Amazon Mobile, Newegg Mobile	6	6	0	CVR = 0
o. Online Banking such as Lloydstsb Mobile Banking, NatWest Mobile Banking	8	4	0	CVR = 0.33
p. Reading online News and online Magazines such as BBC, Sky News, Google Currents, Flipboard	7	5	0	CVR = 0.16

q. Using Voice over IP such as Facetime, Skype, oovoo, Google Talk, Viber, Fring	9	3	0	CVR = 0.5
r. Using Instant messenger services such as Blackberry Messenger, Live Messenger, iMessenger, WhatsApp	6	6	0	CVR = 0
s. Tracking items or packages using eg. Royal Mail, DHL, UPS	0	3	9	CVR = -1
t. Using Password management such as Keeper, LastPass Password Mgr	5	7	0	CVR = -0.17
u. Using Finance applications such as stock market applications, currency exchange market applications	10	2	0	CVR = 0.67
v. Using for well-being or health such as track my exercise routine	8	3	1	CVR = 0.33
w. Using for transport information- bus, train or tube checker	3	9	0	CVR = -0.5
x. Using to contact government authorities – NHS, Jobcentreplus, UKBA	2	8	1	CVR = -0.67

Question	Suggestion			Note/CVR
	Essential	Useful but not essential	Not necessary	
18. What is (are) your consideration(s) when buying a smartphone? (You may choose more than one option) a. Appearance (such as colour or material) b. Brand (such as Apple, Samsung, Nokia or Blackberry) c. Price of the smartphone d. Camera e. Operation System (Such as iOS, Android or Windows Mobile)	11	1	0	Remove e., f., g., l., m., n., o., and p. CVR = 0.83

f. Operating Speed g. Voice Clarity h. Screen Size i. Screen Resolution j. Weight k. Battery life l. Size of Memory in the phone to store files such as (Phones, movies or documents) m. Quality of Applications (apps) n. Price of Applications (apps) o. Number of Applications (apps) available in the app Market p. Support LTE (4G)				
19. Where did you get information regarding the use of your smartphone? (You may choose more than one option) a. Word of mouth from friends and family b. High street stores c. Media –TV, Radio and Newspapers d. Magazines e. On-line social networks f. Professional technology review websites such as CNET.co.uk, Trustedreviews.com g. Peer technology review such as unboxing video on YouTube h. Sales person i. Other…	12	0	0	
20. How long did it take you to get comfortable or familiar with using the basic functionalities of your present smartphone? Basic functionalities are described as: Making a phone call, using the internet services, using your SMS, or using email. a. Less than a day	12	0	0	

b. 1 day – 1 week c. 1 week – 2 weeks d. 2 weeks - 1 month e. 1 month – 3 months f. More than 3 months				

Section 5 how has a smartphone helped your well-being or health?

Question	Suggestion			Note/CVR
	Essential	Useful but not essential	Not necessary	
21. How has using a smartphone helped your well-being or health? (You may choose more than one option) a. It helps me seek information on health issues b. It helps me with my appointment time keeping with doctors c. It helps me manage or track my exercise routine d. It helps me manage my diet e. It helps me monitor my weight f. It helps me access health records g. It helps me manage my moods h. It helps me manage prescriptions i. It helps me monitor blood pressure j. It helps me check nearby pollen levels k. It helps me control my cigarette smoking l. Smartphone does not help me with my well-being or health **m.** Other…	11	1	0	CVR = 0.83

Section 6 how a smartphone helped brings your friends and family closer to you?

Question	Suggestion	Note

	Essential	Useful but not essential	Not necessary	
22. How has a smartphone helped bring your friends and family closer to you? (You may choose more than one option) a. Making phone calls to my friends and family b. Emailing my friends and family using my smartphone c. Sharing photos taken from my smartphone d. Sharing videos with from my smartphone e. Sending instant messages such as Blackberry Messenger, WhatsApp, Line, Facebook messenger f. Using video telephony software applications such as Facetime, Tango or Skype g. Following friends' and family's activities using social media such as Facebook, Google+ on my smartphone h. I do not use a smartphone to contact with my friends or family i. Other…	12	0	0	

Section 7 I do plan to get a smartphone

Question	Suggestion			Note
	Essential	Useful but not essential	Not necessary	
23. What are the reasons for why you plan to use a smartphone a. I will get an upgrade from my provider. b. I want to have a handy device that	12	0	0	

can do many things such as making a telephone call, taking a photograph, filming, and surfing the internet. c. Most of my friends have used smartphones, and have convinced me to get one. d. I want to use a smartphone to contact my friends or family. e. My new job or new position requires me to use a smartphone. f. I want to use a smartphone to help with my well-being or health. g. I travel a lot and the smartphone will help me on my travels. h. My new smartphone will help me with my memory. i. My new smartphone will have a bigger screen which is easy for me to see and use. j. Other..				
24. What is (are) your consideration(s) when buying a smartphone? (You may choose more than one option) a. Appearance (such as colour or material) b. Brand (such as Apple, Samsung, Nokia or Blackberry) c. Price of the smartphone d. Camera e. Operation System (Such as iOS, Android or Windows Mobile) f. Operating Speed g. Voice Clarity h. Screen Size i. Screen Resolution j. Weight k. Battery life l. Size of Memory in the phone to store files such as (Phones, movies or documents) m. Quality of Applications (apps)	12	0	0	

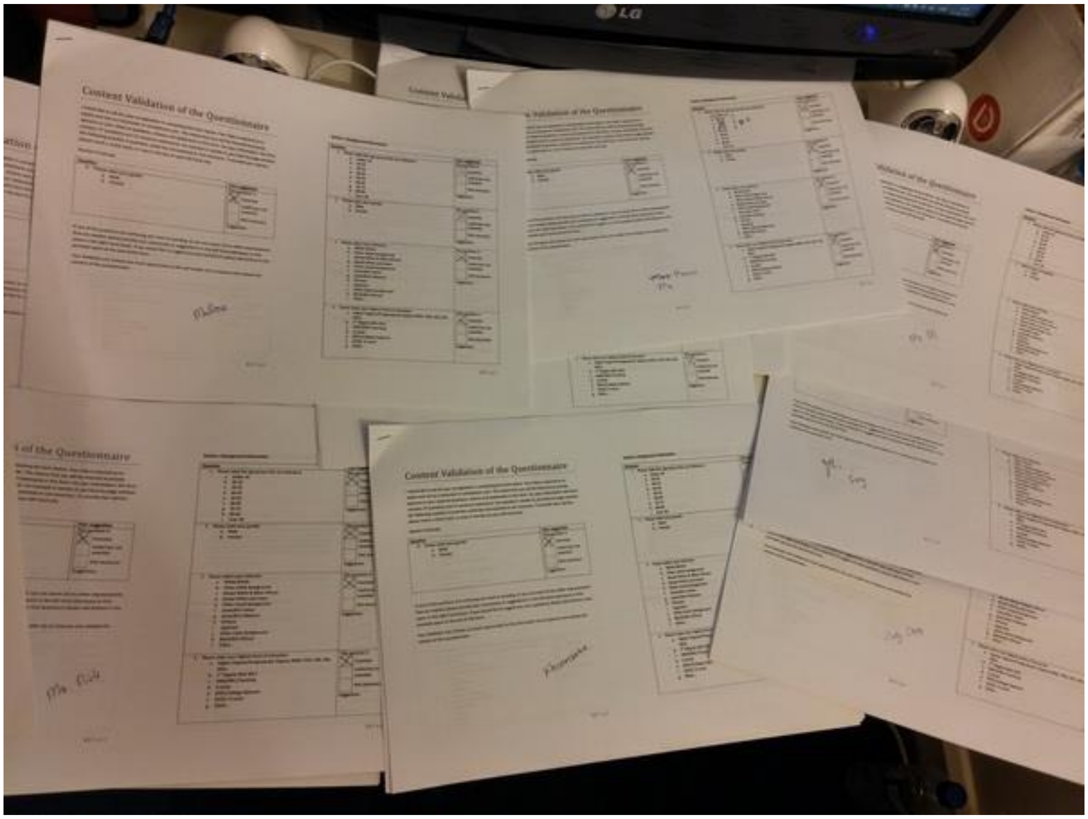
n. Price of Applications (apps) o. Number of Applications (apps) available in the app Market p. Support LTE (4G)				
25. Where do you get information regarding use of your smartphone? (You may choose more than one option) a. Word of mouth from friends and family b. High street stores c. Media –TV, Radio and Newspapers d. Magazines e. On-line social network f. Professional technology review website such as CNET.co.uk, Trustedreviews.com g. Peer technology review such as unboxing video on YouTube h. Sales person i. Other….	12	0	0	

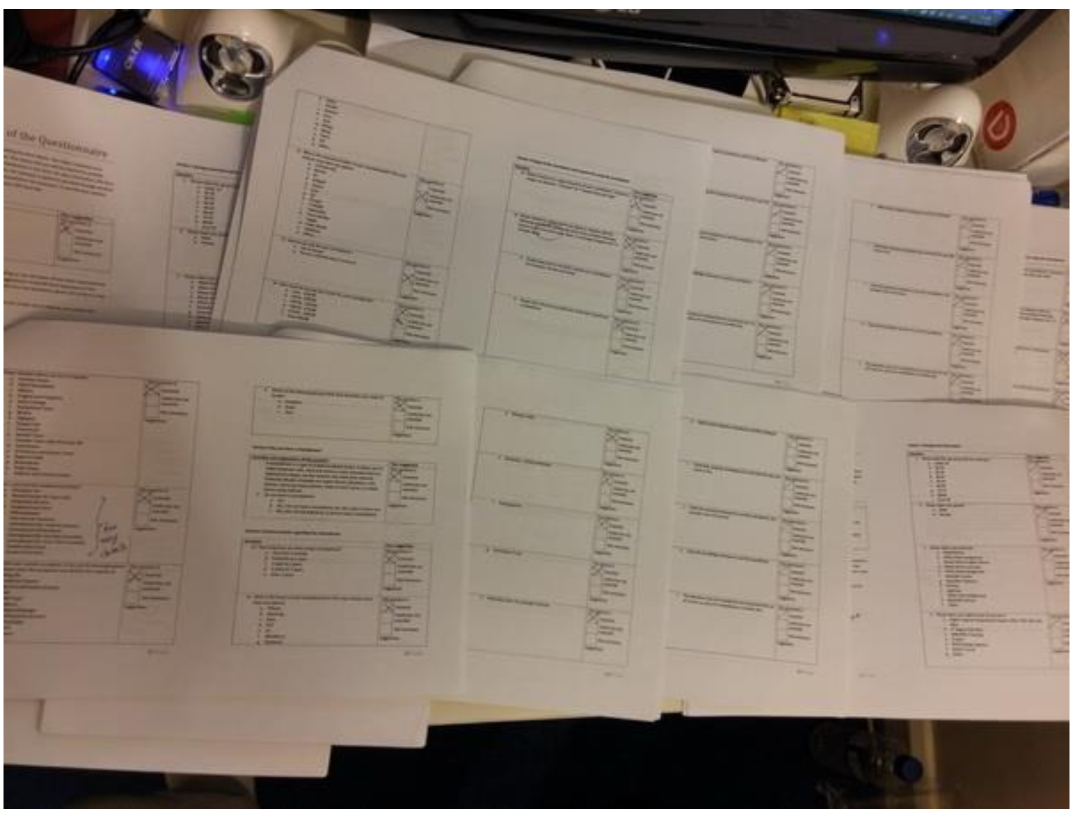
Section 8 I do not plan to get a smartphone

Question	Suggestion			Note
	Essential	Useful but not essential	Not necessary	
26. What is/are the reasons/s for not getting a smartphone? (You may choose more than one option) a. I am too old for a smartphone b. It is too much of an effort to use a smartphone c. A smartphone is too complicated and difficult to use. d. I do not think a smartphone is useful. e. Physical discomfort or accessibility	12	0	0	

problems f. The cost of using a smartphone – I do not want to spend a lot of money when using a smartphone. g. I want peace and quiet after my working hours h. I do not feel comfortable using small screens and tiny keyboards. i. I do not know much about how to use a smartphone. j. I have other devices such as a laptop or a netbook that can function as well, or better than a smartphone. k. Using a smartphone does not fit with my lifestyle. **l.** Other…				
27. Factors that may encourage future use of a smartphone. a. Nothing/ will never use a smartphone in the future b. Free training c. Reduce cost of a smartphone d. Reduce cost of month contract e. Other…	12	0	0	

3-3 Paper-based Validation Forms (Photos)





4-1 Original Construct Measures

Constructs	Constructs Measure	Source
Behavioral Intention	I intend to continue using mobile Internet in the future.	(Venkatesh et al., 2012)
	I will always try to use mobile Internet in my daily life.	
	I plan to continue to use mobile internet frequently.	
	Whenever possible, I intend to use the smartphone in my job.	(Park & Chen, 2007)
	I intend to increase my use of the smartphone in the future.	
Social Influence	People important to me think I should use service (climate for networking).	(Shin, 2007)
	It is expected that people like me use service (nationalistic feelings).	(Shin, 2007)
	People who influence my behavior think that I should use mobile internet.	(Venkatesh et al., 2012)
	I want to use the service because my friends do so, and I want to belong to the Group	(Verkasalo et al., 2010)
Observability	It is easy for me to observe others using the smartphone in my work.	(Park & Chen, 2007)
	I have had a lot of opportunity to see the smartphone being used.	
Compatibility	I believe that using mobile banking will fit my lifestyle.	(Koenig-Lewis et al., 2010)
	I believe that using mobile banking is suitable for me.	
	I think that using the smartphone fits well with the way I like to work.	(Park & Chen, 2007)

	Using the smartphone fits into my work style.	
Facilitating Condition	I have the resource necessary to use mobile Internet.	(Venkatesh et al., 2012)
	I have knowledge necessary to use mobile Internet.	
	Operating cost do not prevent the use of smartphones.	(Qurashi, 2012)
	I have the person available for assistance with mobile banking use.	(Gu et al., 2009)
Performance Expectancy	I feel mobile banking is useful.	(Zhou et al., 2010)
	Mobile banking lets me make payments more quickly.	
	Using mobile Internet increase my productivity.	(Venkatesh et al., 2012)
	Using mobile Internet helps me accomplish things more quickly.	
Effort Expectancy	I find that using mobile banking is easy.	(Zhou et al., 2010)
	Learning how to use mobile banking is easy for me.	(Zhou et al., 2010)
	I find mobile Internet easy to use.	(Venkatesh et al., 2012)
	Learning how to use mobile Internet is easy for me.	(Venkatesh et al., 2012)
Enjoyment	I think it is fun to use the service (mobile service).	(Verkasalo et al., 2010)
	I find service fun (I had fun using Wi-Bro).	(Shin, 2007)

4-2 Pilot Survey Questionnaire

Silver Surfer and Smartphones in UK

Dear Sir/Madam,

We would like to seek your co-operation in completing this survey, which is part of an important research project being conducted at University of Hertfordshire's Systems Management Research Unit (SyMRU), Business School.

The purpose of this research is to identify and explain how people in UK use and spread the use of smart phones. The ethical number is BS/R/033 10.

For your information, this questionnaire includes a number of questions that should take approximately 5 minutes to complete. Please check (tick) all appropriate answers. if your answer is not displayed, could you please kindly state your answer in the "Other" option category. You may omit any questions that you do not wish to answer.

Also, please be assured that none of the information you provide will be disclosed. If you have any questions regarding this study, please feel free to contact the investigating team responsible for this project at the following address:

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University of Hertfordshire	Reader, Information Systems
Director, SyMRU	University of Hertfordshire
Business School	Director, SyMRU
DeHavilland campus	Business School, DeHavilland campus
Hatfield Herts	Hatfield Herts
AL10 9EU	AL10 9EU
Email: supibee@gmail.com	Email: j.choudrie@herts.ac.uk; jyotichoudrie@gmail.com
Mobile: 07828 696614	Telephone: (01707) 281271 Fax: 01707 285410.
	Mobile: 07950 481708

We would like to take the opportunity to thank you for your time and patience in completing this questionnaire!

Page 1

Silver Surfer and Smartphones in UK

Background Information

***1. Please state the age group you belong to?**

- Under 20
- 20-29
- 30-39
- 40-49
- 50-59
- 60-69
- 70-79
- 80-89
- Over 90

***2. Please state your gender**

- Male
- Female

3. Please select your ethnic group

- White British
- Other White background
- Mixed White & Black African
- Mixed White and Asian
- Other mixed background
- Asian/Brit Indian
- Asian/Brit Pakistani
- Other Asian background
- Black/Brit African

Other (please specify)

4. Please state your highest level of education

- Higher Degree/Postgraduate Degree (MBA PhD MD MA MSc)
- 1st Degree (BA / BSc)
- HND/HNC/Teaching
- A-Level
- BTEC/College Diploma
- GCSE/OLevel

Other (please specify)

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Silver Surfer and Smartphones in UK

5. Please indicate where you are

- Channel Islands
- East of England
- Isle of Man
- London
- Midlands East
- Midlands West
- North East and Cumbria
- North West of England
- Northern Ireland
- Scotland
- South East of England
- South of England
- South West of England
- Wales
- West of England
- Yorkshire and Lincolnshire

Other (please specify)

6. What is your current employment status?

- Pensioner 65+
- Retired (under 65 years old)
- Employed full time
- Employed part time
- Self-employ
- Own my own business
- Unemployed (for less than 6 months)
- Unemployed (for medical reasons)
- Unemployed (for more than 6 months)
- Student (part-time)
- Student (full-time)

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Silver Surfer and Smartphones in UK

7. Please state your current occupation.
If you are of retired/pensioner status, please select the occupation you held for the majority of your working life.

- Academic/Teacher
- Agricultural/Forestry/Fishery
- Clerk
- Craft/Trade
- Freelance
- Legislator/Manager
- Plant/Machine Operator
- Services/sales
- Student

Other (please specify)

***8. Which of the following do you think best describes your state of health?**

- Excellent
- Good
- Poor

Silver Surfer and Smartphones in UK

If unwell due to your age, could you please state your ailment?

9. Could you please state your ailment(s) that occurred due to old age? (You may choose more than one option)

- ☐ Alzheimer's Disease
- ☐ Arthritis
- ☐ Balance Disorders
- ☐ Cancer
- ☐ Eye Diseases
- ☐ Ear Disorders
- ☐ Depression
- ☐ Dementia
- ☐ Diabetes
- ☐ Falls & Mobility Problems
- ☐ Generalized Anxiety Disorder
- ☐ Heart Disease
- ☐ High Blood Pressure
- ☐ High Cholesterol
- ☐ Hip Fracture
- ☐ Memory Loss
- ☐ Menopause
- ☐ Neck Fracture
- ☐ Osteoarthritis
- ☐ Osteoporosis
- ☐ Parkinson's Disease
- ☐ Stroke

Other (please specify)

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Silver Surfer and Smartphones in UK

Do you have a smartphone?

A smartphone is a type of mobile handheld device. It lets you make telephone calls, send and receive e-mail, download and use Applications (Apps), use the internet and Voice Over Internet Protocols (Skype). Example are Apple iPhone, BlackBerry, HTC phones, Samsung Galaxy phones, Nokia N and E series or mobile phone using Android.

***10. Do you have a smartphone?**

- ○ Yes
- ○ No

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Silver Surfer and Smartphones in UK

Using a smartphone: about your smartphones

***11. How long have you been using a smartphone?**

- ○ less than 6 months
- ○ 6 months to 1 year
- ○ 1 year to 2 years
- ○ 2 years to 3 years
- ○ over 3 years

12. What is the brand of your smartphone(s)? (You may choose more than one option)

- ☐ iPhone (Apple)
- ☐ Blackberry
- ☐ HTC
- ☐ Samsung
- ☐ Nokia
- ☐ Motorola
- ☐ Sony
- ☐ LG

Other (please specify)

13. Who is the network provider of your smartphone(s)? (You may choose more than one option)

- ☐ 3 (Three UK)
- ☐ EE
- ☐ Giffgaff
- ☐ Lebara
- ☐ O2
- ☐ Orange
- ☐ T-Mobile
- ☐ Talkmobile
- ☐ Virgin Media
- ☐ Vodafone

Other (please specify)

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Silver Surfer and Smartphones in UK

***14. How do you pay for your smartphone?**

- ☐ Pay as you go
- ☐ Pay on a monthly basis (Contract)

***15. How much do you pay per month for your smartphone?**

- ☐ Free - £10.00
- ☐ £10.01 - £30.00
- ☐ £30.01 - £50.00
- ☐ £50.01 - £70.00
- ☐ £70.01 - £90.00
- ☐ <£90.01

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Silver Surfer and Smartphones in UK

***16. Please indicate to which extent you agree or disagree with the following statements. Please rate each of the provided following factors on the five-point scale. Note: 1 is Strongly Disagree and 5 is Strongly Agree.**

	Strongly Disagree (1)	(2)	(3)	(4)	Strongly Agree (5)
1. People important to me think I should use a smartphone. (For example, friends and family)	○	○	○	○	○
2. People who influence my behaviour think that I should use a smartphone.	○	○	○	○	○
3. It is expected that people like me use smartphones. (For example, similar age or position people)	○	○	○	○	○
4. I want to use a smartphone because my friends do so.	○	○	○	○	○
5. I have had a lot of opportunity to see smartphones being used.	○	○	○	○	○
6. It is easy for me to observe others using smartphones. (For example, I saw my friends use smartphones)	○	○	○	○	○
7. I believe that using the smartphone is suitable for me.	○	○	○	○	○
8. I believe that using the smartphone will fit my life style.	○	○	○	○	○
9. I think that using the smartphone fits well with the way I like to work.	○	○	○	○	○
10. Using the smartphone fits into my work style.	○	○	○	○	○
11. I have the resources necessary to use the smartphone. (For example, time and money)	○	○	○	○	○
12. I have the knowledge necessary to use the smartphone.	○	○	○	○	○
13. The operation costs of a smartphone do not prevent the use of it (such as price of smartphone or monthly fee).	○	○	○	○	○
14. I have a person available to assist me in using my smartphone.	○	○	○	○	○
15. I feel a smartphone is useful.	○	○	○	○	○
16. Using a smartphone enables me to finish tasks more quickly.	○	○	○	○	○
17. Using a smartphone increases my productivity.	○	○	○	○	○
18. I find that using the smartphone is easy.	○	○	○	○	○
19. Learning how to use a smartphone is easy for me.	○	○	○	○	○
20. I think it is fun to use a smartphone.	○	○	○	○	○
21. I find a smartphone fun (I had fun using a smartphone).	○	○	○	○	○
22. I intend to use a smartphone as much as possible.	○	○	○	○	○
23. I intend to continue using a smartphone in the future.	○	○	○	○	○
24. Whenever possible, I intend to use a smartphone in my job.	○	○	○	○	○
25. I intend to increase my use of a smartphone in the future.	○	○	○	○	○

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Silver Surfer and Smartphones in UK

17. What features of a smartphone are you using?
(You may choose more than one option)

- ☐ 1. Making a phone call
- ☐ 2. SMS,text messaging
- ☐ 3. E-mailing
- ☐ 4. Browsing - surfing website(s)
- ☐ 5. Downloading applications (apps)
- ☐ 6. Mapping, Navigator such as Google Map, TomTom, Copilot
- ☐ 7. Online Shopping such as eBay, Google Shopper, Groupon, Amazon Mobile, Newegg Mobile
- ☐ 8. Online Banking such as Lloydstsb Mobile Banking, NatWest Mobile Banking
- ☐ 9. Reading online News and online Magazines such as BBC, Sky News, Google Currents, Flipboard
- ☐ 10. Using Social networks such as Facebook, twitter, LinkedIn, Foursquare, Google+
- ☐ 11. Using Voice over IP such as Facetime, Skype, oovoo, Google Talk, Viber, Fring
- ☐ 12. Using Instant messenger such as Blackberry Messenger, Live Messenger, iMessenger, WhatsApp
- ☐ 13. Tracking items or packages usging eg. Royal Mail, DHL, UPS
- ☐ 14. Taking a photo – photography
- ☐ 15. Filming a video
- ☐ 16. Playing games
- ☐ 17. Using Password management such as Keeper, LastPass Password Mgr
- ☐ 18. Using Finance application, stock market application, currency exchange market application
- ☐ 19. Using for health, fitness and medical
- ☐ 20. Using for transportation- bus, train or tube checker
- ☐ 21. Using to contact government authorities – NHS, Jobcentreplus, UKBA

Other (please specify)

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Silver Surfer and Smartphones in UK

***18. Please choose your usage frequency form each of the following. Frequency ranges are between "1 (never)" to "5 (many times per day)". I use a smartphone for :**

	Never (1)	(2)	(3)	(4)	Many times per day (5)
1. Making a phone call	◯	◯	◯	◯	◯
2. SMS,text messaging	◯	◯	◯	◯	◯
3. E-mailing	◯	◯	◯	◯	◯
4. Browsing - surfing website(s)	◯	◯	◯	◯	◯
5. Downloading applications (apps)	◯	◯	◯	◯	◯
6. Using Social networks such as Facebook, twitter, LinkedIn, Foursquare, Google+	◯	◯	◯	◯	◯
7. Using Voice over IP such as Facetime, Skype, oovoo, Google Talk, Viber, Fring	◯	◯	◯	◯	◯
8. Taking a photo – photography	◯	◯	◯	◯	◯
9. Playing games	◯	◯	◯	◯	◯

19. What is(are) your consideration(s) in buying a smartphone? (You may choose more than one option)

- ☐ Appearance (such as colour or material)
- ☐ Brand (such as Apple, Samsung, Nokia or Blackberry)
- ☐ Price of the smartphone
- ☐ Camera
- ☐ Operating System (such as iOS, Android or Windows8)
- ☐ Operating Speed
- ☐ Voice Clarity
- ☐ Screen Size
- ☐ Screen Resolution
- ☐ Weight
- ☐ Battery life
- ☐ Size of Memory in the phone to store files such as (photos, movies or documents)
- ☐ Quality of Applications(app)
- ☐ Price of Applications(app)
- ☐ Number of Applications(app) available in app Market
- ☐ Support LTE (4G)

Other (please specify)

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Silver Surfer and Smartphones in UK

20. Where do you get information regarding the use of your smartphone? (You may choose more than one option)

- ☐ Word of mouth by friends and family
- ☐ High street stores
- ☐ Media – TV, Radio and Newspapers
- ☐ Magazines
- ☐ On-line social network
- ☐ Professional technology review website such as CNET.co.uk, Trustedreviews.com
- ☐ Peer technology review such as unboxing video on Youtube

Other (please specify)

21. How long did it take you to get comfortable or familiar with using the basic functionalities of your present smartphone? Basic functionalities are described as: Making a phone call, using the internet services, using your SMS or using your Bluetooth facilities.

- ○ Less than a day
- ○ 1 day - 1 week
- ○ 1 week - 2 weeks
- ○ 2 weeks - 1 month
- ○ 1 month - 3 months
- ○ More than 3 months

***22. Has having a smartphone helped your well-being or health?**

- ○ Yes
- ○ No

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Silver Surfer and Smartphones in UK

How a smartphone helped your well-being or health?

23. How has using a smartphone help your well-being or health? (You may choose more than one option)

☐ A. It helps me seek information on health issues

☐ B. It helps me access health records

☐ C. It helps me manage or track my exercise

☐ D. It helps me manage sleep

☐ E. It helps me monitor weight

☐ F. It helps me manage food (Diet)

☐ G. It helps me manage moods

☐ H. It helps me track my pregnancy

☐ I. It helps me manage prescriptions

☐ J. It helps me monitor blood pressure

☐ K. It helps me check nearby pollen level

☐ L. It helps me control my cigarette smoking

Other (please specify)

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Silver Surfer and Smartphones in UK

Has a smartphone helped bring your friends and family closer to you?

***24. Has having a smartphone helped bring your friends and family closer to you? (For example by using applications such as using Facebook, Facetime, Skype, Viber, or Tango)**

- Yes
- No

Silver Surfer and Smartphones in UK

How a smartphone helped bring your friends and family closer to you?

25. How a smartphone helped bring your friends and family closer to you? (You may choose more than one option)

- ☐ A. Making phone call to my friends and family
- ☐ B. Emailing my friends and family using my smartphone
- ☐ C. Sharing photo taken from my smartphone
- ☐ D. Sharing video taken from my smartphone
- ☐ E. Sending instant message such as Blackberry Messenger, WhatsApp, Line, Facebook messenger
- ☐ F. Using videotelephony software application such as Facetime, Tango or Skype
- ☐ G. Following friends and family's activities using social media such as Facebook, Google+ provided on my smartphone
- ☐ H. Playing games with friends and family such as scrabble game from my smartphone
- ☐ I. Sharing my location with my friends and family

Other (please specify)

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Silver Surfer and Smartphones in UK

I do not plan to get a smartphone

26. What is/are the reason/s for not using a smartphone? (You may choose more than one option)

- ☐ A. The cost of using a smartphone – I do not want to spend a lot of money when using a smartphone.
- ☐ B. I want peace and quiet after my working hours (Privacy).
- ☐ C. I do not feel comfortable using small screens and tiny keyboards.
- ☐ D. I do not know much on how to use a smartphone.
- ☐ E. I have other devices such as a laptop or netbook that can function as well, or better than a smartphone.
- ☐ F. Using a smartphone does not fit my lifestyle.

Other (please specify)

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Silver Surfer and Smartphones in UK

Thank you

Thank you very much for your valuable time, co-operation and patience in completing this questionnaire! If you have any questions, comments, suggestions or would like to find out about the results of this research, please do not hesitate in getting in touch with us at:

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5-1 Final Survey Questionnaire

Adoption, Use and Diffusion of Smartphones in Older Adults (50+)

Dear Sir/Madam,

We would like to seek your co-operation in completing this survey, which is part of an important research project being conducted at University of Hertfordshire's Systems Management Research Unit (SyMRU), Business School.

The purpose of this research is to identify and explain how people in London use and spread the use of smart phones. The ethical number is BS/R/033 10.

For your information, this questionnaire includes a number of questions that should take approximately 10 minutes to complete. Please check (tick) all appropriate answers. if your answer is not displayed, could you please kindly state your answer in the "Other" option category. You may omit any questions that you do not wish to answer.

Please be assured that any information you provide will be used for academic research purposes only. . If you have any questions regarding this study, please feel free to contact the investigating team responsible for this project at the following address:

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We would like to take the opportunity to thank you for your time and patience in completing this questionnaire!

Page 1

Adoption, Use and Diffusion of Smartphones in Older Adults (50+)

Background Information

***1. Please state the age group that you belong to**

- Under 20
- 20-29
- 30-39
- 40-49
- 50-59
- 60-69
- 70-79
- 80-89
- Over 90

***2. Please state your gender**

- Male
- Female

3. Please select your ethnicity

- White British
- Other white background
- Mixed White & Black African
- Mixed White and Asian
- Other mixed background
- Asian/Brit Indian
- Asian/Brit Pakistani
- Chinese
- Japanese
- Other Asian background
- Black/Brit African
- Other (please specify)

4. Please state your highest level of education

- Higher Degree/Postgraduate Degree (MBA, PhD, MD, MA, MSc)
- 1st Degree (BA/ BSc)
- HND/HNC/Teaching
- A-Level
- BTEC/College Diploma
- GCSE/ O Level
- Other (please specify)

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Adoption, Use and Diffusion of Smartphones in Older Adults (50+)

5. Please indicate where you live in London

- Barnet
- Camden
- Enfield
- Haringey
- Islington
- Westminster
- Other (please specify)

6. What is your current employment status?

- Pensioner 65+
- Retired (Under 65 Years Old)
- Employed full time
- Employed part time
- Self-employed
- Own my own business
- Unemployed (for medical reasons)
- Unemployed (Redundant)
- Unemployed (for less than 6 months)
- Unemployed (for more than 6 months)
- Student (Part-time)
- Student (Full-time)

7. Please state your current occupation.
If you are of retired/pensioner status, please select the occupation you held for the majority of your working life.

- Academic/Teacher
- Agricultural/Forestry/Fishery
- Clerk
- Craft/Trade
- Freelance
- Legislator/Manager
- Plant/Machine Operator
- Services/Sales
- Student
- Other (please specify)

***8. Which of the following do you think best describes your state of health?**

- Excellent
- Good
- Poor

Adoption, Use and Diffusion of Smartphones in Older Adults (50+)

Do you have a smartphone?

A smartphone is a type of mobile handheld device. It allows you to make telephone calls, send and receive e-mail, download and use Applications (Apps), use the internet and Voice Over Internet Protocols (Skype). Examples are Apple iPhone, BlackBerry, HTC phones, Samsung Galaxy phones, Nokia N and E series or mobile phone using Android.

***9. Do you have a smartphone?**

- ○ Yes
- ○ No, I do not have a smartphone yet, but I plan to have one.
- ○ No, and I do not intend to, or plan to have a smartphone.

Adoption, Use and Diffusion of Smartphones in Older Adults (50+)

General details regarding the smartphone

***10. How long have you been using a smartphone?**

- less than 6 months
- 6 months to 1 year
- 1 year to 2 years
- 2 years to 3 years
- over 3 years

11. What is the brand of your smartphone(s)? (You may choose more than one option)

- Acer
- Alcatel
- Apple iPhone
- Asus
- Blackberry
- HTC
- Huawei
- LG
- Motorola
- Nokia
- Philips
- Samsung
- Sharp
- Sony
- Vertu
- ZTE
- Other (please specify)

12. Who is the network provider of your smartphone(s)? (You may choose more than one option)

- 3 (Three UK)
- EE
- Giffgaff
- Lebara
- O2
- Orange
- T-Mobile
- Talkmobile
- Tesco Mobile
- Virgin Media
- Vodafone
- Other (please specify)

***13. How do you pay for your smartphone?**

- Pay as you go
- Pay on a monthly basis (Contract)

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Adoption, Use and Diffusion of Smartphones in Older Adults (50+)

*** 14. How much do you pay per month for your smartphone?**

- ☐ Free - £10.00
- ☐ £10.01 - £30.00
- ☐ £30.01 - £50.00
- ☐ £50.01 - £70.00
- ☐ £70.01 - £90.00
- ☐ Over £90.01

Adoption, Use and Diffusion of Smartphones in Older Adults (50+)

Usage of the smartphone and reasons for using the smartphone

15. Please choose your usage frequency of your smartphone. Frequency ranges are between "1 (never)" to "7 (many times per day)".

Never (1)						many times per day (7)
○	○	○	○	○	○	○

***16. Please indicate to which extent you agree or disagree with the following statements. Please rate each of the provided following factors on the seven-point scale. Note: 1 is Strongly Disagree and 7 is Strongly Agree.**

	Strongly Disagree (1)	(2)	(3)	(4)	(5)	(6)	Strongly Agree (7)
1. People important to me think I should use a smartphone (For example, friends and family)	○	○	○	○	○	○	○
2. People who influence my behaviour think that I should use a smartphone	○	○	○	○	○	○	○
3. It is expected that people like me will use smartphones (For example, similar age or position people).	○	○	○	○	○	○	○
4. I want to use a smartphone because my friends do so.	○	○	○	○	○	○	○
5. I have had many opportunities to see smartphones being used.	○	○	○	○	○	○	○
6. It is easy for me to observe others using smartphones. (For example, I saw my friends use smartphones)	○	○	○	○	○	○	○
7. I believe that using the smartphone is suitable for me.	○	○	○	○	○	○	○
8. I believe that using the smartphone will fit my lifestyle.	○	○	○	○	○	○	○
9. I think that using the smartphone fits well with my lifestyle or my work.	○	○	○	○	○	○	○
10. I have the resources necessary to use the smartphone. (For example, time and money)	○	○	○	○	○	○	○
11. I have the knowledge necessary to use the smartphone.	○	○	○	○	○	○	○
12. The operation costs of a smartphone do not prevent the use of it (such as, price of a smartphone or monthly fee).	○	○	○	○	○	○	○
13. I have a person available to assist me when using my smartphone.	○	○	○	○	○	○	○
14. I feel a smartphone is useful. (eg. with my lifestyle, my daily routine and my work)	○	○	○	○	○	○	○
15. Using a smartphone enables me to finish my personal tasks or work more quickly.	○	○	○	○	○	○	○
16. Using a smartphone increases my productivity (eg. to receive or reply emails faster).	○	○	○	○	○	○	○
17. I find that using the smartphone is easy.	○	○	○	○	○	○	○
18. Learning how to use a smartphone is easy for me.	○	○	○	○	○	○	○
19. I think it is fun to use a smartphone.	○	○	○	○	○	○	○
20. I find a smartphone fun (I had fun using a smartphone).	○	○	○	○	○	○	○
21. I intend to use a smartphone as much as possible.	○	○	○	○	○	○	○
22. I intend to continue using a smartphone in the future.	○	○	○	○	○	○	○
23. Whenever possible, I intend to use a smartphone in my daily lifestyle or job.	○	○	○	○	○	○	○

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Adoption, Use and Diffusion of Smartphones in Older Adults (50+)

17. What features of a smartphone are you using? Please choose your usage frequency form each of the following. Frequency ranges are between "1 (never)" to "7 (many times per day)". If you never use the features please chose 1 as "never".

	Never (1)	(2)	(3)	(4)	(5)	(6)	many times per day (7)
1. Making a phone call	○	○	○	○	○	○	○
2. SMS, text messaging	○	○	○	○	○	○	○
3. E-mailing	○	○	○	○	○	○	○
4. Taking a photo – photography	○	○	○	○	○	○	○
5. Filming a video	○	○	○	○	○	○	○
6. Browsing – surfing website(s)	○	○	○	○	○	○	○
7. Playing games	○	○	○	○	○	○	○
8. Listening to music	○	○	○	○	○	○	○
9. Watching videos for example YouTube	○	○	○	○	○	○	○
10. Mapping, Navigator such as Google Map, TomTom, Copilot	○	○	○	○	○	○	○
11. Taking notes such as shopping lists or task that I need to do	○	○	○	○	○	○	○
12. Managing my appointment on my calendar such as doctor appointment , business appointment, or meeting with friends	○	○	○	○	○	○	○
13. Using a smartphone to downloading applications (apps)	○	○	○	○	○	○	○
14. Using Social networks such as Facebook, twitter, LinkedIn, Foursquare, Google+	○	○	○	○	○	○	○
15. Online Shopping such as eBay, Google Shopper, Groupon, Amazon Mobile, Newegg Mobile	○	○	○	○	○	○	○
16. Online Banking such as Lloydstsb Mobile Banking, NatWest Mobile Banking	○	○	○	○	○	○	○
17. Reading online News and online Magazines such as BBC, Sky News, Google Currents, Flipboard	○	○	○	○	○	○	○
18. Using Voice over IP such as Facetime, Skype, oovoo, Google Talk, Viber, Fring	○	○	○	○	○	○	○
19. Using Instant messenger services such as Blackberry Messenger, Live Messenger, iMessenger, WhatsApp	○	○	○	○	○	○	○
20. Using Password management such as Keeper, LastPass Password Mgr	○	○	○	○	○	○	○
21. Using Finance applications such as stock market applications, currency exchange market applications	○	○	○	○	○	○	○
22. Using for well-being or health such as track my exercise routine	○	○	○	○	○	○	○
23. Using for transport information- bus, train or tube checker	○	○	○	○	○	○	○
24. Using for tracking items or packages being delivered. For example, when buying clothes online.	○	○	○	○	○	○	○
25. Using to contact government authorities – NHS, Jobcentreplus, UKBA	○	○	○	○	○	○	○

Other (please specify)

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Adoption, Use and Diffusion of Smartphones in Older Adults (50+)

18. What is(are) your consideration(s) in buying a smartphone? (You may choose more than one option)

- [ ] Appearance (such as colour or material)
- [ ] Brand (such as Apple, Samsung, Nokia or Blackberry)
- [ ] Price of the smartphone
- [ ] Camera
- [ ] Operating System (such as iOS, Android or Windows8)
- [ ] Operating Speed
- [ ] Screen Size
- [ ] Screen Resolution
- [ ] Weight
- [ ] Voice Clarity
- [ ] Battery life
- [ ] Size of Memory in the phone to store files such as (photos, movies or documents)
- [ ] Quality of Applications(app)
- [ ] Price of Applications(app)
- [ ] Number of Applications(app) available in app Market

Other (please specify)

19. Where did you get information regarding the use of your smartphone? (You may choose more than one option)

- [ ] Word of mouth from friends and family
- [ ] High street stores
- [ ] Media –TV, Radio and Newspapers
- [ ] Magazines
- [ ] On-line social networks
- [ ] Professional technology review websites such as CNET.co.uk, Trustedreviews.com
- [ ] Peer technology review such as unboxing video on YouTube
- [ ] Sales person
- [ ] Other (please specify)

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Adoption, Use and Diffusion of Smartphones in Older Adults (50+)

20. How long did it take you to get comfortable or familiar with using the basic functionalities of your present smartphone? Basic functionalities are described as: Making a phone call, using the internet services, using your SMS, or using email.

- Less than a day
- 1 day - 1 week
- 1 week - 2 weeks
- 2 weeks - 1 month
- 1 month - 3 months
- More than 3 months

Adoption, Use and Diffusion of Smartphones in Older Adults (50+)

How a smartphone helped your well-being or health?

21. How has using a smartphone helped your well-being or health? (You may choose more than one option)

- [ ] It helps me seek information on health issues
- [ ] It helps me with my appointment time keeping with doctors
- [ ] It helps me manage or track my exercise routine
- [ ] It helps me manage my diet
- [ ] It helps me monitor my weight
- [ ] It helps me access health records
- [ ] It helps me manage my moods
- [ ] It helps me manage prescriptions
- [ ] It helps me monitor blood pressure
- [ ] It helps me check nearby pollen levels
- [ ] It helps me control my cigarette smoking
- [ ] Smartphone does not help me with my well-being or health
- [ ] Other (please specify)

Adoption, Use and Diffusion of Smartphones in Older Adults (50+)

How a smartphone helped brings your friends and family closer to you?

22. How has a smartphone helped bring your friends and family closer to you? (You may choose more than one option)

- ☐ Making phone calls to my friends and family
- ☐ Emailing my friends and family using my smartphone
- ☐ Sharing photos taken from my smartphone
- ☐ Sharing videos with from my smartphone
- ☐ Sending instant messages such as Blackberry Messenger, WhatsApp, Line, Facebook messenger
- ☐ Using video telephony software applications such as Facetime, Tango or Skype
- ☐ Following friends' and family's activities using social media such as Facebook, Google+ on my smartphone
- ☐ I do not use a smartphone to contact with my friends or family
- ☐ Other (please specify)

Adoption, Use and Diffusion of Smartphones in Older Adults (50+)

I do plan to get a smartphone

23. What are the reasons for why you plan to use a smartphone

- ☐ I will get an upgrade from my provider.
- ☐ I want to have a handy device that can do many things such as making a telephone call, taking a photograph, filming, and surfing the internet.
- ☐ Most of my friends have used smartphones, and have convinced me to get one.
- ☐ I want to use a smartphone to contact my friends or family.
- ☐ My new job or new position requires me to use a smartphone.
- ☐ I want to use a smartphone to help with my well-being or health.
- ☐ I travel a lot and the smartphone will help me on my travels.
- ☐ My new smartphone will help me with my memory.
- ☐ My new smartphone will have a bigger screen which is easy for me to see and use.
- ☐ Other (please specify)

24. What is (are) your consideration(s) when buying a smartphone? (You may choose more than one option)

- ☐ Appearance (such as colour or material)
- ☐ Brand (such as Apple, Samsung, Nokia or Blackberry)
- ☐ Price of the smartphone
- ☐ Camera
- ☐ Operation System (Such as iOS, Android or Windows Mobile)
- ☐ Operating Speed
- ☐ Screen Size
- ☐ Screen Resolution
- ☐ Weight
- ☐ Voice Clarity
- ☐ Battery life
- ☐ Size of Memory in the phone to store files such as (Phones, movies or documents)
- ☐ Quality of Applications (apps)
- ☐ Price of Applications (apps)
- ☐ Number of Applications (apps) available in the app Market
- ☐ Other (please specify)

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Adoption, Use and Diffusion of Smartphones in Older Adults (50+)

25. Where do you get information regarding use of your smartphone? (You may choose more than one option)

- ☐ Word of mouth by friends and family
- ☐ High street stores
- ☐ Media –TV, Radio and Newspapers
- ☐ Magazines
- ☐ On-line social network
- ☐ Professional technology review website such as CNET.co.uk, Trustedreviews.com
- ☐ Peer technology review such as unboxing video on YouTube
- ☐ Sales person
- ☐ Other (please specify)

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Adoption, Use and Diffusion of Smartphones in Older Adults (50+)

I do not plan to get a smartphone

26. What is/are the reasons/s for not getting a smartphone? (You may choose more than one option)

- ☐ I am too old for a smartphone
- ☐ It is too much of an effort to use a smartphone
- ☐ A smartphone is too complicated and difficult to use.
- ☐ I do not think a smartphone is useful.
- ☐ Physical discomfort or accessibility problems
- ☐ The cost of using a smartphone – I do not want to spend a lot of money when using a smartphone.
- ☐ I want peace and quiet after my working hours
- ☐ I do not feel comfortable using small screens and tiny keyboards.
- ☐ I do not know much about how to use a smartphone.
- ☐ I have other devices such as a laptop or a netbook that can function as well, or better than a smartphone.
- ☐ Using a smartphone does not fit with my lifestyle.
- ☐ Other (please specify)

27. Factors that may encourage future use of a smartphone.

- ☐ Nothing/ will never use a smartphone in the future
- ☐ Free training
- ☐ Reduce cost of a smartphone
- ☐ Reduce cost of month contract
- ☐ Other (please specify)

Adoption, Use and Diffusion of Smartphones in Older Adults (50+)

Thank you

Thank you very much for your valuable time, co-operation and patience in completing this questionnaire! If you have any questions, comments, suggestions or would like to find out about the results of this research, please do not hesitate in getting in touch with us at:

Mr. Sutee Pheeraphuttharangkoon
PhD. Student of University of Hertfordshire
University of Hertfordshire
Business School
System Management Research Unit (SyMRU)
DeHavilland campus
Hatfield Herts
AL10 9EU
Email: lonphd@gmail.com

Dr. Jyoti Choudrie
Reader of Information Systems
University of Hertfordshire
Business School
System Management Research Unit (SyMRU)
DeHavilland campus
Hatfield Herts
AL10 9EU
Email: j.choudrie@herts.ac.uk
Telephone: (01707) 281271. Fax:01707 285410

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5-2 Final Survey Cover Letter

Silver Surfer and Smartphones in UK

Dear Sir/Madam,

We would like to seek your co-operation in completing this survey, which is part of an important research project being conducted at University of Hertfordshire's Systems Management Research Unit (SyMRU), Business School.

The purpose of this research is to identify and explain how people in UK use and spread the use of smart phones. The ethical number is BS/R/033 10.

For your information, this questionnaire includes a number of questions that should take approximately 5 minutes to complete. Please check (tick) all appropriate answers. if your answer is not displayed, could you please kindly state your answer in the "Other" option category. You may omit any questions that you do not wish to answer.

Also, please be assured that none of the information you provide will be disclosed. If you have any questions regarding this study, please feel free to contact the investigating team responsible for this project at the following address:

Mr. Sutee Pheeraphuttharangkoon	Dr. Jyoti Choudrie
University of Hertfordshire	Reader, Information Systems
Director, SyMRU	University of Hertfordshire
Business School	Director, SyMRU
DeHavilland campus	Business School, DeHavilland campus
Hatfield Herts	Hatfield Herts
AL10 9EU	AL10 9EU
Email: supibee@gmail.com	Email: j.choudrie@herts.ac.uk; jyotichoudrie@gmail.com
Mobile: 07828 696614	Telephone: (01707) 281271 Fax: 01707 285410.
	Mobile: 07950 481708

We would like to take the opportunity to thank you for your time and patience in completing this questionnaire!

5-3 Final Survey Closing Page

Silver Surfer and Smartphones in UK

Thank you

Thank you very much for your valuable time, co-operation and patience in completing this questionnaire! If you have any questions, comments, suggestions or would like to find out about the results of this research, please do not hesitate in getting in touch with us at:

Mr. Sutee Pheeraphuttharangkoon	Dr. Jyoti Choudrie
PhD. Student of University of Hertfordshire	Reader of Information Systems
University of Hertfordshire	University of Hertfordshire
Business School	Business School
System Management Research Unit (SyMRU)	System Management Research Unit (SyMRU)
DeHavilland campus	DeHavilland campus
Hatfield Herts	Hatfield Herts
AL10 9EU	AL10 9EU
Email: supibee@gmail.com	Email: j.choudrie@herts.ac.uk; jyotichoudrie@gmail.com
Mobile: 07828 696614	Telephone: (01707) 281271. Fax:01707 285410

5-4 Ethics Form

Please complete this form by 'tabbing' your way through each answer box using a word processor. Save a copy of the completed form entitled as follows - 'Family Name, Ethics'. Return the completed form as per instructions

University of Hertfordshire

Business School

For official use only
Protocol Number
Date emailed to student

Where any research involves the use of human subjects there is always the possibility that the subjects may be exposed to procedures, which may be harmful to them. These possibilities might include; exploitation, physical harm, emotional harm or intrusion of their privacy. The University must ensure that these possibilities do not occur. This application form enables the Ethics Committee to monitor your research so that it complies with the University of Hertfordshire ethical protocols.

It is important to note that you should not proceed with your research without clearance from the University. The assignment for which the research is carried out will not be processed for examination without Ethics Committee approval.

Your application for ethical approval should be completed as early as is practicable whereupon you will be supplied with a protocol number or referred to your supervisor. The above is an abridged version of the University's regulations regarding "…studies involving the use of human subjects". Please refer to UPR AS/A/2 for a full explanation.

SECTION A. THIS SECTION SHOULD BE COMPLETED BY ALL APPICANTS.

A1 DETAILS

Name of Applicant: Mr. Sutee Pheeraphuttharangkoon

Student Number (if appropriate): 5129573

UH Email address: s.pheeraphuttharangkoon@herts.ac.uk

(Note: we will only correspond with you on a UH email address)

Programme (if appropriate): PhD

Name of Academic Supervisor: Dr. Jyoti Choudrie

Proposed research title: To Evaluate the diffusion of smartphones within silver-surfers

Reasons for research **Doctoral Thesis**

If other please explain

A2 STATUS OF APPLICATION – tick as appropriate:

First application for Ethics approval	Yes
Referred application	**No**
Revised application when research approach changes *Minor changes need to be notified, but the same Ethics number will usually apply. Major changes of approach or academic focus will result in the issuing of a new Ethics number*	

Last Amended 31-01-11 1

A3 PRIMARY OR SECONDARY RESEARCH?
Primary research involves gathering new information from interviews, observation or questionnaires. This includes research done face-to-face, by telephone or email. *Secondary research* involves using publicly available information that has already been collected by other people, organisations or academics.

Is your research to be based solely on secondary information? No

Even if secondary research only is being proposed, students will still need to obtain an Ethics number in order to submit their dissertations

If the answer to A3 above is YES, proceed to SECTION C. and certify the declaration. If the answer is NO, complete the rest of the application, and then certify the declaration.

Note*:* If you are a student on the DMan programme, intend doing action research or research that involves participant observation then Ethics Form B should be completed. This can be obtained from Ruth Grillo in the administration office (r.grillo@herts.ac.uk).

SECTION B: ONLY COMPLETE THIS SECTION IF YOU ARE CONDUCTING PRIMARY RESEARCH

B1 DESCRIPTION OF STUDY

Briefly describe the study:

We need a short overview (approximately 150 words) of the subject area in order to put the proposed methodology into context. This should be available from the proposal already submitted.

If your research is addressing any contentious issues which may disturb or distress informants, then you must provide (in this form) details of relevant support organisations or individuals who can provide counselling if required: so, for example, research into such topics as gambling or drinking would need this kind of backup, referring to Alcoholics or Gamblers Anonymous.

Any research into health issues – including stress in the workplace - must be handled extremely carefully and any potential research focusing on these areas must prepare a very detailed proposal for consideration by the Ethics Committee.

Please note that researchers should not accept contractual conditions that are contingent upon a particular outcome from a proposed inquiry

A smart phone is innovative technology that allows users to work anywhere wirelessly. However, it is difficult to determine when and how an organisation has adopted and used the innovative ICT amongst silver-surfer entrepreneurs. This sample population has been selected as it is a gropu that creates wealth and holds immense wealth of the economy and is one that has not grown up and used computers increasingly. For this research, there are 2 main aims: The initial aim is to examine early and later adopters of smartphones. Then, this research will examine the factors leading to the adoption and how Small Enterprises within the SME sector in UK are adopting and using the innovative ICT. For these aims to be fulfilled, both a qualitative and quantitative approach involving interviews, focus groups, online questionnaires will be pursued. By doing so, the reearch intends to contribute to academia by providing a unique insght to a topic that is of immense interest. For industry such research will idenitfy and explain to organsiations the requirments and needs of such a group.

B2 INFORMED CONSENT
This is a process whereby a participant voluntarily agrees to willingly participate in a piece of research once they have been fully informed of what it entails and its purpose. The Applicants should give details of the purpose of the research and how long an interview/ questionnaire will take. Further, the participant should be assured of anonymity and informed that they can withdraw at any time. These details can be given by letter. In the case of questionnaires, telephone interviews or focus groups a verbal explanation can be given, but MUST be supported by written information about the project that is offered to participants. A respondent information sheet must be provided to all respondents, giving them clear information about the research and the need for their consent to be given, and a copy of this sheet included in an appendix in the final report. Written information must be available for participants in research via the internet. Additional Guidelines for Ethics includes a specimen letter that should be used. Hard copy may be used or an electronic attachment in the case of email surveys.

B2 (i) APPLICANTS DECLARATION

I confirm that I have read and understand the instructions above on informed consent. **Yes**

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I agree that written information will be available for all participants and that verbal or written consent will be obtained from all participants

Yes

I agree that this written permission MUST BE included in the final copy of the report

Yes

B3 PARTICIPANTS: SELECTION AND APPROACH

B3 (i) Complete the table:

Method	Proposed Sample Size?	*Issues to think about:*
Paper / Postal Questionnaires	1100	*How will you make contact?*
Face to face interviews / questionnaires	200	*How will you make contact?*
Telephone Interviews	200	*How will you obtain the required telephone numbers? Who, precisely, will you want to speak to?*
Focus groups	500	*How many groups and how many in each group? How will you recruit people? Where will the focus groups be held?*
Email	1100	*How will you get email addresses? Check that if all informants are emailed out then names are ONLY included in a blind CC listing*
Web based / On line Questionnaires	1100	*How will you ensure an appropriate sample?*
Other	0	

If other please explain:	Using social networks such as, Facebook, Twitter, LinkedIn to identify organisations and individuals who can assist with this research.

Please note that you are ***not required*** *to use all of these methodological approaches – you need to discuss with your supervisor and select that approach/s which will be most appropriate to your research. Think carefully here about such issues as: how many questionnaires constitute viable research? How easy will it be to identify informants? How will you obtain email addresses/telephone numbers? Do not assume that people or organisations will hand over customer lists or be willing to see you at your convenience!*

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B3 (ii) How will your respondent(s)be selected?

	Delete the answer not applicable
Family/ friends	Yes
Students at UH*	No
Other (Please give full details of who your respondents will be and how they will be selected. For example, how will you get email addresses or where will you put the online survey?)	The sample groups are silver-surfers entrepreneurs in UK. The link to a survey is expected to be posted on social network sites, eg. Facebook. Moreover, the researcher will use a snowball method. This will begin by identifying a companies, associations and personal network and extending it from there.

If using family and friends then this is specific enough BUT if you say, for example, 'Respondents in Shanghai' then we need information on precisely who will be targeted, how they will be identified, and how you will get their addresses/email addresses/contact details

Please note that applications will be rejected which claim to use family and friends for informants when this group is clearly inappropriate to the research area identified.

Research such as giving out questionnaires can be carried out in town centres and high streets, although the Ethics form should give some indication of precisely where and when the research will take place. This approval DOES NOT include research in shopping centres, as for this you need the permission of the Management of the Centre.

B3 (iii) If you are carrying out primary data collection, where will this research take place?

	Delete the answer not applicable
At your home/ student accommodation	Yes
At UH (but not in the LRC)*	Yes
Other **(Please give full details)**	Online, Participants' places
Will it be necessary to get the permission of the owner/manager? (i.e in the case of shopping malls) *If you are carrying out research within an organisation's building then you MUST get written permission even if the owner/manager is a friend or relative and this should go into into an appendix in the final report*	Yes. Any organisation or location, eg. trade fairs and conferences that I identify as likely targets, I will seek permission beforehand from management and then conduct my research.

Note: * Informants are not to be recruited in the LRC, although you may of course book a room in the LRC to conduct interviews or questionnaires with informants recruited elsewhere.

Please note that sections B3(ii) and B3(iii) should reflect section B3(i) – if you have selected more than one methodology then it should be clear how informants will be selected in each case, and where the research will take place.

B4 RESEARCH IN ORGANISATIONS

B4 (i) Do you intend conducting research in: private firms, public sector organisations, charities or NGOs? Yes *If yes, you MUST complete B4(ii)*

If NO, proceed to B5

B4 (ii) If known, give the name of the organisation(s) in which you will be conducting your research.

Finchley and Frognal, Nour London Ltd., Very thai commnumity, Thai Trade Centre London. I already have associations with the Thai Embassy and will seek permission using the links that I have already established.

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B4 (iii) If the organisation(s) in which you will be conducting your research is not yet known please explain how you will find and select your sample.

The researcher expects to use the connections from the above named organizations and any other links that I have established through the years in order to acquire the sample.

Be careful about research that involves assessing individual's work within an organisation: this can present problems, as they can worry that results can be fed back to their employers or that it may affect their standing.

APPLICANTS DECLARATIONS

B4 (iv) I agree to get written permission from an appropriate senior manager if I intend collecting data from employees in any organisation. Yes

Written permission MUST be obtained even if the owner/manager/director of the company is a friend or relative and this written permission MUST be included as an appendix in your final report.

B4 (v) I agree that it will be made clear to employees in an organisation that their participation is voluntary. Yes

B5 MINORS AND VULNERABLE GROUPS

You are advised not to include minors (under 18 years) and/or members of other vulnerable groups in your research.

A clear definition of vulnerable groups is difficult: minors are an obvious example, but in some cases groups are vulnerable because of their situation, not because they are vulnerable per se. So, for example, migrant workers, not in their home countries, would be vulnerable; workers who are possibly in a country illegally would be vulnerable; people living in one country, who are encouraged to express political or social views at odds with their home government, could be vulnerable.

There may also be a problem with possible coercion. So, for example, if one of your family members runs an organisation, including their employees in the research must be very carefully handled as they may perceive that they are being coerced or pressured to take part, and will then provide answers which they think the researcher/manager wants to hear.

ANYTHING TO DO WITH RESEARCHING STRESS OR THE HEALTH SERVICE IS VERY DIFFICULT AND WILL ONLY BE APPROVED WITH EXTREME CAUTION! Any Health Service research involving patients also has to submit a separate ethics application to be dealt with by the National Research Ethics Committee

We appreciate that some of the sensitivities we have outlined may be less important in other countries, and that different ethical standards and codes of behaviour apply. Nonetheless, you are carrying out research as a student of the University of Hertfordshire and, as such, your research must abide by the ethical guidelines set out by the University.

If your research involves participant observation then you must abide by the guidelines set out by the University.
Please see the following web site for detailed guidance.

http://sitem.herts.ac.uk/secreg/upr/RE01.htm

Do you intend including minors and/or member of other vulnerable groups? No

Please be aware that if the answer is YES you will be required to present a justification report to the Ethics Committee. Your supervisor may be asked to attend for that item of business.

Do you intend to use participant observation? : No

If yes, do you agree to abide by the university guidelines? Yes

Last Amended 31-01-11 5

B6 ANONYMITY

The anonymity of Respondents anonymity must be preserved. This involves not only withholding their names and addresses, but also other information provided by or about them which could in practice identify them (for example, their company and job title) must be safeguarded.

Do you agree to preserve the anonymity of participants both individuals and organisations?
Yes

Even if informants appear happy for their identity to be known, you should still ensure anonymity

If the answer is NO, discuss with your supervisor and detail reasons:

B7 ACCESS TO DATA

I agree that access to the data gathered and final report will only be made available to the University, participants, participating organisation(s) or client(s).

Yes

I understand that information gathered or the final report should only be used for academic purposes and should not be used for commercial purposes without the express permission of the client or your academic supervisor.

Yes

B8 CONFIDENTIALITY

Your research will be confidential in exceptional circumstances. Some firms or organisations may make this a precondition of allowing access. Research that is confidential will contain sensitive information which will mean that there can be only limited access to the results. This must be discussed with your supervisor.

Confidentiality should not be confused with anonymity.

The rights of facilitators or sponsors to be consulted before publication should be respected.

Can you confirm that your research will <u>not</u> be considered confidential as defined above?
Yes

If NO, please detail the reasons. This MUST be discussed in detail with your supervisor and may delay allocation of an Ethics number

B9 STUDIES UNDERTAKEN WITHOUT AN APPROVED PROTOCOL

UPR AS/A12 states that;

'Any employee of the University who acts in contravention of these regulations will normally be subject to the University's disciplinary procedures. Any student acting in contravention of these regulations may be penalised by having his or her programmes of study declared invalid and may not be permitted to graduate or may have his or her award revoked'.

I have read the UPR above and understand the implications of undertaking studies without approved protocol. Yes Date: 1/5/2011

SECTION C. SIGNATURES AND DECLARATIONS (THIS SECTION SHOULD BE COMPLETED BY ALL APPLICANTS)

C1 APPLICANT'S DECLARATIONS

I understand that my research should not proceed until my application has been approved and a protocol number received Yes Date: 1/5/2011

I undertake to inform my supervisor at every stage of the research and to gain approval for each part of the research process (introductory letter/ questionnaire /interview design) and that I have read and will abide by the ethical guidelines of the University of Hertfordshire. Yes Date: 1/5/2011

I understand that Ethics protocol is given for a specific research project and methodology as detailed in this Ethics Form and that if I want to change my project or methodology then a reapplication for Ethics protocol must be made. Yes Date: 1/5/2011

Students or employees failing to get new approval may be subject to the procedures in UPR AS/A12 (see B9).

C2 HOST ORGANISATION SUPERVISOR'S DECLARATION (MAINLY APPLICABLE FOR PLACEMENT STUDENTS).

Name of host organisation supervisor:

Position:

Signature (or attach an email):

NOW RETURN THE FORM AS PER INSTRUCTIONS.

PLEASE NOTE: The Ethics Committee are concerned with ensuring that your proposed research meets university-required ethical standards. This approval does NOT imply that your methodology is appropriate or suitable for the proposed research.

C3 ETHICS COMMITTEE DECISION (PLEASE CIRCLE)

- Accepted
- Accepted with conditions (see below)
- Referred (see below)

Signed on behalf of the Ethics Committee: Date:

C3 (i) ETHICS COMMITTEE COMMENTS

C3 (ii) The applicant has read and accepted the conditions as laid out above:

Signature: Date:

Last Amended 31-01-11 7

5-5 Ethics Approved Confirmed

From: Grillo, Ruth E [mailto:r.grillo@herts.ac.uk]
Sent: Wednesday, May 18, 2011 10:42 AM
To: s.pheeraphuttharangkoon@herts.ac.uk
Cc: Choudrie, Jyoti
Subject: Ethics application

Dear Sutee

Your ethics application for your PhD has been approved and you protocol number is BS/R/033 10.

Ruth Grillo
Deputy Faculty Registrar
Business School
De havilland Campus
Direct Line: 01707 285516
Fax: 01707 285556

2010
THE AWARDS
AWARD WINNER

The University of Hertfordshire was awarded 'Entrepreneurial University of the Year 2010' by the Times Higher Education.

The University is the UK's leading business-facing University and an exemplar in the sector. It is innovative and enterprising and challenges individuals and organisations to excel. The University of Hertfordshire is one of the region's largest employers with over 2,600 staff and a turnover of almost £235 million. With a student community of over 27,500 including more than 2,000 international students from over eighty five different countries, the University has a global network of over 200,000 alumni. For more information, please visit www.herts.ac.uk

5-6 Final Survey Sampling List

0	Agar Town	41	Dartmouth Park	82	Kensal Green	123	Seven Sisters
1	Aldwych	42	Dollis Hill	83	Kentish Town	124	Soho
2	Alperton	43	East Barnet	84	Kenton	125	Somers Town
3	Angel	44	East Finchley	85	Kilburn	126	South Hampstead
4	Archway	45	Edgware	86	Kings Cross	127	South Tottenham
5	Arkley	46	Edmonton	87	Kingsbury	128	Southgate
6	Arnos Grove	47	Enfield Chase	88	Knightsbridge	129	St Ann's
7	Barnet	48	Enfield High way	89	Lisson Grove	130	St James's
8	Barnet Gate	49	Enfield Island Village	90	Little Russia	131	St John's Wood
9	Barnsbury	50	Enfield Lock	91	Lower Holloway	132	St Luke's
10	Bayswater	51	Enfield Town	92	Maida Vale	133	St Pancras
11	Belgravia	52	Enfield Wash	93	Marylebone	134	St. Giles
12	Belsize Park	53	Farringdon	94	Mayfair	135	Stonebridge
13	Bloomsbury	54	Finchley	95	Mildmay	136	Stroud Green
14	Botany Bay	55	Finsbury	96	Mill Hill	137	Sudbury
15	Bounds Green	56	Finsbury Park	97	Millbank	138	Swiss Cottage
16	Bowes Park	57	Fitzrovia	98	Monken Hadley	139	Temple Fortune
17	Brent Cross	58	Fortis Green	99	Muswell Hill	140	The Hale
18	Brent Park	59	Fortune Green	100	Nag's Head	141	The Hyde
19	Brimsdown	60	Forty Hill	101	Neasden	142	Tokyngton
20	Broadwater Farm	61	Freezywater	102	New Barnet	143	Tottenham
21	Brondesbur y	62	Friern Barnet	103	New Southgate	144	Tottenham Hale
22	Brondesbur y Park	63	Frognal	104	Newington Green	145	Totteridge
23	Brunswick Park	64	Golders Green	105	Noel Park	146	Tufnell Park
24	Bulls Cross	65	Gospel Oak	106	North Finchley	147	Upper Holloway
25	Burnt Oak	66	Grahame Park	107	North Wembley	148	Victoria
26	Bush Hill Park	67	Grange Park	108	Northumberla nd Park	149	Wembley
27	Camden Town	68	Hadley Wood	109	Oakleigh Park	150	Wembley Park
28	Canonbury	69	Hampstead	110	Oakwood	151	West End of London

29	Chalk Farm	70	Hampstead Garden Suburb	111	Osidge	152	West Green
30	Childs Hill	71	Harlesden	112	Paddington	153	West Hampstead
31	Church End	72	Harringay	113	Paddington Green	154	West Hendon
32	Clay Hill	73	Haverstock	114	Palmers Green	155	Westbourne Green
33	Clerkenwell	74	Hendon	115	Park Royal	156	Westminster
34	Cockfosters	75	Highbury	116	Pentonville	157	Whetstone
35	Colindale	76	Highgate	117	Pimlico	158	Willesden
36	Colney Hatch	77	Holborn	118	Ponders End	159	Willesden Green
37	Covent Garden	78	Holloway	119	Preston	160	Winchmore Hill
38	Crews Hill	79	Hornsey	120	Primrose Hill	161	Wood Green
39	Cricklewoo d	80	Hyde Park	121	Queen’s Park	162	Woodside Park
40	Crouch End	81	Islington	122	Queensbury	163	World’s End

5-7 Final Survey Invitation Letter

University of Hertfordshire
Systems Management Research Unit (SyMRU)
Business School
Hatfield
Hertfordshire AL10 9EU

Your household has been randomly chosen by the University of Hertfordshire to participate in an important research project.

This research project is being conducted by Sutee Pheeraphuttharangkoon, a research student, Dr. Jyoti Choudrie, Reader in Information System (IS) and Dr. Marija Cubric, Reader in e-learning and principal lecturer at the University of Hertfordshire Business School located at De Havilland Campus. Hatfield, Hertfordshire AL10 9 EU.

The University of Hertfordshire kindly requests members of your household **AGED 50 YEARS OR ABOVE** for 10 minutes of their time to complete a multiple-choice online survey regarding Smartphones. We do not ask for any personal or private household information. Please be assured that any information you provide will be used for academic research purposes only.

As the UK's 50+ population is increasing significantly, the aim of this research project is to obtain the views and opinions of the UK's 50+ population in order to understand how and why they **use or not use** Smartphones. This researcher is seeking to explore how to assist older people and improve their quality of life. Therefore, we ask you and your household member age 50+ to PLEASE give 10 minutes of your valuable time for this important research.

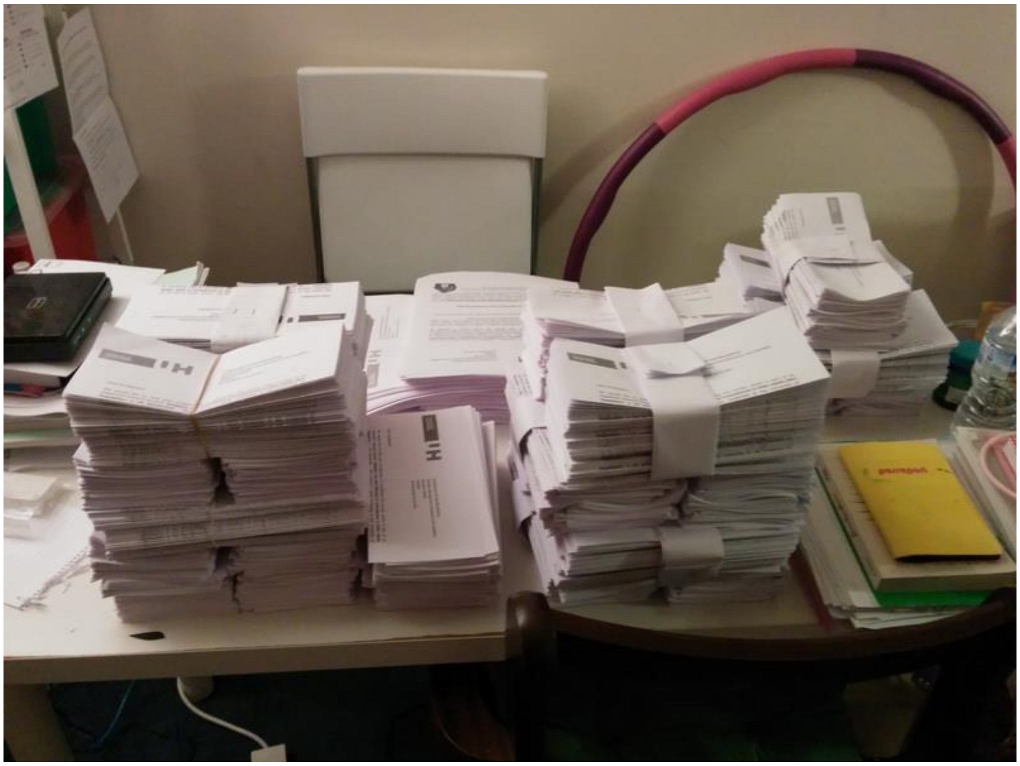
The online survey can be accessed from all computers, laptops, iPads, and smartphones at the following website address:

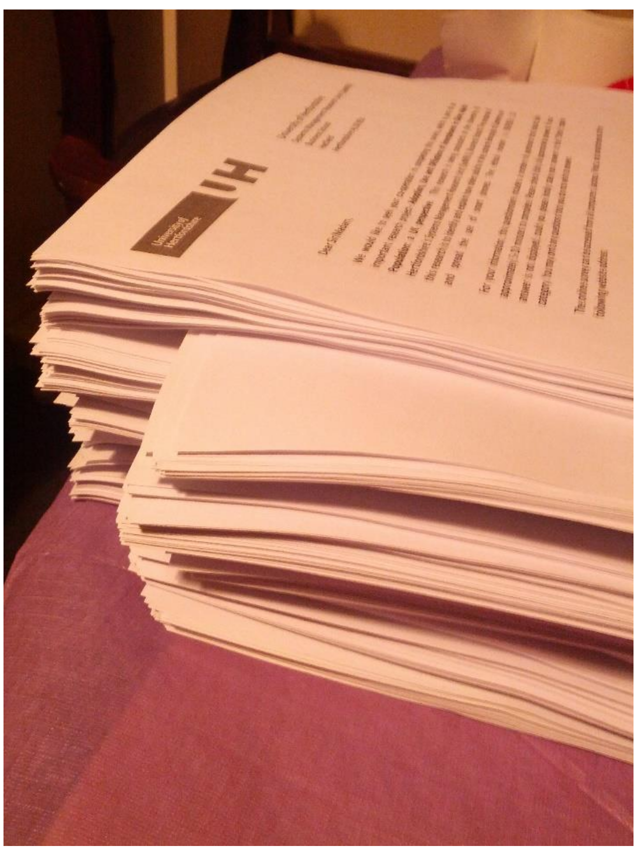
www.surveymonkey.com/r/smartphonelondon

The research team at the University of Hertfordshire would like to take this opportunity to thank you in advance for your time, patience and co-operation. Survey participants are welcome to enquire about the outcomes of this research project by email one of the researchers (contact details below).

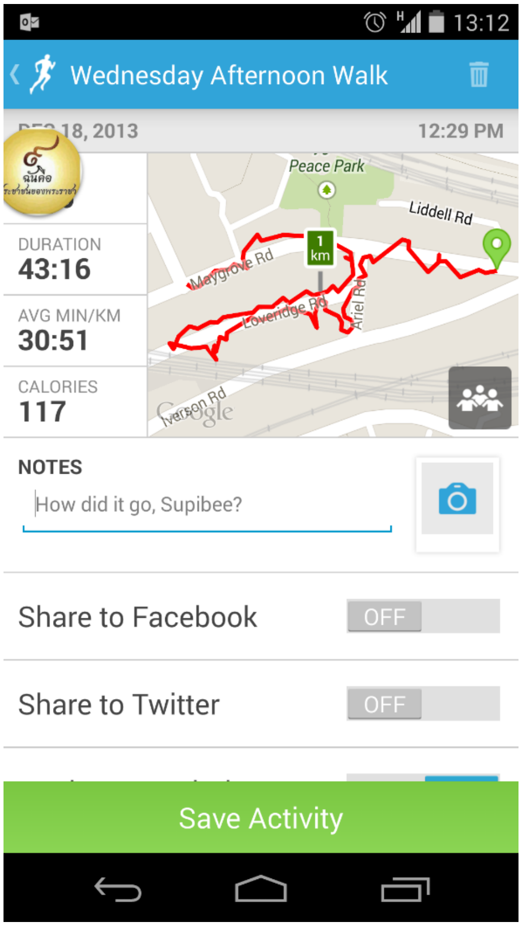
If you have any questions about this research, please contact the principal researcher: Mr Sutee Pheeraphuttharangkoon, research student, De Havilland campus, Hatfield, Herts, AL10 9AB Email: s.pheeraphuttharangkoon@herts.ac.uk All responses are anonymous. The information you provide will be reported only in aggregate terms, without any information identifying specific individuals. UH Ethics Protocol No. BS/R/033 10.

5-8 Final Survey Invitation Letters (Photo)





5-9 Survey Distribute Track



5-10 Process of Finding Moderated Variable

To find moderator variable, the long process need to be completed. First of all data was divide regarding to the moderator variables. In this case this research consider age, gender, health, education, experience and area. Therefore, SmartPLS need to be used to analyse 25 sub data. Such as male, female, Higher Degree, and First Degree. The table below are Path coefficients (β) for each cases to see the overall details. The raw results from SmartPLS are in Appendix 5-11.

Health			
Hypothesis	Poor	Good	Excellent
OBS->INT	0.029	-0.013	-0.043
COM->INT	0.365	0.271	0.149
SOC->INT	-0.087	0.001	-0.025
FC->INT	0.064	0.119	-0.001
PE->INT	0.109	0.191	0.419
EE->INT	0.078	0.080	0.065
ENJ->INT	0.404	0.373	0.410
INT->ACU	0.611	0.410	0.479

Education						
Hypothesis	Higher Degree	First Degree	HND	Diploma	A Level	O Level
OBS->INT	0.003	0.014	-0.132	-0.071	-0.026	-0.033
COM->INT	0.125	0.414	0.412	0.263	0.202	0.170
SOC->INT	0.019	-0.034	0.081	-0.034	-0.010	-0.026
FC->INT	0.200	-0.148	0.280	0.214	0.201	0.156
PE->INT	0.390	0.212	0.266	0.128	0.281	0.295
EE->INT	0.090	0.058	-0.014	0.146	-0.022	0.091

ENJ->INT	0.172	0.434	0.160	0.374	0.349	0.354
INT->ACU	0.542	0.516	0.374	0.540	0.385	0.378

Gender		
Hypothesis	Male	Female
OBS->INT	-0.056	0.029
COM->INT	0.242	0.257
SOC->INT	-0.014	-0.027
FC->INT	0.093	0.085
PE->INT	0.223	0.252
EE->INT	0.070	0.095
ENJ->INT	0.412	0.339
INT->ACU	0.431	0.485

Age			
Hypothesis	50-59	60-69	70-79
OBS->INT	-0.010	-0.022	-0.006
COM->INT	0.284	0.216	0.156
SOC->INT	-0.010	-0.048	0.089
FC->INT	0.088	0.062	-0.071
PE->INT	0.228	0.226	0.146
EE->INT	0.105	0.087	-0.062
ENJ->INT	0.342	0.449	0.635
INT->ACU	0.455	0.439	0.288

Area in North London							
Hypothesis	Barnet	Brent	Camden	Enfield	Haringey	Islington	Westminster
OBS->INT	-0.026	-0.120	-0.013	0.024	-0.037	0.033	-0.110
COM->INT	0.493	0.136	0.048	0.284	0.446	0.135	0.258
SOC->INT	-0.021	0.023	-0.005	-0.027	0.014	-0.128	-0.006
FC->INT	0.081	0.124	0.146	0.150	0.101	0.059	0.117
PE->INT	0.066	0.259	0.308	0.171	0.118	0.412	0.167
EE->INT	-0.121	0.156	0.209	0.116	0.014	0.003	0.154
ENJ->INT	0.477	0.412	0.291	0.323	0.399	0.463	0.376
INT->ACU	0.411	0.502	0.335	0.619	0.547	0.537	0.281

Experience				
Hypothesis	Less than 1 year	1-2 years	2-3 years	More than 3 years
OBS->INT	-0.141	0.015	0.112	-0.004
COM->INT	0.112	0.338	0.065	0.359
SOC->INT	0.003	0.013	-0.046	-0.028
FC->INT	0.198	0.032	0.055	0.066
PE->INT	0.328	0.178	0.264	0.190
EE->INT	0.076	0.124	0.025	0.077

ENJ->INT	0.366	0.368	0.534	0.350
INT->ACU	0.557	0.448	0.468	0.231

In some cases we can identify by our eyes. However, we need to provide the solid evident and numbers to show the significant in terms of statistic. Unfortunately SmartPLS version 2 is not support finding moderator variables. Please note that new SmartPLS version 3 supports this feature. The useful YouTube is https://www.youtube.com/watch?v=-BI8VweLQPc . The example of calculating moderator variable are from Lowry and Gaskin (2014) and using formula from Chin (2000). The formula to calculate t-value between two subgroups is shown below.

$$t = \frac{Path_{sample\_1} - Path_{sample\_2}}{\left[\sqrt{\frac{(m-1)^2}{(m+n-2)} * S.E.^2_{sample1} + \frac{(n-1)^2}{(m+n-2)} * S.E.^2_{sample2}}\right] * \left[\sqrt{\frac{1}{m} + \frac{1}{n}}\right]}$$

Where

M = number of response in case 1 such as number of female

N = number of responses in case 2 such as number of male

Path sample1 = Mean of case 1 or Regression Weight which similar to Path coefficients of case 1

Path sample2 = Mean of case 2 or Regression Weight which similar to Path coefficients or case 2

S.E. = Standard Error. Or STERR

Chin (2000) provided Excel file attached to this email to calculate, Stats Tools Package.xlsm.

Mean and STERR are from Bootstrapping analyse which the results are in PLS results ALL.docx file. The below tables are from the formula to calculate t-value and p-value.

For example, Mean and STERR from Male, blue colour, and Mean and STERR from Female, yellow colour, was bought to the excel file to calculate T-value and P-value, red colour. The t-value more than approximately 1.96 is significant.

Moderating Model- Gender

Hypothesis	Male (n=382)				Female(n=320)				Compare	
	β	t-value	Mean	STERR	β	t-value	Mean	STERR	t-value	p-value
OBS->INT	-0.056	1.488	-0.055	0.0377	0.029	0.672	0.0287	0.0429	1.473	0.141
COM->INT	0.242	3.803	0.2455	0.0636	0.257	3.595	0.2593	0.0715	0.145	0.885
SOC->INT	-0.014	0.426	-0.0141	0.032	-0.027	0.911	-0.0238	0.0293	0.220	0.826
FC->INT	0.093	1.467	0.0947	0.0632	0.085	1.418	0.079	0.0598	0.178	0.858
PE->INT	0.223	3.691	0.2205	0.0604	0.252	5.268	0.2537	0.0478	0.420	0.675
EE->INT	0.070	1.490	0.0686	0.0473	0.095	1.993	0.0938	0.0476	0.373	0.709
ENJ->INT	0.412	8.730	0.4115	0.0472	0.339	6.169	0.3393	0.0549	1.004	0.316
INT->ACU	0.431	8.396	0.4296	0.0514	0.485	8.802	0.4834	0.0551	0.714	0.476

Moderating Model- Health										
	Poor(n=82)				Good-Excellent(n=620)				Compare	
Hypothesis	β	t-value	Mean	STERR	β	t-value	Mean	STERR	t-value	p-value
OBS->INT	0.029	0.311	0.0335	0.0934	-0.015	0.535	-0.0145	0.0275	0.580	0.562
COM->INT	0.365	2.695	0.3596	0.1353	0.241	4.842	0.2413	0.0497	0.816	0.415
SOC->INT	-0.087	1.439	-0.0835	0.0601	-0.013	0.553	-0.012	0.0239	1.034	0.302
FC->INT	0.064	0.399	0.0541	0.1607	0.089	2.042	0.089	0.0437	0.262	0.794
PE->INT	0.109	0.678	0.1259	0.1613	0.244	5.867	0.2443	0.0417	0.921	0.357
EE->INT	0.078	0.931	0.0686	0.0839	0.085	2.293	0.0835	0.0371	0.140	0.889
ENJ->INT	0.404	4.010	0.4073	0.1008	0.380	10.010	0.3798	0.0379	0.249	0.803
INT->ACU	0.611	6.476	0.6121	0.0943	0.427	10.828	0.4263	0.0395	1.633	0.103

Moderating Model-Experience on using smartphones										
	Less than 2 years (n=238)				More than 2 years (n=464)				Compare	
Hypothesis	β	t-value	Mean	STERR	β	t-value	Mean	STERR	t-value	p-value
OBS->INT	-0.057	1.262	-0.0577	0.0454	0.022	0.642	0.023	0.0346	1.388	0.166

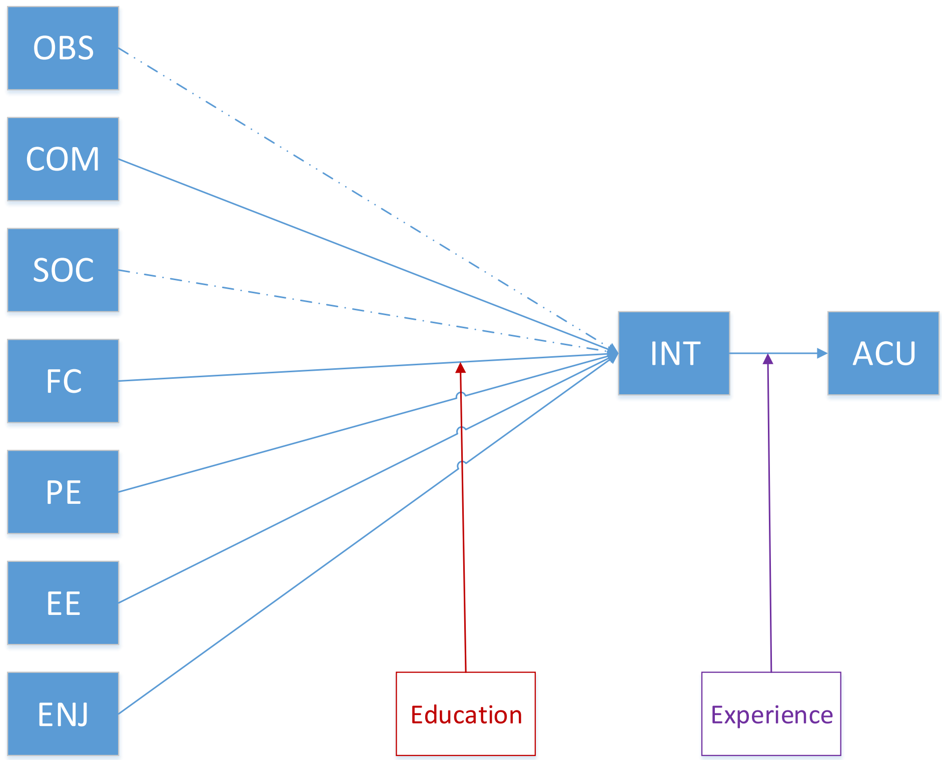
COM->INT	0.192	2.512	0.1957	0.0765	0.287	5.151	0.2882	0.0558	0.973	0.331
SOC->INT	0.005	0.118	0.0054	0.0451	-0.032	1.282	-0.0319	0.0252	0.782	0.434
FC->INT	0.119	1.651	0.1188	0.072	0.075	1.390	0.0758	0.0536	0.474	0.636
PE->INT	0.265	3.735	0.2679	0.0711	0.204	4.657	0.2026	0.0437	0.823	0.411
EE->INT	0.096	1.648	0.0941	0.0581	0.072	1.808	0.0709	0.0399	0.334	0.738
ENJ->INT	0.384	5.980	0.3807	0.0643	0.379	8.945	0.3778	0.0423	0.039	0.969
INT->ACU	0.525	9.342	0.5232	0.0562	0.352	7.079	0.3502	0.0497	2.159	0.031

Moderating Model-Education										
	Low(n=405) O, A Level, diploma				High(n=282) Higher Degree, First Degree				Compare	
Hypothesis	β	t-value	Mean	STERR	β	t-value	Mean	STERR	t-value	p-value
OBS->INT	-0.049	1.384	-0.0487	0.0352	0.011	0.221	0.0119	0.0476	1.047	0.295
COM->INT	0.216	3.729	0.2188	0.0579	0.339	4.108	0.3403	0.0826	1.244	0.214
SOC->INT	-0.019	0.734	-0.0196	0.0262	-0.015	0.376	-0.0156	0.0391	0.088	0.930
FC->INT	0.199	3.687	0.1997	0.054	-0.088	1.320	-0.087	0.0666	3.366	0.001
PE->INT	0.238	4.783	0.2375	0.0497	0.263	3.941	0.2623	0.0668	0.304	0.761
EE->INT	0.050	1.197	0.0472	0.0415	0.100	1.680	0.0984	0.0593	0.731	0.465
ENJ->INT	0.366	7.576	0.3644	0.0483	0.357	6.024	0.359	0.0592	0.071	0.943
INT->ACU	0.404	7.923	0.4027	0.051	0.523	9.847	0.5233	0.0531	1.600	0.110

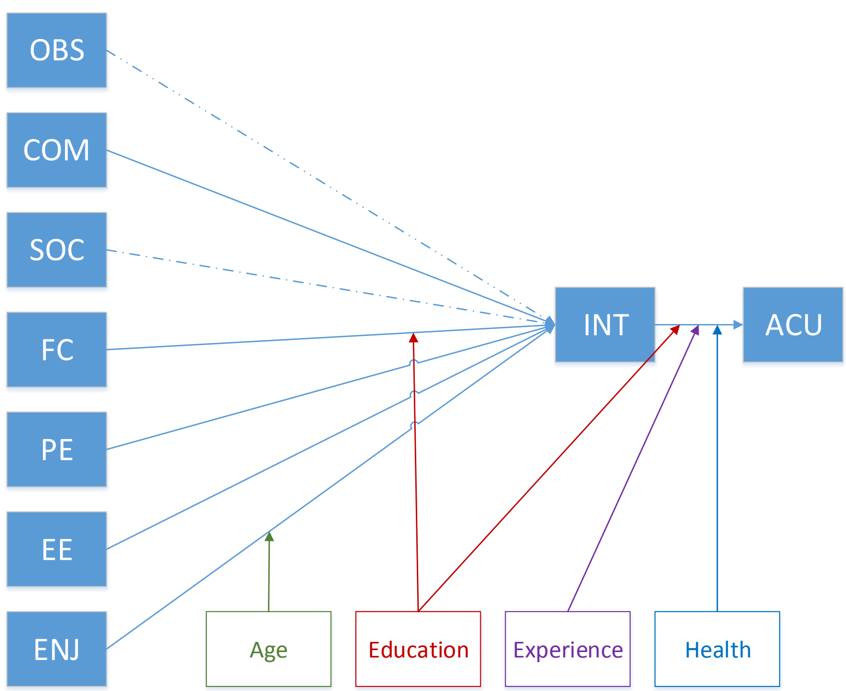
Moderating Model-Age										
Hypothesis	Young (50-59) (n=450)				Old (60-69) (n=250)				Compare	
	β	t-value	Mean	STERR	β	t-value	Mean	STERR	t-value	p-value
OBS->INT	-0.010	0.281	-0.0099	0.0367	-0.019	0.400	-0.0179	0.0478	0.132	0.895
COM->INT	0.284	4.679	0.2865	0.0606	0.209	2.654	0.213	0.0788	0.734	0.463
SOC->INT	-0.010	0.406	-0.0102	0.0247	-0.029	0.672	-0.0305	0.0439	0.437	0.663
FC->INT	0.088	1.540	0.0884	0.0574	0.048	0.690	0.046	0.0699	0.457	0.648

PE->INT	0.228	5.046	0.2293	0.0452	0.218	3.142	0.2185	0.0695	0.136	0.892
EE->INT	0.105	2.371	0.102	0.0443	0.075	1.309	0.0727	0.0575	0.400	0.689
ENJ->INT	0.342	8.043	0.3408	0.0426	0.457	7.090	0.4571	0.0644	1.561	0.119
INT->ACU	0.455	9.337	0.4562	0.0488	0.417	7.824	0.4165	0.0534	0.519	0.604

After long calculation from above table. The final research model is show below. If we set p<0.1 there are only two moderators, Education on FC->INT, and, Experience on INT-> ACU. However, if we set p-value <0.15 then 3 more moderators will be include. Which are Age on ENJ->INT, Education on INT->ACU, Health on INT->ACU, the bright yellow highlight.



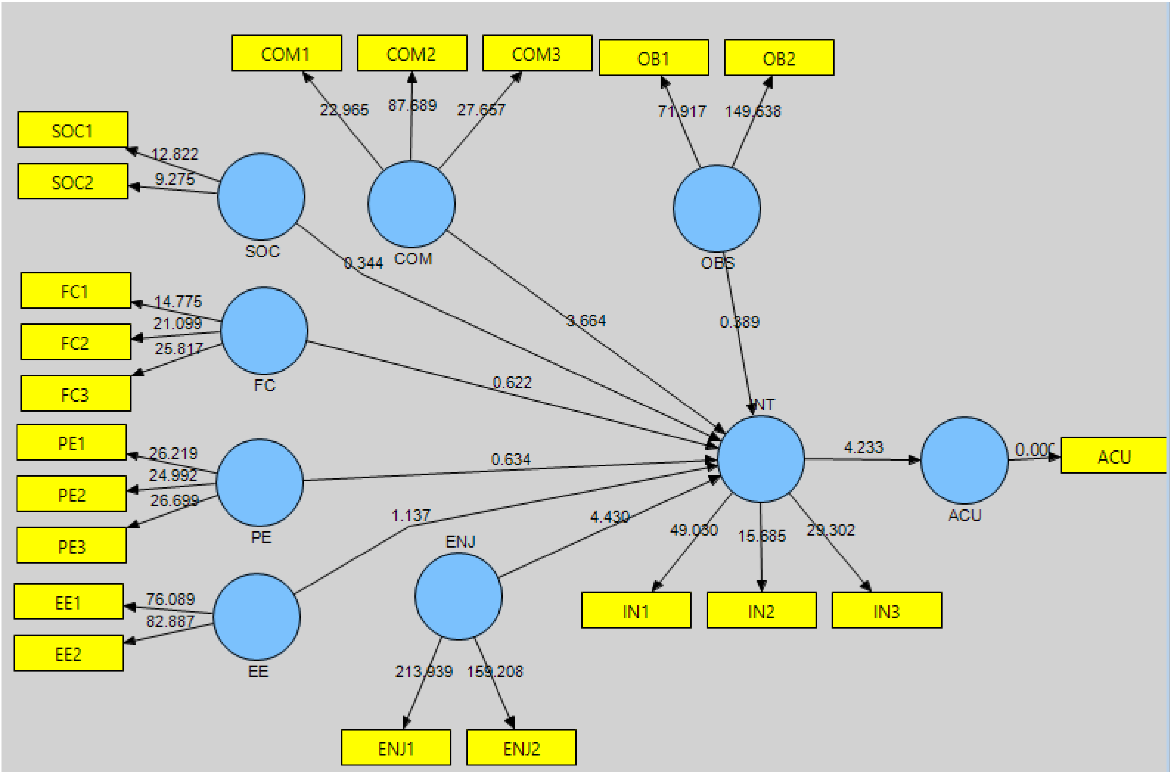
Research Model with Modified Variables (p<0.1)

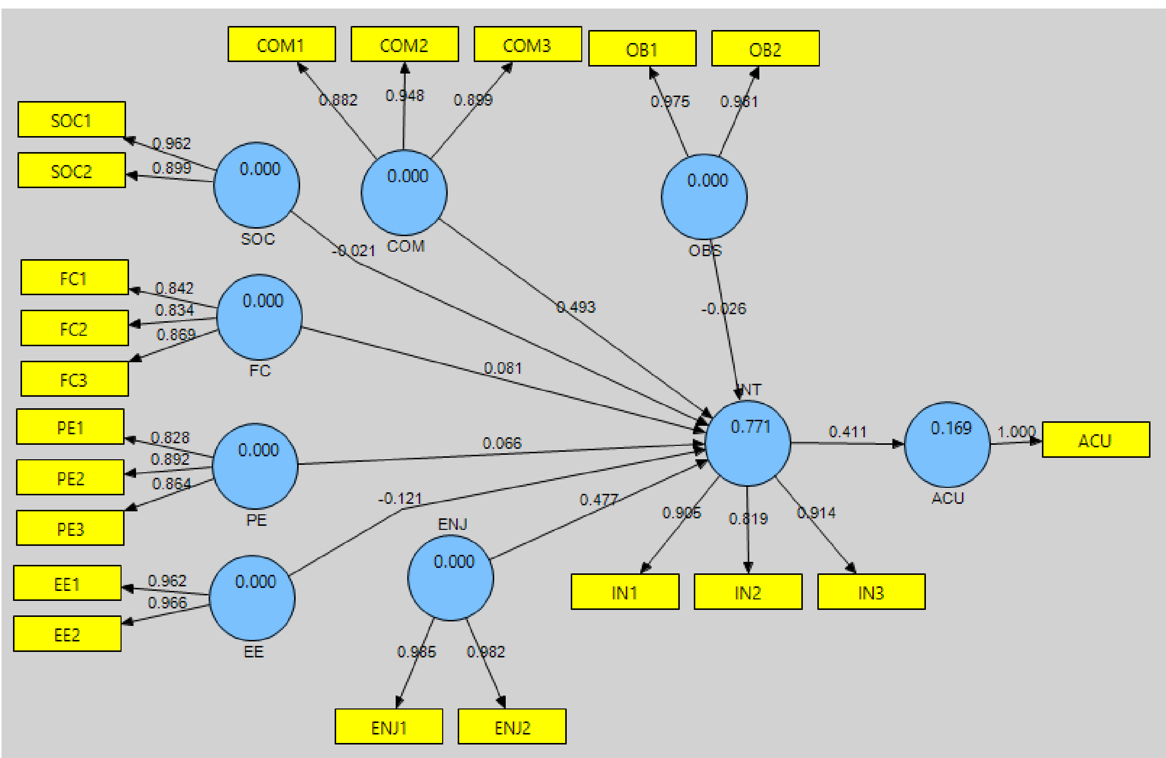


Research Model with Modified Variables (p<0.15)

5-11 Results from SmartPLS for finding Moderated Variables

Area Barnet



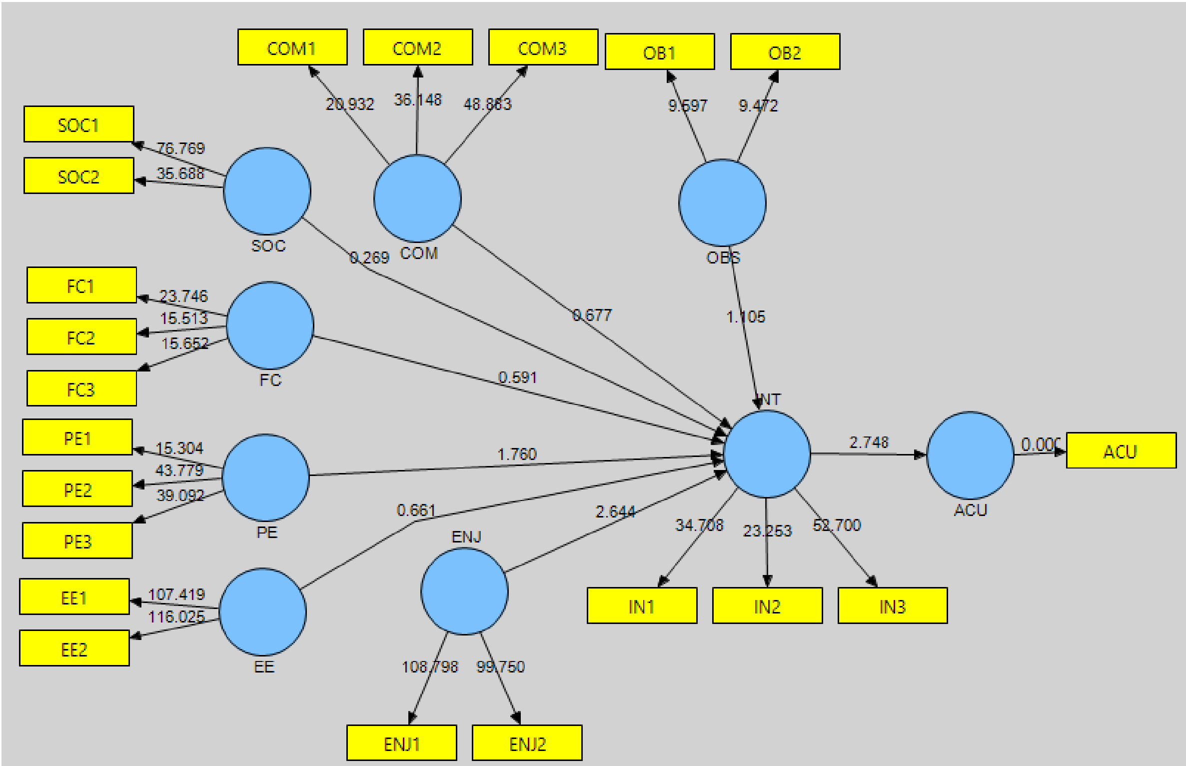


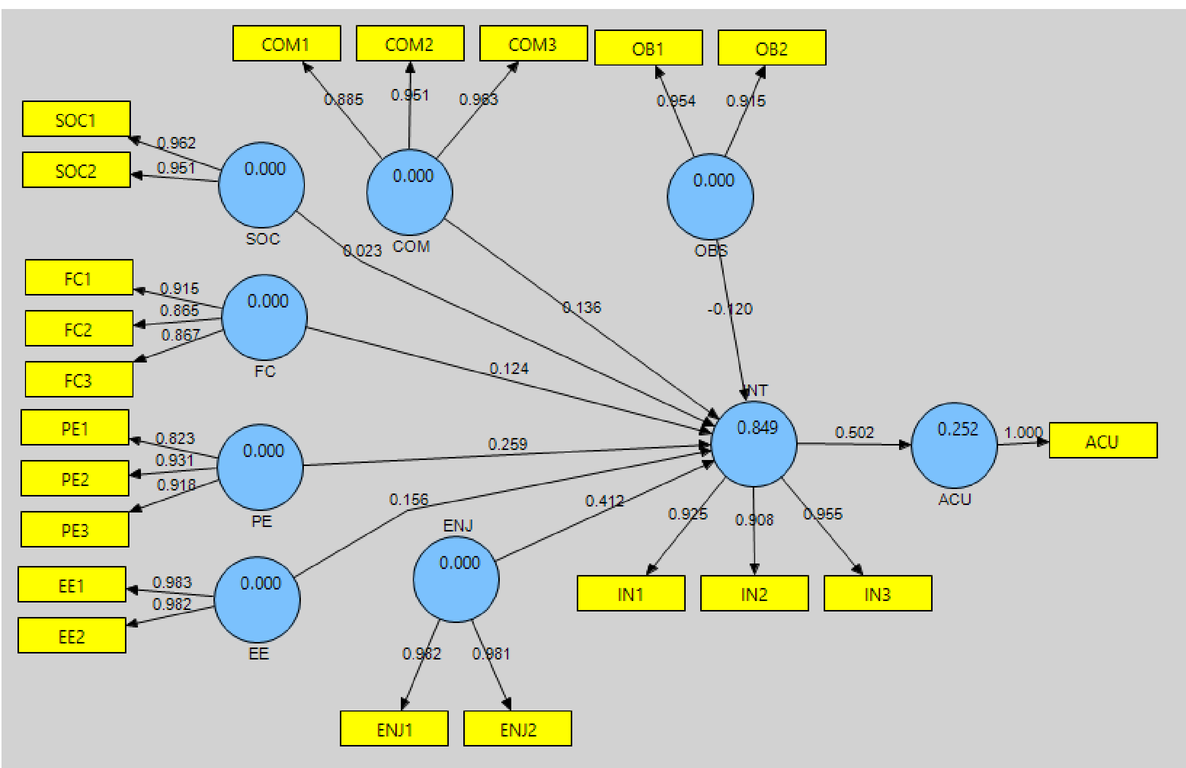
	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	Standard Error (STERR)	T Statistics (|O/STERR|)
COM -> INT	0.4929	0.4924	0.1345	0.1345	3.6636
EE -> INT	-0.121	-0.1242	0.1065	0.1065	1.137
ENJ -> INT	0.4767	0.4705	0.1076	0.1076	4.4301
FC -> INT	0.0809	0.0891	0.1301	0.1301	0.6215
INT -> ACU	0.4108	0.4145	0.0971	0.0971	4.2329
OBS -> INT	-0.0263	-0.0338	0.0675	0.0675	0.3894
PE -> INT	0.0662	0.0741	0.1043	0.1043	0.6342
SOC -> INT	-0.0208	-0.0147	0.0606	0.0606	0.3441

	AVE	Composite Reliability	R Square	Cronbachs Alpha	Communality	Redundancy
ACU	1	1	0.1688	1	1	0.1688
COM	0.8286	0.9354	0	0.8963	0.8286	0
EE	0.9287	0.963	0	0.9233	0.9287	0
ENJ	0.9673	0.9834	0	0.9663	0.9673	0
FC	0.7201	0.8853	0	0.8072	0.7201	0
INT	0.7754	0.9118	0.7712	0.8551	0.7754	0.4345
OBS	0.9563	0.9777	0	0.9545	0.9563	0
PE	0.743	0.8965	0	0.8281	0.743	0
SOC	0.8667	0.9285	0	0.8538	0.8667	0

	ACU	COM	EE	ENJ	FC	INT	OBS	PE	SOC
ACU	1	0	0	0	0	0	0	0	0
COM	0.39	1	0	0	0	0	0	0	0
EE	0.2732	0.6316	1	0	0	0	0	0	0
ENJ	0.3798	0.6419	0.7161	1	0	0	0	0	0
FC	0.3134	0.7487	0.6591	0.4381	1	0	0	0	0
INT	0.4108	0.8126	0.615	0.7685	0.603	1	0	0	0
OBS	0.1859	0.4608	0.2677	0.2561	0.4746	0.3341	1	0	0
PE	0.3158	0.7591	0.6028	0.5774	0.6365	0.6824	0.2082	1	0
SOC	0.2256	0.4089	0.133	0.2317	0.273	0.3061	0.4126	0.2995	1

Area Brent


COM1
COM2
COM3
OB1
OB2
SOC1
SOC2
20.932
36.148
48.883
9.597
9.472
76.769
35.688
SOC
COM
OBS
0.269
0.677
1.105
FC1
FC2
FC3
23.746
15.513
15.652
FC
0.591
PE1
PE2
PE3
15.304
43.779
39.092
PE
1.760
0.661
2.644
2.748
ACU
ACU
ENJ
34.708
23.253
52.700
EE1
EE2
107.419
116.025
EE
IN1
IN2
IN3
108.798
99.750
ENJ1
ENJ2

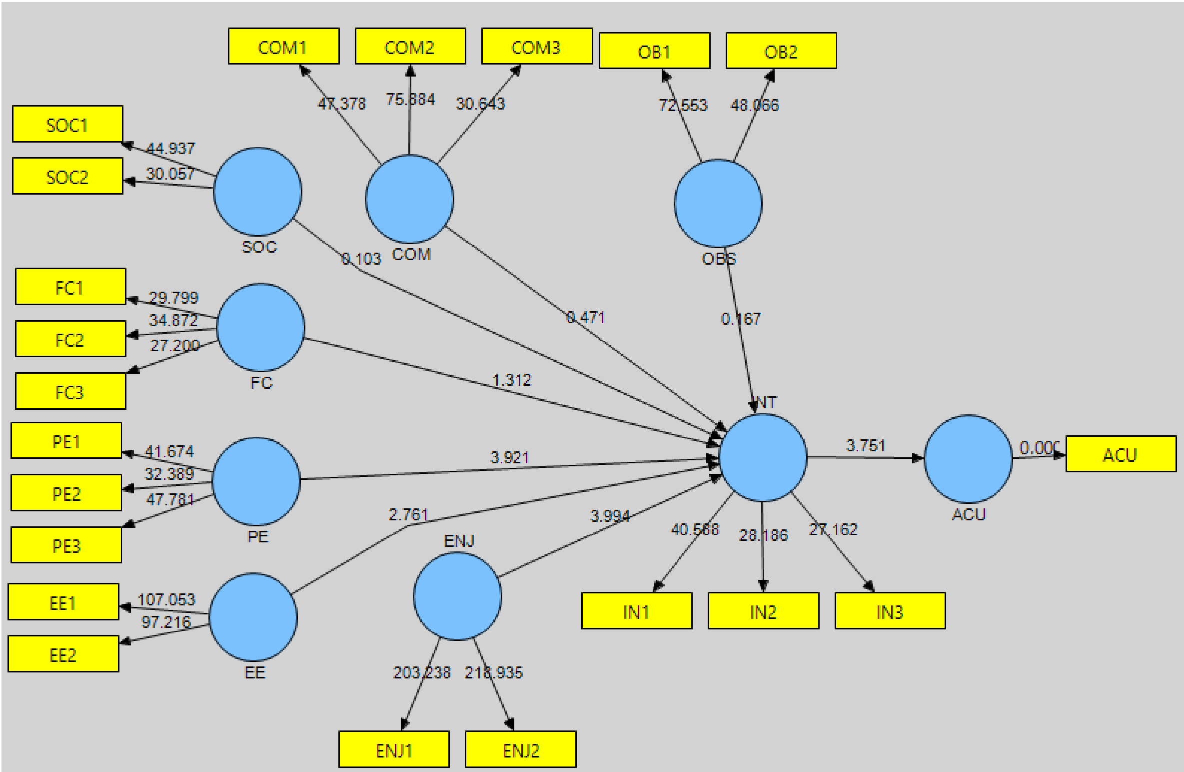

COM1
COM2
COM3
OB1
OB2
0.885
0.951
0.983
0.954
0.915
SOC1
SOC2
0.962
0.951
0.000
0.000
0.000
SOC
COM
OBS
0.023
0.136
-0.120
FC1
FC2
FC3
0.915
0.865
0.867
0.000
FC
0.124
0.849
0.502
0.252
1.000
ACU
ACU
PE1
PE2
PE3
0.823
0.931
0.918
0.000
PE
0.259
0.156
0.412
ENJ
0.000
0.925
0.908
0.955
EE1
EE2
0.983
0.982
0.000
EE
IN1
IN2
IN3
0.982
0.981
ENJ1
ENJ2

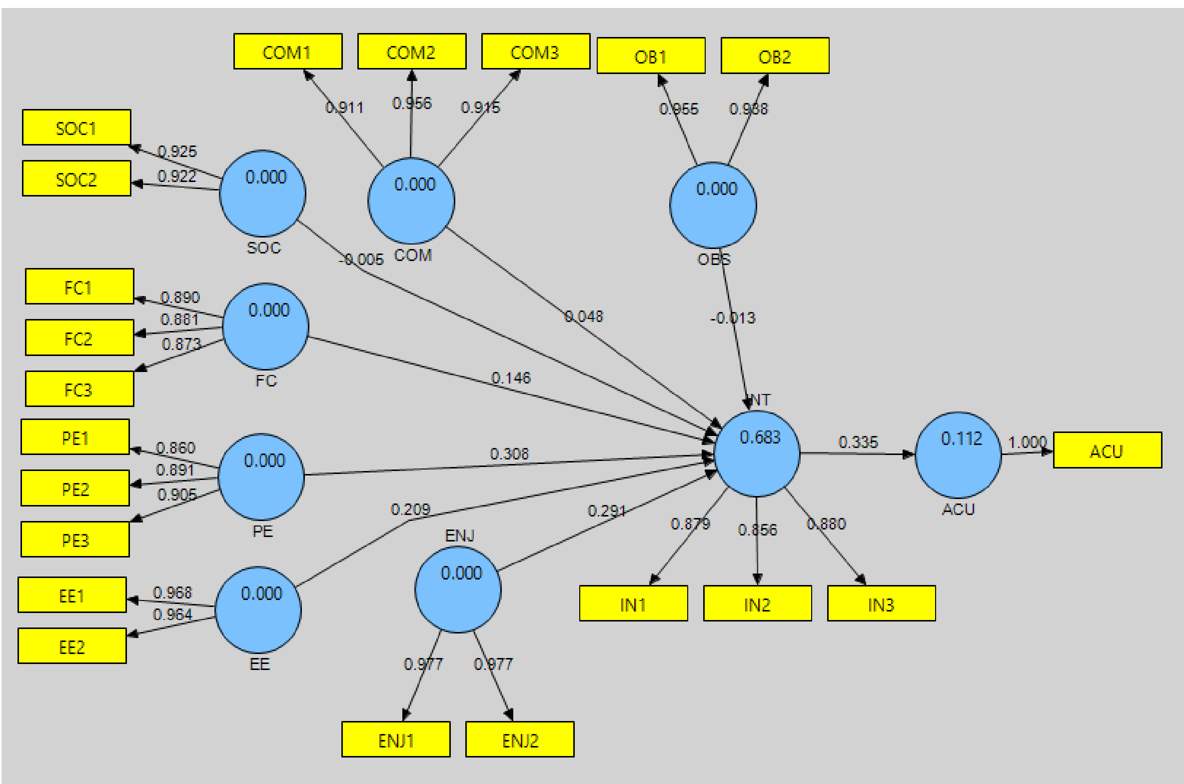
	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	Standard Error (STERR)	T Statistics (|O/STERR|)
COM -> INT	0.1364	0.1376	0.2015	0.2015	0.6768
EE -> INT	0.1563	0.17	0.2366	0.2366	0.6607
ENJ -> INT	0.412	0.3472	0.1559	0.1559	2.6437
FC -> INT	0.1236	0.1711	0.2092	0.2092	0.5908
INT -> ACU	0.5021	0.4754	0.1827	0.1827	2.7478
OBS -> INT	-0.1196	-0.0881	0.1083	0.1083	1.1051
PE -> INT	0.2588	0.239	0.147	0.147	1.76
SOC -> INT	0.0226	0.0228	0.0842	0.0842	0.2688

	AVE	Composite Reliability	R Square	Cronbachs Alpha	Communality	Redundancy
ACU	1	1	0.2521	1	1	0.2521
COM	0.872	0.9533	0	0.926	0.872	0
EE	0.9652	0.9823	0	0.9639	0.9652	0
ENJ	0.9631	0.9812	0	0.9617	0.9631	0
FC	0.7792	0.9136	0	0.8583	0.7792	0
INT	0.8643	0.9502	0.8491	0.9213	0.8643	0.1667
OBS	0.8744	0.933	0	0.8594	0.8744	0
PE	0.796	0.9211	0	0.8704	0.796	0
SOC	0.9158	0.9561	0	0.9084	0.9158	0

	ACU	COM	EE	ENJ	FC	INT	OBS	PE	SOC
ACU	1	0	0	0	0	0	0	0	0
COM	0.419	1	0	0	0	0	0	0	0
EE	0.4864	0.6441	1	0	0	0	0	0	0
ENJ	0.3662	0.7027	0.7681	1	0	0	0	0	0
FC	0.4327	0.7282	0.8349	0.669	1	0	0	0	0
INT	0.5021	0.7748	0.7986	0.8603	0.7648	1	0	0	0
OBS	0.1321	0.4953	0.3488	0.2897	0.5285	0.3502	1	0	0
PE	0.3793	0.7852	0.6574	0.6734	0.7283	0.7762	0.5931	1	0
SOC	0.1731	0.6303	0.2822	0.4448	0.465	0.469	0.4248	0.4883	1

Area Camden


COM1
COM2
COM3
OB1
OB2
47.378
75.884
30.643
72.553
48.066
SOC1
SOC2
44.937
30.057
SOC
COM
OBS
0.103
FC1
FC2
FC3
29.799
34.872
27.200
FC
0.471
0.167
1.312
INT
PE1
PE2
PE3
41.674
32.389
47.781
PE
3.921
3.751
0.000
ACU
ACU
2.761
3.994
ENJ
40.588
28.186
27.162
EE1
EE2
107.053
97.216
EE
IN1
IN2
IN3
203.238
218.935
ENJ1
ENJ2

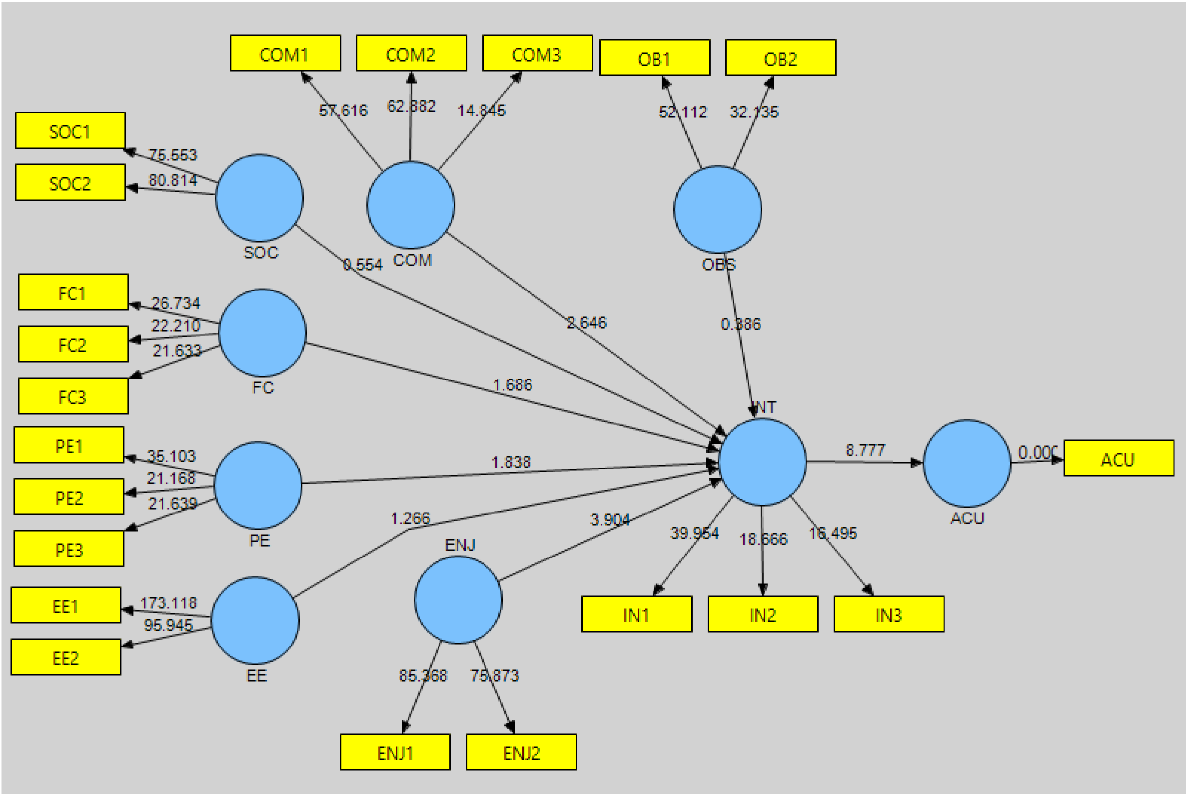

COM1
COM2
COM3
OB1
OB2
0.911
0.956
0.915
0.955
0.938
SOC1
SOC2
0.925
0.922
0.000
0.000
0.000
SOC
-0.005
COM
OBS
FC1
FC2
FC3
0.890
0.881
0.873
0.000
FC
0.048
-0.013
0.146
INT
PE1
PE2
PE3
0.860
0.891
0.905
0.000
PE
0.308
0.683
0.335
0.112
1.000
ACU
ACU
0.209
0.291
ENJ
0.879
0.856
0.880
EE1
EE2
0.968
0.964
0.000
EE
0.000
IN1
IN2
IN3
0.977
0.977
ENJ1
ENJ2

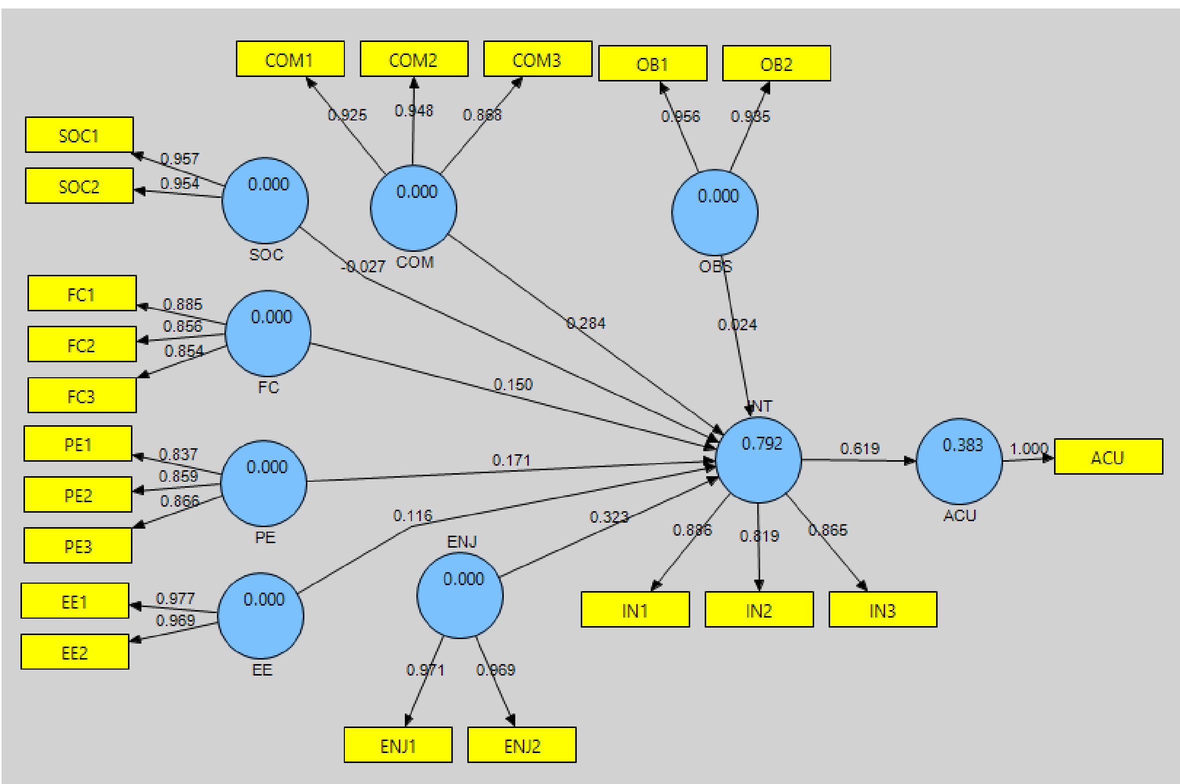
	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	Standard Error (STERR)	T Statistics (|O/STERR|)
COM -> INT	0.0483	0.0499	0.1025	0.1025	0.4712
EE -> INT	0.2087	0.2081	0.0756	0.0756	2.7613
ENJ -> INT	0.2908	0.2909	0.0728	0.0728	3.9938
FC -> INT	0.1463	0.1421	0.1115	0.1115	1.312
INT -> ACU	0.335	0.334	0.0893	0.0893	3.7511
OBS -> INT	-0.0131	-0.0086	0.0782	0.0782	0.1674
PE -> INT	0.3084	0.3056	0.0786	0.0786	3.9215
SOC -> INT	-0.0052	-0.0045	0.0508	0.0508	0.1027

	AVE	Composite Reliability	R Square	Cronbachs Alpha	Communality	Redundancy
ACU	1	1	0.1123	1	1	0.1123
COM	0.8602	0.9486	0	0.9186	0.8602	0
EE	0.9337	0.9657	0	0.9291	0.9337	0
ENJ	0.955	0.977	0	0.9529	0.955	0
FC	0.7767	0.9125	0	0.8566	0.7767	0
INT	0.7599	0.9047	0.6826	0.8422	0.7599	0.0473
OBS	0.8956	0.9449	0	0.8842	0.8956	0
PE	0.7844	0.916	0	0.8632	0.7844	0
SOC	0.8526	0.9205	0	0.8272	0.8526	0

	ACU	COM	EE	ENJ	FC	INT	OBS	PE	SOC
ACU	1	0	0	0	0	0	0	0	0
COM	0.3646	1	0	0	0	0	0	0	0
EE	0.2485	0.6554	1	0	0	0	0	0	0
ENJ	0.2457	0.6099	0.5794	1	0	0	0	0	0
FC	0.2938	0.7681	0.706	0.6033	1	0	0	0	0
INT	0.335	0.6686	0.6829	0.7008	0.6576	1	0	0	0
OBS	0.255	0.6001	0.4178	0.3379	0.572	0.4101	1	0	0
PE	0.3341	0.6601	0.5746	0.5755	0.5198	0.6963	0.4115	1	0
SOC	0.1112	0.367	0.1898	0.3365	0.2784	0.2981	0.3589	0.3635	1

Area Enfield



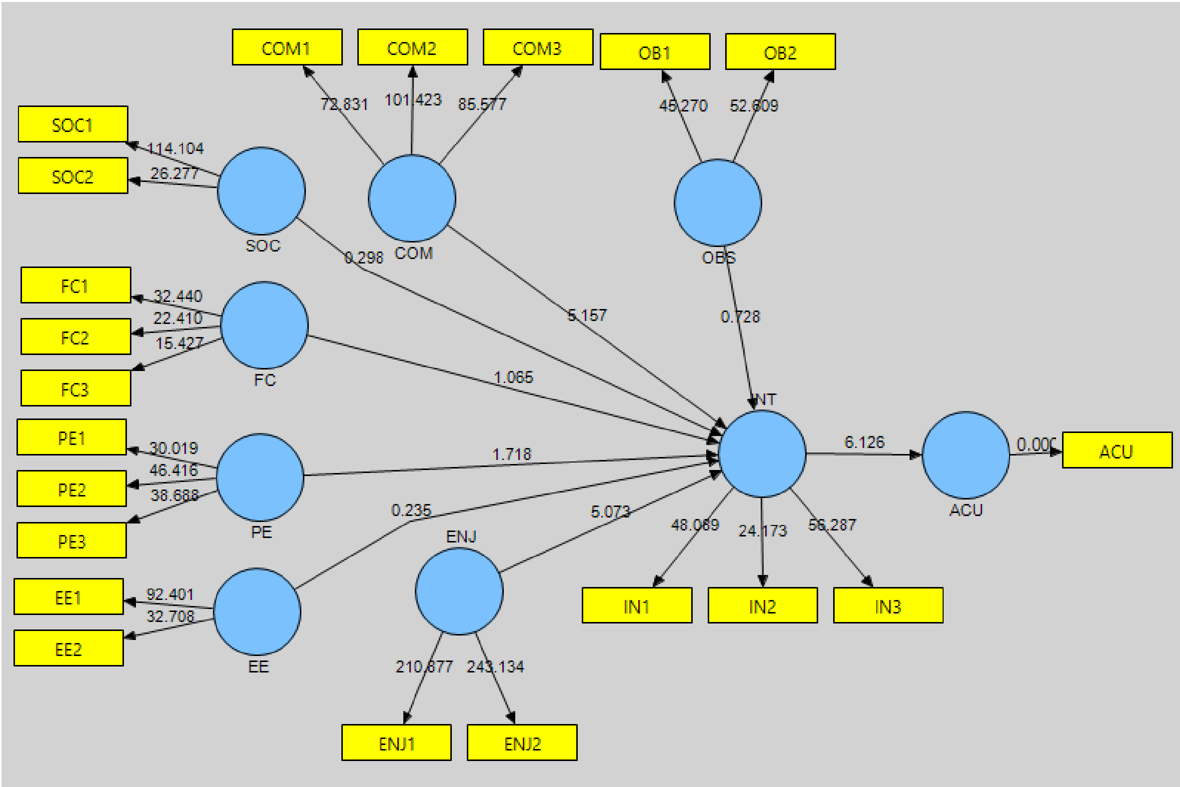


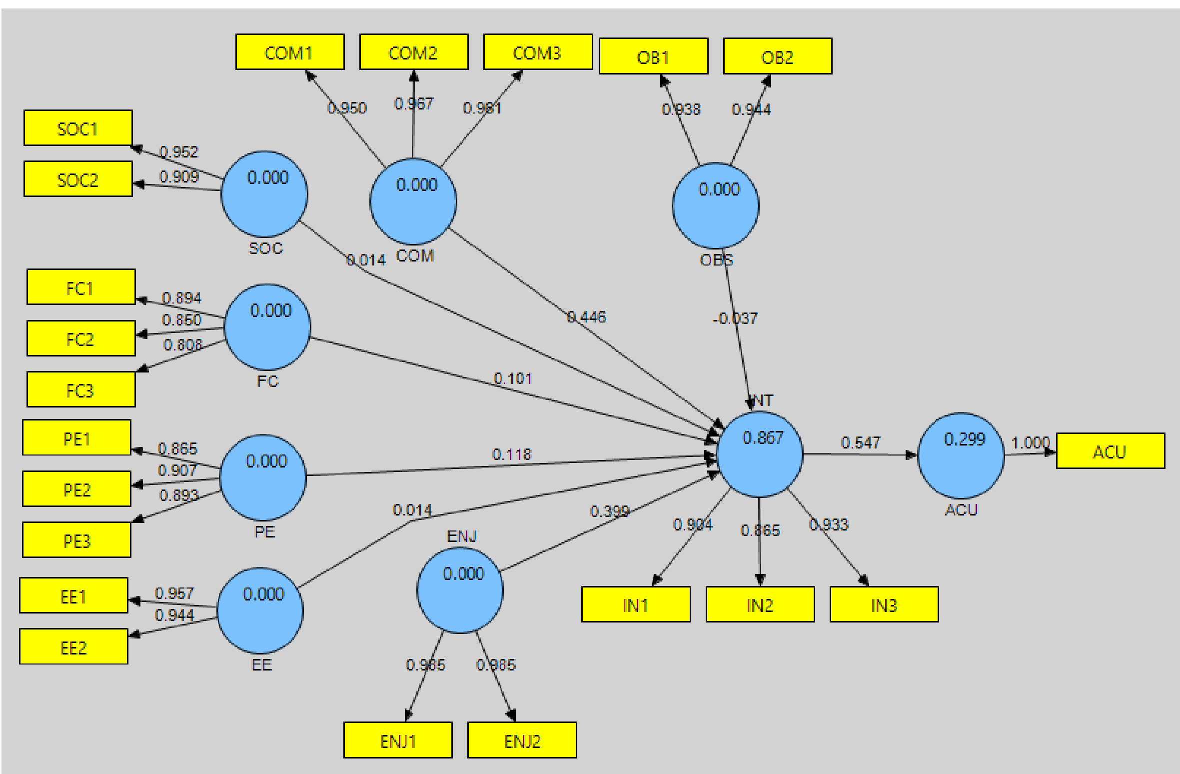
	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	Standard Error (STERR)	T Statistics (|O/STERR|)
COM -> INT	0.2845	0.2809	0.1075	0.1075	2.6455
EE -> INT	0.116	0.1086	0.0916	0.0916	1.2662
ENJ -> INT	0.3232	0.321	0.0828	0.0828	3.904
FC -> INT	0.1497	0.1494	0.0888	0.0888	1.6858
INT -> ACU	0.619	0.6185	0.0705	0.0705	8.7766
OBS -> INT	0.0236	0.0263	0.0612	0.0612	0.3861
PE -> INT	0.1714	0.1794	0.0932	0.0932	1.8382
SOC -> INT	-0.0271	-0.0214	0.0489	0.0489	0.5538

	AVE	Composite Reliability	R Square	Cronbachs Alpha	Communality	Redundancy
ACU	1	1	0.3832	1	1	0.3832
COM	0.8358	0.9384	0	0.9018	0.8358	0
EE	0.9466	0.9726	0	0.9438	0.9466	0
ENJ	0.9403	0.9692	0	0.9365	0.9403	0
FC	0.7482	0.8991	0	0.8318	0.7482	0
INT	0.7349	0.8926	0.7925	0.8193	0.7349	0.2826
OBS	0.8948	0.9445	0	0.8835	0.8948	0
PE	0.7298	0.8901	0	0.8198	0.7298	0
SOC	0.9131	0.9546	0	0.9049	0.9131	0

	ACU	COM	EE	ENJ	FC	INT	OBS	PE	SOC
ACU	1	0	0	0	0	0	0	0	0
COM	0.6053	1	0	0	0	0	0	0	0
EE	0.5196	0.6799	1	0	0	0	0	0	0
ENJ	0.4807	0.7582	0.5728	1	0	0	0	0	0
FC	0.4508	0.6276	0.696	0.4836	1	0	0	0	0
INT	0.619	0.821	0.7074	0.7839	0.6636	1	0	0	0
OBS	0.2129	0.417	0.3326	0.1997	0.5059	0.3706	1	0	0
PE	0.5269	0.7031	0.627	0.6487	0.5522	0.7321	0.3396	1	0
SOC	0.1524	0.4311	0.2472	0.3603	0.3041	0.3722	0.3211	0.4573	1

Area Haringey



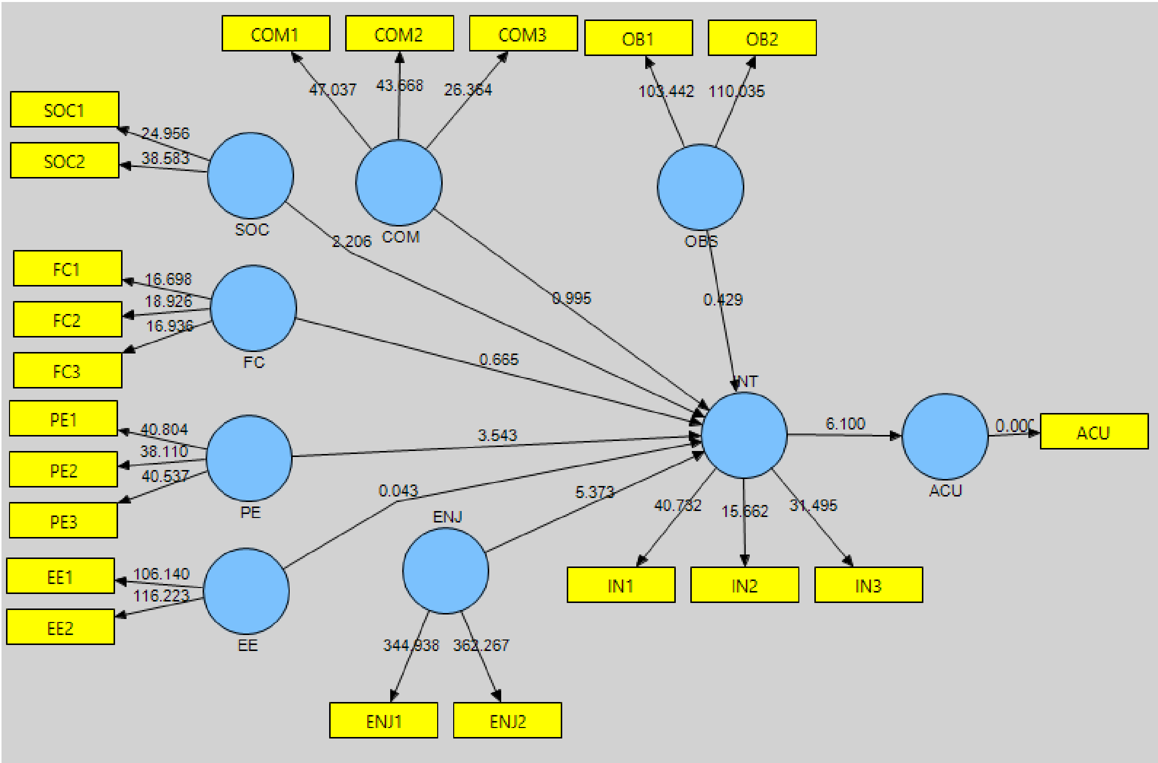


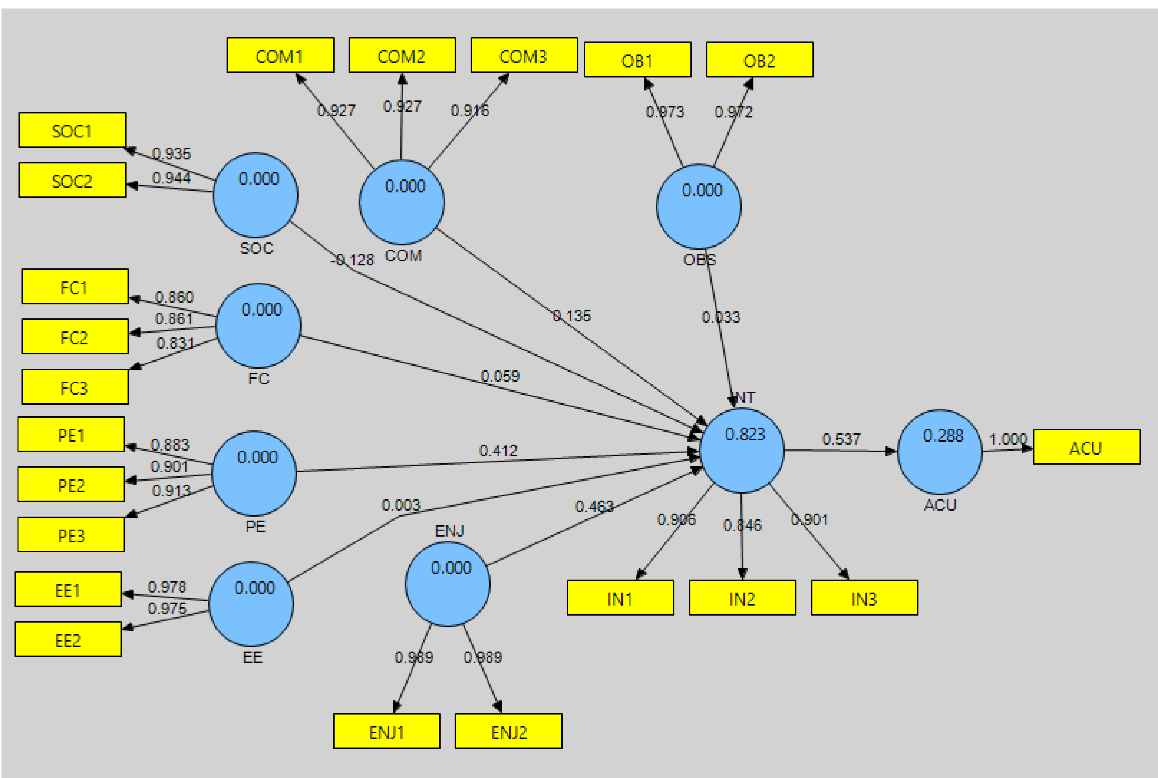
	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	Standard Error (STERR)	T Statistics (|O/STERR|)
COM -> INT	0.4458	0.4441	0.0864	0.0864	5.1568
EE -> INT	0.0142	0.0115	0.0605	0.0605	0.2346
ENJ -> INT	0.3992	0.3919	0.0787	0.0787	5.0728
FC -> INT	0.1008	0.1102	0.0947	0.0947	1.065
INT -> ACU	0.5472	0.5408	0.0893	0.0893	6.126
OBS -> INT	-0.0368	-0.0361	0.0506	0.0506	0.7278
PE -> INT	0.1181	0.1199	0.0688	0.0688	1.7181
SOC -> INT	0.0143	0.0102	0.0479	0.0479	0.2985

	AVE	Composite Reliability	R Square	Cronbachs Alpha	Communality	Redundancy
ACU	1	1	0.2994	1	1	0.2994
COM	0.9205	0.972	0	0.9568	0.9205	0
EE	0.9034	0.9493	0	0.8936	0.9034	0
ENJ	0.9699	0.9847	0	0.9689	0.9699	0
FC	0.725	0.8876	0	0.8095	0.725	0
INT	0.8121	0.9283	0.8671	0.8838	0.8121	0.462
OBS	0.8853	0.9392	0	0.8706	0.8853	0
PE	0.7894	0.9183	0	0.8669	0.7894	0
SOC	0.8664	0.9284	0	0.8493	0.8664	0

	ACU	COM	EE	ENJ	FC	INT	OBS	PE	SOC
ACU	1	0	0	0	0	0	0	0	0
COM	0.5444	1	0	0	0	0	0	0	0
EE	0.3605	0.5002	1	0	0	0	0	0	0
ENJ	0.3308	0.6381	0.6106	1	0	0	0	0	0
FC	0.4985	0.7202	0.5806	0.5152	1	0	0	0	0
INT	0.5472	0.8611	0.5843	0.8097	0.7035	1	0	0	0
OBS	0.3754	0.6354	0.4961	0.5551	0.6679	0.6212	1	0	0
PE	0.541	0.8207	0.5052	0.6646	0.7366	0.8149	0.6053	1	0
SOC	0.2481	0.509	0.2422	0.5102	0.3706	0.5198	0.5093	0.4479	1

Area Islington



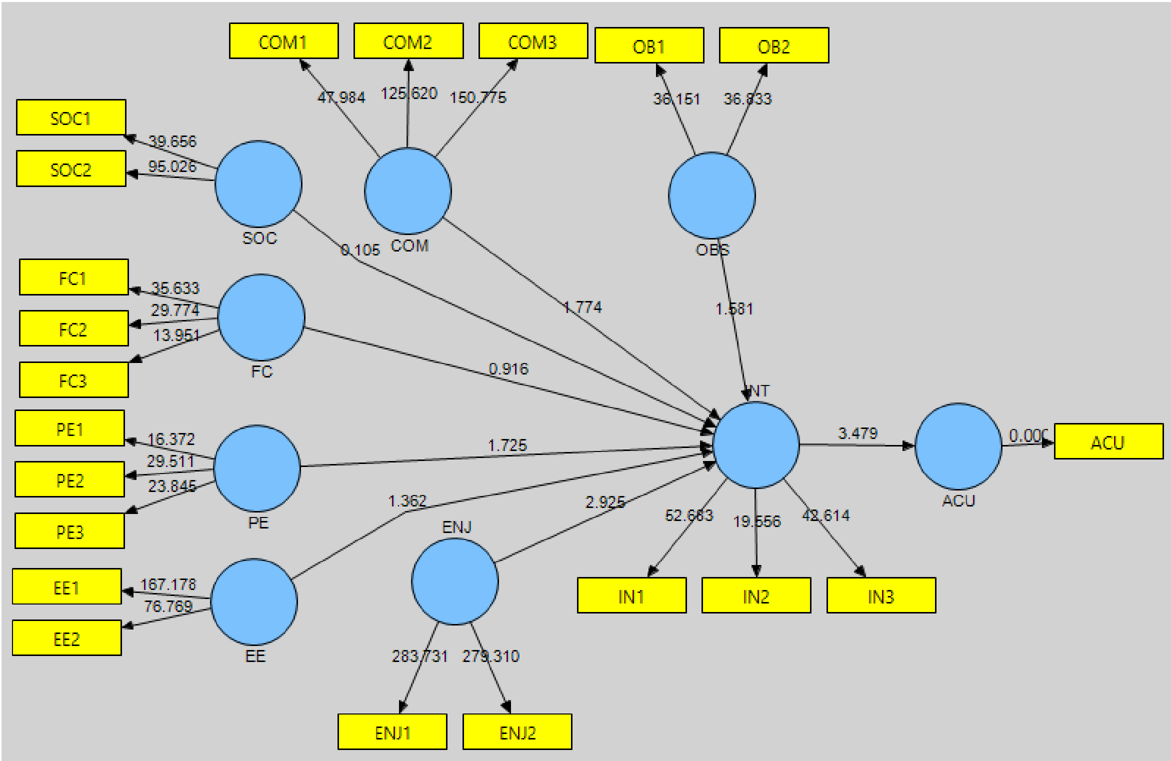


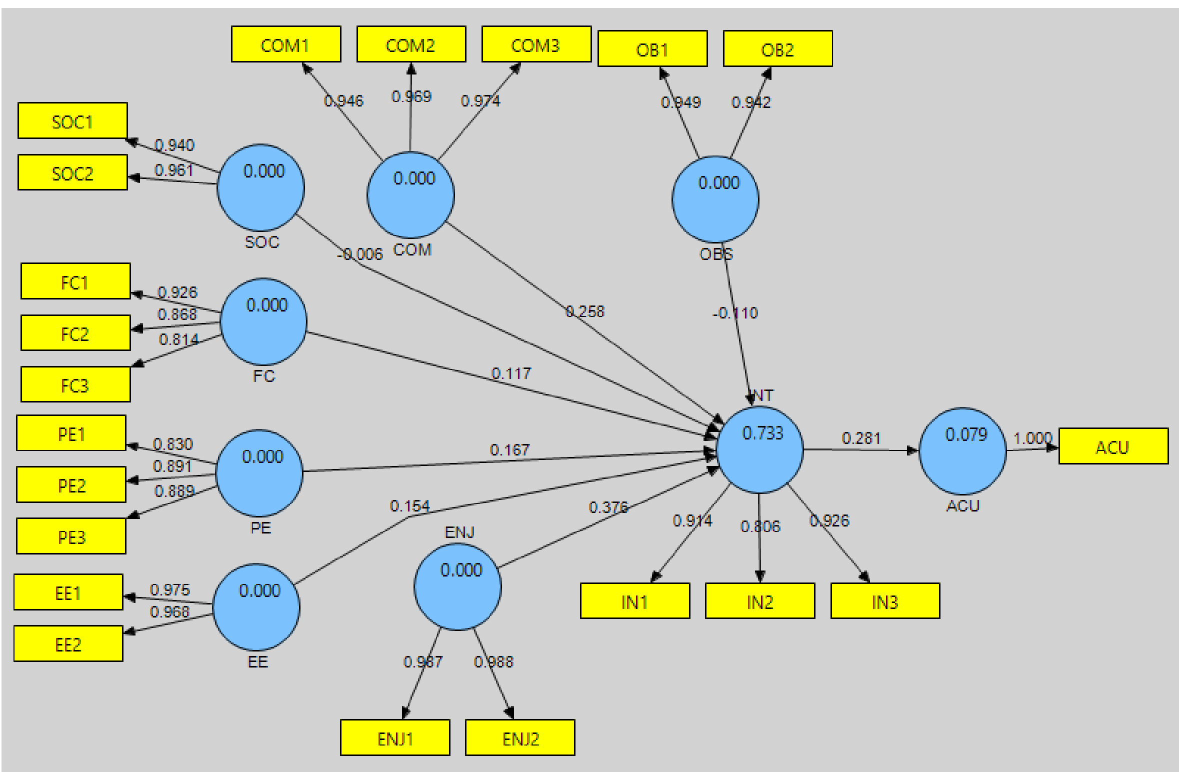
	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	Standard Error (STERR)	T Statistics (|O/STERR|)
COM -> INT	0.1348	0.1322	0.1355	0.1355	0.9949
EE -> INT	0.0033	-0.0052	0.0757	0.0757	0.043
ENJ -> INT	0.4634	0.464	0.0863	0.0863	5.3731
FC -> INT	0.0589	0.0557	0.0885	0.0885	0.6651
INT -> ACU	0.5369	0.5333	0.088	0.088	6.0998
OBS -> INT	0.0332	0.0332	0.0773	0.0773	0.4291
PE -> INT	0.4123	0.4132	0.1164	0.1164	3.5426
SOC -> INT	-0.1277	-0.1082	0.0579	0.0579	2.2055

	AVE	Composite Reliability	R Square	Cronbachs Alpha	Communality	Redundancy
ACU	1	1	0.2882	1	1	0.2882
COM	0.8524	0.9454	0	0.9135	0.8524	0
EE	0.9526	0.9757	0	0.9503	0.9526	0
ENJ	0.9786	0.9892	0	0.9781	0.9786	0
FC	0.7231	0.8868	0	0.8084	0.7231	0
INT	0.7825	0.9151	0.8226	0.8612	0.7825	0.1509
OBS	0.9455	0.972	0	0.9424	0.9455	0
PE	0.8083	0.9267	0	0.8814	0.8083	0
SOC	0.8832	0.938	0	0.8679	0.8832	0

	ACU	COM	EE	ENJ	FC	INT	OBS	PE	SOC
ACU	1	0	0	0	0	0	0	0	0
COM	0.5438	1	0	0	0	0	0	0	0
EE	0.3729	0.6638	1	0	0	0	0	0	0
ENJ	0.4511	0.6983	0.7194	1	0	0	0	0	0
FC	0.4515	0.8011	0.7024	0.6355	1	0	0	0	0
INT	0.5369	0.7823	0.6634	0.81	0.6909	1	0	0	0
OBS	0.2691	0.6153	0.3994	0.3363	0.5814	0.4687	1	0	0
PE	0.52	0.7456	0.5199	0.6093	0.5809	0.7883	0.4952	1	0
SOC	0.1522	0.417	0.2476	0.3891	0.2471	0.3263	0.3365	0.4632	1

Area Westminster



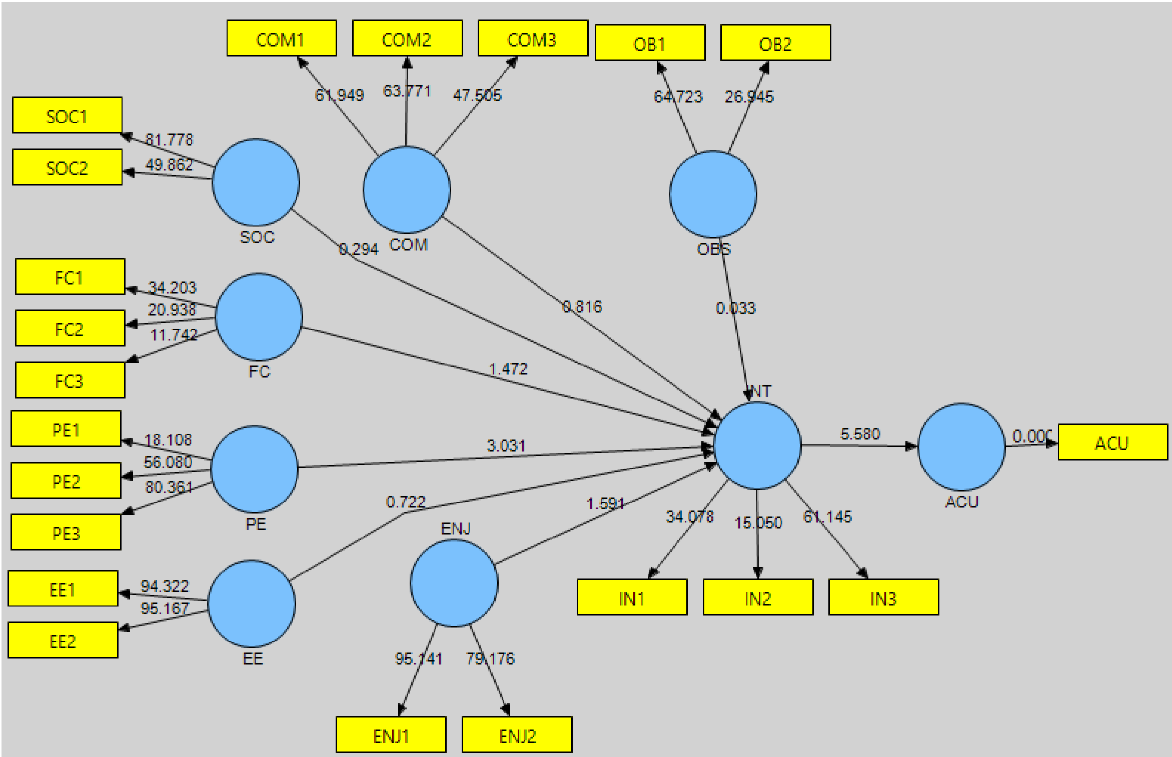


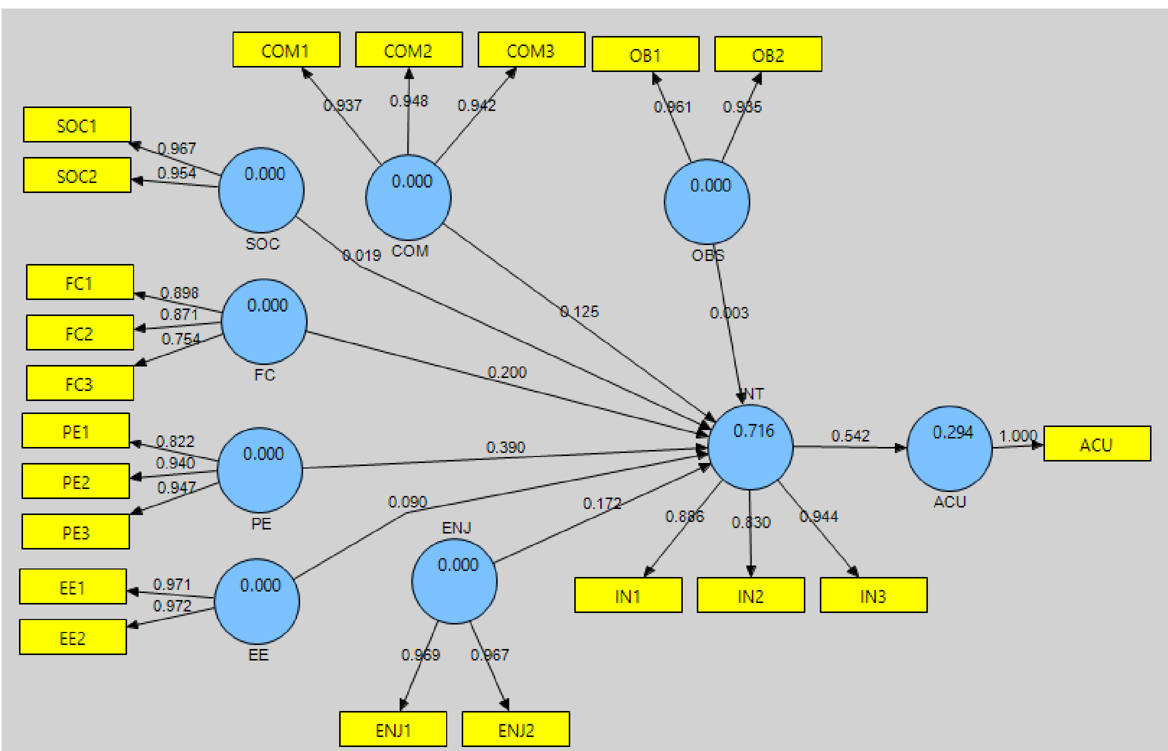
	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	Standard Error (STERR)	T Statistics (|O/STERR|)
COM -> INT	0.2576	0.2639	0.1453	0.1453	1.7737
EE -> INT	0.154	0.1477	0.1131	0.1131	1.3616
ENJ -> INT	0.3764	0.369	0.1287	0.1287	2.9249
FC -> INT	0.1166	0.106	0.1274	0.1274	0.9158
INT -> ACU	0.2813	0.284	0.0808	0.0808	3.4788
OBS -> INT	-0.1103	-0.0956	0.0697	0.0697	1.5813
PE -> INT	0.1666	0.1761	0.0966	0.0966	1.7246
SOC -> INT	-0.0055	0.0009	0.053	0.053	0.1047

	AVE	Composite Reliability	R Square	Cronbachs Alpha	Communality	Redundancy
ACU	1	1	0.0791	1	1	0.0791
COM	0.9272	0.9745	0	0.9607	0.9272	0
EE	0.9432	0.9708	0	0.94	0.9432	0
ENJ	0.9748	0.9872	0	0.9741	0.9748	0
FC	0.758	0.9035	0	0.84	0.758	0
INT	0.7802	0.9139	0.7331	0.8575	0.7802	0.237
OBS	0.8943	0.9442	0	0.8819	0.8943	0
PE	0.7575	0.9035	0	0.8392	0.7575	0
SOC	0.9043	0.9497	0	0.8954	0.9043	0

	ACU	COM	EE	ENJ	FC	INT	OBS	PE	SOC
ACU	1	0	0	0	0	0	0	0	0
COM	0.2598	1	0	0	0	0	0	0	0
EE	0.2077	0.5148	1	0	0	0	0	0	0
ENJ	0.1974	0.6172	0.6766	1	0	0	0	0	0
FC	0.2279	0.6949	0.584	0.4543	1	0	0	0	0
INT	0.2813	0.7187	0.679	0.7677	0.6037	1	0	0	0
OBS	0.046	0.5634	0.203	0.2055	0.5245	0.282	1	0	0
PE	0.3455	0.8026	0.5588	0.5984	0.6441	0.7044	0.4743	1	0
SOC	0.0792	0.572	0.2062	0.3579	0.4258	0.4163	0.3156	0.5589	1

Education Higher Degree



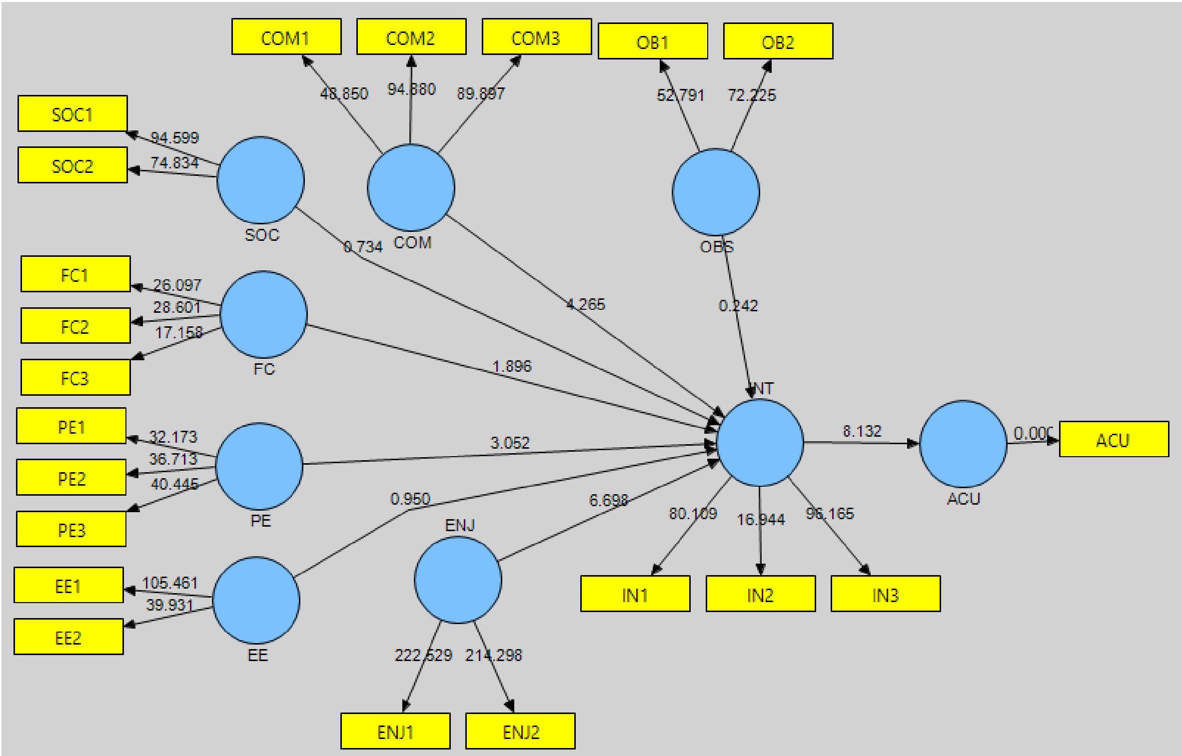


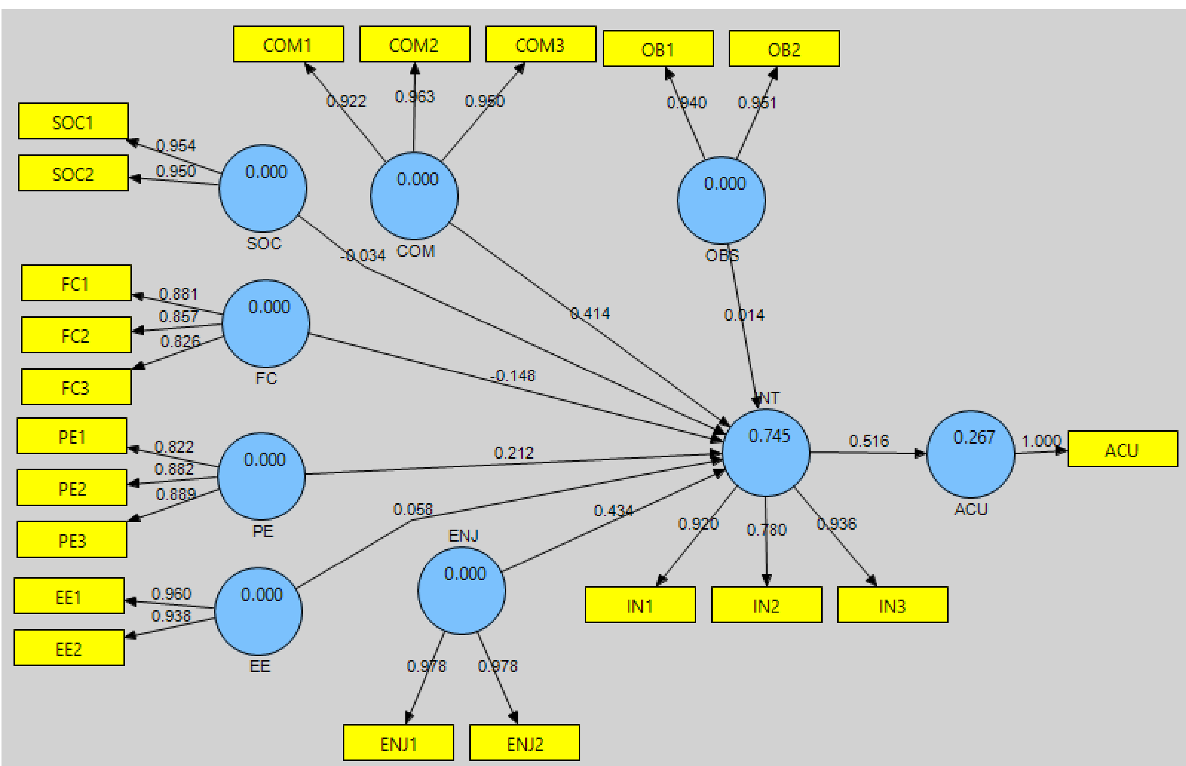
	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	Standard Error (STERR)	T Statistics (|O/STERR|)
COM -> INT	0.1246	0.1406	0.1528	0.1528	0.8157
EE -> INT	0.09	0.1191	0.1245	0.1245	0.7224
ENJ -> INT	0.1724	0.1695	0.1084	0.1084	1.591
FC -> INT	0.2002	0.1775	0.136	0.136	1.4722
INT -> ACU	0.5423	0.537	0.0972	0.0972	5.5797
OBS -> INT	0.0033	0.0012	0.1009	0.1009	0.0329
PE -> INT	0.3897	0.3739	0.1286	0.1286	3.0313
SOC -> INT	0.0188	0.0238	0.064	0.064	0.2942

	AVE	Composite Reliability	R Square	Cronbachs Alpha	Communality	Redundancy
ACU	1	1	0.2941	1	1	0.2941
COM	0.8875	0.9595	0	0.9368	0.8875	0
EE	0.9434	0.9709	0	0.94	0.9434	0
ENJ	0.9372	0.9676	0	0.933	0.9372	0
FC	0.7114	0.8803	0	0.7962	0.7114	0
INT	0.7882	0.9176	0.7163	0.8642	0.7882	0.1327
OBS	0.8986	0.9466	0	0.8889	0.8986	0
PE	0.8186	0.9309	0	0.8871	0.8186	0
SOC	0.9223	0.9596	0	0.9163	0.9223	0

	ACU	COM	EE	ENJ	FC	INT	OBS	PE	SOC
ACU	1	0	0	0	0	0	0	0	0
COM	0.4733	1	0	0	0	0	0	0	0
EE	0.5169	0.7058	1	0	0	0	0	0	0
ENJ	0.4469	0.6546	0.6962	1	0	0	0	0	0
FC	0.3403	0.7958	0.747	0.5705	1	0	0	0	0
INT	0.5423	0.7378	0.7123	0.6922	0.6803	1	0	0	0
OBS	0.213	0.6279	0.5098	0.4631	0.6679	0.4775	1	0	0
PE	0.5831	0.6894	0.6643	0.6508	0.5357	0.7624	0.3356	1	0
SOC	0.1717	0.3588	0.2249	0.3308	0.231	0.3222	0.3057	0.3441	1

Education First Degree



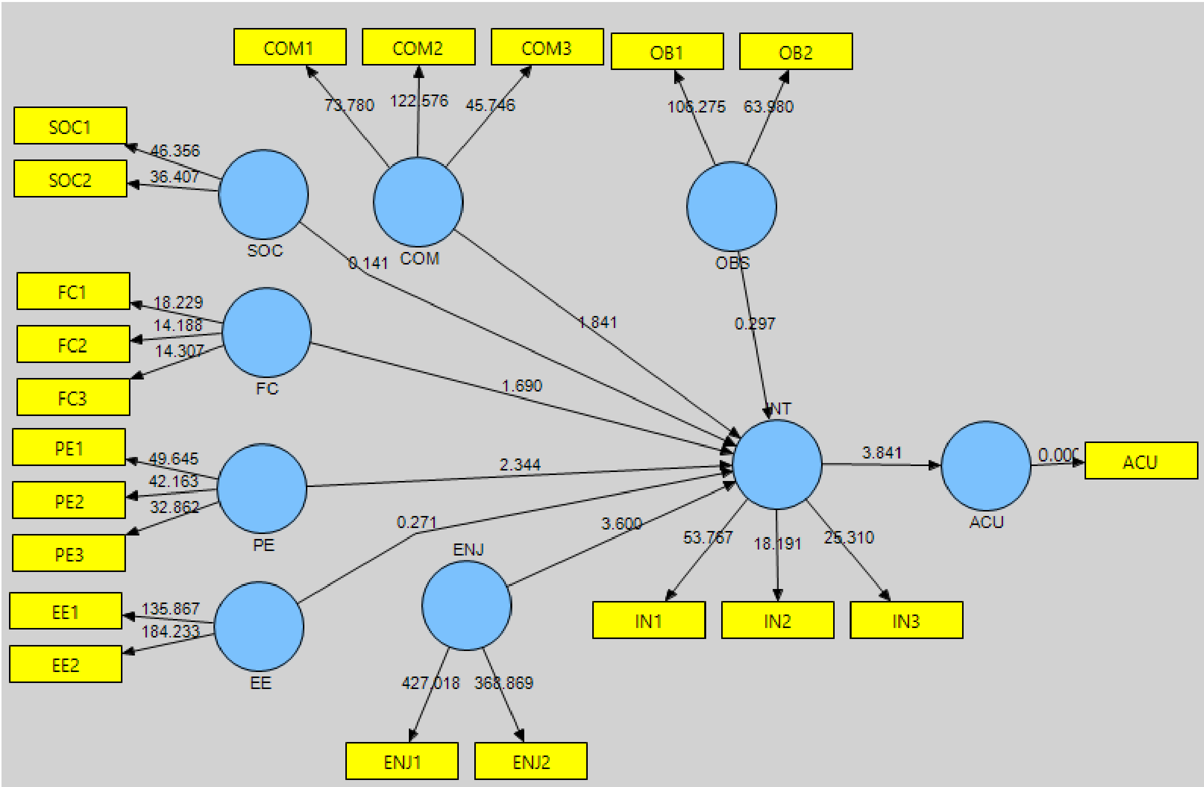


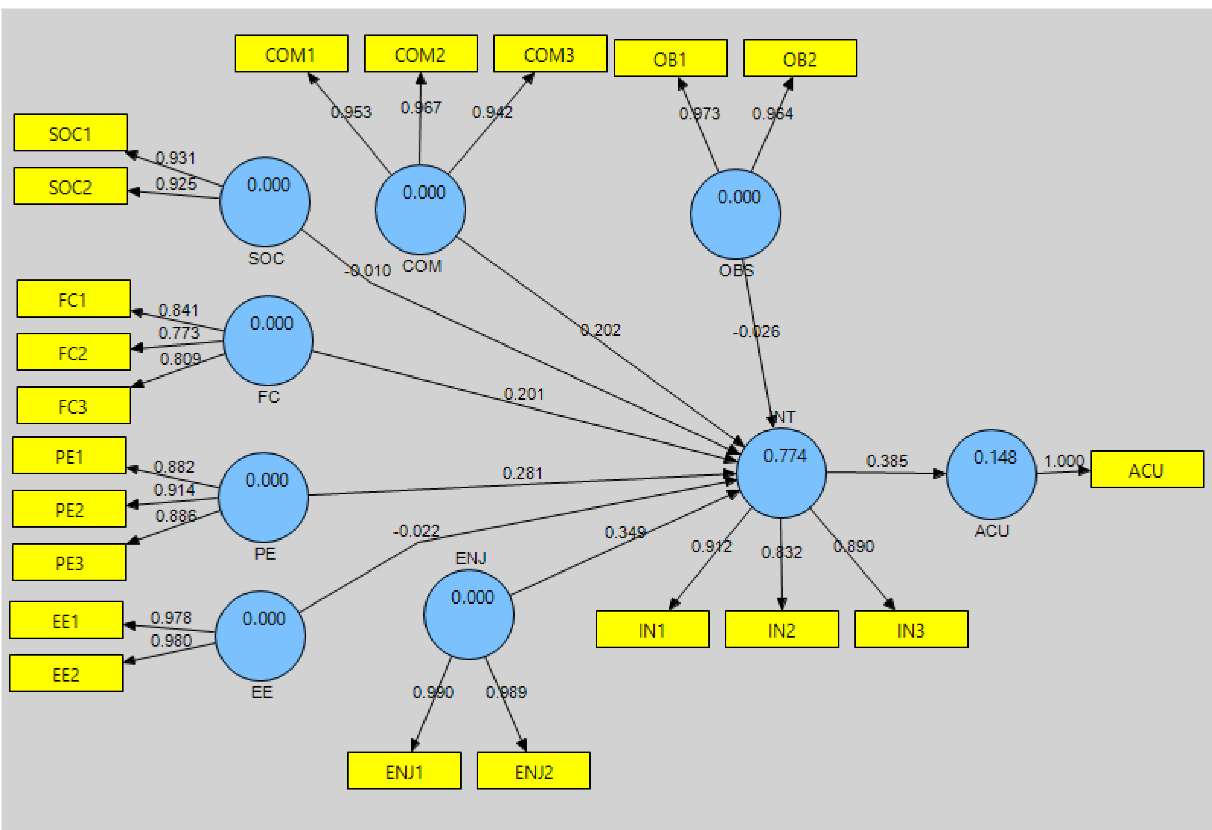
	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	Standard Error (STERR)	T Statistics (|O/STERR|)
COM -> INT	0.4137	0.4076	0.097	0.097	4.2654
EE -> INT	0.0581	0.0606	0.0612	0.0612	0.9501
ENJ -> INT	0.4339	0.4325	0.0648	0.0648	6.698
FC -> INT	-0.1476	-0.1441	0.0779	0.0779	1.8963
INT -> ACU	0.5163	0.5194	0.0635	0.0635	8.1321
OBS -> INT	0.014	0.0155	0.0577	0.0577	0.2423
PE -> INT	0.2116	0.2156	0.0693	0.0693	3.0522
SOC -> INT	-0.0338	-0.0321	0.0461	0.0461	0.7339

	AVE	Composite Reliability	R Square	Cronbachs Alpha	Communality	Redundancy
ACU	1	1	0.2665	1	1	0.2665
COM	0.8932	0.9617	0	0.9401	0.8932	0
EE	0.9011	0.948	0	0.8914	0.9011	0
ENJ	0.9569	0.978	0	0.9549	0.9569	0
FC	0.731	0.8907	0	0.8184	0.731	0
INT	0.7772	0.9123	0.7451	0.8548	0.7772	0.3484
OBS	0.8938	0.9439	0	0.8815	0.8938	0
PE	0.7473	0.8986	0	0.8313	0.7473	0
SOC	0.9071	0.9513	0	0.8977	0.9071	0

	ACU	COM	EE	ENJ	FC	INT	OBS	PE	SOC
ACU	1	0	0	0	0	0	0	0	0
COM	0.548	1	0	0	0	0	0	0	0
EE	0.3282	0.5277	1	0	0	0	0	0	0
ENJ	0.4062	0.5628	0.6443	1	0	0	0	0	0
FC	0.405	0.6973	0.4753	0.4165	1	0	0	0	0
INT	0.5163	0.7458	0.586	0.7505	0.4658	1	0	0	0
OBS	0.3604	0.5809	0.3131	0.3038	0.4859	0.4207	1	0	0
PE	0.5317	0.7844	0.481	0.5456	0.5661	0.7131	0.4769	1	0
SOC	0.2409	0.4148	0.1759	0.3523	0.2945	0.3303	0.3784	0.3195	1

Education A Level



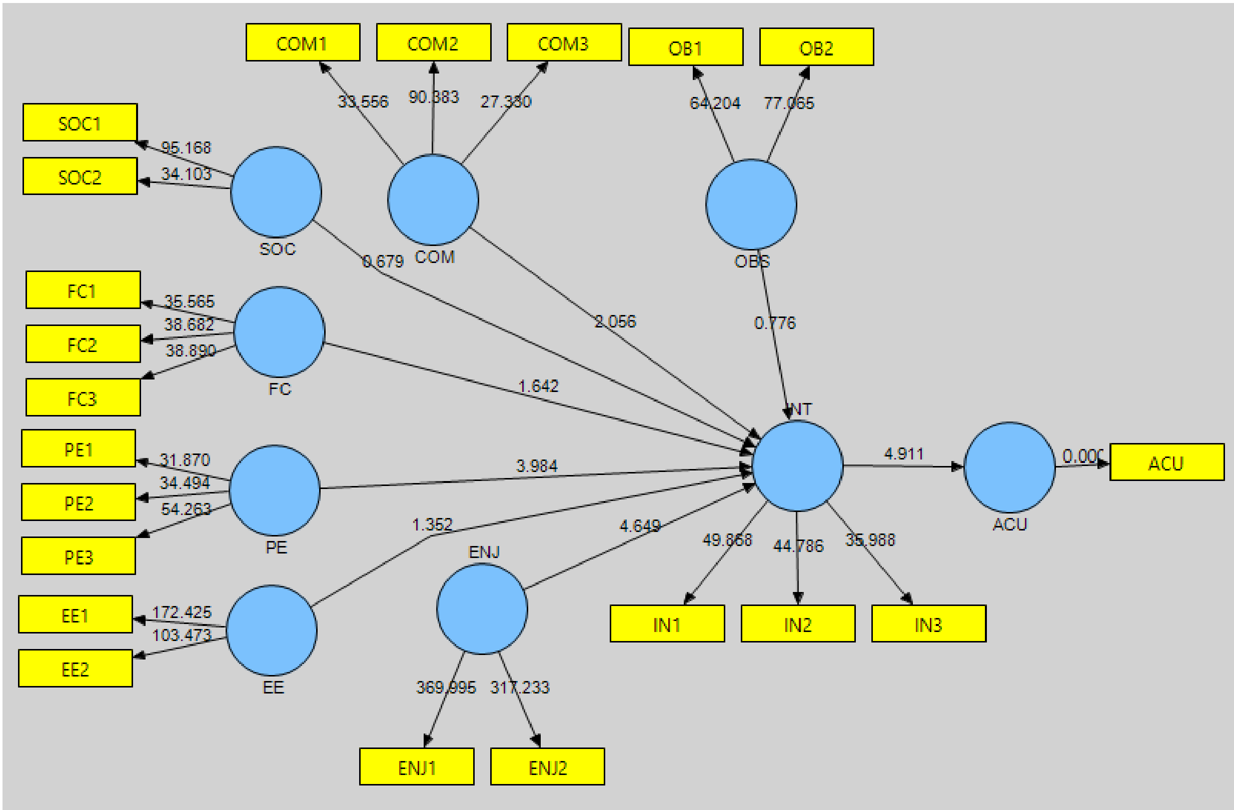


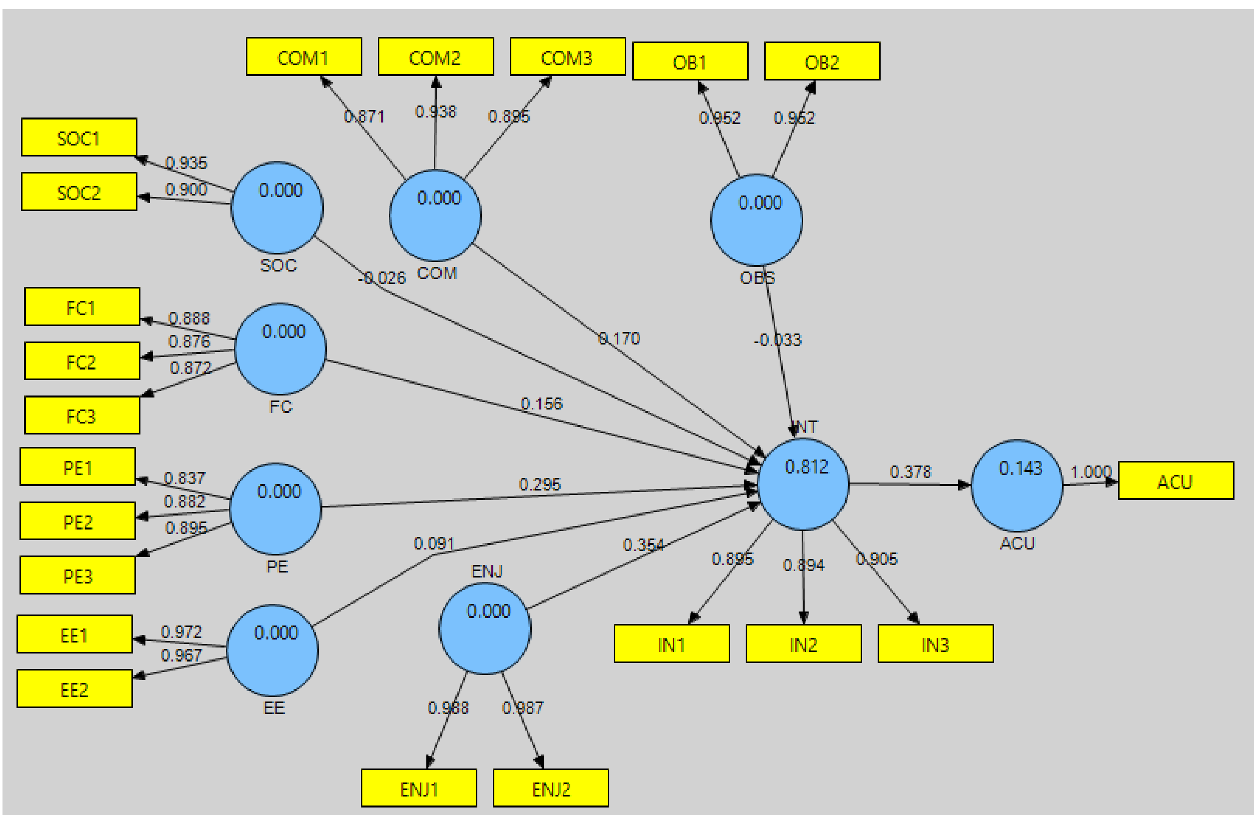
	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	Standard Error (STERR)	T Statistics (|O/STERR|)
COM -> INT	0.2021	0.2059	0.1098	0.1098	1.841
EE -> INT	-0.0224	-0.0287	0.0829	0.0829	0.2707
ENJ -> INT	0.3494	0.3423	0.097	0.097	3.6
FC -> INT	0.201	0.2131	0.1189	0.1189	1.6897
INT -> ACU	0.3853	0.385	0.1003	0.1003	3.8411
OBS -> INT	-0.0264	-0.0309	0.0886	0.0886	0.2974
PE -> INT	0.2809	0.2828	0.1199	0.1199	2.3437
SOC -> INT	-0.0095	-0.0094	0.0674	0.0674	0.1413

	AVE	Composite Reliability	R Square	Cronbachs Alpha	Communality	Redundancy
ACU	1	1	0.1485	1	1	0.1485
COM	0.9101	0.9681	0	0.9507	0.9101	0
EE	0.9585	0.9788	0	0.9568	0.9585	0
ENJ	0.9792	0.9895	0	0.9788	0.9792	0
FC	0.6535	0.8496	0	0.7345	0.6535	0
INT	0.772	0.9103	0.7737	0.8523	0.772	0.219
OBS	0.9378	0.9679	0	0.9341	0.9378	0
PE	0.7996	0.9229	0	0.8759	0.7996	0
SOC	0.8617	0.9257	0	0.8396	0.8617	0

	ACU	COM	EE	ENJ	FC	INT	OBS	PE	SOC
ACU	1	0	0	0	0	0	0	0	0
COM	0.3568	1	0	0	0	0	0	0	0
EE	0.3297	0.5678	1	0	0	0	0	0	0
ENJ	0.335	0.7699	0.5517	1	0	0	0	0	0
FC	0.4049	0.7651	0.6728	0.6015	1	0	0	0	0
INT	0.3853	0.8062	0.5764	0.7887	0.7251	1	0	0	0
OBS	0.1442	0.4741	0.2789	0.3126	0.5699	0.4098	1	0	0
PE	0.3264	0.7524	0.5899	0.6698	0.6869	0.7749	0.4521	1	0
SOC	0.082	0.501	0.2349	0.4965	0.371	0.4692	0.43	0.5199	1

Education O Level



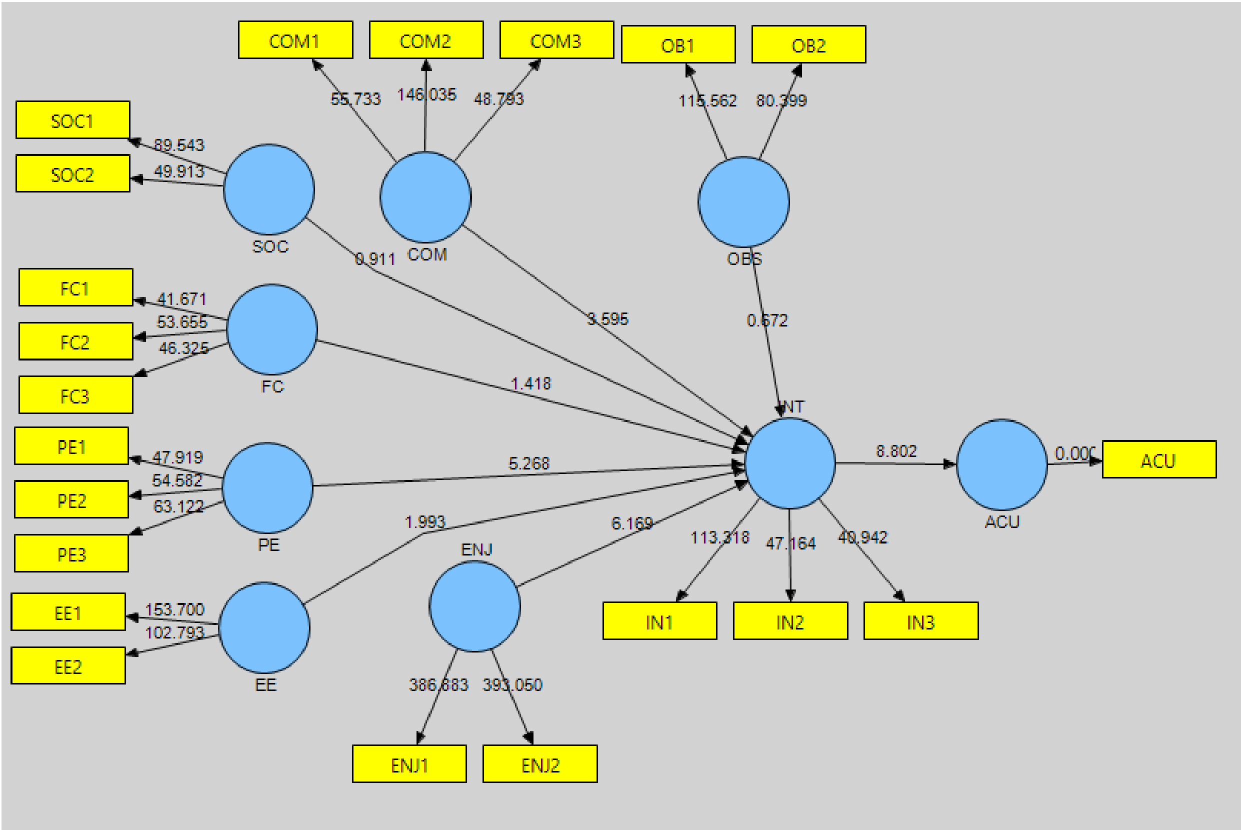


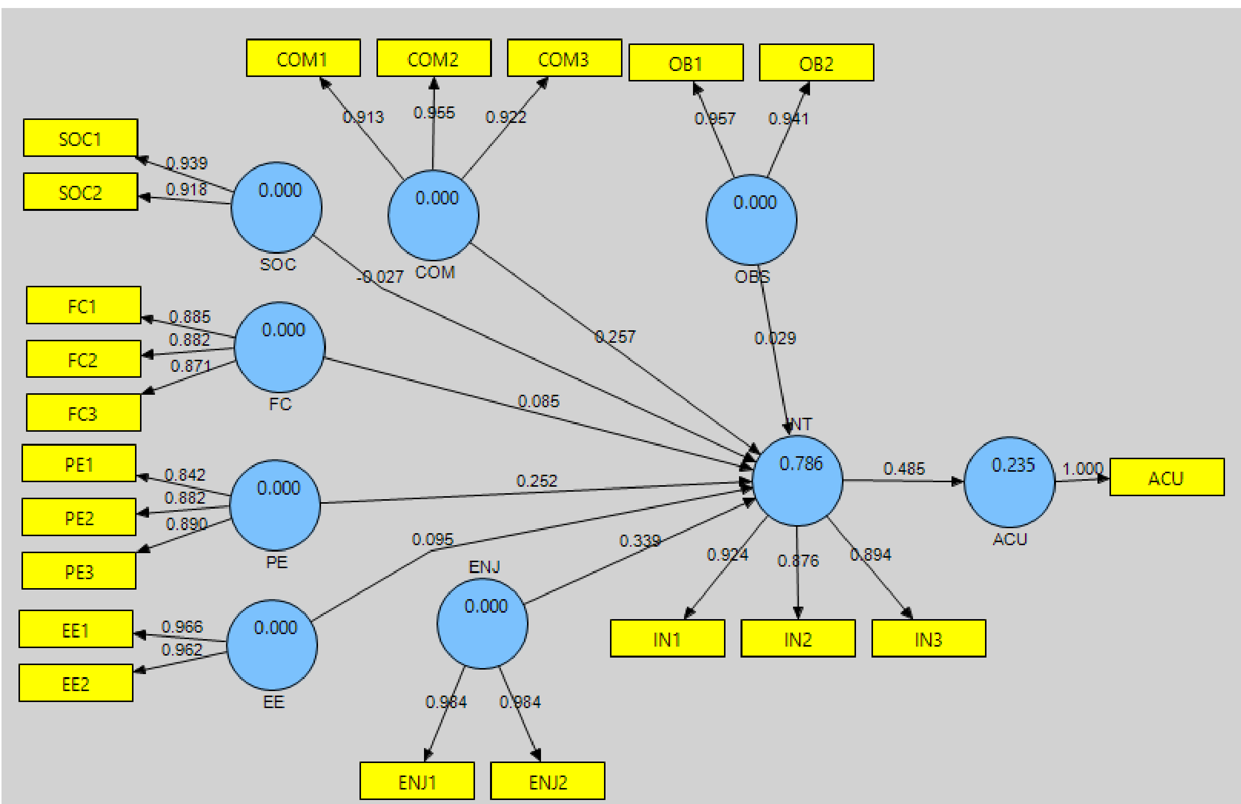
	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	Standard Error (STERR)	T Statistics (|O/STERR|)
COM -> INT	0.1697	0.1749	0.0825	0.0825	2.0565
EE -> INT	0.0908	0.0874	0.0671	0.0671	1.3517
ENJ -> INT	0.3537	0.3522	0.0761	0.0761	4.6487
FC -> INT	0.1557	0.1534	0.0948	0.0948	1.6424
INT -> ACU	0.3784	0.3741	0.077	0.077	4.9109
OBS -> INT	-0.0326	-0.028	0.0419	0.0419	0.7764
PE -> INT	0.2946	0.2942	0.074	0.074	3.9835
SOC -> INT	-0.0261	-0.0265	0.0384	0.0384	0.6795

	AVE	Composite Reliability	R Square	Cronbachs Alpha	Communality	Redundancy
ACU	1	1	0.1431	1	1	0.1431
COM	0.8133	0.9289	0	0.8847	0.8133	0
EE	0.9399	0.969	0	0.9362	0.9399	0
ENJ	0.9757	0.9877	0	0.9751	0.9757	0
FC	0.772	0.9104	0	0.8526	0.772	0
INT	0.8065	0.9259	0.812	0.88	0.8065	0.1872
OBS	0.9065	0.951	0	0.8969	0.9065	0
PE	0.7592	0.9043	0	0.8412	0.7592	0
SOC	0.8422	0.9143	0	0.8145	0.8422	0

	ACU	COM	EE	ENJ	FC	INT	OBS	PE	SOC
ACU	1	0	0	0	0	0	0	0	0
COM	0.3278	1	0	0	0	0	0	0	0
EE	0.3024	0.6506	1	0	0	0	0	0	0
ENJ	0.213	0.6407	0.7216	1	0	0	0	0	0
FC	0.3153	0.7465	0.7283	0.5932	1	0	0	0	0
INT	0.3784	0.7681	0.7403	0.8058	0.7339	1	0	0	0
OBS	0.1342	0.5214	0.3309	0.222	0.5806	0.3582	1	0	0
PE	0.3072	0.7753	0.6406	0.6864	0.6983	0.8089	0.3895	1	0
SOC	0.1449	0.5746	0.2855	0.3639	0.4336	0.4408	0.4405	0.5485	1

Gender Female



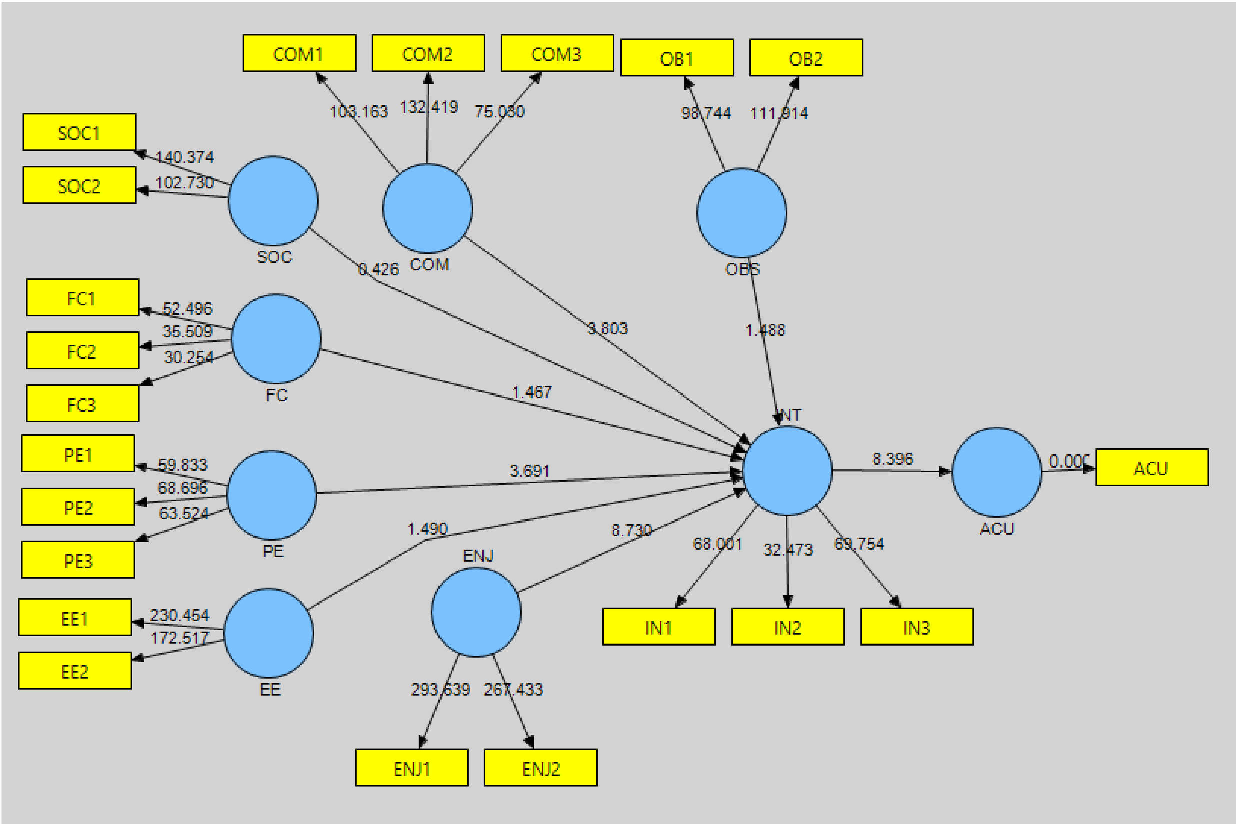


	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	Standard Error (STERR)	T Statistics (|O/STERR|)
COM -> INT	0.257	0.2593	0.0715	0.0715	3.5955
EE -> INT	0.095	0.0938	0.0476	0.0476	1.9934
ENJ -> INT	0.3386	0.3393	0.0549	0.0549	6.1693
FC -> INT	0.0848	0.079	0.0598	0.0598	1.418
INT -> ACU	0.4848	0.4834	0.0551	0.0551	8.8016
OBS -> INT	0.0288	0.0287	0.0429	0.0429	0.6716
PE -> INT	0.2518	0.2537	0.0478	0.0478	5.2683
SOC -> INT	-0.0267	-0.0238	0.0293	0.0293	0.9109

	AVE	Composite Reliability	R Square	Cronbachs Alpha	Communality	Redundancy
ACU	1	1	0.235	1	1	0.235
COM	0.865	0.9505	0	0.9218	0.865	0
EE	0.9295	0.9634	0	0.9242	0.9295	0
ENJ	0.9683	0.9839	0	0.9673	0.9683	0
FC	0.7736	0.9111	0	0.8539	0.7736	0
INT	0.807	0.9261	0.7858	0.8804	0.807	0.2685
OBS	0.901	0.9479	0	0.8908	0.901	0
PE	0.7598	0.9046	0	0.8427	0.7598	0
SOC	0.8627	0.9263	0	0.8417	0.8627	0

	ACU	COM	EE	ENJ	FC	INT	OBS	PE	SOC
ACU	1	0	0	0	0	0	0	0	0
COM	0.4563	1	0	0	0	0	0	0	0
EE	0.3813	0.6056	1	0	0	0	0	0	0
ENJ	0.3905	0.6409	0.7035	1	0	0	0	0	0
FC	0.4193	0.7525	0.6562	0.6101	1	0	0	0	0
INT	0.4848	0.7763	0.697	0.7821	0.7115	1	0	0	0
OBS	0.332	0.6175	0.3502	0.3421	0.5857	0.487	1	0	0
PE	0.4495	0.6888	0.5803	0.6262	0.6174	0.7513	0.4428	1	0
SOC	0.1542	0.3875	0.1373	0.276	0.2975	0.3089	0.403	0.3681	1

Gender Male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COM2
COM3
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OB2
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SOC2
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SOC
COM
OBS
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1.488
FC1
FC2
FC3
52.496
35.509
30.254
FC
1.467
INT
PE1
PE2
PE3
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68.696
63.524
PE
3.691
8.396
ACU
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ACU
1.490
8.730
ENJ
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IN3
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EE2
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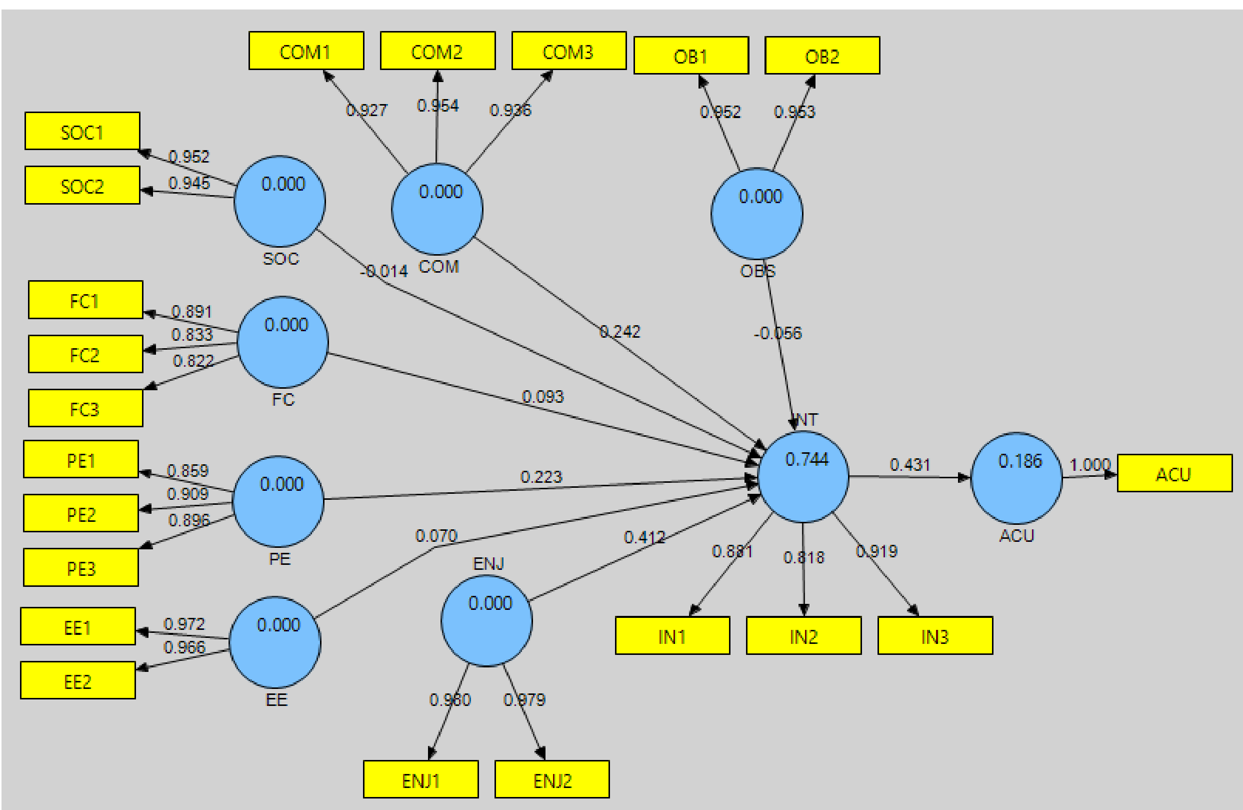
ENJ1
ENJ2


COM1
COM2
COM3
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OB2
SOC1
SOC2
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SOC
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FC1
FC2
FC3
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IN2
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EE2
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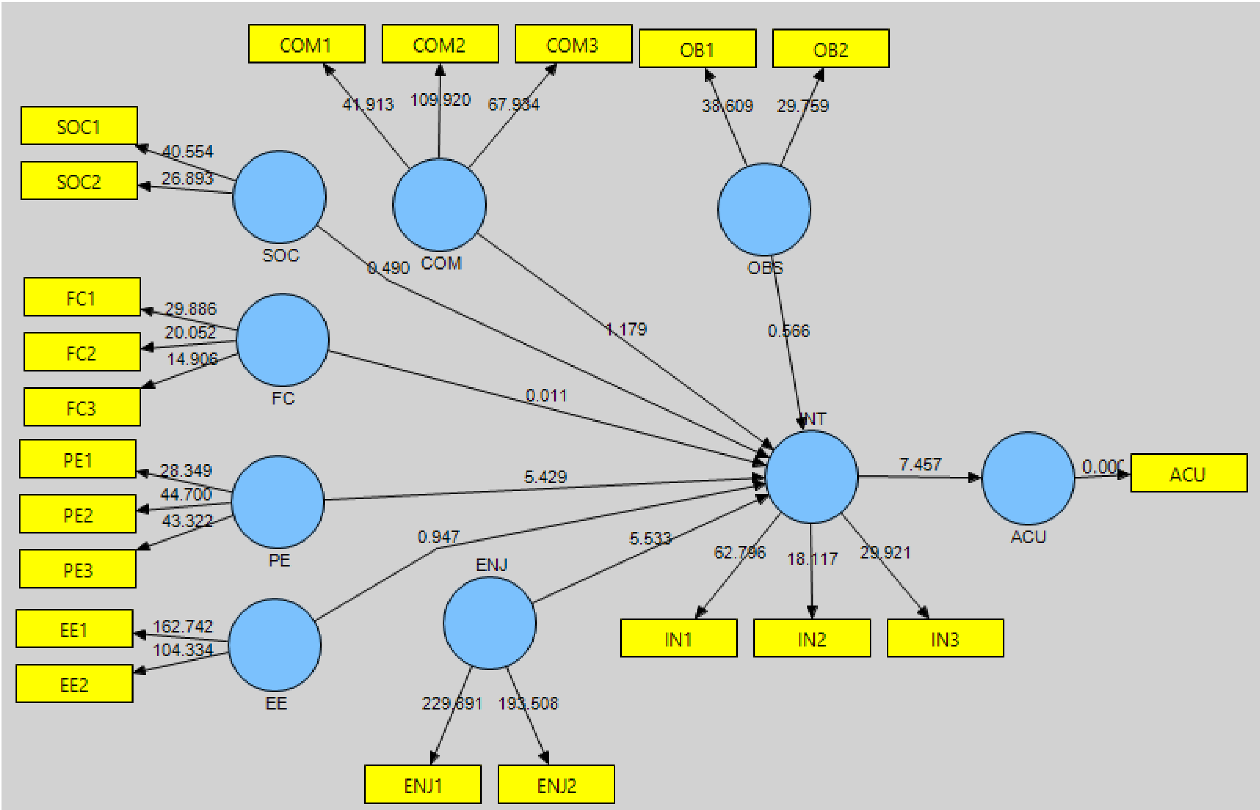
EE
0.980
0.979
ENJ1
ENJ2

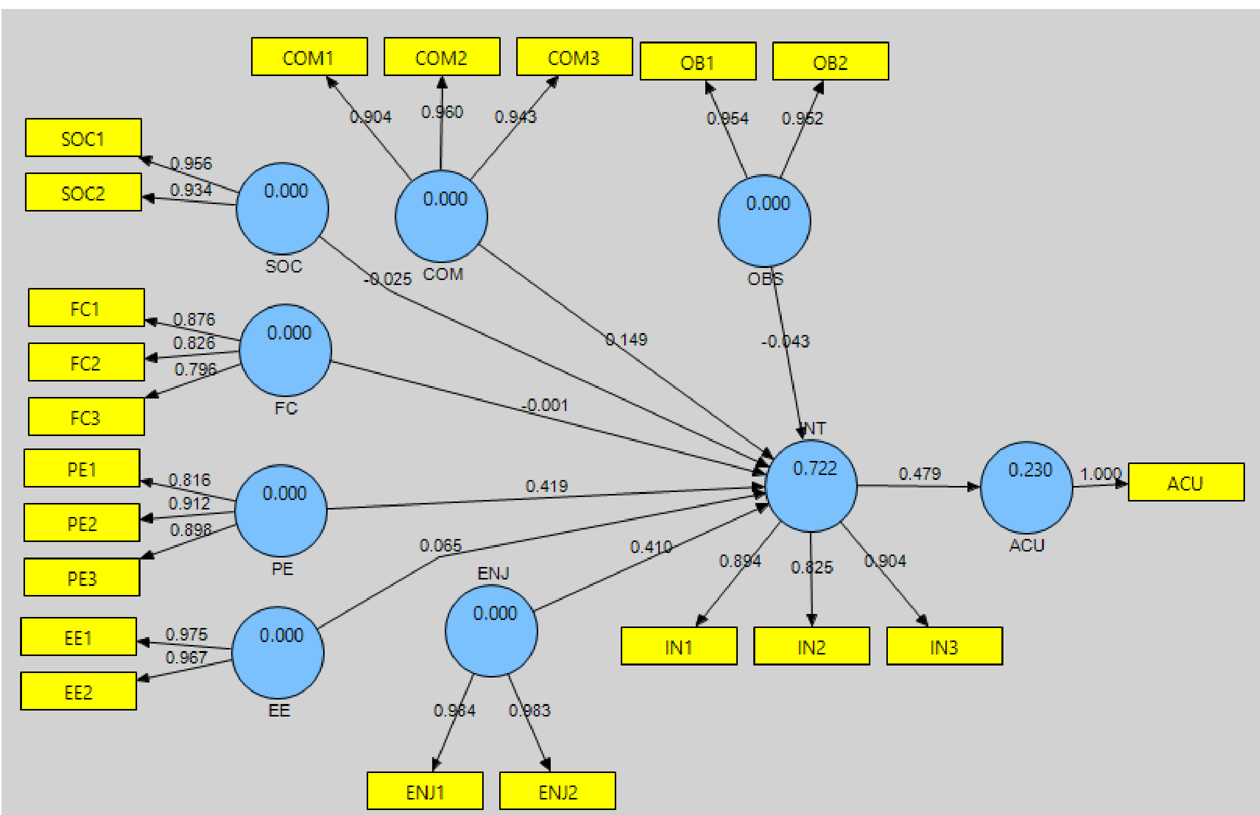
	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	Standard Error (STERR)	T Statistics (|O/STERR|)
COM -> INT	0.242	0.2455	0.0636	0.0636	3.803
EE -> INT	0.0704	0.0686	0.0473	0.0473	1.4905
ENJ -> INT	0.4124	0.4115	0.0472	0.0472	8.7295
FC -> INT	0.0926	0.0947	0.0632	0.0632	1.4665
INT -> ACU	0.4312	0.4296	0.0514	0.0514	8.3956
OBS -> INT	-0.0562	-0.055	0.0377	0.0377	1.4883
PE -> INT	0.223	0.2205	0.0604	0.0604	3.6911
SOC -> INT	-0.0136	-0.0141	0.032	0.032	0.4255

	AVE	Composite Reliability	R Square	Cronbachs Alpha	Communality	Redundancy
ACU	1	1	0.1859	1	1	0.1859
COM	0.8813	0.957	0	0.9326	0.8813	0
EE	0.939	0.9686	0	0.9352	0.939	0
ENJ	0.9602	0.9797	0	0.9585	0.9602	0
FC	0.7209	0.8855	0	0.8061	0.7209	0
INT	0.7627	0.9058	0.7438	0.8437	0.7627	0.2391
OBS	0.9076	0.9516	0	0.8983	0.9076	0
PE	0.7886	0.9179	0	0.866	0.7886	0
SOC	0.8994	0.947	0	0.8882	0.8994	0

	ACU	COM	EE	ENJ	FC	INT	OBS	PE	SOC
ACU	1	0	0	0	0	0	0	0	0
COM	0.4282	1	0	0	0	0	0	0	0
EE	0.302	0.6159	1	0	0	0	0	0	0
ENJ	0.3027	0.6605	0.6132	1	0	0	0	0	0
FC	0.3419	0.7172	0.6734	0.4811	1	0	0	0	0
INT	0.4312	0.7675	0.6343	0.7726	0.6138	1	0	0	0
OBS	0.1436	0.4901	0.3795	0.3087	0.529	0.354	1	0	0
PE	0.4044	0.7957	0.5581	0.6085	0.6097	0.7325	0.4183	1	0
SOC	0.1387	0.4904	0.2633	0.4216	0.3345	0.4123	0.3486	0.464	1

Health Excellent



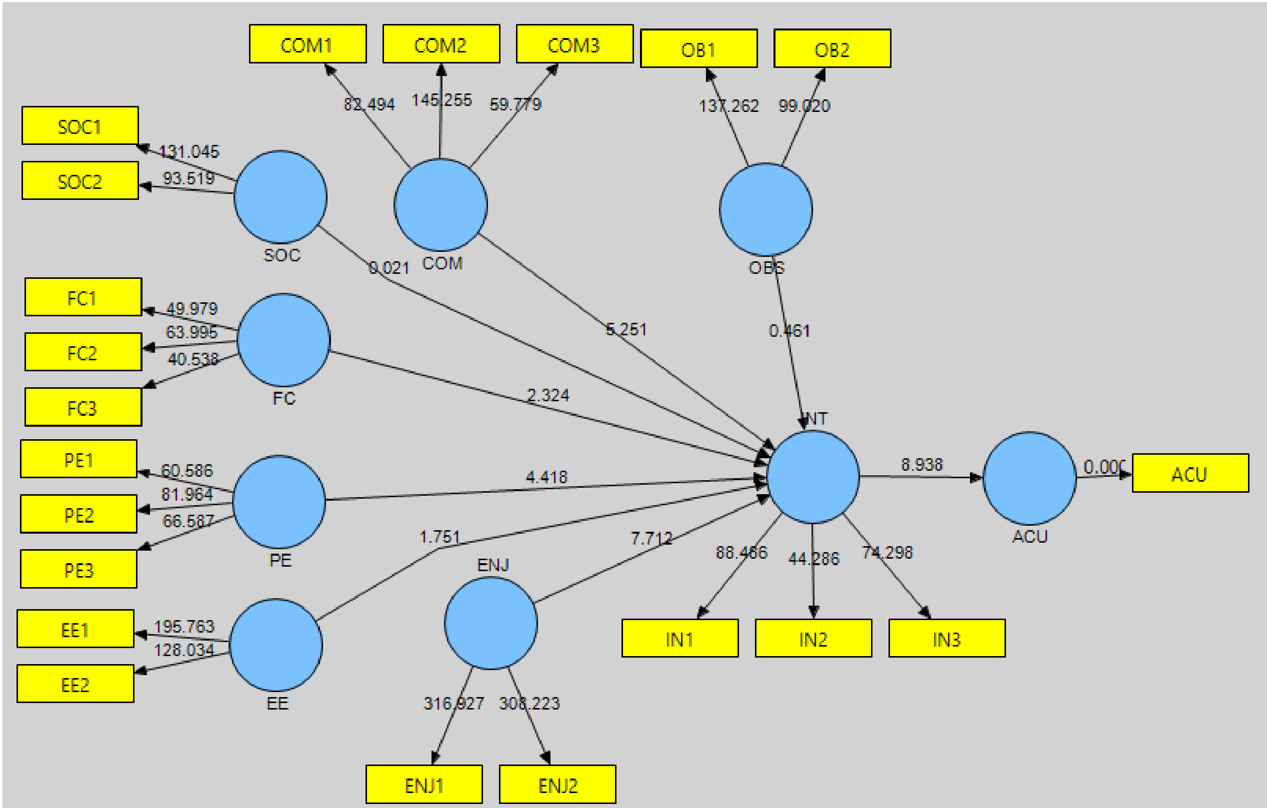


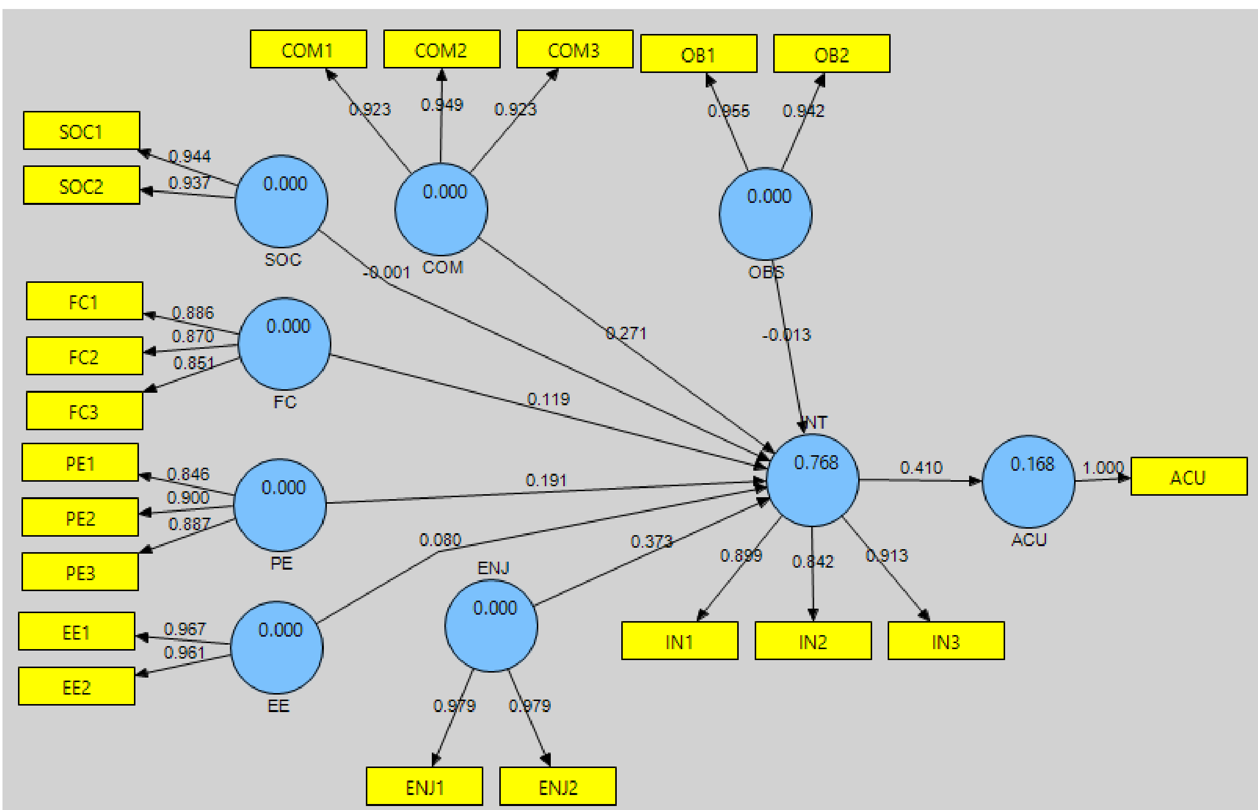
	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	Standard Error (STERR)	T Statistics (|O/STERR|)
COM -> INT	0.1492	0.1633	0.1265	0.1265	1.1792
EE -> INT	0.0649	0.0658	0.0685	0.0685	0.9467
ENJ -> INT	0.4095	0.4038	0.074	0.074	5.5328
FC -> INT	-0.001	-0.0099	0.0895	0.0895	0.0112
INT -> ACU	0.4794	0.4806	0.0643	0.0643	7.4566
OBS -> INT	-0.0432	-0.0353	0.0763	0.0763	0.5664
PE -> INT	0.4188	0.4161	0.0771	0.0771	5.4292
SOC -> INT	-0.0248	-0.0284	0.0505	0.0505	0.4899

	AVE	Composite Reliability	R Square	Cronbachs Alpha	Communality	Redundancy
ACU	1	1	0.2298	1	1	0.2298
COM	0.8754	0.9547	0	0.9286	0.8754	0
EE	0.9429	0.9706	0	0.9396	0.9429	0
ENJ	0.967	0.9832	0	0.9658	0.967	0
FC	0.695	0.8722	0	0.7808	0.695	0
INT	0.7657	0.9073	0.7221	0.8472	0.7657	0.1322
OBS	0.9088	0.9522	0	0.8997	0.9088	0
PE	0.7674	0.908	0	0.8474	0.7674	0
SOC	0.8934	0.9437	0	0.8818	0.8934	0

	ACU	COM	EE	ENJ	FC	INT	OBS	PE	SOC
ACU	1	0	0	0	0	0	0	0	0
COM	0.4209	1	0	0	0	0	0	0	0
EE	0.2857	0.4789	1	0	0	0	0	0	0
ENJ	0.3601	0.5422	0.6574	1	0	0	0	0	0
FC	0.2229	0.6326	0.5009	0.4166	1	0	0	0	0
INT	0.4794	0.6497	0.6187	0.7282	0.4887	1	0	0	0
OBS	0.1505	0.5501	0.2355	0.2529	0.4924	0.3186	1	0	0
PE	0.4172	0.6808	0.5406	0.5075	0.5276	0.7363	0.4094	1	0
SOC	0.2381	0.535	0.1021	0.2449	0.2978	0.2911	0.4033	0.3508	1

Health Good


COM1
COM2
COM3
OB1
OB2
82.494
145.255
59.779
137.262
99.020
SOC1
SOC2
131.045
93.519
SOC
COM
OBS
0.021
5.251
0.461
FC1
FC2
FC3
49.979
63.995
40.538
FC
2.324
INT
PE1
PE2
PE3
60.586
81.964
66.587
PE
4.418
8.938
0.000
ACU
ACU
1.751
7.712
88.486
44.286
74.298
ENJ
EE1
EE2
195.763
128.034
EE
IN1
IN2
IN3
316.927
308.223
ENJ1
ENJ2

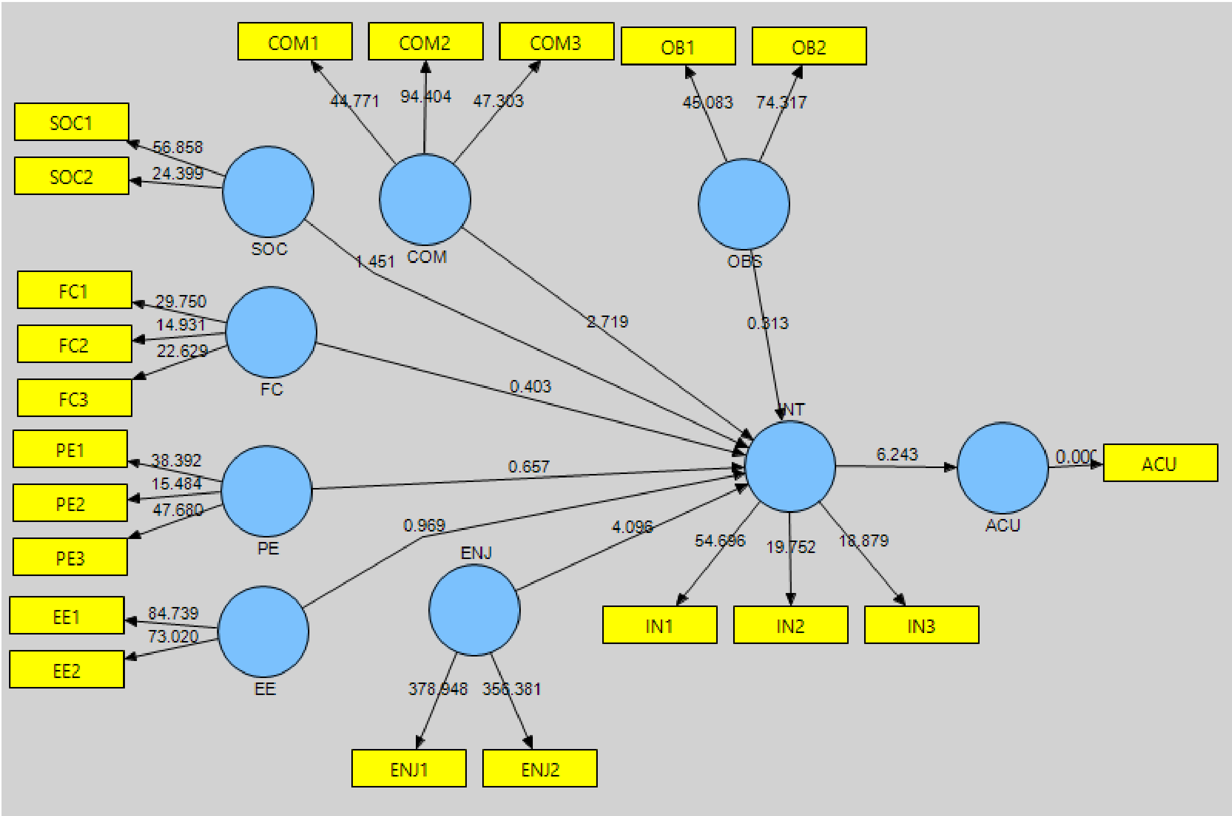

COM1
COM2
COM3
OB1
OB2
0.923
0.949
0.923
0.955
0.942
SOC1
SOC2
0.944
0.937
0.000
0.000
0.000
SOC
COM
OBS
-0.001
0.271
-0.013
FC1
FC2
FC3
0.886
0.870
0.851
0.000
FC
0.119
INT
PE1
PE2
PE3
0.846
0.900
0.887
0.000
PE
0.191
0.768
0.410
0.168
1.000
ACU
ACU
0.080
0.373
0.899
0.842
0.913
ENJ
0.000
EE1
EE2
0.967
0.961
0.000
EE
IN1
IN2
IN3
0.979
0.979
ENJ1
ENJ2

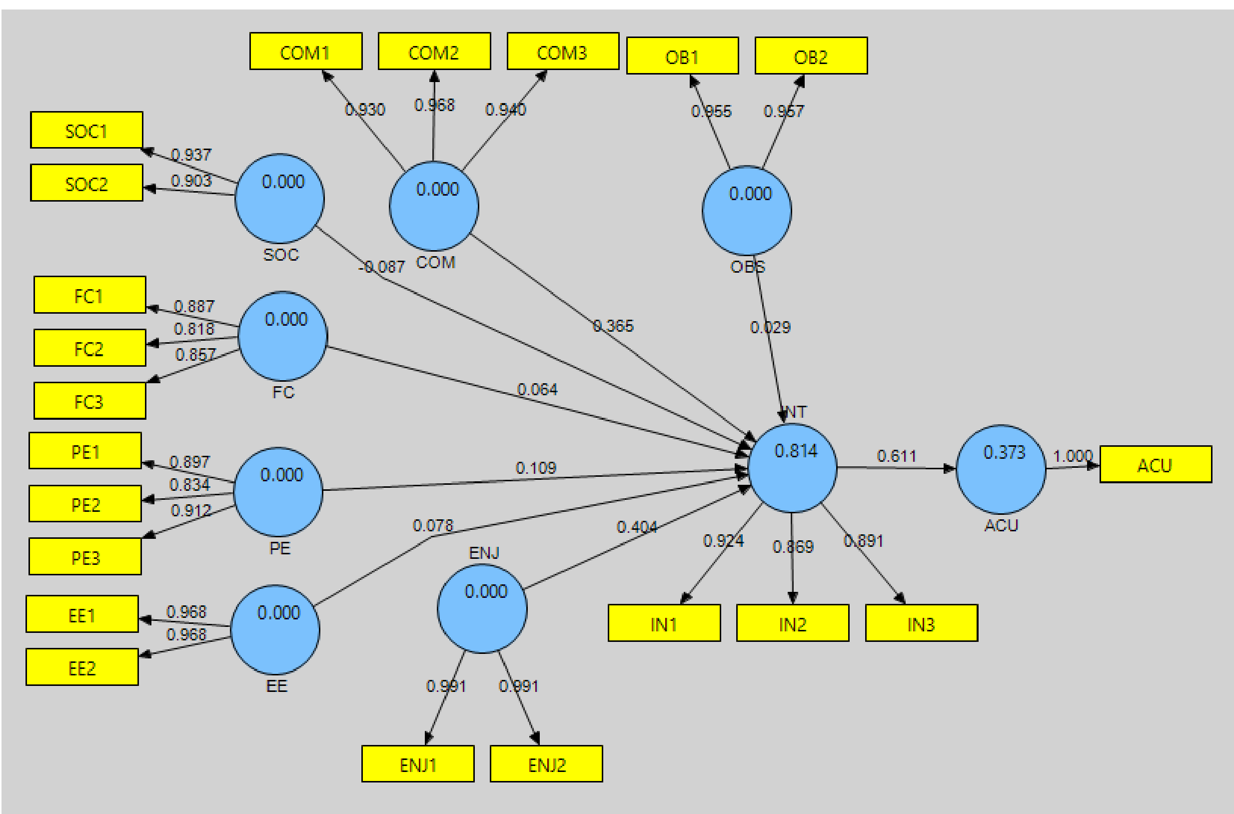
	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	Standard Error (STERR)	T Statistics (|O/STERR|)
COM -> INT	0.2712	0.2724	0.0516	0.0516	5.2512
EE -> INT	0.0797	0.0768	0.0455	0.0455	1.7508
ENJ -> INT	0.3732	0.3713	0.0484	0.0484	7.712
FC -> INT	0.1187	0.1204	0.0511	0.0511	2.3236
INT -> ACU	0.4098	0.4085	0.0459	0.0459	8.9384
OBS -> INT	-0.013	-0.0133	0.0281	0.0281	0.4609
PE -> INT	0.1909	0.1919	0.0432	0.0432	4.4176
SOC -> INT	-0.0005	0.0001	0.0262	0.0262	0.0205

	AVE	Composite Reliability	R Square	Cronbachs Alpha	Communality	Redundancy
ACU	1	1	0.168	1	1	0.168
COM	0.8682	0.9518	0	0.924	0.8682	0
EE	0.9287	0.963	0	0.9233	0.9287	0
ENJ	0.9584	0.9788	0	0.9566	0.9584	0
FC	0.7551	0.9024	0	0.838	0.7551	0
INT	0.7832	0.9154	0.7679	0.8611	0.7832	0.2756
OBS	0.9	0.9474	0	0.8893	0.9	0
PE	0.7712	0.91	0	0.8519	0.7712	0
SOC	0.8848	0.9389	0	0.8699	0.8848	0

	ACU	COM	EE	ENJ	FC	INT	OBS	PE	SOC
ACU	1	0	0	0	0	0	0	0	0
COM	0.4023	1	0	0	0	0	0	0	0
EE	0.3137	0.6139	1	0	0	0	0	0	0
ENJ	0.297	0.6592	0.6447	1	0	0	0	0	0
FC	0.3642	0.7276	0.6739	0.5373	1	0	0	0	0
INT	0.4098	0.7842	0.6657	0.7777	0.6749	1	0	0	0
OBS	0.2291	0.5672	0.3667	0.3348	0.5569	0.4369	1	0	0
PE	0.3842	0.7295	0.5436	0.603	0.5867	0.7213	0.3981	1	0
SOC	0.1045	0.4019	0.1873	0.3685	0.2939	0.3683	0.3676	0.4049	1

Health Poor


COM1
COM2
COM3
OB1
OB2
44.771
94.404
47.303
45.083
74.317
SOC1
SOC2
56.858
24.399
SOC
COM
OBS
1.451
2.719
0.313
FC1
FC2
FC3
29.750
14.931
22.629
FC
0.403
INT
PE1
PE2
PE3
38.392
15.484
47.680
PE
0.657
6.243
ACU
0.000
ACU
0.969
4.096
ENJ
54.696
19.752
18.879
EE1
EE2
84.739
73.020
EE
IN1
IN2
IN3
378.948
356.381
ENJ1
ENJ2

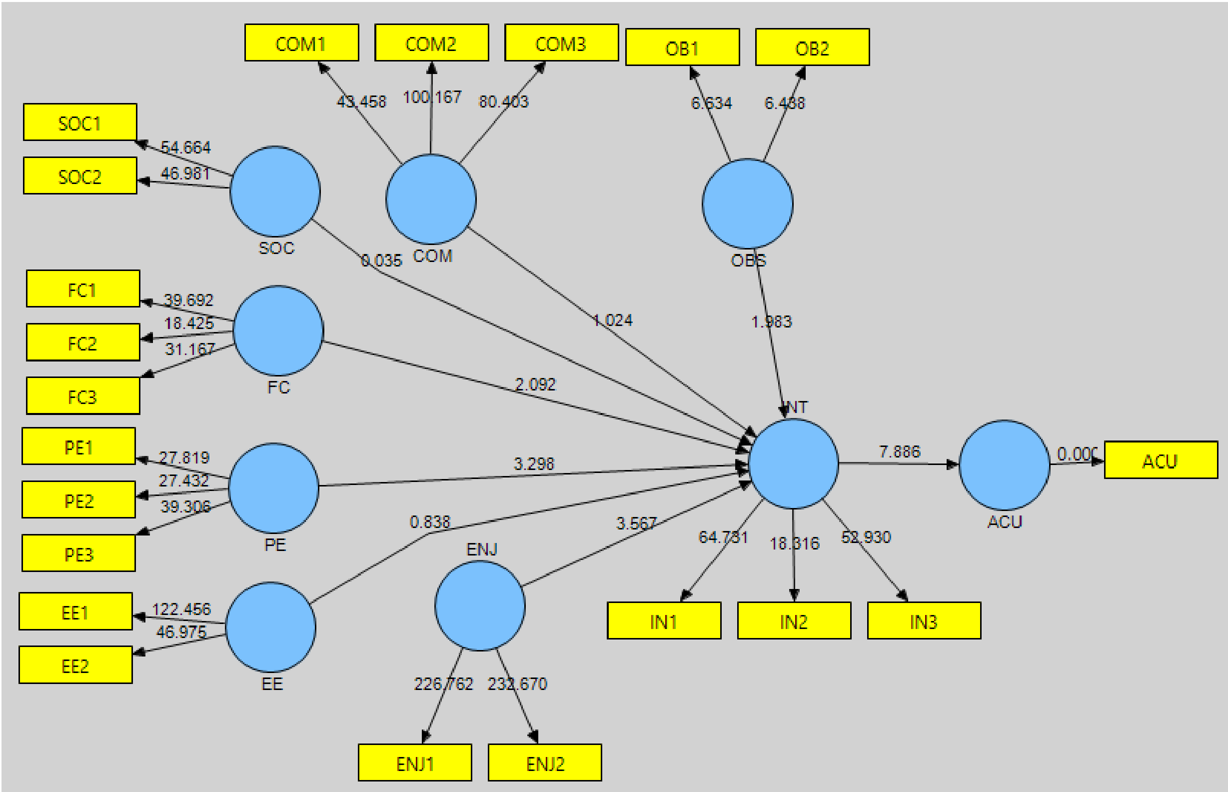

COM1
COM2
COM3
OB1
OB2
0.930
0.968
0.940
0.955
0.957
SOC1
SOC2
0.937
0.903
0.000
SOC
0.000
COM
0.000
OBS
-0.087
0.365
0.029
FC1
FC2
FC3
0.887
0.818
0.857
0.000
FC
0.064
INT
PE1
PE2
PE3
0.897
0.834
0.912
0.000
PE
0.109
0.814
0.611
0.373
ACU
1.000
ACU
0.078
0.404
ENJ
0.000
0.924
0.869
0.891
EE1
EE2
0.968
0.968
0.000
EE
IN1
IN2
IN3
0.991
0.991
ENJ1
ENJ2

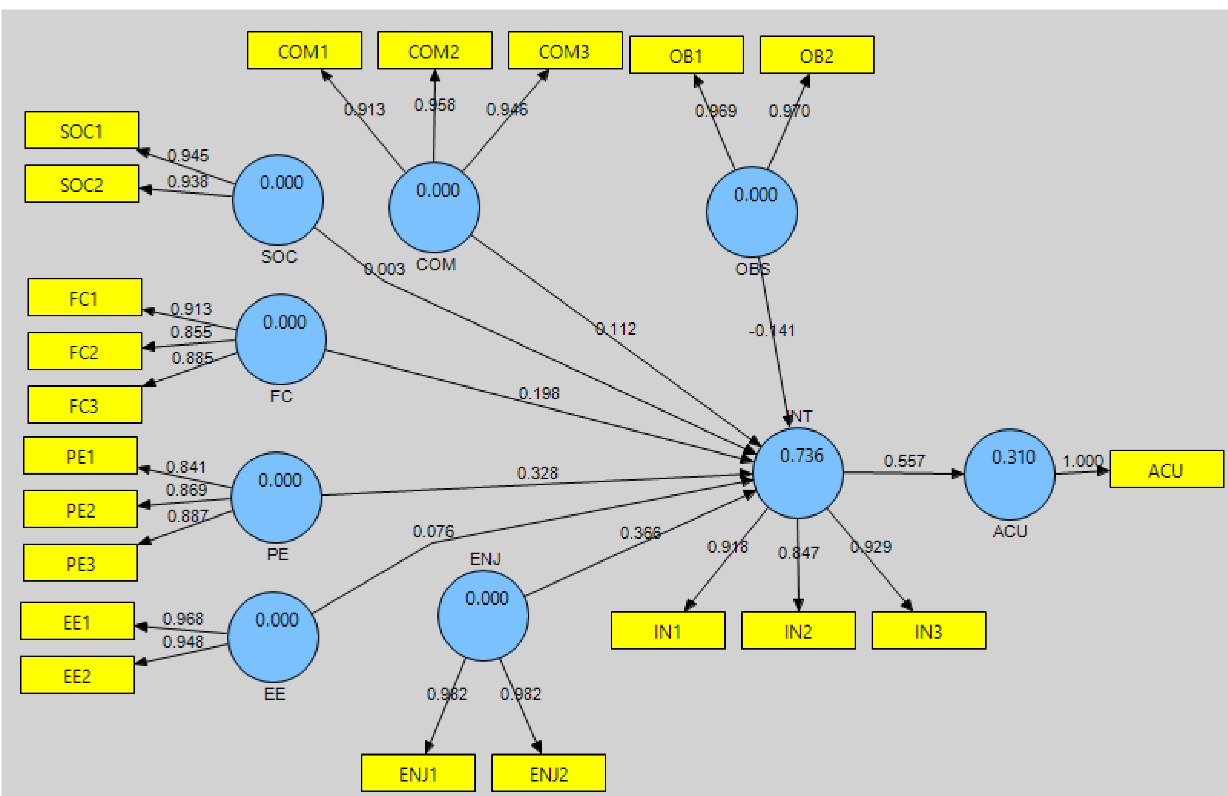
	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	Standard Error (STERR)	T Statistics (|O/STERR|)
COM -> INT	0.3645	0.3653	0.1341	0.1341	2.7193
EE -> INT	0.0782	0.0677	0.0807	0.0807	0.9685
ENJ -> INT	0.4043	0.412	0.0987	0.0987	4.0958
FC -> INT	0.064	0.0636	0.1588	0.1588	0.4034
INT -> ACU	0.6108	0.6094	0.0978	0.0978	6.2429
OBS -> INT	0.029	0.0301	0.0927	0.0927	0.313
PE -> INT	0.1094	0.1112	0.1665	0.1665	0.6566
SOC -> INT	-0.0865	-0.0838	0.0596	0.0596	1.451

	AVE	Composite Reliability	R Square	Cronbachs Alpha	Communalit y	Redundanc y
ACU	1	1	0.3731	1	1	0.3731
CO M	0.8948	0.9623	0	0.9411	0.8948	0
EE	0.9378	0.9679	0	0.9337	0.9378	0
ENJ	0.9825	0.9912	0	0.9822	0.9825	0
FC	0.7299	0.8901	0	0.8142	0.7299	0
INT	0.8006	0.9233	0.8141	0.8755	0.8006	0.3889
OBS	0.9133	0.9547	0	0.9051	0.9133	0
PE	0.7769	0.9125	0	0.8573	0.7769	0
SOC	0.8463	0.9167	0	0.8202	0.8463	0

	ACU	COM	EE	ENJ	FC	INT	OBS	PE	SOC
ACU	1	0	0	0	0	0	0	0	0
COM	0.6261	1	0	0	0	0	0	0	0
EE	0.4341	0.6914	1	0	0	0	0	0	0
ENJ	0.5275	0.7844	0.6589	1	0	0	0	0	0
FC	0.5486	0.8216	0.7774	0.6972	1	0	0	0	0
INT	0.6108	0.8487	0.6971	0.84	0.7684	1	0	0	0
OBS	0.2865	0.4375	0.4551	0.3769	0.5753	0.4388	1	0	0
PE	0.5853	0.8843	0.6525	0.8178	0.7868	0.8249	0.5447	1	0
SOC	0.2602	0.567	0.3918	0.54	0.4686	0.4797	0.394	0.6319	1

Time less than 1 year



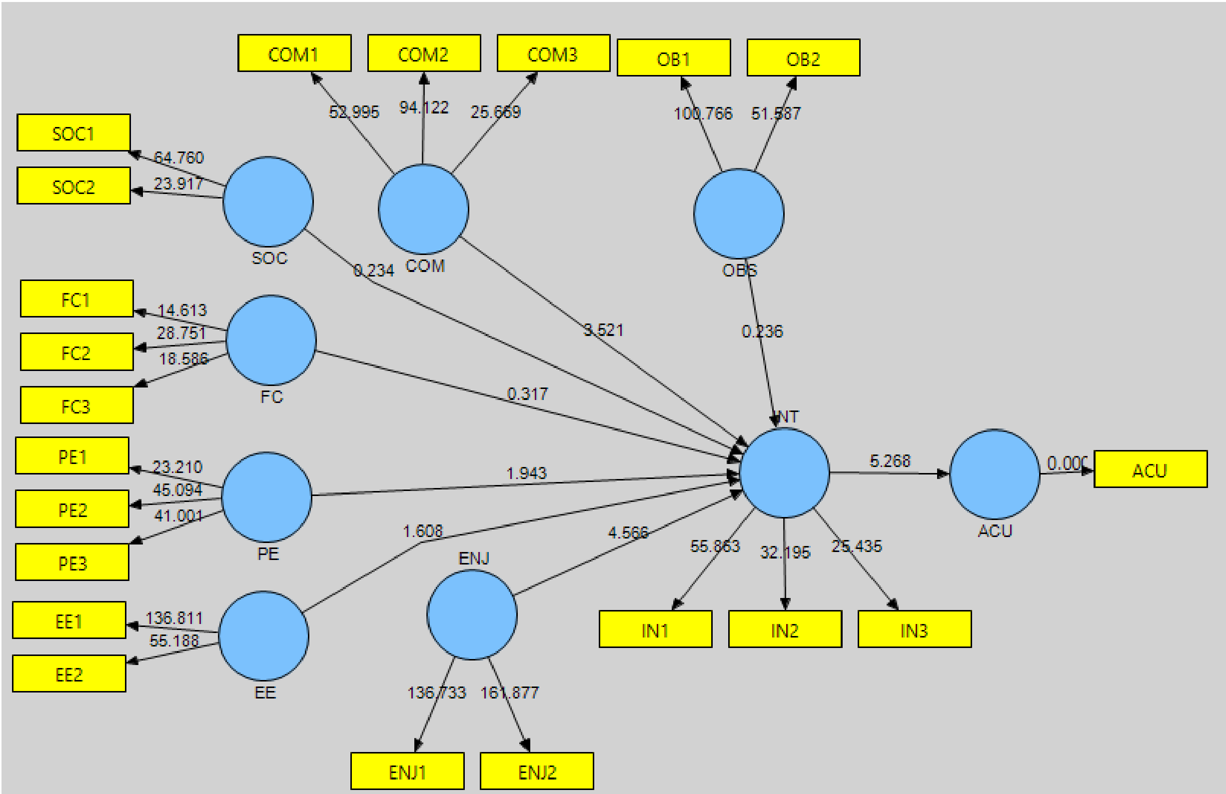


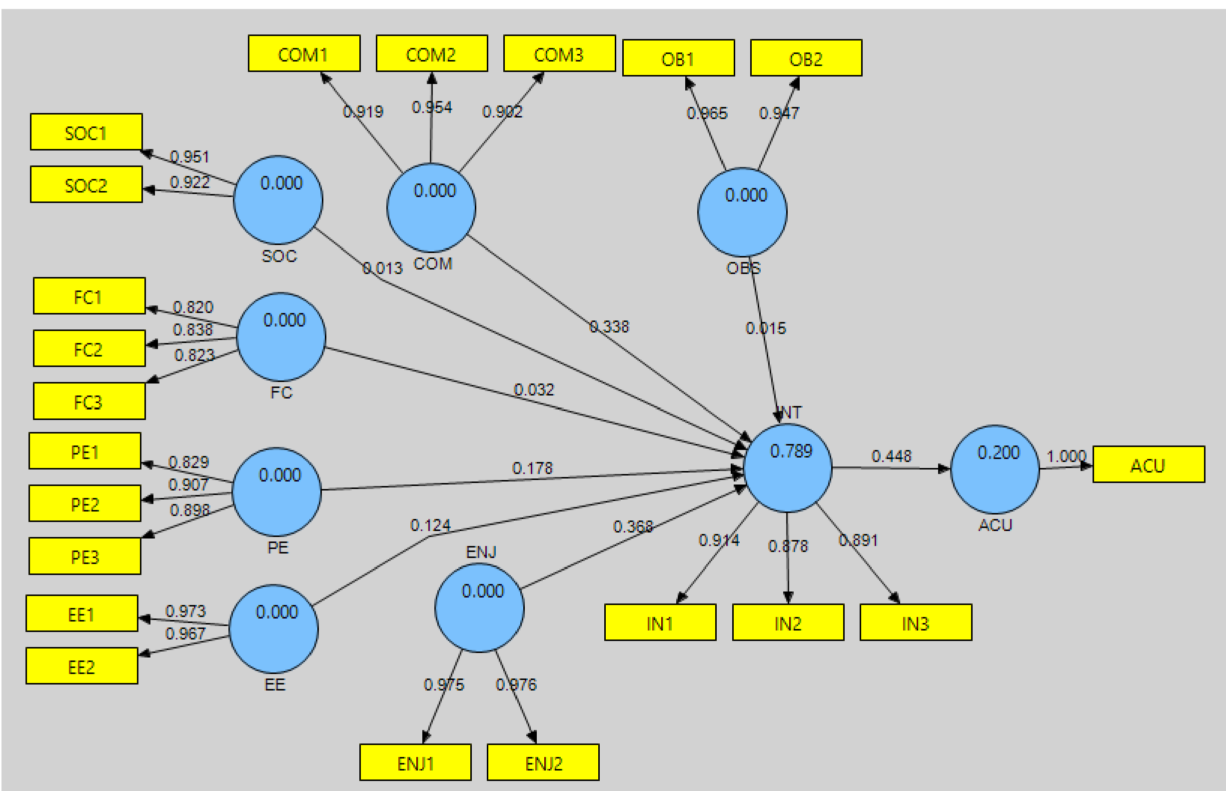
	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	Standard Error (STERR)	T Statistics (|O/STERR|)
COM -> INT	0.1124	0.1117	0.1098	0.1098	1.0238
EE -> INT	0.0758	0.0653	0.0906	0.0906	0.8376
ENJ -> INT	0.3658	0.3606	0.1026	0.1026	3.5673
FC -> INT	0.1983	0.1975	0.0948	0.0948	2.0916
INT -> ACU	0.5572	0.5543	0.0707	0.0707	7.8855
OBS -> INT	-0.1412	-0.1361	0.0712	0.0712	1.9827
PE -> INT	0.3275	0.3371	0.0993	0.0993	3.2985
SOC -> INT	0.0028	0.0121	0.0791	0.0791	0.0354

	AVE	Composite Reliability	R Square	Cronbachs Alpha	Communality	Redundancy
ACU	1	1	0.3105	1	1	0.3105
COM	0.8825	0.9575	0	0.9332	0.8825	0
EE	0.9174	0.9569	0	0.9111	0.9174	0
ENJ	0.9651	0.9822	0	0.9639	0.9651	0
FC	0.7824	0.9151	0	0.861	0.7824	0
INT	0.8075	0.9263	0.7361	0.881	0.8075	0.1105
OBS	0.9401	0.9691	0	0.9363	0.9401	0
PE	0.7498	0.8999	0	0.8333	0.7498	0
SOC	0.8864	0.9398	0	0.872	0.8864	0

	ACU	COM	EE	ENJ	FC	INT	OBS	PE	SOC
ACU	1	0	0	0	0	0	0	0	0
COM	0.4709	1	0	0	0	0	0	0	0
EE	0.3289	0.5276	1	0	0	0	0	0	0
ENJ	0.3987	0.5911	0.6697	1	0	0	0	0	0
FC	0.4066	0.6582	0.6353	0.4959	1	0	0	0	0
INT	0.5572	0.667	0.6212	0.7622	0.5948	1	0	0	0
OBS	0.2019	0.4645	0.2717	0.1437	0.4781	0.1606	1	0	0
PE	0.45	0.7074	0.4672	0.611	0.4868	0.7292	0.2461	1	0
SOC	0.2642	0.5896	0.1632	0.3396	0.3246	0.3889	0.3454	0.5117	1

Time 1 year to 2 years



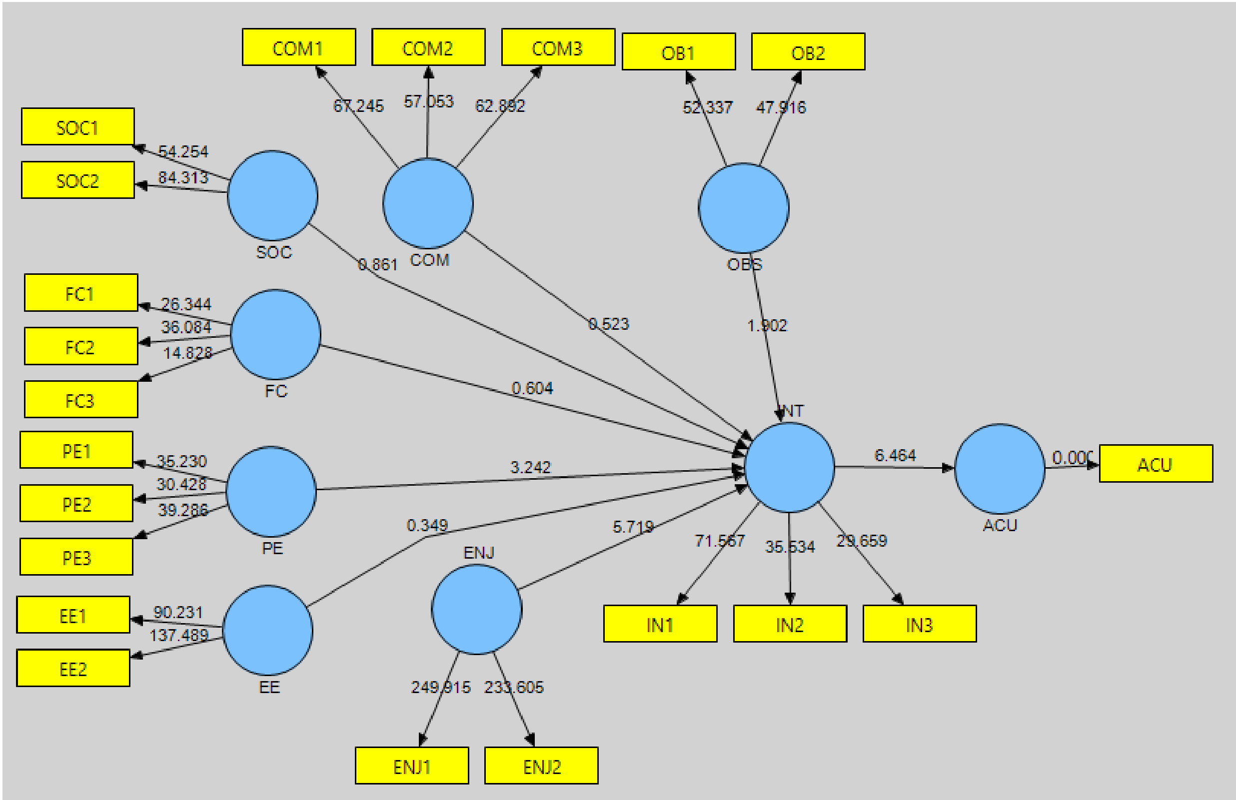


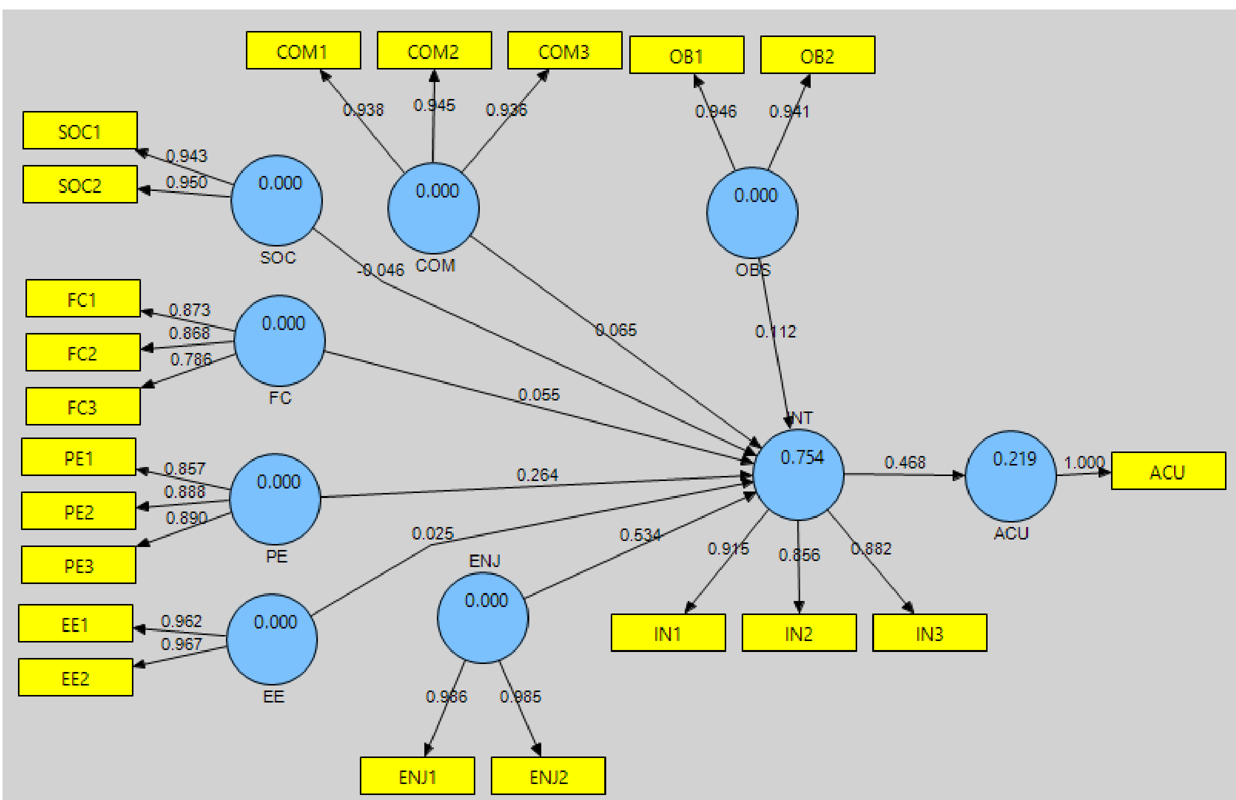
	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	Standard Error (STERR)	T Statistics (|O/STERR|)
COM -> INT	0.3384	0.3382	0.0961	0.0961	3.5213
EE -> INT	0.1242	0.1177	0.0773	0.0773	1.6077
ENJ -> INT	0.3683	0.3695	0.0807	0.0807	4.5657
FC -> INT	0.0319	0.0383	0.1006	0.1006	0.3171
INT -> ACU	0.4476	0.4502	0.085	0.085	5.2683
OBS -> INT	0.0149	0.0147	0.063	0.063	0.236
PE -> INT	0.178	0.1787	0.0916	0.0916	1.9426
SOC -> INT	0.0135	0.0126	0.0577	0.0577	0.234

	AVE	Composite Reliability	R Square	Cronbachs Alpha	Communalit y	Redundanc y
ACU	1	1	0.2004	1	1	0.2004
CO M	0.8558	0.9468	0	0.9159	0.8558	0
EE	0.9411	0.9697	0	0.9376	0.9411	0
ENJ	0.9521	0.9755	0	0.9497	0.9521	0
FC	0.684	0.8665	0	0.7716	0.684	0
INT	0.7996	0.9229	0.7886	0.8748	0.7996	0.3368
OBS	0.9136	0.9548	0	0.9063	0.9136	0
PE	0.7722	0.9104	0	0.8517	0.7722	0
SOC	0.8772	0.9345	0	0.8617	0.8772	0

	ACU	COM	EE	ENJ	FC	INT	OBS	PE	SOC
ACU	1	0	0	0	0	0	0	0	0
COM	0.4606	1	0	0	0	0	0	0	0
EE	0.382	0.5363	1	0	0	0	0	0	0
ENJ	0.3502	0.5899	0.5851	1	0	0	0	0	0
FC	0.3663	0.7491	0.5954	0.4795	1	0	0	0	0
INT	0.4476	0.79	0.6353	0.7628	0.6636	1	0	0	0
OBS	0.2129	0.5505	0.2955	0.3337	0.5755	0.4585	1	0	0
PE	0.4118	0.73	0.5075	0.5581	0.6469	0.7256	0.4138	1	0
SOC	0.1999	0.4167	0.0239	0.1903	0.2903	0.3111	0.4216	0.3819	1

Time 2 years to 3 years



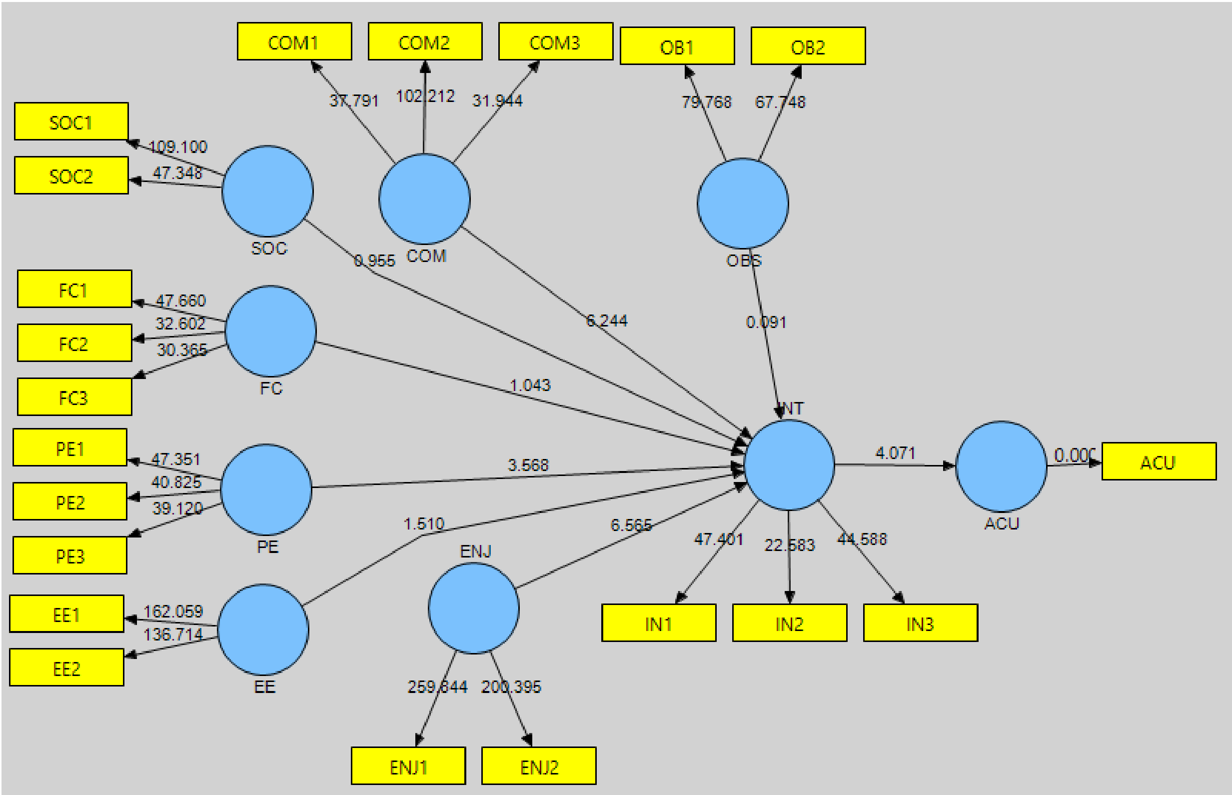


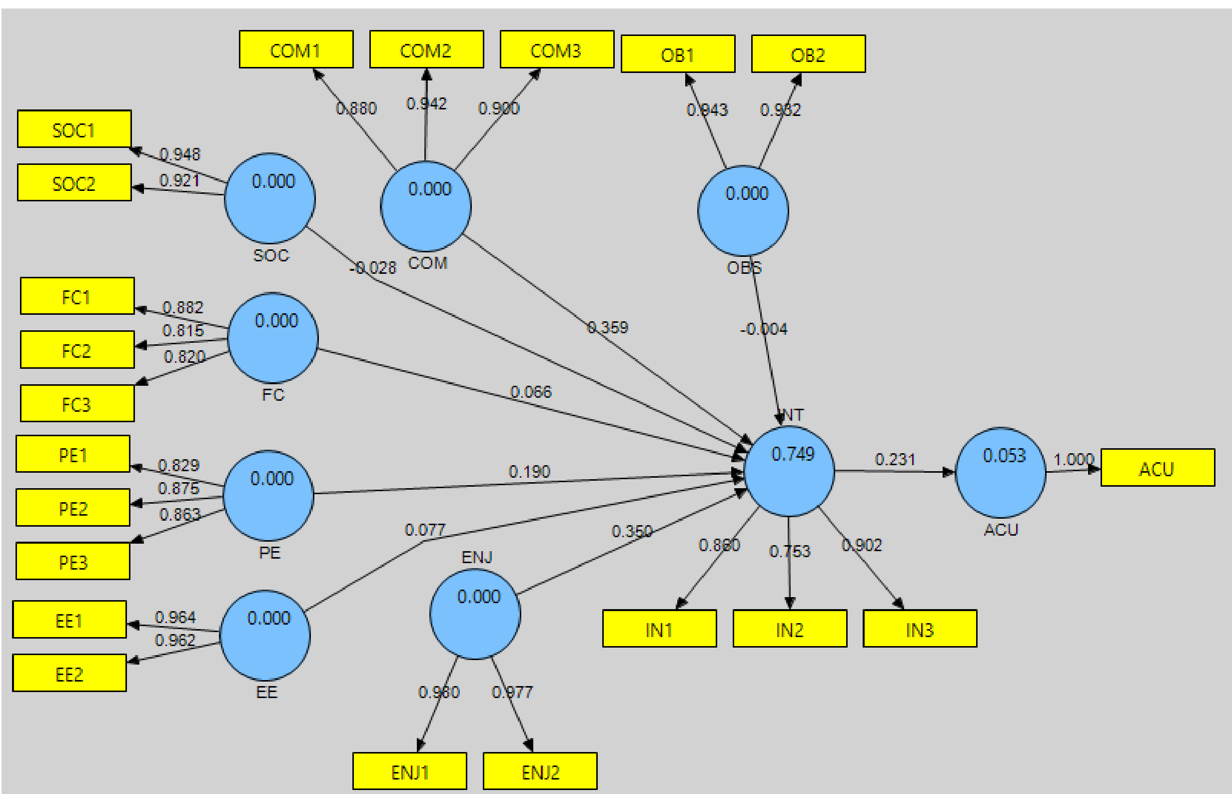
	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	Standard Error (STERR)	T Statistics (|O/STERR|)
COM -> INT	0.0652	0.064	0.1246	0.1246	0.5231
EE -> INT	0.0253	0.0124	0.0723	0.0723	0.3494
ENJ -> INT	0.5342	0.5422	0.0934	0.0934	5.7192
FC -> INT	0.0553	0.0589	0.0916	0.0916	0.6043
INT -> ACU	0.4678	0.4664	0.0724	0.0724	6.464
OBS -> INT	0.1124	0.1114	0.0591	0.0591	1.9018
PE -> INT	0.2645	0.2643	0.0816	0.0816	3.2417
SOC -> INT	-0.0459	-0.0429	0.0533	0.0533	0.8614

	AVE	Composite Reliability	R Square	Cronbachs Alpha	Communality	Redundancy
ACU	1	1	0.2188	1	1	0.2188
COM	0.8827	0.9576	0	0.9337	0.8827	0
EE	0.9295	0.9635	0	0.9242	0.9295	0
ENJ	0.9711	0.9854	0	0.9703	0.9711	0
FC	0.7109	0.8804	0	0.7976	0.7109	0
INT	0.7828	0.9153	0.7542	0.8609	0.7828	0.0739
OBS	0.8904	0.942	0	0.877	0.8904	0
PE	0.7719	0.9103	0	0.8527	0.7719	0
SOC	0.8955	0.9449	0	0.8834	0.8955	0

	ACU	COM	EE	ENJ	FC	INT	OBS	PE	SOC
ACU	1	0	0	0	0	0	0	0	0
COM	0.4181	1	0	0	0	0	0	0	0
EE	0.3621	0.5783	1	0	0	0	0	0	0
ENJ	0.3853	0.7445	0.689	1	0	0	0	0	0
FC	0.4168	0.7561	0.6305	0.6114	1	0	0	0	0
INT	0.4678	0.7597	0.6411	0.8064	0.6626	1	0	0	0
OBS	0.3123	0.6316	0.3852	0.3885	0.6086	0.5072	1	0	0
PE	0.4186	0.7265	0.5429	0.5654	0.6246	0.6926	0.4536	1	0
SOC	0.1102	0.4962	0.2543	0.453	0.395	0.4173	0.3767	0.4473	1

Time more than 3 years



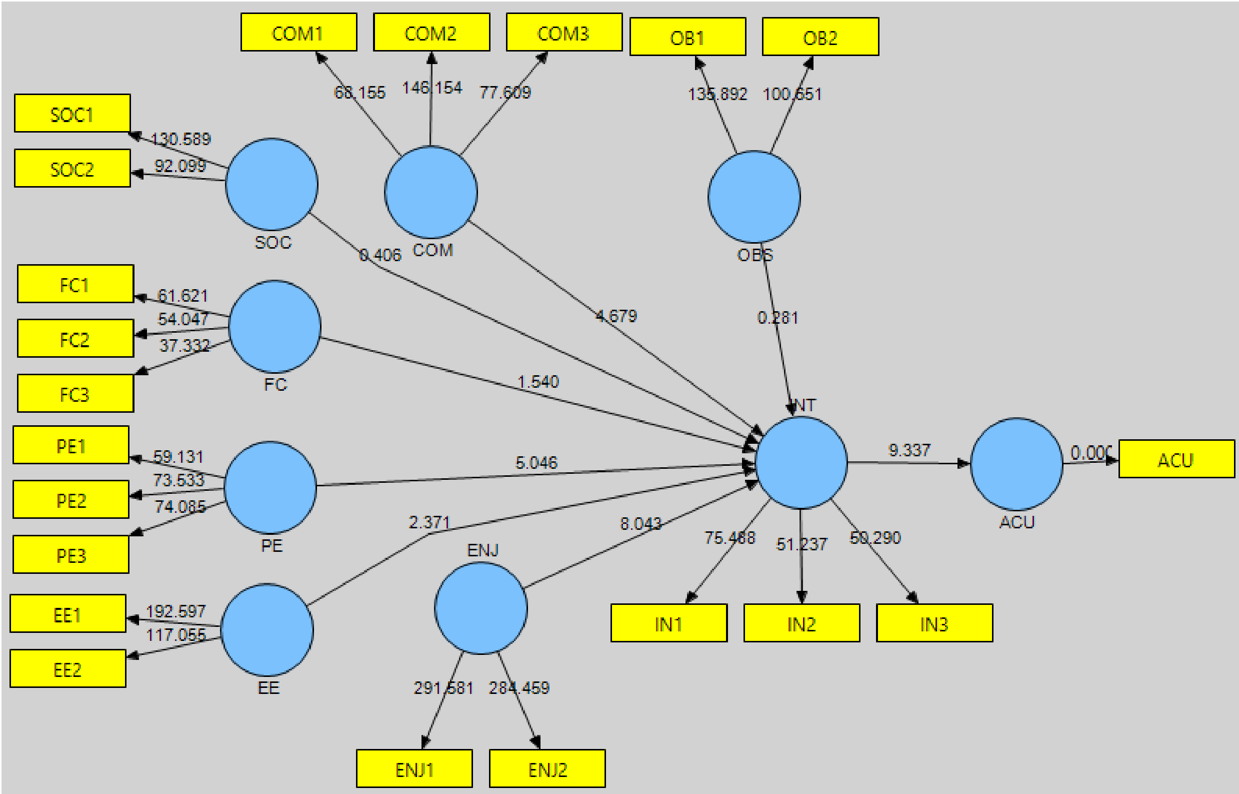


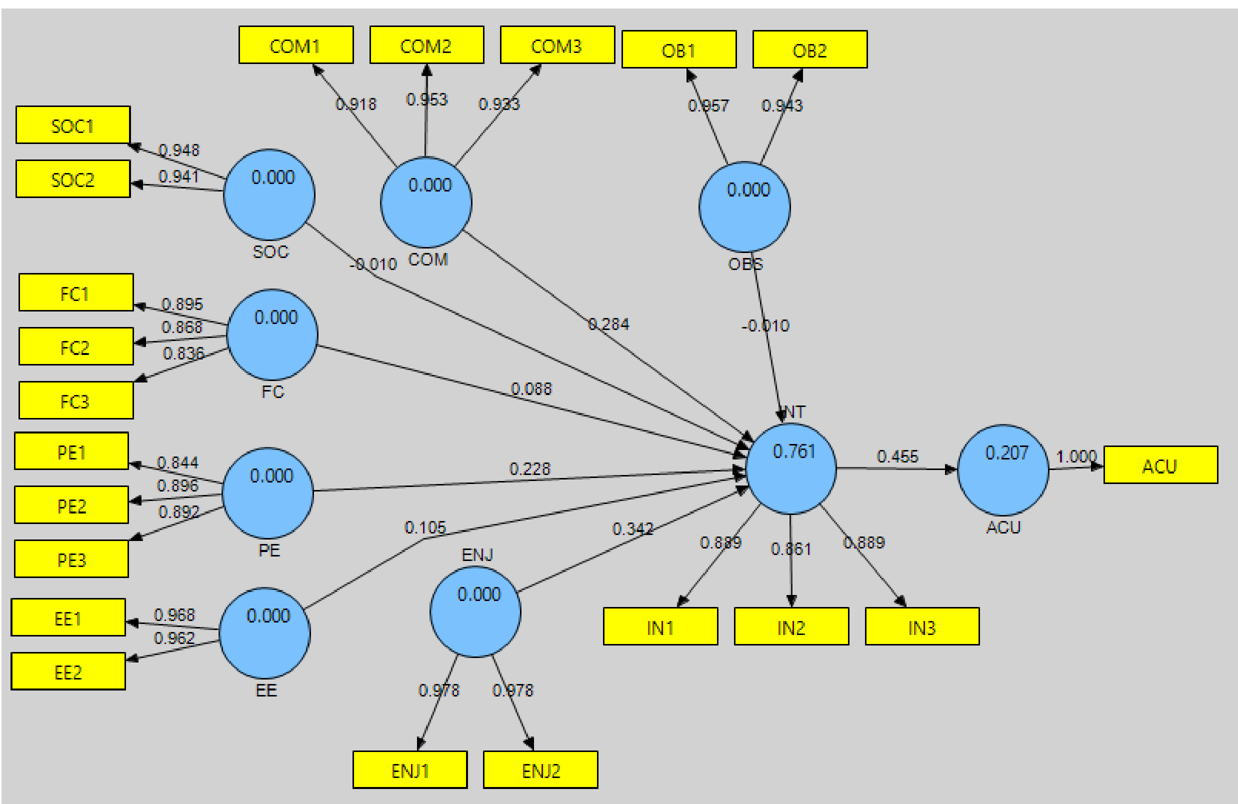
	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	Standard Error (STERR)	T Statistics (|O/STERR|)
COM -> INT	0.3592	0.364	0.0575	0.0575	6.244
EE -> INT	0.0771	0.0767	0.051	0.051	1.5099
ENJ -> INT	0.3503	0.3462	0.0534	0.0534	6.5652
FC -> INT	0.0664	0.0681	0.0637	0.0637	1.043
INT -> ACU	0.2308	0.2312	0.0567	0.0567	4.0708
OBS -> INT	-0.0039	-0.0029	0.0427	0.0427	0.0905
PE -> INT	0.1902	0.189	0.0533	0.0533	3.5683
SOC -> INT	-0.028	-0.0279	0.0293	0.0293	0.9551

	AVE	Composite Reliability	R Square	Cronbachs Alpha	Communality	Redundancy
ACU	1	1	0.0533	1	1	0.0533
COM	0.8241	0.9335	0	0.8929	0.8241	0
EE	0.9276	0.9624	0	0.9219	0.9276	0
ENJ	0.9579	0.9785	0	0.9561	0.9579	0
FC	0.7044	0.8771	0	0.7897	0.7044	0
INT	0.7073	0.8782	0.7487	0.7917	0.7073	0.3036
OBS	0.879	0.9356	0	0.8627	0.879	0
PE	0.732	0.8912	0	0.8195	0.732	0
SOC	0.8733	0.9324	0	0.8563	0.8733	0

	ACU	COM	EE	ENJ	FC	INT	OBS	PE	SOC
ACU	1	0	0	0	0	0	0	0	0
COM	0.2552	1	0	0	0	0	0	0	0
EE	0.1339	0.5868	1	0	0	0	0	0	0
ENJ	0.1473	0.5864	0.5728	1	0	0	0	0	0
FC	0.1316	0.6415	0.6459	0.4404	1	0	0	0	0
INT	0.2308	0.7756	0.6263	0.7351	0.5889	1	0	0	0
OBS	0.0831	0.4606	0.3184	0.2823	0.4656	0.3849	1	0	0
PE	0.2596	0.7077	0.5374	0.5889	0.507	0.7139	0.4122	1	0
SOC	0.0281	0.3457	0.2179	0.3594	0.2352	0.3225	0.3366	0.3644	1

Age 50-59


COM1
COM2
COM3
OB1
OB2
SOC1
SOC2
FC1
FC2
FC3
PE1
PE2
PE3
EE1
EE2
ENJ1
ENJ2
IN1
IN2
IN3
ACU
SOC
COM
OBS
FC
PE
EE
ENJ
INT
68.155
146.154
77.609
135.892
100.651
130.589
92.099
0.406
4.679
0.281
61.621
54.047
37.332
1.540
59.131
73.533
74.085
5.046
2.371
8.043
9.337
0.000
192.597
117.055
75.488
51.237
50.290
291.581
284.459

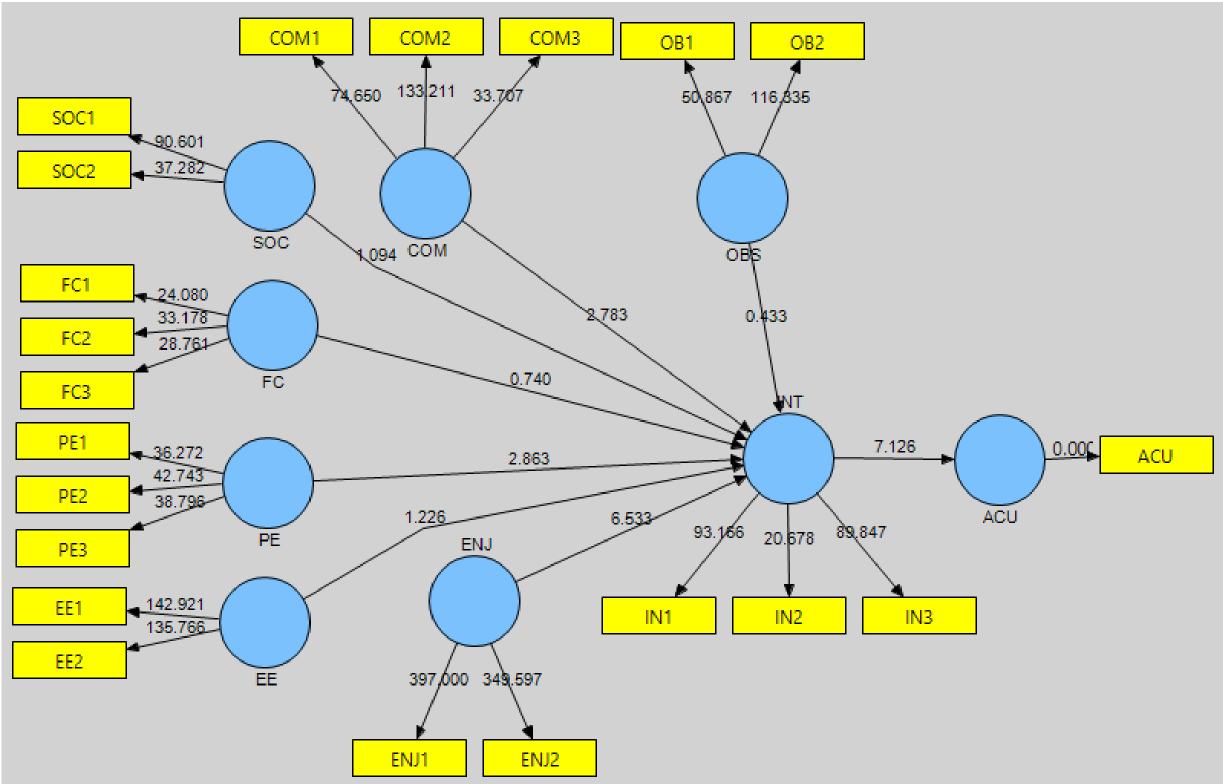

COM1
COM2
COM3
OB1
OB2
SOC1
SOC2
FC1
FC2
FC3
PE1
PE2
PE3
EE1
EE2
ENJ1
ENJ2
IN1
IN2
IN3
ACU
SOC
COM
OBS
FC
PE
EE
ENJ
INT
0.918
0.953
0.933
0.957
0.943
0.948
0.941
0.000
-0.010
0.284
-0.010
0.895
0.868
0.836
0.088
0.844
0.896
0.892
0.228
0.105
0.342
0.761
0.455
0.207
1.000
0.968
0.962
0.889
0.861
0.889
0.978
0.978

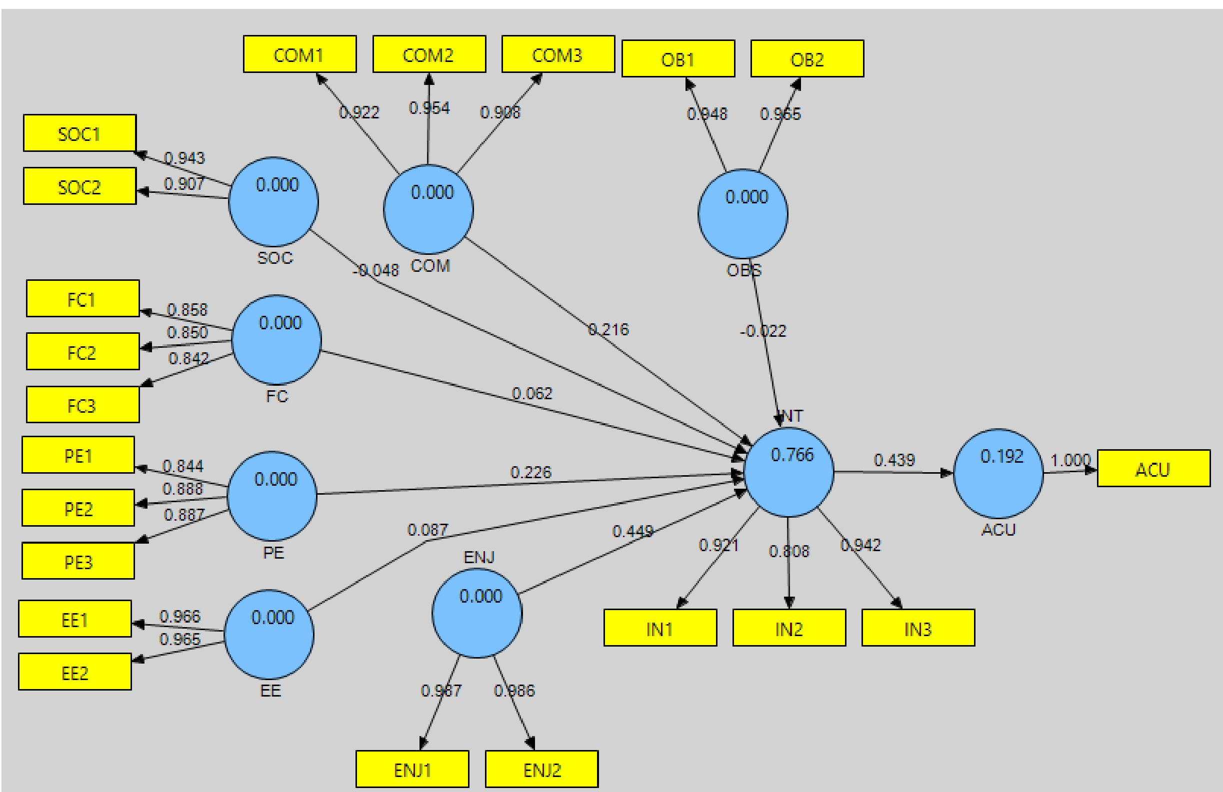
	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	Standard Error (STERR)	T Statistics (|O/STERR|)
COM -> INT	0.2836	0.2865	0.0606	0.0606	4.6787
EE -> INT	0.105	0.102	0.0443	0.0443	2.3708
ENJ -> INT	0.3424	0.3408	0.0426	0.0426	8.0435
FC -> INT	0.0884	0.0884	0.0574	0.0574	1.5404
INT -> ACU	0.4554	0.4562	0.0488	0.0488	9.3366
OBS -> INT	-0.0103	-0.0099	0.0367	0.0367	0.2811
PE -> INT	0.2279	0.2293	0.0452	0.0452	5.0457
SOC -> INT	-0.01	-0.0102	0.0247	0.0247	0.4061

	AVE	Composite Reliability	R Square	Cronbachs Alpha	Communality	Redundancy
ACU	1	1	0.2074	1	1	0.2074
COM	0.8736	0.954	0	0.9275	0.8736	0
EE	0.9306	0.964	0	0.9255	0.9306	0
ENJ	0.9562	0.9776	0	0.9542	0.9562	0
FC	0.7506	0.9002	0	0.8339	0.7506	0
INT	0.7735	0.9111	0.7615	0.8536	0.7735	0.2758
OBS	0.9028	0.9489	0	0.8929	0.9028	0
PE	0.7705	0.9096	0	0.8513	0.7705	0
SOC	0.8922	0.943	0	0.8793	0.8922	0

	ACU	COM	EE	ENJ	FC	INT	OBS	PE	SOC
ACU	1	0	0	0	0	0	0	0	0
COM	0.425	1	0	0	0	0	0	0	0
EE	0.3082	0.5715	1	0	0	0	0	0	0
ENJ	0.3022	0.5963	0.6537	1	0	0	0	0	0
FC	0.3577	0.7439	0.6514	0.5265	1	0	0	0	0
INT	0.4554	0.7699	0.6653	0.747	0.679	1	0	0	0
OBS	0.2306	0.6085	0.3746	0.3933	0.5904	0.4966	1	0	0
PE	0.4149	0.7305	0.5349	0.5599	0.6143	0.7284	0.4916	1	0
SOC	0.1591	0.3846	0.123	0.3229	0.2915	0.33	0.3812	0.3757	1

Age 60-69


COM1
COM2
COM3
OB1
OB2
SOC1
SOC2
74.650
133.211
33.707
50.867
116.335
90.601
37.282
SOC
COM
OBS
1.094
FC1
FC2
FC3
24.080
33.178
28.761
FC
2.783
0.433
0.740
INT
PE1
PE2
PE3
36.272
42.743
38.796
PE
2.863
7.126
ACU
0.000
ACU
1.226
6.533
ENJ
93.166
20.678
89.847
EE1
EE2
142.921
135.766
EE
IN1
IN2
IN3
397.000
349.597
ENJ1
ENJ2

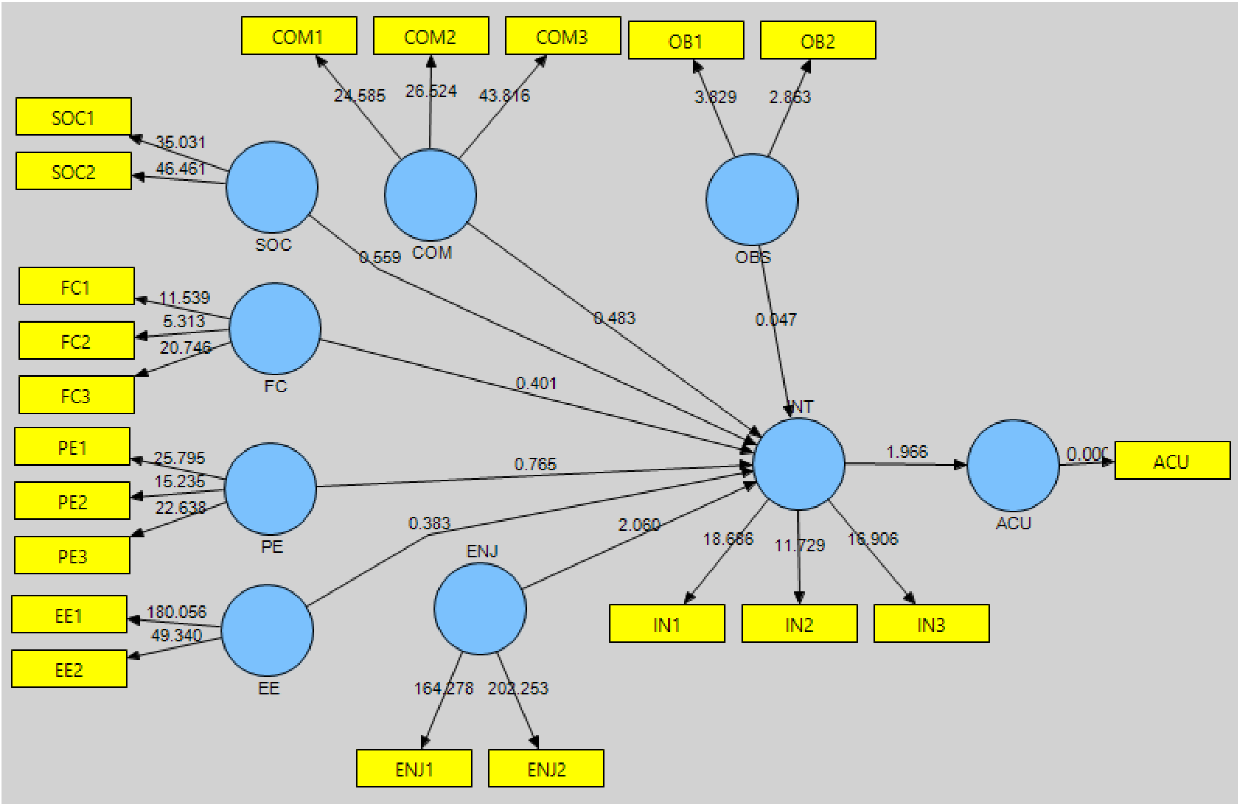

COM1
COM2
COM3
OB1
OB2
0.922
0.954
0.908
0.948
0.965
SOC1
SOC2
0.943
0.907
0.000
SOC
0.000
COM
0.000
OBS
-0.048
0.216
-0.022
FC1
FC2
FC3
0.858
0.850
0.842
0.000
FC
0.062
INT
0.766
0.439
0.192
1.000
ACU
ACU
PE1
PE2
PE3
0.844
0.888
0.887
0.000
PE
0.226
0.087
0.449
ENJ
0.000
0.921
0.808
0.942
EE1
EE2
0.966
0.965
0.000
EE
IN1
IN2
IN3
0.987
0.986
ENJ1
ENJ2

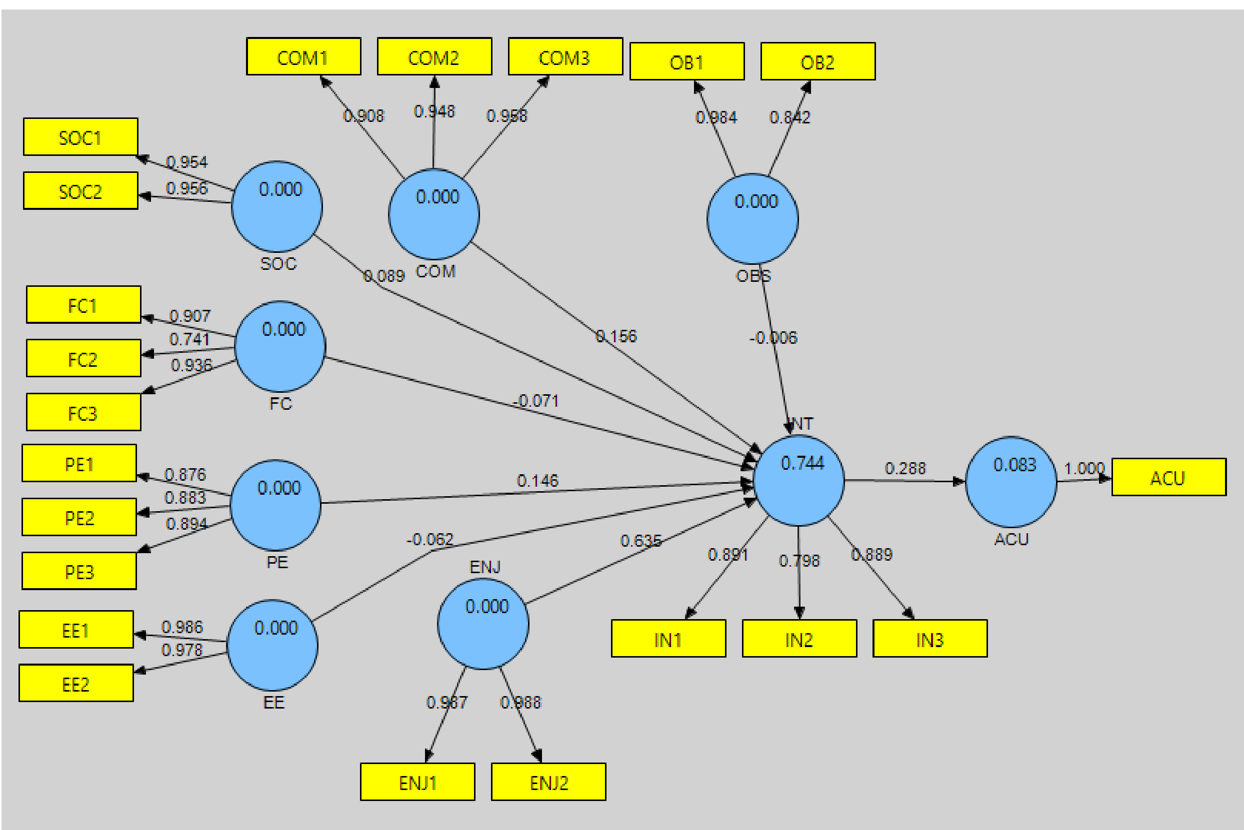
	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	Standard Error (STERR)	T Statistics (|O/STERR|)
COM -> INT	0.2159	0.2221	0.0776	0.0776	2.7831
EE -> INT	0.0875	0.0856	0.0714	0.0714	1.2256
ENJ -> INT	0.4494	0.4484	0.0688	0.0688	6.5334
FC -> INT	0.0624	0.0604	0.0843	0.0843	0.7405
INT -> ACU	0.4386	0.4384	0.0616	0.0616	7.1262
OBS -> INT	-0.0218	-0.02	0.0503	0.0503	0.4328
PE -> INT	0.2257	0.2232	0.0788	0.0788	2.8629
SOC -> INT	-0.0475	-0.0477	0.0435	0.0435	1.0935

	AVE	Composite Reliability	R Square	Cronbachs Alpha	Communalit y	Redundanc y
ACU	1	1	0.1924	1	1	0.1924
CO M	0.8614	0.9491	0	0.9195	0.8614	0
EE	0.9321	0.9648	0	0.9271	0.9321	0
ENJ	0.9735	0.9866	0	0.9728	0.9735	0
FC	0.7231	0.8868	0	0.8095	0.7231	0
INT	0.7963	0.9211	0.7657	0.8709	0.7963	0.2229
OBS	0.9147	0.9554	0	0.9076	0.9147	0
PE	0.7627	0.906	0	0.8449	0.7627	0
SOC	0.8561	0.9225	0	0.8342	0.8561	0

	ACU	COM	EE	ENJ	FC	INT	OBS	PE	SOC
ACU	1	0	0	0	0	0	0	0	0
COM	0.4121	1	0	0	0	0	0	0	0
EE	0.3399	0.639	1	0	0	0	0	0	0
ENJ	0.3761	0.6888	0.6243	1	0	0	0	0	0
FC	0.4206	0.6884	0.7146	0.5153	1	0	0	0	0
INT	0.4386	0.7556	0.6594	0.8108	0.6168	1	0	0	0
OBS	0.1817	0.4806	0.3463	0.2071	0.4781	0.2964	1	0	0
PE	0.3883	0.7402	0.5752	0.6608	0.6055	0.7398	0.351	1	0
SOC	0.1137	0.5315	0.2826	0.3933	0.3069	0.3896	0.3786	0.4873	1

Age 70-79


COM1
COM2
COM3
OB1
OB2
24.585
26.524
43.816
3.829
2.863
SOC1
SOC2
35.031
46.461
SOC
COM
OBS
0.559
FC1
FC2
FC3
11.539
5.313
20.746
FC
0.483
0.047
0.401
INT
PE1
PE2
PE3
25.795
15.235
22.638
PE
0.765
1.966
0.000
ACU
ACU
0.383
ENJ
2.060
18.686
11.729
16.906
EE1
EE2
180.056
49.340
EE
IN1
IN2
IN3
164.278
202.253
ENJ1
ENJ2

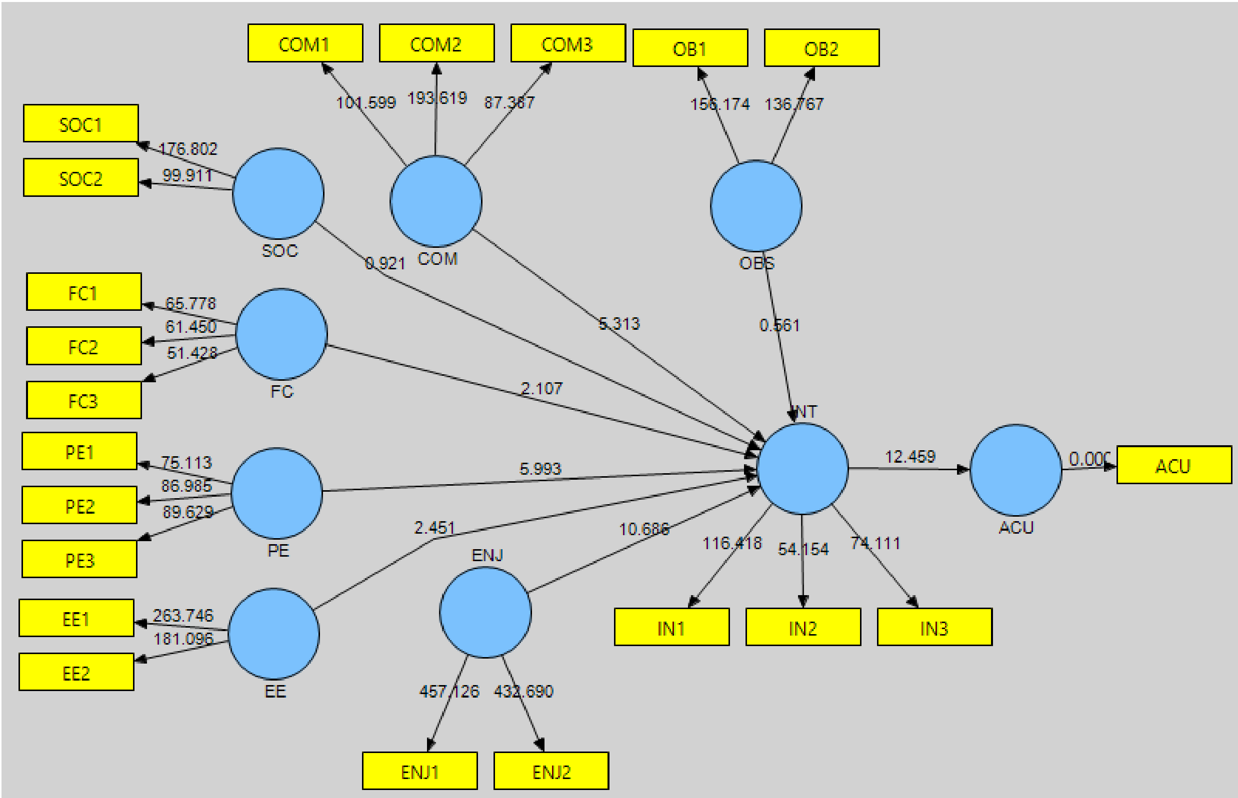

COM1
COM2
COM3
OB1
OB2
0.908
0.948
0.958
0.984
0.842
SOC1
SOC2
0.954
0.956
0.000
SOC
0.000
COM
0.000
OBS
0.089
FC1
FC2
FC3
0.907
0.741
0.936
0.000
FC
0.156
-0.006
-0.071
INT
PE1
PE2
PE3
0.876
0.883
0.894
0.000
PE
0.146
0.744
0.288
0.083
1.000
ACU
ACU
-0.062
ENJ
0.635
0.891
0.798
0.889
EE1
EE2
0.986
0.978
0.000
EE
0.000
IN1
IN2
IN3
0.987
0.988
ENJ1
ENJ2

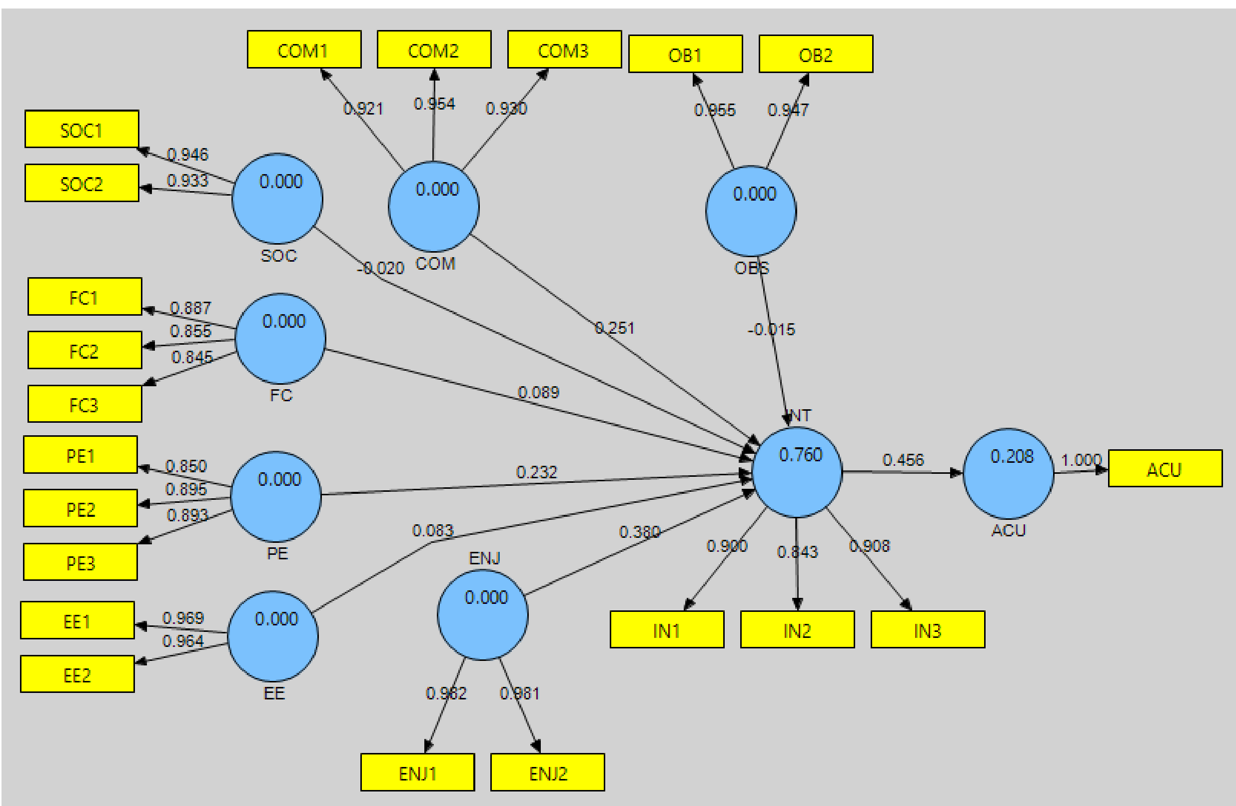
	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	Standard Error (STERR)	T Statistics (|O/STERR|)
COM -> INT	0.1563	0.1493	0.3235	0.3235	0.4832
EE -> INT	-0.0623	-0.0834	0.1627	0.1627	0.3833
ENJ -> INT	0.6352	0.6477	0.3084	0.3084	2.0601
FC -> INT	-0.0707	-0.078	0.1761	0.1761	0.4013
INT -> ACU	0.2877	0.2852	0.1463	0.1463	1.9663
OBS -> INT	-0.0064	-0.004	0.1372	0.1372	0.0466
PE -> INT	0.1459	0.1638	0.1906	0.1906	0.7652
SOC -> INT	0.0895	0.0967	0.1599	0.1599	0.5595

	AVE	Composite Reliability	R Square	Cronbachs Alpha	Communalit y	Redundanc y
ACU	1	1	0.0828	1	1	0.0828
CO M	0.8801	0.9565	0	0.9316	0.8801	0
EE	0.9639	0.9816	0	0.9631	0.9639	0
ENJ	0.9746	0.9872	0	0.974	0.9746	0
FC	0.7493	0.8988	0	0.8305	0.7493	0
INT	0.7401	0.895	0.7438	0.8233	0.7401	0.1663
OBS	0.8388	0.9119	0	0.8461	0.8388	0
PE	0.7823	0.9151	0	0.861	0.7823	0
SOC	0.9121	0.954	0	0.9036	0.9121	0

	ACU	COM	EE	ENJ	FC	INT	OBS	PE	SOC
ACU	1	0	0	0	0	0	0	0	0
COM	0.349	1	0	0	0	0	0	0	0
EE	0.1201	0.5445	1	0	0	0	0	0	0
ENJ	0.2419	0.8864	0.6561	1	0	0	0	0	0
FC	0.2175	0.7776	0.5226	0.7145	1	0	0	0	0
INT	0.2877	0.8007	0.5175	0.846	0.5961	1	0	0	0
OBS	0.2888	0.2862	0.2441	0.2213	0.465	0.1674	1	0	0
PE	0.3526	0.8203	0.5901	0.8062	0.5649	0.7505	0.1032	1	0
SOC	0.0668	0.5851	0.3399	0.5303	0.4982	0.5277	0.24	0.4655	1

Overall


COM1
COM2
COM3
OB1
OB2
SOC1
SOC2
FC1
FC2
FC3
PE1
PE2
PE3
EE1
EE2
ENJ1
ENJ2
IN1
IN2
IN3
ACU
SOC
COM
OBS
FC
PE
EE
ENJ
INT
101.599
193.619
87.387
156.174
136.767
176.802
99.911
0.921
5.313
0.561
65.778
61.450
51.428
2.107
75.113
86.985
89.629
5.993
2.451
10.686
12.459
0.000
116.418
54.154
74.111
263.746
181.096
457.126
432.690

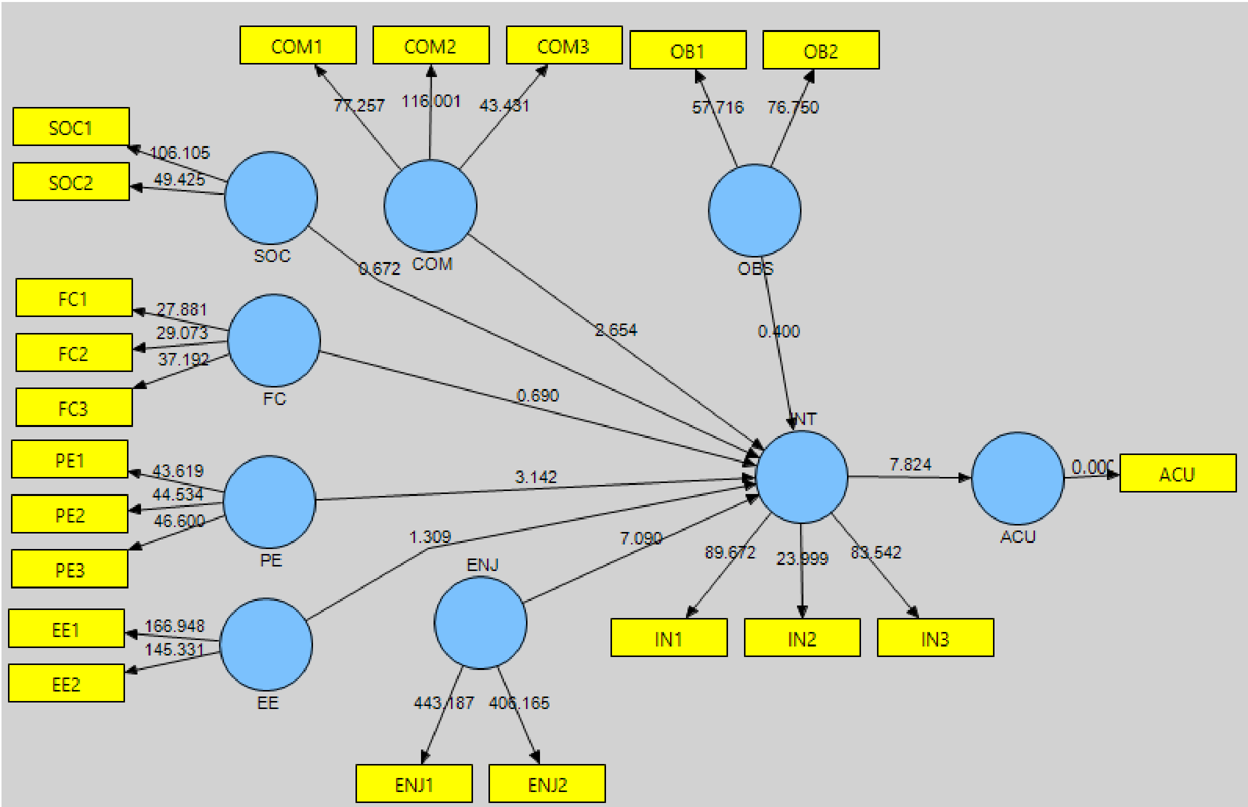

COM1
COM2
COM3
OB1
OB2
SOC1
SOC2
FC1
FC2
FC3
PE1
PE2
PE3
EE1
EE2
ENJ1
ENJ2
IN1
IN2
IN3
ACU
SOC
COM
OBS
FC
PE
EE
ENJ
INT
0.921
0.954
0.930
0.955
0.947
0.946
0.933
-0.020
0.251
-0.015
0.887
0.855
0.845
0.089
0.850
0.895
0.893
0.232
0.083
0.380
0.760
0.456
0.208
1.000
0.900
0.843
0.908
0.969
0.964
0.982
0.981

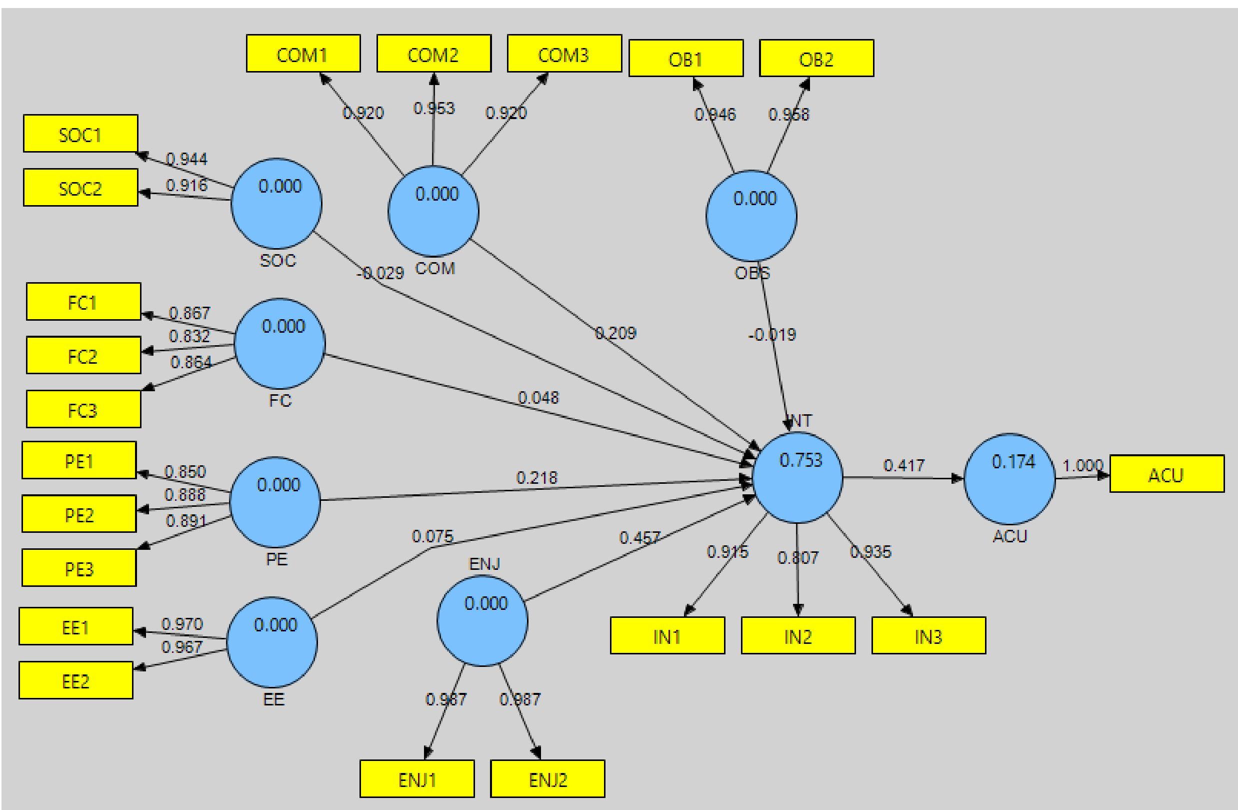
	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	Standard Error (STERR)	T Statistics (|O/STERR|)
COM -> INT	0.2506	0.2519	0.0472	0.0472	5.3132
EE -> INT	0.0829	0.0819	0.0338	0.0338	2.4513
ENJ -> INT	0.3803	0.3809	0.0356	0.0356	10.6863
FC -> INT	0.0888	0.0884	0.0421	0.0421	2.107
INT -> ACU	0.4558	0.4561	0.0366	0.0366	12.4595
OBS -> INT	-0.0154	-0.0153	0.0275	0.0275	0.5606
PE -> INT	0.232	0.2313	0.0387	0.0387	5.9926
SOC -> INT	-0.0201	-0.0199	0.0218	0.0218	0.9212

	AVE	Composite Reliability	R Square	Cronbachs Alpha	Communality	Redundancy
ACU	1	1	0.2078	1	1	0.2078
COM	0.8747	0.9544	0	0.9283	0.8747	0
EE	0.9339	0.9658	0	0.9293	0.9339	0
ENJ	0.9637	0.9815	0	0.9624	0.9637	0
FC	0.7441	0.8971	0	0.828	0.7441	0
INT	0.7819	0.9149	0.7596	0.8602	0.7819	0.2532
OBS	0.9049	0.9501	0	0.8951	0.9049	0
PE	0.774	0.9113	0	0.8543	0.774	0
SOC	0.8823	0.9374	0	0.8669	0.8823	0

	ACU	COM	EE	ENJ	FC	INT	OBS	PE	SOC
ACU	1	0	0	0	0	0	0	0	0
COM	0.4447	1	0	0	0	0	0	0	0
EE	0.334	0.6057	1	0	0	0	0	0	0
ENJ	0.3454	0.6551	0.6499	1	0	0	0	0	0
FC	0.3756	0.7301	0.6638	0.5379	1	0	0	0	0
INT	0.4558	0.7707	0.6625	0.7765	0.6585	1	0	0	0
OBS	0.2301	0.5493	0.3629	0.3269	0.5535	0.4181	1	0	0
PE	0.4251	0.7474	0.5656	0.6148	0.6121	0.7393	0.4304	1	0
SOC	0.1538	0.4494	0.1988	0.3616	0.3174	0.3667	0.3769	0.4215	1

Compare Age 69-79



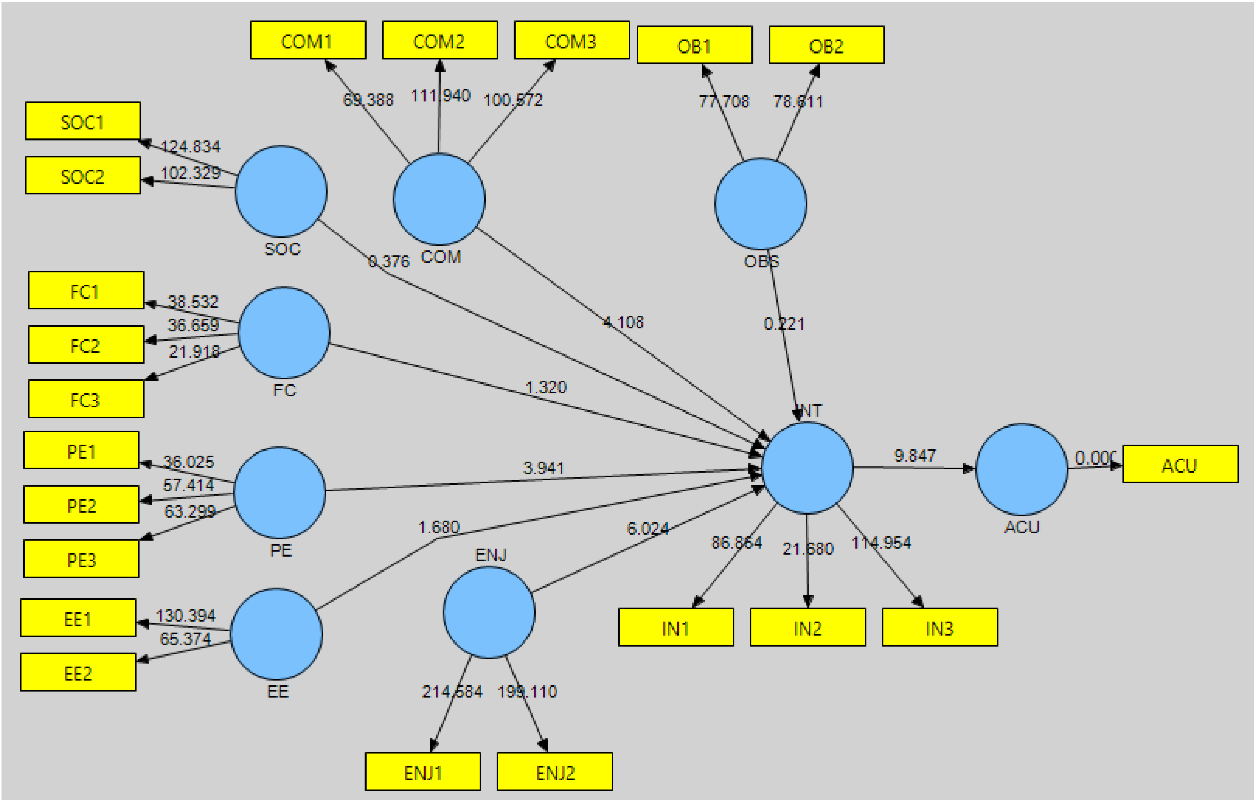


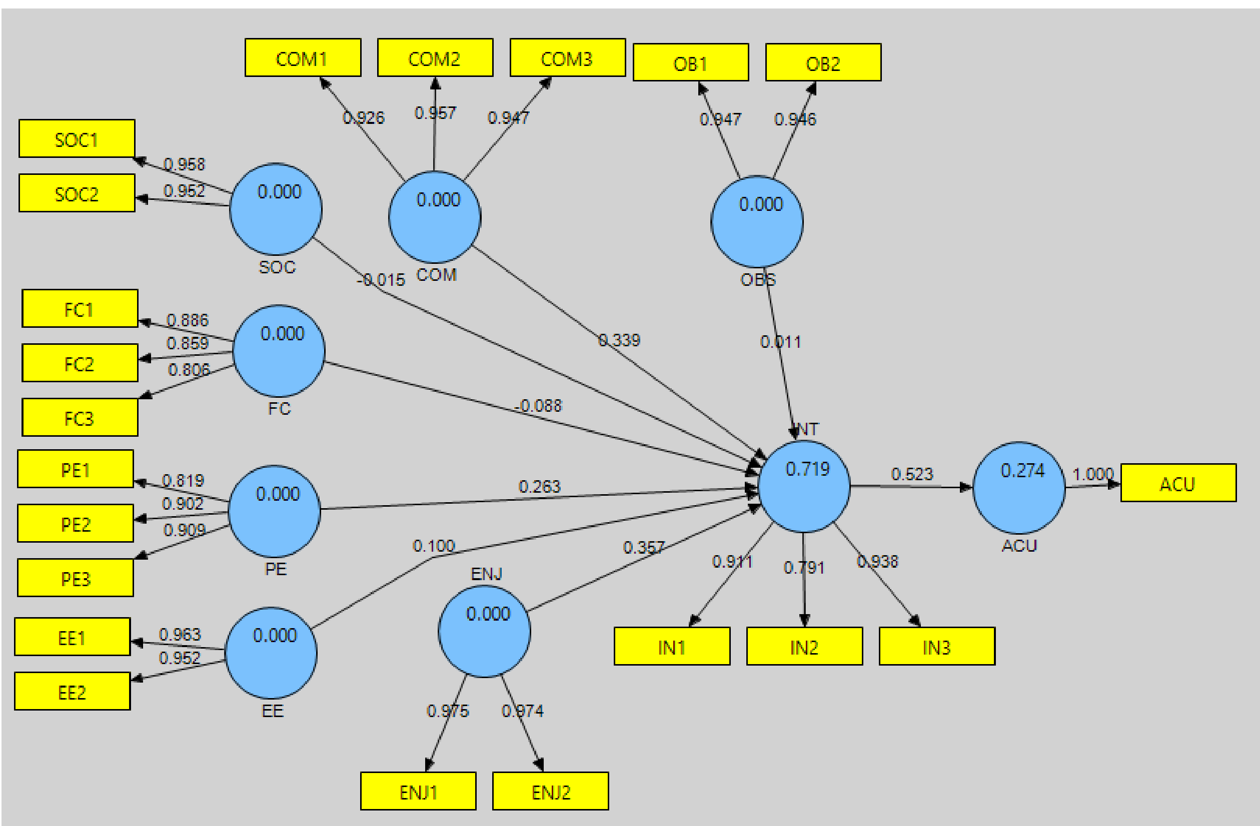
	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	Standard Error (STERR)	T Statistics (|O/STERR|)
COM -> INT	0.2091	0.213	0.0788	0.0788	2.654
EE -> INT	0.0753	0.0727	0.0575	0.0575	1.3087
ENJ -> INT	0.4568	0.4571	0.0644	0.0644	7.0905
FC -> INT	0.0483	0.046	0.0699	0.0699	0.6904
INT -> ACU	0.4175	0.4165	0.0534	0.0534	7.8244
OBS -> INT	-0.0191	-0.0179	0.0478	0.0478	0.4003
PE -> INT	0.2184	0.2185	0.0695	0.0695	3.1417
SOC -> INT	-0.0295	-0.0305	0.0439	0.0439	0.672

	AVE	Composite Reliability	R Square	Cronbachs Alpha	Communality	Redundancy
ACU	1	1	0.1743	1	1	0.1743
COM	0.8668	0.9512	0	0.9231	0.8668	0
EE	0.9384	0.9682	0	0.9344	0.9384	0
ENJ	0.9737	0.9867	0	0.973	0.9737	0
FC	0.7296	0.89	0	0.8149	0.7296	0
INT	0.7875	0.9172	0.7531	0.8639	0.7875	0.2161
OBS	0.9057	0.9505	0	0.8963	0.9057	0
PE	0.7684	0.9087	0	0.8497	0.7684	0
SOC	0.8654	0.9278	0	0.8459	0.8654	0

	ACU	COM	EE	ENJ	FC	INT	OBS	PE	SOC
ACU	1	0	0	0	0	0	0	0	0
COM	0.4095	1	0	0	0	0	0	0	0
EE	0.3131	0.6271	1	0	0	0	0	0	0
ENJ	0.3576	0.7201	0.6288	1	0	0	0	0	0
FC	0.3867	0.7075	0.6782	0.5501	1	0	0	0	0
INT	0.4175	0.7602	0.6397	0.8142	0.6097	1	0	0	0
OBS	0.1874	0.4427	0.3181	0.2027	0.4731	0.2687	1	0	0
PE	0.3905	0.7576	0.5878	0.6829	0.5973	0.7416	0.304	1	0
SOC	0.1168	0.5468	0.3033	0.4163	0.3481	0.4145	0.3561	0.4882	1

Compare Education High



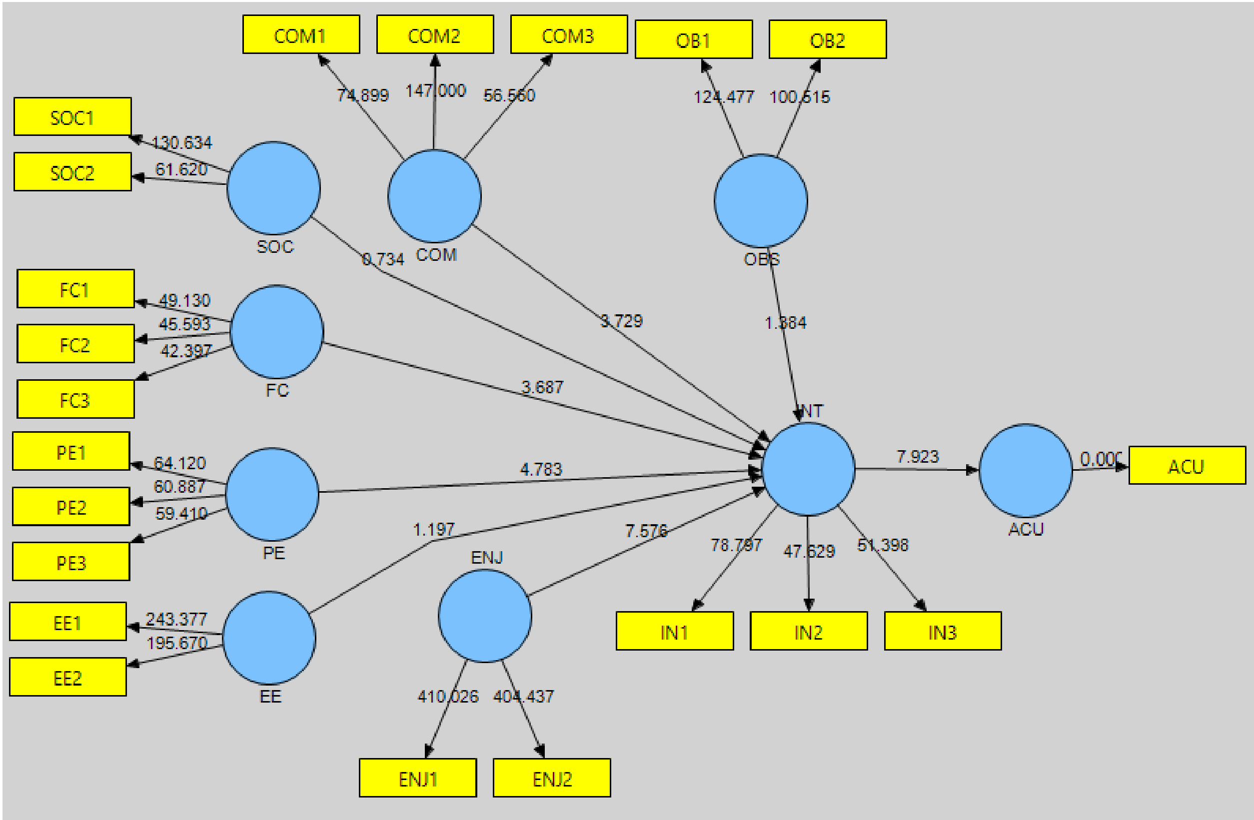


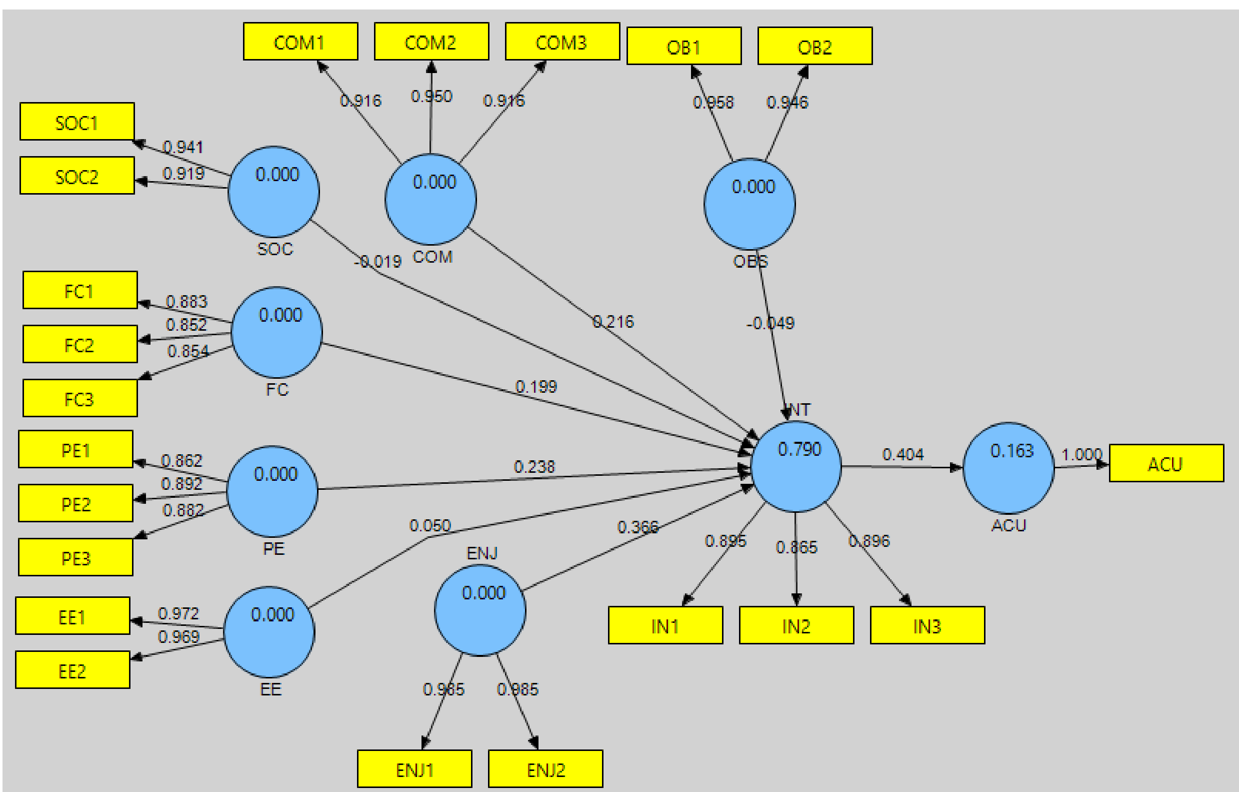
	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	Standard Error (STERR)	T Statistics (|O/STERR|)
COM -> INT	0.3392	0.3403	0.0826	0.0826	4.1084
EE -> INT	0.0997	0.0984	0.0593	0.0593	1.68
ENJ -> INT	0.3568	0.359	0.0592	0.0592	6.0238
FC -> INT	-0.088	-0.087	0.0666	0.0666	1.3205
INT -> ACU	0.5231	0.5233	0.0531	0.0531	9.8474
OBS -> INT	0.0105	0.0119	0.0476	0.0476	0.2211
PE -> INT	0.2631	0.2623	0.0668	0.0668	3.941
SOC -> INT	-0.0147	-0.0156	0.0391	0.0391	0.3761

	AVE	Composite Reliability	R Square	Cronbachs Alpha	Communality	Redundancy
ACU	1	1	0.2736	1	1	0.2736
COM	0.8902	0.9605	0	0.9382	0.8902	0
EE	0.9167	0.9565	0	0.9095	0.9167	0
ENJ	0.9496	0.9742	0	0.947	0.9496	0
FC	0.7237	0.887	0	0.8104	0.7237	0
INT	0.7787	0.9131	0.7186	0.8562	0.7787	0.3031
OBS	0.8956	0.9449	0	0.8834	0.8956	0
PE	0.77	0.9093	0	0.8495	0.77	0
SOC	0.912	0.954	0	0.9036	0.912	0

	ACU	COM	EE	ENJ	FC	INT	OBS	PE	SOC
ACU	1	0	0	0	0	0	0	0	0
COM	0.5227	1	0	0	0	0	0	0	0
EE	0.3779	0.5806	1	0	0	0	0	0	0
ENJ	0.414	0.5923	0.6604	1	0	0	0	0	0
FC	0.3888	0.7252	0.5584	0.4629	1	0	0	0	0
INT	0.5231	0.7411	0.6242	0.7319	0.5266	1	0	0	0
OBS	0.3158	0.5911	0.3739	0.3495	0.5325	0.4342	1	0	0
PE	0.549	0.7451	0.5317	0.5719	0.5552	0.7239	0.4305	1	0
SOC	0.2167	0.3974	0.1909	0.3448	0.2712	0.3268	0.3537	0.3222	1

Compare Education Low



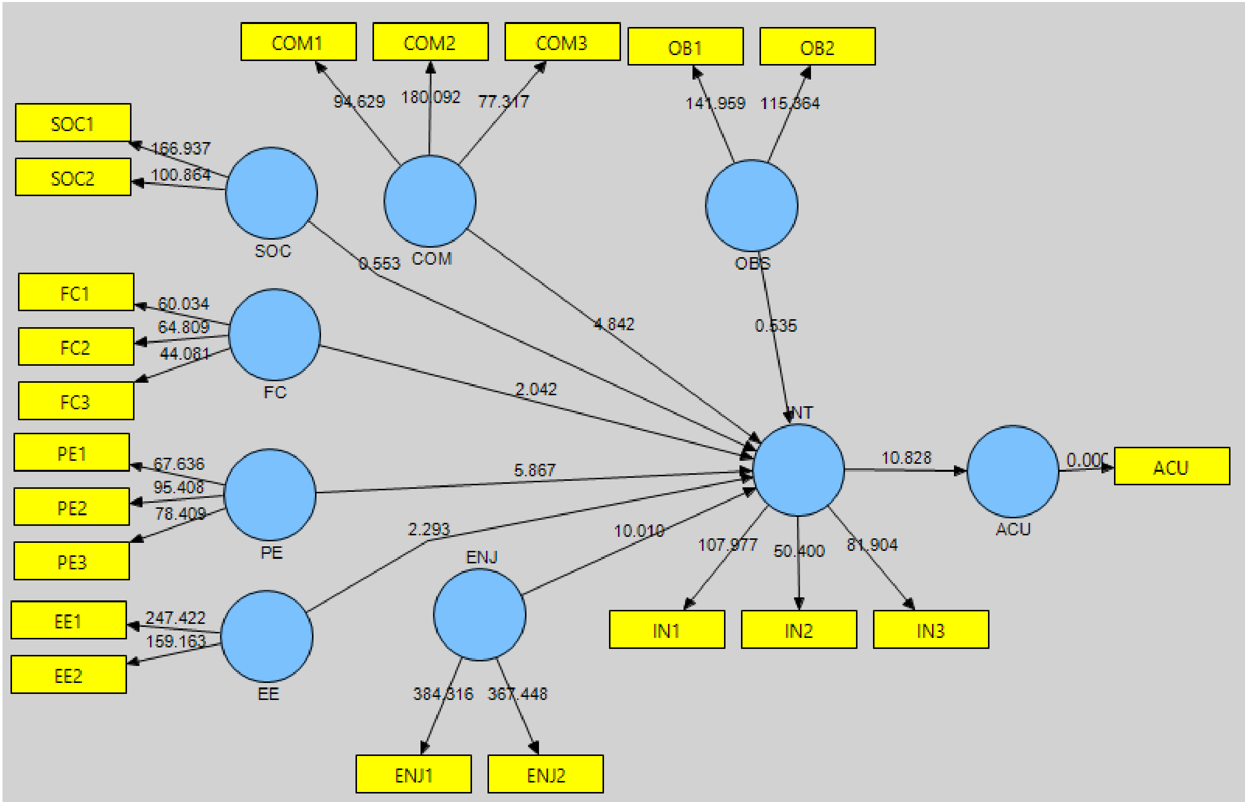


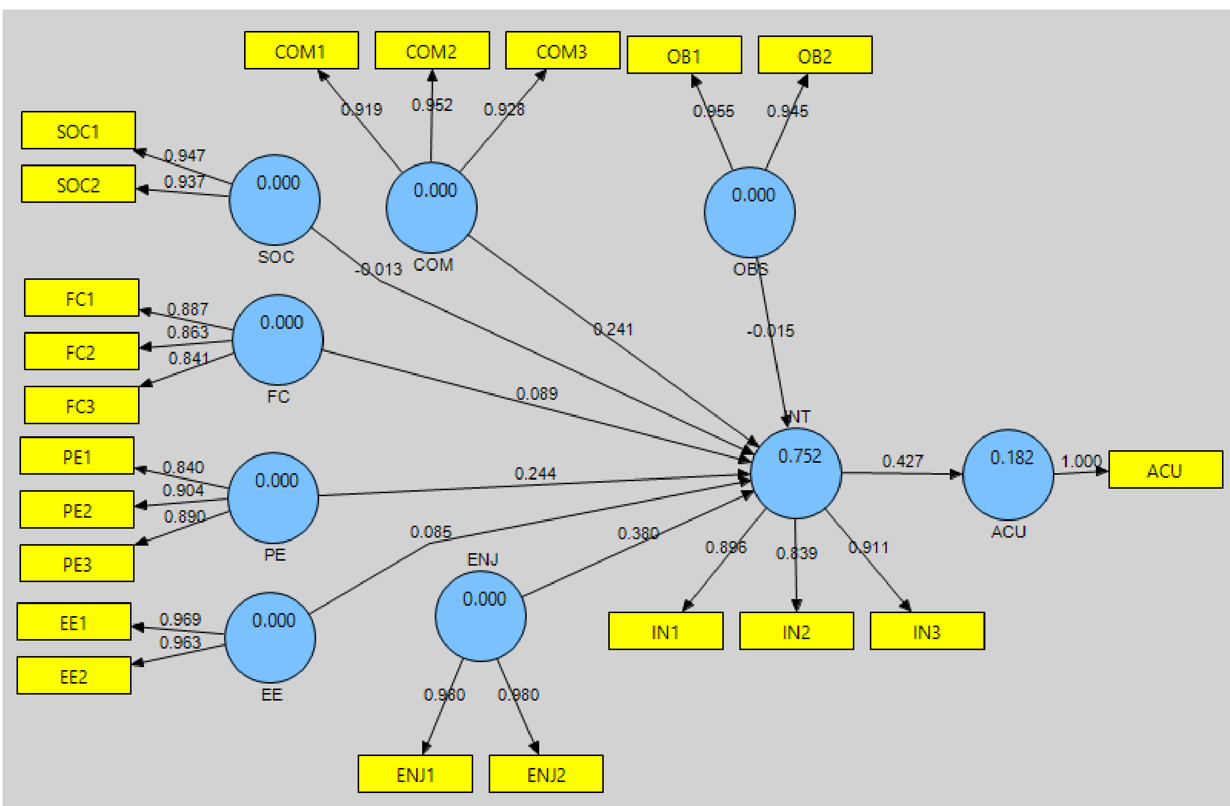
	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	Standard Error (STERR)	T Statistics (|O/STERR|)
COM -> INT	0.216	0.2188	0.0579	0.0579	3.729
EE -> INT	0.0496	0.0472	0.0415	0.0415	1.1968
ENJ -> INT	0.3655	0.3644	0.0483	0.0483	7.576
FC -> INT	0.1989	0.1997	0.054	0.054	3.6869
INT -> ACU	0.404	0.4027	0.051	0.051	7.9226
OBS -> INT	-0.0487	-0.0487	0.0352	0.0352	1.3836
PE -> INT	0.2376	0.2375	0.0497	0.0497	4.7832
SOC -> INT	-0.0192	-0.0196	0.0262	0.0262	0.7339

	AVE	Composite Reliability	R Square	Cronbachs Alpha	Communality	Redundancy
ACU	1	1	0.1632	1	1	0.1632
COM	0.8602	0.9486	0	0.9187	0.8602	0
EE	0.9426	0.9705	0	0.9391	0.9426	0
ENJ	0.9706	0.9851	0	0.9697	0.9706	0
FC	0.7451	0.8976	0	0.829	0.7451	0
INT	0.7844	0.9161	0.7903	0.8626	0.7844	0.2286
OBS	0.9065	0.951	0	0.8973	0.9065	0
PE	0.7724	0.9106	0	0.8537	0.7724	0
SOC	0.8652	0.9277	0	0.8451	0.8652	0

	ACU	COM	EE	ENJ	FC	INT	OBS	PE	SOC
ACU	1	0	0	0	0	0	0	0	0
COM	0.3887	1	0	0	0	0	0	0	0
EE	0.2919	0.6053	1	0	0	0	0	0	0
ENJ	0.279	0.6846	0.6421	1	0	0	0	0	0
FC	0.3529	0.7265	0.7068	0.5776	1	0	0	0	0
INT	0.404	0.7825	0.6744	0.7928	0.7207	1	0	0	0
OBS	0.1652	0.5111	0.3409	0.3056	0.5544	0.3919	1	0	0
PE	0.3589	0.7396	0.5852	0.6509	0.6413	0.7627	0.416	1	0
SOC	0.1229	0.4768	0.1957	0.3714	0.3496	0.3908	0.3934	0.4677	1

Compare Health Good Ex



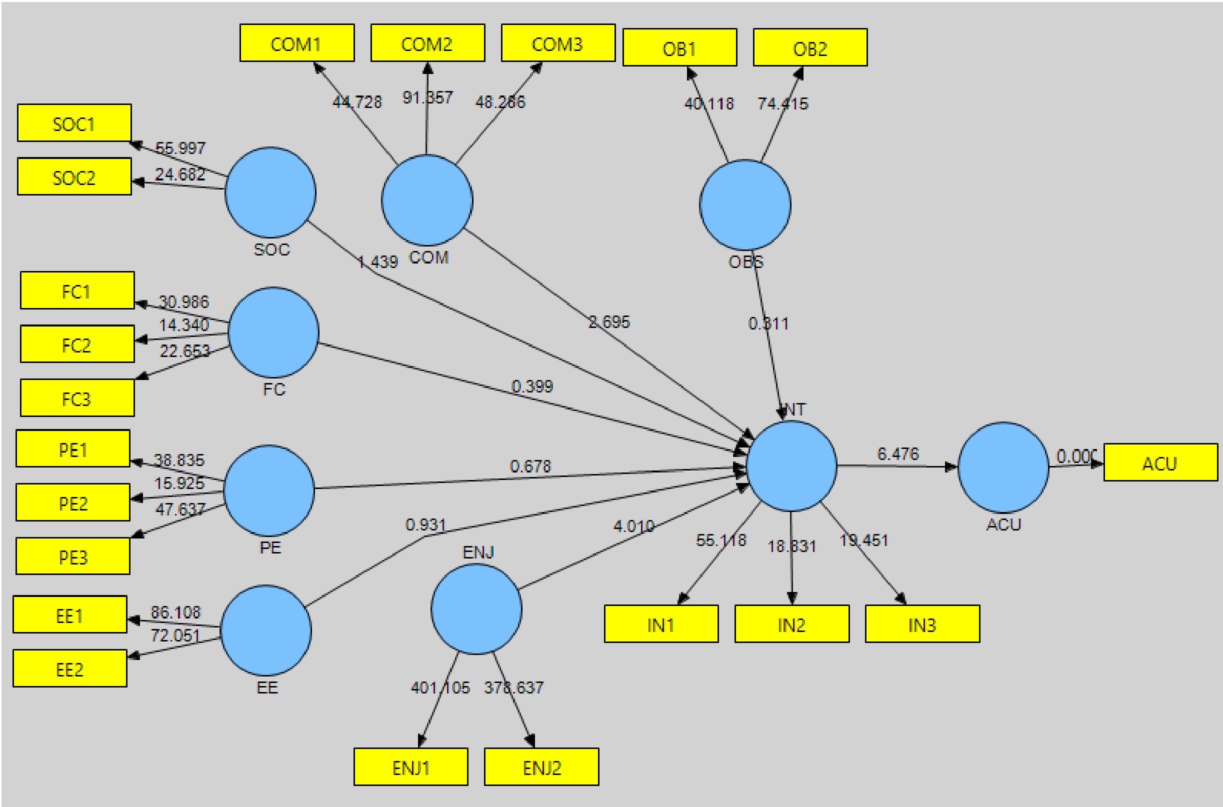


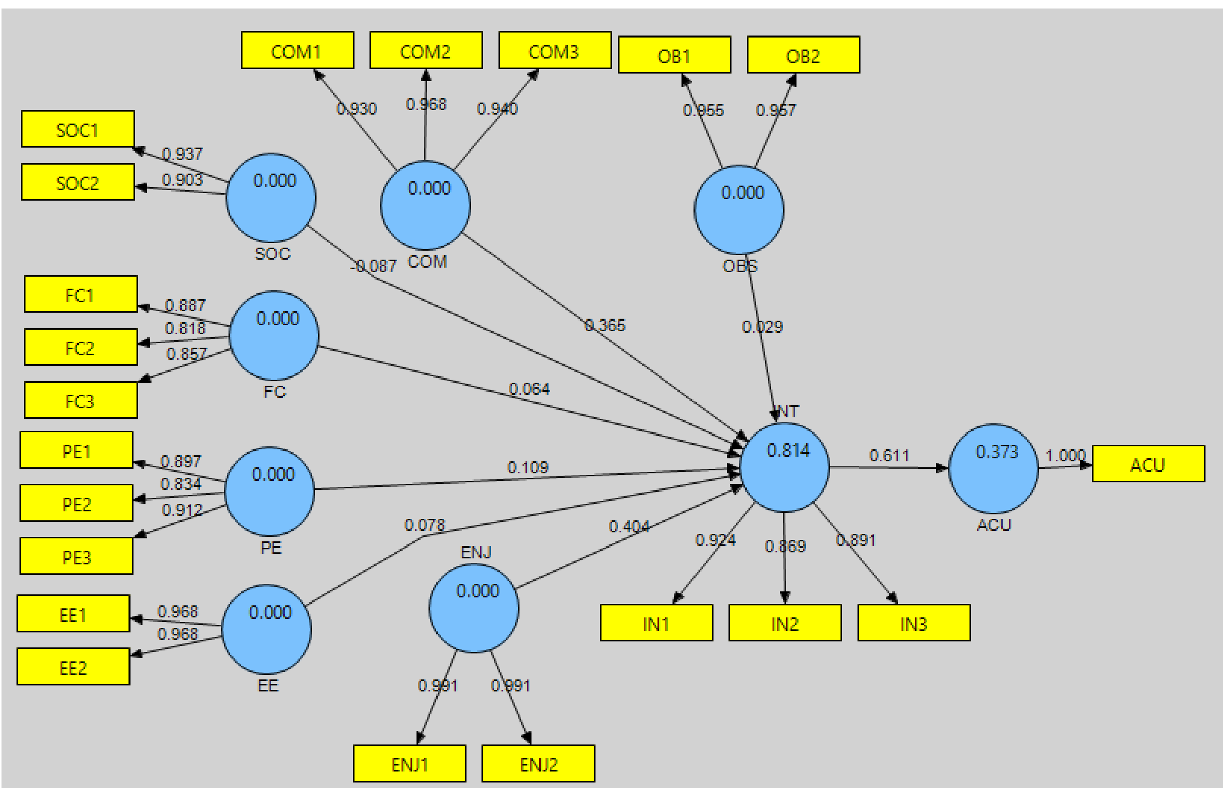
	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	Standard Error (STERR)	T Statistics (|O/STERR|)
COM -> INT	0.2406	0.2413	0.0497	0.0497	4.8423
EE -> INT	0.0852	0.0835	0.0371	0.0371	2.2928
ENJ -> INT	0.3798	0.3798	0.0379	0.0379	10.0101
FC -> INT	0.0892	0.089	0.0437	0.0437	2.0418
INT -> ACU	0.4272	0.4263	0.0395	0.0395	10.8276
OBS -> INT	-0.0147	-0.0145	0.0275	0.0275	0.5346
PE -> INT	0.2444	0.2443	0.0417	0.0417	5.8668
SOC -> INT	-0.0132	-0.012	0.0239	0.0239	0.5526

	AVE	Composite Reliability	R Square	Cronbachs Alpha	Communality	Redundancy
ACU	1	1	0.1825	1	1	0.1825
COM	0.8705	0.9527	0	0.9255	0.8705	0
EE	0.9329	0.9653	0	0.9282	0.9329	0
ENJ	0.9606	0.9799	0	0.959	0.9606	0
FC	0.746	0.8981	0	0.8299	0.746	0
INT	0.7793	0.9136	0.752	0.858	0.7793	0.2387
OBS	0.9023	0.9486	0	0.892	0.9023	0
PE	0.7719	0.9102	0	0.8522	0.7719	0
SOC	0.8876	0.9404	0	0.8736	0.8876	0

	ACU	COM	EE	ENJ	FC	INT	OBS	PE	SOC
ACU	1	0	0	0	0	0	0	0	0
COM	0.4101	1	0	0	0	0	0	0	0
EE	0.3136	0.5872	1	0	0	0	0	0	0
ENJ	0.3133	0.6317	0.6479	1	0	0	0	0	0
FC	0.3432	0.7116	0.6415	0.5098	1	0	0	0	0
INT	0.4272	0.7562	0.6562	0.7653	0.6382	1	0	0	0
OBS	0.2161	0.565	0.3413	0.3167	0.5459	0.4131	1	0	0
PE	0.3956	0.7211	0.5474	0.5808	0.5787	0.7256	0.4041	1	0
SOC	0.139	0.4346	0.1709	0.3366	0.2973	0.3509	0.3773	0.3936	1

Compare Health Poor



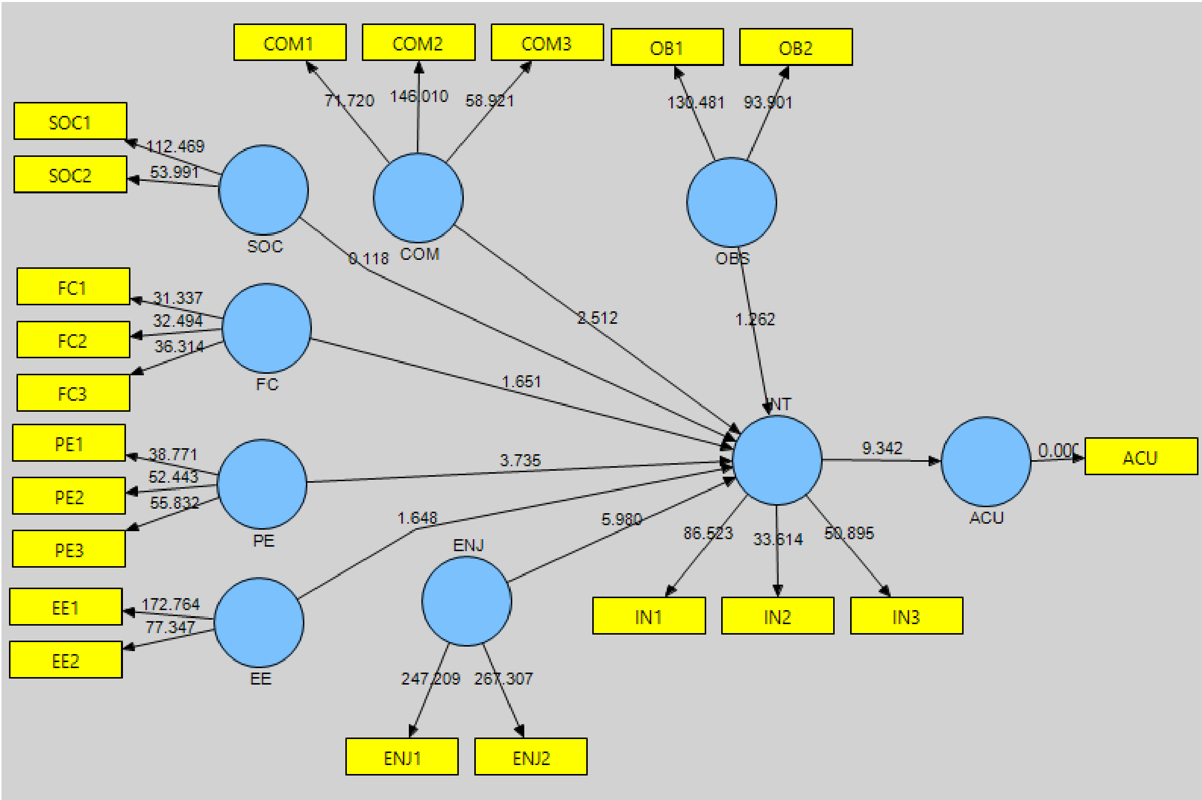


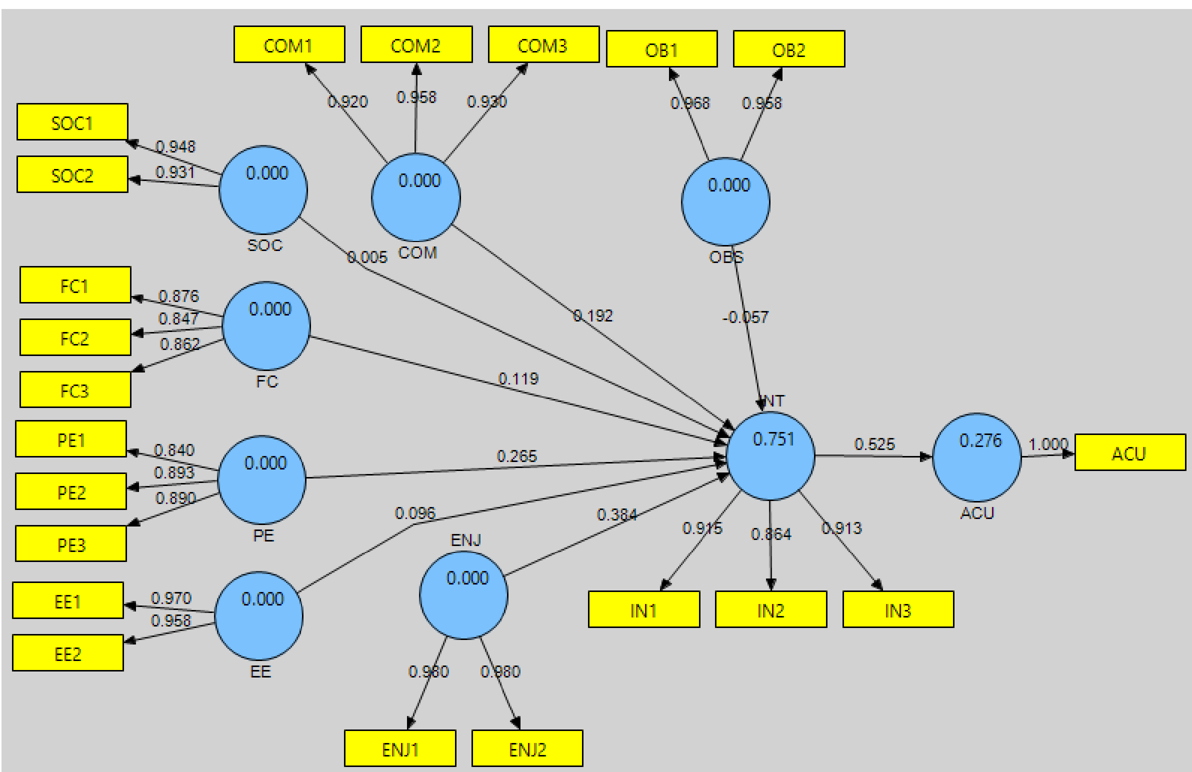
	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	Standard Error (STERR)	T Statistics (|O/STERR|)
COM -> INT	0.3645	0.3596	0.1353	0.1353	2.6948
EE -> INT	0.0782	0.0686	0.0839	0.0839	0.9313
ENJ -> INT	0.4043	0.4073	0.1008	0.1008	4.0102
FC -> INT	0.064	0.0541	0.1607	0.1607	0.3986
INT -> ACU	0.6108	0.6121	0.0943	0.0943	6.4762
OBS -> INT	0.029	0.0335	0.0934	0.0934	0.3105
PE -> INT	0.1094	0.1259	0.1613	0.1613	0.6782
SOC -> INT	-0.0865	-0.0835	0.0601	0.0601	1.4385

	AVE	Composite Reliability	R Square	Cronbachs Alpha	Communality	Redundancy
ACU	1	1	0.3731	1	1	0.3731
COM	0.8948	0.9623	0	0.9411	0.8948	0
EE	0.9378	0.9679	0	0.9337	0.9378	0
ENJ	0.9825	0.9912	0	0.9822	0.9825	0
FC	0.7299	0.8901	0	0.8142	0.7299	0
INT	0.8006	0.9233	0.8141	0.8755	0.8006	0.3889
OBS	0.9133	0.9547	0	0.9051	0.9133	0
PE	0.7769	0.9125	0	0.8573	0.7769	0
SOC	0.8463	0.9167	0	0.8202	0.8463	0

	ACU	COM	EE	ENJ	FC	INT	OBS	PE	SOC
ACU	1	0	0	0	0	0	0	0	0
COM	0.6261	1	0	0	0	0	0	0	0
EE	0.4341	0.6914	1	0	0	0	0	0	0
ENJ	0.5275	0.7844	0.6589	1	0	0	0	0	0
FC	0.5486	0.8216	0.7774	0.6972	1	0	0	0	0
INT	0.6108	0.8487	0.6971	0.84	0.7684	1	0	0	0
OBS	0.2865	0.4375	0.4551	0.3769	0.5753	0.4388	1	0	0
PE	0.5853	0.8843	0.6525	0.8178	0.7868	0.8249	0.5447	1	0
SOC	0.2602	0.567	0.3918	0.54	0.4686	0.4797	0.394	0.6319	1

Compare Less Than 2 Years



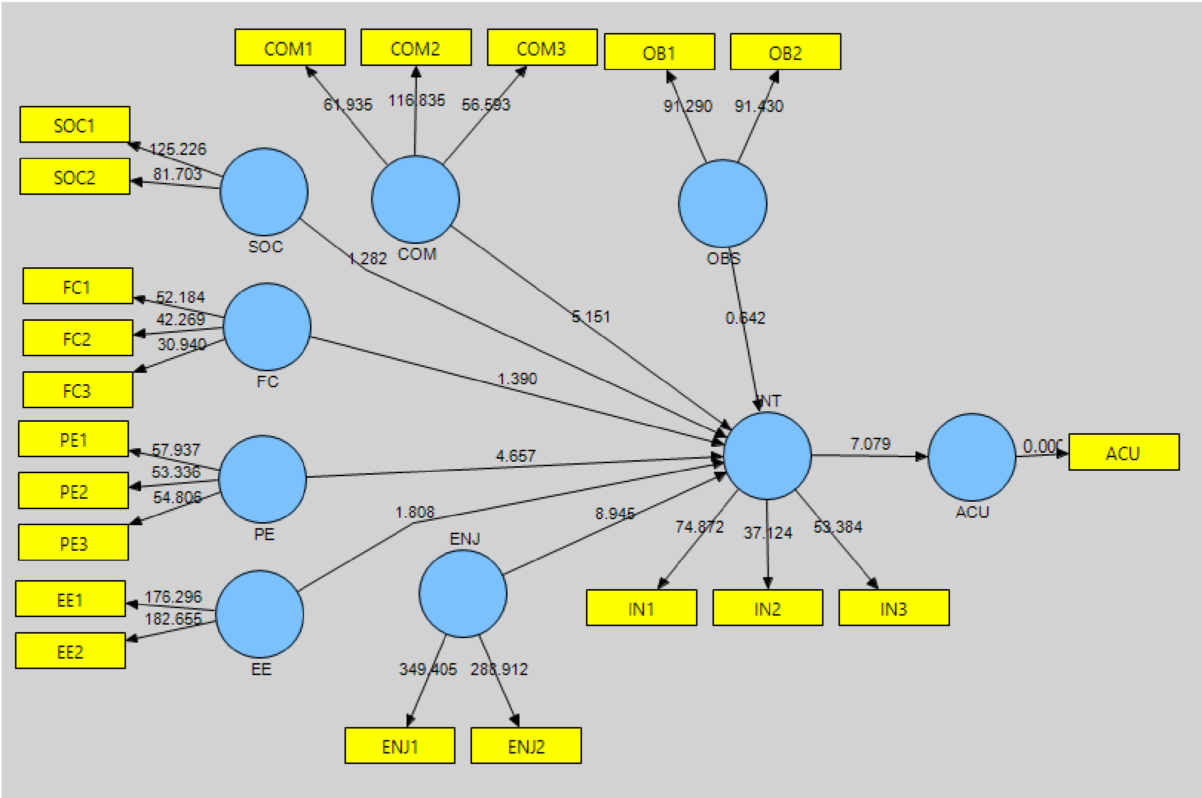


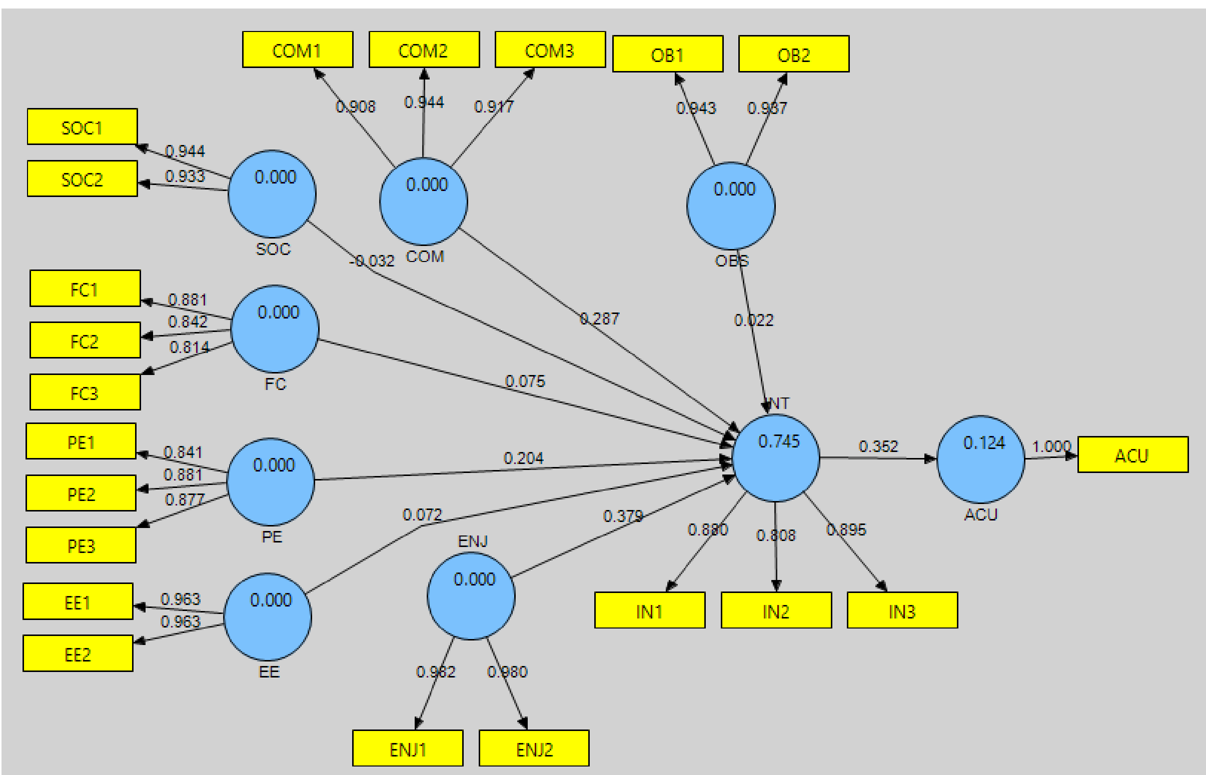
	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	Standard Error (STERR)	T Statistics (|O/STERR|)
COM -> INT	0.1923	0.1957	0.0765	0.0765	2.5116
EE -> INT	0.0957	0.0941	0.0581	0.0581	1.6477
ENJ -> INT	0.3845	0.3807	0.0643	0.0643	5.9804
FC -> INT	0.1188	0.1188	0.072	0.072	1.6509
INT -> ACU	0.5253	0.5232	0.0562	0.0562	9.3424
OBS -> INT	-0.0573	-0.0577	0.0454	0.0454	1.2618
PE -> INT	0.2654	0.2679	0.0711	0.0711	3.7349
SOC -> INT	0.0053	0.0054	0.0451	0.0451	0.1183

	AVE	Composite Reliability	R Square	Cronbachs Alpha	Communality	Redundancy
ACU	1	1	0.2759	1	1	0.2759
COM	0.8767	0.9552	0	0.9296	0.8767	0
EE	0.9301	0.9638	0	0.9253	0.9301	0
ENJ	0.9603	0.9798	0	0.9587	0.9603	0
FC	0.7427	0.8964	0	0.8268	0.7427	0
INT	0.8055	0.9255	0.7505	0.8794	0.8055	0.1964
OBS	0.9277	0.9625	0	0.9224	0.9277	0
PE	0.765	0.9071	0	0.8462	0.765	0
SOC	0.8827	0.9377	0	0.8678	0.8827	0

	ACU	COM	EE	ENJ	FC	INT	OBS	PE	SOC
ACU	1	0	0	0	0	0	0	0	0
COM	0.501	1	0	0	0	0	0	0	0
EE	0.3703	0.5414	1	0	0	0	0	0	0
ENJ	0.4057	0.6061	0.6365	1	0	0	0	0	0
FC	0.415	0.7101	0.621	0.504	1	0	0	0	0
INT	0.5253	0.7295	0.6346	0.7681	0.6328	1	0	0	0
OBS	0.2228	0.5094	0.2912	0.2446	0.534	0.3178	1	0	0
PE	0.459	0.7327	0.4988	0.5984	0.5768	0.7357	0.338	1	0
SOC	0.2543	0.513	0.1039	0.2823	0.3228	0.3601	0.3916	0.4586	1

Compare Time more than 2 years



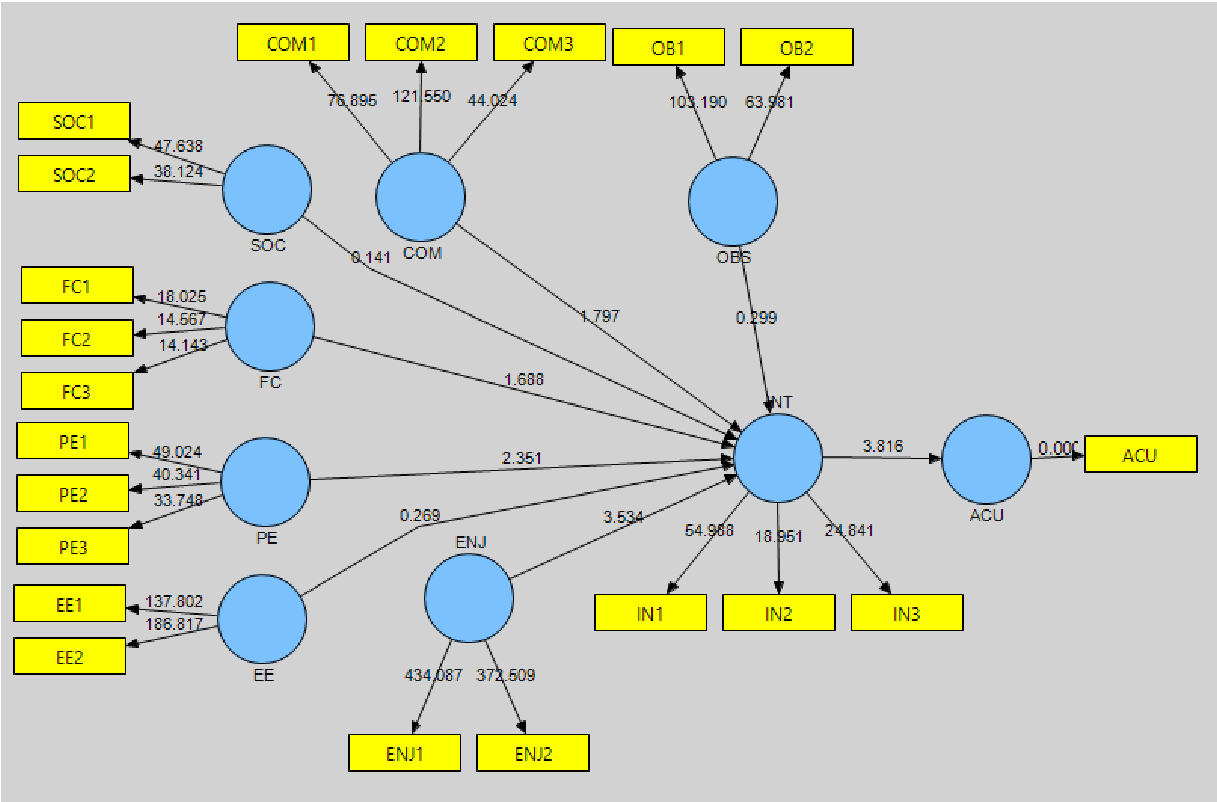


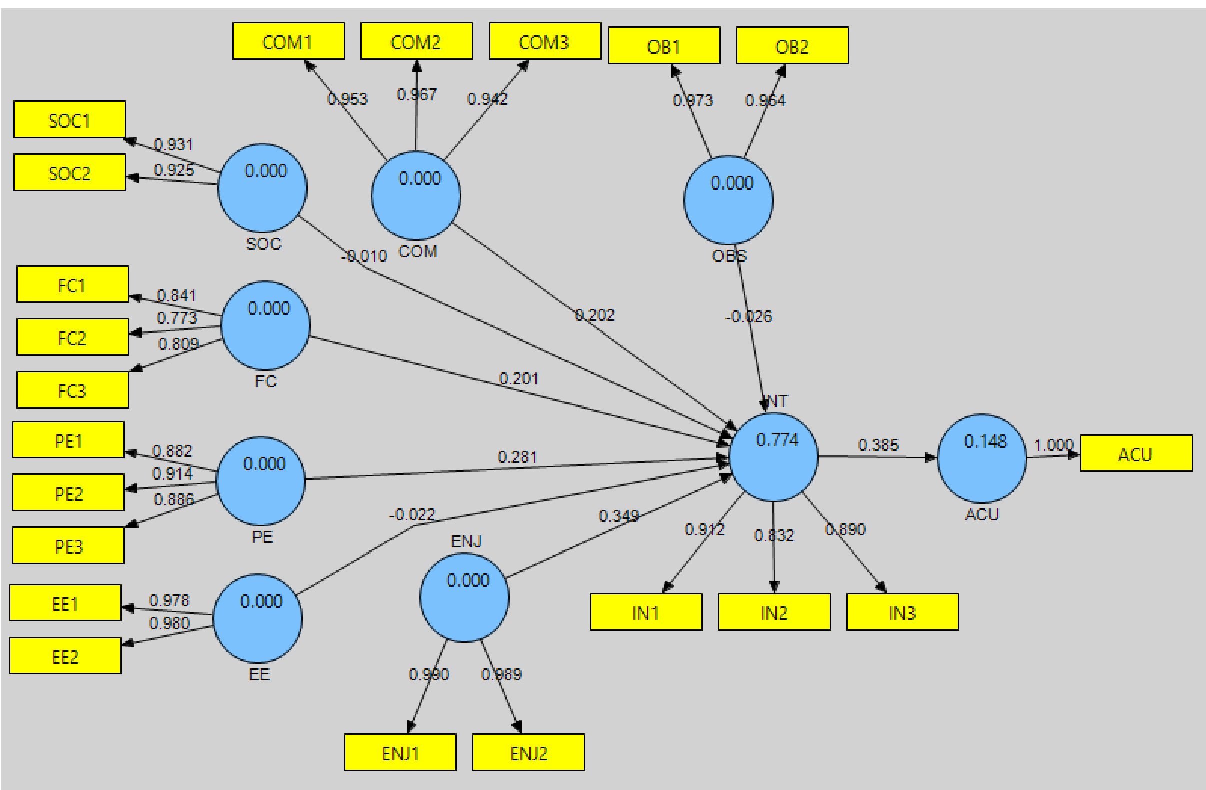
	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	Standard Error (STERR)	T Statistics (|O/STERR|)
COM -> INT	0.2874	0.2882	0.0558	0.0558	5.1508
EE -> INT	0.0721	0.0709	0.0399	0.0399	1.8083
ENJ -> INT	0.3785	0.3778	0.0423	0.0423	8.9451
FC -> INT	0.0745	0.0758	0.0536	0.0536	1.3897
INT -> ACU	0.3519	0.3502	0.0497	0.0497	7.0792
OBS -> INT	0.0222	0.023	0.0346	0.0346	0.6422
PE -> INT	0.2035	0.2026	0.0437	0.0437	4.6574
SOC -> INT	-0.0323	-0.0319	0.0252	0.0252	1.2818

	AVE	Composite Reliability	R Square	Cronbachs Alpha	Communality	Redundancy
ACU	1	1	0.1238	1	1	0.1238
COM	0.8518	0.9452	0	0.9129	0.8518	0
EE	0.9278	0.9626	0	0.9222	0.9278	0
ENJ	0.9629	0.9811	0	0.9615	0.9629	0
FC	0.716	0.8831	0	0.8017	0.716	0
INT	0.7431	0.8965	0.7449	0.8263	0.7431	0.2687
OBS	0.8836	0.9382	0	0.8683	0.8836	0
PE	0.7506	0.9002	0	0.8353	0.7506	0
SOC	0.8806	0.9365	0	0.8647	0.8806	0

	ACU	COM	EE	ENJ	FC	INT	OBS	PE	SOC
ACU	1	0	0	0	0	0	0	0	0
COM	0.3413	1	0	0	0	0	0	0	0
EE	0.2347	0.5868	1	0	0	0	0	0	0
ENJ	0.2475	0.6488	0.6171	1	0	0	0	0	0
FC	0.2839	0.7002	0.6434	0.507	1	0	0	0	0
INT	0.3519	0.7723	0.6336	0.76	0.6325	1	0	0	0
OBS	0.1809	0.5307	0.3469	0.3244	0.5222	0.4379	1	0	0
PE	0.3463	0.7173	0.5458	0.5803	0.5715	0.7083	0.4314	1	0
SOC	0.0644	0.4017	0.2326	0.392	0.2951	0.3575	0.3522	0.3901	1

Compare Education V2 Alevel and O Level



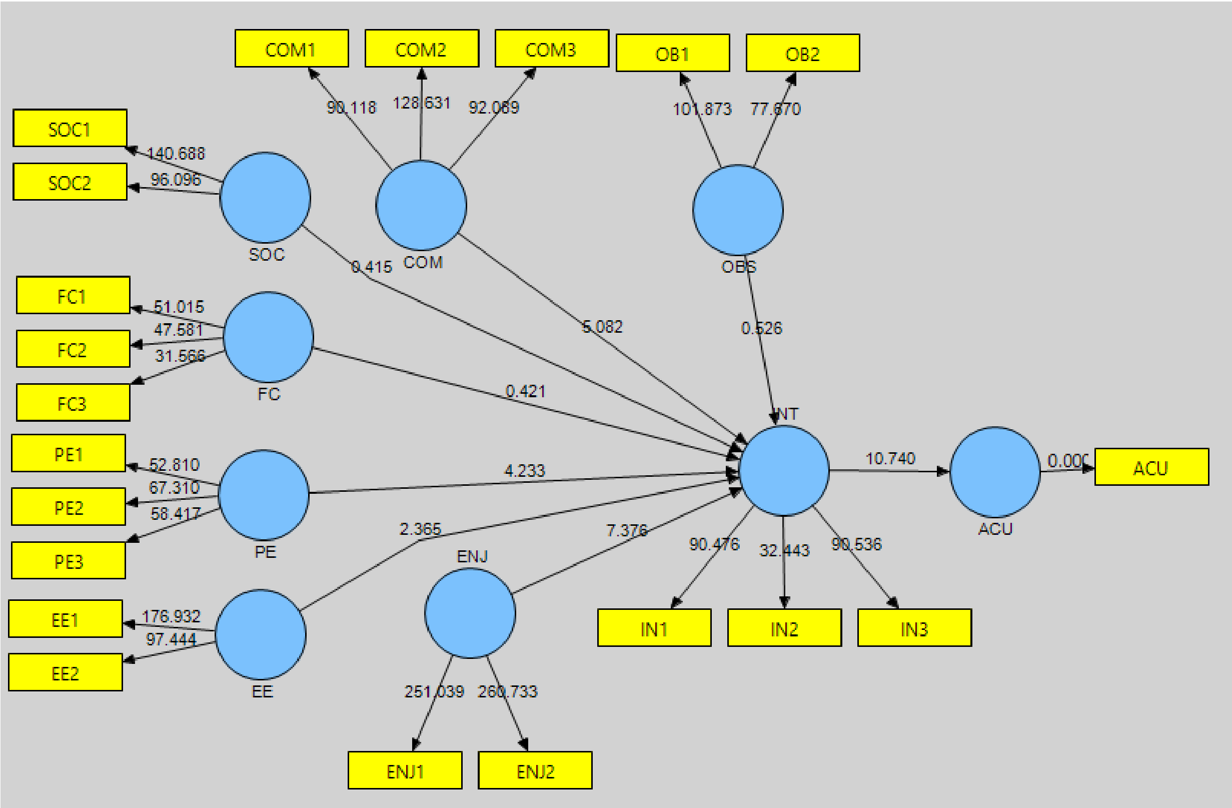


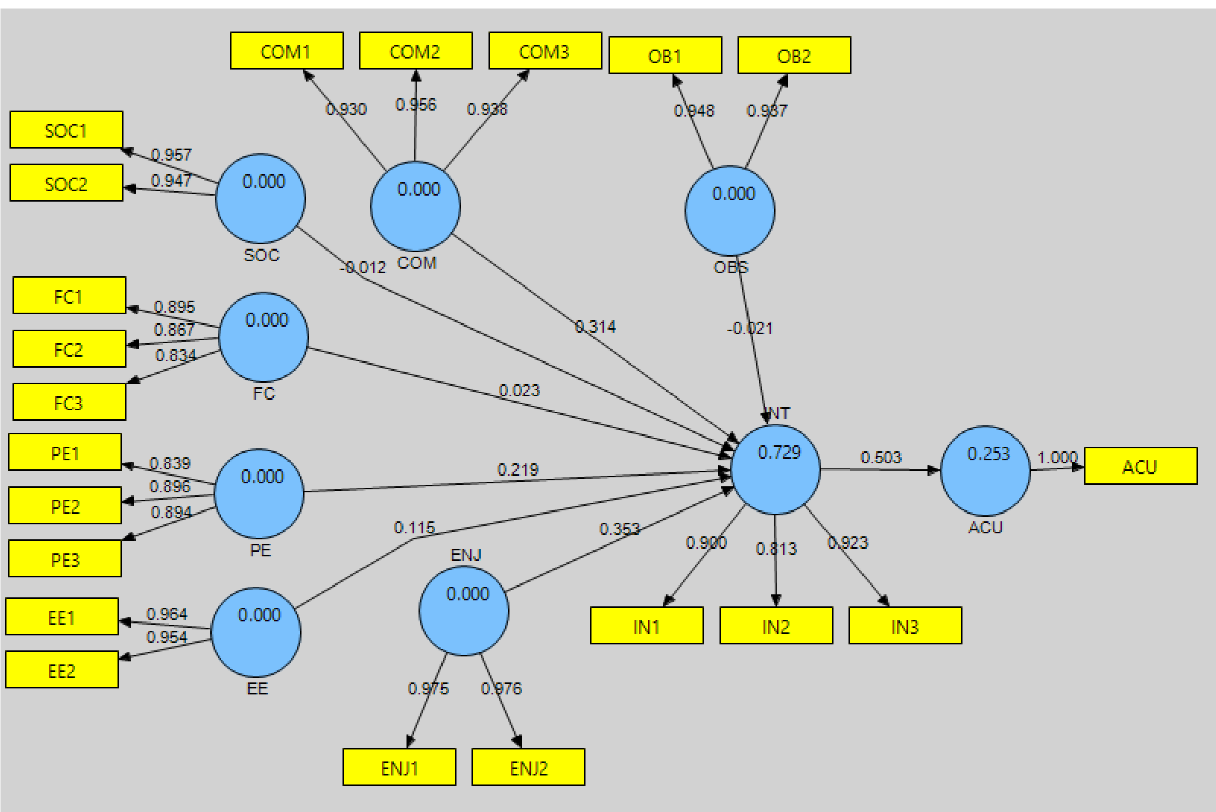
	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	Standard Error (STERR)	T Statistics (|O/STERR|)
COM -> INT	0.2021	0.2032	0.1125	0.1125	1.7967
EE -> INT	-0.0224	-0.0318	0.0833	0.0833	0.2694
ENJ -> INT	0.3494	0.3472	0.0988	0.0988	3.5344
FC -> INT	0.201	0.2137	0.1191	0.1191	1.6876
INT -> ACU	0.3853	0.3838	0.101	0.101	3.8158
OBS -> INT	-0.0264	-0.0284	0.088	0.088	0.2994
PE -> INT	0.2809	0.2794	0.1195	0.1195	2.3507
SOC -> INT	-0.0095	-0.0085	0.0674	0.0674	0.1413

	AVE	Composite Reliability	R Square	Cronbachs Alpha	Communality	Redundancy
ACU	1	1	0.1485	1	1	0.1485
COM	0.9101	0.9681	0	0.9507	0.9101	0
EE	0.9585	0.9788	0	0.9568	0.9585	0
ENJ	0.9792	0.9895	0	0.9788	0.9792	0
FC	0.6535	0.8496	0	0.7345	0.6535	0
INT	0.772	0.9103	0.7737	0.8523	0.772	0.219
OBS	0.9378	0.9679	0	0.9341	0.9378	0
PE	0.7996	0.9229	0	0.8759	0.7996	0
SOC	0.8617	0.9257	0	0.8396	0.8617	0

	ACU	COM	EE	ENJ	FC	INT	OBS	PE	SOC
ACU	1	0	0	0	0	0	0	0	0
COM	0.3568	1	0	0	0	0	0	0	0
EE	0.3297	0.5678	1	0	0	0	0	0	0
ENJ	0.335	0.7699	0.5517	1	0	0	0	0	0
FC	0.4049	0.7651	0.6728	0.6015	1	0	0	0	0
INT	0.3853	0.8062	0.5764	0.7887	0.7251	1	0	0	0
OBS	0.1442	0.4741	0.2789	0.3126	0.5699	0.4098	1	0	0
PE	0.3264	0.7524	0.5899	0.6698	0.6869	0.7749	0.4521	1	0
SOC	0.082	0.501	0.2349	0.4965	0.371	0.4692	0.43	0.5199	1

Compare Education v2 Higher, First Degree, High and Diploma





	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	Standard Error (STERR)	T Statistics (|O/STERR|)
COM -> INT	0.314	0.3177	0.0618	0.0618	5.0817
EE -> INT	0.1152	0.112	0.0487	0.0487	2.3646
ENJ -> INT	0.353	0.3523	0.0479	0.0479	7.3757
FC -> INT	0.023	0.0236	0.0546	0.0546	0.4212
INT -> ACU	0.5033	0.5028	0.0469	0.0469	10.7396
OBS -> INT	-0.0209	-0.0217	0.0398	0.0398	0.5256
PE -> INT	0.2189	0.2182	0.0517	0.0517	4.2333
SOC -> INT	-0.0121	-0.0109	0.0292	0.0292	0.4147

	AVE	Composite Reliability	R Square	Cronbachs Alpha	Communality	Redundancy
ACU	1	1	0.2533	1	1	0.2533
COM	0.8862	0.9589	0	0.9357	0.8862	0
EE	0.9204	0.9586	0	0.9138	0.9204	0
ENJ	0.9514	0.9751	0	0.949	0.9514	0
FC	0.7491	0.8995	0	0.8328	0.7491	0
INT	0.774	0.9111	0.7288	0.8529	0.774	0.2911
OBS	0.8891	0.9413	0	0.8755	0.8891	0
PE	0.7691	0.909	0	0.8502	0.7691	0
SOC	0.9064	0.9509	0	0.897	0.9064	0

	ACU	COM	EE	ENJ	FC	INT	OBS	PE	SOC
ACU	1	0	0	0	0	0	0	0	0
COM	0.5123	1	0	0	0	0	0	0	0
EE	0.3291	0.5792	1	0	0	0	0	0	0
ENJ	0.3834	0.6127	0.6495	1	0	0	0	0	0
FC	0.3745	0.7068	0.6139	0.4913	1	0	0	0	0
INT	0.5033	0.7541	0.6437	0.7444	0.5945	1	0	0	0
OBS	0.2916	0.572	0.3898	0.3843	0.5152	0.4411	1	0	0
PE	0.5191	0.7191	0.5166	0.5708	0.5451	0.7053	0.4297	1	0
SOC	0.1855	0.374	0.1405	0.3247	0.2551	0.3055	0.3347	0.322	1

6-1 OxIS and ONS Probit Analysis Variable Specification

The variables from OxIS and ONS are need to be manipulated before process Probit Analysis

- Age 25_34- dummy variable (1: age 25 – 34, 0: Otherwise)
- Age 35_49- dummy variable (1: age 35 – 49, 0: Otherwise)
- Age50_65- dummy variable (1: age 50 - 65, 0: Otherwise)
- Age66plus- dummy variable (1: age more than 66, 0: Otherwise)
- Gender-1 is male, 0 is female
- Single- dummy variable (1: single, 0: Otherwise)
- Married_together- dummy variable (1: married and living with your husband/wife, 0: Otherwise)
- Divided_seperated_widowed- dummy variable (1: divorced, widowed, married and separated from your husband/wife, 0: Otherwise)
- Scotland- dummy variable (1: Scotland, 0: Otherwise)
- Wales- dummy variable (1: Wales, 0: Otherwise)
- North- dummy variable (1: North East, North West, 0: Otherwise)
- Midland- dummy variable (1: East Midlands, West Midlands, 0: Otherwise)
- South- dummy variable (1: South East, South West, 0: Otherwise)
- London- dummy variable (1: London, 0: Otherwise)
- Sumgross is annual gross income, this variable used the value that ONS provided
- Englishwhite - dummy variable (1: White, 0: Otherwise)
- Irish - dummy variable (1: Irish, 0: Otherwise)
- Gcse_o_level - dummy variable (1: GSCE and O levels, 0: Otherwise)
- A_level - dummy variable (1: A Levels, 0: Otherwise)
- Higher_education - dummy variable (1: Higher/ Highest Education, 0: Otherwise)
- Degree_level - dummy variable (1: Degree level , 0: Otherwise)
- Employed - dummy variable (1: London, 0: Otherwise)
- Unemployed - dummy variable (1: London, 0: Otherwise)

6-2 Evaluation ONS Variables

Dependent Variable		
Variable Description	Values	Appear in Year
Do you use any of the following mobile devices to access the internet away from home or work?	1 Mobile phone or smartphone 2. Portable computer (e.g. laptop, tablet) 3. Other devices (e.g. IPod, handheld games console, E-Book reader) 4. I don't access the internet via any mobile deice away from home or work	2010 2011 2012 2013
In the last 3 months, for which of the following activities did you use the Internet, via a handheld device, for personal use?	1. Sending and/or receiving emails 2. Reading or downloading online news, newspapers, news magazines 3. Reading or downloading online books or e-books 4. Playing or downloading games, images, video, or music 5. Using podcast service to automatically receive audio or video files of interest 6. Social networking, using websites such as Facebook or Twitter	2012

Independent Variable		
Variable Description	Values	Appear in Year
Age of Respondent	In years	2010-13
Sex of Respondent	1 Male 2 Female	2010-13
Marital status of Respondent	1 single, that is never married, 2 married and living with your husband/wife, 3 married and separated from your husband/wife, 4 divorced, 5 or widowed?	2010-13

	6 a civil partner in a legally-recognised Civil Partnership, 7 Spontaneous only - In a legally-recognised Civil Partnership and separated from his/her civil partner 8 Spontaneous only - Formerly a civil partner, the Civil Partnership now legally dissolved 9 Spontaneous only - A surviving civil partner: his/her partner having since died	
Highest level of education qualification	1 Degree level qualification (or equivalent) 2 Higher educational qualification below degree level 3 A-Levels or Higher 4 ONC / National Level BTEC 5 O Level or GCSE equivalent (Grade A-C) or O Grade/CSE equivalent 6 GCSE grade D-G or CSE grade 2-5 or Standard Grade level 4-6 7 Other qualifications (including foreign qualifications below degree level) 8 No formal qualifications	2010-13
Employment Status	1. Full time (30 hours a week or more) 2. Part time (8-29 hours a week) 3. Retired 4. Unemployed 5. Permanently sick or disabled 6. In community or military service 7. Undergraduate Student 8. Post graduate student 9. In full time education (not higher degree) 10. In part time education (not higher degree) 11. Doing house work, looking after children or other persons	2010-13

Ethnicity	1. White British 2. Any other White background 3. Mixed – White and Black Caribbean 4. Mixed – White and Black African 5. Mixed – White and Asian 6. Any other Mixed background 7. Asian or Asian British – Indian 8. Asian or Asian British – Pakistani 9. Asian or Asian British – Bangladeshi 10. Asian or Asian British – Any other Asian background 11. Black or Black British – Black Caribbean 12. Black or Black British – Black African 13. Black or Black British – Any other Black background 14. Chinese	2010
Ethnicity	1. English, Welsh, Scottish, Northern Irish, British 2. Irish 3. Gypsy or Irish Traveller 4. Any other White background 5. White and Black Caribbean 6. White and Black African 7. White and Asian 8. Any other Mixed/Multiple Ethnic background 9. Indian 10. Pakistani 11. Bangladeshi 12. Chinese 13. Any other Asian background 14. African 15. Caribbean 16. Any other Black/African/Caribbean background 17. Arab	2011-2013

	18. Any other Ethnic group	
Government Office Region	1 North East 2 North West 3 Yorkshire and the Humber 4 East Midlands 5 West Midlands 6 East of England 7 London 8 South East 9 South West 10 Wales 11 Scotland	2010-13
Annual Gross Income	1 Up to £519 2 £520 up to £1,039 3 £1,040 up to £1,559 4 £1,560 up to £2,079 5 £2,080 up to £2,599 6 £2,600 up to £3,119 7 £3,120 up to £3,639 8 £3,640 up to £4,159 9 £4,160 up to £4,679 10 £4,680 up to £5,199 11 £5,200 up to £6,239 12 £6,240 up to £7,279 13 £7,280 up to £8,319 14 £8,320 up to £9,359 15 £9,360 up to £10,399 16 £10,400 up to £11,439 17 £11,440 up to £12,479 18 £12,480 up to £13,519 19 £13,520 up to £14,559 20 £14,560 up to £15,599 21 £15,600 up to £16,639 22 £16,640 up to £17,679 23 £17,680 up to £18,719 24 £18,720 up to £19,759	2010-13

	25 £19,760 up to £20,799 26 £20,800 up to £23,399 27 £23,400 up to £25,999 28 £26,000 up to £28,599 29 £28,600 up to £31,199 30 £31,200 up to £33,799 31 £33,800 up to £36,399 32 £36,400 up to £38,999 33 £39,000 up to £41,599 34 £41,600 up to £44,199 35 £44,200 up to £46,799 36 £46,800 up to £49,399 37 £49,400 up to £51,999 38 £52,000 or more	
Health in general	1 Very Good 2 Good 3 Fair 4 Bad 5 Very Bad	2010-13

6-3 Evaluation OXiS Variables

Dependent Variable		
Variable Description	Values	Appear in Year
Do you yourself have a mobile phone?	0 No 1 Yes	2007 2009 2011
Do you use your mobile phone for …	A. Making phone calls/Talking to others B. Sending or reading email C. Sending text messages D. Playing games E. Taking photos F. Sending photos G. Listening to music H. Finding direction or location I. Browse or update a social network site J. Browse the Internet	2011
How frequently do you use your mobile phone for …	A. Making phone calls/ Taking to others B. Sending text messages C. Playing games D. Accessing email or the internet E. Taking photos F. Sending photos G. Listening to music (Mp3s)	2009
Besides making phone calls, do you use your mobile phone for …	A. Sending text message B. Playing game C. Accessing email or the Internet D. Taking pictures E. Sending photos F. Listening to music (Mp3s)	2007

Independent Variable		
Variable Description	Values	Appear in Year
Age of Respondent	In years	2007 2009 2011
Region	1. Scotland 2. North West 3. South West	2009 2011

	4. Wales 5. South East 6. London 7. East of England 8. East Midlands 9. West Midlands 10. Yorkshire & the Humber 11. North East	
Region	1. Scotland 2. North West 3. South West 4. Wales 5. South 6. South East 7. London 8. Anglia 9. East Midlands 10. West Midlands 11. Yorkshire 12. North East	2007
Gender	0. Male 1. Female	2007 2009 2011
Employment Status	1. Full time (30 hours a week or more) 2. Part time (8-29 hours a week) 3. Retired 4. Unemployed 5. Permanently sick or disabled 6. In community or military service 7. Undergraduate Student 8. Post graduate student 9. In full time education (not higher degree) 10. In part time education (not higher degree) 11. Doing house work, looking after children or other persons	2007 2009 2011

Marital Status	1. Single 2. Married 3. Living together with partner 4. Divorced, separated 5. Widowed	2007 2009 2011
Highest Education	0. No qualifications 1. SNQ (Scottish National Qualification) 2. 5 or more GCSE grades A-C 3. 4 or less GCSE grade A-C 4. GCSE grade D-G 5. CSEs 6. 5 or more O Level 7. 4 or less O Level 8. GCE A levels or equivalent 9. NVQ 1 or 2 10. NVQ 3 or 4 11. GNVQ Foundation 12. GNVQ Intermediate 13. GNVQ Advanced	2007
Highest Education	In 2009 the following choice were added from 2007 14. Certificate or Diploma of Higher Education 15. Bachelor's degree 16. Graduate Certificates and Diploma 17. Master Degree 18. Doctoral Degree	2009
Highest Education	0. No qualifications 1. 5 or more GCSE grades A-C 2. 4 or less GCSE grade A-C 3. GCSE grade D-G 4. 5 or more Scottish Standard Grades, grades 1-3 5. 4 or less Scottish Standard Grades, grades 1-3 6. Scottish Standard Grades, grades 4-7 7. Scottish Higher 8. CSEs 9. 5 or more O levels 10. 4 or less O levels 11. GCE A levels or equivalent 12. NVQ 1 or 2 13. NVQ 3 or 4	2011

	14. GNVQ Foundation 15. GNVQ Intermediate 16. GNVQ Advanced 17. Certificate or Diploma of Higher Education 18. Bachelor's Degree 19. Graduate Certificates and Diploma 20. Master Degree 21. Doctoral Degree	
Ethnic group membership	1. Asian: of Indian origin 2. Asian: of Pakistani origin 3. Asian: of Bangladeshi origin 4. Asian: Chinese origin 5. Asian: other origin 6. Black: of African origin 7. Black: of Caribbean origin 8. Black: of other origin 9. White: of British origin 10. White: of other origin 11. Other	2007 2009 2011