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# **Understanding and Conceptualising the Adoption, Use and Diffusion of Mobile Banking in Older Adults: A Research Agenda and Conceptual Framework**

## **Abstract**

Mobile banking has become increasingly important to society; however, not all members of society adopt and/or use it as much as others: older adults, the disabled and lower-income families remain behind in their use and adoption of this service. This finding helped us recognise a research gap and led us to form our primary aim: to understand and explain the factors that influence the adoption, use and diffusion of mobile banking among one of those groups in particular, older adults, in the UK. To form a theoretical understanding, this paper presents a comprehensive review of the surrounding literature in the area and proposes a conceptual framework that can be used for future research. The implications of this research for academia and businesses are also provided in this paper.

**Keywords:** Mobile Banking, Older adults, Adoption and Use, Diffusion, Risk,

# 1. Introduction

Services enabled by information and communication technologies (ICTs) are becoming increasingly important to society (Barrett, Davidson, Prabhu, & Vargo, 2015; Mathiassen & Sørensen, 2008), with growth intensifying among the consumer markets (Tuunanen, Myers, & Cassab, 2010). Due to increasing penetration rates of broadband, mobile devices such as tablets, smartphones, online products, and services including online shopping, online banking and electronic government among society and organisations, ICT has become part of daily life (Choudrie & Vyas, 2014). Some attempts have been made to understand consumers' use of such ICT services, although more research is required regarding their adoption and use (McKenna, Tuunanen, & Gardner, 2013). When considering the adoption and use issues, it is apparent that there also exists some resistance to innovation, and scepticism of new technologies by some groups of consumers (Jahanmir & Lages, 2015, 2016), which may cause new innovations to fail (Heidenreich & Spieth, 2013). Talke and Heidenreich (2014) argue that innovation resistance by consumers must be recognised to facilitate new product adoption.

In response to innovation resistance, Talke and Hultink (2010) argue for the influence of different stakeholder groups for new innovations. There is a steady stream of research into the use of ICT by younger generations (Vodanovich et al., 2010); however, few studies have explored the motivations and reasons underlying older adults' adoption, non-adoption and use of ICTs (Choudrie & Vyas, 2014). There is evidence of older generations' using mobile technology for online shopping and entertainment (Kuoppamäki, Taipale, & Wilska, 2017), but there is still little research about older adults' use of a broader range of mobile services, for example, mobile banking (Chawla & Joshi, 2017).

Given the scarcity of research on mobile banking and older adults, this research study was motivated to identify and understand the factors that would lead to the adoption, acceptance and widespread use of mobile banking among the older adult population. Taking this into consideration, alongside the importance of ICT in today's society, the resistance that some consumer groups have towards adoption of new technologies and the recognition that older adults are less confident in using mobile banking, we were motivated to explore this research gap. We address this gap by proposing a research agenda based on the main themes of this research study and a conceptual framework to guide the study of mobile banking use by older adults. Shapira (2011) argues that conceptual frameworks provide a structure to organise observations while describing the structure in a precise way. They may also be used when the research phenomenon is at an early stage of enquiry, which our study is.

Prior to forming the conceptual framework, an aim for this research was formulated: *to examine and identify the factors that influence the adoption, use and diffusion of mobile banking among older adults in the context of smartphones*. For this purpose, initially, a literature review of mobile banking and the theories that are applied to research the area, as well as theories being used to examine the adoption, use and diffusion of novel ICT among older adults and mobile phones, namely smartphones, was undertaken. Further, to contextualise mobile banking, a review of studies associated with mobile banking, adoption, trust and risk was undertaken, which provided the theoretical background of this paper. To fulfil the aim, the following research question was formulated: *Is mobile banking being accepted and used among the older adult population?* By answering this question and determining the aim, the following contributions are envisaged. For academia, the main contribution of this research is a theoretically based review of mobile banking and research on older adults and smartphones. Research on this topic is developing, and we intend to provide a detailed examination of the leading theories in this research area. Thereafter, for

businesses, our research provides factors to consider when seeking to promote and effect the adoption, use and diffusion of a mobile banking product or service. Thus, for an organisation considering developing new apps or finding ways to cater to its older consumer market segment, such research is of immense importance.

To familiarise readers with this context, the following section provides the various concepts of this study and how they are all aligned to provide a theoretical foundation to the present work.

## **2. Theoretical Background**

As there are several keywords and themes surrounding this research, the literature review had to be divided into several sub-sections. The first examines the role of older adults in society, followed by research that examines the digital divide and studies emphasising older adults having access or no access to the internet.

### **2.1. Older adults and their role in society**

Older adults have become larger and a more significant sector of society due to declining mortality rates resulting from enhanced advances in medicine and healthcare, quality of life and wellbeing, and to an extent, a phenomenon in which novel ICT applications and awareness have played a part (Taha, Sharit, & Czaja, 2009). This has led to older adults' becoming more important members of organisations, societies and economies alike. For organisations, older adults offer lower absenteeism, reduced staff turnover, better retention levels and a wealth of skills and knowledge transferable to younger workers (Zaniboni, Truxillo, & Fraccaroli, 2013). As an example, in the United Kingdom (UK) older adults aged 65 and above have contributed around £45 billion in taxes and are expected, by 2030, to pay an estimated figure of £82 billion annually to the UK economy (Pride, 2013). Further, 'an increase in the portion of adult life lived in old age will lead to an increase in saving rates'

(Mason & Kinugasa, 2005). As definitions vary according to research purposes, for this research, older adults are individuals aged 50 years and above who have the knowledge and ability of using ICT, with this group of older adults known as 'silver surfers' (Edwards, Duffy, & Kelly, 2015). Older adults' categorization begins from 50 years and above, as at this age adults' health, cognitive skills and vision begin to decline, which, in turn, affects their daily activities and underlying performance (Choudrie & Vyas, 2014). In terms of the older adult population, the number of persons aged 60 or older is expected almost to triple, increasing from 737 million in 2009 to 2 billion by 2050 (United Nations, 2008).

In terms of ICT usage, older adults are different from young people in two essential ways (Newell et al., 2006). First, they have a relatively low familiarity with information and communication technology (ICT). Second, as individuals' age, the declining physical, sensory and cognitive capabilities lead to significant barriers of ICT use. Moreover, their mobility, which is an essential part of offline social activities, is quite limited because of the effect of aging. As such, research in this area should be considered. To inform such calls, the next section considers research of the digital divide and older adults.

## **2.2. The Digital Divide and Older Adults Research**

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

The digital divide is defined as the divide between "those who have access to a particular technology and those who do not" (Curwen & Whalley, 2016, p. 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, p. 19). The digital divide is also often referred to as the “information gap” or “information inequality” and has promoted immense debates that have resulted in the digital divide being considered in a variety of contexts, including socio-economic status, gender, age, race, region or geography (Tsatsou, 2011).

One significant component of the digital divide is age (Selwyn, 2004). For many years older adults have avoided, or not intended to use, the internet and associated products and services as they tended to perceive the internet as a ‘non-essential’. Additionally, age-related problems such as declining vision and cognition, as well as chronic diseases such as arthritis, pose major challenges to overcome. This has resulted in a significant age-based divide between young and old, with internet use declining in every advancing age group (Greengard, 2009). Large numbers of studies of older and younger adults have been undertaken, where emphasis has been placed upon the social capital divide that exists between the older and younger population’s internet and computer use and electronic commerce (Passyn, Diriker, & Settle, 2011; Wagner, Hassanein, & Head, 2010). As an example, comparing different age and gender groups showed that different age groups (under 35 vs. 35-50 vs. over 50) have diverse perceptions towards online shopping (Dennis, Alamanos, Papagiannidis, & Bourlakis, 2016; Lian & Yen, 2014). Understanding the older adult population is also pertinent for businesses as they can then cater to the needs and requirements of this demographic group, an issue highly emphasised in the United States of America (USA), particularly given that governments and organisations, including marketing businesses, are gaining immensely due to internet-based strategies (Porter & Donthu, 2006).

Given the important role of older adults in society, the last decade has witnessed research studies on older adults’ applications of and the benefits of novel technologies that have led to several diverse aspects. For example, it was found that older adults face difficulties when adopting novel technologies (Lee et al., 2011). When considering the use of the internet in the

55-years-old-and-above population of Finland, it was found that around one-third of the respondents did not use the internet (Vuori & Holmlund-Rytkönen, 2005). In Australia, silver surfing individuals were found to use the internet five times less than the under-30 age group (Willis & Tranter, 2006). From such studies, it has been confirmed that a digital divide exists and is recognised by many global researchers. Several research studies have attempted to study this issue and to identify the factors leading to the age-related digital divide. These factors have been found to include perceived lack of benefits (Mann, Belchior, Tomita, & Kemp, 2005), lack of interest or motivation (Carpenter & Buday, 2007; Selwyn, 2004), lack of knowledge and lack of access (Peacock & Künemund, 2007), cost (Carpenter & Buday, 2007; Mann et al., 2005) and physical limitation (Carpenter & Buday, 2007). It is clear that these gaps still exist today, as evidenced in the following sections.

### **2.3. Older Adults and ICT research**

Combining the previous sections of older adults and digital divide studies and older adults and their pertinent role in society suggested a research gap in the area of older adults and ICT research. To reduce this gap, the following section offers a review of older adults and ICT research.

In the literature on older adults and ICT in general, there were diverse examples of literature highlighting older adult internet usage such as, for example, Niehaves and Plattfaut (2014), who studied the intentions of the elderly with regards to internet use. They concluded that a growing group of the elderly have different attitudes, beliefs and intentions when it comes to technology usage. In terms of internet use, Frissen (2005) highlighted the existence of the ‘voluntary nonusers’, older adults who feel quite content without the internet in their lives. As part of the public sector, the health sector is also considered, which accounts for studies such as that of Sum et al. (2008), who found that there is greater use of the internet as a



communication tool in order to achieve a lower level of social loneliness. Comparatively, greater use of the internet to find new people to connect with socially was associated with a higher level of emotional loneliness. Gatto and Tak (2008) revealed that older adults found computers to be beneficial in terms of providing a sense of connectedness, satisfaction, utility and positive learning experiences. However, they identified the barriers for computer use as including frustration, physical and mental limitations, mistrust and time issues. Older adults have also reported that current internet interfaces are not user-friendly. Program designers do not take into account their special visual, perceptual, motor and cognitive declines (Schieber, 2003). This has become an explicit obstacle that prevents older adults from using the internet. Internet interface and program designers should thus attempt to minimise the burden on impaired functions that older adults may already be suffering. Buse (2010) provided a diverse perspective on this issue by considering the 'technobiographies' of these older computer users, where it was learnt that changes in body techniques are prompted and in some cases required by broader cultural and technological change. The findings suggested the process of acquiring computing skills as an embodied competency, and as a form of 'practical knowledge' that can only be 'learned by doing'. The experiences of technology use were embedded among constructions and experiences of ageing bodies.

In terms of internet acceptance and use, Morris, Goodman and Brading (2007) revealed that, in the UK, people aged 55 and over are far less likely to use computers and the internet than younger people. They also show a decline in computer and internet use and internet awareness with age. Internet use also appears to be affected by background and gender, with higher usage among those with a background of non-manual work and among men, although computer use itself was fairly balanced between the genders. What is more, the most common location of computer use is in the home, indicating difficulties for those who cannot afford or for other reasons do not own a computer. There is indeed a 'grey digital divide', but it is not

uniform, and this work highlights particular segments of the older population that are missing out on the benefits that computers can bring. The two most popular internet activities regardless of age were e-mail and information seeking and research. Younger respondents (55–64 years) also enjoyed activities like online games, bulletin boards and shopping, while older age groups (65 years plus) tended to pursue a narrower range of online goals and activities, disliking online shopping for reasons such as fear of fraud. In terms of gender, older men and women tended to have diverse preferences for online activities. A higher number of female respondents favoured e-mail, whereas male respondents tended to favour information seeking and research. More men than women also preferred to shop and bank online; word-processing, internet and e-mail appeared to be the main computer applications used by older people. Online shopping is not popular, and older people most commonly look up information on hobbies and interests, travel, holidays and local information. A particular finding suitable for this study is the definite link between such interests and the perceived usefulness of the technology, with the interviews also highlighting the importance of communicating with family, general interest and curiosity, as well as social aspects, as motivators for learning to use computers. Conversely, lack of interest is linked to misconceptions that computers are not suitable for older people, too difficult to use or not useful.

Human factors research has developed senior-friendly internet design guidelines that will facilitate older adults' use of the internet (Holt & Morrell, 2002; Zajicek & Hall, 2000), such as larger fonts, high-contrast background, easy-to-operate keyboards and mouse equipment, and better video and audio applications. In China, efforts have been made to develop senior-friendly interfaces. For instance, Zhou, Yasuda and Yokoi, (2007) evaluated a Senior Internet Support & Learning Environment system where the senior-friendly interface design of the system proved to reduce Chinese older adults' anxiety about internet use significantly.

Another recent phenomenon is the emergence of a collaborative economy, known as the 'sharing economy'. In such an economy resources and assets, particularly those that have been accumulated over time but remain under-utilised, are re-utilised or re-combined to create value (Möhlmann, 2015). The sharing economy concept has created markets out of items that were not regarded as possessing monetisable properties before. As a result, the emergence of profit-based online platforms for peer-to-peer (P2P) sharing of consumer goods and services provides new ways for end-users to generate income from their possessions. P2P sharing is also moving from a means of bolstering personal incomes in a stagnant wage market into a disruptive economic force (Geron, 2013). Diverse types of businesses based on the sharing economy concept are continuing to grow at a phenomenal rate (Heo, 2016), and specifically in the tourism sector, the rise of profit-based online marketplace platforms, such as AirBnB, 9flats, Housetrip, HomeAway, Uber and Liftshare have changed the way people travel and find a place to live, which is of great significance for the traditional tourism sector.

Older adults are using P2P platforms, which accounted for a study of the perceptions towards in-vehicle technologies and their relationships to age, health and preconceptions. Findings suggested that people's subjective perceptions and self-evaluation of a relevant hands-on experience have stronger influence on their attitudes and expectations toward in-vehicle technologies compared to preconceptions, individual characteristics and task performance (Lee, Mehler, Reimer, & Coughlin, 2015).

Amongst the early studies of mobile banking, the internet-related activity that this study is considering, Selwyn, Gorard, Furlong and Madden (2003) suggested that using a computer is not only a minority activity amongst older adults but also highly stratified by gender, age, marital status and educational background. Conversely, non-use of computers can be attributed to their low relevance and 'relative advantage' to older people.

Considerations of mobile banking also led to studies of other automated banking services such as Automated Telling Machines (ATM) (Thatcher et al., 2006), where a specific study of ATMs and education in terms of interfaces and literacy and illiteracy showed that among each group there were few significant differences based on the type of interface, but significant differences in understanding between the groups. Significant differences in the literate group were primarily due to prior exposure to similar ATM interfaces, whereas significant differences in the illiterate group were primarily due to variations in icon comprehensibility.

Of the mobile banking adoption literature, some research indicated that typical users of electronic banking were relatively young (Joshua & Koshy, 2011) or that the elderly had more resistance to change and negative attitudes toward using mobile banking services (Laukkanen, Sinkkonen, Kivijärvi, & Laukkanen, 2007). However, certain studies found that respondents aged 50 or over were mostly eager to use mobile banking services (Suoranta & Mattila, 2004), typical mobile banking users were aged between 30 and 49 (Laukkanen & Pasanen, 2008), and middle-aged or older customers were the main users of electronic banking (Dasgupta, Paul, & Fuloria, 2011; Laforet & Li, 2005). Additionally, Laforet and Li (2005) reported that mobile banking's main users were not necessarily young and highly educated. Laukkanen et al. (2007) used age (over 55 or not) to separate Finnish respondents into two groups and identified that these two groups differed in risk, tradition and image barriers. Cruz, Barretto Filgueiras Neto, Munoz-Gallego and Laukkanen (2010) claimed that older people perceived mobile banking as more difficult to use than younger people did. Likewise, Püschel, Mazzon and Hernandez (2010) observed that typical users' attitudes towards mobile banking were significantly impacted by relative advantages and perceived ease of use.

The Task Technology Fit (TTF) and UTAUT models were combined to understand users' behavioural intentions toward mobile banking and found that, with the exception of effort expectation, the other three drivers have significant effects (Lian & Yen, 2014; Zhou, Lu and Wang, 2010). Perceived difficulties in using computers, combined with the lack of personal service in e-banking, were found to be the main barriers of internet banking adoption among mature customers. Internet banking was also found to be more insecure among mature customers than bank customers in general (Mattila, Karjaluoto, & Pentto, 2003).

However, access to a computer can also lead to older adults' not using mobile banking, as suggested by Fox (2013): 'Because of the gaps in access among age groups, differences among those who bank online are more pronounced. For example, since only 56% of U.S. adults age 65 and older have access to the internet, the percentage of that age group who bank online is just 26%.'

What can be learnt from these studies so far is that ICTs, whether in the healthcare sector or logistics, are important largely for overcoming the issues of social isolation and loneliness. Further, in some instances, some older adults do not see the relevance of the internet to their lives, but in some cases, they have found challenges in using internet-related products and devices that have prompted studies of the functions and features of the internet-related products and services to be considered for research. This has prompted the present research team to consider whether ICTs are being accepted and considered pertinent for mobile banking, which leads to the following reviews of mobile banking, older adults and adoption studies.

### **3. Mobile Banking**

Before reviewing the literature on adoption, mobile banking, smartphones and older adults, a theoretical understanding of mobile banking will be provided to put the topic into context.

Mobile banking (m-banking) is among the latest in a series of recent mobile technological wonders to impact daily life activities and the financial sector. The evolution of ICT began with automated teller machine (ATM), telephone and internet banking, offering effective delivery channels for traditional banking products, with the latest financial delivery channel in many developed and developing countries offering m-banking that is likely to have significant effects on the market (Safeena, Date, Kammani, & Hundewale, 2012). In particular, the expanded uses of smartphones has increased demand for m-banking services, prompting many more banks, microfinance institutions, software houses and service providers to offer this innovative service together with new sets of products and applications designed to extend their client reach (including to unbanked populations), improve customer retention, enhance operational efficiency, increase market share and provide new employment opportunities (Shaikh, 2013).

Mobile banking is one of the major technological innovations for financial institutions and daily life activities that offer immense benefits (Lin, 2011). It provides customer value creation due to being inherently time- and place-independent (Lin, 2013) – “anywhere and anytime” – free from temporal and spatial constraints (Laukkanen, 2007). Moving clients to electronic channels is an important issue for banks because it allows them to reduce operational costs (Calisir & Gumussoy, 2008), providing a more convenient means for customers to meet their banking needs with more complete and more timely information (Gerrard & Cunningham, 2003).

### **3.1 Adoption, Use and Diffusion Studies of Mobile Banking and Smartphones**

The previous sections on older adults and ICT research studies have revealed a scarcity of research on older adults and mobile banking. Further scrutiny reveals that, for this reason, the theories of adoption, use and diffusion are still being used to consider this issue. When

considering the theories used in information systems (IS) to study the adoption, use and diffusion of mobile banking, it was discovered that the classic theories that have been used include Diffusion of Innovation (DoI) theory (Rogers, 2010), Unified Theory for the Acceptance and Use of Technology (UTAUT) (Venkatesh, Morris, Davis, & Davis, 2003), Technology Acceptance Model (TAM) (Davis, Vagozzi, & Warshaw, 1989) and Theory of Reasoned Action (TRA) (Ajzen & Fishbein, 1980). In addition to these theories, also utilised was the factor of perceived risk, which is defined as a combination of uncertainty plus seriousness of outcome involved (Bauer, 1960) and has several dimensions in the context of e-services including performance, financial, time, psychological, social, privacy and overall risk (Featherman & Pavlou, 2003). Also applied to mobile banking was the factor of self-efficacy drawn from social cognitive theory and defined as a person's perception of how easy or difficult it would be to carry out a behaviour (Bandura, 1986). In mobile banking, self-efficacy has been applied to refer to users' judgment of their capability to adopt mobile banking. Jerusalem and Schwarzer (1992) found that self-efficacy is the belief that one can perform a novel or difficult task or cope with adversity in various domains of human functioning. Finally, trust, an important factor of consideration, was also found to be pertinent for research on mobile banking (Zhou, 2008).

In studies of adoption, use and diffusion of mobile banking specifically with smartphones, TAM has been found to be the most popular theory, followed by UTAUT and TRA (Aldhaban, 2012). However, a number of studies have shown 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 a logistics industry (Chen, Yen, & Chen, 2009). This combination was also applied to research the adoption of smartphones among medical practitioners, doctors and nurses (Park, Yang, & Lehto, 2007; Park & Chen, 2007). A different combination in the form of UTAUT and the activity

enjoyment that reflects feelings of fun, excitement, and interest at a particular time in a particular space, and influenced by the perceived challenge of the activity and the perceived skill of the participant, as well as intrapersonal factors such as age, sex, and race/ethnicity led to identifying the importance of the activity enjoyment in mobile services (Song & Han, 2009). To ensure that this research study will make a contribution to theory, we have proposed combining more than two classic adoption-and-use theories to study older adults, mobile banking and smartphones. By doing so, we will also provide a better understanding of the adoption, use and diffusion of mobile banking using smartphones in the silver-surfer population of UK. The following section discusses how the theories to be applied to this research were determined and formulated.

## **4. Conceptual Framework**

### **4.1 Development of the Research Model**

For the earlier formed literature review, we initially used the online library services of Google scholar and Scopus. To identify the required literature, there were some terms used: 'older adults', 'mobile banking', 'mobile phones' and 'smartphones' and a time period ranging from the last decade or so was used. This resulted in qualitative data, which is defined as: "Empirical research where the data are not in the form of numbers. (Punch, 1998: 4) and in the case of this study, text based data was obtained.

Next, as mobile banking is still emerging in various countries, when forming the conceptual understanding for this study that involved combining the theories, a pre-adoption perspective was applied. To ensure that this research study would make a substantial contribution, we drew on determinants drawn from the UTAUT that was built on the following eight theories: the theory of reasoned action (TRA), TAM, the motivational model, TPB, the PC utilization model, the innovation diffusion theory (DoI), social cognitive theory (SCT) and the



integrated model of technology acceptance and planned behaviour. As a reminder, the four determinants of UTAUT are performance expectancy, effort expectancy, social influences and facilitating conditions (Venkatesh et al., 2003). Along with UTAUT, the Diffusion of Innovations theory factor of compatibility, service quality, trust and risk were incorporated in the model and individual differences were moderated by age.

#### **4.2 Proposed Research Model**

To explain how the classic theories are combined for this study and their influence, a conceptual framework was formed. Previous research suggests conceptual frameworks “explain graphically or in narrative form, the main things to be studied – the key factors, variables, or constructs – and the presumed interrelationships among them. Frameworks can be simple, elaborate, common sense based, theory driven, descriptive or causal” (Miles and Huberman, 1994: p. 20). Maxwell (2013) discusses conceptual frameworks as being a tentative theory of the phenomena under investigation, which functions to inform the rest of the design in terms of refining goals, developing research questions, selecting methods and helping researchers to justify their research. Ravitch and Riggan (2012) present them as an argument about why a topic is important and how it should be researched. They argue that a conceptual framework is a set of sequenced and logical propositions used to convince readers of the rigour and importance of a study. Robson and McCartan (2016) argue that, when conceptual frameworks force researchers to be explicit in what they are doing, it helps them to be selective, and to decide what are the most important features and relationships and what kind of data to collect.

Based on Robson and McCartan (2016) we found that the main features of the research model for this study are trust and compatibility, an attribute drawn from the diffusion of innovations theory, with service qualities being used to extend the UTAUT with age as the

moderating factor. This is due to the fact that this research study emphasises the older adult. In the following explanations, the reasoning and applications of the theories are provided.

In mobile banking, UTAUT has been applied for analysing the adoption of mobile banking, sometimes combined with technology task fit theory (Zhou, 2008), other times by itself, but with the moderators of age, gender, education and voluntariness of use (Park & Chen, 2007). For the present research, the determinants of social influences and facilitating conditions have been considered. Social influence, one of the factors drawn from UTAUT, can be defined as the degree to which an individual perceives that other individuals important to the person, such as family, friends or other close peers, believe that the person should use a new system, such as a smartphone (Venkatesh, Thong, & Xu, 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 close friends (Choudrie & Vyas, 2014). Previous research studies associated with smartphones also show that social influence is important for technology adoption (Song & Han, 2009; Zhou, 2011, 2012a; Zhou et al., 2010). Facilitating conditions drawn from UTAUT can be defined as the degree to which an individual believes that an organisational and technical infrastructure exists to support the use of a smartphone (Venkatesh et al., 2012). This factor can be explained by older adults' having the necessary resources such as knowledge, time and money to adopt smartphones and mobile banking (Venkatesh et al., 2012; T. Zhou, 2008). However, as with any novel technology, a user who wants to adopt a smartphone and mobile banking will need to have some understanding when using the new device. Additionally, the costs of using a smartphone, a handset and the monthly fee are also included among this factor. If the fee for using the smartphone is affordable and viewed as mostly beneficial to the silver surfers, which in this instance is mostly for secure online shopping and online banking, then a positive attitude may occur and the users can use the technology. From previous research on

mobile acceptance, the construct facilitating conditions is viewed as one of the main factors leading to acceptance and thus adoption (Zhou, 2008; Zhou et al., 2010). Effort expectancy, also taken from UTAUT, is defined as the degree of ease associated with the use of a system (Venkatesh et al., 2012). Effort expectancy reflects the perceived effort construct when users adopt a new system, in this case a smartphone for mobile banking. This factor is comparable to the perceived ease-of-use construct of TAM and the complexity construct from DoI (Venkatesh et al., 2003). It explains a user's perception of the difficulty associated with using a smartphone. If using a smartphone is considered to be a difficult task, then fewer older adults will adopt and use a smartphone. Also drawn from UTAUT, Performance Expectancy 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. The theory also suggests that performance is one of the factors that affect users' behavioural intentions (Baker and Crompton, 2000). UTAUT identifies a user's perception of the benefits of a smartphone, such as mobility, internet connection, and application that can assist older adults in many ways. If older users recognise the potential benefits that a smartphone provides, then they are likely to adopt and use a smartphone.

As diffusion is also considered by this research, compatibility is the attribute drawn from DoI that this research also intends to apply. Compatibility is defined as the degree that a smartphone providing mobile banking is compatible with silver surfers' lifestyles (Rogers, 2010). Smartphones can benefit users in many ways, such as business and personal communication, information on the health issues identified earlier and mobile banking. Therefore, smartphones may be compatible with silver surfers' lifestyles and mobile banking, which led to its inclusion.

Alongside UTAUT's determinants, this research drew upon service quality, which is based on marketing terms. Service quality is seen as a measure of how well the quality level

delivered by a product or service matches customer expectations (Lewis, 1991). In essence, delivering a quality service means conforming to customer expectations on a constant basis. Also, service quality tends to reflect reliability, responsiveness, assurance and personalisation (Parasuraman, Zeithaml, & Berry, 1985). Pitt, Watson and Kavan (1995) suggested that information researchers should include a measure of service quality in the assessment of information system effectiveness. Grönroos (1982), on the other hand, proposed two types of service quality, namely technical and functional quality, which will be included as constructs in our conceptual framework. For this research, we suggest that older adults will adopt mobile banking if service quality exists.

Trust is another very important factor in online communication and usage and is something that is experienced on a daily basis. However, what has also been learnt is that trust is a concept that is quite challenging to define. Grandison and Sloman (2000) defined trust as a strong belief in the capability of a thing to act consistently, securely and dependably among a definite context. Jøssang, Keser and Dimitrakos (2005) stated in their study that lack of trust is like sand in the social machinery, and represents a real obstacle for the uptake of online services. Trust represents a catalyst for exchange relationships between buyers and sellers (Pavlou, 2003; Wang, Ngamsiriudom, & Hsieh, 2015). Trust reflects a willingness to be in a state of vulnerability based on the positive expectation toward another party's future behaviour (Mayer, Davis, & Schoorman, 1995). Trust often includes three beliefs: ability, integrity and benevolence (Zahedi & Song, 2008). Ability is defined as service providers having the knowledge and ability necessary to fulfil their tasks. Integrity means that service providers keep their promises and do not deceive users. Benevolence means that service providers are concerned with users' interests, not just their own benefits. In research, in the development phase, trust can be divided into initial trust and continuance trust. When users gain more direct experience, initial trust develops into continuance trust. Due to its significant

role, initial trust has received considerable attention in the online commerce context. Various factors are identified to affect initial trust. The first category of factors is related to the website. As the interface between consumers and online vendors, website quality is a significant factor affecting initial trust (Lowry, Vance, Moody, Beckman, & Read, 2008). Information quality is also found to affect initial trust in inter-organisational data exchange (Nicolaou & McKnight, 2006). Due to the high degree of uncertainty and perceived risk in e-commerce operations, trust becomes an important factor for a person to obtain confidence in an exchange partner (Li & Yeh, 2010; Palvia, 2009). In mobile banking environments that are provided by mobile terminals, viruses and trojan horses may exist. Such problems can lead to long-term financial and technological difficulties, which in turn increase users' concern about payment security and decrease their trust in mobile banking. This can affect their usage intention and behaviour (Zhou, 2012a), thus suggesting that, if customers do not trust the mobile banking terminals, there is no adoption and no use of this technology (T. Zhou, 2012b).

An added important factor of mobile banking is risk perception, which has been viewed as a major barrier of mobile banking in countries such as China (Laforet & Li, 2005) and a significant factor affecting users' attitudes and intentions when using mobile banking in Iran (Mohammadi, 2015). Risk perception involves the concern about: (i) use of personal information without the knowledge or permission of the owner (Akturan & Tezcan, 2012); (ii) transference of money for third parties without knowledge and permission (Akturan & Tezcan, 2012; Hanafizadeh, Behboudi, Koshksaray, & Tabar, 2014); and (iii) vulnerability of mobile devices to hackers, Trojan horses and information interception (Zhou, 2012a; Zhou et al., 2010). This construct also has a significant relationship with internet banking adoption (Yiu, Grant, & Edgar, 2007), and with customers' lack of interest in online commercial transactions (Liao, Liu, & Chen, 2011). The perception of risk is a significant factor affecting

trust (Al-Gahtani, 2011) and affecting mobile banking adoption (Mishra et al., 2016). A further set of studies considered when constructing the conceptual framework is presented in the appendix.

Based on the discussion presented above, our conceptual research framework has been developed as depicted in Figure 1. Having explained the foundations of this conceptual framework, the next section offers the conclusions, limitations, and implications of this research.

**[Place Figure 1 here]**

**Figure 1: Conceptualising Adoption in terms of Trust, Diffusion, Quality and Age**

## **5. Conclusion**

This paper has presented evidence of an ICT digital divide of older generations using technology (Choudrie & Vyas, 2014), particularly for mobile banking (Chawla & Joshi, 2017). Talke and Heidenreich (2014) argue that innovation resistance by consumers must be recognised to facilitate new product adoption. There also exists some resistance to innovation, as well as scepticism of new technologies by some groups of consumers (Jahanmir & Lages, 2015, 2016), which may cause new innovations to fail (Heidenreich & Spieth, 2013). It is here that this paper contributes. The aim of this paper has been to understand and explain the factors that influence the adoption, use and diffusion of mobile banking among older adults. Using age as a moderator to this research, the UTAUT theory along with factors drawn from DoI, service quality, trust and risk were combined to provide a conceptual framework that will be a contribution to research as it provides reasoning for combining the factors and illustrates how the association occurs. The paper also provided a review of studies on mobile banking, on mobile banking and older adults and on older adults and smartphones. It was found that there are few studies of older adults' relationships with

mobile banking and smartphones. Therefore, such a research study will provide a contribution to research and practice.

### **5.1. Implications for Research**

Mobile banking is still taking off in many countries, which suggests that the pre-adoption theories of adoption were suitable for this research study. When considering pre-adoption, adoption theories such as TAM are cited more often than not. What is also known is that research on older adults adopting, using and diffusing mobile banking with smartphones is minimal. Therefore, by undertaking a literature review of this topic, this research paper has offered an in-depth overview of the adoption, use and diffusion studies of mobile banking, older adults and smartphones that can assist researchers to identify potential gaps in the research area. What was learnt is that studies of older adults and mobile banking are minimal; therefore, studies of this topic such as this one would offer a substantial contribution to the academic literature. From the adoption, use and diffusion studies of mobile banking it was found that the theories of TAM and UTAUT as well as DoI were prevalent when considering research studies on adoption of mobile banking. However, alongside these theories, studies have included the factors of trust and risk. What is also interesting to note is that most studies have been quantitative in nature; therefore, a study involving qualitative research would be of immense benefit. An interesting revelation from the review of mobile banking was that earlier studies of mobile banking were from the South East Asian or tiger economies and some from Africa, countries that in essence were the early adopters of the internet or mobile devices and where internet penetration and mobile devices had proliferated in daily life. Further, by conceptualising the research using some of the factors that earlier studies had used but using service quality and age as a moderator, a novel contribution to research has been offered.

## **5.2. Implications for Industry**

Mobile banking is becoming prevalent in individuals' daily lives in both developed and developing countries. In developing countries, recent legislation in countries such as India, Nigeria, Myanmar, North Korea and Australia seeking demonetisation (Borkar & Pande, 2016) has led some of them to consider solutions emerging from mobile banking. This paper has attempted to shed some light and provide knowledge and information on whether a marginal group in society will adopt, use and diffuse mobile banking offered on smartphones. Smartphones have penetrated society and organisations alike, which has led to its being viewed as a suitable mobile device to consider for this research. What we have also shown is how an innovative device and product or service such as mobile banking has to be compatible with individuals' lifestyles and should offer a support service by way of its novelty. When it provides the support, the complexities and difficulties that a customer perceives are reduced or eliminated, thereby promoting trust while avoiding or preventing risk. These are factors of importance in all countries around the globe, which explains the reasons for including them in the conceptual framework. Ageing populations are increasing globally, and mobile banking is being implemented in all countries due to the improved and advanced infrastructure and motivation for individuals to try novel technologies; thus, such research studies offer impetus for future research directions.

## **5.3. Limitations and Future Directions**

Presently, this research study has offered a conceptual work, which is a limitation as the application of this framework needs to be determined. Research should offer a practical slant to show its application in real life. Therefore, a future direction to overcome this limitation is to identify and apply a suitable research methodology that will provide insight into the factors leading to adoption, use and diffusion of mobile banking provided by smartphones. Ravitch



and Riggan (2012) argue that a conceptual framework is a set of sequenced and logical propositions used to convince readers of the rigour and importance of a study. Researchers can use our framework to guide their development of hypotheses and to conduct empirical research. Additionally, qualitative studies will be able to provide a deep understanding of the reasons for or against mobile banking adoption.

Presently, this study has focused on trust, but older adults are also very cautious, which leads to a suggestion of extending this framework to include other issues such as prevention of fraud and risk, as well as other factors affecting adoption and use. Further, if other factors such as gender and education are included in the framework and applied in practice, a greater diversity of results will emerge.

## References

- Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting social behaviour*. Englewood Cliffs, NJ: Prentice-Hall.
- Akturan, U., & Tezcan, N. (2012). Mobile banking adoption of the youth market: Perceptions and intentions. *Marketing Intelligence & Planning*, 30(4), 444-459.
- Al-Gahtani, S. S. (2011). Modeling the electronic transactions acceptance using an extended technology acceptance model. *Applied Computing and Informatics*, 9(1), 47-77.
- Aldhaban, F. (2012). *Exploring the adoption of Smartphone technology: Literature review*. Paper presented at the Technology Management for Emerging Technologies (PICMET), 2012 Proceedings of PICMET'12.
- Baker, D. A. and Crompton, J. L. (2000). Quality, satisfaction and behavioral intentions. *Annals of Tourism Research*, 27(3): 785-804.
- Bandura, A. (1986). *Social foundation of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice Hall.
- Barrett, M., Davidson, E., Prabhu, J., & Vargo, S. L. (2015). Service innovation in the digital age: Key contributions and future directions. *MIS Quarterly*, 39(1), 135-154.
- Bauer, R. A. (1960). *Consumer behavior as risk taking*. Paper presented at the Proceedings of the 43rd National Conference of the American Marketing Association, June 15, 16, 17, Chicago, Illinois, 1960.
- Borkar, S., & Pande, H. (2016). *Application of 5G next generation network to Internet of Things*. Paper presented at the Internet of Things and Applications (IOTA), International Conference.
- Buse, C. E. (2010). E-scaping the ageing body? Computer technologies and embodiment in later life. *Ageing & Society*, 30(6), 987-1009.
- Calisir, F., & Gumussoy, C. A. (2008). Internet banking versus other banking channels: Young consumers' view. *International Journal of Information Management*, 28(3), 215-221.

- Carpenter, B. D., & Buday, S. (2007). Computer use among older adults in a naturally occurring retirement community. *Computers in Human Behavior*, 23(6), 3012-3024.
- Chawla, D., & Joshi, H. (2017). Consumer perspectives about mobile banking adoption in India—A cluster analysis. *International Journal of Bank Marketing*, 35(4), 616-636.
- Chen, J. V., Yen, D. C., & Chen, K. (2009). The acceptance and diffusion of the innovative smart phone use: A case study of a delivery service company in logistics. *Information & Management*, 46(4), 241-248.
- Choudrie, J., & Vyas, A. (2014). Silver surfers adopting and using Facebook? A quantitative study of Hertfordshire, UK applied to organizational and social change. *Technological Forecasting and Social Change*, 89, 293-305.
- Cruz, P., Barretto Filgueiras Neto, L., Munoz-Gallego, P., & Laukkanen, T. (2010). Mobile banking rollout in emerging markets: Evidence from Brazil. *International Journal of Bank Marketing*, 28(5), 342-371.
- Curwen, P., & Whalley, J. (2016). *Mobile telecommunications in a high-speed world: Industry structure, strategic behaviour and socio-economic impact*. CRC Press.
- Dasgupta, S., Paul, R., & Fuloria, S. (2011). Factors affecting behavioral intentions towards mobile banking usage: Empirical evidence from India. *Romanian Journal of Marketing* (1), 6-28.
- Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science*, 35(8), 982-1003.
- Dennis, C., Alamanos, E., Papagiannidis, S., & Bourlakis, M. (2016). Does social exclusion influence multiple channel use? The interconnections with community, happiness, and well-being. *Journal of Business Research*, 69(3), 1061-1070.
- Edwards, K., Duffy, R., & Kelly, B. (2015). The silver surfer: Trends of internet usage in the over 65 and the potential health benefits. *Irish Medical Journal*.108, (6): 171-4.
- Featherman, M. S., & Pavlou, P. A. (2003). Predicting e-services adoption: A perceived risk facets perspective. *International Journal of Human-Computer Studies*, 59(4), 451-474.
- Fox, S. (2013). 51% of U.S. adults bank online 32% of adults transact bank business on their mobile phones. Retrieved from [http://www.pewinternet.org/files/old-media/Files/Reports/2013/PIP\\_OnlineBanking.pdf](http://www.pewinternet.org/files/old-media/Files/Reports/2013/PIP_OnlineBanking.pdf). Viewed January 16, 2016.
- Frissen, V. (2005). The myth of the digital divide. In A. Zerdick, A. Picot, K. Schrape, J. Burgelman, R. Silverstone, V. Feldmann, C. Wernick, & C. Wolff (Eds.), *E-merging media: Communication and the media economy of the future* (pp. 271-284). Berlin: Springer.
- Gatto, S. L., & Tak, S. H. (2008). Computer, Internet, and e-mail use among older adults: Benefits and barriers. *Educational Gerontology*, 34(9), 800-811.
- Geron, T. (2013). Airbnb and the unstoppable rise of the share economy. Retrieved from <http://www.forbes.com/sites/tomiogeron/2013/01/23/airbnb-and-theunstoppable-rise-of-the-share-economy>
- Gerrard, P., & Cunningham, J. B. (2003). The diffusion of internet banking among Singapore consumers. *International Journal of Bank Marketing*, 21(1), 16-28.
- Grandison, T., & Sloman, M. (2000). A survey of trust in internet applications. *IEEE Communications Surveys & Tutorials*, 3(4), 2-16.
- Greengard, S. (2009). Facing an age-old problem. *Communications of the ACM*, 52(9), 20-22.
- Grönroos, C. (1982). An applied service marketing theory. *European Journal of Marketing*, 16(7), 30-41.
- Hanafizadeh, P., Behboudi, M., Koshksaray, A. A., & Tabar, M. J. S. (2014). Mobile-banking adoption by Iranian bank clients. *Telematics and Informatics*, 31(1), 62-78.

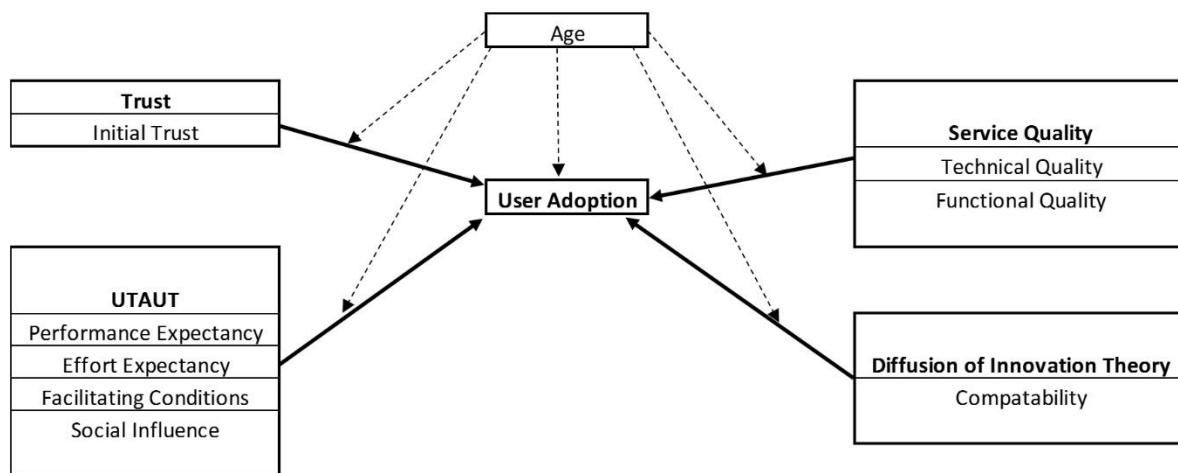
- Heidenreich, S., & Spieth, P. (2013). Why innovations fail—The case of passive and active innovation resistance. *International Journal of Innovation Management*, 17(5), 1350021.
- Heo, C. Y. (2016). Sharing economy and prospects in tourism research. *Annals of Tourism Research*, 58(C), 166-170.
- Hwang, J. (2006). *Deconstructing the discourse of the global digital divide in the age of neo-liberal global economy*. (Doctoral Dissertation). The Pennsylvania State University, Pennsylvania. Retrieved from [https://etda.libraries.psu.edu/files/final\\_submissions/3156](https://etda.libraries.psu.edu/files/final_submissions/3156) . Viewed January 15, 2016.
- Jahanmir, S. F., & Lages, L. F. (2015). The lag-user method: Using laggards as a source of innovative ideas. *Journal of Engineering and Technology Management*, 37, 65-77.
- Jahanmir, S. F., & Lages, L. F. (2016). The late-adopter scale: A measure of late adopters of technological innovations. *Journal of Business Research*, 69(5), 1701-1706.
- Jerusalem, M., & Schwarzer, R. (1992). Self-efficacy as a resource factor in stress appraisal processes. In R. Schwarzer (Ed.), *Self-efficacy: Thought control of action*. London and New York: Routledge.
- Jøsang, A., Keser, C., & Dimitrakos, T. (2005). Can we manage trust? *Trust Management*, 13-29.
- Joshua, A. J., & Koshy, M. P. (2011). Usage patterns of electronic banking services by urban educated customers: Glimpses from India. *The Journal of Internet Banking and Commerce*, 16(1), 1-12.
- Kuoppamäki, S.-M., Taipale, S., & Wilska, T.-A. (2017). The use of mobile technology for online shopping and entertainment among older adults in Finland. *Telematics and Informatics*, 34(4), 110-117.
- Laforet, S., & Li, X. (2005). Consumers' attitudes towards online and mobile banking in China. *International Journal of Bank Marketing*, 23(5), 362-380.
- Laukkanen, T. (2007). Internet vs mobile banking: Comparing customer value perceptions. *Business Process Management Journal*, 13(6): 788-797.
- Laukkanen, T., & Pasanen, M. (2008). Mobile banking innovators and early adopters: How they differ from other online users? *Journal of Financial Services Marketing*, 13(2), 86-94.
- Laukkanen, T., Sinkkonen, S., Kivijärvi, M., & Laukkanen, P. (2007). Innovation resistance among mature consumers. *Journal of Consumer Marketing*, 24(7): 419-427.
- Lee, B., Chen, Y., & Hewitt, L. (2011). Age differences in constraints encountered by seniors in their use of computers and the internet. *Computers in Human Behavior*, 27(3), 1231-1237.
- Lee, C., Mehler, B., Reimer, B., & Coughlin, J. F. (2015). User perceptions toward in-vehicle technologies: Relationships to age, health, preconceptions, and hands-on experience. *International Journal of Human-Computer Interaction*, 31(10), 667-681.
- Lewis, B. R. (1991). Service quality: An international comparison of bank customers' expectations and perceptions. *Journal of Marketing Management*, 7(1), 47-62.
- Li, Y.-M., & Yeh, Y.-S. (2010). Increasing trust in mobile commerce through design aesthetics. *Computers in Human Behavior*, 26(4), 673-684.
- Lian, J.-W., & Yen, D. C. (2014). Online shopping drivers and barriers for older adults: Age and gender differences. *Computers in Human Behavior*, 37, 133-143.
- Liao, C., Liu, C.-C., & Chen, K. (2011). Examining the impact of privacy, trust and risk perceptions beyond monetary transactions: An integrated model. *Electronic Commerce Research and Applications*, 10(6), 702-715.

- Lin, H.-F. (2011). An empirical investigation of mobile banking adoption: The effect of innovation attributes and knowledge-based trust. *International Journal of Information Management*, 31(3), 252-260.
- Lin, H.-F. (2013). Determining the relative importance of mobile banking quality factors. *Computer Standards & Interfaces*, 35(2), 195-204.
- Lowry, P. B., Vance, A., Moody, G., Beckman, B., & Read, A. (2008). Explaining and predicting the impact of branding alliances and web site quality on initial consumer trust of e-commerce web sites. *Journal of Management Information Systems*, 24(4), 199-224.
- Mann, W. C., Belchior, P., Tomita, M. R., & Kemp, B. J. (2005). Computer use by middle-aged and older adults with disabilities. *Technology and Disability*, 17(1), 1-9.
- Mason, A., & Kinugasa, T. (2005). *Why nations become wealthy: The effects of adult longevity on saving*. Retrieved from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2128687/>. Viewed January 15, 2016.
- Mathiassen, L., & Sørensen, C. (2008). Towards a theory of organizational information services. *Journal of Information Technology*, 23(4), 313-329.
- Mattila, M., Karjaluoto, H., & Pentto, T. (2003). Internet banking adoption among mature customers: Early majority or laggards? *Journal of Services Marketing*, 17(5), 514-528.
- Maxwell, J. A. (2013). *Qualitative research design: An interactive approach* (3rd ed.). London: Sage.
- Mayer, R. C., Davis, J. H., & Schoorman, F. D. (1995). An integrative model of organizational trust. *Academy of Management Review*, 20(3), 709-734.
- McKenna, B., Tuunanen, T., & Gardner, L. (2013). Consumers' adoption of information services. *Information & Management*, 50, 248-257.
- Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook* (2nd ed.). Newbury Park, CA: Sage.
- Mishra, D., Gunasekaran, A., Childe, S. J., Papadopoulos, T., Dubey, R., & Wamba, S. (2016). Vision, applications and future challenges of Internet of Things: A bibliometric study of the recent literature. *Industrial Management & Data Systems*, 116(7), 1331-1355.
- Mohammadi, H. (2015). A study of mobile banking loyalty in Iran. *Computers in Human Behavior*, 44, 35-47.
- Möhlmann, M. (2015). Collaborative consumption: Determinants of satisfaction and the likelihood of using a sharing economy option again. *Journal of Consumer Behaviour*, 14(3), 193-207.
- Morris, A., Goodman, J., & Brading, H. (2007). Internet use and non-use: Views of older users. *Universal Access in the Information Society*, 6(1), 43-57.
- Newell, A. F., Dickinson, A., Smith, M. J., & Gregor, P. (2006). Designing a portal for older users: A case study of an industrial/academic collaboration. *ACM Transactions on Computer-Human Interaction*, 13, 347-375.
- Nicolaou, A. I., & McKnight, D. H. (2006). Perceived information quality in data exchanges: Effects on risk, trust, and intention to use. *Information Systems Research*, 17(4), 332-351.
- Niehaves, B., & Plattfaut, R. (2014). Internet adoption by the elderly: Employing IS technology acceptance theories for understanding the age-related digital divide. *European Journal of Information Systems*, 23(6), 708-726.
- Palvia, P. (2009). The role of trust in e-commerce relational exchange: A unified model. *Information & Management*, 46(4), 213-220.

- Parasuraman, A., Zeithaml, V. A., & Berry, L. L. (1985). A conceptual model of service quality and its implications for future research. *The Journal of Marketing*, 41-50.
- Park, J., Yang, S., & Lehto, X. (2007). Adoption of mobile technologies for Chinese consumers. *Journal of Electronic Commerce Research*, 8(3), 196-206.
- Park, Y., & Chen, J. V. (2007). Acceptance and adoption of the innovative use of smartphone. *Industrial Management & Data Systems*, 107(9), 1349-1365.
- Passyn, K. A., Diriker, M., & Settle, R. B. (2011). Images of online versus store shopping: Have the attitudes of men and woman, young and old really changed? *Journal of Business & Economics Research*, 9(1), 99-110.
- Pavlou, P. A. (2003). Consumer acceptance of electronic commerce: Integrating trust and risk with the technology acceptance model. *International Journal of Electronic Commerce*, 7(3), 101-134.
- Peacock, S. E., & Künemund, H. (2007). Senior citizens and Internet technology. *European Journal of Ageing*, 4(4), 191-200.
- Pitt, L., Watson, R., and Kavan, C. B. (1995). Service Quality: A Measure of Information Systems Effectiveness, *MIS Quarterly*, (19: 2), 173-87.
- Porter, C. E., & Donthu, N. (2006). Using the technology acceptance model to explain how attitudes determine Internet usage: The role of perceived access barriers and demographics. *Journal of Business Research*, 59(9), 999-1007.
- Pride, J. (2013). SEEFA Policy Panel on Later Life and Ageing: Summary of the key issues on valuing the older population. Retrieved from <http://ageactionalliance.org/wordpress/wp-content/uploads/2014/05/SEEFA-key-issues-on-Valuing-the-Older-Population.pdf>
- Punch, K (1998). *Introduction to Social Research: Quantitative and Qualitative Approaches*, London, Sage.
- Püschel, J., Afonso Mazzon, J., & Mauro C. Hernandez, J. (2010). Mobile banking: Proposition of an integrated adoption intention framework. *International Journal of Bank Marketing*, 28(5), 389-409.
- R.J. Holt, & Morrell, R. W. (2002). Guidelines for web site design for older adults: The ultimate influence of cognitive factors. In R. W. Morrell (Ed.), *Older adults, health information, and the world wide web* (pp. 109-132). New Jersey: Lawrence Erlbaum Associates.
- Ravitch, S. M., & Riggan, M. (2012). *Reason & rigor: How conceptual frameworks guide research*. London: Sage Publications.
- Robson, C., & McCartan, K. (2016). *Real world research*. Chichester, UK: John Wiley & Sons.
- Rogers, E. M. (2010). *Diffusion of innovations*. New York: Simon and Schuster.
- Safeena, R., Date, H., Kammani, A., & Hundewale, N. (2012). Technology adoption and Indian consumers: Study on mobile banking. *International Journal of Computer Theory and Engineering*, 4(6), 1020.
- Schieber, F. (2003). Human factors and aging: Identifying and compensating for age-related deficits in sensory and cognitive function. In K. W. Schaie & N. Charness (Eds.), *Impact of technology on successful aging* (pp. 85-89). New York: Springer.
- Selwyn, N. (2004). The information aged: A qualitative study of older adults' use of information and communications technology. *Journal of Aging Studies*, 18(4), 369-384.
- Selwyn, N., Gorard, S., Furlong, J., & Madden, L. (2003). Older adults' use of information and communications technology in everyday life. *Ageing & Society*, 23(5), 561-582.
- Shaikh, A. (2013). Mobile banking adoption issues in Pakistan and challenges ahead. *Journal of the Institute of Bankers Pakistan*, 80(3), 12-15.

- Shapira, Z. (2011). "I've got a theory paper—do you?": Conceptual, empirical, and theoretical contributions to knowledge in the organizational sciences. *Organization Science*, 22(5), 1312-1321.
- Song, Y., & Han, J. (2009). *Is enjoyment important? An empirical research on the impact of perceive enjoyment on adoption of new technology*. Paper presented at the Information management, innovation management and Industrial Engineering International Conference.
- Sum, S., Mathews, R. M., Hughes, I., & Campbell, A. (2008). Internet use and loneliness in older adults. *CyberPsychology & Behavior*, 11(2), 208-211.
- Suoranta, M., & Mattila, M. (2004). Mobile banking and consumer behaviour: New insights into the diffusion pattern. *Journal of Financial Services Marketing*, 8(4), 354-366.
- Taha, J., Sharit, J., & Czaja, S. (2009). Use of and satisfaction with sources of health information among older Internet users and nonusers. *The Gerontologist*, 49(5), 663-673.
- Talke, K., & Heidenreich, S. (2014). How to overcome pro- change bias: Incorporating passive and active innovation resistance in innovation decision models. *Journal of Product Innovation Management*, 31(5), 894-907.
- Talke, K., & Hultink, E. J. (2010). Managing diffusion barriers when launching new products. *Journal of Product Innovation Management*, 27(4), 537-553.
- Thatcher, A., Mahlangu, S., & Zimmerman, C. (2006). Accessibility of ATMs for the functionally illiterate through icon-based interfaces. *Behaviour & Information Technology*, 25(1), 65-81.
- Tsatsou, P. (2011). Digital divides revisited: What is new about divides and their research? *Media, Culture & Society*, 33(2), 317-331.
- Tuunanen, T., Myers, M. D., & Cassab, H. (2010). A conceptual framework for consumer information systems development. *Pacific Asia Journal of the Association for Information Systems*, 2(1), 47-66.
- United Nations. (2008). World population prospects: The 2008 revision. Retrieved from [http://www.un.org/esa/population/publications/wpp2008/wpp2008\\_highlights.pdf](http://www.un.org/esa/population/publications/wpp2008/wpp2008_highlights.pdf)
- Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, 425-478.
- Venkatesh, V., Thong, J. Y., & Xu, X. (2012). Consumer acceptance and use of information technology: Extending the unified theory of acceptance and use of technology. *MIS quarterly*, 36(1), 157-178.
- Vodanovich, S., Sundaram, D., & Myers, M. D. (2010). Research commentary—Digital natives and ubiquitous information systems. *Information Systems Research*, 21(4), 711-723.
- Vuori, S., & Holmlund-Rytkönen, M. (2005). 55+ people as internet users. *Marketing Intelligence & Planning*, 23(1), 58-76.
- Wagner, N., Hassanein, K., & Head, M. (2010). Computer use by older adults: A multi-disciplinary review. *Computers in Human Behavior*, 26, 870-882.
- Wang, S. W., Ngamsiriudom, W., & Hsieh, C.-H. (2015). Trust disposition, trust antecedents, trust, and behavioral intention. *The Service Industries Journal*, 35(10), 555-572.
- Willis, S., & Tranter, B. (2006). Beyond the 'digital divide': Internet diffusion and inequality in Australia. *Journal of Sociology*, 42(1), 43-59.
- Yiu, C. S., Grant, K., & Edgar, D. (2007). Factors affecting the adoption of Internet Banking in Hong Kong—Implications for the banking sector. *International Journal of Information Management*, 27(5), 336-351.
- Zahedi, F. M., & Song, J. (2008). Dynamics of trust revision: Using health infomediaries. *Journal of Management Information Systems*, 24(4), 225-248.

- Zajicek, M., & Hall, S. (2000). Solutions for elderly visually impaired people using the Internet. *People and Computers*, 299-308.
- Zaniboni, S., Truxillo, D. M., & Fraccaroli, F. (2013). Differential effects of task variety and skill variety on burnout and turnover intentions for older and younger workers. *European Journal of Work and Organizational Psychology*, 22(3), 306-317.
- Zhou, T. (2008). *Exploring mobile user acceptance based on UTAUT and contextual offering*. Paper presented at the Electronic Commerce and Security, 2008 International Symposium on.
- Zhou, T. (2011). An empirical examination of initial trust in mobile banking. *Internet Research*, 21(5), 527-540.
- Zhou, T. (2012a). Examining mobile banking user adoption from the perspectives of trust and flow experience. *Information Technology and Management*, 13(1), 27-37.
- Zhou, T. (2012b). Understanding users' initial trust in mobile banking: An elaboration likelihood perspective. *Computers in Human Behavior*, 28(4), 1518-1525.
- Zhou, T., Lu, Y., & Wang, B. (2010). Integrating TTF and UTAUT to explain mobile banking user adoption. *Computers in Human Behavior*, 26(4), 760-767.
- Zhou, W., Yasuda, T., & Yokoi, S. (2007). Supporting senior citizens using the internet in China. *Research and Practice in Technology Enhanced Learning*, 2(1), 75-101.



**Figure 1: Conceptualising Adoption in terms of Trust, Diffusion, Quality and Age**

## Appendix

Publication Title	Year	Author(s)/ Organization(s)	Vol/No/Pages	Article Title	Aims/Methods/Findings
Communications of the ACM	2004	Mallat, N., Rossi, M., & Tuunainen, V.K.	Vol. 47 (5): 42-46	Mobile banking services	A European context investigation of emerging mobile financial applications, including both mobile payments and banking services, was undertaken. The study showed how the new financial services can be deployed in mobile networks and identified the main players in the emerging mobile financing value chain. Examples from the European context were used to highlight the features of the new services, and an exploration of the players' particular strengths and weaknesses in providing the services was pursued.
Journal of Global Information Management	2004	Siu-Cheung, C. & Ming-te, L.	Vol. 12 (3)	Understanding Internet banking adoption and use behavior: A Hong Kong perspective	TAM and social cognitive theory were applied. A quantitative study revealed that perceived usefulness, perceived ease of use, subject norm and self-efficacy are the main factors influencing the adoption and continuous usage of new technology.
Computers in Human Behavior	2005	Luarn P. & Lin, H.H.	Vol. 21: 873-891	Toward an understanding of the behavioral intention to use mobile banking	TAM and TPB were used in a quantitative study to find that perceived self-efficacy, financial cost, creditability, perceived ease-of-use, and perceived usefulness had a significant impact on the intention to adopt.
European Journal of Innovation Management	2007	Ratten, V., & Ratten, H.	Vol. 10 (1): 90-108	Social cognitive theory in technological innovation.	Social cognitive theory and a quantitative approach showed that media exposure, modelling of other, outcome expectancy, self-efficacy and outcome values were proposed to influence the behavioural intention to use mobile banking.
Expert Systems with Applications	2009	Gu, J-C., Lee, S. C., & Suh, Y-H	Vol. 36 (9): 11605-16	Determinants of behavioral intention to mobile banking	TAM and TRA along with a quantitative approach that involved users and providers revealed that perceived self-efficacy, perceived ease-of-use, perceived usefulness and trust are the main factors that influence behavioural intention when adopting mobile banking.
The International Journal of Bank Marketing	2010	Koenig-Lewis, N., Palmer, A., & Moll, A.	Vol. 28 (5): 410-32	Predicting young consumers' take up of mobile banking services.	TAM and DoI were used along with a quantitative approach to show that compatibility, perceived usefulness and risk are influential factors for customers when adopting mobile banking services.



Journal of Electronic Commerce Research	2012	Yu, C. S.	13: 104-21	Factors affecting individuals to adopt mobile banking: Empirical evidence from the UTAUT model	Individual intention to adopt mobile banking was significantly influenced by social influence, perceived financial cost, performance expectancy, and perceived credibility, in their order of influencing strength. The behaviour was considerably affected by individual intention and facilitating conditions. As for moderating effects of gender and age, this study discovered that gender significantly moderated the effects of performance expectancy and perceived financial cost on behavioural intention, and the age considerably moderated the effects of facilitating conditions and perceived self-efficacy on actual adoption behaviour.
Romanian Journal of Marketing	2011	Dasgupta, S., Paul, R., & Fuloria, S.	Number 1	Factors affecting behavioural intentions towards mobile banking usage: Empirical evidence from India	The results showed that, apart from traditional TAM variables like perceived usefulness and perceived ease of use, factors like perceived image, perceived value, self-efficacy, perceived credibility and tradition all significantly affected behavioural intentions towards mobile banking usage.
International Journal of Information Management	2014	Tiago, O., Faria, M., Abraham, M., & Popovic, A.	Vol. 34: pp. 689-703	Extending the understanding of mobile banking adoption: When UTAUT meets TTF & ITM	The rationale for the research was to test an integrative model to elaborate the adoption of mobile banking on the individual level. The study found that facilitating conditions and behavioural intentions directly influence m-banking adoption. Initial trust, performance expectancy, technology characteristics and task technology fit have total effect on behavioural intention.
International Journal of Information Management	2010	Hsiu-fen, L.	Vol. 2 (31): pp. 252-260	An empirical investigation of mobile banking adoption: The effect of innovation attributes & knowledge-based trust	The rationale for this research was to contribute to the theoretical aspect of two identified perspective factors that lead to mobile banking adoption. The results indicate that perceived relative advantage, ease of use, compatibility, competence and integrity significantly influence attitude, which in turn leads to behavioural intention to adopt (or continue to use) mobile banking.

Journal of Decision Support Systems	2010	Xin, L., Han L., Jie, Z., & Shim, J.P.	p. 222-234	Examining multi-dimensional trust and multi-faceted risk in initial acceptance of emerging technologies: An empirical study of mobile banking services	The research aims at identifying the factors affecting rejection and acceptance of an emerging IT artefact (e.g. mobile banking) as well as risks. The findings place performance expectancy as the most significant determining factor for mobile banking acceptance. This study indicates that risk perception, derived from eight different facets, is a salient antecedent to innovative technology acceptance. Beyond prior studies, the results also provide empirical support for employing personal trait factors in analysing acceptance of emerging IT artefacts.
Journal of Expert Systems with Applications	2009	Ja-chul, G., Sang-Chul, L., & Yung-Ho, S.,	pp.11605-11616	Determinants of behavioural intention to mobile banking	The rationale for this study focuses on examining and validating the determinants of users' intentions of mobile banking. The model used was tested and linked different variables; for example, it pointed out that self-efficacy is the strongest antecedent of perceived ease-of-use. In this report a few variables are linked. This study found that self-efficacy was the strongest antecedent of perceived ease-of-use, which directly and indirectly affected behavioural intention through perceived usefulness in mobile banking. Structural assurances are the strongest antecedent of trust, which could increase behavioural intentions of mobile banking. This research verified the effect of perceived usefulness, trust and perceived ease of use on behavioural intention in mobile banking.

Journal of Computers in Human Behaviour	2010	Tao, Zhou., Yaobin., Lu & Bin., Wang	Vol 26: pp. 760-767	Integrating TTF and UTAUT to explain mobile banking user adoption	The Task Technology Fit and Unified Theory of Acceptance and Usage of Technology were combined to examine mobile banking. Three items of technology characteristics were used for mobile banking: ubiquity, immediacy and security. From UTAUT and adoption, the following was obtained: Items of performance expectancy reflect the improved payment efficiency and convenience when using mobile banking. Items of effort expectancy reflect the ease of learning to use or skilfully using mobile banking. Items of social influence show the influence of people important to the user on the adoption behavior. Items of facilitating conditions reflect the resources and knowledge owned by the user. Items of user adoption include the use of account management, money transfer and payments. Findings revealed that both task characteristics and technology characteristics strongly affected the task technology fit, which further determines user adoption. For the UTAUT model, except for effort expectancy, performance expectancy, social influence, and facilitating conditions had significant effects on user adoption. In addition, effort expectancy strongly affected performance expectancy. There were also correlations between TTF constructs and UTAUT ones. Technology characteristics strongly affected effort expectancy and the task technology fit had an obvious effect on performance expectancy.
International Journal of Banking Marketing	2010	Puschel, J., Mazzon, J. A., & Hernandez, J. M.	Vol. 28 (5), 2010: pp. 389-409	Mobile banking: Proposition of an integrated adoption intention framework	The Decomposed Theory of Planned Behaviour along with the Diffusion of Innovations Theory was applied, which led to the inclusion of a conceptual framework based on relative advantage (RA), compatibility (CO), image (IM), results demonstrability (RD), trialability (TR), visibility (VI), perceived ease of use (PEU), self-efficacy (SE), resource facilitating conditions (RFC), technology facilitating conditions (TFC) and subjective norm (SN). The dependent variables of the framework are attitudes (AT), perceived behavioural control (PBC) and intentional (IN)/usage (US) of mobile banking. A quantitative study in Brazil of 666 users was pursued to show the strength of the model.

Journal of Electronic Commerce Research	2012	Al-Jabri, I. M., & Sohail, M. S.	Vol. 13 (4): pp. 379-391	Mobile banking adoption: Application of diffusion of innovation theory	This research study was undertaken for mobile banking in Saudi Arabia. A mixed approach was pursued that resulted initially in a focus group and then a quantitative approach that led to 496 completed replies. Diffusion of Innovations theory was applied to reveal that relative advantage, compatibility and observability have a positive influence on adoption. Trialability and complexity did not affect adoption. Perceived risk was negative.
Hawaii International Conference on System Sciences	2006	Carlsson, C., Carlsson, J., Hyvonen, K., Puhakainen, J., & Walden, P.	Proceedings of the 39th Annual Hawaii International Conference on System Sciences - Vol. 06: p. 132.1	Adoption of mobile devices/services – Searching for answers with the UTAUT	The research explores reasons and answers to the adoption rates of acceptance with mobile devices. It was found using UTAUT that performance expectancy and effort expectancy could be found as explanations for behavioural intention, but that social influence could not be used as such for explanations. It was also found that attitudes towards mobile devices/services influenced behavioural intention but that mobile device/service anxiety did not. The study substantiated that behavioural intention will have a positive influence on usage by analysing the actual use of three different mobile services: MMS, search services and icons and ring tones. Furthermore, facilitating conditions did not have a link to the use of mobile services. Thus the obtained results did not support in all cases the original UTAUT hypotheses.
International Journal of Information & Management	2008	June, L., Chang, L., Chun-Sheng, Y., & Kanliang, W	Vol. 45: pp. 52-64	Determinants of accepting wireless mobile data services in China.	Wireless mobile data services (WMDS) research was conducted using the argument that individuals form their intention to adopt WMDS under the influence of wireless mobile technology, the social environment, personal innovativeness of IT, trust awareness and facilitating conditions. The findings suggest that WMDS adoption intention in China is determined by consumers' perceived usefulness and perceived ease of use.
Proceedings of the 4th International Conference on Engineering, Project, and Production Management (EPPM 2013)	2013	Witeepanich, C., Emklang, N., Matsmak, J., Kanokviriyasanti, P., & Chanvarasuth, P.		Understanding the adoption of mobile banking services: An empirical study	Using UTAUT and a quantitative approach, the results showed that social influence and occupation influence users' adoption of mobile banking the most. Trust also rated high, but not as much as the first two.

Business and Management Research	2013	Jeong, B-K, & Yoon, T.E.	Vol. 2 (1)	An empirical investigation on consumer acceptance of mobile banking services	With TAM, five factors were identified as influencing consumers' behavioural intention to adopt mobile banking: perceived usefulness, perceived ease of use, perceived credibility, perceived self-efficacy, and perceived financial cost. Results indicated that all the factors except for perceived financial cost significantly impacted behavioural intention towards mobile banking usage. Perceived usefulness was the most influential factor to explain the intention to adopt. For users, perceived ease of use is the important factor while perceived self-efficacy significantly influences non-users' adoption intention.
Computers in Human Behaviour	2016	Baptista, G. & Oliveira, T.	Vol. 63: pp. 480-89	A weight and a meta-analysis on mobile banking acceptance research	Factors of consideration for mobile banking are: (i) attitude, (ii) initial trust, (iii) perceived risk and (iv) performance expectancy. In terms of use of mobile banking, considering the same assumptions, the best predictors are: (i) intention and (ii) performance expectancy. Facilitating conditions on attitude, task technology fit on performance expectancy and performance expectancy on initial trust have the potential to be added to the list of the most important predictors, but they still need additional research.
Journal of Business Research	2016	Veríssimo, J. M. C.	Vol. 69 (11): pp. 5456-60	Enablers and restrictors of mobile banking app use: A fuzzy set qualitative comparative analysis (fsQCA)	A qualitative approach study examines how perceived risk, perceived ease of use, perceived usefulness, compatibility, age, and income all affect mobile banking app use and non-use. The analysis of necessary conditions shows that mobile banking app use is associated with low perceived risk, high compatibility, high perceived ease of use and high perceived usefulness. The findings also reveal that a combination of low compatibility, low perceived usefulness, low perceived ease of use, and a high perceived risk is a sufficient condition for mobile banking app non-use.
Journal of Business Research	2016	Falk, T., Kunz, W. H., Schepers, J. J. L., & Mrozek, A. J.	Vol. 69 (7): pp. 2417-23	How mobile payment influences the overall store price image	Although not directly about mobile banking, this paper used an experiment to determine the role of mobile payments. Results showed that mobile payments, as an innovative payment option, lead to more positive judgments. Mobile payments also significantly increased customers' willingness to pay when compared to cash payments.

Computers in Human Behaviour	2016	Malaquiasa, R.F., & Hwang, Y.	Vol. 54: pp. 453-461	An empirical study on trust in mobile banking: A developing country perspective	Risk perception, age, gender, task characteristics, personal innovativeness and social influence were considered in this study of mobile banking. Also included was a novel variable, an undergraduate course to capture a potential difference in perception from people who study in the area of technology.
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**Table A1: A further set of studies considered when constructing the conceptual framework**