Literature review of mobile banking and individual performance

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Abstract

Purpose – Most empirical studies of m-banking seek to understand the factors and motivations that influence the adoption or behaviour intention. This paper focuses on analysing and synthesizing existing studies and makes recommendations to researchers and practitioners.

Design/methodology/approach – Few papers focus on the m-banking use and individual performance, but on the determinants of adoption measures, instead. This research examines 64 journal articles published between 2002 and 2016 in top journals. Following a comprehensive review of the literature, we propose a research agenda.

Findings – The importance of use and individual performance has long been recognized by academics and practitioners in a variety of functional disciplines. The present review indicates that the topics of m-banking adoption and behavioural intention dominate the majority of research, but finds very few studies on post-adoption. The two most significant drivers of intentions to adopt m-banking are perceived ease of use and perceived usefulness. Considering several m-banking definitions, we propose a new, broader definition that takes into account the technological changes that have occurred over time. M-banking is a service or product offered by financial institutions that makes use of portable technologies.

Originality/value – This paper assembles this diverse body of knowledge into a coherent whole. We expect that this review will be of benefit to anyone interested in m-banking research and that it will help to stimulate further interest. In order to advance research in m-banking, future research should consider other theories uncovered in our findings.

Keywords: M-banking, M-banking definition evolution, individual performance, IS Success, TTF, M-banking theory framework

Literature review of mobile banking and individual performance

1. Introduction

Mobile banking (m-banking) is one of the most important strategic changes to occur in retail banking in more than a decade. Changes in technological interfaces have made it possible for the financial industry to delight its customers with instant solutions to their problems through the use of self-service technologies. Today, the financial industry offers a wide range of channel services to its customers, such as branch service for traditional use, self-service devices such as automated teller machines (ATM), telephone banking, internet banking, and m-banking. Internet banking allows customers to conduct financial transactions, such as account transfers, paying bills, stock exchange transactions, and other financial services on a secure website offered by the financial institution (Lee and Chung, 2009; Martins *et al.*, 2014), usually accessed via a laptop device or desktop PC (Shaikh and Karjaluoto, 2015). M-banking users can perform almost the same transactions of internet banking by using a mobile device (mobile phone, smartphone, or tablet) (Shaikh and Karjaluoto, 2015). M-banking and internet banking are commonly perceived as two similar alternative self-service channels for banks to deliver products and services for their customers (Thakur, 2014). Many banks are encouraging theirs customers to adopt self-service technology, which allows additional benefits such as cost savings and cross-selling activity (Hoehle and Huff, 2012; Sharma and Govindaluri, 2014; Sharma *et al.*, 2015; Al-Somali *et al.*, 2009). At the same time, offering different multi-channel services and products enhances the relationship between banks and their customers (Laukkanen, 2007). For these reasons, the e-commerce literature is vast and the research streams continue to grow, as does their impact on the financial industry.

Most studies investigating the youngest channel in the financial industry – m-banking – focus on adoption. Most empirical studies of m-banking seek to understand the factors and motivations that influence the adoption or behaviour intention (e.g. Baptista and Oliveira, 2016). However, there is a paucity of studies on the post-adoption phase, retention, or even continuance of using m-banking. This study focuses on understanding the use of m-banking as a benefit for the user, especially on the individual performance. Although several authors relate "performance" to effectiveness and productivity (e.g. Manzoor, 2012; Adler and Benbunan-Fich, 2012; Mahdi *et al.*, 2014), we associate individual performance in the m-banking context with efficiency and effectiveness in the performance of m-banking tasks as a benefit for the user.

Our contribution with this paper is threefold. Firstly, we identify several m-banking definitions and propose a new one. Considering several "front-office" technologies' evolution over

time, including portable technologies, which make it possible for the banking industry to offer a portfolio of products and services on several platforms. The definition of m-banking has changed along with the evolving technologies, and we propose a new, more inclusive definition. Secondly, we review, analyse, and synthesize the body of literature reporting empirical studies of m-banking over the last decade. Extensive research has been undertaken to understand the determinants of m-banking and the focus of m-banking studies (adoption and behavioural intention). This helps us to characterize the development of this research stream and show where it is today. Based on that, and motivated by the research gap mentioned, we provide further insights on individual performance at the post-adoption phase. Thirdly, and, most importantly, we provide recommendations regarding where the focus of effort of m-banking studies should be in the future and outline future research avenues. Understanding m-banking's future trends may help researchers and service providers to develop strategies to attract potential adopters and retain users.

The structure of the paper is as follows. In the next section we describe how we collected our data. We then examine m-banking definitions and present an overview of empirical studies published in the last 15 years, and set the boundaries of our work. We then present the individual performance and associated main theories. Finally, the conclusions and recommendations for future research are made.

2. Research methodology

To determine the state-of-the-art and future directions in m-banking research we conducted an extensive literature review based on the research methodology proposed by Orlando *et al*. (2013). Firstly, we conducted a systematic literature search based on the descriptors, "mobile banking" and "m-banking" using Google Scholar and Ebsco. The search scope was performed for the 15-year period from 2002 to 2016. Our search terms help to determine the scope of our definition of m-banking since many of the terms include the word "m-commerce", "e-commerce", and "m-payments". Although this search was not exhaustive, it serves as a comprehensive base for an understanding of m-banking research. Secondly, we identified published articles pertaining to m-banking, refining the search by reading the abstract and excluding papers not strictly focused on our research objective. In addition, we selected seminal handbooks and other articles whose objective(s) and results were consistent with the scope of our research. The first extraction indicated 121 papers, but more than half were excluded and the final selection included 64 contributions, including seminal articles and conceptual and/or

empirical research papers. We have adopted the following criteria for including or excluding an article from the review:

- Publication date after 2002 (inclusive) to present.
- The research must be empirically investigating m-banking.
- The research must have reported correlation coefficients, or other values that could be converted to correlation coefficients.
- Studies from any geographical location are considered.
- We selected articles by reading the abstract. Articles that apparently do not focus on our research objective were excluded manually from the list.
- Goals and results of the studies must be within the scope of our research.
- Only articles published in scholarly journals were considered.
- Non-English language studies were excluded.

At the end of this selection stage, the number of studies was 64. Figure 1 summarizes the works by year of publication.

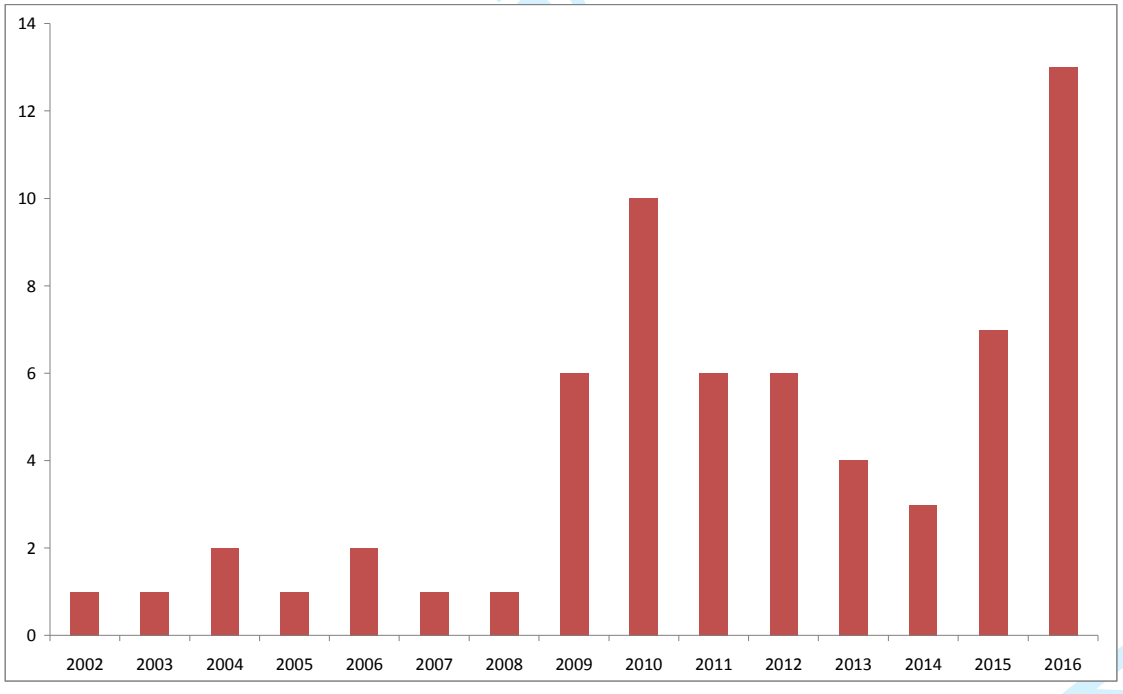

Figure 1. M-banking articles included in the review (January 2002–July 2016).

3. Mobile banking

Customers interact with their banks today through multiple channels. Branches, automated teller machines (ATM), telephone banking, internet banking, and m-banking are all efficient ways of selling products and services to banking customers (Hoehle and Huff, 2012). The evolution from a focus on local-centric (branches and ATM) to place-centric (internet banking) and then to equipment-centric (accessible anywhere, 24 hours per day and 7 days a week) has yielded benefits in the form of time savings and shorter customer queues. Equipment-centric vision brings the customer closer to the bank since (s)he needs only a mobile device to carry out a financial-service activity. In local-centric banking customers need to go to a physical place (a branch or an ATM), which may not be close to them. In place-centric banking, customers can conveniently carry out the vast majority of banking transactions remotely, provided that they have a computer with internet access. Consumers favour specific banking channels for specific product categories. Hoehle and Huff (2012) noted that branches are used for complex products categories (for example, mortgages and loans) while more simple operations such as bill payments or other domestic transactions can be done through self-service technology. Many banks charge a fee for domestic transactions made at branches to encourage customers to adopt self-service technology.

The composite services and products offered on the mobile platform range from simple accounting balance inquiries to payment of services, funds transfers, and more complex products, such as stock exchange transactions (Suoranta and Mattila, 2004). Complex transactions are quite difficult to perform on mobile devices due to their hardware limitations, such as small screens and clumsy input mechanisms. Consequently, consumers tend to use mobile devices for simple banking transactions, in situations in which they need instant access to their accounts, and when their other banking channels are not in reach (for example, checking their account balance before purchasing goods at a point of sale) (Hoehle and Huff, 2012).

The huge explosion of mobile device usage and the initiatives in e-commerce have drawn the attention of researchers to m-banking. Various management information system researchers have provided different definitions of m-banking. M-banking is often considered to be a subset of m-commerce, and m-commerce a subset of e-commerce (Coursaris and Hassanein, 2002). Some studies explicitly qualify device type for use under m-banking (e.g. Barnes and Corbitt (2003), Lee and Chung (2009), Shaikh and Karjaluoto (2015)), while many others do not (e.g. Suoranta and Mattila (2004), Oliveira *et al.* (2014)), the reasoniong being that accessing banking services from a laptop should not be considered as m-banking, since the interface is similar to a desktop PC, which

is not a mobile device (Shaikh and Karjaluoto, 2015). Table 1 presents several definitions of m-banking. It can be seen that the evolution of the several definitions has changed throughout the last decade.

Table 1 – M-banking definitions

(Barnes and Corbitt, 2003)	…can be defined as a channel whereby the customer interacts with a bank via a mobile device, such as a mobile phone or personal digital assistant (PDA).
(Suoranta and Mattila, 2004)	…is among the newest electronic delivery channels to be offered by banks. In using the term 'electronic banking' the authors refer to a definition that explains it as the provision of information and services by a bank to its customers via electronic wired or wireless channels, for example the internet, telephone, mobile phone, or interactive television.
(Pousttchi and Schurig, 2004)	... a type of execution of financial services in the course of which - within an electronic procedure - the customer uses mobile communication techniques in conjunction with mobile devices.
(Porteous, 2006)	Mobile payments (m-payments) are financial transactions undertaken using mobile device such as a mobile phone. Mobile banking (m-banking) includes m-payments but involves access by mobile device to the broader range of banking services, such as account-based savings or transactions products offered by banks.
(Laukkanen, 2007)	… has emerged as a wireless service delivery channel providing increased value for customers' banking transactions.
(Clarke III, 2008)	… can be considered as a subset of e-banking or online-banking and refers to the shift of conducting financial transactions from wired networks to wireless networks.
(Morawczynski and Miscione, 2008)	… a platform for the delivery of financial services via the mobile phone.
(Lee and Chung, 2009)	… is defined as banking transactions using mobile devices such as cellphones, PDAs (Personal Digital Assistants), smart phones, and other devices (except for laptops).
(Riquelme and Rios, 2010)	… is used in this paper to mean electronic banking that uses mobile phone technology (or other wireless devices) to deliver electronic financial services to consumers.
(Luo *et al.*, 2010)	… an innovative method for accessing banking services via a channel whereby the customer interacts with a bank via a mobile device (e.g., mobile phone or personal digital assistant).
(Laukkanen and Kiviniemi, 2010)	… an interaction in which a customer is connected to a bank via a mobile device such as cell phone, smartphone, or personal digital assistant (PDA).
(Oliveira *et al.*,	… an instance of a mobile commerce (mCommerce) application in which financial

2014)	institutions enable their customer to carry out banking activities via mobile device.
(Shaikh and Karjaluoto, 2015)	… is a product or service offered by a bank or a microfinance institute (bank-led model) or MNO (non-bank-led model) for conducting financial and non-financial transactions using a mobile device, namely a mobile phone, smartphone, or tablet.
(Koksal, 2016)	…is any form of banking transaction that is carried out through a mobile device, such as a mobile phone or a personal digital assistant.

Considering these many definitions and the technological changes over time, we propose the following definition since it is more broadly inclusive:

> "M-banking is a service or product offered by financial institutions that makes use of portable technologies."

The improvement of mobile platform technologies enables m-banking users to carry out banking services anytime from anywhere. The new paradigms of banking services in the last decade have changed the face of retail banking, with new services and products and new points of interaction with their customers (Ensor and Wannemacher, 2015). The mobility offers banks the opportunity to tailor products and services to their customers' exact needs - or exact location, in order to preserve them (Floh and Treiblmaier, 2006). Additional benefits arising from the m-banking technologies:

- For the consumers, m-banking reduces time and expenses by allowing users to review transactions, transfer funds, pay bills, check balances, and perform other financial services, without relatively expensive phone calls to a bank's customer service call centre or by visiting a branch (Kim *et al.*, 2009; Hoehle *et al.*, 2012).
- For the financial industry, m-banking affords banks additional benefits such as cost savings, attracting new customers, and retaining old ones (Hoehle and Huff, 2012). This channel allows the bank to cross-sell and up-sell their other complex banking products and services such as vehicle loans, credit cards, etc. In addition, the m-banking channel helps banks to improve service operational efficiency, customer satisfaction, and cost effectiveness.

An extensive body of research has been developed to understand the factors that influence m-banking user adoption. These factors include perceived usefulness (e.g. Hanafizadeha *et al.*, 2014), perceived ease of use (e.g. Hanafizadeha *et al.*, 2014), trust (e.g. Hanafizadeha *et al.*, 2014), social influence (e.g. Aboelmaged and Gebba, 2013), perceived risk (e.g. Chitungo and Munongo, 2013), self-efficacy (e.g. Amin *et al.*, 2012), facilitating conditions (e.g. Yu, 2012), demographic factors (e.g. Laukkanen *et al.*, 2007; Amin *et al.*, 2006; Alafeef *et al.*, 2011), resistance (e.g. Laukkanen *et*

al., 2008; Cruz *et al.*, 2010), and many others. The main targets of the dependent variable are antecedents of attitude (e.g. Püschel *et al.*, 2010), behavioural intention (e.g. Luo *et al.*, 2010), and usage (e.g. Crabbe *et al.*, 2009). Table 2 shows a chronology of relevant empirical research published from January 2005 to July 2016. No empirical study was published in 2008.

Table 2 - M-banking empirical studies

Model/Theory	Dependent Variable	Source	Constructs																							
			Attitude	Behavioural control	Culture	Effort expectancy	Facilitating conditions	Habit	Hedonic motivation	Information quality	Interface quality	Perceived compatibility	Perceived credibility	Perceived ease of use	Perceived relative advantage	Perceived risk	Perceived self-efficacy	Perceived usefulness	Performance expectancy	Price value	Social influence	Subjective norm	System quality	Task characteristics	Technology characteristics	Task technology fit	Trust
Extend TAM	Behaviour intention	(Luarn and Lin, 2005)											●	●			●	●		●							
IDT	Adoption	(Amin *et al.*, 2006)	●																								
Mean-end theory	Adoption	(Laukkanen, 2007)													●												
D&M	Satisfaction	(Lee and Chung, 2009)								●	●												●				●
IDT – Trust	Behaviour intention	(Kim *et al.*, 2009)													●												●
Extend TAM	Behaviour intention	(Gu *et al.*, 2009)					●							●			●	●					●				●
TAM	Behaviour intention	(Crabbe *et al.*, 2009)	●				●						●	●				●									
D&M	Satisfaction	(Chung and Kwon, 2009)								●													●				●
TTF, UTAUT	Adoption	(Zhou *et al.*, 2010)				●	●												●		●			●	●	●	
TAM, TPB, IDT	Adoption	(Riquelme and Rios, 2010)												●	●	●		●				●					
IDT, DTPB	Adoption	(Püschel *et al.*, 2010)	●	●									●	●	●							●					
TAM	Behaviour intention	(Schierz *et al.*, 2010)	●										●	●				●				●					
Trust and Risk	Adoption	(Luo *et al.*, 2010)														●	●		●								●
TAM, IDT	Adoption	(Koenig-Lewis *et al.*, 2010)											●	●	●		●	●		●							●
TAM	Behaviour intention	(Shen *et al.*, 2010)															●										●
TAM, TRA, DOI	Adoption	(Cruz *et al.*, 2010)								●				●	●	●		●									
TAM, TPB, D&M	Satisfaction	(Saleem and Rashid, 2011)												●		●		●									●
IDT	Behaviour intention	(Lin, 2011)											●		●	●											
IDT	Adoption	(Khraim *et al.*, 2011)											●		●	●	●										
TAM, TPB	Behaviour intention	(Sripalawat *et al.*, 2011)						●						●		●	●	●				●					

Model/Theory	Dependent Variable	Source	Constructs																						
			Attitude	Behavioural control	Culture	Effort expectancy	Facilitating conditions	Habit	Hedonic motivation	Information quality	Interface quality	Perceived compatibility	Perceived credibility	Perceived ease of use	Perceived relative advantage	Perceived risk	Perceived self-efficacy	Perceived usefulness	Performance expectancy	Price value	Social influence	Subjective norm	System quality	Task characteristics	Technology characteristics	Task technology fit	Trust
TAM	Behaviour intention	(Cheah *et al.*, 2011)												●	●	●		●								
UTAUT	Behaviour intention	(Yu, 2012)				●	●						●				●		●	●	●					
TAM	Behaviour intention	(Amin *et al.*, 2012)											●	●			●	●								
Trust	Trust	(Zhou, 2012b)								●							●						●			
Trust	Behaviour intention	(Zhou, 2012a)												●												
TAM, TPB	Adoption	(Aboelmaged and Gebba, 2013)	●	●										●				●				●				
TAM	Behaviour intention	(Jeong and Yoon, 2013)											●	●			●	●								
TTF, UTAUT, ITM	Adoption	(Oliveira *et al.*, 2014)				●	●												●		●			●	●	●	●
TAM	Behaviour intention	(Hanafizadeha *et al.*, 2014)												●		●		●		●							●
TAM	Intention to use	(Mortimer *et al.*, 2015)			●									●		●		●			●						
UTAUT2	Use Behaviour	(Baptista and Oliveira, 2015)			●	●	●	●	●										●	●	●						
TAM	Behaviour intention	(Mohammadi, 2015a)	●									●		●		●		●				●					
TAM	Behaviour intention	(Mohammadi, 2015b)	●									●		●		●	●	●	●								
UTAUT	Use Behaviour	(Bhatiasevi, 2015)				●	●						●						●	●	●						
UTAUT, TTF, ITM.	Behaviour intention	(Afshan and Sharif, 2016)				●	●												●		●			●	●	●	●
Trust	Adoption	(Malaquias and Hwang, 2016)														●					●			●			
ECM	Continuance intention	(Susanto *et al.*, 2016)															●	●									●
TAM	Adoption	(Alalwan *et al.*, 2016)												●		●	●	●									
TTF	Individual Performance	(Tam and Oliveira, 2016a)																						●	●	●	
D&M, TTF	Individual Performance	(Tam and Oliveira, 2016b)								●													●	●	●	●	
Quality	Adoption	(Jun and Palacios, 2016)																					●				
SC, Risk Value, WOM	Continuous usage	(Shaikh and Karjaluoto, 2016)														●				●							

Model/Theory	Dependent Variable	Source	Constructs																						
			Attitude	Behavioural control	Culture	Effort expectancy	Facilitating conditions	Habit	Hedonic motivation	Information quality	Interface quality	Perceived compatibility	Perceived credibility	Perceived ease of use	Perceived relative advantage	Perceived risk	Perceived self-efficacy	Perceived usefulness	Performance expectancy	Price value	Social influence	Subjective norm	System quality	Task characteristics	Technology characteristics	Task technology fit	Trust
TAM, Risk	Adoption	(Afshan and Sharif 2016)												●		●		●								
TAM	Adoption	(Koksal, 2016)										●	●	●			●	●								●
TRA,TAM, IDT, UTAUT	Adoption	(Tran and Corner, 2016)											●					●			●					
UTAUT	Behaviour intention	(Tan and Lau, 2016)				●										●			●		●					

Notes: TRA- Theory of Reasoned Action; TAM – Technology Acceptance Model; TPB - Theory of Planned Behaviour; TTF - Task Technology Fit; UTAUT - Unified Theory of Acceptance and Usage of Technology; ITM - Initial Trust Model; IDT - Innovation Diffusion Theory; DTPB - Decomposed Theory of Planned Behaviour; D&M – DeLone and McLean; SC- Self-congruence; WOM- word-of-mouth; ECM-Expectation-Confirmation Model

The dependent variables of the majority of the 46 empirical studies in Table 2 are behaviour intention and adoption. Of 46 studies, 18 (39%) are behaviour intention, and 17 (37%) are adoption. The results of these various studies suggest that there are very few studies on post-adoption and use stage. There are three studies on satisfaction, and two studies on individual performance of using m-banking as a benefit for the consumer.

4. Individual performance

M-banking is the most important strategic change in retail banking in more than a decade, and has quickly moved beyond being simply online banking using a smartphone. It is at the hub of the customer relationship and is quickly becoming a point of differentiation and a potential source of revenue for progressive banks (Ensor and Wannemacher, 2015). Attracting potential users and retaining existing users is crucial to the long-term business success of m-banking firms (Gu *et al.*, 2009).

Several authors relate "performance" to effectiveness and productivity (e.g. Manzoor, 2012; Adler and Benbunan-Fich, 2012; Mahdi *et al.*, 2014). Despite the fact that performance measurement has received considerable attention, the focus of the majority of m-banking studies is the adoption field, to attract potential users. In this research we adopt the term "performance" at the

individual level to express the idea of users' efficiency and effectiveness in performing m-banking tasks. There is no single accepted view about these terms, however. Effectiveness is usually described as "doing the right things", while efficiency means "doing things right" (Sink and Tuttle, 1989). The following table summarizes the meaning of task effectiveness and task efficiency.

Performance Indicators	Elements
Task Effectiveness The degree to which a given banking task undertaken by a user improves well-being.	- Reducing number of errors and delays.
Task Efficiency The degree to which a given banking task undertaken by a user leads to a more efficient workflow.	- Doing transactions more quickly. - Skips queues and avoids long waiting times.

Performing banking tasks at a high level could enhance time saving and reduce effort, and can be a source of individual performance. DeLone and McLean (1992) reported 39 studies associated with different aspects of individual performance, including improved time efficiency of task accomplishment, increased job performance, enhanced decision-making effectiveness, individual productivity, and improved efficiency of effort. For Hou (2012), individual performance impact of IS refers to the actual performance of an individual using an IS. Sonnentag and Frese (2002) link the research on individual performance to the research on work-related well-being. For them "accomplishing tasks and performing at a high level can be a source of satisfaction, with feelings of mastery and pride. Low performance and not achieving the goals might be experienced as dissatisfying or even as a personal failure". They also discuss if and how well-being and performance are empirically related, and argue, especially, that self-regulation might account for such a relationship.

The nature of the specific banking operation drives the customer to the specific channel. Some operations related to the task time criticality and task importance in performing financial transactions, such as stock market operations, are highly sensitive due to market volatility and to their *just-in-time* nature. Examples include checking an account balance and verifying a salary deposit or urgent-payments processing. These are m-banking transactions that aim to meet market and customer demands of high level of individual performance (Kim *et al.*, 2009; Tan and Teo, 2000). An empirical study based on a focus group discussion reported the relationship between the use of certain banking channels and the nature of banking tasks (Hoehle and Huff, 2012). The

urgency of the banking task was determined in their investigation to be the driver in the selection of banking channel.

The main theories that explain the individual performance as a dependent construct in a post-adoption context (i.e., by using an IS/IT) are: IS Success model (DeLone and McLean, 1992) and Task technology Fit (TTF) model (Goodhue and Thompson, 1995). The individual performance refers to the consequences or a result of using IS/IT. For example, a student using a calculator to do a homework assignment will probably have a better result than another student who does not use it. Or imagine a bank customer using a self-service channel for payments; this customer will enjoy the availability of service anytime, unlike another customer using only a traditional channel, such as a branch facility, which is open only during certain hours of the day.

However, there are other models that apply the terminology "performance expectancy", "outcome expectation", and "perceived usefulness" as main independent construct(s)/factor(s) or predictor variable to explain behaviour intention to use or adopt IS/IT. These include Perceived usefulness in the technology acceptance model (TAM) (Davis, 1989), job fit in the Model of PC Utilization (MPCU) (Thompson *et al.*, 1991), outcome expectations in the Social Cognitive Theory (SCT) (Compeau and Higgins, 1995), and performance expectancy in the unified theory of acceptance and use of technology (UTAUT) (Venkatesh *et al.*, 2003). The subsequent section shows the IS Success model and the TTF model and how they were used in the m-banking context.

4.1 IS Success model

A major contribution to the individual performance area was DeLone and McLean's (D&M) study, which proposed a comprehensive framework for the IS Success model (original and updated version) (DeLone and McLean, 1992; DeLone and McLean, 2003).

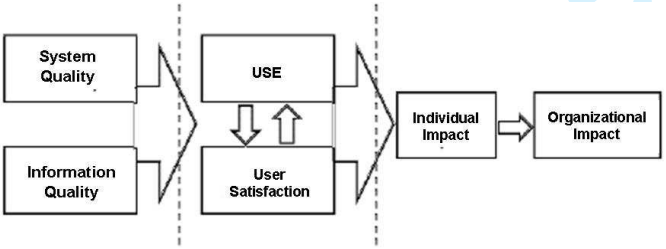

Figure 2. Original D&M IS Success model

Numerous studies have sought to explain what makes some IS "successful". Studies that were published prior to the D&M model, such as Theory of Reasoned Action (TRA) (Fishbein and Ajzen, 1975) and Technology Acceptance Model (TAM) (Davis, 1989) attempted to explain why some IS are more readily accepted by users than others. Acceptance is not equivalent to success, although acceptance of an information system is a necessary prerequisite to success. To address this IS success gap, DeLone and McLean (D&M) identified 180 references published between 1981 and 1987, and created a taxonomy of IS success based upon this review. The original version of the D&M model reviewed IS success measures and devised a model of the interrelationships between six IS success factors: (1) system quality, (2) information quality, (3) use, (4) user satisfaction, (5) individual impact, and (6) organizational impact. Later, in the updated version DeLone and McLean (2003) added the "service quality" measure. For D&M, "to measure the success of a single system, 'information quality' or 'system quality' may be the most important quality component. For measuring the overall success of the IS department, as opposed to individual systems, 'service quality' may become the most important variable". The following list summarizes the meaning of some IS success dimensions:

- System quality – the desirable characteristics of an information system. These measures focus on ease of use, system flexibility, system reliability, and ease of learning, as well as system features of intuitiveness, sophistication, flexibility, and response times.
- Information quality – the desirable characteristics of the information system outputs. The focuses of these measures are the relevance, understandability, accuracy, conciseness, completeness, currency, timeliness, and usability. These measures focus on the quality of the information that the system produces and its usefulness for the user.
- Service quality – the quality of the support that system users receive from the IS department and IT support personnel. For example: responsiveness, accuracy, reliability, technical competence, and empathy of the personnel staff. This dimension is an enhancement of the updated D&M IS Success model, and was adapted from the field of marketing, and is a popular instrument for measuring IS service quality (Pitt et al., 1995).
- System use – the degree and manner in which staff and customers utilize the capabilities of an information system. Amount of use, frequency of use, nature of use, appropriateness of use, extent of use, and purpose of use, are some examples of system use.

- User satisfaction – users' level of satisfaction when using an IS. The most widely used multi-attribute instrument for measuring user information satisfaction can be found in Ives et al. (1983).
- Individual performance – is certainly evidence that the IS has had a positive impact. Task effectiveness, productivity, usefulness, performance, decision quality, and task efficiency, are some examples of individual performance measure.

Many studies have used and supported the validity of the D&M framework. Table 3 reports some examples of different applications of the D&M model, such as knowledge management systems (KMS) (Wu and Wang, 2006), learning success systems (Lin, 2007), websites success goals (Schaupp *et al.*, 2006), implementation success of enterprise resource planning (ERP) (Tsai *et al.*, 2012), evaluation of the electronic health record (Bossen *et al.*, 2013), and employee portal success (Urbach *et al.*, 2010). Several authors demonstrate that D&M can be combined with other models such as the unified theory of acceptance and usage of technology (UTAUT) to explain electronic patient records (Maillet *et al.*, 2015); D&M with trust dimension to explain repurchase intention in online services (Hsu *et al.*, 2014), or continuance intention of mobile payment service (Zhou, 2013). The variety of applications of the D&M model, alone or in combination with other theories, provides a basis and support for our investigation in the m-banking context.

Table 3 - Overview of DeLone and McLean applications

Authors	IS applications	Theory	Sample / Method	Findings
(Qian and Bock, 2005)	Knowledge Repository Systems	D&M	110 responses, PLS	Output quality and system quality influence user satisfaction. Output quality and user satisfaction influence the use. Use and user satisfaction explain 61.5% of variation in individual impact.
(Schaupp *et al.*, 2006)	Websites success goals	D&M	199 regular users, PLS	Information quality, system quality, and perceived effectiveness influence website satisfaction.
(Wu and Wang, 2006)	Knowledge management systems (KMS)	D&M	204 KMS users, CFA	Perceived benefits and user satisfaction explain 60% of variation in system use.
(Lin, 2007)	Online Learning Systems Success	D&M	232 undergraduate students	System quality, information quality, and service quality influence the use and user satisfaction.
(Teo *et al.*, 2008)	Electronic Government Success	D&M, Trust	214 university students, PLS	System quality and service quality explain 43% of variation in user satisfaction. Information quality and user satisfaction explain 40% of variation in intention to continue using,
(Lee and Chung, 2009)	M-banking	D&M, Trust	276 m-banking customers, PLS	System quality and information quality explain 56.5% of variation in customer satisfaction.
(Urbach *et al.*, 2010)	Employee portal success	D&M	6,210 responses, PLS	System quality, information quality, process quality, and collaboration quality influence user satisfaction. Collaboration quality influences the use. Use and user satisfaction explain 59.4% of

Authors	IS applications	Theory	Sample / Method	Findings
				the variation individual performance, which consequently explains 14.3% of variation in organizational impact.
(Park *et al.*, 2011)	Digital object identifier systems	D&M	120 respondents, PLS	Perceived usefulness and user satisfaction explain 57.8% of variation in organizational benefit.
(Tsai *et al.*, 2012)	Implementation success of enterprise resource planning	D&M	278 responses, PLS	System quality and service quality explain 68% of the variation in user perspective. User perspective explains 65% of the variation in net benefit.
(Hollmann *et al.*, 2013)	Open source software repositories	D&M	117 users, PLS	Perceived usefulness and user satisfaction explain 61% of variation in net benefit.
(Bossen *et al.*, 2013)	Evaluation of a comprehensive electronic health record	D&M	244 professionals, ANOVA	The results produced using the D&M framework are valid and reliable, and were accepted by staff, system providers, and political decision makers.
(Zhou, 2013)	Mobile payment services	D&M, Trust	195 users	Trust, flow, and satisfaction explain 58.4% of the variation in continuance intention.
(Hsu *et al.*, 2014)	Repurchase intention in online services	D&M, Trust	253 customers	Satisfaction with website, satisfaction with sellers, and perceived quality of site explains 39% of the variation in repurchases intention.
(Rana *et al.*, 2015)	Online public grievance redressal system (OPGRS)	D&M	419 users, PLS	System quality, information quality, service quality, perceived ease of use, and perceived usefulness explain 47% of the variation in perceived satisfaction

It can be seen that the most common studies applying D&M models are related to technology adoption, technology evaluation, impact on learning, and task performance, and not with individual performance as initially suggested by Goodhue and Thompson (1995), as post-adoption phase.

4.2 Task Technology Fit

Another contribution to this area came from Goodhue and Thompson, who proposed a task-technology fit (TTF) model (Goodhue and Thompson, 1995). This theory suggests that individual performance is a consequence of the use of, and the fit between, the technology and the task it supports (Goodhue and Thompson, 1995). Goodhue and Thompson (1995) empirically tested the TTF model with 600 users in two companies to evaluate whether IS and services meet end users' needs in a given organization. They found support for the link of TTF constructs and individual performance but not for a causal link between TTF and use. The following list summarizes the meaning of TTF model dimensions:

- Task characteristics – are broadly defined as the actions carried out by individuals in turning inputs into outputs.

- Technology characteristics – are related to the tools and features used by individuals in carrying out their tasks.
- Task technology fit – is the degree to which a technology assists an individual in performing his or her tasks.
- Use – is the behaviour of employing the technology in completing tasks.
- Performance impact – relates to the accomplishment of a portfolio of tasks by an individual.

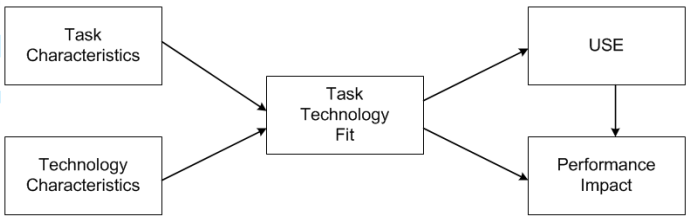

Figure 3. TTF model

Table 4 lists some examples of different applications of the TTF model, such as knowledge management systems (KMS) use (Lin and Huang, 2008), location-based services (LBS) (Junglas *et al.*, 2008), use of information technology (Dishaw and Strong, 1999), use of mobile commerce in the insurance industry (Lee *et al.*, 2007a), and performance impact using learning management systems (LMS) (McGill and Klobas, 2009). TTF can combine with other models such as UTAUT to explain user adoption of m-banking (Zhou *et al.*, 2010), TAM to explain users' intention to use wireless technology in organizations (Yen *et al.*, 2010), and UTAUT combined with initial trust model (ITM) to explain m-banking adoption (Oliveira *et al.*, 2014). Our review of the literature on TTF indicates that task-technology fit measurement has been operationalized in a variety of different ways.

Table 4 - Overview of TTF applications

Authors	IS applications	Theory	Sample / Method	Findings
(Kositanurit *et al.*, 2006)	Enterprise resource planning (ERP) systems	TTF	349 respondents, PLS	System quality, ease of use, and use explain 73.3% of variation in individual performance.
(Lee *et al.*, 2007a)	Adoption of mobile commerce in the insurance industry.	TTF	238 Insurance agents	TTF and Individual differences.
(Lin and Huang, 2008)	Understanding KMS use	TTF	192 subjects, Taiwan, PLS	Task interdependence and tacitness, perceived TTF, self-efficacy, personal and performance outcome expectation, and KMS use. The model explained 31.7% of the variation in personal outcome expectations that play a role in KMS use.

Authors	IS applications	Theory	Sample / Method	Findings
(Junglas *et al.*, 2008)	Mobile locatable IS	TTF	112 US students, ANOVA	Locatability, location sensitivity, and TTF.
(Gebauer and Ginsburg, 2009)	Overall technology evaluation	TTF	144 user community, US, Z Score	Task-related fit, Technology performance, and user context-related fit explain 43% of variation in overall technology evaluation.
(McGill and Klobas, 2009)	Learning management systems	TTF	267 Students, Australia, PLS	Attitude, social norms, facilitation conditions, TTF, and use explain 44.8% of the variation in perceived impact on learning.
(Larsen *et al.*, 2009)	Users' motivation to continue IS use	TTF	135 Respondents, PLS	Perceived TTF, perceived usefulness, utilization, confirmation, and satisfaction explain 68% of variation in IS continuance intentions.
(Zhou *et al.*, 2010)	Adopt m-banking	TTF + UTAUT	250 respondents, PLS	TTF, performance expectancy, effort expectancy, social influence, and facilitating conditions explain 57.5% of the variation in user's behavioural intention to adopt m-banking
(Yen *et al.*, 2010)	Adopt wireless technology	TTF + TAM	231 employees, US, CFA	Behavioural intention, perceived usefulness, perceived ease of use, and TTF explain 69% of the variation in user's behavioural intention to adopt wireless technology in organizations.
(Yuan *et al.*, 2010)	Mobile work support	TTF	179 mobile worker, Canada, PLS	Time criticality, mobility, location dependency, and intention to use explain variations ranging between 71% and 77% in perceived usefulness of mobile work supporting functions.
(Lepanto *et al.*, 2011)	Picture archiving and communication system (PACS)	TTF	45 professionals, Canada, ANOVA	Use and task technology fit explain 86% of the variation in perceived net benefits
(Lin, 2012)	Virtual learning system (VLS)	TAM + TTF	165 students, Taiwan, PLS	Perceived fit, satisfaction, and VLS continuance intention explain 57% of the variation in perceived impact on learning.
(Parkes, 2013)	Effects of TTF on user attitude and performance	TTF	94 Subjects, Australia, ANCOVA	Task-individual-technology fit, perceived usefulness, and decision quality explain 37.8% of the variation in user attitude and technology performance on task performance
(Oliveira *et al.*, 2014)	Adopt m-banking	TTF UTAUT ITM	194 individuals, Portugal, PLS	Facilitating conditions and behavioural intention explain 66.7% of the variation to adopt m-banking
(Yang and Lin, 2015)	Use cloud storage service	TTF TAM	294 individuals, Taiwan, PLS	Perceived usefulness explains 58.4% of the variation to use cloud storage service

It can be seen that the most common studies applying TTF models are related to technology adoption, technology evaluation, impact on learning, and task performance, and not with individual performance as initially suggested by Goodhue and Thompson (1995), as post-adoption phase.

5. Mobile banking theory framework

In Figure 4, we provide a theoretical framework for a technological evolution adapted to the m-banking system. This framework was based on Larsen (2003) taxonomy of Information Systems

Success Antecedent (ISSA), which identified three main stages of dependent variable in ISSA research. These stages are implementation process, behaviour and perceptions, and performance. The stage one, know as (a) adoption, corresponding to a initial stage of implementation of m-banking system - m-banking users tends to adopt or not the system; the stage two (b) intention to use, use, user satisfaction, and acceptance, handle with perceptions and behaviour related to the implemented system - after adopt the m-banking system, the user may tend to use it; and finally (c) individual impact, deal with technology performance - by performing m-banking tasks, the users enhance time saving and reduce effort, which can be seen as source of individual performance. The research framework suggests that these influences are connected in a continuous sequence of learning and change. The interest of this theoretical framework is establishing the links to the several m-banking studies and positioning future investigations in the field.

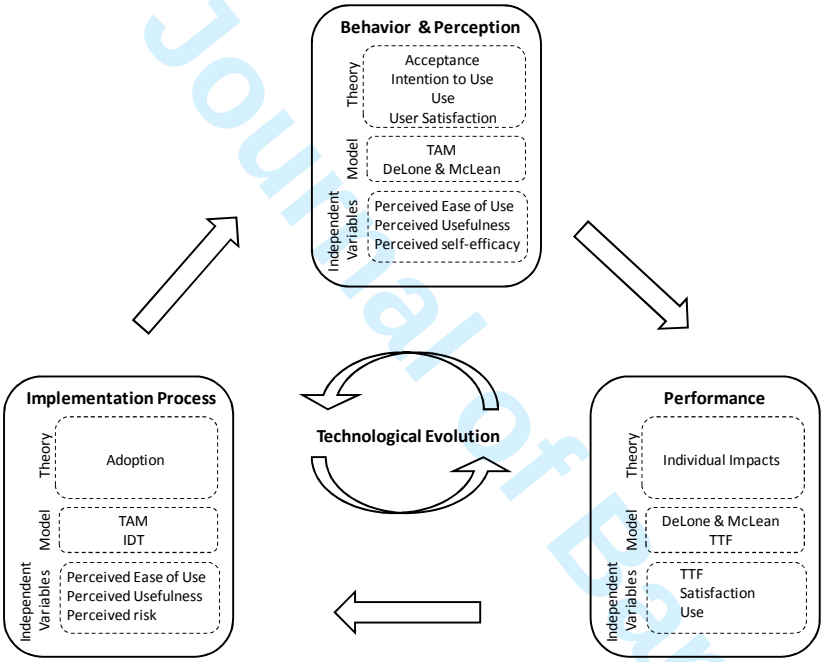

Figure 4. M-banking systems theoretical framework

6. Conclusion and future research

The financial industry, like many other industries, has grown and innovated within their own spheres of operation. The technology boom opened up new channels for banking. Channel proliferation is still underway; m-banking is being rolled out by an ever increasing number of banks. In this research we identified 64 m-banking articles published between 2002 and 2016.

Although we do not claim it to be exhaustive, it does provide a reasonable amount of insight into m-banking research. The interest of this research is a frame of reference that serves as basis for future studies on the field. We trust that this literature review will stimulate other researchers to go further because it provides: (a) a clearer understanding of m-banking investigation landscape, and (b) new research avenues. Firstly, this research provides the evolution of several m-banking definitions from different angles, not reported in similar studies (e.g. Shaikh and Karjaluoto (2015)), and proposes a new, broader definition that takes into account the technological changes that have occurred over time. Considering the novelty of this concept, this research helps researchers and practitioners to better understand the evolution of m-banking and support future development in the m-banking domain.

Secondly, in terms of theoretical perspectives, with the exception of three studies that focused on user satisfaction and two studies on individual performance, our findings reveal that the literature mostly addresses on potential adopters of m-banking, characterized by behaviour intention and adoption. Additionally, the theoretical framework provides the assessment for future investigations. The independent constructs most often applied in empirical studies are, in this order: of 46 m-banking empirical studies, 23 apply perceived ease of use, perceived usefulness (22 studies), perceived risk (17 studies), perceived self-efficacy (14 studies), and trust (13 studies). The main theory applied in these 46 studies was TAM (22 studies). Potential gaps in the literature are therefore identified that might stimulate further research. One possible direction is to focus on the post-adoption phase of m-banking, such as individual performance, as a consequence of using m-banking. We believe that by enhancing the quality of m-banking, the service will retain more users and attract potential adopters of m-banking, with the consequence of enhancing the individual performance, in turn.

Thirdly, cross-country evaluations may expose different national cultural values that affect m-banking post-adoption (Lee *et al.*, 2007b). Cultural differences going far beyond country boundaries, can exist within a country or a city (Baskerville, 2003), influencing how people think and behave. Cultural research may enable a better understanding of certain cultural characteristics of m-banking users, which may influence potential adopters. Fourthly, the majority of m-banking research is time-sectional, measuring perceptions at a single point in time. Longitudinal research may provide other insights into m-banking usage.

It is essential for the financial industry to be clear about what "customer centric" means, and how to convert efforts in that realm into profits. We understand the several advantages for the financial industry in encouraging customers to adopt and use the remote channel, and its

relationship to the scope of research in most m-banking studies. However, knowing the determinants of the post-adoption phase, and keeping customers loyal to m-banking are the emerging issues that should be considered in future research.

The results presented herein have several important implications for future studies. There is no doubt that portable technology evolution will affect the way that customers interact with their financial institutions. One example of this evolution is Apple's launch of *smartwatch* in April 2015. The financial industry is moving in that direction. This evolution would make it interesting to study different types of equipment (e.g. mobile device versus tablet, or other equipment). In addition, m-banking faces several trends for the future:

- Make the movement of money via payments and transfer easier. According to the Forrester survey Q4 2011 undertaken in Europe, besides checking account transactions and balance enquiries, the two most popular transactions made on mobile devices are money transfers and the paying of bills (Forrester, 2011).
- Give customers the flexibility to use any channel at any time. System unavailability or other problems can harm company image and lead customers to feel less satisfied with the service.
- Leverage smartphone capabilities. For example, customer feedback can guide and inform a company's decision-making and influence its product roadmap.
- Go beyond the password with authentication. According to a Deloitte report, 72% of consumers would appreciate the use of biometric identification (such as fingerprints or iris recognition) as a means of device authentication during financial services transactions (Srinivas *et al.*, 2014).

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