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Factors influencing Sudanese microfinance intention to adopt mobile banking

Anwar Ammar¹ and Elsadiq Musa Ahmed^{2*}

Abstract: Access to financial service has become a key phenomenon for economic development and poverty alleviation. Microfinance is one way of fighting poverty in Sudan, where most citizens are in need of it. However, despite the initial results showing a positive impact of microfinance on the livelihood of low-income people in Sudan, around 8 million of the Sudanese poor people are excluded from microfinance services. One potential remedy for the limited outreach of microfinance in Sudan may lie within enhancing the capacity of microfinance services providers (MFPs) in the utilization of modern technology. Recent innovation in providing financial services in a convenient and efficient way is the use of mobile banking (m-banking) technology in microfinance. M-banking promises to increase the efficiency and outreach of microfinance services in developing countries. This paper tries to examine the factors that influence the adoption of m-banking by microfinance sector in Sudan. In this respect, hypotheses were developed guided by Unified Theory of Acceptance and Use of Technology (UTAUT) and Technology-organization-Environment (TOE) models. Primary data were collected from MFPs and microfinance customers in Sudan using questionnaires and interviews. The study contributes to knowledge in terms of methods used by extending aforementioned theories through adding new variables to both models by putting both models in

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PUBLIC INTEREST STATEMENT

The Sudanese experience showed that microfinance—the major tool to combat poverty—has a positive impact on income-generating activities, poverty reduction, women's empowerment, and better access to education and health services. However, late statistics show that microfinance covers only 8% of the total potential clients leaving 8 million unserved people behind. With baby steps, microfinance industry in Sudan will never get anywhere. Nonetheless, the enormous growth of mobile banking (M-banking) has created a new opportunity to expand financial services to this unserved population. Sudan's mobile phone network covers 77% of the population, including the poor. The main objective of this study is to identify the major factors determining the adoption of M-banking in the Sudanese microfinance sector. The findings from this research study can be used by microfinance providers to improve m-banking facilities and to identify those factors that can contribute to either the failure or success of the m-banking services and this could be further used for decision-making.

one study to fill the gaps in past studies; via examination of the demand (customers) and supply (institutions) through modifying them to include new variables related to m-banking in microfinance.

Subjects: Arts & Humanities; Social Sciences; Technology

Keywords: M-banking; microfinance; Sudan; ICT; UTAUT; TOE

1. Introduction

According to the National Baseline Household Survey (2009), the poverty rate in Sudan is 46.5% nationwide and varies considerably between rural and urban areas (57.6 vs. 26.5%, respectively) (Sudan 2015 African Economic Outlook, 2015). Unemployment is also high in Sudan, according to The African Development Bank (2014) the unemployment rate stood at 10.8% in 2012, with male unemployment at 13% compared to 20% for females. Sudan is one of the countries which adopted microfinance as a tool to address issues of poverty and unemployment.

The Sudanese experience showed that microfinance has a positive impact on income-generating activities, poverty reduction, women's empowerment, and better access to education and health services. However, late statistics showed that the total number of clients is 970,000, i.e. 8% coverage of the total potential clients estimated at 7.2 million (Ibrahim, 2014). This might be due to several reasons such as lack of basic public infrastructures, high operation cost, MFIs¹ deliberately ignoring the rural areas' clients because of the high risk; microfinance programs offer only a limited number of products and limited management capacity of MFIs.

It is clear that the present delivery channels are not quite meeting the challenges of microfinance in Sudan, especially when it comes to serving communities in remote locations characterized by low population density. In recent years, Mobile technology was successfully used in many countries of similar situation to Sudan (e.g. MPESA in Kenya and WIZIT in South Africa) for delivering financial services to the poor. While microfinance in Sudan is still in fledgling stage (8% coverage), mobile phone estimated penetration rate in 2015 is 77% (BuddeComm, 2015). Based on this, many studies suggest m-banking as a solution to microfinance problems (Impact Evaluation Assessment MFI Sector in Sudan 2007–2012, 2013; Mapping, capacity assessment & capacity development of microfinance providers in Sudan, 2012; Situational Analysis of the Microfinance Sector in Sudan, 2006).

M-banking has its own challenges which according to this research include the need for strong institutions and technology infrastructure (HORUS CBOS, 2011; Khattab, Balola, & Eldabi, 2012; Mapping, capacity assessment & capacity development of microfinance providers in Sudan, 2012) an innovative business model that can reach microfinance customers with a broader range of financial products at lower costs (HORUS CBOS, 2011; Impact Evaluation Assessment MFI Sector in Sudan 2007–2012, 2013); understanding the factors that influence Sudanese microfinance customer's intentions to use m-banking services (Karma, Ibrahim, and Ali (2014); Tingari & Abdelrahman, 2012), partnerships, and collaboration between different stakeholders (HORUS CBOS, 2011; Khattab et al., 2012); and lack of a clear regulatory framework (HORUS CBOS, 2011; Khattab et al., 2012).

In Sudan, there are certain gaps on supply side of microfinance services that is evident from outreach statistics. The gap in the financial services market is creating a unique niche for m-banking, thus enabling a growing number of people to access to financial services for the first time. In Sudan, little research was conducted to understand m-banking and the environment needed to develop an effective m-banking for serving Sudan's microfinance sector. Thus, this paper aims to examine the factors that should be considered to develop a successful m-banking that is suitable for Sudan's microfinance sector.

2. Significance of the study

Theoretically, the study contributes to the available literature by filling the gap of past studies that did not examine both supply and demand in one study, and empirically examines the demand (customers) and supply (microfinance providers) of microfinance activities by using Unified Theory of Acceptance and Use of Technology (UTAUT) and Technology-organization-Environment (TOE) models.

The findings of this study are expected to contribute to the adoption literature in the area of m-banking in Sudan and developing nations. More specifically, to bridge the gap that exists for Sudan by serving as a starting point for further research. The findings provided by this research can be used by microfinance providers to improve m-banking facilities and to identify those factors that can contribute to either the failure or success of the m-banking services and this could be further used for decision-making. To academia, the research would serve as a source of academic reference for further studies.

3. Literature review

Microfinance around the globe has shown promise of providing financial services to the poor people. It is considered as an effective tool to alleviate poverty (Armendariz & Morduch, 2010). Moreover, microfinance has developed as the provision of financial services to micro entrepreneurs and small businesses that lack access to banking and related services due to the high transaction costs (Maneiah, 2012) and it is generally used in order to provide help to micro and small-scaled entrepreneurs and companies which generally have difficulties in reaching financial and banking services due to cost and financial resource limitations (Turner, 2011). Hartarska, Shen, and Mersland (2013) describe microfinance as the financial service supplied for poor people and micro-scaled companies. MFPs are now offering many financial services such as deposits, insurance, remittances, automatic teller machines (ATMs) services, housing and money transfer (Ahmed, 2012).

The Sudanese experience showed that microfinance has a positive impact on income-generating activities, women's empowerment, improvement in education, access to financial services, poverty alleviation, and better health services. Badri's (2013) study's main findings revealed that participation of women in micro-credit program helps in promoting women's empowerment, in particular the economic and sociocultural dimensions of empowerment. Impact Evaluation Assessment MFI Sector in Sudan 2007–2012 (2013) study shows that microfinance clients respondents reported an improvement in nutrition for their families (46.7% of clients), followed by better access to education (36.3%), better access to health services (33.8%), and purchase of property (30%). When compared to non-clients, less impact is reported by non-clients in all areas. El Habeeb, Maruod, and Elteama (2014) study the role of Rural Development Project (NKRDP) as a microfinance institution in women development in North Kordofan. The results showed that the project helped in providing education services, health services, water services, fuel services, and handcrafts, respectively. Siddig (2013) stated that microfinance providers in Sudan have shown impressive contribution in delivering financial services to the poor and their enterprises. Microfinance institutions enable poor low-income households to develop their microenterprises, which enhance their income earning capacity, and improve their living standard. Sayed and Belal (2013) study results show that there is a positive effect of microfinance on poverty reduction by 16%.

Furthermore, offering financial services to poor people under the traditional microfinance setting is sometimes costly, unproductive, unprofitable, and unappealing for MFPs; the main problem with poor people's access to finance is that they are too costly to serve (Mas, 2011). Sudan microfinance market maintains a high operating expense ratio at 56% (Situational Analysis of the Microfinance Sector in Sudan, 2006). Equally, for MFPs, the cost of reaching people is high. The lack of physical infrastructure increases the transaction costs for micro and small enterprises. Distance of microfinance institutions is a variable that is always associated with high transaction costs (Hassan & Bauer, 2013). Further, Hinson (2011) highlighted geographical distance as a main factor preventing poor people from accessing traditional banking services. Ivatury and Pickens (2006) study stresses

that banks will aggressively target the poor as a market only if they find ways to serve these customers profitably.

It should be noted that microfinance is an important and influential tool to combat poverty in Sudan. The Sudanese microfinance project made moderate satisfactory progress toward achieving the proposed objectives. Microfinance in Sudan has proven to be an impressive tool for applying business practices to solutions of poverty. It is important to continue building on this success to develop innovative solutions that can reach all microfinance customers. Yousif, Elizabeth, Jacinta, and Olga (2013) claim that even now MFIs face two important barriers in achieving scale: operational inefficiencies and high operational costs, both of which contribute to keeping interest rate high. She noted that with the appearance and development of mobile payments, it comes to the promises for many MFIs to address these barriers and offer m-banking.

3.1. Mobile banking

To reach large clients and offer better services, MFPs should bring the banking services to the doorstep of poor people (Nestor & Edelstein, 2011). The mobile revolution has transformed the lives of many people in developing countries, providing not just communications, but also basic financial access in the forms of phone-based money transfer and storage (Demombynes & Thegeya, 2012).

It should be recalled that M-banking can carry financial services close to the poor peoples' lives (Alexandre, 2011); it can reduce the problem of lack of proximity and high cost to reach distant clients with bricks and mortars branches (Breul, 2012). Besides, M-banking uses mobile phones to perform various functions like mini statement, checking of account history, SMS alerts, access to card statement, balance check, mobile recharge, etc. (Vinayagamoorthy & Sankar, 2012). Researchers use various terms to refer to mobile banking, including M-banking (Liu, Min, & Ji, 2009), branchless banking (Ivatury & Mas, 2008), m-payments, m-transfers, m-finance (Donner & Tellez, 2008). M-banking, also known as mobile money, is used as a broad term to define the usage of a mobile phone to access financial services (Pierre-Laurent, 2011). It allows customers to use their mobile phone as another channel for their banking services, such as deposits, withdrawals, account transfer, bill payment, and balance inquiry.

Additionally, the implementations of m-banking have many advantages for microfinance institutions. M-banking helps microfinance institutions to serve existing customers better as well as to reach new customers. Due to mobile banking, rural banks in the Philippines reduced interest rate monthly from "2.5 to 2%" and "fees from 3 to 2.5%", mobile banking also reduces at least 2.20 cents travel costs for clients (Kumer, McKay, & Rotman, 2010). Meanwhile, the Pakistan experience highlights an important point about the link between M-banking and microfinance. (Michel & Sarah, 2013) According to the PHB Development¹, there are 154 microfinance institutions using m-banking channel around the world (Voorrips, Breul, & Coupienne, 2012) Nestor and Edelstein (2011) argued that m-banking can amplify trust and transparency for MFIs by sending short message services (SMS) to customers after repayment or disbursement of loan. Conzett, Pulido, Lacalle, and Javier's (2010) study with microfinance institutions in Tanzania shows that m-banking increases outreach in rural areas. Moshy and Mukwaya's (2011) survey results in Uganda and Tanzania show that mobile financial services reach rural areas and greater number of clients who were previously excluded from financial services. M-banking is considered more convenient for clients in terms of flexibility, especially in saving small amount, in obtaining loan and repayment (Goss, Mas, Radcliffe, & Stark, 2011) due to its reliability and convenience (Ivatury & Mas, 2008).

Moreover, realizing the importance of m-banking technology for Sudanese microfinance sector, in October 2010, the Central Bank of Sudan (CBOS) contracted two consultants from HORUS Development Finance to investigate a pro-poor branchless banking initiative in Sudan. Yassir's (PACT, Yassir & Hassan, 2012) study reveals that in Sudan, the traditional and informal mobile phone transfer is dominating the market by 62% varying from one region to another, but it seems that where the banking services are not accessible probably, this percent increased as appears in West 80% and

East 81% . Meanwhile, Aversano, Evers, Latif, and Vaca-Viana's (2013) study reveals that mobile phone coverage in Sudan is extremely high, with 80% of retailers owning one phone, and 18% owning two. Most importantly, the results highlight the direct positive impact of mobiles on business efficiency in Sudan. According to ZAIN PWC (report 2014), in Sudan, m-banking for the unbanked has the potential to include a huge part of the population in banking services. Ismail's (Ismail & Osman, 2012) study results show that 84% of the retail banking industry clients uses at least one of the e-banking services, among all e-banking channels in Sudan m-banking is used by 12.6% of the clients.

3.2. Factors influencing mobile banking adoption

An individual's acceptance and adoption of innovation differs from organization innovation adoption in terms of the factors that influence such adoption (Moon & Norris, 2005; Titah & Barki, 2006 cited in Al-Zoubi, Sam, & Eam, 2011).

In this regard, various factors may influence customers' adoption to new technology. There is a need, therefore, to understand users' acceptance and adoption of m-banking and to identify the factors affecting their intentions to use mobile banking. Masinge (2010) conducted a study on the factors influencing the adoption of m-banking services at the bottom of the pyramid (BOP) in South Africa. The results of the study revealed that perceived usefulness (PU), perceived ease of use (PEOU), perceived cost, and customer's trust had a significant effect on the adoption of M-banking at the BOP, while perceived risk (PR) was found to have no significant effect. Tingari and Abdelrahman (2012) use extended TAM to explore the evolution of banking technology in Sudan. The study found that demographic factors such as age, income, education, and bank treatment period have no effect on customers' intention to use bank technology. Using TAM, Crabbe, Standing, Standing, and Karjaluoto's (2009) study showed that social and cultural factors in the form of perceived credibility, facilitating conditions, and demographic factors play an important role in influencing adoption and sustained usage of m-banking in Ghana . Carlsson, Carlsson, Hyvönen, Puhakainen, and Walden (2006) studied the factors affecting intention to use mobile devices/services. The study reveals that performance expectancy and effort expectancy are affecting behavioral intention, but social influence is not influencing behavior intention to use mobile devices/services. Also, Yu (2012) employs the (UTAUT) to investigate what impacts people to adopt m-banking in Taiwan. His study concluded that the individual intention to adopt m-banking was influenced by; social influence, performance expectancy, perceived financial cost, and perceived credibility. Furthermore, Karjaluoto, Mattila, and Pento (2002) evinced that prior experience with computers and technology and attitudes toward computers influence both attitudes toward online banking and actual behaviors. McKay and Pickens (2010) argue that in order for the poor segments of the population to adapt the service, it is important for the service provider to develop products that meet their needs in terms of product characteristics as well as price. Moreover, a study by Laforet and Li (2005) on factors influencing the adoption of online banking among Chinese banking clients shows that two-thirds of their surveyed sample did not adopt online banking because they were either not aware of the service or were not clear about its benefits. Besides, Benjamin (2013) investigates the facilitators and obstacles to entrepreneurial mobile banking in Nigeria, the study found lack of basic needs for banking services arising from low income and unemployment was the main reason for financial exclusion. It should be recalled that banking needs refer to the variety of banking products and services required by an individual (Tan & Teo, 2000). Ketkar, Shankar and Banwet (2012) identify lack of basic need for banking/ payment services as barriers to m-banking adoption. Luarn and Lin (2005) deem perceived self-efficacy as a necessary capability in using m-banking.

On the supply side, within the organization context, Muriuki's (2009) study aims to establish factors affecting the adoption of E- banking by microfinance institutions in Kenya. This study's results indicate that MFIs with a strong support and commitment to e-banking from top management are more likely to adopt it. MFIs that have requested ICT and business resource (Infrastructure, Infostructure, and skills) for e-banking adoption stands a better chance at adopting e-banking. Further, Khattab et al.'s (2012) study's aims are to investigate the factors that are essential to the

development of branchless banking in Sudan using mobile technology. Their study results revealed that there are essential factors for the success of branchless banking in Sudan, e.g. the identification of the industry key players and their roles, the enabling regulatory environment, the infrastructure readiness, and Sudanese cultural values. Moreover, Benjamin's (2013) study's findings revealed that conservative and vague regulations; security issues; underdeveloped infrastructures; lack of interoperability; business model issues; and lack of basic need for banking/financial services were identified to be the obstacles to entrepreneurial m-banking. Further, Khatri's (Khatri & Kurnia, 2011) study's results show that lack of collaboration between the banks and telecommunications providers, consumer's lack of experience with technology, and poor network reception could be a reason as to why implementation of mobile-based services has been slow in Australia. A study conducted by Chong, Ooi, Lin, and Tan (2010) in Vietnam found out that a government support in connection with consumer intention to use online banking is highly essential. Toufaily and Daghfous (2009), using TOE framework, conducted study on success and critical factors in adoption of E-banking by Lebanese banks. The results of their study show that the organizational variables (bank size, functional divisions, technical staff, technical infrastructure, perceived risks, decision makers' international experience and mastery of innovation) are variables which exert significant impact on the adoption of E-banking. Ismail and Osman's (2012) study on e-banking usage in Sudan shows that available infrastructure in Sudan is not sufficient to fulfill the requirements of e-banking technology in all parts of the country. Besides, the government has a major role to play in promoting the basic infrastructure required to increase the diffusion of e-banking. Moreover, there is need to enact legislation to protect e-transactions. Financial resources are an important factor in facilitating innovation adoption for any organization and they are often correlated with the firm size (Iacovou, Benbasat, & Dexter, 1995; Kuan & Chau, 2001). Al Nahian Riyadh, Akter, and Islam's (2009) study aims to investigate the factors that affect SMEs' adoption of e-banking in Bangladesh. The study identified seven variables affecting e-banking adoption by SMEs. They are: organizational capabilities, perceived benefits, perceived credibility, perceived regulatory support, ICT industries readiness, lack of financial institutions readiness, and institutional influence. Moreover, Ramdani, Kawalek, and Lorenzo (2009) combined TPB, TRA, TAM, DOI, UTAUT, and TOE to study adoption of Enterprise Systems, including ERP, CRM, SCM, and E-procurement by SMEs in (UK). Their results indicate that firms with a greater perceived relative advantage, a greater ability to experiment with ES before adoption, a greater top management support, a greater organizational readiness, and a larger size are predicted to become adopters of ES. Further, Yousif et al. (2013) reviewed MFI experiences with mobile financial services. The study suggested that: the right market environment is essential (Mobile network operators dominate the MFS market, current markets are primarily urban and semi-urban, a vibrant mobile payments market—such as money transfers—is a necessary condition for the success of mobile financial services). There is a need to advance organizational structure, training, and communication strategies. Ensuring that MFIs successfully implement MFS requires a carefully thought-out change leadership strategy. There are challenges with IT/MIS integration. IT/MIS integration is one of the greatest challenges faced by MFIs today. Innovation in products and services is limited. The regulatory environment influences everything. A CGAP research about microfinance and mobile (Michel & Sarah, 2013) noted that MFIs that have been successful in using m-banking for their operations are located in mature m-banking markets where customers are already aware that the mobile phone can be used for payments. Ongwenyi (2012) study was carried out to examine the influence of mobile phone banking technology on traditional banking transactions with reference to Kenya's banking institutions. The study's findings indicated that mobile phone banking can be said to have transformed the way banking activities are undertaken. This has been through introduction of new products and services that as per the study findings include cash transfers, payment of bills, deposits and account statement inquiries. Ketkar et al. (2012) show that, Critical mass of users for growth, as barriers to m-banking implementation. Zhu and Kraemer (2005) developed theoretically and evaluated empirically an integrative research model incorporating TOE factors, for assessing e-business use and value at the firm level, based on which a series of hypotheses are developed. The study found that technology competence, firm size, financial commitment, competitive pressure, and regulatory support are important antecedents of e-business use.

3.3. Technology adoption theories

There are various models that help to study the adoption behavior of mobile banking services. These models include various attributes that judge the intention of the mobile banking user and his/her attitude toward it. These models are: Theory of Reasoned Action (TRA) Fishbein and Ajzen (1975); Technology Acceptance Model (TAM) Davis (1989); Theory of Planned Behaviour (TPB) Taylor and Todd (1995); Innovation Diffusion Theory (IDT) Rogers (1995); Unified Theory of Acceptance and Use of Technology Model (UTAUT) Venkatesh, Morris, Davis, and Davis (2003) and Technology-organization-Environment framework (TOE) (Tornatzky & Fleischer, 1990).

In this respect, the factors that affect the technology adoption decision of m-banking services by individuals were studied using either the Technology Acceptance Model (TAM) such as Masinge (2010), Tingari and Abdelrahman (2012), Luarn and Lin (2005), Crabbe et al. (2009), Sripalawat, Thongmak, and Ngramyarn (2011), Al Nahian Riyadh et al. (2009), Tobbin and Kuwornu (2011), Ramdani et al. (2009) or the Unified Theory of Acceptance and Use of Technology (UTAUT) model such as Park, Yang, and Lehto (2007), Yu (2012), Carlsson et al. (2006), Ramdani et al. (2009).

It should be mentioned that TAM is a popular technology model and is a widely applied model for the acceptance and usage of ICT. According to Bagozzi (2007), TAM fails to take the group, cultural, or social aspects of technology acceptance into account. TAM has limited use in explaining users' attitudes and behavioral intentions to adopt mobile services (Venkatesh & Davis, 2000). The UTAUT model successfully integrates key constructs from existing ICT adoption models and is able to explain 70% of the variance in intention to use a system, as compared to 40% by TAM (Aldhaban, 2012; Yun, Han, & Lee, 2011). The UTAUT model explains the determinants of behavioral intention and use behavior of technology systems. The direct determinants include performance expectancy, effort expectancy, social influence, and facilitating conditions. The key moderators include gender, age, experience, and voluntariness of use. According to Park et al. (2007) UTAUT has been considered the most prominent and unified model in the stream of information technology adoption research with high robustness of the instruments regarding the key constructs.

Meanwhile, the Technology-organization-Environment (TOE) framework identifies three aspects of an enterprise's context that influence the process by which it adopts and implements a technological innovation: technological context, organizational context, and environmental context. Although TOE was not used widely in the m-banking context, it has been employed in e-business (Zhu & Kraemer, 2005), e-banking (Al Nahian Riyadh et al., 2009; Ayana, 2014; Kurnia, Peng, & Liu, 2010; Toufaily & Daghfous (2009)), e-government (Sara, 2012) Enterprise Systems (Ramdani et al., 2009). These applications have similar contexts and share common features with m-banking.

3.4. Theoretical framework

To build the research framework, we need to first identify the factors that affect M-banking intention to use and adoption by Sudan microfinance sector. Based on the literature review, there are five factors, microfinance customer factors, microfinance service providers' factors, mobile banking model, stakeholder's collaboration, and the enabling environment.

In this regard, UTAUT framework is selected to investigate factors influencing intention to use M-banking by microfinance customers for two reasons: firstly, it is the most widely utilized IS/IT adoption-based theory after TAM (Tobbin & Kuwornu, 2011). Secondly, it is a unified theory mapped onto the constructs of eight individual theories of adoption and diffusion (i.e. TRA, TAM, TPB, C-TAM-TPB, MM, SCT, MPCU, and DOI/IDT) and found to outperform all of them with a variance of as much as 70%. This study also aims to further extend UTAUT model with the inclusion of six additional factors, namely Previous Experience, Banking Needs, Perceived Self-efficacy, Awareness, Perceived credibility, and Perceived financial cost factors.

Meanwhile, the TOE has been used extensively by IS researchers to explain ICT adoption in enterprises and provides a useful analytical framework for the development and discussion of specific

factors that influence the adoption decision. It has a solid theoretical basis, consistent empirical support, and the potential for application across various IS innovations domains (Oliveira & Martins, 2011). Based on this, TOE is employed to investigate the factors that influence microfinance providers (MFPs) adoption of M-banking technology. TOE framework (Tornatzky & Fleischer, 1990) was extended by adding factors related to the adoption of M-banking within the organization and environment contexts such as *Business Model*, *Market* and *Products*, and *Partners Collaboration* (Figures 1 and 2).

The proposed framework of this study combines UTAUT, TOE and Banking Needs, Perceived Self-efficacy, Awareness, Perceived Credibility, Prior Experience, and Perceived financial cost factors to investigate factors influencing intention to use M-banking by microfinance customers and microfinance services providers in Sudan. As depicted in Figure 3.

3.5. Hypotheses development

To explain the key drivers and barriers to M-banking adoption in Sudan microfinance sector, this study is guided by UTAUT model, and the technology–organization–environment (TOE) framework proposed by Tornatzky and Fleischer (1990). Based on these models, five types of factors are described below.

Figure 1. Microfinance customer factors based on UTAUT framework.

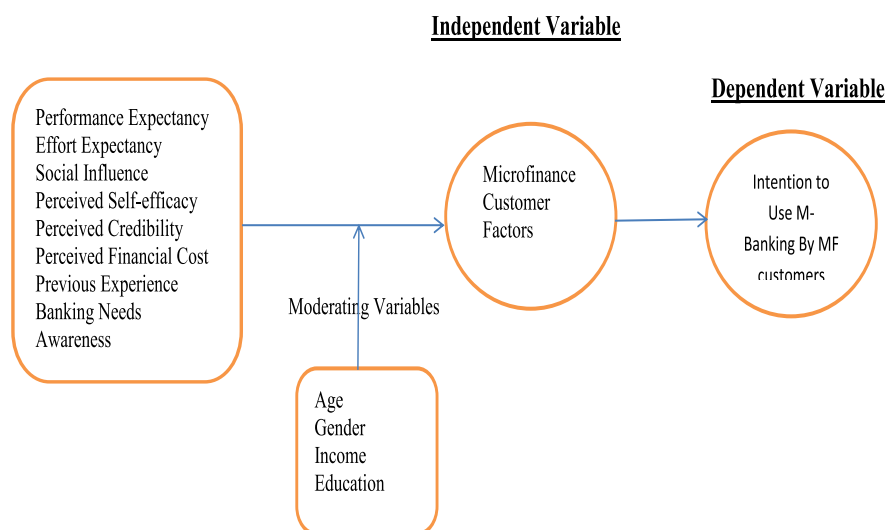


Figure 2. Microfinance service providers factors based on TOE framework.

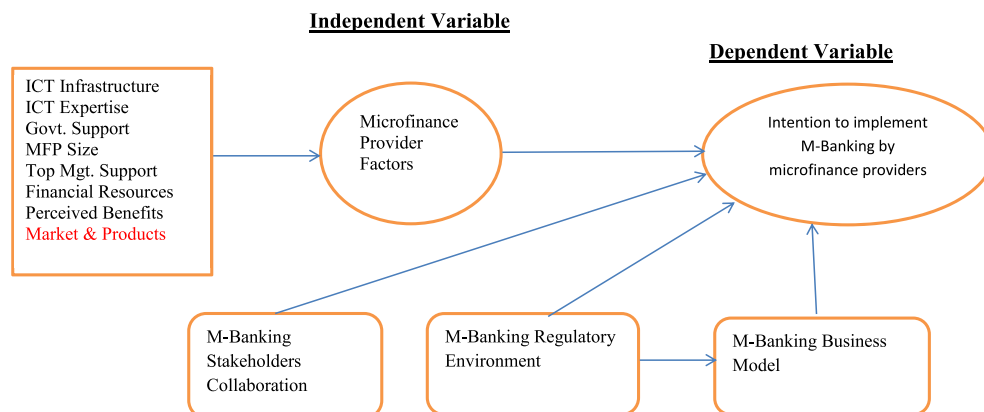
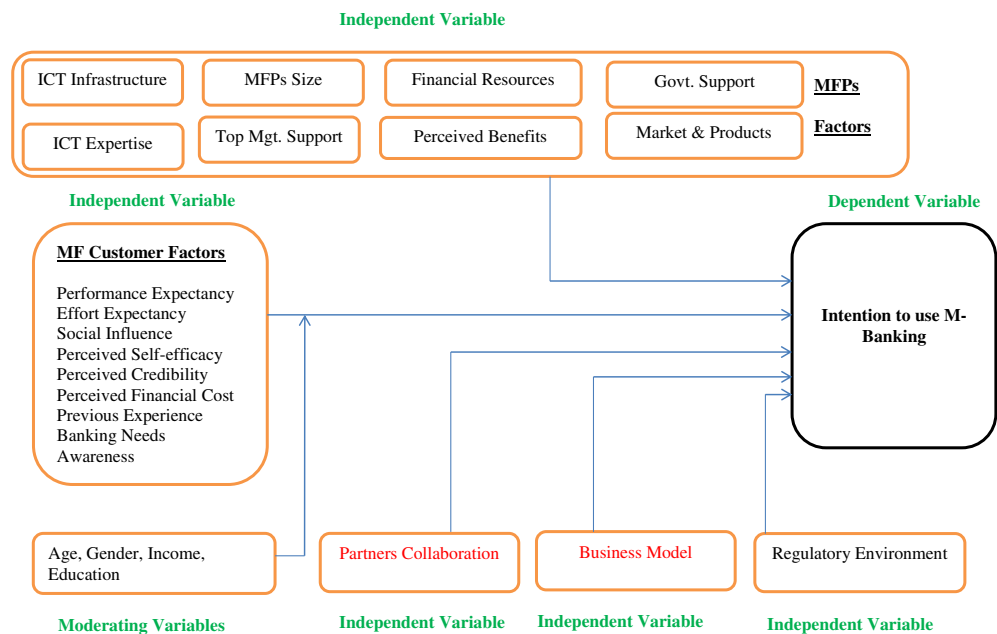


Figure 3. The combined study framework.



3.6. Microfinance customer factors

- H1: Performance Expectancy: Performance Expectancy (PE) is the degree to which an individual believes that using the system will help him/her attain gains in job . Performance expectance significantly affects individual intention to use M-banking.
- H2: Effort Expectancy: is the degree of ease associated with the use of system. Effort expectation significantly affects individual intention to use M-banking.
- H3: Social Influence: is the degree to which an individual perceives that important others believe he/she should use the new system. Social influence significantly affects individual intention to use M-banking.
- H4: Perceived Self-Efficacy: is defined as the “judgement of one’s ability to use M-banking.” Perceived self-efficacy significantly affects individual behavior of using M-banking.
- H5: Perceived Credibility: is defined as the “one’s judgment on the privacy and security issues of M-banking.” Perceived credibility significantly affects individual intention to use M-banking.
- H6: Perceived Financial Cost: Are the monetary expenses incurred when adopting an innovation. Perceived financial cost significantly affects individual intention to use M-banking.
- H7: Previous Experience: Previous experience of M-banking will have a significant influence on adoption of M-banking adoption.
- H8: Banking Needs: is defined as “the variety of banking products and services required by an individual.’ The greater the extent to which m-banking meets the individual’s needs for banking products and services, the more likely that M-banking will be adopted”.
- H9: Awareness: Awareness about M-banking has a positive effect on intention to adopt and use M-banking.

Demographic Variables: demographics characteristics, such as gender, age, business sector, and income affect M-banking user acceptance.

H10: Age will moderate the relationships among the proposed model constructs.

H11: Gender will moderate the relationships among the proposed model constructs.

H12: Education level will moderate the relationships among the proposed model constructs.

H13: Income will moderate the relationships among the proposed model constructs.

3.7. Microfinance service providers (MFPs) factors

H14: ICT Infrastructure: Increased ICT infrastructure will increase the likelihood of successful M-banking adoption.

H15: ICT Expertise: Higher level of ICT Expertise is positively related to M-banking adoption.

H16: MFP Size: The greater the MFPs size (number of employees), the more likely M-banking technology will be adopted by MFPs.

H17: Top Management Support: Top management support will positively influence M-banking adoption.

H18: Financial Resources: MFPs with greater financial commitment are more likely to achieve a greater extent of M-banking adoption.

H19: Perceived benefits: The greater the perceived benefits of M-banking, the more likely M-banking technology will be adopted by MFPs.

H20: Governmental Support: Government support affects the adoption of M-banking by MFPs.

H21: Market and Products: M-banking services adoption in a country is affected by its market conditions and Products provided.

H22: Business Model: Business model have effect on the adoption of M-banking. Regulatory framework has effect on the business model.

H23: Regulatory: Enabling Regulatory Environment affect the adoption of M-banking by MFPs.

H24: Stakeholders' collaboration: The greater the degree of partner collaboration, the more likely the MFP will adopt and use M-banking services.

4. Methodology and estimation procedure

The study used the survey research methodology. The population of the study was the microfinance customers in Khartoum, Kasala and North Kordofan states, and microfinance services providers MFPs in Sudan. Personal administered questionnaires were employed to collect the data from the customers and MFPs. Several items were used to measure all variables and for each item, a corresponding Likert Scale with anchors ranging from 1 as "Strongly Disagree" and 5 as "Strongly Agree" was used. For each item listed, the respondents were requested to mark any of the five options given. The collected data were analyzed using SPSS Version 16. Altogether, a total of 550 questionnaires were distributed and 413 were returned. However, only 393 were found usable for data analysis.

4.1. Data collection instruments

4.1.1. Primary data

Two types of questionnaires were developed to collect primary data from microfinance customers and microfinance services providers (MFPs). To ensure content validity, four (4) knowledgeable individuals, including MF and MB experts and faculty members participated in a pre-testing with an initial draft of the questionnaires. The comments and suggestions received from these individuals helped to improve the quality of the final questionnaire. This study also used a semi-structured interview for collecting relevant qualitative data.

The interviewees include microfinance sector senior staff and consulting firms.

4.1.2. Secondary information

Secondary sources of data collection were obtained for additional information. The study relied on both unpublished and published data such as articles from journals and the internet which is related to the topic.

4.2. Data analysis

Data was analyzed using descriptive statistics such as frequencies and percentages. The analysis of data was done with the help of the statistical software of Statistical Package for Social Sciences (SPSS version 21).

4.3. Reliability

To analyze the data, internal reliability of the data was first tested using SPSS. The Cronbach's alpha for the microfinance customer variables is shown in Table 1, and for MFPs variables in Table 2. Cronbach's alpha for all microfinance customer variables and MFPs variables are greater than 0.7, and therefore, the reliability of data is acceptable.

5. Results and discussion

The main purpose of this section is to present the analysis and discussion of the findings of the study. The analysis is done in line with the objectives.

Table 1. Cronbach's alpha for the microfinance costumers' variables

No.	MF customer variables	Items	Alpha
1	Performance expectance	4	0.860
2	Effort expectance	4	0.860
3	Social influence	4	0.865
4	Perceived credibility	4	0.869
5	Perceived financial cost	4	0.865
6	Perceived self-efficacy	4	0.863
7	Banking needs	3	0.865
8	Awareness	3	0.860
9	Gender		0.870
10	Age		0.871
11	Education		0.874
12	Income		0.869
13	Mobile phone experience		0.868

Table 2. Cronbach's alpha for the microfinance service provider's variables

No.	MFPs and external variables	Items	Alpha
1	ICT infrastructure	3	.944
2	ICT expertise	3	.941
3	Government support	3	.941
4	Top management support	3	.938
5	Financial resources	4	.941
6	Perceived benefits	10	.940
7	Market and services	8	.939
8	Business model	6	.940
9	Business partners collaboration	6	.942
10	Regulatory environment	4	.941
11	MFP size (number of employees)		.649

5.1. Microfinance customer

Females represent the majority of respondents with 57%. The breakdown of age groups is dominated by the group of 28–37 years which consists of 35%, this is followed by those respondents aged 38–47, which had 33%. The majority (36%) of respondents earn income ranged 1,001–2,000 Sudanese pounds, followed by (34%) an earning income less than 1000 Sudanese pounds. University graduates compose the majority of respondents (35%), followed by intermediate (19%) and Secondary (16%). Table 3 below displays major demographic data of respondent.

Majority of respondents (99%) own a mobile phone, evidencing a very high cell phone penetration rate in microfinance communities. As for the purpose of using mobile phones, 69% reported using it for personal and business reasons, followed by those who used it for personal (26%). The most preferable way to communicate using mobile phones were reported to be call and talk to people (48%), followed by those who use mobile to transfer money 31%, the least important way of communication was sending only texts 10%. In terms of years of using the mobile phone, majority (61%) had good experience in using the mobile phone since their usage is more than 6 years, followed by those who used it between 3 and 5 years (19%). In response to frequency of usage, majority (85%) use mobile on daily basis. Table 4 displays customer characteristics related to mobile phone.

Majority of respondents belong to trade sector (40%), the respondents were asked to indicate which financial services were needed, majority of respondent (60%) want Send / Receive Money services, followed by loan request 58%, paying utilities bills 56%, balance enquiry 52%, payment for services and products 51%, 49% request bank statement, 48% Saving, 42% buy airtime, and the least services needed is insurance 34%.

The data also showed that among the respondents, 56% of them owning bank accounts, 55% get microfinance services from banks, followed by 34% from MFIs. Only 48% of respondents were aware of mobile banking services; however, a huge proportion (84%) believe that m-banking is important

Table 3. Demographic statistics

Variable	Description	Frequency	Percent (%)
Gender	Male	170	43.3
	Female	223	56.7
Age	18–27	65	16.5
	28–37	138	35.2
	38–47	125	31.8
	48–60	65	16.5
Education level	Illiterate	36	9.3
	Primary	39	9.9
	Intermediate	76	19.4
	Secondary	64	16.1
	Diploma	41	10.4
	University	137	34.9
Income level	Rather not say	52	13.2
	<1,000	132	33.6
	1,001–2,000	142	36.2
	2,001–3000	48	12.2
	3,001–4,000	13	3.3
	>4,000	6	1.5

Source: Field data 2015.

Table 4. Mobile phone ownership and usage

Mobile phone	Frequency	Percentage (%)
Ownership		
Yes	388	99
No	5	01
Mobile usage purposes		
Personal	95	26
Business	17	05
Both	250	69
Mobile services		
Calls	177	48
SMS	37	10
Money transfer	116	31
Other	42	11
Mobile experience		
One year	25	06
One-to-two years	53	14
Three-to-five years	73	19
Six to eight years	235	61
Frequency of usage		
Daily	327	85
2–5 times a week	19	05
Once a week	7	02
When required	32	08

Source: Field Data 2015.

for Sudanese community, 1% of respondent use m-banking, as per customer view only 1% of the MFPs provide m-banking services.

As shown in Figure 4, the major factors affecting adoption of m-banking from customer perspective are performance expectancy (perceived usefulness) 77%, effort expectancy (perceived ease of use) 72%, and perceived credibility (security and privacy) 71%.

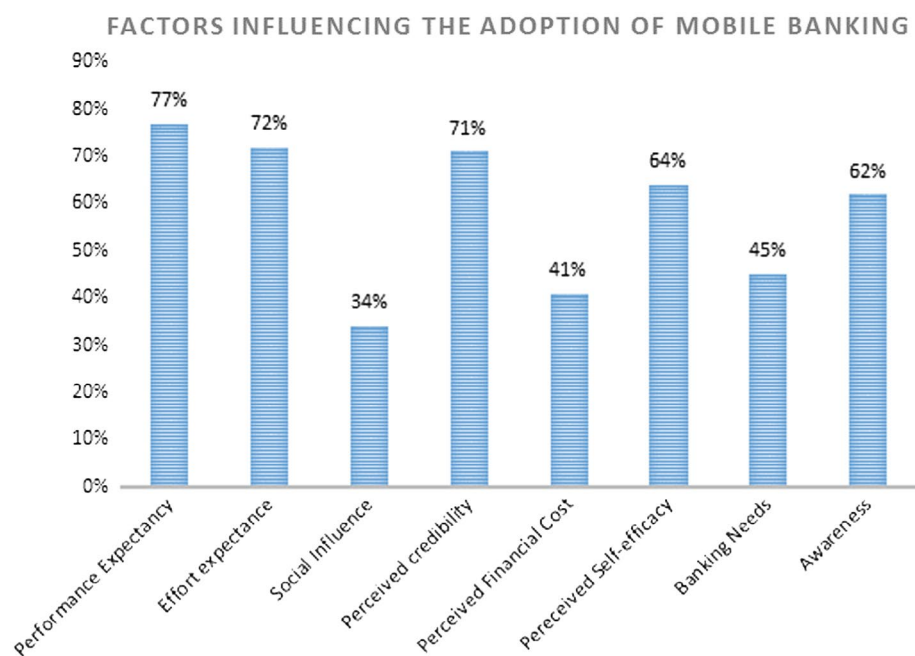
As for moderating effects of gender, age, education, and income, gender significantly moderated the effects of performance expectancy and Social Influence, Perceived Credibility perceived financial cost, Perceived Self-Efficacy, and awareness to behavioral intention. Age significantly moderated the effects of Social Influence, Perceived Credibility, Perceived Self-Efficacy, and Banking Needs. Education significantly moderated the effects of Performance Expectance, Effort Expectance, Social Influence, Perceived Credibility, Perceived Financial Cost, Perceived Self-Efficacy, and Banking Needs. Income significantly moderated the effects of Performance Expectance, Effort Expectance, Social Influence, Perceived Credibility, Perceived Financial Cost, Perceived Self-Efficacy, and Banking Needs.

5.2. Microfinance service providers (MFPs)

Majority (90%) of the responding MFPs serve in urban areas, 60% of them are banks, 20% are MFIs, 10% are companies, and 7% are NGOs. The majority of the respondents (52%) have more than 15 years in operation, 24% have six to ten years in operation, and 21% have one to five years in operation. Most of the responding MFPs (52%) have less than 5,000 active clients, 26% have more than 30,000 active clients, and 16% have between 5,001 and 10,000 active clients. The study revealed that 41% of responding MFPs have between 50 and 200 employees, and 41% have more than 200 employees.

Figure 4. Factors influencing the adoption of m-banking based on microfinance customer perspectives.

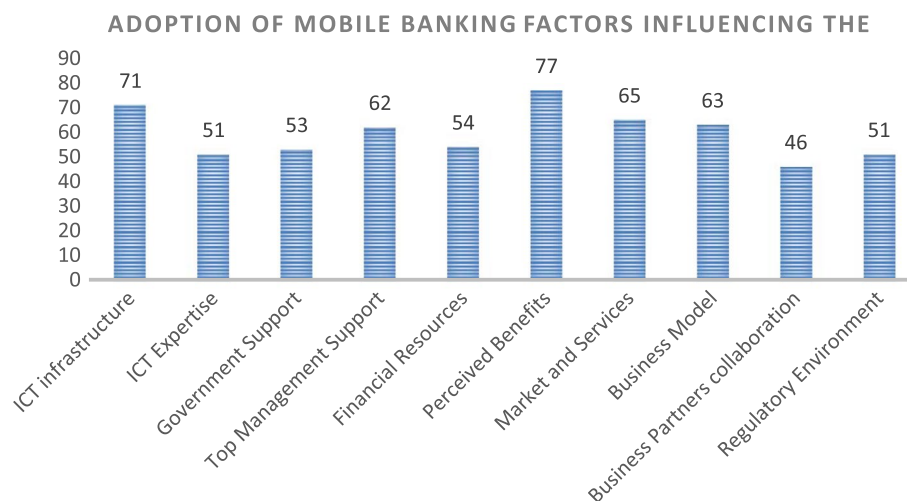
Source: Field Data 2015.



All MFPs use computerized systems in operation, majority (61%) have 100 computers, and 26% have more than 300 computers. The majority of responding MFPs (70%) have more than 5 years' experience with computers, 20% have between 3 and 5 years' experience with computers, and the rest (10%) have less than 3 years' experience with computer systems. There are 63% of the MFPs have MIS, 53% have LTS, 53% provide ATM services, and 27% provide m-banking services. Results show that majority of MFPs (87%) have a WEB page, 48% of them use it for marketing, and 31% for status, 80% for information, and 7% use the WEB page for sales purposes.

The factors affecting adoption of m-banking by MFPs are depicted in Figure 5. Majority of respondents 77% articulated benefits of m-banking to their organization as a major factor of adoption, 71% of the respondents testify that their organizations have adequate ICT infrastructure to

Figure 5. Factors influencing the adoption of m-banking based on MFPs perspectives.



accommodate m-banking applications, 65% articulated that their organization understands customers' requirements and in which market to announce its products and services. Based on Likert, MFPs that have more than 200 employees (measurement of MFP size) give high scores to ICT infrastructure readiness, ICT skills, top management support, Financial Resources, Perceived Benefits, Market and Services, Business Model, and Business Partners Collaboration.

5.3. Interview interpretation

Qualitative semi-structured face-to-face interviews were conducted with microfinance senior staff in Khartoum and Kassal states. The main objectives of the interviews were to understand the major problems facing microfinance sector outreach in Sudan and the role of mobile banking to resolve these problems. The results reveal that there is a huge market for microfinance market in Sudan, but operating cost is a major problem especially in rural areas due to local population density and poor road infrastructure. Hence, the need for m-banking services is obvious. Implementing mobile banking would require reliable ICT infrastructure mainly in rural and semi-urban areas. Most of the microfinance providers rely on traditional core banking systems, which is not suitable for the inclusion of the poor and micro-financing activities. There is no significant mobile banking initiative which can be launched in Sudan without ensuring that microfinance services providers are equipped with a stable and scalable MIS such as loan tracking system LIS, managed by competent ICT staff. There are huge differences in the degree of satisfaction and perception of clients according to the differences in geographical locations, gender types, and age intervals. Hence, the nature of products, their level of sophistications of processes and technology used should be adapted to the targeted clients, supplying such services will require adapting their organization, products, and processes. Innovation in products and services in Sudanese microfinance are limited, for example, savings and remittance services are a real need for clients of microfinance, but remain underdeveloped. Respondents claimed that government support is one of the important factors that influence adoption of mobile banking in Sudan. Issues related to customers illiteracy and awareness were also raised as factors influencing the acceptance of mobile banking services. Collaboration of different mobile banking stakeholders was also mentioned by banks' senior staff as one of the most important factors. There are two banks and one MFI realizing the benefits of mobile banking and they have begun a practical action to proceed.

6. Empirical findings discussion

The findings of the study showed that most of the microfinance customers are female, age range 28–47, educated, have moderate income, majority need financial services such as loan, saving, money transfer. Besides, majority have bank accounts, own a mobile phone, and have more than six years of mobile experience. Moreover, majority did not hear about mobile banking services but they think it is important for the Sudanese community.

The research showed that a lot of people in microfinance sector had no knowledge at all about mobile banking services, as evidenced by 48% citing lack of knowledge of the services. Results also showed that there were more people with cell phones (99%) than with bank accounts (56%). Majority of respondents (99%) don't use the m-banking service, these findings are in line with Chitungo and Munongo's (2013) findings that stated that mobile banking is a new phenomenon in developing countries and has not been well adopted by customers.

From this research finding, perceived performance expectancy (perceived usefulness), perceived effort expectancy (ease of use), perceived credibility (security and privacy), perceived self-efficacy, and awareness are seen as determinants of mobile banking adoption by microfinance customers in Sudan. As such, the study's findings were supported by the studies undertaken by Masinge (2010); Yu (2012), and Carlsson et al. (2006) that reveal that performance expectancy is a major factor in intention to use m-banking. Meanwhile, Tingari and Abdelrahman (2012); and NG Karma et al. (2014) supported perceived ease-of-use as a determinant impacting people to use m-banking. Perceived Credibility was supported by Yu (2012); and Luarn and Lin (2005) studies. Luarn and Lin (2005) deem perceived self-efficacy as a necessary capability in using m-banking. Moreover, Laforet and Li's

(2005) study reveals lack of awareness and understanding of benefits is the main factor affecting mobile banking adoption. Contrary to the author's expectation Social influence, perceived financial cost, and banking needs were found to have no influence on the microfinance customers' intention to use m-banking. According to Carlsson et al. (2006), social influence does not seem to be a major factor influencing behavior intention to use mobile devices/services. Studies from Koenig-Lewis, Palmer, and Moll (2010), Petrova and Yu (2010) suggest that there is no significant relationship between cost and behavioral intention to use technology.

Within the MFPs factors, all factors mentioned in the study—except collaboration between stakeholders—ICT infrastructure, ICT expertise, MFP size, Top management Support, organization financial resources, perceived benefits, government support, market and products, business model, and enabling regulatory environment were found to have influence on m-banking implementation by MFPs. Many empirical studies support these findings such as studies undertaken by Ayana (2014) in Ethiopia, Muriuki's (2009) study in Kenya, and Khattab et al. (2012) in Sudan revealed that infrastructure readiness is an essential factor for the success of m-banking. Ayana (2014) and Muriuki (2009) studies consider ICT expertise as a major factor in E-banking implementation. Toufaily and Daghighi (2009) and Zhu and Kraemer's (2005) studies support the importance of firm size. Top management support findings are in line with Muriuki (2009) and Zhu and Kraemer's (2005) studies. Zhu and Kraemer (2005), and Kuan and Chau's (2001) studies support organization financial resources as an influencing factor in the adoption of E-channels. Importance of perceived benefits in technology adoption has been supported by Xu, Zhu, and Gibbs (2010). Government support findings are in line with Chong et al. (2010) study in Vietnam. Market and Products findings are in line with Yousif et al. (2013) and Khattab et al. (2012) studies. According to Benjamin (2013), and Khattab et al. (2012) studies, business model is a major factor in m-banking adoption. Enabling Regulatory Environment factor was supported by Yousif et al. (2013), Khattab et al. (2012); Ismail and Osman (2012), Ayana (2014) and Zhu and Kraemer's (2005) studies.

7. Conclusion and policy implications

A significant contribution of this study is that this study extends UTAUT model with the inclusion of six additional variables, namely Previous Experience, Banking Needs, Perceived Self-efficacy, Awareness, Perceived credibility, and Perceived financial cost factors to study MF customers intention to use m-banking. The second significant contribution is that TOE framework developed by (Tornatzky & Fleischer, 1990) was also extended by adding variables related to the adoption of m-banking within the organization and environment contexts in Sudan such as Business Model, Market and Products, and Partners Collaboration. The two extended framework were combined to identify the factors influencing adoption of m-banking in the Sudanese microfinance sector. The study fills the gaps in both demand and supply of this area of important study, as most of the studies studied them individually.

We notice with optimism that most respondents of microfinance customers and MFPs had strong intentions to use m-banking. Performance expectancy and effort expectancy were the primary determinants of behavior intention in our study. This is also related to the education, age, gender, income, mobile phone ownership and customer's experience with mobile phone. Most of the MFPs (especially banks) have long experience with technology. ICT Infrastructure and ICT experts in the country are ready for m-banking. The study's results also show that participants are familiar with mobile phone technology. The use of mobile phone in Sudan microfinance sector is high. High usage of mobile phone motivates MFPs to implement mobile banking; in this case, people are familiar with the main tools of mobile banking and can use it efficiently. Moreover, the results also indicate that intention to use M-banking services is predicted by most of the factors that we used in the research models. The existing E-banking regulations can pave the road for m-banking regulations.

There are several limitations evidenced in this study. These limitations should be considered for future research and improvement. Firstly, the results of this study are collected within a few microfinance communities (three states) in Sudan and the results may not be generalized and

inapplicable to other nationalities. Secondly, most of MFPs contributed in the questionnaire are banks with good organization setup (technical, managerial, and financial). Also, most of the face-to-face interviews were carried out with senior knowledgeable MFPs staff, most of whom were exposed to microfinance experience both inside and outside the country.

Since the adoption and usage of mobile technology highly varies across countries with different adoption levels and perceptions, researchers may want to further research on multi-nationalities through expanding geographical areas to gain better generalizations in future studies.

Based on the study's findings, following are the recommendations to be considered by the concerned groups in this area:

- (1) There is a need to address security issues associated with M-banking technology so as to ensure success of m-banking technology implementation. More specifically, the issues that need to be addressed in the time being is to ensure security and privacy of existing e-channels such as ATM, EPOS and resolve all network problems.
- (2) Building customer awareness and informing the public on benefits and use of m-banking products and services is required. There should be rigorous marketing campaigns by mobile banking service providers; banks and MNOs alike, especially targeting the urban and rural communities.
- (3) Proper regulatory environment, respecting user guidelines, trusts, rights and protections, proper integration and partnership between mobile network operators and MFPs, adequate staff training and introducing client literacy for proper use, developing reliable and adequate ICT infrastructure and better product and service design are necessary to implement m-banking.
- (4) Success of m-banking implementation is highly dependent on the dedication and specialization of capacities of the MFPs. Microfinance customers need safer, more reliable, affordable, and convenient ways to manage the little money they have. A deep and realistic understanding of financial needs, constraints, and opportunities of the microfinance customers are needed to address in its proper designing.

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Note

1. Throughout this paper, an organization providing microfinance to the poor is referred to as MFP (Microfinance Provider) rather than MFI (Microfinance Institute). There

are many microfinance-providing organizations which are not MFIs, namely NGOs, CBOS, commercial banks, etc. Microfinance is one of the programs/sectors they undertake.

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