

Survey on Customer Satisfaction, Adoption, Perception, Behaviour, and Security on Mobile Banking

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ABSTRACT

This literature survey is done to throw more light on current trends, purpose and future work done in the field of mobile banking. The areas considered here include customer satisfaction, adoption, perception, behaviour, security and privacy. Most of the research papers were on mobile banking adoptions while the last two were on post-adoption and security. Research papers on mobile banking within the last ten years on adoption, with post-adoption and security related papers, were examined. After diligent and thorough search, 68 articles satisfied the criteria for this review. The review has shown that security remains one of the principal constructs that hinder users in adopting and post-adoption of mobile banking. The research also showed that the most used model in mobile banking was TAM. Again, trust, perceived usefulness, perceived ease of use, perceived risk, compatible, and performance and effort expectation constructs remain the most studied variable in the mobile banking literature. This review captures and summarizes the huge knowledge of research work done on mobile banking, where security is one of the least discussed areas. However, most of the research reviewed did suggest that future work should consider security, especially on the protection of users on this emerging technology in banking. This survey has also given researchers and academia to look for other areas besides security.

Keywords: Mobile banking; Security; Adoption; Customer satisfaction; Adoption; Perception; Behavior; Cryptography; Encryption; Decryption

INTRODUCTION

Sixteen years since the inception of activities involved in mobile banking solution in Ghana, the service can be said to be a game-changer in the country's financial services industry [1].

Mobile banking has had its inception struggles around the world, Zantel, the first mobile money telecom company launched in 1999 in Zanzibar failed just as it's launched. B-Kash a Bangladesh company; operating as over-the-counter service was not able to convince it the user's to convert their cash into digital form to manage themselves. Wizzit, which was one first mobile model banking from South Africa, suffered the same fate and faded out in the market [2]. Zain Ghana introduced mobile money in Ghana in the year 2000 known as Zain Zap, this provides customers with increased security and flexibility, reducing the need to carry cash and ensuring prompt payments of bills, goods and services. That service, however, did not get much patronage and soon faded out too. The Philippines too had Globe & Smart telecom, they had almost no active usage not more than airtime resellers, and that resulted in its collapse. However, this outlook of mobile banking has since changed.

As a result of high rate mobile phones penetration over the last decade, this technology has made possible by the financial industry players to deploy to its customers an instant financial solution through the use of self-service technologies. Mobile technology has consciously become a tool used by stakeholders in the mobile banking industry to posit consumers' adoption for mobile banking [3-5]. Their almost constant proximity to the user, together with their storage and transmission capabilities, making them suitable for a variety of payment options and for storing everything that would normally carry in a physical wallet.

The mobile banking technology is also to address the problems related to bricks and mortar banks, thus queuing, and travelling over a long distance in most cases to carry out simple banking service such as checking of balance, withdrawal and transfers of money. Payment systems and mobile devices and services are crucial, and these are defining the way we live in the twenty-first century in terms of banking. Therefore, mobile payments offer a universal payment solution, thus delivering distinctive value to both consumers and merchants [6].

The Ghana mobile telecommunication industry (GMTI) is one of

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Received: September 14, 2019; Accepted: October 01, 2019; Published: October 09, 2019

Citation: Kelly AE, Palaniappan S (2019) Survey on Customer Satisfaction, Adoption, Perception, Behaviour, and Security on Mobile Banking. J Inform Tech Softw Eng 9:259. doi: 10.35248/2165-7866.19.9.259

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the keenly competitive markets in Sub-Sahara Africa with six major international players, Yeboah -Asiamah et al. has regarded as one of the powerful economic sectors in the Ghanaian economy [7,8].

Mobile banking is a typical application in the mobile financial field. It refers to the integration of electronic money and mobile communication services through multi-industry and multi-platform cooperation between mobile telecom carriers and banking institutions [9].

Mobile payments are predicted to be one of the future's most successful mobile services but have achieved limited acceptance in developing countries to date [10-17].

This literature review is distinct on two grounds; firstly, the review has shown some common trends that cut across the already study areas under consideration with mobile banking. Thus, the review has shown that mobile adoption literature, its social and economic impact is widely studied, and the least of such literature is security on mobile banking.

Secondly; this survey reviewed over a decade articles their trends and elements this gives the best-fit understanding of the matter in the field of mobile banking and then posit in the gap of knowledge in that regard.

Mobile banking has a threefold effect and impact on the society and the country as a whole. Firstly user's impact; with the inception of mobile banking, the number of people that have drawn into this informal banking system is enormous, which formally were left unattended to by the mortal brick system of banking, this has covered almost the remotest areas as far as the network coverage could go. Mobile banking has also opened up the habit of saving by the unbanked users, [18-20]. Now there are more people have a financial account than the combination of all banks put together. This technology has reduced the issues of travelling, joining long queues, waiting for a particular time to start or close a transaction, these and many other factors have zero in the attention to mobile banking. These technologies have cut downtime, workings simultaneously on different issues and increasing efficiency [21-25].

Secondly, the industry players' in effect (Banks and Telecoms); the industry players are raking in huge sums of profit, these institutions use their existing platform to extend other services to their client through technology. The banks have added on online technology either internet or mobile banking. Mobile banking has enabled the industry to stay in touch with the client and meet their needs during off working hours. Also, the Telecoms have added this mobile banking through mobile banking operators. Mobile banking has been a game-changer for both the banks and the telecoms as an additive and transformative model in mobile banking [26,27]. The cost per channel usage in the financial transaction is higher compared to the mobile system; this has helped reducing cost on the user and overhead cost for the operators [28]. Mobile banking services monetising the value of customer analytics, delivering greater real-time access to products and services, and conducting target marketing that have increased their revenues [29,30].

Finally, the State; the introduction of mobile banking has enabled the government to get extra revenue through the taxes from the agencies, and there are more financial transaction conducted on mobile banking than the mainstream banks [31]. Again with the emerging of centralising all transactions through the operability platforms set by the government helps to enable the government to plan its activities.

LITERATURE REVIEW

The literature review considered the outcomes based on the articles, thus the discussion pattern below.

Customer satisfaction

Customers are very much happy with mobile banking transactions, according to Nagaraju the most effective factor of mobile banking is customer's satisfaction [32]. Wang and Liao describe customer satisfaction as the total effective response of varying intensity that follows mobile transaction ecosystems, this manipulated by known variables such as information quality, system quality, and service quality [33].

The inception of mobile banking technology has led to an increase in levels of customer satisfaction. Stakeholders have ventured into the use of virtual banks, mobile banking and internet banking to reduce their user's costs as well as improve on customer satisfaction, [34]. Customer satisfaction used as an indicator success of the mobile banking adoption [35].

Customer satisfaction of mobile banking has being extensible studied over this scoping period of this research, Geetha and Vinay used an empirical survey to study value-added to technology-savvy customers, the research indicated that financial security, education and training, connectivity and reliability were the most assertive factors influencing the value added to the customers satisfaction [36]. In the other narratives from Nagaraju he used exploratory research method to look out for factors affecting the satisfaction of users in mobile banking [37]. The study conclusion came out that, cost, security and time are the main factors leading on consumer satisfaction to adopt mobile banking. However, they suggested that if banks will spend time and resource on awareness creation and building customer-friendly software's that will also go a long way to enhance customer satisfaction.

Notwithstanding that, Oscar mentioned that factors such as tangibles, reliability, responsiveness, security, and empathy, thus, communication and understanding; would be the most demanding factors to uphold users satisfaction, he however also indicated that perception of individual could improve in other not negatively affect the service, in the case of physiotherapy services [38]. Romario and Maseke using quantitative design, crystallising through the factors to influence the customer satisfaction, had this principle factors such as; reliable, convenient, cost-effective, available on different mobile networks, advertisements are encouraging, service is compatible with mobile devices, income (social aspect of transacting) is contribution factors on customer satisfaction [39]. In the study of Brown et al. using qualitative approach and UTAUT model, to investigate factors influencing satisfaction with cell phone banking in South Africa, their conclusion was that; service quality, information quality, system quality, transaction and payment quality, perceived usefulness, trust, innovativeness were most established factors to influence customer satisfaction [40].

In summary, customer satisfaction was one of the most researched areas in the mobile banking literature, the most occurrence factors, which influence customer satisfaction and have strongly suggested in almost all the research under customer satisfaction, is "security". It was determined to be the most preferred factor in satisfying and assuring customers of their safety and interns of data generated along their transactional process of mobile banking. The following factors also appeared to have influenced customer satisfaction,

reliability, perceived ease of use, perceived usefulness, system quality, compatible, and cost-effectiveness. Table 1 gives additional information on literature, on customer satisfaction.

Adoption and impact

There are several definition, concept and model that have used adoption, this review set is not on any particular field of definition on adoption, but the general customer adoption concept. According to Bharti mobile banking has received as adoption tool for banking

in the recent years than ever, and this has had a huge impact on the global business pattern across individuals and state [41-47].

According to Rogers, adoption as a process composed of learning, deciding and acting over some time, till a decision to continue full use of an innovation [48]. Adoption may be both an economic necessity and the result of peer pressure [49]. The process of adopting innovation has well been studied, and one of the most popular adoption models described by Rogers, Diffusion of Innovations, Sherry et al. and Rogers have used the term "Innovation-decision

Table 1: Customer satisfaction.

Author/year	Main Task resolved	Tools and methodology used	Principal factors discovered
Geetha and Vinay (2017) [36]	value-added, innovative mobile financial services while retaining and even extending their base of technology-savvy customers	An empirical survey Statistical Package for Social Sciences (SPSS. 20) Diffusion of innovation	Financial security, Education and training Connectivity and reliability
Nagaraju (2015) [32]	factors affecting the satisfaction in mobile banking	Exploratory research/chi-square test and factor analysis TAM	cost, security, time and customer satisfaction
Romario and Bernardus (2018) [39]	the factors of mobile banking that influences customer satisfaction	Quantitative design/self-administered structured questionnaire/Descriptive statistic/Excel SERVQUAL model	Reliable, convenient, cost-effective, available on different mobile networks, advertisements are encouraging, service is compatible with mobile devices, income (the social aspect of transacting)
Brown et al. (2010) [40]	investigate the factors influencing satisfaction with cell phone banking in South Africa.	UTAUT/qualitative approach/face-to-face interviews/Convenience and snowball sampling	Service Quality/Information Quality/System Quality/Transaction and Payment Quality/Perceived Usefulness/Trust/Innovativeness/Security
Oscar (2013) [38]	to assess the quality of physiotherapy services (customer satisfaction)	Survey SERVQUAL model	Tangibles, reliability, responsiveness, assurance (including competence, courtesy, credibility, and security) and empathy (including access, communication, and understanding)
Gomathinayagam et al. (2019)	to analyse the problems faced by the customers during the use of mobile banking	chunk sampling technique Mann-Whitney U Test in SPSS package, Descriptive design	Login/Sign off are not easy/My handset does not have the capability to use Mobile Banking/Security issues/Required facility not available/Outdated Apps often mean out of date security/I Poor connectivity lead to poor security/Virus attack the mobile banking App/Risk by hackers
Susobhan (2017)	Investigating customers ready to use mobile technology for banking transaction.	Questionnaire/cross-section research TAM	Perceived usefulness and/perceived ease of use/utilitarian attitude
Jannatul (2010)	to understand the impact of variables of e-banking on customer satisfaction in Bangladesh.	SERVQUAL model survey interview	reliability, responsiveness and assurance
Sagib and Zapan (2014)	to explore the perceived service quality dimensions and their impact on customer satisfaction	self-administered questionnaire survey and a confirmatory factor analysis SERVQUAL	reliability and responsiveness, efficiency and convenience
Amiri and Faghani (2012)	To examine the relationship between mobile banking services and customer satisfaction.	SERVQUAL model The ANOVA test questionnaire	Tangible, Reliability, Responsiveness Assurance, Empathy
Thakur (2014)	Customer satisfaction and loyalty	PLS-SEM Model	Previous interactions mobile interface usability and service
George and Kumar (2013)	To investigate the effect of TAM variables on customer satisfaction in the internet-banking context	Technology Acceptance Model (TAM)	Perceived Ease of Use, Perceived Usefulness Perceived Risk of negative outcome
Mohamad et al(2014)	To investigate the relationship between technology trust and mobile banking satisfaction	The mobile network, the mobile banking website and the mobile phone a survey	The mobile network, the mobile banking website and the mobile phone
Mahamudul et al. (2017)	To investigate how the SERVQUAL dimensions influence customer satisfaction in the mobile banking industry of Bangladesh	SERVQUAL ANNOVA Questionnaire Survey Descriptive statistics	Tangible, reliability, responsiveness, and empathy significant positive relationship assurance factor has no significant

process” in place of ‘adoption process’ and have conceptualised the following five stages [50,51]:

- i. Knowledge: The individual has encountered the existence of innovation and gains some understanding of how it functions.
- ii. Persuasion: The individual forms a favourable or unfavourable attitude toward innovation adapt to it.
- iii. Decision: The individual engages in activities which lead to a choice to adopt or reject the innovation.
- iv. Implementation: It occurs when an individual or other decision-making unit puts an innovation into use.
- v. Confirmation: The individual search for reinforcements on the innovation-decision he or she has made, but they may reverse their previous decision if exposed to conflicting messages about the innovation.

The adoption process grouped into five categories and their composition give a complete meaning of adoption, as shown in Figure 1 above. Thus; innovator, they can apply and understand technical knowledge and have understood uncertainty. Early adopters, they are cautious about approving of innovation and others turned to seek their view of such innovation. Early majority, they wait and deliberate on such innovation, but they do adopt quite early before average members of the society do. Late majority they are careful and influenced by peer pressure. Laggards are cautious of change and mostly about far behind awareness of new knowledge. Under this section, the research review considers the factors for adoption and impact related to why consumers will want to adopt, in this case to mobile banking. According to Shamsher the adoption and impact of mobile banking on consumers influenced by safety and security, reliability, efficiency and responsiveness [52]. Notwithstanding that, Prerna and Singh in their earlier research using exploration methods indicated that mobile handset operability, security or privacy and standardization of services, have indeed influenced the consumer in adoption to mobile banking [53]. In Mostafa and Eneizan study’s on factors influencing the acceptance of mobile banking, using a survey, the research findings showed that perceived self-efficacy, perceived

ease of use, and perceived usefulness are reliable to impact on consumer’s choice on the adoption of mobile banking [54]. This was similar to what, Emma Slade et al. when using exploration study, mentioned that, the factors affecting nonusers’ intention to adopt, even though they used UTUAT model and a survey method, their study outcome includes; performance expectancy, social influence, innovativeness, and perceived risk to be the most influential in aiding in adoption to mobile banking [55]. Then Endah et al. in their quantitative research to determine the attitude of the customer and the value of the customer to adopt mobile banking, they came up with outcomes which were focusing on the bank’s actions to aid adoption [56]. The following factors stand as factors which customer will look out for in adoption, thus; compatibility, and relative profitability and integrity. According to Glavee-Geo et al. in their study, provides comprehensive insight into the factors affecting an individual’s intention to adopt mobile banking services in Pakistan [57]. Their survey concluded that, perceived behavioural control and attitudes toward mobile banking adoption intentions were significant, they also observed that the effect of perceived behavioural control on mobile banking adoption intention was found to be significantly stronger for men than for women, even though the study was to look at gender difference in adoption of mobile banking in Pakistan. From Hamza et al. using exploratory study through a survey to determine factors affecting Jordanian consumers’ adoption of mobile banking services, from their finding which came close with what have been discussed on adoption, but concluded that self-efficacy, trialability, compatibility, complexity, risk and relative advantage were statistically significant in influencing mobile banking adoption [58]. Again from Ibrahim and Sohail with a different perspective influenced, concluded that trial ability and complexity perceived risk hurts adoption influence consumers to adopt [59,60]. Their study was done under a different jurisdiction, by Kibicho and Mungai to evaluate the intention of adopting a future mobile payment service from the perspective of Brazilian consumers of mobile phones [61-62]. Using a Unified Theory of Acceptance and Use of Technology (UTAUT) model, indicated that, performance expectation, effort expectation, social influence and perceived risk, good performance, easy to use, security promotes the action of the social circle in adopting mobile

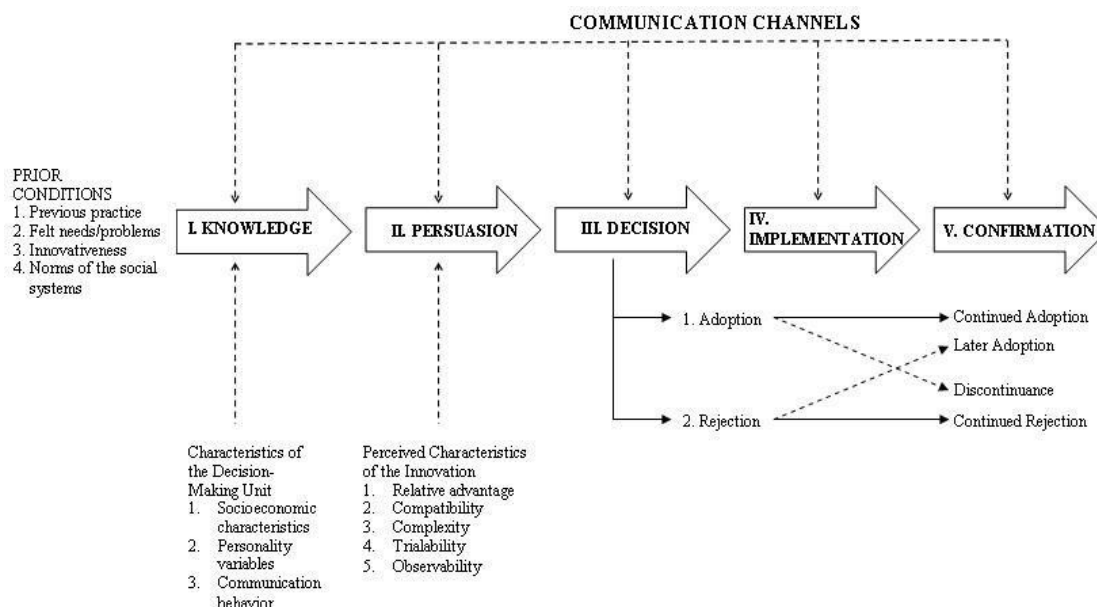


Figure 1: A Model of Five Stages in the Innovation-Decision Process (Source: Diffusion of Innovations, Fifth Edition by Everett M. Rogers. Copyright (c) 2003 by The Free Press.

banking. However, added that Perceived cost not significant in influencing the adoption.

From the overview of the review as shown in Table 2, summarise of factors considered by different research under the adoption of

mobile banking; there are several other factors which have strongly influenced the users in adopting mobile banking. This is consistent with other literature reviewed, where perceived privacy, security and risk are most factor which has negative impact influencing

Table 2: Adoption of consumers

Author/year	Main Task resolved	Tools and methodology used	Principal factors Discovered
Shamsher (2014) [52]	The adoption and impact of mobile banking on customers	Survey research convenience sampling method, Anova and factor analysis, SPSS 16 DOI	Safety/security, reliability, efficiency and responsiveness
Perna (2011) [53]	To explore the issues in mobile banking which was perceived as critical for adoption by mobile banking users as well as non-users	A structured questionnaire/Data analysis was done using correlation, Independent sample T-test, ANOVA, percentile analysis TAM	Mobile handset operability, security/privacy and standardization of services
Mostafa and Eneizan (2018) [54]	To investigate factors influencing the acceptance of mobile banking in Libya	Survey/Quantitative approach/linear regression analysis/Statistical Package for Social Scientists (SPSS) TAM	Perceived self-Efficacy, Perceived ease of use, and perceived usefulness
Emma et al. (2015) [55]	To explore the factors affecting nonusers' intentions to adopt Remote Mobile Payments	Unified Theory of Acceptance and Use of Technology (UTAUT)/A survey/Structural equation modeling (SEM)	Performance expectancy, social influence, innovativeness, and perceived risk
Endah and Isnalita, (2018) [56]	The attitude of the customer and the value of customer to adopt mobile banking.	Questionnaires/quantitative research/structural equation modeling (SEM) using SMARTPLS application TAM	Compatibility/relative profitability/integrity
Richard et al. (2017) [57]	Provides comprehensive insight into the deciding factors affecting an individual's intention to adopt mobile banking (m-banking) services in Pakistan	A survey approach TAM and TPB	Perceived behavioral control (PBC) and attitudes (ATT) toward m-banking adoption intentions
Hamza et al. (2011) [58]	Factors affecting Jordanian consumers' adoption of mobile banking services	Exploratory study/the survey UTAUT	Self-efficacy, trailability, compatibility, complexity, risk and relative advantage were statistically significant in influencing mobile banking adoption
Ibrahim and Sadiq (2012) [59]	Mobile banking adoption: application of diffusion of innovation theory	Diffusion of Innovation convenience sampling technique	Past experiences, lifestyle and beliefs banking support and provision of variety of services
Mohamed and Tarek. (2013) [60]	Mobile Banking Adoption: An Examination of Technology Acceptance Model and Theory of Planned Behavior	TAM and TPB models. A survey	Mobile banking adoption Attitude Perceived usefulness/Behavioral control Subjective norm/Perceived ease of use
Shamrao Ghodke (2013)	Explores the factors which help in penetrating the use of mobile banking among major consumers	A survey research Factor analysis UTAUT	Consumer awareness/usefulness and/ease of use
Ricardo de Sena (2013) [62]	To evaluate the intention of adopting a future mobile payment service from the perspective of current Brazilian consumers of mobile phones, based on the Unified Theory of Acceptance and Use of Technology (UTAUT)	Unified Theory of Acceptance and Use of Technology (UTAUT)/The survey/structural equation modeling	Performance expectation, effort expectation, social influence and perceived risk. Good performance, easy to use, secure and promotes the action of the social circle
Kibicho and Mungai (2019) [61]	To establish the effect of Mobile banking adoption on financial credit accessibility by residents in Wote sub-county	Descriptive research design SPSS TAM	perceived usefulness, perceived ease of use, and perceived risk
Ali Tarhinib, et al.(2019) [91]	To examine the key factors that may hinder or facilitate the adoption of mobile banking services in a cross-cultural context	Unified Theory of Acceptance and Use of Technology UTAUT2 self-administrated questionnaire g structural equation modelling based on AMOS 23.0	Trust (TR), security (PS) and privacy (PP) behavioural intention towards adoption of mobile banking services was influenced by habit (HB), perceived security (PS), perceived privacy (PP) and trust (TR) for both the Lebanese and English consumers

Mu Inoz-Leiva et al. (2016)	Develops a technology acceptance model that integrates the innovation diffusion theory, perceived risk and trust in the classic TAM model to shed light on what factors determine user acceptance of mobile banking applications	Online survey Applying structural equation modelling (SEM) DOI, Perceived risk and Trust TAM	Perceived ease of use/Perceived usefulness Attitude to use/Social image/Trust Perceived risk/Intention to use
Gëzim Tosuni et al. (2019) [15]	To evaluate the state at which mobile banking is being utilised in the Republic of Kosovo, and to what extent banks are taking advantage of this aspect of banking business	A survey quantitative research methods	Lower transaction cost/Security from fraud/Physical security Safe transaction with feedback on transfer
Hossien (2013) [60]	To investigate the factors that influence Isfahanian' intention to adopt mobile banking	Exploratory study Technology Acceptance Model (TAM)	perceived usefulness (PU), perceived ease of use (PEOU) and compatibility
Mohd et al. (2011) [11]	Factors that influence the adoption of mobile banking in Malaysia using extended Technology Acceptance Model (TAM)	Extended Technology Acceptance Model (TAM)	Perceived usefulness, perceived credibility and awareness
Hussein and Abdelhalim (2016)	Investigating the adoption of Internet banking by customers of Jordanian commercial banks	Self-administered questionnaire The factor analysis- varimax rotation TAM	Perceived privacy and security, perceived ease of use, service quality, customer trust, and customer feedback
Chen (2013) [9]	The effects of diffusion and adopters of mobile banking services (MBSs)	Questionnaires SPSS and LISREL. behavioral models	Brand awareness brand image
Cruz et al. (2010)	To investigate the perceived obstacles to the adoption of mobile banking services among Brazilian internet users	Online survey multidimensional scaling, while chi-square tests TAM	Perception of cost, risk, low perceived relative advantage and complexity
Ching et al. (2011) [64]	To investigate the factors that influence Malaysians' intention to adopt mobile banking	Technology Acceptance Model (TAM), self-administrated questionnaire, multiple regression and factor analysis	Perceived usefulness (PU), perceived ease of use (PEOU), relative advantages (RA) and personal innovativeness (PI) social norms (SN) not significant perceived risks (PR) negatively associated
Akturan and Tezcan (2012)	To investigate consumers' mobile banking adoption through an integration of the technology acceptance model (TAM) with work on perceived benefits and perceived risks	TAM structural equation modeling (SEM).	Perceived usefulness, perceived social risk, perceived performance risk and perceived benefit
Alalwan et al. (2016) [99]	Conceptual model that best explains the key factors influencing Jordanian customers' intention to adopt mobile banking	Technology Acceptance Model (TAM). Structural equation modelling (SEM) survey questionnaires	Perceived usefulness, perceived ease of use, and perceived risk.
Wessels.and Drennan(2010)	To identify and test the key motivators and inhibitors for consumer acceptance of mobile phone banking (M-banking)	A web-based survey Questionnaire TAM	Perceived usefulness, perceived risk, cost and compatibility
Sun et al. (2012) [9]	To explore the effects religious affiliation and commitment have on Southeast Asian young adults' intention to adopt Islamic mobile phone banking	Online self-administered survey TAM	Socially-oriented consumer awareness and experience
Tobbin(2012) [44]	To determine the factors that will affect the acceptance of mobile banking by the rural unbanked.	Qualitative research open-ended questions TAM	Perceived usefulness and perceived ease of use from the technology acceptance model, economic factors and trust influence
Tiago et al. (2016) [43]	To identify the main determinants of mobile payment adoption and the intention to recommend this technology	Extended unified theory of acceptance and use of technology (UTAUT2) Diffusion of innovations (DOI) Structured equation modeling (SEM)	Compatibility, perceived technology security, performance expectations, innovativeness, and social influence
Nyi Lwin et al. (2019) [63]	To explore the effects of important factors that affect that adoption of mobile banking technology by customers of Private Commercial Banking Sector in Yangon, Myanmar	Technology Acceptance Model (TAM) survey	Perceived usefulness and perceived ease of use Perceived Risk and Perceived transaction costs were found to have a negative correlation with the adoption

Abdul and Muhammad (2013) [65]	The determinants likely to influence the adoption of mobile banking services, with a special focus on underbanked/unbanked low income population of Pakistan	Technology Acceptance Model (TAM) surveying	Social influence, perceived risk, perceived usefulness, and perceived ease of use.
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consumers adoption, [63,64]; together, however; these factors also, fuel the impact on adoption of mobile banking, perceived usefulness, perceived ease of use, compatibility, subjective norm, perceived relative advantage, innovativeness, and trust according to Abdul and Muhammad [65].

Customer perception

User's perception associated with technology through the concept of TAM developed by Davis [66]. TAM explains the determinants of computer acceptance that lead to explaining users' behaviour thus, end-user computing technologies and user interest to use. The basic TAM model included and tested two specific beliefs: Perceived Usefulness and Perceived Ease of use [67-70]. Perceived Usefulness described as "the degree to which a person believes that using a particular system would enhance their job performance", Perceived ease of use refers to the degree to which a person believes that using a particular system would be free from effort" [71]. The belief of the person towards a system may influence by several other factors referred to as external variables in TAM, and these factors are what customer perception literature turns to consider and look at it veracity and degree to influence one's choice of decision making to use, in this instance mobile banking.

The survey under customer perception considered research work as customer perception in adopting mobile banking [72] research works focus on customer perception through perceived quality, using the service quality model (SERQUAL). The outcome from their work to prove why consumers will adapt to technology includes factors such as reliability, empathy and network quality. Their research was done in the telecom industry to merit why telecommunication and mobile services were relevant was indeed not far-fetched. Also, according to Tai and Fang in establishing a better measurement model for post-adoption user perception of mobile banking services using exploratory factor analysis (EFA), it was concluded that six (6) constructs were outstanding in supporting post-adoption behaviour analysis, thus; security, interactivity, relative advantage, ease of use, interface creativity and customer satisfaction [73].

In the latest research by Ali AlSoufi and Hayat Ali using an empirically study with Technology Adoption Model (TAM) to incorporate the role of factors in influencing customer's perception towards mobile banking adoption, the following was what the research come-up with as convenience to influence mobile banking [74]. Thus, perceived usefulness and ease of use, the study did also suggest that factors such as perceived cost and perceived risk did not show any effect on the users' intention to use mobile banking. The study was to enable managers to consider them as influential factors in aiding their decision making towards costumers adoption understanding. In this section of understanding the factors and reasons assigned to why customers will adapt to mobile banking, the most factors which came up was security and ease of use were preferred variable to consider. Table 3 gives detail and overview of the work done in this area on customer perception of mobile banking.

Security and encryption

Security-related matters that come with mobile banking are as a result of the insurgent from the medium from which the mobile banking is carried out and those who use it, and not necessarily because of transactions therein. Security (privacy, trust and security) issues have gradually crept into mobile banking because the reason to do so or otherwise is obvious.

Trust frequently used in the mobile banking literature, often as a common term for "privacy" and "security" Huang and Nicol, Kim and Kim and Chong et al. have explained that the precision of facts and information is known as the accuracy of trust, which means that the computation of trust is accurate at estimation time [75,76]. Trust model consists of various parameters that depend on sub-parameters and functions, and Trust model is nothing but some set of protocols which are to be followed by the service provider and their users or customers [77].

Goodwin used term privacy as the users' ability to control the environment during a transaction and dissemination of information related to providing such transactions [78].

From the survey, Uma Dixit discuss various data encryption techniques based on cryptographic technologies and review various methods of electronic banking security [79]. The various cryptographic methods looked and each working according to the medium it was intended and purposed it was built for, Advanced Encryption Standard (AES) for ATMs, fuzzy extractor, Global System for Communication (GSM) and Radio Frequency Identification for EMV cards, (Europay, MasterCard and Visa) and One Time Password (OTP) for Mobile banking. Nyamtiga et al. also with their research, on SMS based model designed security features to enhance data protection across mobile networks. Their model is a prototype to test their algorithms; they use both Global System for Communication (GSM) and Advanced Encryption Standard (AES) [80]. The outcome shows that there were still some issues that were considered to hinder mobile security, and that includes data confidentiality, user authentication and message integrity.

Hayikader et al., they examine issues on the architecture and some security issues of mobile internet banking apps; they explore some security measures to deal with the associated security challenges [81]. They adopted the Intrusion Detection System (IDS) to enhance the existing security deployed on the current system. According to Kavita and Kumar they considered the adoption of mobile banking services in the UAE [82]. The perception of risk factors about the customer, they developed a model which deployed on the customer adoption process of mobile banking. They were some concern in the cause of deployment and modelling, and the concluded that time risk, financial risk and performance risk are the most prominent factors which could hinder the security matters on adoption by the consumer. According to Wu et al. examining the security risks of mobile banking applications through the blog, mining concluded that security remains a significant attribute in determining the choice of use of mobile banking by a user [83]. However, from Ahmad and Saleh security and acceptance of

Table 3: Customer perception.

Author/year	Main Task resolved	Tools and methodology used	Principal factors Discovered
Tai and Kwoting (2009) [73]	To establish a better measurement model for post adoption user perception of mobile banking services	Exploratory factor analysis (EFA) survey	It was concluded that 6 constructs are important for post adoption behavior analysis i.e security, interactivity, relative advantage, ease of use, interface creativity and customer satisfaction
Ali and Hayat (2014) [74]	Technology Adoption Model (TAM) to incorporate the role of factors in influencing customer's perception towards M-banking adoption	Empirically study TAM	Perceived Usefulness and Ease of Use
Hiram et al. (2016) [16]	To determine the effect of antecedent variables on intention towards m-payment system using the theory of planned behaviour (TPB)	Theory of planned behaviour (TPB) SPSS Quantitative approach by means of questionnaire-based survey	Perceived Usefulness/Perceived Ease of Use Trust/Perceived Safety/Interpersonal Influence/External Influence/Self-efficacy Facilitating Condition/Attitude/Subjective Norm/Perceived Behavioural Control Intention
Kim et al. (2009) [76]	Understanding dynamics between initial trust and usage intentions of mobile banking	Empirical research a survey/ Structural equation modelling DOI	Relative benefits, propensity to trust and structural assurances
Tiago et al. (2014) [43]	A model for understanding the importance and relationship between the user perception of mBanking, initial trust in mBanking services, and the fit between the technology and mBanking task characteristics	IS theories – task technology fit (TTF) model, unified theory of acceptance and usage of technology (UTAUT), and initial trust model (ITM) partial least squares (PLS)	Initial trust, performance expectancy, technology characteristics, and task technology fit reliability
Milena et al. (2014)	Young Customers' Perception of the Quality of M-banking Services	SERVPERF questionnaire exploratory study, TAM	Saving time
Prerna and Preeti, (2011) [53]	Explores the issues in mobile banking perceived critical for adoption by both mobile banking users as well as non-users	Questionnaire ANNOVA Bank-led-model	Mobile handset operability/security/privacy, standardization of services, customization, Downloading & installing application software and Telecom services quality
Shanmugam et al. (2015) [96]	To investigate customer perceptions of internet banking in the UK	Interview DOI	Money transfers/bill payment/security
Mullan et al. (2017)	To explore drivers and barriers of bank adoption of mobile banking from a stakeholder perspective	Diffusion of innovation (DOI) Data were collected using blogging	Global mobile phone penetration, competitive advantage, customer convenience, strategic importance, customer demand, low perceived risk/security concerns and stakeholder partnerships

mobile banking depends on social influence, mobile self-efficacy, trust and the user's resistance to change [84].

The conclusion from Oluwafemi et al. studies gives the best summary to the general review of security in mobile banking usage and its other related matters [85]. Using forensic analysis of mobile banking application in Nigeria concluded that security was not given due consideration in the development of those mobile applications and certainly would induce such problem in all facets of users adoption, behaviour, satisfaction, and perception of the technology. Table 4 also gives much information about the overall work done on security related to mobile banking.

Customer behaviour

According to Hale et al. behavioural intentions are thought to be the result of both an individual influence and a normative influence [86]. Davis and Davis et al. [87,88] in the TAM, proposed that behavioural intention affects and causes actual behaviour when using a new system, this supported [87-89]. According to Davis, this concept was proposed from the perspective of behavioural

science, integrating expectation theory and self-efficacy theory, and is mainly used to study the behavioural intentions of individuals to use technology [90].

Customer behaviour or intention is an antecedent effect of both perceived usefulness and perceived ease of use Al-Gahtani, Venkatesh and Bala, Zhou, Hanafizadeh [91]. From Shaikh, in his paper, contributing to the mobile banking literature by examining consumer behaviour in mobile banking services as well as technology adoption and continuous usage using exploratory research design, concluded that perceived value is the most significant factor to influence a consumer to adopt [91-95].

Moreover, Shanmugam et al. using the same model of TAM, to find out the factors that influence Malaysian to adopt mobile banking as the tool for their banking purpose where attitude as a mediator, listed perceived usefulness, perceived benefit and perceived credibility as been the factors that influence customer or user behavior [96]. Siddik1 et al. could not agree more on these, but to support such [97]. In the case of Tobbin, exploring the key factors that affect the Ghanaian consumer's acceptance and use of mobile money transfer, his outcomes were not much different [98].

Table 4: Security

Author/year	Main Task resolved	Tools and methodology used	Principal factors Discovered
Uma Dixit(2017) [79]	To discuss various data encryption techniques based on cryptographic technologies and review various methods of E-Banking security	Cryptography	One Time Password (OTP)
Nyamtiga et al. (2013) [80]	An SMS based model designed with security features to enhance data protection across mobile networks	Encryption/GSM	Data confidentiality, user/ authentication and message integrity
Sameer Hayikader et al. (2016) [81]	They examine issues on the architecture, and some security issues of mobile internet banking apps. And then we will explore some security measures to deal with the associated security challenges		Intrusion Detection System (IDS)
Kavita and Kumar(2018) [82]	The adoption of mobile banking services by respondents in UAE and the perception of risk factors	Model was developed on the Customer Adoption Process of mobile banking	Time risk, financial risk and performance risk
Shoriful Islam(2014) [13]	Security challenges of mobile banking and payments system	Qualitative data analysis	Security Data extraction method Data synthesis
José Palacios et al. (2019)	To evaluate security of mobile applications based on Android	OWASP Mobile Security Project dex2jar, PeaZip, axml2printer, jd-gui, logcat, OWASP ZAP and Drozer.	Information gathering, static analysis and dynamic analysis the design of the test protocol
Srinivas et al. (2019)	A Survey on Accelerating Crypto Operation	SSL de-facto code coding survey	
Oluwafemi et al. (2019) [85]	Forensic Analysis Of Mobile Banking Applications In Nigeria	The OWASP Mobile Application Security Verification Standard (OWASP).	Suggest the fact that security was not given due consideration in the development of those mobile applications.
Normalini (2017)	To identify the impact of perceived security and privacy factors on customer trust and its influence on intention to continue using Internet banking in Malaysia	Self-administered questionnaires distributed using the drop-off and pick-up (DOPU) technique The SPSS statistical analysis software package and Partial Least Squares statistical	Intention Perceived Privacy Perceived Security Trust
Ahmad and Zakarya (2015) [57]	Community Perception of the Security and Acceptance of Mobile Banking Services in Bahrain: An Empirical Study	Statistical Package for Social Science (SPSS Model developed using (TAM)	Wireless connection quality, mobile banking awareness, the social influence, mobile self-efficacy, trust, and resistance to change
Wu He, et al. (2015) [83]	Examining Security Risks of Mobile Banking Applications through Blog Mining	Blog mining	Security is a significant barrier

Again, Alalwan et al. from their study to determine factors influencing behavioural intention and adoption of mobile banking by customers of Jordanian banks using UTAUT model also had the same outcome especially on performance expectancy, effort expectancy, hedonic motivation, but the construct they added price value and trust also influence the user [99]. Tan and Lau. in work to examine the intention to adopt mobile banking services among Generation Y consumers also concluded that performance expectancy, effort expectancy, perceived risk and social influence [100].

The research users of the GAM model and frequency and monetary model (RFM), for Shareef et al. who used GAM model to investigate consumers' behavioural intentions to adopt mobile banking [101]. There are three distinct service stages stated such as static, interaction and transaction service would influence users to adopt, while Behrooz Noori using RFM to the analysis of mobile banking user behaviour using customer segmentation indicated

the customer segregated to clear understanding of their needs so, as to meet their choose of influence [102].

Apart from the TAM and TPB model, the UTAUT model was also another model that mostly used for customer behaviour research. These have some interesting outcomes, according to Waranpong and Krittipat trying to explore the determinants affecting behavioral intention to adopt mobile banking among generation Y, concluded that, hedonic motivation, social influence, performance expectancy, effort expectancy facilitating security, self-efficacy in mobile banking application and behavioural intention will influence user to adopt mobile banking [103]. However, added that security hurt influencing users to adopt.

The constructs that influence users to adopt mobile banking were performance and effort expectation, perceived trust, perceived usefulness, perceived risk, perceived ease of use and self-efficacy as the most determinant that influenced a consumer to adopt. Table 5 on customer behaviour can be related to detail information on customer behaviour.

Table 5: customer behaviour.

Author/year	Main Task resolved	Tools and methodology used	Principal factors Discovered
Mahmud et al.(2018) [101]	Investigates consumers' behavioural intentions to adopt mobile banking at the three distinct service stages	Quantitative study/theoretical concept of GAM model/empirical study/regression or SEM analysis	Static, interaction, and transaction service
Shaikh, (2016) [47]	To contribute to the mobile banking(m-banking) literature by examining consumer behavior in m-banking services as well as technology (application) adoption and continuous usage	Exploratory research design TAM	Perceived value
Chian-Son (2014)	Investigating factors that influence consumers to make a transition from online to mobile banking	Decomposed theory of planned behavior (DTPB, SPSS	Relative advantage/ Relative complexity Relative compatibility/Peer group Superior group/Relative self-efficacy Relative resource facilitating condition Relative technology facilitating condition
Waranpong and Pitchayadejanant (2017) [103]	To explore the determinants affecting behavioral intention to adopt mobile banking among generation Y	Unified Theory of Acceptance and Use of Technology (UTAUT structural Equation model (SEM)	Hedonic motivation , social influence, performance expectancy, effort expectancy facilitating security self-efficacy in mobile banking application, behavioural intention security had a negative
Abrahão et al. (2016) [62]	To evaluate the intention of adopting a future mobile payment service from the perspective of current Brazilian consumers of mobile phones,	Unified Theory of Acceptance and Use of Technology (UTAUT) Structural equation modeling	Performance expectation, effort expectation, social influence and perceived risk Perceived cost was not significant
Shanmugam et al. (2014) [96]	The factors that influence Malaysian to adopt mobile banking as the tool for their banking purpose where attitude as a mediator	The technology acceptance model (TAM, 1993) structural equation modeling (SEM) using AMOS version 21	Perceived usefulness, perceived benefit and perceived credibility
Behrooz Noori (2015) [102]	An Analysis of Mobile Banking User Behavior Using Customer Segmentation	Frequency and monetary (RFM) model, Cross-selling Analysis data mining techniques	Segregation of customers
Alalwan et al.,(2017) [99]	The factors influencing behavioural intention and adoption of Mobile banking by customers of Jordanian banks	Extended Unified Theory of Acceptance and Use of Technology (UTAUT2) along with trust field survey questionnaire	Performance expectancy, effort expectancy, hedonic motivation, price value and trust
Siddhartha et al. (2011)	To investigate the antecedents of behavioral intentions of mobile banking services	Exploratory factor analysis TAMsurvey questionnaire	Perceived Usefulness and Perceived Ease of Use, factors like Perceived Image, Perceived Value, Self Efficacy, Perceived Credibility and Tradition
Hossein et al. (2012)	To analysis the factors affecting the use of mobile banking in city of Isfahan.	Theory of planned behavior (TPB), Technology acceptance model (TAM), perceived risk Structured Equation Modeling (SEM)	Behavioral intention Perceived risk Behavioral control Attitude Perceived ease of use Perceived usefulness Subjective norms
Tobbin (2010) [98]	Explored the key factors that affect the Ghanaianconsumer's acceptance and use of mobile money transfer	TAM and DoI theory Structural Equation Modeling (SEM)	Perceived Ease of Use and perceived usefulness/Perceived Trust, Trialability and Perceived Risk
Tan and Leby (2016) [100]	To examine the intention to adopt mobile banking services among Generation Y consumer	Unified Theory of Acceptance and Use of Technology (UTAUT) model	performance expectancy (PE)
Koksal (2016)	To identify the factors that differentiate customers with high intentions to adopt mobile banking	Regression analysis testing structured questionnaire snowball approach TAM	Effort expectancy perceived risk and social influence. perceived compatibility, trialability, perceived
Siddik1 et al. (2014) [97]		Structural equation modeling (SEM) TAM	Perceived financial cost, Perceived risk and Subjective norm

RESEARCH METHODOLOGY

This research was conducted with extensive literature, from various works of literature related to mobile banking, within the period of ten (10) years thus; ranging from 2009 to 2019. This survey is from the various journal, article and conference database such as Science Direct, Emerald, IEEE, Research gate, ERIC, JSTOR, Science open, British library, ACM, Wiley, google scholar, and other related research sources for this survey. These were recent broad base research ranging from peer-reviewed, scientific, working papers, conferences papers and business journals over the period.

The outcome of the raw data of the survey was grouped into like and common lexis, which appears in each research into a single related grouping. The outcome was the following; customer satisfaction, adoption and impact, customer perception and security and encryption and those that did not fall into any of these was classified as “others”. This done on the backdrop of the current trends in the field of mobile banking from reports, articles, journals and working papers were considered. This research was not restricted to any specific classification of mobile banking, either m-banking or mobile banking each research articles from that title was used.

According to Carlos and Tiago definitions given to mobile banking geared toward the scope of work that particular research is considering [104]. He classified banking as “local-centric (branches and ATM) to place- centric (internet banking) and then to equipment-centric (accessible anywhere)”, so to avoid such, the definition used in this study was considered to have general technology inclined definition about what mobile banking is, how it is, and the benefit therein with the technology. However, there were a few exceptions to the articles, any article without conclusion and future reference was not used. Again, those articles that were written in any other language apart from English was not selected. Also, there was a mixture of snowball review approach; where within the article review you pick on other articles as and when you deem fit to use; thus those that meet your scope and criteria. In all, there were 132 articles, per the criteria only 84 articles satisfied the research criteria, from these, there were articles which were grouped as “other” it had two difficult classifications these were also not used. Finally, only 68 made the specific conditions and that was what was used for the final review.

The articles were grouped base on the purpose it was presented, the author and year, the main task resolved, tools and methodology used, and principal factors discovered in the article. This resulted in haven the articles classified into, customer satisfaction, adoption, perception, behaviour, security. The articles were then reviewed based on the classification given.

Tools and methods for mobile banking

There were several tools and methods deployed in the reviewed research for mobile banking research; each one has its limitations. This section group the research work into classification, this was done after the various articles were reviewed and did not influence the search criteria. This happened as a result of the ideas, outcome and title of the research articles. Thus this classification resulted in the following, customer satisfaction, adoption and impact, customer perception, consumer behaviour, trends and development and security and encryption.

Deduction from literature

From the general outlook of the review done in respect to the best of literature, there are some issues that were not conclusively resolved from the various literature. The ultimate underline of the models could not tell, whether the conditions from which user adopted mobile banking was the same or have changed over time and as result, they have or will want to stop using the technology. There was some literature on post-adoption, which will determine how relevant these technology are to the users. Even those that were studied still could not give a general overview of the need why the adoption was relevant. The most studied literature from the review was adoption of mobile banking. The most model used in all literature under review was TAM. Finally, the most construct studied in all were Security (trust and privacy), perceived usefulness, perceived ease of use, perceived risk, performance and effort expectations, competitive advantage and benefit, compatible, self-efficacy and subjective norm.

RESULTS AND DISCUSSION

Customer satisfaction

Under customer satisfaction, the most methodology used was surveyed either qualitative or quantitative, the qualitative research was 60%, and quantitative was 40% of the research method used under customer satisfaction. The model that the literature most used for customer satisfaction was, in the ascending order, SERVQUAL, TAM, UTAUT and DOI. The variables that were considered most under section from the literature were; Security (trust and financial), reliability, compatible, connectivity, cost-effective, perceived ease of use, perceived usefulness and system quality. This can be related to in Figure 2, which gives the summary of occurrence on the models used in the articles reviewed.

Adoption and impact

With the research work done in mobile banking under the adoption and impact, the tools and methods used for all the articles indicated that; the most used tool was surveyed, this was categorised under quantitative and qualitative, the overall outcome concluded that 90% of the tools used for all research work was quantitative under the adoption. Again the most used model for research work under section was TAM, this was followed by the UTAUT. The most combined model was TAM and TPB. The review also indicated that there are some variables under

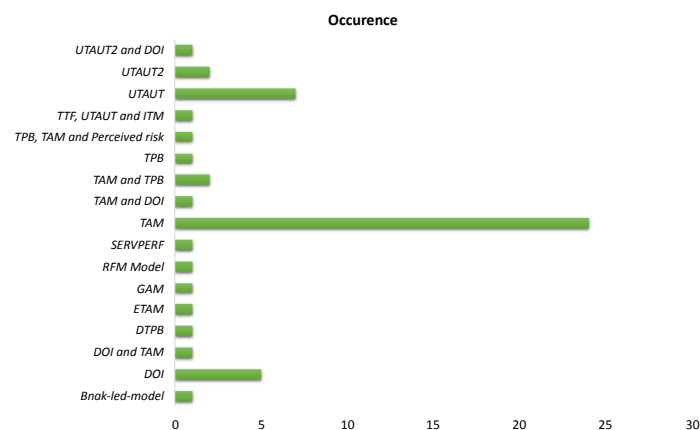


Figure 2: The models and their occurrence over the period from 2010 to 2019.

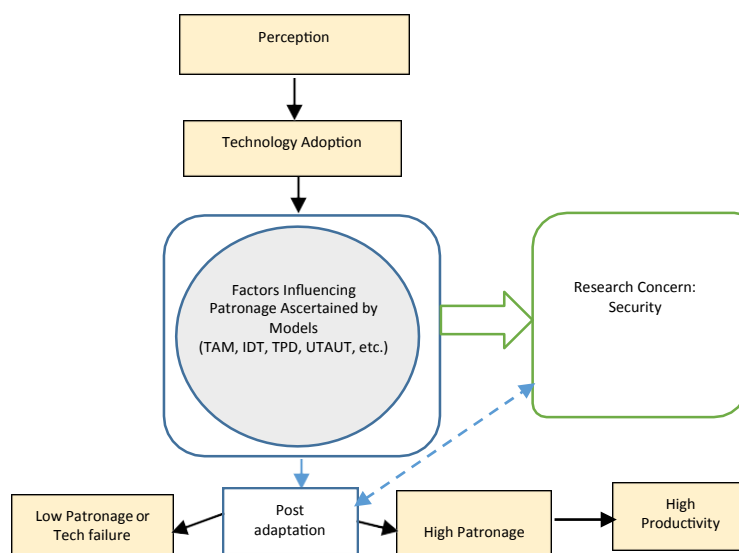


Figure 3: Security concern a major factor incomplete adoption of mobile banking.

these model which were most used. The outcome shows that, the variables that are likely to be used under adoption are; perceived usefulness, perceived risk, perceived ease of use, perceived (privacy, trust and security), compatibility and perceived relative advantage, the least used variable is, trialability, service quality, perceived credibility, consumer feedback and consumer awareness.

Security

The outcomes from the security review indicated that there is very little research work done in this field and also very little or none recommendations are followed up by stakeholders to reach the needed outcomes and benefit related to such research. The well-known tools used from the literature were cryptography and encryption and their related tools to be used. These tools were tried on some limited mobile application. This result shows the level of security lapses in the mobile security settings in those applications and others indicate the none existence of security in such applications.

Customer perception

The review shows that most of the research methodology used is survey under customer perception, also comprising of both qualitative and quantitative tools. In the section, most of the research data collection tools were quantitative, representing 93% of such numbers under the articles reviewed. The most research model used for these studies under the literature for customer perception, DOI, followed by TAM. Also, the new model for such studies introduced was SERVPERF and Bank-led-model. The most variable considered under the customer perception literature were, in the order of most used, security concerns and trust, competitive advantage and relative advantage, perceived ease of use, perceived usefulness, perceived risk, structure assurance and service quality. In conclusion, the most used model for the research review articles' were, TAM, UTAUT and DOI respectively and not or little recommendation of about security were followed up in the development stages of development (Figure 3).

CONCLUSION AND FUTURE SCOPE

The future scope of this literature will consider two issues; one the security issues which have been the most considered and

recommended factor as hindering consumers. This is seen as pervasive influence consumers' attitude, perception, behaviour and satisfaction in accepting and adopting mobile technology. Secondly, what are the imperative measure that should be considered by stakeholder and consumers in making mobile banking most outstanding banking service in the 21st century technological world, the above figure entrenched on what should have been considered as the future works on mobile banking.

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