Determinants of Mobile Cloud Computing Adoption by Financial Services Firms

Milind Sathye, University of Canberra, Australia

Sam Goundar, RMIT University, Vietnam

🆔 https://orcid.org/0000-0001-6465-1097

Akashdeep Bhardwaj, University of Petroleum and Energy Studies, India*

🆔 https://orcid.org/0000-0001-7361-0465

ABSTRACT

Prior studies have found that mobile cloud computing could bring substantial cost savings to firms, ultimately resulting in reduced transaction cost to customers. Despite this, financial firms in Fiji are slow adopters of mobile cloud computing. The study identifies the challenges faced by financial firms in the adoption of mobile cloud computing to advance the literature on innovation adoption with evidence from a unique context – a Pacific Island country. The context is important as the issues are likely to be similar in other developing and remote island countries, but the extant research is largely confined to developed countries. The findings suggest that the lack of mobile cloud computing policy, infrastructure constraints, and security constraints, among others are the main barriers to the adoption thereof. The study contributes by presenting a revised model based on factors that emerged from the study.

KEYWORDS

Cloud Computing (CC), E-Commerce, Financial Service Firms, IT in the Pacific, IT Management, Mobile Cloud Computing (MCC), Technology Innovation Adoption

1. INTRODUCTION

Adoption of mobile cloud computing (MCC) presents strategic competitive advantages to organizations. It reduces the upfront cost of computing and the costs incurred due to underutilisation of investment in ICT infrastructure (Almaiah & Al-Khasawneh, 2020, Carreiro & Oliveira 2019). VM Ware (2008) found that servers use only 10-30% of their capacity and desktop computers less than 5%. MCC is, particularly, important for financial services firms, given the major advantages such as cost reduction and strategic benefits, more efficient and effective processes and technologies and strategic advantages in global advertising (Zheng, et al. 2019, Qiu, et al. 2018). The same global survey also found that 81% of businesses are in the early or advance stages of planning or are already fully implanting cloud technologies despite concerns about provider performance, downtime and data security. Interestingly, academic research in adoption of MCC by organizations, particularly, in developing and remote island countries such as Fiji, is still limited. Furthermore, the need for identifying the factors that influence the adoption of MCC by financial services firms such as banks has been highlighted in the literature (Almaiah & Al-Khasawneh, 2020, Carreiro & Oliveira 2019).

*Corresponding Author

The Fijian context is unique in many respects. First, such remote islands suffer from the tyranny of distance which makes it harder for the businesses in these countries to participate in the wider world market and grow. ICT innovations such as MCC are considered as a solution to help businesses in these countries grow and thereby contribute to the overall growth of the economy. Second, Fiji is characterised by large scale poverty. It is estimated that 31% of the total population lives in poverty (ADB, 2014). ICT innovations such as MCC would enable provision of social and economic services to the poor by government (GoF 2006). Last, Fiji and other island countries can reduce costs and increase efficiency by fully utilising ICT resources through MCC.

Against the above background, the present study seeks to address the following research question:

What are the determinants of adoption of MCC by financial services firms in Fiji?

Qualitative semi-structured interviews of relevant senior managers in financial services firms were conducted. The research is drawn from the diffusion of innovation theory (Rogers, 2003) and the Technology-Organization-Environment (TOE) framework of Tornatzky & Fleischer (1990). The next section provides the literature review, followed by the Fijian context, methodology and data, results, discussion and the conclusion.

2. LITERATURE REVIEW

According to the US National Institute of Standards and Technology (NIST) "Mobile cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction" (NIST, 2011, p. 2). The distinguishing features of cloud computing are availability of service on demand, clustering of resources and broadband access. The models of MCC and cloud computing in general include: software as service (SaaS), platform as a service (PaaS) and infrastructure as a service (IaaS) (Akherfi, et al. 2018, Noor et al. 2018). All these are used in Fiji. A financial service firm is "any firm that provides financial products and services to individuals or other firms" (Damodaran, 2013, p. 5) and is of four types: banks, insurance companies, investment banks and firms. Rogers (2003, p.2) defines innovation as "an idea, practice or object that is perceived as new by an individual or unit of adoption". Accordingly, MCC can be considered as an innovation from an organisational perspective. Furthermore, Rogers and Shoemaker (1971, p. 95) define adoption as "making full use of a new idea as the best course of action available". Theories about adoption of innovation include the diffusion of innovation (DoI) theory (Rogers 2003), theory of planned behaviour (TPB) (Ajzen 1985, 1991), the technology acceptance model –TAM- (Davis 1986, 1989, Davis et al. 1989), and the unified theory of acceptance and use of technology – UTAUT - (Venkatesh et al. 2003). Most of these theories refer to adoption of innovation at the individual level. Rogers (2003) postulated the DoI theory which asserts that innovation adoption is influenced by relative advantage, compatibility, complexity, trialability and observability. Tornatzky and Klein (1982), found that only relative advantage, compatibility, complexity, consistently influenced adoption of innovation.

Relative advantage refers to increase in organisational performance, effectiveness and time saving (Davis, 1989). Yang and Tate (2012) consider relative advantage to be a major determinant of adoption of cloud computing. Relative advantage would exert a positive influence on adoption decision. Advantages of mobile cloud computing have been posited by Ibtihal & Hassan (2020), and Elazhary (2019). Cost savings contribute to relative advantage. According to Meng, et al. (2018), and Guo, et al. (2018) MCC assists in offloading tasks, hybrid cloud models, and energy efficiency to save costs. Rogers (2003) notes that cost advantage gets incorporated in the relative advantage of innovation. Ambrose et al. (2010) state that cloud services are cost effective. For Luarn and Lin

(2005) and Wang (2005) relative advantage includes cost savings in mobile banking and mobile payments context. Security concerns adversely impact relative advantage. Roman, Lopez, & Mambo (2018), and Stergiou, et al. (2018), among others, highlight issues and challenges of security with MCC. Gefen et al. (2003) and Jarvenpaa et al. (2000), among others, document the negative impact of security concerns. Thus, security concerns would negatively influence relative advantage and through it adoption of MCC.

Following from the above, the hypothesis is:

H1: Relative advantage would have a positive association with the adoption of MCC by financial firms.
H1a: Cost savings would have a positive association with the relative advantage of the adoption of MCC.
H1b: Security concerns would have a negative association with relative advantage of the adoption of MCC.

Compatibility refers to the extent to which the new innovation meets the expectations of potential adopters and the value it brings to them (Rogers, 1995). Lin and Lin (2008), Oliveira & Martins (2009) found positive association between compatibility innovation adoption. Accordingly, following hypothesis is proposed:

H2: Compatibility would have a positive association with adoption of MCC by financial firms.

Rogers (1995, p. 16) defines complexity as the "degree to which an innovation is perceived as difficult to understand and use". Jarvenpaa et al. (2000), Lin and Lin (2008), Oliveira & Martins (2009) also found that complexity reduces usability of an innovation. Accordingly, the following hypothesis is proposed:

H3: Complexity of MCC would have a negative association with its adoption by financial firms.

The TOE theory posits that innovation adoption is influenced by the technological context, the organizational context, and the environmental context (Tornatzky and Fleisher 1990). The internal and external technologies, equipment and processes constitute the technology context. Firm characteristics, resources, size, and such other factors constitute the organisational context. The industry structure, competition, the macroeconomic situation, and regulation is the environment within which an organisation has to operate (Tornatzky and Fleisher 1990). These three elements act as constraints as well as opportunities for technological innovation and influence the adoption behaviour of the firm. Premkumar and Roberts (1999), Lin and Lin (2008) found positive association between the role of technology readiness in adoption decision. Accordingly, the below hypothesis is proposed:

H4: Technology readiness of a firm would have a positive association with the adoption of MCC.

Without top management support the possibility of adoption of new technology by a firm is unlikely (Tornatzky & Fleisher 1990). Chau & Tam (1997), and Carlsson et al. (2006) found that top management support exerts a positive influence on adoption decisions. This leads to the below hypothesis:

H5: Top management support would have a positive association with the firm's adoption of MCC.

Tornatzky and Fleisher (1990) assert that size influences adoption decision positively. Large size firms are more likely to adopt a new innovation. Premkumar and Roberts (1999) and Lin and Lin (2008), among others, also found positive association between firm size and adoption decision. This leads to the below hypothesis:

H6: Firm size would have a positive association with firm's adoption of MCC.

Many researchers have suggested combining the DoI theory and the TOE framework (for example, Oliviera et al., 2014; Wu et al., 2013). The present study does this.

Research in adoption of MCC is currently at early stages. Low & Chen (2011) surveyed 111 ðrms in Taiwanese high-tech industry to understand determinants of MCC. Abdollahzadehgan et al. (2013) provide a conceptual model of adoption of MCC. Wu et al. (2013) use logistic regression to examine the question in what circumstances organizations may consider adopting MCC. The sample size was 289 and the target population consisted of U.S. firms operating within the manufacturing and retail industries. Nikhoma and Dang (2013) used structural equation modelling and partial least square procedures to understand the drivers and barriers to the adoption of MCC. Lin & Chen (2012) did a qualitative interview-based study of 19 IT professionals. Trigueros et al., (2013) studied 94 Spanish SMEs while Kshetri (2013) did a conceptual study of privacy and security issues in MCC. None of these studies focused on services firms except Oliviera et al. (2014). Furthermore, these studies were confined to developed countries and financial firms were not the focus.

Financial firms (in particular) banks have been in the forefront of using ICT and other sectors have followed. Obviously, why financial firms are or are not adopting MCC is a question that needs to be addressed. Furthermore, developing country and remote island countries such as Fiji are envisaged to benefit from MCC significantly and yet no study is available in such contexts. Mujinga and Chipangura (2011) found that cost-effectiveness and data security remain the main concerns in MCC adoption. Despite several challenges faced by MCC service providers and consumers in developing countries, cost effectiveness is the main advantage. MCC is particularly important for financial firms given its use in mobile based payment systems. "There are successful initiatives that are using MCC services such as M-Pesa and M-Banking service. M-Pesa (Swahili for M-Money) money transfer service was first a success in Kenya" (Hughes & Lonie, 2007, p. 65). In remote islands such as the Pacific Island countries, reaching out to far off places is a challenge from financial inclusion and poverty alleviation perspective. Against this background, the present study fills a major research gap by focusing on financial firms in remote island countries and contributes to extant literature by identifying new factors that impact MCC adoption.e research model of the study is presented in Figure 1. The model is derived from the earlier work of Oliviera et al. (2014) and Low & Chen (2011).

3. METHODOLOGY AND DATA COLLECTION

As MCC is at initial stages in Fiji, an exploratory study was considered suitable. Quantitative methods were not considered suitable due to lack of data, small number of financial firms and early stage of MCC in Fiji. Accordingly, semi-structured interviews were used for data collection. Typically, only one or two MCC experts per financial firm were available and willing to be interviewed. In exploratory studies semi-structured interviews are common (Byrne et al., 2015; Alismaili et al. 2015). A list of financial firms was prepared and relevant official in each firm was identified and contacted to fix interview appointment. The interviews lasted for about one to two hours. Three suitably trained higher degree research students of the University of South Pacific conducted the interviews. The interviews were conducted in Suva – the national capital and the financial hub of Fiji. There are 18 financial firms in Fiji. The data was collected in November-December 2015. In all 24 managers were interviewed. All respondents were provided the participant information sheet and an informed consent obtained.

The responses were written by the interviewer and read out later to ensure that the intended meaning is reflected in the responses. The questionnaire used is available at Appendix A. The transcripts were read to get an overall feel of the responses and thereafter re-read to identify specific themes or issues which got repeated. The textual responses received were appropriately coded following the qualitative clustering method (Miles and Huberman, 2014). All statements that related to the research question/ particular construct such as the relative advantage, for example, were identified, and assigned a code, or category (open coding). The initial list of codes included the adoption factors as depicted in the research model (Fig 1). During the analysis of rich text data, however, additional codes came to the fore. The study objective was to identify the determinants of MCC. The discussion focussed on future adoption intentions given MCC is at an early stage of development.

Figure 1. Research Model for Study
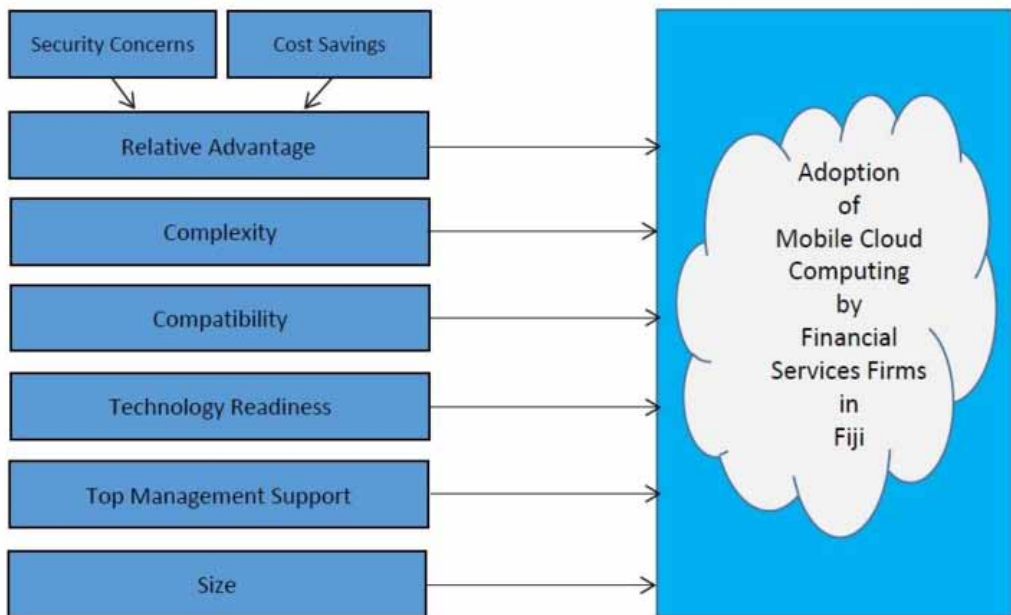
4. RESULTS

The responses received have been arranged as per various constructs that form the research model. The directional impact thereof on the dependent variable is also indicated against each of these.

Security Concerns

The respondents indicated data protection, network security and bandwidth, system storage protection, unauthorised access, low battery power, and privacy as the security issues affecting the adoption of MCC.

"Major concerns are low battery power – may cause loss of data if an uploading or downloading of data is in process and Security of data/files – could be compromised"

"Violation of privacy rights – sharing of device passwords, unauthorised use leading to data integrity issues/ consequently, the originator of the data files needs to be identified"

Respondents were concerned about the possible leakage of client information in financial services firms.

"Customer Information being leaked. This is very serious concern, therefore choosing the right host for MCC is very important and the most secure one should be used"
"Loss of control over data and dependence on the MCC provider' services incompatibility given the multiple vendors' security concerns would undermine the relative advantage".

Security concerns reduce the relative advantage of potential MCC users. The finding supports the DoI theory of Rogers (2003). Marston et al., (2011); Subashini & Kavitha (2011) also confirm that security concerns are a drag on adoption of MCC.

Cost Savings

The respondents identified cost savings such as backup and recovery handled by the company providing cloud services, no need to buy servers, and low maintenance cost.

"Mobile devices have chargeable batteries that can be charged and processing can be done with the use of device batteries as a power supply consequently significant energy saving is possible"
"Users only pay for what they use with a cloud platform rather than buying media for data storage and software for data processing"

Some respondents indicated that environmental cost reduction is possible under certain conditions.

"Mobiles in itself require a fast network for that we need extra servers or the same servers which are already running computers on it. So the energy costs and environmental costs is still minimal however if we reduce use of commuters we may see a reduction in environmental and general costs"

The above responses demonstrate that the relative advantage of MCC would be enhanced as postulated by the DoI theory of Rogers (2003) and empirically found by Leinbach (2008), Mujinga, & Chipangura (2011).

Relative Advantage

The relative advantages of MCC as indicated by the respondents include increased efficiency, improved quality of operations, increase in business productivity, advantage to be storage and access to large data, significant improvement in reliability and accessibility, easy data sharing, scalability and elasticity of MCC.

"Allows easy access of data and since data can be shared among users therefore data will be up to date and fresh for business processing. Data is in the cloud so always available to the users"
"There is a lot of automated optimization. For example, in the case of AWS (Amazon Web Service) they have this thing called capacity on demand which is a key feature of their elastic technology… it automatically provides additional resources to the client when it detects that the client is running low on resources… this is smart scalability with minimum or no manual intervention at all"

Many respondents felt that the flexibility, improved collaboration, improved client relationships were the additional advantages that MCC offered.

"Availability of company data and resources at any location enables organisational staff to interact seamlessly which enhances productivity"
"Increased collaboration among employees is enabled as documents can be shared simultaneously"
"It does offer opportunities as most people would like to business with a better technology, reaching to their customers in a timely manner….. Good customer service, reaching to providers on time"

Some respondents noted that MCC can help perform tasks more quickly, as customers can action part of a process (application request), decision making can be automated, and staff can action any manual steps within the same system. Automated communications and notification functions can inform customers status of their requests. These findings are in line with the DoI theory of Rogers (2003). Empirical studies by Mujinga & Chipangura (2011), Wu et al., (2013), Wang (2005) found relative advantage is a major MCC determinant.

Compatibility

The compatibility of MCC with legacy systems was checked. It was found to be compatible with current systems. Respondents indicated that integration of services was simple and effortless.

"We do have hardware's and software's that is compatible with MCC hardware and software"
"For the MCC we use, yes it fits seamlessly in our work style".

Some respondents, however, seemed to disagree with the above responses.

"Users may face several difficulties like traffic overload, network unavailability and connectivity issues"
"we are using a well-recognised MCC host, we do not seem to have any issues but others may have"

Overall, compatibility was not a major barrier in MCC adoption. It was so postulated by the DoI theory (Rogers 2003). Oliviera et al. (2014), Abdollahzadehgan et al. (2013) found that compatibility with existing systems positively influences the adoption of MCC. The findings of this study are in line with these studies.

Complexity

The respondents considered that it was easy to set up and the integration with current systems was not an issue.

'No it isn't complex; the implementation of MCC is fairly simple and easy to learn. However, those who aren't as computer literate may find it difficult to move from computer users to mobile users'.
'To seamlessly integrate the business in MCC, all workers in the business should be first trained on how the MCC works and what they need in order to work without any problems occurring mid-way through the integration/migration from computers to mobile. Furthermore, the company would also have to find out that all software's currently being used by the company is compatible with the mobile architecture'.
'It is fairly simple if you can understand the concept on which it functions. The good/bad and other aspects such as speed, reliability and security. Yes it has, they found it fairly complex at first but after presentations, they got understanding of the system functions and how it will help us grow further'.

Overall, complexity was not an issue adversely impacting the adoption of MCC in Fiji. The DoI theory (Rogers 2003) considers that complexity influences adoption. Leinbach (2008), Mujinga, & Chipangura (2011) also found the adverse impact of complexity on adoption. Complexity was not a particular issue in this study.

Technology Readiness

Respondents stated that organisations were technologically ready for MCC and trained staff.

"We did have in-house skills available; Yes we did carry out training programs for all staff. Most if not all staff liked the presentation of the new technology. Some found it hard at first but slowly understood and appreciated the effort that was put into the implementation of MCC. The staffs were pleased''.
"There is in-house skills available to implement MCC. We did not need to train staff as the use is pretty straight forward and easy to use".
"Implementing MCC's require specialised skills, and our organisation has acquired staff with relevant training, expertise and experience. Existing staff are provided training to acquire relevant knowledge".

Accordingly, organisations are technologically ready for MCC. The findings support TOE theory. Kuan & Chau(2001); Oliveira & Martins (2009) confirm technologically ready firms adopt new innovation.

Top Management Support

The respondents didn't envisage that top management support was an issue. Any technology solution that can improve customer services gets top management support.

"Management support any approach that improves customer service, improve the risk management and reduce costs, and if MCC's are able to provide these, then management fully supports MCC's"
"We enjoy unwavering support from management with our entire major IT Projects'.
"After we had a good meeting in which we discussed various problems and came up with solutions to which the management were very doubtful off but later realized that it may be a stepping stone towards a better future for the company We came to a resolution that we should carry forward the migration/implementation of MCC into the business'.

But respondents in some organisations were not so certain. When asked about the support from top management, some of the responses were:

"Not yet"
"For Management to support the implementation I don't think so, because the greatest risk is storing all our clients and staffs information in the internet, let alone the bank details"

The responses on top management support were mixed as could be seen from the above. Such support can positively influence adoption but in the case of MCC the results are mixed. Top management support is a factor identified by the TOE model. Oliveira & Martins (2009) found that top management support helps adoption.

Size

The intention to adopt MCC was found to be size neutral. Organisations included in the study sample had varying size (from 30 employees to in excess of 215 employees) but irrespective of the size the respondents were willing to adopt MCC. Though size impacted organisational adoption of innovation according to the TOE our study found that the intention to adopt MCC was neutral to size.

During the course of our study two additional variables emerged, that is, policy framework and industry challenges that prior studies haven't considered. The effect of these variables is especially important in the context of remote island and developing countries where the lack of appropriate policy framework, eco-system and supporting infrastructure have been found to be major hurdles in adoption of ICT. In developed countries, well designed policy framework underpins the development of any industry. On the contrary, policy paralysis mars the growth in developing countries (Sherlock, 2014). Furthermore, Fiji is sparsely populated and spread over 100 small islands. Furthermore, financial literacy, penetration of mobile phones puts developed countries at an advantage while developing countries like Fiji have to struggle. Accordingly, the revised model proposed by the present study is more appropriate for developing countries like Fiji.

Policy-framework and industry challenges become particularly important in the context of financial services industry. The industry consists of large subsectors such as banking, insurance, managed funds industry. The financial services industry not only faces heavy domestic regulation but also international regulation. The banking regulators, for example, are unsure whether to regulate virtual currency such as Bitcoins. Wirdum (2016) reports that the European Banking Authority has proposed a virtual-currency specific regulatory body, while there is no regulation of virtual currency in Fiji so far. Similarly, the anti-money laundering legislations are applicable to Bitcoin in Australia (Topsfield, 2016) but several developing countries have yet to make any move in this area. In the context of public cloud computing, the Australian Prudential Regulation Authority stated that the risk management and mitigation techniques have yet to reach required maturity level and potentially threaten regulated entities (Lau, 2015).

As resources and data sharing is at the heart of cloud computing, to develop trust in it, appropriate policy/legal framework needs to exist in any country. India, for example, doesn't have a dedicated cloud computing regulatory framework consequently some British banks are moving call centres back to the UK (Menon, 2013). Similar is the situation in Fiji and given the data protection issues implicit in cloud computing, a lack of policy framework would impact adoption of MCC by firms as they possess highly sensitive client financial data.

The competitive advantage that cloud computing brings would affect industry players. Large banks would easily adopt cloud computing to quickly respond to market changes and customer needs (Nedelcu et al., 2015). KPMG (2013) found that new business models enabled by cloud computing can fundamentally shift competitive landscapes. For some of the services available through cloud, for example, mobile value-added services, the industry adaptation of cloud would be dictated by network externalities especially the availability of critical mass which is hard in thinly populated and widely spread countries like Fiji. Accordingly, industry challenges in small island countries such as Fiji could impact on adoption decisions.

Industry Challenges

On the competitive pressure influencing the uptake of MCC, the respondents had mixed views. Network externalities was considered to be an issue in mobile value-added services by respondents.

"MCC's is going to be a differentiator for many business types, including financial institutions. Organisations need to invest in technology to offer such services as their customers begin to use smartphones and other technology for other services"
"Our company is one of the leaders, so we feel our competitors are under pressure to match or improve on service provided by us, however, there is always pressure to improve further and remain ahead of the competition"

Some respondents, however, felt that there is unlikely to be any competitive pressure.

"To some degree. But Fiji is third world developing country so I don't expect MCC to come rushing in with bang. It will be a gradual revolution. But it will come whether we are ready or not"
"MCC success requires the presence of a critical mass of merchants who subscribe to the system – for example, mobile payments – which can adversely affect MCC."

Policy/Regulatory Framework

Policy related hurdles do affect MCC which can be considered as a mobile value-added service.
The major hurdles were found to be:

"There is no licensing regime for mobile services which also impacts mobile cloud computing take up"
"The government has no policy on mobile value added services including mobile cloud computing"
"There is no forum available for consumers of mobile cloud computing services to redress grievances which impacts its adoption by them and in turn the organisational provision thereof"

Overall respondents felt that policy/regulatory barriers significantly impacted the uptake of MCC services.
A revised model that incorporates the above two factors is presented in Figure 2 below.

Figure 2. Revised Model
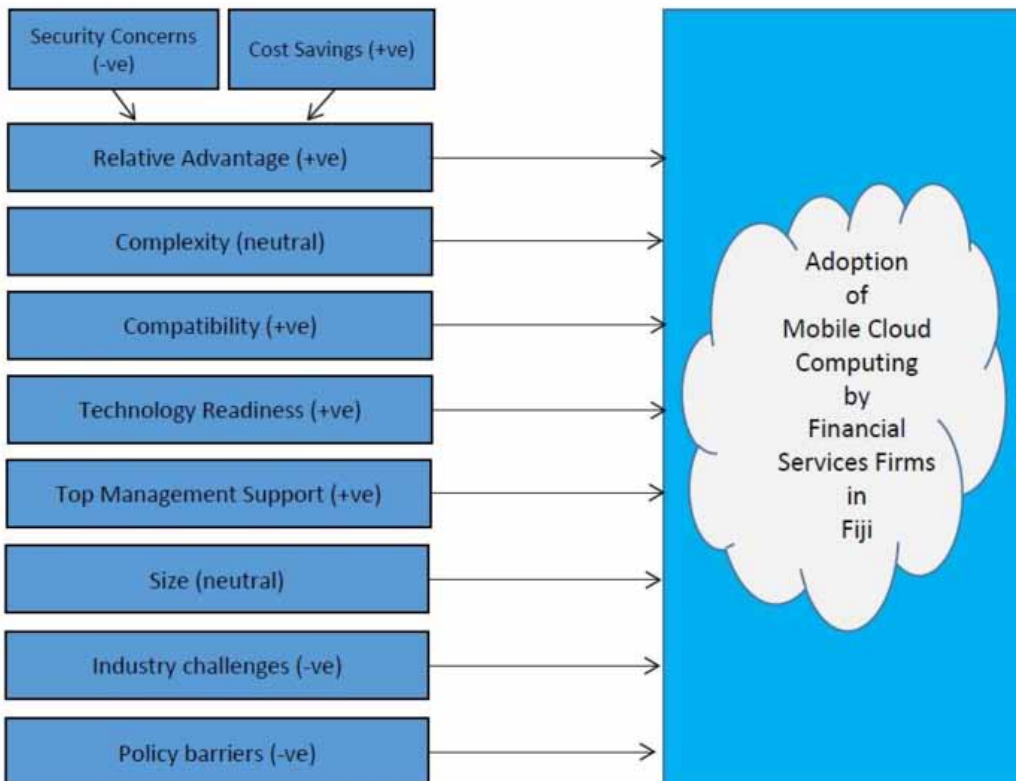
A major contribution of the study is the identification of these two themes (constructs) – policy barriers and industry challenges – that impact adoption decisions. The lack of well formulated policy on cloud computing, typically seen in developing countries in particular, makes it harder for the industry players to venture into new areas and take risks. Industry players also face other challenges such as the lack of critical mass as the present study found. Accordingly, the adoption of innovation model should account for these factors especially when applied to developing countries.

5. DISCUSSION

The aim of this exploratory study was to identify the determinants of MCC. We conducted semi-structured interviews of IT managers in financial services firms in Fiji. The diffusion of innovation theory augmented by the TOE framework provided the theoretical framework. The study confirmed the research model in as much as security concerns, cost savings, relative advantage, compatibility, technology readiness and top management support were found to be positively associated with the adoption of MCC by financial firms. Complexity and size were not found to be relevant determinants in the Fijian context.

Two additional factors emerged from this study, that is, policy barriers and industry challenges especially network externalities. Security concerns, lack of policy framework, industry challenges came to the fore as major hurdles in the way of rapid adoption of MCC in Fijian financial services firms.

MCC adoption brings flexibility in accessing and provision of financial services. It is particularly important in remote islands such as Fiji which is a tourist destination. Clients typically would like to access financial services from anywhere in the world which the MCC facilitates. The availability of real time data is yet another advantage of MCC. Furthermore, MCC is platform neutral in as much as it can run on multiple platforms. It is also cost effective as no license fee or other fees are involved for use and the user pays only for actual use. The modern trend towards green IT also makes cloud computing an attractive proposition that can reduce energy consumption and carbon footprint of firms.

MCC would enable organisations to bring several enhancements/improvements. Importantly, as the data would be stored in the cloud, the investment in local servers and space would get freed. From financial services marketing perspective, organisations that adopt MCC would be preferred by clients due to anytime, anywhere availability. It could provide a competitive advantage for firms. Financial services firms need to consider their requirement before deciding which MCC technology to implement. Cloud technologies are broadly distinguished between infrastructure-as-a-service, platform-as-a-service and software-as-a-service. However, each of these cater to particular organisational needs which would differ by firms. Consequently, it is a strategic decision that firms need to make based on their own service type needs.

The study makes significant contributions to the extant literature on MCC adoption. First, the ability of MCC to improve quality of business operations, its efficiency, and newer opportunities it could generate were found to be the relative advantages. These findings are similar to prior studies, however, the relative advantage of MCC as indicated above were different from those highlighted in prior studies. We suggest that future studies may like to examine the adoption of cloud computing in the light of the above findings and may like to explore the following research question:

RQ1: Is the revised formulation of the construct relative advantage more appropriate for MCC?

Second, the findings suggest that factors such as security concerns and new factors such as policy barriers and industry challenges impact the adoption of MCC. The new factors are particularly crucial in the context of developing countries such as Fiji. While security concerns have been highlighted in prior studies, the new factors that came to the fore is the major contribution of our study. The extant adoption model evolved from developed countries where such issues may not have been relevant but the model can't be applied as it is to developing countries that face a different set of problems.

We suggest that future studies may consider exploring the influence of these factors, in addition to the factors as per extant adoption models, in other developing countries and suggest the following research question:

RQ2: What influences do the factors such as policy barriers and industry challenges exercise in adoption of MCC?

Third, our findings suggest that factors such as complexity and compatibility may not be relevant in the context of MCC given that it is fairly simple to use. Appropriate training to staff can mitigate any concerns with respect to complexity. Our study also finds that adoption of MCC technology is size neutral and the top management was generally found to be supportive of adoption. The study provides strategic direction for organisations that are considering adoption of MCC. It also informs the cloud computing technology providers the factors that influence organisational adoption thereof.

A limitation of our study is it was based on empirical data collected from one country. The findings may vary according to the context. Furthermore, the penetration of mobile phones would impact the adoption of MCC by consumers and in turn by organisations.

6. CONCLUSION AND FUTURE SCOPE

Drawing from the diffusion of innovation theory and the TOE framework, the present study examined the factors that impact the adoption of mobile cloud computing. The authors focussed on financial services firms which have generally escaped the attention of researchers. The required data was collected by semi-structured interviews of key experts. The authors make a significant contribution to the extant literature by identifying new or additional factors that impact adoption of mobile cloud computing, that is, industry challenges and policy barriers which negatively affect adoption.

The authors suggest that the financial services industry, cloud services providers, regulators and consumer associations collaborate to develop cloud computing market in Fiji. Suitable risk management standards need to be developed for the financial sector such as minimum threshold requirements for financial services firms before adopting cloud computing. It will help allay security concerns about cloud computing and enhance trust. Similarly, firms considering to adopt cloud computing need to follow a risk-based approach which is aligned with their overall corporate strategy and risk assessment.

For future work, we plan to ascertain whether these factors are also impacting mobile cloud adoption in other developing countries such as Ethiopia. Fiji's population, for example, is less than one million but many African and Asian countries have large population. Consequently, some of the industry challenges such as lack of critical mass may not be relevant in these countries, though similar to Fiji, these countries also face significant poverty, limited financial literacy and mobile penetration.

FUNDING AGENCY

REFERENCES

Abdollahzadehgan, A., Gohary, M., & Amini, M. (2013). The Organizational Critical Success Factors for Adopting Cloud Computing in SMEs. *Journal of Information Systems Research and Innovation*, *4*(1), 67–74.

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*(2), 179–211. doi:10.1016/0749-5978(91)90020-T

Akherfi, K., Gerndt, M., & Harroud, H. (2018). Mobile cloud computing for computation offloading: Issues and challenges. *Applied Computing and Informatics, 14*(1), 1-16.

Alismaili, A., Shen, J., & He, Q. (2015). A Multi Perspective Approach for Understanding the Determinants of Cloud Computing Adoption among Australian SMEs. *Australasian Conference on Information Systems*.

Almaiah, M. A., & Al-Khasawneh, A. (2020). Investigating the main determinants of mobile cloud computing adoption in university campus. *Education and Information Technologies*, *25*(4), 1–21. doi:10.1007/s10639-020-10120-8

Ambrose, W., Athley, S., & Dagland, N. (2010). *Cloud Computing: Security risks, SLAs and Trust* (Unpublished Honours Dissertation). Jonkoping University, Sweden.

Asian Development Bank. (2014). *Poverty Analysis Summary*. Retrieved February 16, 2017, from https://www.adb.org/sites/default/files/lin ked -documents/cps-fij-2014-2018-pa.pdf

Byrne, J., Liston, P., & Byrne, P. (2015). Cloud based data capture and representation for simulation in small and medium enterprises. In *Proceedings of the 2015 Winter Simulation Conference*. (pp. 2195-2206). IEEE Press. doi:10.1109/WSC.2015.7408332

Carlsson, C., Walden, P., & Bouwman, H. (2006). Adoption of 3G+ services in Finland. *International Journal of Mobile Communications*, *4*(4), 369–385. doi:10.1504/IJMC.2006.008947

Carreiro, H., & Oliveira, T. (2019). Impact of transformational leadership on the diffusion of innovation in firms: Application to mobile cloud computing. *Computers in Industry*, *107*, 104–113. doi:10.1016/j.compind.2019.02.006

Damodaran, A. (2013). Valuing financial services firms. *The Journal of Financial Services Perspectives. Earnst & Young*, *1*(1), 1–16.

Davis, F. (1986). *A technology acceptance model for empirically testing new end-user information systems: Theory and results* (Unpublished Doctoral dissertation). MIT Sloan School of Management, Cambridge, MA.

Davis, F. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *Management Information Systems Quarterly*, *13*(3), 319–339. doi:10.2307/249008

Davis, F., Bagozzi, P., & Warshaw, P. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science*, *35*(8), 982–1003. doi:10.1287/mnsc.35.8.982

Elazhary, H. (2019). Internet of Things (IoT), mobile cloud, cloudlet, mobile IoT, IoT cloud, fog, mobile edge, and edge emerging computing paradigms: Disambiguation and research directions. *Journal of Network and Computer Applications*, *128*, 105–140. doi:10.1016/j.jnca.2018.10.021

Government of Fiji. (2006). *Strategic Development Plan 2006-11*. Ministry of Finance.

Guo, S., Liu, J., Yang, Y., Xiao, B., & Li, Z. (2018). Energy-efficient dynamic computation offloading and cooperative task scheduling in mobile cloud computing. *IEEE Transactions on Mobile Computing*, *18*(2), 319–333.

Hughes, N., & Lonie, S. (2007). *M-PESA: Mobile Money for the "Unbanked" Turning Cellphones into 24-Hour Tellers in Kenya*. Retrieved October 10, 2016 from http://www.gsma.com/mobilefor development/wp-content/uploads/ 2012/06/ innovationsarticleon mpesa_0_d_14.pdf

IBM. (2013). *Cloud computing for banking Driving business model transformation*. Retrieved February 20, 2017, from ibm.com/services/cloud

Ibtihal, M., & Hassan, N. (2020). Homomorphic encryption as a service for outsourced images in mobile cloud computing environment. In Cryptography: Breakthroughs in Research and Practice (pp. 316-330). IGI Global.

It, A., & Chen, N.C. (2012). Cloud computing as an innovation: Perception, attitude, and adoption. *International Journal of Information Management*, *32*(6), 533–540.

Jarvenpaa, S. L., Tractinsky, N., & Vitale, M. (2000). Consumer trust in an Internet store. *Information Technology and Management*, *1*(1-2), 45–71.

KPMG. (2013). *Cloud computing for banking*. Retrieved February 5, 2017, from file:///C:/Users/sathye/Downloads/Cloud_Computing_for_Banking.pdf

KPMG. (2014). *Cloud Survey Report: Elevating Business in the Cloud*. Retrieved October 16, 2016, from http://www.kpmg.com/US/en/about/alliances/Documents/2014-kpmg-cloud-survey-report.pdf

Kshetri, N. (2013). Cloud Computing in Sub-Saharan Africa. *IT Professional*, *15*(6), 64–67.

Kuan, K. K. Y., & Chau, P. Y. K. (2001). A perception-based model for edi adoption in small businesses using a technology-organization-environment framework. *Information & Management*, *38*(8), 507–521.

Lau, C. (2015). *Finance Transformation in the Cloud… Are you ready?* Retrieved February 5, 2017, from http://newsroom.kpmg.com.au/?p=2443

Leinbach, T. R. (2008). Global E-Commerce: Impacts of National Environment and Policy. Cambridge University Press.

Lin, H., & Lin, S. (2008). Determinants of e-business diffusion: A test of the technology diffusion perspective. *Technovation*, *28*(3), 135–145.

Low, C., & Chen, Y. (2011). Understanding the determinants of cloud computing adoption. *Industrial Management & Data Systems*, *111*(7), 1006–1023.

Marston, S., Li, Z., Bandyopadhyay, S., Zhang, J., & Ghalsasi, A. (2011, April). Cloud computing—The business perspective. *Decision Support Systems*, *51*(1), 176–189.

Meng, T., Wolter, K., Wu, H., & Wang, Q. (2018). A secure and cost-efficient offloading policy for Mobile Cloud Computing against timing attacks. *Pervasive and Mobile Computing*, *45*, 4–18.

Menon, G. (2013). Regulatory Issues in Cloud Computing -An Indian Perspective, *Journal of Engineering, Computers &. Applied Sciences (Basel, Switzerland)*, *2*(7), 1–5.

Miles, M., Huberman, A., & Saldana, J. (2014). *Qualitative Data Analysis: A Methods Sourcebook*. Retrieved February 26, 2017, from http://researchtalk.com/wp-content/uploads/2014/01/Miles-Huberman-Saldana-Drawing-and-Verifying-Conclusions.pdf

Mujinga, M., & Chipangura, B. (2011). *Cloud computing concerns in developing economies*. Edith Cowan University, Secau Security Research Centre.

Nedelcu, B., Stefanet, M., Tamasescu, L., Tintoiu, S., & Vezeanu, A. (2015). Cloud Computing and its Challenges and Benefits in the Bank System. *Database Systems Journal*, *VI*(1), 44–58.

NIST. (2011). *The NIST definition of cloud computing*. Retrieved October 12, 2016, from https://nvlpubs.nist.gov/nistpubs/Legacy/SP/nistspecialpublication800-145.pdf

Noor, T. H., Zeadally, S., Alfazi, A., & Sheng, Q. Z. (2018). Mobile cloud computing: Challenges and future research directions. *Journal of Network and Computer Applications*, *115*, 70–85.

Oliveira, T., & Martins, M. F. (2009). Determinants of information technology adoption in Portugal. In *ICE-B 2009 Proceedings of the international conference on e-business* (pp 264-270). Milan, Italy: Universidade Nova de Lisboa.

Oliviera, T., Thomas, M., & Espadanal, M. (2014). Assessing the Determinants of Cloud Computing Adoption: An Analysis of the Manufacturing and Services Sectors. *Information & Management*, *51*(5).

Premkumar, G., & Roberts, M. (1999). Adoption of New Information Technologies in Rural Small Businesses. *Omega: The International Journal of Management Science*, *27*(4), 467–484.

Qiu, M., Gai, K., Thuraisingham, B., Tao, L., & Zhao, H. (2018). Proactive user-centric secure data scheme using attribute-based semantic access controls for mobile clouds in financial industry. *Future Generation Computer Systems*, *80*, 421–429.

Rogers, E. M. (1995). *Diffusion of Innovations*. Free Press.

Rogers, E. M. (2003). *Diffusion of Innovations*. Free Press.

Roman, R., Lopez, J., & Mambo, M. (2018). Mobile edge computing, fog et al.: A survey and analysis of security threats and challenges. *Future Generation Computer Systems*, *78*, 680-698.

Sherlock, S. (2014). *Democratic achievement and policy paralysis: Implications for Indonesia's continued ascent*. National Security College Issues Brief. Retrieved February 26, 2014, from http://nsc.anu.edu.au/documents/Indonesia-Article3.pdf

Stergiou, C., Psannis, K. E., Kim, B. G., & Gupta, B. (2018). Secure integration of IoT and cloud computing. *Future Generation Computer Systems*, *78*, 964–975.

Subashini, S., & Kavitha, V. (2011). A survey on security issues in service delivery models of cloud computing. *Journal of Network and Computer Applications*, *34*(1), 1–11.

Topsfield, J. (2016). *Australian to regulate bitcoin under counterterrorism finance laws*. Retrieved February 5, 2017, from https://www.smh.com.au/world/australia-to-regulate-bitcoin-under-counterterrorism-finance-laws-20160808-gqnne2.htm

Tornatzky, L., & Fleischer, M. (1990). *The Process of Technological Innovation*. Lexington Books.

Tornatzky, L., & Klein, K. (1982). Innovation characteristics and innovation adoption-implementation: A meta-analysis of findings. *IEEE Transactions on Engineering Management*, *29*, 28–45.

Trigueros-Preciado, S., Perez-Gonzalez, D., & Solana-Gonzalez, P. (2013). Cloud computing in industrial SMEs: Identification of the barriers to its adoption and effects of its application. *Electronic Markets*, *23*, 105–114.

Venkatesh, V., Morris, M., Davis, G., & Davis, F. (2003). User acceptance of information technology: Toward a unified view. *Management Information Systems Quarterly*, *27*, 425–478.

VMWare. (2008). *Addressing Desktop Challenges*. VMWare. Retrieved October 20, 2016, from https://www.vmware.com/pdf/vdi _solution.pdf

Wirdum, A. (2016). *European Banking Authority proposes Virtual Currency-specific Regulatory Body*. Retrieved February 4, 2017, from https://bitcoinmagazine.com/articles/european-banking-authority-proposes-virtual-currency-specific-regulatory-body-1473969820

Wu, Y., Cegielski, H., & Hall, D. (2013). Cloud Computing in Support of Supply Chain Information System Infrastructure: Understanding When to go to the Cloud. *The Journal of Supply Chain Management*, *49*, 25–41.

Yang, H., & Tate, M. (2012). A descriptive literature review and classification of cloud computing research. *Communications of the Association for Information Systems*, *31*, 2.

Zheng, R., Jiang, J., Hao, X., Ren, W., Xiong, F., & Ren, Y. (2019). bcBIM: A blockchain-based big data model for BIM modification audit and provenance in mobile cloud. *Mathematical Problems in Engineering*.

APPENDIX A – ADDITIONAL TABLES

Table 1. Use of Mobile Cloud Computing (MCC) by Financial Services Firms in Fiji – Interview Questionnaires.

Construct	Questions
Security concerns	Could you able to tell us what you consider to be the major data security concerns that your organisation envisages in the use of MCC and how significant these concerns are?
	Could you able to tell us what you consider to be the major data security concerns that your clients envisage in the use of MCC and how significant these concerns are?
	What do you consider to be the privacy issues that may arise in MCC? How serious the concerns are likely and what possible remedies are envisaged to address those?
Cost savings	In your opinion are the benefits of MCC greater than the costs of this adoption? Can you tell us what according to you are the MCC benefits and costs?
	In your opinion, does MCC result in reduction of energy costs and environmental costs? Can you give some examples?
	In your opinion are the maintenance costs of mobile cloud computing very low? If so, what according to you are the reasons?
Relative advantage	In your view, does MCC allows businesses to manage business operations in an efficient way? If so, why? Can you give some examples that you know of?
	In your view, does MCC improve the quality of operations of a business? If so, why? Can you give some examples?
	In your view, does MCC helps in performing specific tasks more quickly? If so, why? Can you give some examples?
	Does the use of MCC offers new opportunities to businesses? If so, how? Can you give some examples?
	Does the use of MCC allows you to increase business productivity? If so, how? Can you give some examples?
	Does the use of MCC brings considerable mental stress?? If so, why? Can you give some examples?
Complexity	Have you come across cases where MCC was found frustrating? If so, why was it the case? Can you give some examples?
	Do you think MCC is too complex for running business operations? If so, in what respects? What needs to happen so that it can enmesh seamlessly in business operations?
	Do you think the skills required for adoption of MCC are too complex for the staff of the firm? If so, has appropriate training helped? How did the staff find the MCC after the training?
Compatibility	Does the MCC fits seamlessly in the work style of your organisation? Did you experience any specific issues? If so, what were they and how were they resolved?
	In your opinion is MCC fully compatible with your current business operations? If not, why? What actions would be required for it to be made fully compatible?
	In your opinion, is the use of MCC compatible with your company's corporate culture and value system? If there were tensions what were they and how were these resolved?
	Is MCC compatible with existing hardware and software in your organisation? If not, what changes were required? Can you give examples?
	Could we ask what percentage of your staff currently have internet access? Is there any plan to further extend the access to other staff? If not, what are the reasons?
Technology readiness	Would you be confident to say that your organisation does know how ICT can be used in general to support business operations?

Table 1 continued

Construct	Questions
	Would you be confident to say that there are in-house skills available to implement MCC? Did you organisation carry out any specific training programs for staff to improve their knowledge and skill of MCC? If so, what was the response from staff?
	Does the management of your company support the implementation of MCC? How did you secure the support of management for MCC implementation?
Top management support	Does the company's top management provides strong leadership and engages in the process when it comes to information systems? If so, can you give some examples? If there were instances of lack of support can you give examples?
	According to you, is your company's management willing to take risks (financial and organizational) involved in the adoption of mobile cloud computing? If so, can you give some examples?
Firm size	Could we ask what is the total number of staff employed by your company?
	Could we ask what is the annual business volume in dollar terms of your company?
Industry challenges such as Competitive pressure	In your opinion, does MCC has an influence on competition within industry?
	Is your firm under pressure because of competition to adopt MCC?
	Have some of your competitors already started using MCC?
Other comments	Do you have any other thoughts about MCC that you would like to share with us?

Milind Sathye is Professor in the School of Information Systems and Accounting, University of Canberra, Australia. Milind's interest is in financial technology and mobile technology in particular. He has published in these areas among others. Milind was Project Leader of University of California /Bill Melinda Gates Funded project on mobile value added services in Fiji and a paper produced out of that study is already published in Journal of Global Information Management.

Sam Goundar is an Editor-in-Chief of the International Journal of Blockchains and Cryptocurrencies (IJFC) – Inderscience Publishers, Editor-in-Chief of the International Journal of Fog Computing (IJFC) – IGI Publishers, Section Editor of the Journal of Education and Information Technologies (EAIT) – Springer and Editor-in-Chief (Emeritus) of the International Journal of Cloud Applications and Computing (IJCAC) – IGI Publishers. He is also on the Editorial Review Board of more than 20 high impact factor journals.As a researcher, apart from Blockchains, Cryptocurrencies, Fog Computing, Mobile Cloud Computing and Cloud Computing, Dr. Sam Goundar also researches in Educational Technology, MOOCs, Artificial Intelligence, ICT in Climate Change, ICT Devices in the Classroom, Using Mobile Devices in Education, e-Government, and Disaster Management. He has published on all these topics. He was a Research Fellow with the United Nations University.He is a Senior Lecturer in IS at The University of the South Pacific, Adjunct Lecturer in IS at Victoria University of Wellington and an Affiliate Professor of Information Technology at Pontificia Universidad Catolica Del Peru.

Akashdeep Bhardwaj achieved his PhD from University of Petroleum & Energy Studies (UPES), Post Graduate Diploma in Management (PGDM), Engineering graduate in Computer Science. He has worked as Head of Cyber Security Operations and currently is a Professor in a leading university in India. He has over 24 year experience working as an Enterprise Risk and Resilience and Information Security and Technology professional for various global multinationals.