

# Motivations and Challenges for M-Business Transformation: A Multiple-Case Study

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## Abstract

With the advance of wireless technology in recent years, issues of mobile (m-) business transformation become more important for researchers and practitioners. Subsequent to e-business transformation, mobile technology creates another opportunity of innovation inside and outside businesses. However, there is still limited information for m-business transformation. Hence, this study investigates the phenomenon by answering the questions: 'Why do businesses transform into m-businesses?' And 'What are the possible challenges during the process of m-transformation?' This study uses a multiple case study method, and reports the consolidated results of 17 interviews with 6 Australian organisations depicted as a framework, and aims at identifying the factors that influence the motivations for m-transformation, as well as the possible challenges during the process. The findings of this study can provide more understanding of the phenomenon, and further form the basis for a successful m-business transformation.

**Key words:** Mobile business, M-business, M-transformation, Business transformation, M-commerce

## 1 Introduction

The world is experiencing a surge in the usage of mobile devices and mobile services [3]. Recent technological advances in the areas of mobile and service-oriented computing have enabled novel scenarios of use that involve mobile devices (laptops, cellular phones, etc) that can both consume and provide mobile services [8], [43]. Internet with mobile technology transforms employee, supply chain, and customer interaction, and providing new innovation, cost-reduction and revenue opportunities [14]. For example, personal digital assistants (PDAs) support a wide variety of enterprise-level applications in fields ranging from industrial manufacturing, the airline industry, to healthcare. Business and personal productivity applications range from document readers to street maps and vacation planners [16]. This has given rise to the concept of mobile business. Mylonopoulos and Doukidis [27] defined mobile business (m-business) as 'an ecosystem of individuals and business actors, in given historical socioeconomic contexts, engaging in multiple successive technological frames through a learning process of co-creating new experiences of social interaction with the use of wireless and mobile technologies'. The number of global wireless Internet users will grow to nearly 600 million by 2008 [34]. Steinbock [38] also predicted that mobile Internet, with the support of digital and multimedia cellular—after personal computers and Internet-enabled systems—will become the mainstream activity by 2010.

Mobile technologies can be helpful to business processes such as decision support, database applications and information service applications design [4], [13]. Furthermore, it is very likely that in the near term future standard mobile business processes in a company will be supported by business applications running on an appropriate electronic device such as PDA, laptop, etc. [39]. However, from web-based activities to m-commerce, innovation is 'architectural' for customers and e-commerce companies [44]. Although some studies indicate that there are difficulties for businesses in implementing new wireless systems [10], the overall investigation and suggested framework of business mobilisation process has not been available yet. Therefore, it motivates this study to answer the questions 'Why do businesses transform into m-businesses?' and 'What are the possible challenges in m-transformation?'

## 2 Literature Review

In the literature review, the definitions of m-business are provided in the first section, as well as the business models. The motivations and advantages for business mobilization are then discussed in the next section. Lastly, some current challenges for the m-business transformation are briefly mentioned.

### 2.1 Definitions and Business Models of Mobile Business

The concept of m-commerce is different from m-business. Gunasekaran and Ngai [11] defined m-commerce as any direct or indirect transactions involving monetary value, and can be called m-commerce as long as they are completed on wireless telecommunication networks. Some researchers also gave similar definitions [6], [21], [40]. The concept of m-business emerged later than m-commerce, and currently there are fewer existing definitions of m-business. M-business is not limited to transactions with mobile devices on wireless network infrastructures. For example, Kalakota and Robinson [15] claimed m-business should combine Internet, wireless technologies, and e-business. Further, Mylonopoulos and Doukidis [27] defined m-business as 'an ecosystem of individuals and business actors, in given historical socioeconomic contexts, engaging in multiple successive technological frames through a learning process of co-creating new experiences of social interaction with the use of wireless and mobile technologies'. They further explained m-business as 'a number of different industries (hardware, software, telecommunications, content provision, public organizations, etc.) in a process of convergence and competition toward a vague vision of a wireless future'.

As to the business models, there are some definitions and classifications available. Business model is a logical architecture for products, services and information flows, including a description of the involved business actors and their roles, as well as sources of revenue [41], [42]. It is also a set of strategies for corporate establishment and management which includes a revenue model, high-level business processes, and alliance [19]. Lam and Harrison-Walker [17] indicated that e-business models are methods, concepts, frameworks, or architectures by which companies can use the Internet or the web to carry out their strategies of capturing dominant market positions, establishing viable market niches, adding value for their stakeholders, or sustaining themselves over time.

Tsalgatidou and Pitoura [42] believe business models should include content providers, mobile portals, WAP gateway providers (for m-commerce over WAP), service providers, or a combination of the above. Olla and Patel [30] further classified the mobile revenue models as mobile Intranet/extranet, customised infotainment, multimedia messaging service, mobile Internet, location-based service, simple voice, and rich voice. Kalakota and Robinson [15] also classified emerging mobile businesses into seven main areas: network infrastructure; access; content; commerce; software; hardware; and applications. Furthermore, Leem, Suh and Kim [20] indicated that previous classifications are mainly focused on mobile service, not the mobile business model, and most of them only deal with services in the B2C area. Therefore, they not only summarised the classification schemes for mobile businesses according to the previous studies, but also subdivided the m-business models into B2C and B2B/B2E.

M-business transformation can be defined as the effort and process of introducing mobile technology into an organisation, and adopt one or more m-business models into the current ones in order to provide services or connections to its customers, employees, or business partners. By the definition and discussion above, it is clear the concept of m-business is different from m-commerce or e-business. With more successful m-business models emerge, the scope and characteristics of m-business transformation will be more evident.

## 2.2 Motivations for M-Business Transformation

Even in its nascent stage, mobile commerce can enhance business efficiency by distributing information to the workforce remotely, and offering new channels on which to interact with customers [16]. The distinction of m-business from e-business is based on the value proposition attributes of ubiquity, convenience, localization and personalization [6]. When these attributes are combined, the potential to improve the business value becomes enormous. For the Internet value-adding activities such as search, evaluation, problem-solving, and transaction, mobile technology also enhances the value by making them more convenient and efficient [23]. In addition, a mobile service framework enables whole new levels of customer care, as well as new business opportunities [29]. Consequently, mobile business will be the main driving force for the next phase of electronic commerce growth because the rapid adoption of the mobile telecommunication systems has created a market opportunity of several hundred million consumers worldwide [37].

Clarke [6] presented the following reasons why mobile technology is beneficial for businesses: e-commerce applications that succeed on the desktop PC will not necessarily meet with a similar accomplishment in a wireless commerce; industries that are time sensitive, such as financial services and travel, are likely to benefit from mobile commerce; the convenience of it offers tremendous opportunities to expand a client-base by eliminating some of the customers' labour of life's activities; vendors can deliver promotions based on the user's location, and real time discounting may become the 'killer application'; and personalized information and transaction feeds (such as past behaviour, situation, profile), via mobile devices, offer the greatest potential for the customization necessary for long-term success.

## 2.3 Challenges for M-Business Transformation

Currently, however, mobile technology encounters limitations. For example, high costs, slow speed, difficulties in typing text using a phone keypad, cumbersome navigation, and unreliable service are the top five dissatisfactions for mobile users [16]. Handheld devices still have restricted capabilities that hinder the design of straightforward communication protocols and prevent the management of data or services in an easy way. Limitations of mobile devices involve restricted processing capabilities and storage space, increased power consumption, limited display capabilities, variable bandwidth availability, sudden disconnections [8]. Clarke [6] also discusses the problems in terms of uniform standards, ease of operation, security for transactions, minimum screen size, display type and bandwidth, billing services, and relatively impoverished web sites. The lack of practical applications is another problem [15], [33]. On the business side, the challenges for developing m-commerce include different terminals, multi-transaction services, flexible location, flexible service and configurations, users' experience and enterprise integration [7]. Additionally, it may be difficult for decision makers to choose the most suitable business model. Managers also face the risk of wasting company resources chasing a changing technological environment, consumer alienation, and erosion of e-commerce market share [12]. Although many of these limitations are being eliminated or improved, nonetheless they need to be taken into account in m-business planning.

## 3 Research Design and Methodology

With limited information currently available on mobile business transformation, the exploratory and qualitative research method is found to be appropriate at this Stage. Exploratory research is suitable for the theory-building stage, and aims at formulating more precise questions that future research can answer [28]. Furthermore, Leedy and Ormrod [18] indicated case study is suitable for learning more about a little-known, or poorly understood situation. It provides understanding about complex phenomena within their context, and is the most popular research design for qualitative research in business disciplines. Riege [35] incorporated ideas from five other definitions and defined the case study methodology as 'A research method which focuses on a particular part of an organisation or an industry within its context in order to rigorously explore and analyse contemporary real-life experiences in-depth using a variety of evidence (p. 142)'. Furthermore, in case study research, multiple cases can improve the quality of data collection and research findings [2], [25], [26], [32], [36], [45]. Therefore, a *multiple case study* will be appropriate to answer the research issues, 'Why do businesses transform into m-businesses?' and 'What are the challenges in transforming current businesses to m-businesses?'

In multiple case study research, each case must be chosen so that it either predicts similar results (a literal replication), or predicts contrasting results but for predictable reasons (a theoretical replication) [45]. Therefore, to reflect the replication logic, the random selection of cases is neither necessary, nor preferable [24]. To illustrate the research matrix, a table (see Table 1) was built based on the literature [1], [20]. In this table, B2C m-business

includes those corporate providing service or product in the areas in commerce, intermediary, and information. B2B/B2E m-business includes those employ mobile systems in their value chain, such as procurement and inbound logistics, operation, outbound logistics, etc.

Further, there are two criteria for case selection. The first is that the company has made progress in mobile areas, or is interested in launching their mobile services related to customers, suppliers, or employees in the near future. The second criterion is geographic location. The organisations in southeast Queensland are preferred for the time and cost limitation of data collection. Since the aim of this study is to try to elaborate the framework of m-transformation, the unit of analysis is 'organisation'. Information on the current situation, company policies, challenges, and solutions in their mobile services will be collected from people in different positions and analysed. Research protocol will be prepared and reviewed prior to data collection.

Table 1: Research Matrix of the Case Study

B2C Mobile Business (Commerce, intermediary, information)	B2B/B2E Mobile Business (Operation, Procurement and inbound logistics, Outbound logistics, etc.)
Case A – Education	Case D – Government Sector
Case B – Banking	Case E – Health Care, Public
Case C – Telecommunication	Case F – Health Care, Private

The findings of this study are limited by the geographic factor of the cases. They are all in the southeast Queensland. In addition, the mobile business transformation is a relatively new issue, the constraint in case selection also needs to be considered during the process.

## 4 Process and Findings of This Study

This section contains the process and findings of the multiple-case study. It includes the brief introduction of cases, process of data collection and analysis, and findings.

### 4.1 Background Information of the Cases and Interviewees

There are six Australian cases included in the data collection and analysis. The first case is an educational institution (Case A). It is a dynamic and young university that offers award programs at undergraduate and postgraduate level by on-campus, off-campus and online study. It has a well-resourced main campus in southeast Queensland, and many regional support offices throughout Australia and in other countries where offer the awards programs. At May 2004, the university had approximately 26,000 enrolments, including over 7,400 international students. The university has strong research programs in such areas as biotechnology, agricultural and environmental engineering, sustainable land use, the design and development of fibre composites, numerical modelling and simulation, e-business and e-commerce, school leadership, children's literacy, theatre studies, literature and regional history.

In Case A, there were four people being interviewed. Interviewee A1 is the Chief Technology Officer (CTO) of the university, and has been worked in computing and telecommunications industry for 25 years. The position is to provide technical input on information and communication technology (ICT) infrastructure and architecture for the university's ICT strategic and operational plans. There are about 110 employees in the Division of Information and Communication Technology Services. Interviewee A2 is the Associate Director of Desktop Services in ICT. This division provides desk services for the university core systems. It is the only provider of network services. It is also in charge of the mainframe systems like People Soft. If people want to connect to wireless network, the division makes the registration and helps their computers to access it. The interviewee has worked at the university for 28 years, and 20 years in the division. Interviewee A3 is the Associate Director of Network Services in ICT, and responsible for all communication services of the university. It includes wired and wireless networking, voice data, IP telephony, and so forth. He has been working at the university for 32 years, and the last 21 years in the current unit. Interviewee A4 is the principal manager of Service Delivery in ICT. The unit is responsible for delivering all the services via networking to the university.

The second case is a financial institution (Case B). It provides the functions of banking by more than 100 branches and 630 employees. The financial institute was formed in 1981. Since that it has become firmly established as the largest mutual building society in Queensland, as well as one of the largest in Australia as well as a recognised force in Australia's building society industry. The objective of the financial institute is to provide members with excellent value through competitive pricing, user-friendly services, reliability and convenience. It seeks to be the preferred provider of finance, risk management and quality of life products and services to its members. It also has a philosophy of supporting communities, and has a proud history of community involvement and support. To achieve these objectives, it is essential that the society maintains a high level of integrity as an organisation both internally and externally.

There are three interviewees in Case B including the senior executive and managers. Interviewee B1 is the Head of Technology and Payment Systems, and is also one of the senior executives in the organisation. His duty is mainly related to information technology, as well as payment systems. It is the fulltime management through the divisions, project administration, and etc. He has been worked in the organisation for 15 years. Interviewee B2 is the IT Systems Manager. His duties are management of the system development process – all those analysts and project leaders report to him. The interviewee has worked in this organisation for 20 years and in the financial industry since 1964. Interviewee B3 is the IT operations manager. He is responsible for hardware control and hardware deployment, such as PCs and various other platforms of the organisation. He has been working in the organisation for 12 years and approximately 18 years in the industry.

The third case is a countrywide telephone and Internet service provider (Case C). It is one of the Australia's leading telecommunications and information services companies, with one of the best known brands in the country. It offers a full range of services and competes in all telecommunications markets throughout Australia, providing more than 9.86 million Australian fixed line and more than 8.9 million mobile services. The corporate responsibility vision is to connect with customers, communities and suppliers in an accessible, healthy and environmentally sound way. The main activities include the provision of basic access services to most homes and businesses in Australia; local and long distance telephone calls in Australia and international calls to and from Australia; mobile telecommunications services; broadband access and content; a comprehensive range of data and Internet services; management of business customers' IT and telecommunications services; wholesale services to other carriers, carriage service providers and ISPs; advertising, search and information services; and cable distribution services for cable subscription television services. One of the major strengths in providing integrated telecommunications services is the vast geographical coverage through both fixed and mobile network infrastructure. This network and systems infrastructure underpins the carriage and termination of the majority of Australia's domestic and international voice and data telephony traffic.

Interviewee C1 is an Account Executive. He has worked in the organisation for 13 years, and is in charge of the business customers in the countrywide area of southeast Queensland. The position has a top portion of understanding customers' businesses. It is to help the customers grow the revenue with the supporting of proper solutions and products that meet the customers' requirements and reduce the operational costs.

The fourth case is a public sector under the government (Case D). It has approximately 12,000 employees and staff members. During more than 130 years of its history, the traditions of the organisation has been shaped by immense social changes, incredible advances in technology and the continual evolution of operational procedures and staff attitudes toward the role and community cooperation. Its mission is to serve the people of Queensland by protecting life and property, preserving peace and safety, preventing crime and upholding the law in a manner which has regard for the public good and the rights of the individual. The vision of this organisation is to provide a professional service, dedicated to excellence and committed to working in partnership with the people of Queensland to enhance the safety and security of the community. To achieve its mission and vision, the organisation needs: to provide a corruption-free service to the Queensland community, based on integrity, fairness, equity, professionalism and accountability; in partnership with the Queensland community, as well as with other law enforcement agencies, provide responsive services to meet the service's statutory responsibility to preserve peace and good order and to prevent, detect and investigate breaches of the law by the use of problem-solving approaches; to help create a safe environment for all Queensland residents and visitors; to employ effective and efficient management systems which provide maximum support to operational officers and all other staff.

Interviewee D1 is the Manager of Division of Telephone Coordination, and worked in the unit for 9 years. The main duties of this unit are managing the telecommunications for the service from fixed phones, mobile phones, satellite, pagers, and etc. It is providing strategic planning, tactical and operational planning and implementation of the projects, as well as down to the administration of existing phone services. Interviewee D2 is the Manager of Radio and Electronics in the organisation, and has worked in the division for 34 years. There are 79 employees that look after all the radio communications infrastructure, electronics, and other equipments for all the various regions. The main duties include the strategic and tactical implementation of radio communications and electronic systems for the organisation. Interviewee D3 is a team leader in the Network Design and Implementation Unit, and worked in the organisation for 7 years. It deals with any new technologies based in the side of the environment and data communication for employees to connect to the network and access the databases. Interviewee D4 is the Chief of the department, and worked for 24 years in the organisation. He deals with the Minister's office and part of the senior officers across the service and helps the commissioner to ensure the operations of the department are working.

The fifth case is a public health sector (Case E), which manages and supports the public hospitals with 65,000 staff. It is a dynamic organisation committed to providing a range of services aimed at achieving good health and well-being for all Queenslanders. Through a network of 20 health service districts and the hospitals, it delivers a range of integrated services including hospital inpatient, outpatient and emergency services, community and mental health services, aged care services and public health and health promotion programs. The mission is creating dependable health care and better health for all Queenslanders. To fulfil its mission and sustain this trust, it shares four core values: caring for people, leadership, respect, and integrity. The strategic directions include: working with communities to improve health; creating a patient-focused health system; responding justly and fairly to need; working together; making the organisation a good place to work; building the next generation of health workers,

ideas and health services; promoting a problem solving approach to reform the organisation; better manage performance of systems assets and information.

There are 4 interviewees of this organisation. Interviewee E1 is a Project Director of Information Division and worked 4 years for this organisation. Information Division provides and maintains all IT systems such as telecommunications and application software. It standardises telecommunication products and services for the department including the mobile project. He is also in charge of the Mobility Project of the organisation. Interviewee E2 is a Critical Care Nurse in a public hospital and worked for 12 years. He also obtained a position on the Mobility Project, to give the project a business focus and engage the customers of mobile computing in their work space. High level business requirements were gathered for the project, and makes mobility more valuable in business areas. Interviewee E3 is a Site Manager. The duties are primarily to look over the health care requirements of the staff, and to assist in managing workloads, projects, maintenance of the information and communication technology services that the organisation delivers to its clients throughout the district. The interviewee worked for 4 years in the organisation and 25 years in information and communication technology areas. Interviewee E4 is the Manager of the South West Cluster of the Information Division in the organisation. His main duty is to maintain information technology service in the south west corner of the state that is from Ipswich to the southern border with NSW and out to the western border past Charleville. He worked in the organisation for 21 years and 12 years is for IT related position.

The last case is a private health organisation (Case F). The main business is orthopaedic operation for customers. Normally the patients are referred from their local doctor or the casualty department in the emergency centre. There are two orthopaedic surgeons and four staff. There is wired and wireless connection in the main office, and two virtual private networks (VPN) are setup in the office. One of the directors is introducing more mobile technology into their office, and the connection speed and stability are the most important factors during the process. The customers of this company are the patients who need orthopaedic services. Interviewee F1 is one of the principals and an orthopaedic surgeon who works for 18 years in this company. The main duty is to have orthopaedic operation for the clients and manage and support other employees. There are 2 orthopaedic surgeons, 2 practice managers, and 4 staff in the company.

Brief background of the cases and interviewees are summarised in Table 2. The size of organisation is divided into micro business (4 or less employees), small business (5-19 employees), medium business (20-199 employees), and large business (200 or more employees) by the classification scheme of Australian Bureau of Statistics.

Table 2: Brief Background of the Cases and Interviewees

Number of Case	Number and Position of Interviewee
Case A - Education, Large	Interviewee A1, Chief Technical Officer.
	Interviewee A1, Associate Director, ITS Desktop Service.
	Interviewee A3, Associate Director, ITS Network Services.
	Interviewee A4, Principal Manager, ITS Service Delivery.
Case B - Banking, Large	Interviewee B1, Head of Technology and Payment Systems.
	Interviewee B2, IT Systems Manager.
	Interviewee B3, IT Operations Manager.
Case C - Telecommunication, Large	Interviewee C1, Account Executive.
Case D - Public Sector, Large	Interviewee D1, Manager of Telephone Cord.
	Interviewee D2, Manager of Radio & Extension.
	Interviewee D3, Senior IT Officer.
	Interviewee D4, Superintendent.
Case E - Public Health Care, Large	Interviewee E1, Project Director.
	Interviewee E2, Business Analyst.
	Interviewee E3, Site manager.
	Interviewee E4, IT Manager.
Case F - Private Health Care, Small	Interviewee F1, Principal.

## 4.2 Process of Data Collection and Analysis

In the data collection stage, open-ended questions were used for the interviews. The interviewees were selected from IT operational staff, middle and senior management. Two pilot tests were conducted as the references to refine the interview questions.

After the interview invitations were accepted and consent forms were collected, the interviews were conducted in the interviewees' offices. The discussions normally took about 45 to 90 minutes with recording. Two interviewers participated in the process. One was responsible for conducting the interview and controlling time, the other was to make key notes and further clarify some unclear issues. After the interviews, the recordings were transcribed by two experienced research administration officers, as the preparation for data analysis.

According to Carson et al. [5], content analysis can be used to code groups of words in the transcripts into categories. In this study, each transcript was divided into 20 sections according to the interview questions. The related sections were examined, interpreted, and coded to identify the key terms or ideas. These key items and then be searched and compared in the same transcript to further identify as a factor (motivation or challenge) for m-business transformation. During this process, the summary of the relationships between factors and interviewees were also produced for data reduction and data display.

For the quality issue, some authors have demonstrated that validity and reliability can be achieved in case study research [9], [22], [31], [45]. Therefore, they were tested in different steps in this study. In the research design, replication logic was used in this multiple-case design for improving external validity. Case study protocol and multiple sources of evidence were prepared and collected to enhance construct validity and reliability in data collection stage [24], [45].

### 4.3 Motivations of M-Transformation

Some factors and sub-factors are identified as the motivations of performing m-transformation from the interviews. To help an organisation succeeds in their e-business development, Kalakota and Robinson [14] proposed three directions of focused excellence: *service excellence*, *operational excellence*, and *continuous-innovation excellence*. The motivational factors identified from case study are further grouped by these directions, as well as the *value creation excellence* that is proposed in this study. Figure 1 illustrates the four groups of motivational factors and sub-factors for m-business transformation that was identified and interpreted from the positive statements of the interviews. These focuses and factors are discussed from Section 4.3.1 to 4.3.4.

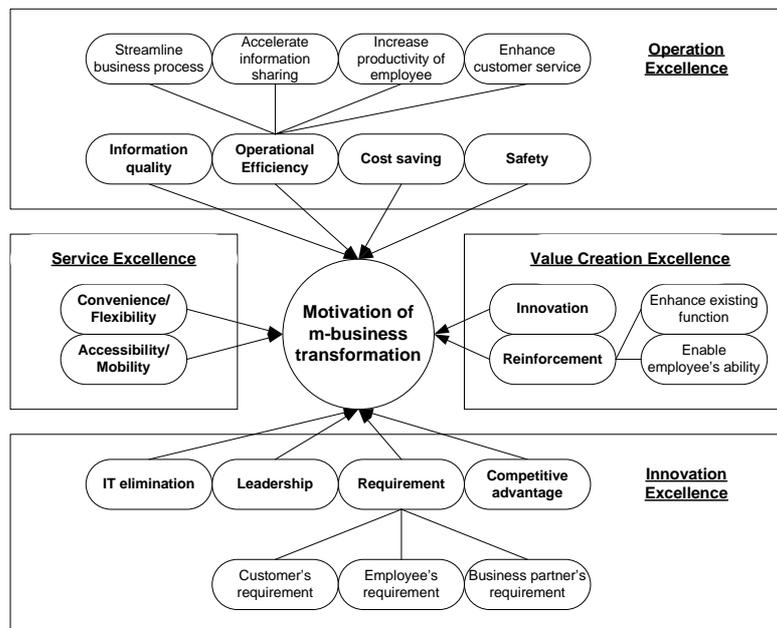


Figure 1: Motivations of M-Business Transformation

#### 4.3.1 Operation Excellence

Businesses or organisations introduce mobile service for delivering service or products more efficiently, with less error or lower cost. One of these factors is *information quality*. It refers to the intention to increase the accuracy and updating efficiency of business data. Another factor, *cost saving*, represents the intention to reduce costs in long-term IT investment, upgrading and maintenance, such as network infrastructure, mobile devices, etc. *Operational efficiency* includes either make business function/process quicker or more cost-efficient. It is the intention to increase the productivity of employees or to save time, money, or manpower for business processes. There are four sub-motivations: to increase productivity of employee, to enhance customer service, to streamline business process, and to accelerate information sharing. In other cases, to ensure people's *safety* motivates businesses or organisations to use mobile technology. These factors are further discussed in the following paragraphs.

*Information Quality.* Businesses or organisations intend to increase the accuracy of data, and to have better efficiency in updating business information on a real-time basis. It refers to the intention of increasing the accuracy and updating efficiency of business data (Interviewee E2). On the other hand, it can also reduce errors and delays when people have to take the data back to office, and give it to someone else to enter into computerised systems (Interviewee E3).

*Cost Saving.* Cost saving is the intention to reduce costs in long-term IT investments, including upgrading and maintenance of hardware and software. For example, 'in the university environment, there may be a saving ratio of 3 or 4 to 1 between wireless and wired network' (Interviewee A1).

*Operational Efficiency.* Some organisations are motivated to perform m-transformation by increasing efficiency for the operational business functions. The motivation can be further divided into four categories: increase of employee productivity; enhancement of customer service; streamline of business process; and acceleration of information sharing.

In some cases, providing mobile services can increase efficiency for employees. For example, 'the best thing associated with using mobile service is improving the operational efficiency of our workforce. It means people are not constrained to their desks to do works...that makes them productive' (Interviewee A1). Another case is in hospitals. It increases the ability of health professionals and other agencies to manage customers' information effectively, and help them to access and share the right information anywhere at anytime (Interviewee E2). Similar viewpoints related to better efficiency were mentioned by interviewee D1 for the speed of information update for the government officers, and by interviewee B1 that the financial institution was motivated to provide employees mobile solutions for this reason.

After employees have better efficiency, the productivity increases. It is faster and timesaving for employees to do their work with mobile devices rather than go back to the office. At the same time it provides better service to the customers by cutting their waiting time (Interviewee D4). This demonstrates that using mobile devices can increase efficiency and productivity of employees, as well as enhance customer service. The mobile devices are very good for time management (Interviewee C1) and medical inventory resource management to improve productivity of personnel (Interviewee E2). When hospitals are lack of skilled healthcare professionals, it will drive the technology as an enablement tool. This also involves streamlining some of the activities and working process that people currently perform (Interviewee E4).

*Safety.* The motivation of improving safety refers to the intention to increase safety of people or property by using mobile technology. For both the cases of government and hospital, using wireless technology is helpful to maintain the safety of personnel. For example, in the case of government sector, 'one of the major reasons (of using mobile technology) is the safety of officers and communities. It allows the officers to conduct their business where they need to' (Interviewee D2). In the case of hospital, the ability to provide health professionals with access to location aware and alert systems while in the community also improve the staff's safety (Interviewee E1).

#### 4.3.2 Service Excellence

Businesses or organisations intend to provide their customers better-quality service or give employees better support by the power of mobile technology. *Accessibility/mobility* of customers or employees can be reached by owning the ability to access online resources on mobile devices anytime at anywhere. These online resources can be corporate databases, WWW, email, and so forth. *Convenience/flexibility* can reduce physical labour of customers or employees by providing mobile solutions for them.

*Accessibility/Mobility.* Accessibility or mobility refers to the intention to enable customers or employees to access on-line resources, including corporate databases, WWW, email, etc. anytime at anywhere. Many interviewees mentioned it is one of the motivations for their organisations to perform m-transformation. For example, in the case of university, 'mobility is the key issue... If you want to take advantage of mobility, then wireless is the technology for it' (interviewee A3). People can carry their laptops with them in remote places, and have access to local information (Interviewee A1). In the case of financial institution, besides efficiency, the motivation to provide mobile service is the mobility for employees and customers (Interviewee B2), especially the access to services (Interviewee B1). In the case of hospital, the ability to access real-time information anywhere at anytime extending into other agencies, such as Ambulance Service and Flying Doctor Service, is critical and important (interviewee E1). The mobility can also prevent the clinicians stuck with desktop-type solutions and have to go back to a central area to do data entry or find out information they need (interviewee E4).

*Convenience/Flexibility.* Convenience or flexibility is the intention to reduce physical labour of customers or employees by providing mobile solutions for them. In the case of university, it is an enabling technology that students and staff would have greater flexibility to connect to the Internet...and that would potentially be integrated into a part of the academic program and have the link between delivering content via wireless network for the convenience and mobility purposes (Interviewee A2). It allows users to distribute or give access to information much easier (Interviewee A3). In the case of government, the convenience is one of the motivations to deploy new mobile systems. The executive officers can sit at home, watch the news, and then does an hour work remotely without worry about going back into the office (Interviewee D4). As for Interviewee C1, it is necessary to check diary on the PDA while outside the office, to arrange appointments and avoid people waiting at the office.

### 4.3.3 Value Creation Excellence

New value may be created for businesses or organisations by introducing mobile technology. The factor of *Innovation* means to create innovative business functions. *Reinforcement* refers to enhance or expand existing business functions, such as change the ways they are done before (enhance existing function) or enable employee to do what they can not do before when out of office (enhance employee's communication ability).

*Innovation* refers to the intention to create an innovative business functions. For example, in the case of university, the innovation includes using push technology and having its portal. Make all the information and functions available to students, such as organising peer groups, making discussion lists, and etc. However, 'all those sorts of things would not be possible if we did not have wireless networking across the campus, and if we did not make that kind of access available to them' (Interviewee A1). In the case of the government, it gives 'the opportunity to check on data directly back to the mainframe with wireless devices on the real-time basis' (Interviewee D4). Also, in the case of the private health institution, the practitioners can retrieve patients' information in the form of a letter – an automatic letter to save them dictating. Once the practitioners get it, they can walk around the office with the tablets to do their works. 'The only way I can do that is with wireless technology' (Interviewee F1).

*Reinforcement* is the intention to enhance existing business functions, such as increase the quality or accuracy by changing the ways they are done before. This motivation can be divided into two categories: enhance existing function, and enable employee's ability. In the case of university, mobile service is 'changing the paradigm of teaching, enhancing the university experience, and enabling a workforce that is becoming more mobile' (Interviewee A1). In the hospital, delivery of clinical information in direct support of the work that doctors are doing with patients, thus the doctor can have it via the bedside system. That will allow them to access all the patients' medical information to improve their ability to diagnose and assist with their patients. Also, there is communications benefit in that. Doctors as they move around the state, they can continue to communications with other staff members and colleagues to requests for information without delay. They are able to have the works done with better quality. (Interviewee E3).

### 4.3.4 Innovation Excellence

Businesses or organisations introduce mobile service for the motivations of being competitive by continuous innovation. The power of innovation comes from different sources. Sometimes, it is driven by the *requirement* of customers, suppliers or other business partners. In other cases, the *internal pressure* comes from the top managers within a business or organisation that pushes it to invest on mobile technology. Conversely, it may be motivated by the *external pressure* to keep *competitive advantage* between competitors, or maintain a good business image to the customers. *IT elimination* refers to the pressure that updating the legacy IT systems, it also pushes businesses and organisations adopting new mobile technology.

*Requirement.* User's requirement is one of the motivations of m-business transformation. It is driven by satisfying the demands from customers, suppliers or other business partners. By the target of requirement, this motivation can further be divided into customer's requirement, employee's requirement, and business partner's requirement. In the case of university, it has to look at ways to make mobile services available and offer them to students on campus, 'because there is a requirement for it' (Interviewee A1). In the case of the telecommunication company, interviewee C1 is a firm believer that the customers can get a real benefit from mobile services. In the case of government sector, interviewee D1 indicated the employees have a real demand for the mobile services. In the case of hospital, interviewee E4 specified the ability to keep medical supplies moving efficiently from the suppliers is necessary. For better supply chain management, business partners or the third parties can be the driver for using mobile technology.

*Internal Pressure/Leadership.* Internal pressure or leadership refers to the pressure within an organisation (e.g. intention of top managers) that leads the organisation to invest on mobile technology. For example, the m-transformation 'was really an initiative of the former director' (Interviewee A2). Interviewee C1 also proved this viewpoint: 'Sometimes it can be prompted by the CEOs, such as majors of councils. That is the power base.' Also, in the case of the financial institution, the senior executives are normally very keen on mobile services and devices, for the reason they have more responsibility and need to maintain control over their areas (Interviewee B1).

*External Pressure/Competitive Advantage.* The external pressure or competitive advantage is the intention to keep competitive advantage between competitors, or maintain a good business image to customers. For example, in the case of financial institution, 'sometimes competitive pressures might force us to adopt a particular technology purely not because we feel left out, but because if we do not, we could be seen as behind the times or not competitive' (Interviewee B2). Further, in the adoption of mobile technology, 'we would not necessarily adopt it for our employees just because the employees of other banks had it. But if it involved customers then we would be more likely to want to be competitive' (Interviewee B2). Similarly, in the case of university, the interviewee believes that 'we have not kept pace with how technology has been changing the way of doing e-business, and the problem we have got now is need to re-focus on that, and try to get the competitive advantage back through the appropriate adoption of new technologies' (Interviewee A1).

*IT Elimination.* The pressure of IT elimination comes from new IT products/technology eliminating old ones in the market. It pushes a business or organisation considers adopting new IT when the legacy systems are replaced. For

example, 'it is not just better, faster, and cheaper. It is the manufacturers and the resellers are also pushing stuff. They will take stuff out of the market in order to get a new one, so everyone has to change' (Interviewee D1).

To summarise, the relationship between the motivations of transformation and the interviewees are presented in Table 3. The column of frequency indicates how many interviewees have mentioned this factor in their conversations, and the column of percentage contains the ratios of all 17 interviewees. However, the frequency or percentage does not represent the importance of the factors. A less common motivation does not necessarily mean less important than a common one for an organisation.

Table 3: Quantitative Analysis for the Interview Findings (Motivation)

Focus of Excellence	Factors	Proposed Interviewee	Frequency	Percentage
Operation Excellence	Information Quality	E2, E3	2	12%
	Operational Efficiency	A1, B1, C1, D1, D4, E1, E2, E3, E4	9	53%
	Cost Saving	A1	1	6%
	Safety	D2, E1	2	12%
Service Excellence	Convenience /Flexibility	A2, A3, C1, D1, D4	5	29%
	Accessibility /Mobility	A1, A3, B1, B2, D2, E1, E4, F1	8	47%
Value Creation Excellence	Innovation	A1, A2, D4, F1	4	24%
	Reinforcement	A1, D2, E3	3	18%
Innovation Excellence	IT Elimination	D1	1	6%
	Leadership	A2, B1, C1	3	18%
	Requirement	A1, C1, D1, E1, E4	5	29%
	Competitive Advantage	A1, B2	2	12%

#### 4.4 Challenges for the Transformation Process

In addition to motivation of m-transformation, some other factors and sub-factors are interpreted and classified as the challenges for the m-transformation. These challenges cover the areas of management, finance, design, and innovation. Figure 2 illustrates the factors and the classification scheme.

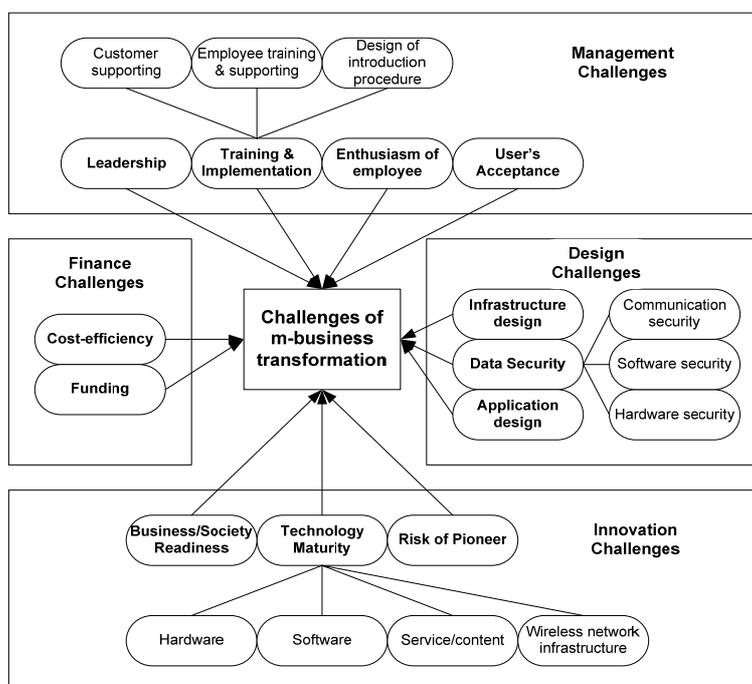


Figure 2: Challenges of M-Business Transformation

#### 4.4.1 Management Challenges

These challenges include *leadership*, the support and authorisation from top managers, which is the important element of successful business transformation. Besides, how to inspire the *enthusiasm of employee* and how to increase the extent of *user's acceptance* are also essential. *Training and implementation* issue comprises design work of introducing procedure, employee training, and customer supporting.

*Leadership* refers to the challenge that how to obtain supporting and authorisation from top managers in the decision making process of m-business transformation. For example, it is essential that business owners take a leadership role for the implementation of mobile technology (Interviewee E1).

*Enthusiasm of Employee*. This challenge refers to the realisation and enthusiasm of employees in an organisation toward changing current ways of doing their job for the m-transformation. In the case of hospital, if there is a change in business process required, people can be resistant to that (Interviewee E3). Lack of enthusiasm can also slow down the development of new systems. For example, part of the difficulty is finding enough clinician involvement. Some systems even took 2 to 5 years to implement in the hospital (Interviewee E4).

*User's Acceptance*. User's acceptance is the challenge that comes from the intention and readiness of customers or employees to accept mobile services. For example, in the case of university, the biggest challenge is adoption. Even the system is set up, if people do not use it effectively, it is impossible to derive maximum benefit from it (Interviewee A1). In the case of government sector, there is a similar problem. Mobile service users in different age groups and positions have various levels of competence in accepting new technology (Interviewee D2). Even new technologies can sometimes be challenging for users, however, 'if we provide a quality of service that they (the users) require improving on operational duties, it will enable the learning curve' (Interviewee D3).

*Training and Implementation*. The challenge of training and implementation refers to a business or organisation to conduct necessary training and education to its employees for a new mobile service or system. It can be divided into three categories: design of introduction procedure; employee training; and customer supporting. As interviewee A1 pointed out, part of the challenges in implementing mobile services is the education of users. Also, in the case of hospital, 'some of the challenges are in deploying the technology, such as training users how to use it, and understanding the limitations and the way it works' (Interviewee E3). For a successful utilisation of mobile devices and services, the access to effective and timely IT support and training is needed (Interviewee E1). In the case of government sector, it is believed to provide a mobile service to the employees needs a lot more support. It needs IT technicians to keep the implementation process going (Interviewee D4).

#### 4.4.2 Finance Challenges

The challenges such as evaluation of the *cost-efficiency* play an important role for the success. The costs of investment for a mobile service or system need to be compared with the benefit deriving from it. *Funding*, the financial ability of the business or organisation to afford the initial and maintaining costs such as hardware, software, education and training, etc. for the mobile systems is another factor to consider.

*Cost-Efficiency*. The challenge to reach cost-efficiency refers to the evaluation of investment costs for mobile service or system comparing to benefit that can derive from it. For example, 'the cost-efficiency is important because the screens of mobile devices are small and varied, the interfaces of applications need to be resigned...Even for e-banking, sometimes we still struggle for whether supporting different operational systems and hardware. It is similar for mobile devices' (Interviewee B2). In the case of the financial institution, cost-benefit analysis is the starting point. If people who propose to introduce a new technology, but they can not cost justify it, then the idea will be rejected (Interviewee B2). One of the reasons people hold a strict attitude towards cost-efficiency consideration is '...enthusiasm will sometimes cloud people's judgement to what the actually business benefit is, where people are carried away with the excitement associated with the device rather than looking at the business benefits' (Interviewee B1). In the case of government sector, there is a similar consideration. Part of the challenges might have in the introduction process of mobile services is to ensure that there are sufficient benefits out of the services to meet the costs (Interviewee D4).

*Funding*. Funding issue challenges the financial ability of an organisation to afford the initial and maintaining costs such as hardware, software, education and so forth to invest on mobile services and systems. For example, 'that is the biggest challenge for us — finding where the underlying funds are. There are challenges in terms of where is the money coming from to actually change the business practices' (Interviewee E4). In the case of government sector, there is a similar situation. A lot of mobile technology is very expensive comparing to what people manually do currently, not mention the following costs of update (Interviewee D4).

#### 4.4.3 Design Challenges

The design issue needs to be considered includes the design and implementation of the *infrastructure* and *applications* of mobile systems/services from a corporate view. In addition, *data security* is the other inevitable problem. This includes the security in the levels of data communication, software, and hardware. For the reasons

that wireless signal is easy to expose to the public, and mobile devices are small and easy to be stolen or lost, data security is a critical challenge.

*Infrastructure Design.* The challenge of infrastructure design refers to plan and build the architecture of mobile system or service infrastructure from a corporate view. Take the case of hospital as an example. 'The architecture needs to be designed by which the mobile infrastructure is to fit into. It relates to physical location of devices and virtual connection. There are some of the challenges that have to be met, and we have met quite a number of those with our design' (Interviewee E3).

*Data Security.* Security concern refers to how to protect business data from different level of threats. The concern includes the levels of hardware, software, and communication. Hardware security is to prevent the threats in mobile device level (e.g. devices are lost). Software security is to prevent the threats in application level (eg. data integrity and virus infection). Communication security is to prevent the threats in data transmission level (eg. privacy and confidentiality of data). Most interviewees agreed the security threat is one of the main challenges in the m-business transformation. For example, 'typically within buildings you have alarm systems and locks, but mobile devices are easy to be stolen' (Interviewee B1). Also, 'our product by definition is housed on the Internet and can be stolen. If people use PDAs but their emails are not secure, the sensitive information would be intercepted by someone else' (Interviewee B2). Another example is caused by the characteristic of wireless signal. The signal may cover areas outside the secure zone where anybody can try to access the wireless network. For instance, 'that is a potential threat to our networks confidentiality and to officer safety' (Interviewee D2). 'We can not have any of our systems open to the public, as you can imagine how sensitive that data is' (Interviewee D3).

Even some actions are taken to protect data security such as multiple levels of firewalls, encryption of data, authentication, protection against viruses, protection against denial of service attacks, management of bandwidth within mobile technology environments (Interviewee B2 and E3), however, the implementation of mobile services is still constrained by the security threats in some extent. For instance, 'at the moment, because of security risks and a number of other things, certain services such as Skype are not condoned on the network' (Interviewee A1).

*Application Design.* It refers to the challenge of designing the applications or software to meet the user's requirements and suit the various mobile devices. For example, 'because the screens of mobile devices are small and varied, the interfaces of applications need to be resigned. The core system may be reused for software development, but interface not. Even for e-banking, sometimes we still struggle for whether support different operational system and hardware. It is similar for mobile devices' (Interviewee B2).

#### 4.4.4 Innovation Challenges

The first consideration when many businesses or organisations try to provide mobile service is the *maturity of mobile technology*. Even the hardware is updating with an incredible speed, currently there are still some limitations for mobile devices, such as performance, screen size, battery life, etc. Next, the availability, easy of use and compatibility of software is another point. Besides, the quality and quantity of value-added mobile services, bandwidth and stability of connection, coverage of wireless network also challenge the quality of mobile services. The uncertainty of technology itself will increase the *risk of pioneer*. The *psychological readiness* also influences the willing of customers and employees to change their habits.

*Technology Maturity.* The challenge of technology maturity refers to the readiness of technological environment, such as stability, security, performance of hardware, availability of software, bandwidth of networking, etc. It can further divide into four categories: hardware, software, service/content, and wireless network infrastructure. Hardware maturity includes the performance, screen size, battery life, and so forth of mobile devices. Software maturity includes the availability, easy of use, and compatibility of the applications for mobile devices. Service or content majority is the quantity and quality of value-added services or information for mobile users. The maturity of wireless network infrastructure includes bandwidth, connection stability, coverage area, and etc. The development of mobile technology both motivates and constrains m-business transformation. For example, 'it is a great tool but if there is no real business applications to drive its adoption, few could see the benefit to use it' (Interviewee A1). In the coverage and bandwidth of wireless network, interviewee A3 and interviewee D1 both mentioned the constraints of it. Interviewee D2 even pointed out the difference between areas: 'the biggest challenge is the geographic size of Queensland. The telecommunication companies provide saturation coverage into Brisbane, but there is less money involved in putting coverage into other areas. Therefore, the challenge is how do we provide the officers safety and meet the requirements in a regional area, and give that person the same level of communications technologies as they are in Brisbane'. In the cases of both private and public hospitals, there is a similar situation. 'The connection speed of 802.11g is only 54 megahertz per second which is not particularly fast...And the reliability is disappointing. The signal drops out. That can be due to interference – electrical interference or people's interference. The speed of the connection, even in a small place where the access points are not very far away, it can vary with time' (Interviewee F1). In the case of university, 'the matter of the student environment is currently we do not provide enough incentives or services for them to use it' (Interviewee A2).

*Business/Society Readiness.* The psychological readiness of people in businesses or societies for using and adoption of mobile technology challenges the acceptance and success of mobile services. Without the acceptance and support of employees and customers from inside and outside of a business, success of m-business

transformation will not be reached. For example, 'you actually see the success or failure of particular mobile product depending on society's readiness' (Interviewee A1).

*Risk of Pioneer.* It refers to all the risks of investing on emerging and unfamiliar technology. Take the case of the financial institution as an example. 'We would like at least to see that it had been proven in other markets either in Australia or overseas. We would not want the reputation of the company involved before making sure it had a good track record' (Interviewee B2). The same challenge happens in the government case. 'Whether it is mature or not, sometimes if technology is too new, it has not got a good track record or people are not sure of reliability' (Interviewee D4). Further, 'the other challenge is the technology itself. The technology changes so quickly. We can not invest a lot of money in a technology that will only work on today' (Interviewee D2).

To summarise, the relationship between the challenges of transformation and the interviewees are presented in Table 4. The column of frequency indicates how many interviewees have mentioned this factor in their conversations, and the column of percentage refers to the ratios comparing to all 17 interviewees. However, the frequency or percentage can not represent the rank or level of challenges.

Table 4: Quantitative Analysis for Interview Findings (Challenge)

Group of Challenge	Factors	Proposed Interviewee	Frequency	Percentage
Management Challenges	Leadership	E1	1	6%
	Training & Implementation	A1, D4, E1, E3	4	24%
	Enthusiasm of Employee	E3, E4	2	12%
	Customer's Acceptance	A1, D2, D3	3	18%
Finance Challenges	Cost-Efficiency	B1, B2, D4	3	18%
	Funding	D1, D4, E1, E4	4	24%
Design Challenges	Infrastructure Design	E3	1	6%
	Data Security	A1, A2, A3, B1, B2, B3, D1, D2, D3, E3, F1	11	65%
	Application Design	B2	1	6%
Innovation Challenges	Business/Society Readiness	A1, E4	2	12%
	Technology Maturity	A1, A2, A3, D1, D2, D3, F1	7	41%
	Risk of Pioneer	B2, D2, D4	3	18%

## 5 Discussion and Conclusion

This study used the multiple-case method to explore the phenomenon of m-business transformation in Australia. It summarised the preliminary findings to understand the m-business transformation, including the motivations for the transformation, and the possible challenges in the process. The transformation activity not only includes technical consideration, but also influences business function, working processes, and management issues. The successful transformation will need a more comprehensive planning and process. The findings of this research may be helpful for the decision makers in understanding their m-transformation and make it more successful. As this is an emerging field, this is perhaps the first attempt in Australia to understand these issues. This is the contribution to the broader field.

M-business transformation can be divided into the groups of customer service and employee/business partner supporting. Both of these groups involve managerial and technological input. This study identified 21 motivational factors and 22 challenges for m-business transformation from the multiple case studies. Based on the findings, some similarities and differences can be found between m-transformation and other organisational changes driven by information technology. For example, one similarity is when a new technology emerges, decision makers often meet the dilemma between taking the uncertain risks by being pioneers or keep safe by being followers but may lose the opportunities to further strengthen competitive advantage. In this part, the experience gained from the previous organisational transformation may be the hints to help managers making the decisions. On the other hand, the unique characteristics of the m-business transformation inspire researchers in looking for solutions that are different from that of the existing ones. For example, by using mobile technology the manner in which both customers and employees do their business can be changed. In this situation, implementation of a mobile solution can start from the employees of a business. This may be a new paradigm in businesses. Compared to customers, employees are more predictable and controllable in implementing new systems. This gives businesses and organisations opportunities to

evaluate the new mobile service or system in a smaller and internal user group. Therefore, the potential risks can be identified and reduced to some extent.

Adoption to m-business does not mean the investment in current e-business is in vain. On the contrary, businesses will have more opportunity to reach customers and keep their competitive advantages in the future. As Carlsson [4] aptly indicated, cyber economy will combine traditional business with new e- and m-business, and will be driven by a new breed of online customers who operate both wired and wireless networks, and who expect fast delivery, easier transactions and more fact-based information. This was evident from the interviews conducted in this study. Most interviewees expressed that the challenges to the adoption of m-business did not really stop their business or organisation from commencing it. In their views, the understanding of such challenges and how to mitigate them is the beginning to forming the basis of a successful m-business transformation.

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