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Australian Case Studies in Mobile Commerce

Jonathan O'Donnell, Margaret Jackson, Marita Shelly and Julian Ligertwood [1]

[1] Smart Internet Technology CRC at RMIT University, Melbourne, Australia. Contact Margaret.Jackson@rmit.edu.au

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Abstract

Sixteen wireless case studies highlight issues relating to mobile commerce in Australia. The issues include: the need for a clear business case; difficulty of achieving critical mass and acceptance of a new service; training and technical issues, as well as staff acceptance issues; that privacy and security issues arise through the potential to track the location of people and through the amounts of personal data collected; difficulties in integrating with existing back-end systems; projects being affected by changes to legislation, or requiring changes to the law; and that while there is potential for mobile phone operators to develop new billing methods that become new models for issuing credit, they are not covered by existing credit laws.

We have placed the case studies in a Fit-Viability framework and analyzed the issues according to key success criteria. While many organizations are keen to use the technology, they are struggling to find a compelling business case for adoption and that without a strong business case projects are unlikely to progress past the pilot stage.

Key words: Australia, Mobile Commerce, Wireless applications, Fit-Viability framework, critical success factors

1 Introduction

The use of wireless technology for a range of business activities, such as mobile commerce, is a small but rapidly growing part of the economy. While there have been some studies in the area, there appears to be little academic research describing the problems and challenges of organizations undertaking wireless-based projects. Most of the available literature is written for technology reviews or by commercial suppliers seeking to attract new customers. As such, it concentrates on the positive aspects of the technology, and largely ignores the problems and challenges.

This means that underlying issues are often not discussed. For example, experience with the growth in e-commerce during the late 1990s has shown that a fast moving area like mobile commerce will often outstrip the ability of the law to keep pace. This can result in both organizations and consumers being exposed to considerable legal and financial risk [35].

This study sought to understand the challenges and issues, particularly those of a legal and regulatory nature, faced by a range of organizations in different sectors when implementing wireless-based projects. We interviewed people undertaking wireless commerce from a range of different sectors. We used a case study approach to 'investigate a contemporary phenomenon within its real-life context' [40]. This meant that we could explore both 'how' and 'why' wireless technologies are being adopted. The case studies gave us a greater understanding of what they have actually done, what difficulties they have encountered and what solutions, if any, they have put in place. This provides industry with information that will help them to plan for, or at least anticipate, these complexities at the outset of a mobile commerce project.

While we were primarily interested in legal issues, the case study approach allowed us to explore the complexity of the situation and uncover a range of business-related issues. These included:

- The need for a clear business case.
- Issues relating to payment models.
- The difficulty of achieving critical mass and acceptance of a new service.
- Training and technical issues, as well as staff acceptance issues.
- Privacy, security and confidentiality issues.
- Difficulties in integrating with existing back-end systems.
- Technical difficulties with the equipment.
- Projects being affected by changes to legislation, or requiring changes to the law.

1.1 Background

In 2002, Coutts et al showed people new mobile devices and explored how they might use them. They found that the mobile internet differed from the wired internet because users regarded their mobile phone as "an extension of themselves", enabling them to enhance their relationships in work, family and daily life. The personal relationship that the user had with their mobile phone would be a key enabler to adoption of internet enabled mobile services. [13], [14]. Her findings were echoed, to some extent, in our findings relating to the difficulty of achieving critical mass and the acceptance of a new service.

There had been a good deal of work evaluating mobile solutions for health care in Australia. Chau and Turner reported on the successful trial of a wireless hand-held clinical care management system at an Aged Care Facility in Launceston Tasmania [7], [8]. Crow reported similar success with the trial of a care coordination system in a hospital emergency department [15]. However, when Gururajan et al and Soar et al undertook to review wireless solutions developed for the Australian healthcare in 2005, they reported that although there was great potential, wireless solutions in the Australian healthcare organizations that they reviewed did not realize major gains [24], [37].

Work has also been undertaken on mobile payments, including some case studies of people implementing mobile payments. Zmijewska et al provided a user-centered mobile payment model [41] and provided an excellent review of available technology which looked at ease of use; usefulness; trust; mobility; cost and expressiveness [42]. At the same time, Teo et al described some of the factors facilitating and inhibiting adoption of wireless payment systems in three mobile payment trials in Australia. They found that mobile payment trials were successful in Australia but were still in a probationary phase. [39].

In 2004, the Victorian Government's Standing Committee of Officials of Consumer Affairs also reported on mobile commerce from the consumer's perspective. They reported that m-commerce services were only at an early stage of development and there was still significant uncertainty as to the services m-commerce will support and the features of these services. They also found that there could be potential for overlapping jurisdictions in some areas [11].

In 2005, Chan and Hoang adopted the user-centric approach to the business and network model for m-commerce. Their novel architecture would improve the way that the network provided services to the user [6]. Innes et al reported two New Zealand organizations experience with wireless field force automation [25]. Marmaridis et al

described their work to introducing wireless solutions into small to medium enterprises (SMEs, less than 200 staff). They saw that a clear set of requirements would prove useful to SME organizations and vendors alike [29].

Concerns about privacy, confidentiality and security are frequently raised by consumers in the context of wireless technology, specifically in respect of the area of control over and access to personal information [10], [31]. However, in many cases, individuals used the terms interchangeably.

There have been few user studies concentrating on how people want to control personal information and manage their identities while engaged in different activities. Existing policy studies for the main part focus on attitudes to privacy rather than behavior in activity contexts [32]. The user studies on the control of personal information conducted in the Smart Internet Technology Cooperative Research Centre have found that privacy is seen as the control of the sharing of personal information and control over the representation of ourselves [26], [36]. Privacy did not equate with anonymity. It also did not mean being left alone.

Over this period, the great bulk of the commonly available public literature on wireless implementations was written for technology reviews or by commercial suppliers seeking to attract new customers. As such, it concentrated on the positive aspects of the technology and largely ignored the problems and challenges [23], [13].

We sought to understand the challenges and issues, particularly those of a legal and regulatory nature, faced by a range of organizations in different sectors when implementing wireless-based projects. Experience with growth in e-commerce during the late 1990s has shown that a fast moving area like mobile commerce will often outstrip the ability of the law to keep pace. This can result in both organizations and consumers being exposed to considerable legal and financial risk [11].

It is very important that if you need to make your image smaller that you reduce the size of the figure by using the diagonals (i.e. the corners of the image) of the box, rather than the sides. This will ensure that figures remain to scale.

2 'Mobile', 'Wireless' and the Space In-between

Wireless technology is being used within enterprises for commercial activities and for provision of services to consumers. In discussing what is happening in this area, it is evident that there is some confusion about the terms. We define the fundamental terms for this area: "mobile", "wireless", "electronic commerce" (e-commerce) and "mobile commerce" (mCommerce). We also describe new terms within mCommerce - "mobile services" (mServices) and "mobile enterprise" (mEnterprise).

2.1 Untangling the Terms: Mobile and Wireless

The wireless environment is sometimes described as mobile commerce (mCommerce) or mobile Internet but it is broader than these terms. Although the terms *mobile* and *wireless* are often used interchangeably, *mobile* pertains to the ability of an entity to be on the move, while *wireless* pertains to the technology that allows transmission of voice, data and other content through radio waves over the air, not restricted to physical cables or other physical mediums [17].

Roger Clarke provides a comprehensive outline of wireless transmission and mobile technologies that clarifies some of the complexities of this area. He suggests five classifications based on the size (or power) of the wireless network: satellite networks (e.g. GPS), wide area wireless networks (WANs, including the mobile phone system), local area wireless networks (LANs, particularly 802.11b and 802.11g), personal area wireless networks (e.g. Bluetooth), and slave-to-master wireless links (e.g. proximity cards and RFID). Most wireless commerce activity is using the mobile phone network, a wide area wireless network [9].

While there is also a great deal of growth in the area of slave-to-master wireless networks, using radio frequency identification (RFID) chips, we did not cover this area in our research. Any organizations that we contacted that were introducing RFID either did not respond or were unwilling to take part in this study.

Clarke also identifies four distinct meanings of the term 'mobile':

- In a different location at any given time from that in which they were at one or more previous times (e.g. mobile EFTPOS machines).
- In any location from which transmission to another device is possible (e.g. satellite phone).
- Currently moving relative to the earth's surface, but nonetheless capable of sustaining data transmission (e.g. in-car navigation systems).
- Designed to be easily and conveniently portable, and to rely on wireless transmission (e.g. wireless PC) [9].

Apart from mobility, there appear to be three essential characteristics that differentiate the mobile data network: immediacy, contextual influences, and location. *Immediacy* refers to the ability to access the Internet and communicate voice and data information instantly, without being bound to a fixed location. Communications networks such as those utilizing satellite technologies also mitigate the restrictions on mobile devices in remote

areas. Globalstar, for example, offers 'satphones' which connect to geostationary satellites and are operated in a manner similar to a mobile phone [22].

The issue of *context* is also greatly enhanced by the use of mobile devices [33]. In fact, one of the most important issues for wireless application developers is the perceived dynamics between the user and context [14], [18]. Context can include environmental factors (e.g. physical location, distraction, crowding), social context (e.g. need for privacy and interaction with others) and personal factors (e.g. emotion, time on hand, movement) [27]. Mobile devices can be used in a variety of contexts; traveling to work, relaxing in a café, or waiting at an airport. As a result, mobile device users have a tendency to accomplish specific tasks that have meaning within that particular context. For instance, Lee et al found that consumers most frequently used mobile devices when they had more time on hand or were off duty, and had little social interaction, distraction or crowding [27]. Moreover, mobile devices are not normally shared, so they tend to carry some personal identity [5]. For instance, the huge revenue from sale of mobile phone ring tones and logos illustrates users' attempts to personalize generic handsets. In fact, Coutts et al argue that the mobile device is 'not just a personal computer without wires', contending that users perceive there to be different values associated with personal computers and mobile devices, and as such they share different relationships between the two [14].

Mobile devices can also enable user *location*-identification. Not only can users engage in 'where am I' and 'where is this' -type services (such as in-car navigation systems), but network providers are able to identify the user's location. Thus, in some circumstances, this information can be passed on to third parties, such as emergency services. Of course, this aspect of wireless communication has significant implications for privacy and security.

Liang and Wei expand on immediacy, context and location by describing wireless applications according to whether they have one or more of the following six characteristics: time critical services, location-aware and location-sensitive services, identity-enacted services, ubiquitous communications and content delivery services, business process streamlining, and mobile offices (personal information management) [28].

2.2 Untangling the Terms: eCommerce and mCommerce

In 1998, the Australian Government's Electronic Commerce Expert Group defined Electronic Commerce as:

… a broad concept covering any trade or commercial transaction effected via electronic means; this would include such means as facsimile, telex, EDI, Internet, and the telephone. For the purpose of this report, the term is limited to those commercial transactions involving computer-to-computer communications whether utilizing an open or closed network. [20].

Mobile commerce (mCommerce) has been defined as the ability to use mobile wireless devices as a secure method to purchase goods, services or digital content [2]. Specifically, eCommerce involves computer transactions while mCommerce involves transaction via a mobile device, although there is some overlap with laptop computers. There are broader definitions of mCommerce, which use the term to include services involving communication, information, transaction and entertainment [34]. In this latter definition the 'mCommerce' label is used to describe all things 'wireless'. The narrower definition of mCommerce is used in this paper.

At a conceptual level, eCommerce and mCommerce share fundamental business principles, including similar business models based on remote transactions, and, as such, mobile commerce could act as another channel through which to add value to eCommerce processes [12], [30]. For both eCommerce and mCommerce, users are commonly required to buy hardware and pay a service provider for a connection, while transactions are generally conducted through a wireless portal for mCommerce or a World Wide Web site for eCommerce [11].

Although eCommerce and mCommerce share a number of characteristics, there are differences between the concepts. For instance, Stafford and Gillenson [38] argue that eCommerce is different because it is mostly transactional (buying and selling of tangible goods and services), while mCommerce is largely driven by sale of data products (such as ring tones or information services). In addition, there appears to be clear consumer preferences in mCommerce and eCommerce; for instance, a significant preference to purchase low-risk items using the mobile devices [5].

2.3 Untangling the Terms: mCommerce, mEnterprise and mServices

Wireless commerce is being undertaken at many different levels of the economy. It spans the boundaries of organizational size and turnover, industry sector and it can affect any aspect of a customer's relationship with the organization, or used to streamline activities within the organization. We view the wireless commerce landscape as growing in three distinct, but inter-related, areas: consumer transactions (including sales of goods and services, which most people would associate with mCommerce), enterprise solutions (mEnterprise; for example, supply chain solutions, logistics applications or field force automation), and other services to individuals and customer organizations which do not involve a direct payment (mServices; such as mobile banking and wireless communications in health) [23]. This paper discusses activities in all of these three areas.

MServices and mEnterprise differ from mCommerce. MServices encompass a wide range of wireless applications that involve individuals or enterprises, but for which there is no transfer of property or digital objects (such as ring tones). MService projects are often trying to provide customers with new ways of undertaking their current activities (for example, mobile banking). While mCommerce encompasses business–to–business (B2B) and business–to–customer (B2C) transactions, mEnterprise concerns the use of mobile devices in inter–and intra–business operations. mEnterprise projects generally entail some aspect of business process reengineering. These areas overlap and the definitions are not precise. We based them on the real differences that we see between different activities within the wireless economy [23]. Table 1 sorts the case studies according to whether they predominantly fall into the areas of mCommerce, mServices or mEnterprise.

The difference between mCommerce and mEnterprise is best expressed in case study 06. In this case study, the City of Fremantle provided residents with the ability to pay parking fees via mobile phone (mCommerce), while using wireless PDAs to monitor parking infringements (mEnterprise).

Table 1: Case studies according to organization size and activity

ID	Organization	Org. size	Area	Activity
CS-01	Shopping Secrets	Small	mCommerce	Shopping, bar and restaurant info via your mobile phone
CS-02	AURA Group	Small	mCommerce	Electronic tickets supplied to mobile phones
CS-03	Telecommunications co.	Large	mCommerce	Use mobile phones to pay for soft drinks.
CS-04	Bank	Large	mCommerce	Recharge your mobile phone at a bank ATM
CS-05	Telecommunications co.	Large	mCommerce	Use mobile phones to pay for parking fees
CS-06	City of Fremantle	Large	mCommerce/ mEnterprise	Parking fees paid by mobile phones; parking infringements monitored by wireless PDAs
CS-07	Dr Andrew Navakas: Dentist	Small	mServices	Sends appointment reminders to patients via SMS
CS-08	John Ewart: Taxi owner	Small	mServices	Taxi drivers connecting in small networks, using wireless for bookings and payments
CS-09	Mortgage broker services	Small	mServices	Providing updated material to wireless PCs and broadcast SMS messages
CS-10	Bank	Large	mServices	Mobile EFTPOS transactions
CS-11	William Angliss: Hospitality	Large	mServices	Providing course materials to students while on 'placement'
CS-12	RMIT University: Nursing	Large	mServices	Providing course materials to students while on 'placement'
CS-13	Yarra Valley Water	Large	mEnterprise	Maintenance field staff use wireless PCs to access water pipe data while in the field
CS-14	Kleenheat: Gas delivery	Large	mEnterprise	Truck drivers use handheld devices to record delivery and account information
CS-15	StorageTek: IT storage co.	Large	mEnterprise	Wireless field dispatch and service platform, using BlackBerry wireless devices
CS-16	Dubbo City Council	Large	mEnterprise	CCTV security system in the city's shopping precinct

Note that while all of the case studies are based on wireless wide area networks, including the mobile phone network, case study 16 is not a mobile project. It uses fixed location wireless CCTV cameras for security within the city area.

3 Australian Case Studies

In this paper we focused on the type of product or service wireless technology can deliver, rather than on the technology itself. This perspective allows us to place the 'transaction' – in whatever form it may take – at the centre of our studies. By adopting a case study approach we can explore both how and why wireless technologies are being implemented.

A case study approach is particularly suitable to situations where little is known about a particular phenomena and the existing literature on the phenomena is limited or inadequate [19]. It is a valuable approach when seeking to describe how particular phenomena operates and has a 'unique strength in its ability to deal with a full variety of evidence – interviews, documents …and observations…' [40]. Case studies often provide multiple outcomes that explore, describe and explain the phenomenon [40] which in this study is the adoption of wireless technology.

3.1 Who We Talked To

In preparing this research, we contacted 38 organizations who were undertaking wireless and mobile projects. Projects were identified through a review of the academic literature, trade press, newspaper media, the researchers' own personal knowledge and personal networks.

Fourteen organizations agreed to participate. As several organizations were doing multiple projects, this resulted in 16 case studies. While some case studies were provided anonymously, most participants agreed to be identified. Table 2 briefly describes the characteristics of each case study and the technology involved. It also rates the case studies according to the Fit-Viability Framework discussed in section 4.

Table 2: Case studies by technology, wireless characteristics and Fit-Viability Framework

ID	Organization	Technology	Wireless characteristics [28]	Fit-Viability [28]
CS-01	Shopping Secrets	Mobile Phones	Content delivery	High fit/ High viability
CS-02	AURA Group	Mobile Phones and SMS	Content delivery, business process reengineering	High fit/ Low viability
CS-03	Telecommunications company	Mobile Phones and IVR	Business process reengineering	High fit/ Low viability
CS-04	Bank	Mobile Phones	Business process reengineering	High fit/ Low viability
CS-05	Telecommunications company	Mobile Phones and IVR	Location aware, business process reengineering	High fit/ Low viability
CS-06	City of Fremantle	Wireless PDAs & SMS	Location aware, business process reengineering	High fit/ Low viability
CS-07	Dr Andrew Navakas: Dentist	SMS	Business process reengineering	High fit/ High viability
CS-08	John Ewart: Taxi owner	Wireless Dispatch & Mobile Phones	Business process reengineering, ubiquitous communications	High fit/ High viability
CS-09	Mortgage broker services	Wireless Laptops & SMS	Ubiquitous communications, business process reengineering	High fit/ High viability
CS-10	Bank	Mobile EFTPOS	Business processes	High fit/ High viability
CS-11	William Angliss: Hospitality	Wireless PDAs & Mobile Phones	Content delivery, business process reengineering	High fit/ High viability
CS-12	RMIT University: Nursing	Wireless PDAs	Content delivery, business process reengineering	High fit/ Low viability
CS-13	Yarra Valley Water	Wireless Dispatch via PCs	Business process reengineering	Low fit/ High viability
CS-14	Kleenheat: Gas delivery	Wireless Dispatch via PDAs	Business process reengineering	High fit/ High viability
CS-15	StorageTek: IT storage co.	Wireless PDAs	Business process reengineering	High fit/ High viability
CS-16	Dubbo City Council	Wireless CCTV	Wireless, but not mobile	High fit/ High viability

3.2 What We Talked About

Interviews were guided by the following questions which were influenced by the existing literature, particularly Adams [1].

- Please describe the extent of wireless and m-commerce activity within your organization.
- What were the main reasons that you adopted wireless applications for this activity?
- What challenges did you experience in introducing the wireless applications?
- How did you overcome these challenges?
- Do you think any of these challenges/issues are unique to Australia?
- Overall, how successful have your wireless activities been in achieving your objectives?
- Will you seek to extend your wireless activities in the future – if so how?
- What issues and challenges still exist for you in this area? How can they be addressed?
- How do you see wireless activities developing within your field?

- What essential lessons have you learned from your experience from your wireless activities?

The organizations were extremely forthcoming in providing information on projects, even when their projects had been shelved, were running late or had been implemented to a less than enthusiastic customer response. While these case studies were not comprehensive, they do show some of the benefits that organizations are looking for when they undertake a wireless project, and some of the issues that they have encountered.

4 Fit-Viability Framework and Critical Success Factors

In their 2004 paper, Liang and Wei described the Fit-Viability Framework [28]. The Fit-Viability Framework grew out of the decision-making process used to assess the potential success of start-up technology businesses. *Fit* measures the extent to which the capabilities of mobile technology meet the requirement of the task, and *viability* measures the extent to which the environment or organization is ready for the application. The target applications should be the ones that have a good fit between task and technology, and strong viability within the organization.

VIABILITY		
High	Find alternative technology	Good target
Low	Forget it	Organizational restructuring
	Low	High
	FIT	

Figure 1: The Fit-Viability Framework [28]

In 2006, Feng et al described ten critical success factors for mobile commerce.

- F1: Business Model.
- F2: Content Innovation.
- F3: Business Support.
- F4: Leisure Time Support.
- F5: System and Content Quality.
- F6: Trust.
- F7: Support. (We have labeled 'Personalization'.)
- F8: User Interface Design.
- F9: Initial and Operating Costs.
- F10: Availability of Technology and Support of Infrastructure [21].

We have described how the critical success factors relate to the issues raised by the case studies. We have relabeled 'support' to 'personalization' to distinguish it from support for business or leisure requirements or technical support.

Both of these approaches are useful. We have applied the Fit-Viability Framework to the case studies in the same way that it would be applied to a business. We have then used the critical success factors to understand more about the specific issues for each case study.

5 Issues and Challenges for mCommerce Projects

The mCommerce projects that we investigated were trials. They were providing consumer transactions (including sales of goods and services), using a mobile phone or wireless Internet. In general, they were looking for new markets or to expand existing markets by attracting new customers. They implemented new ideas for mobile commerce. While attracting new customers was a key driver for these projects, the main benefit was the experience that was gained in this new area.

Therefore, even where a clear business case was not evident, the lessons learned were considered to be very valuable. These trial projects have provided important lessons for the implementing organizations in how to handle content and transactions for small devices and have provided some understanding of the market possibilities. The participants now understand more about the technical, social and legal challenges involved. Table 3 describes the projects and lists the issues encountered. Issues are then described in more detail below.

Table 3: mCommerce case studies by project description and status

ID	Organization	Project description	Status & issues
CS-01	Shopping Secrets	Michelle Matthews produces guidebooks in the form of packs of playing cards. Each deck contains 52 cards. Each card contains a short review, a photo, a location map, contact information and branding for the business. Despite having repackaged the content as a Flash Web site, for iPAQ handhelds and for delivery to mobile phones, she is yet to find a worthwhile business case. In general, she finds that most potential partners undervalue her content	Trial shelved. Content undervalued by the technology providers. No clear business case.
CS-02	AURA Group	Mobile ticketing: a barcode is sent via SMS to the phone, which is then swiped at the venue door, in lieu of an actual ticket. This project has been very successful at music venues.	Successfully implemented. Gaining momentum, but has not yet achieved critical mass.
CS-03	Telecomm. company	When GSM modems began appearing in vending machines, this trial project allowed customers to dial a special number and buy a drink using their mobile phone. While the project clearly improved drink sales, the project was shelved at the end of the trial.	Trial successful, but project shelved. No clear business case. Not enough revenue to warrant the risk. Legal issues when the telecommunications company is billing the client. Telecommunications act does not allow for the sale of actual products (as opposed to telecommunication services).
CS-04	Bank	The bank provides a service whereby pre-paid mobile phone customers can recharge their mobile phones via automatic teller machines. The phone owner can draw funds from their account to buy phone credit. They are provided with a unique number which, when typed into the phone, will 'unlock' the credit. While the service has been available for some time, there has not been a great deal of uptake by the public.	Implemented, but very little use by the public. Not enough critical mass to warrant a marketing campaign.
CS-05	Telecomm. company	This system allowed people to pay for their parking with their mobile phone. The project, while technically successful, encountered strong local opposition. Drivers objected to having to pay for parking where they had not had to pay before, they objected to the fact that they could only pay with one company's mobile phones, and they found the arrangements for paying by coins to be inconvenient. At the end of the trial, the parking meters were replaced with coin-operated parking meters	Trial not continued by council partner. Adverse public reaction. Some types of phones not included in the trial.
CS-06	City of Fremantle	The council allows people to pay for their parking with their mobile phone. Ten minutes before parking expires, the driver receives an SMS reminder to move their car. Infringement officers also have access to the parking data. They use wireless PDAs to scan a barcode on the car. If the car is not parked legally, they issue an infringement notice. While the council is very happy with the way that the system works, public response has been less than enthusiastic.	Implemented. Has not yet achieved critical mass with the public. Privacy of prime importance.

NB: Case study 6 had two parts: providing residents with the ability to pay parking fees via mobile phone (mCommerce) and using wireless PDAs to monitor parking infringements (mEnterprise). It is included in both areas.

5.1 Need for a Clear Business Case

For a project to move beyond the pilot stage, even if that stage has been successful, clear cost recovery must be demonstrated. Even if there is an increase in revenue or customer base, this needs to be balanced against the capital risk involved. Because wireless technology is a new area, the capital risk associated with it is quite large. Most organizations are looking for one successful project that will recover their costs. Even though a number of small projects might recover the costs, the structure and procedures of most large companies will not approve a number of small risky projects.

For example, the telecommunications company (case studies 3 and 5) successfully implemented a number of mCommerce projects, but quickly realized that while all of them might provide a small positive return, none of these

projects were going to provide a large return. They found it much harder to obtain support from senior management for new projects with small, but positive, returns. In terms of the Fit-Viability Framework, these two case studies have a low viability, when considered by themselves. Management is not willing to take the risk until a single 'killer app' is found that has a high viability on its own.

In general, it was difficult to find a compelling business case for the mCommerce projects and for some mServices projects. Case study 1 was quite typical of this problem. While keen on technology, the publisher in case study 1, Michelle Matthews, was not a technical expert. She was a publisher. As such, she needed to rely on a technology company to publish her content. In her experience, the technology companies did not value her content. As a publisher, she knew exactly what her content was worth. However, because of the risk associated with the development of the technology, the technology companies required a significant proportion of any potential profit. This was unacceptable to the publisher, who is looking for a model that recognizes shared risk in the endeavor.

The Fit-Viability Framework indicates that there is a very good chance of this proposal succeeding, if an agreement can be reached. The content fits very well with the target mobile technology, mobile phones. The viability would also seem high as the content is aimed at young urban people, who are a key target group for mCommerce. However, the very first key success criteria is a suitable and viable business model (F1). Until that is found, there will be no progress for any of these case studies.

This echoes work done by several different people. In 2004, Consumer Affairs Victoria reported that 'm-commerce services are currently only at an early stage of development' [11]. In 2005, Teo et al reported that even 'successful businesses still feel uncertain about the time period in which they can make a reasonable return on the investment' [39]. We found this to still be true for most mCommerce services.

5.2 Payment Models

When a consumer pre-pays for the use of a mobile phone, they are pre-paying for telecommunication services. In Australia, there is a legal distinction between telecommunication services and other services. There are certain exemptions for third-party virtual services, such as horoscopes, ring tones and information. However, this does not include using a pre-paid mobile phone to buy actual products, such as a can of drink in case study 3.

The Australian Goods and Services Tax (GST) legislation ("A New Tax System (Goods and Services Tax) Act 1999") says that GST must be applied to all items except for fresh food, water, and other specific exceptions [3]. A technology company, passing payment through to a supplying company, needs to be able to cope with both GST added and GST free items. So, for example, the technology needs to be able to distinguish between bottled water (GST free) and soft drink (which attracts GST). This increases the complexity of the backend system. More importantly, it can increase the complexity of the transaction.

If technology companies are going to sell goods to consumers via a mobile phone, then there needs to be some changes to the way that credit is handled. In Australia, a business cannot accept money from a customer to purchase products from a third party. A business cannot bill a consumer for products that it does not sell to that consumer. Only registered credit suppliers can do that. Both the banks and the telecommunications companies are quite concerned about their areas of business being eroded by the other. So this is not just a legislative matter, but also a political issue between the two sectors.

Legislative changes are being made, but as far as we are aware these issues have not been resolved to date. The Australian Government's Trade Practices Legislation Amendment Act (No. 1) 2006 introduced changes aimed at making it easier for organizations to work together for e-commerce projects. This legislation specifically allows companies to jointly agree on prices without infringing anti-monopoly laws [4]. While this legislation will help in some circumstances, it does not address the issues described above. In 2004, Consumer Affairs Victoria reported that the 'separation of powers … between jurisdictional and national levels could result in either duplication of effort or inconsistencies in approach' [11]. We found that the situation was still confused, or at least was not beneficial to the adoption of mCommerce.

Dahlberg and Öörni provide a useful system when they distinguish between facilitators and differentiators of mobile payments. Facilitators provide a base line that must be met before people will adopt a payment system. Differentiators are the things that will prompt people to change [16]. This provides a way to evaluate several characteristics of payment habits and understand which characteristics might provide fundamental changes. In their terms, the facilitator in this case would be the requisite changes to the law. There can be no progress in this area until the law has been changed. In terms of the Fit-Viability Framework, it does not matter how well the technology fits, these legislative issues will always lower the viability of these sorts of payment models for telecommunication companies within Australia. Feng et al reserved critical success factor F10, the availability of technology and support of the infrastructure as the critical success factor that covered areas outside the control of the organization. However, in our experience the legislative framework is a more fundamental bedrock that must be in place, and is not addressed by their critical success factors.

If a customer challenges an item on his or her bill, they will contact the telecommunications company. However, if they are challenging the cost of a $2 can of drink (for example), then they need to talk to the soft-drink company. While the dispute with the third party is being resolved, the telecommunications company is carrying the debt. If the customer never pays, there needs to be some arrangement about sharing the risk. If the telecommunications company has already paid the third party for the product, there needs to be some mechanism for recovering the money.

The telecommunication company in our case studies was also concerned that if it is processing the sales, 'bill shock' might be an issue when products and services appear on the telephone bill. Generally, people know roughly how much their telephone bill will be each month. However, if they start purchasing other products via their mobile phone, their bill could rise quite unexpectedly. The subsequent unpleasant surprise when the bill arrives is called 'bill shock'. If people respond to bill shock by reducing their telephone costs (rather than by cutting back on third-party products), the telecommunications company may lose out. Zmijewska reports that this could affect the usefulness of these payment processes, particularly for larger payments [41]. While it is not clear if that is what will actually happen, this is an area for further research into actual customer behavior.

5.3 Critical Mass

Because these projects were often providing new ways to do things, they often had difficulty achieving critical mass as adoption by the public was often slower than anticipated. The need for targeted marketing was seen as a key issue. It is important that customers understand that things can be done in a new way. However, a lack of critical mass could mean that a marketing budget was not available. Until a certain critical mass is achieved, it can be seen as not worthwhile to invest in marketing. Case study 4, for example, provides a useful service to bank customers. They can recharge their mobile phone credit at any of the bank's automatic teller machines (ATMs). However, almost no-one knows that the feature is available. With dedicated marketing, it might be more successful. However, the bank is not keen to commit to a marketing campaign until there is some level of customer support. So far, this has not been forthcoming. While the project is a technical success, there has been almost no take-up by the public.

In 2003, Coutts et al emphasized the 'importance of understanding users for realizing the take up of the products of convergence [14]. Case study 4 would seem to bear this out. In terms of the Fit-Viability Framework it fits the target mobile technology, mobile phones, but it is not very viable. The two key success criteria are support for business (F3) and leisure activities (F4). Unfortunately, while the service does support people's business and leisure activities, it does not have a direct impact on business performance, nor does it have a ubiquitous use of entertainment.

5.4 New Service Acceptance

If the vendor is selling via a mobile phone, the new service either needs to be advertised as a key advantage to that brand of phone, or it needs to be available to as many phones as possible. This may involve significant technical and political hurdles. For example, case studies 3 and 5 were technical trials by one telecommunications company. Other telecommunications providers were invited to take part in the trials, but declined. Therefore, only the owners of one sort of mobile phone could take part in the trials. The soft drink manufacturer (case study 3) wanted all phone users to be involved. The city council (case study 5) was criticized for installing parking meters that could only accept payment from one brand of mobile phone. In both cases, there was not enough recognition that the telecommunications company considered these projects to be technical trials but they also demonstrate clearly the difficulties arising from projects driven by the technology rather than by customer demand.

Both of these projects mainly addressed key success criteria F4, leisure time support. The parking trial also addressed key success criteria F3, business support. Case studies 3 seemed to have a high fit with user technology. Trials showed that overall drink sales increased where mCommerce facilities were available. Case study 5, however, seemed to have a very low technology fit, as measured by customer complaints. Moreover, both projects turned out to have a very low viability within the organization's business model. Introducing a new service, Australia-wide or world-wide, is a significant undertaking. As such, it needs to demonstrate a clear business case that minimizes the risk and maximizes returns. Often the cost is shared with another partner, so that the overall risk is shared, and thus lowered for each participant. Generally, it will not be enough to show that a large number of small items will provide the necessary revenue. Most established organizations are seeking a 'killer app' - a single product that will provide enough revenue to cover the risks involved. Often this is because they need to offset the large costs of making changes to an installed user base. Teo et al points out that 'the number of trial machines planned or implemented often represented less than one percent of the total number of machines. … Increasing the number of machines would mean additional investment…' [39].

New ways of paying for an existing product or service must be sufficiently advantageous to compete with the existing payment process. Generally, it has to be easier for the customer, and it has to be cheaper for the supplier. As Teo et al pointed out, 'there would be an additional charge of A33¢ - 55¢, per phone call, to be paid to the network operator, in case of mobile payments' [39]. Working through these issues requires a thorough understanding of both the customer's motivation and the supplier's system. This is not a simple thing to do.

6 Issues and Challenges for mServices Projects

The mServices projects sought to provide services to individuals and organizations, such as banking and education. They were providing information or products to people in new ways. They were able to provide their information or services to customers in new, easier or cheaper ways. Either the information provided was more up to date or the services were seen to be provided in a more convenient way. In addition, most projects resulted in the company obtaining better information from their clients. This allowed them to improve their planning. It was generally felt by the interviewees that they would be able to use this information to provide better services in the future.

Generally, most of these projects were seen to be responding to changes in the way that people worked, or (for personal services) the way that they lived. Table 4 describes the mServices projects, and lists the issues encountered. Issues are then described in more detail below.

Table 4: mServices case studies by project description and status

ID	Organization	Project description	Status and issues
CS-07	Dr Andrew Navakas: Dentist	Dr Navakas sends SMS (Short Message Service) messages to remind his patients of their upcoming appointments. He is very happy with the system as it has eliminated a person-day of time spent ringing patients. Patients can store his mobile number, so that they can ring him if they have any questions or concerns after their surgery.	Implemented. Minor issues with incorrectly recorded mobile numbers.
CS-08	John Ewart: Taxi owner	Taxi drivers are joining together in private 'trunk radio groups', as well as taking bookings as part of a regular taxi fleet. John Ewart was in a private trunk radio group with approximately 60 members. Since joining the trunk radio group his income has increased approximately 50% over a normal cab driver.	Implemented. Equipment is expensive to replace. Wireless transmissions can be relatively expensive.
CS-09	Mortgage broker services	These mortgage aggregators provide mortgage information to a network of 350 brokers who arrange financing for home and land sales. They supply a range of wireless technologies through their network: smart phones for e-mail, phone and appointments; mortgage software that will 'dial home' to synchronize product information; broadband wireless devices for simple Internet connectivity and SMS broadcasting to their brokers.	Implemented. Equipment is expensive to replace. Wireless transmissions can be relatively expensive. Extensive training and support required. Privacy and confidentiality of prime importance.
CS-10	Bank	The bank provides mobile EFTPOS machines. These work the same as standard EFTPOS machines except that they use the mobile phone network to contact the bank. They have been extremely popular with vendors such as market stalls and other operations where there is no ready access to a wired telephone service.	Implemented. Security is of paramount importance.
CS-11	William Angliss: Hospitality	The university provides some hospitality students and staff with PDAs. They are developing content specifically for the PDAs, including short videos. Most students are working part time in the hospitality industry, in work related to their studies. They appreciate the flexibility of being able to review information during 'down time' and while on the job.	Implemented for a limited number of students and staff. Equipment is expensive to replace. Extensive training and support required.
CS-12	RMIT University: Nursing	The university has provided some nursing students with PDAs for use on their practicum rounds in hospitals. The PDAs are loaded with drug information and programs for calculating drug dosage. While use of the PDAs has not resulted in a measurable increase in student learning, the reaction from students has been very favorable.	Trialed successfully. Equipment is expensive to replace. Extensive training and support required. Privacy and confidentiality of prime importance.

6.1 Training and Technical Issues

For some of the mService projects, training of users was required. This was particularly true where a new service was being provided with new equipment. The training required then could spill over into associated issues that are not directly associated with the new service. For example, providing a new service via a smart phone may require training clients in other mobile phone features.

Technical support was often required for the implementation teams, particularly where the projects were being initiated by a non-technical group. This can be difficult to negotiate within an existing technical support structure. Technical support personal may not be familiar with new equipment or software, they may have competing time demands and may be reluctant to assume responsibility for a new, and largely unknown, amount of on-going support work.

Several of the interviewees pointed out that the replacement costs for equipment was quite high. This meant that there were additional costs for the projects for equipment being lost, stolen or damaged which had not been included in their budgets.

Also the cost of the wireless connection was also an issue where connections were being made over the mobile phone network. This was an issue when the new service was competing with an existing service that used the existing telephone system. It increased the cost of each transaction for the new system, which could be a disincentive to adoption.

Training and technical issues can indicate that there is not a strong fit between the content and the target technology. However, in the case of the mortgage broker services (case study 9), they worked hard to make their applications work smoothly and easily. They had to because many of their clients, the mortgage brokers, were not confident with the technology. Viability varied across the mServices case studies. The dentist (case study 7), the taxi driver (case study 8) and the bank (case study 10) were all extending known technology in new ways, so they already knew that their viability was strong. The others were not so strong. The two tertiary institutes, in particular, were operating on government grants. It remains to be seen if their projects will be viable when they need to replace their equipment.

Training and technical issues also illustrate the importance of key success criteria F9, Initial and Operating Costs. Training and technical support will have a direct impact on operating costs. The mortgage broker services (case study 9) have built their training and support up to such an extent that they now consider it part of their competitive advantage. This offsets the costs against the benefit of assisting the organization to attract new customers. While key success factor F10, Availability of Technology and Support of Infrastructure might seem to relate to this issue, Feng, Hoegler and Stucky relate this to the quality of the wireless network and consider it to be outside the control of the organization.

6.2 Privacy, Security and Confidentiality

Privacy, security and confidentiality of information appeared as an issue in a number of different projects. In several projects, sensitive information was stored on wireless handheld or laptop computers. If the equipment was lost or stolen, this could create a breach of privacy. This was particularly an issue for case study 12, where nursing students were dealing with patients' health records. It was also an issue for the mortgage broker service (case study 9). They were often providing equipment to competing sales people. They could not allow any sales person to access a competitor's confidential client information. Also, the information needed to be safeguarded against interception when it was being transmitted via wireless. For example, in case study 10, the bank reported that a few small business operators had tried to fraudulently report transactions by recording the transaction and then trying to stop the transmission of the transaction to the bank. There needed to be adequate roll-back if the transmission was unsuccessful. That is, the system needed to be able to cope with a failed transmission, as well as a successful transmission. This is particularly true when there is a monetary value attached to the transaction, so that people cannot trigger a transmission, deliberately block it from being successful and then claim compensation.

Most mServices and mEnterprise projects were conscious that they were dealing with private and confidential customer information, which needed to be kept secure at all times. This ranged from trivial examples such as case study 7, where the Melbourne-based dentist had mistakenly sent SMS reminder messages to someone in Sydney, to case study 6, where the city council now holds a database that links personal information (including mobile phone numbers) with user's parking data and their credit card details. In case study 13, the water supply company supplied the maintenance contractors with plumbing schematics for every house in the area. In all cases, the organizations had implemented systems to safeguard the information and correct it when it was found to be inaccurate. Privacy, security and confidentiality all relate to key success factor F6, Trust. All the case studies were aware of the importance of trust issues.

7 Issues and Challenges for mEnterprise Projects

The mEnterprise projects were providing enterprise solutions, such as logistics applications or supply chain management solutions. They were generally undertaken by large organizations that were changing the way they did business. As a result they had the clearest goals. Their business cases were generally straight-forward and easy to articulate. These projects aimed to gain efficiencies by improving an existing customer service.

Almost all the projects were seeking to replace some aspect of their paper-based record keeping. This led to an improvement in the accuracy of their book-keeping records. This, in turn, allowed them to improve their billing cycle, with the overall aim of reducing debtor days (the number of days an invoice is outstanding). Because the information

was communicated electronically, they reduced the data-entry time required for the process. This provided a reduction in staff time (operational costs). It also sometimes reduced the communication costs, as the call center did not need to chase up details with staff out on the roads (via mobile phone calls). They could also provide more accurate management statistics, which would allow the organizations to undertake better planning for that aspect of the business.

For some organizations, the change led to a greater connection with 'on-the-road' staff. These staff had traditionally been only loosely connected with the central organization. By providing them with improved access to information, they have strengthened their links with the organization overall.

For the government projects, public satisfaction and stakeholder satisfaction (council and local businesses) were important benefits. This meant that public communication was a key aspect of their projects. Table 5 describes the mEnterprise projects, and lists the issues encountered. Issues are then described in more detail below.

Table 5: mEnterprise case studies by project description and status

ID	Organization	Project description	Status
CS-06	City of Fremantle	The council allows people to pay for their parking with their mobile phone. Ten minutes before parking expires, the driver receives an SMS reminder to move their car. Infringement officers also have access to the parking data. They use wireless PDAs to scan a barcode on the car. If the car is not parked legally, they issue an infringement notice. While the council is very happy with the way that the system works, public response has been less than enthusiastic.	Implemented. Has not yet achieved critical mass with the public. Privacy of prime importance.
CS-13	Yarra Valley Water	The water supply company is moving to a wireless dispatch system for their maintenance requests. Maintenance staff is being supplied with wireless laptops which contain maps of water and sewerage systems and a program for tracking work done and parts used. While the benefits of the system are clear to all, implementation has been delayed by issues with connecting to the existing back-end system.	In development. Difficulties connecting with back-end system. Extensive training and support required. Privacy of prime importance. Intermittent problems with faulty SIM cards.
CS-14	Kleenheat: Gas delivery	The gas company delivers bulk and bottled gas to locations around Australia. They have had a wireless delivery tracking system for their bulk gas for some time. They have just introduced a wireless system for their bottled gas system. This has allowed them to provide better billing to clients and reduce their 'debtor days' within their finance system.	Implemented. Equipment is expensive to replace. Health and safety regulations restrict the equipment that can be used. Intermittent problems with faulty SIM cards. Transmission costs can be expensive.
CS-15	StorageTek: IT storage co.	The company has supplied all of their service engineers with PDAs (Blackberries). Job requests are sent to the PDAs, and engineers can update work details in the field. They can also access service manuals from the PDA. They have greater access to new product details, as they are now sent regular update information.	Implemented. Security is of prime importance. Transmission costs can be expensive.
CS-16	Dubbo City Council	The council has installed 11 safety cameras in the central business district. When laying underground cable proved too expensive, the council implemented a wireless system. The cameras are linked back to screens in the police station. Council, police and shopkeepers are very pleased with the cameras and are planning to install more.	Implemented. Privacy and security are of prime importance. Equipment is expensive to replace. Changes to police procedures may require additional council personal. Training and support required.

NB: Case study 6 had two parts: providing residents with the ability to pay parking fees via mobile phone (mCommerce) and using wireless PDAs to monitor parking infringements (mEnterprise). It is included in both areas.

7.1 Integration with Existing Systems

The major hurdle faced by almost all the mEnterprise projects was integration with existing back-end systems. Often, this was the first time that the organization had tried to integrate a mobile system with other back-end systems (often the finance system). This resulted in existing *implicit* business processes being made *explicit*. Difficulties in connecting with existing systems increased the development time and therefore the development costs.

Case study 13, Yarra Valley Water, and case study 14, Kleenheat, provide an interesting contrast in their experiences with existing systems. Both of them were moving from a relatively primitive wireless system, described

by one participant as being 'just text based, like the taxi screens'. Both were experiencing unforeseen difficulties in moving data seamlessly through to their existing systems. However, Kleenheat were only experiencing minor issues, while Yarra Valley Water was experiencing significant delays. As an organization, Kleenheat seemed to understand that some business processes would need to be reviewed. Yarra Valley Water had a much greater number of implicit businesses processes, and seemed to be having greater difficulty isolating them, examining and documenting them. In part, this may have been because there were more of them, or it may have been a matter of business history and culture. These were beyond the scope of our study.

In their 2005 review of wireless developments in the Australian healthcare system, Gururajan and Murugesan listed three key issues that needed to be solved to realize efficiency gains. Two related to integration issues: 'appropriate development methodology that enables proper integration of the new wireless solutions with the existing solutions' and 'data access and communication and synchronization issues between the mobile devices and existing databases' [24]. (The other issue related to suitable user interfaces.)

Integration with existing back-end systems directly affects the Initial and Operating Costs, key success criteria F9. Most mEnterprise projects were seeking to reduce internal costs by reducing paperwork. However, without flexible back-end systems and the ability to change existing business processes, the new wireless project can experience delays or development cost overruns.

7.2 Equipment Issues

Several projects mentioned device failure as an unexpected issue. In case study 14, they were finding one or two faulty SIM cards for every hundred devices they purchased. This led to communication drop-outs and data loss at unpredictable times. Case study 13 was finding intermittent faults with the devices, which made it difficult to track down and fix the problems.

For all projects that involved new equipment, maintenance and replacement of the equipment needed to be factored into long-term planning. This included staff accidentally dropping or otherwise breaking the PDAs or mobile phones. The equipment was generally seen to be both relatively expensive and often delicate or temperamental. ‘Ruggedising’ the equipment increased the costs, and sometimes was not possible with off-the-shelf purchases. Again, this relates to key success criteria F9, Initial and Operating Costs.

Equipment issues would seem to indicate that these projects did not have a strong fit on the Fit-Viability Framework. However, the 'fit' axis of the Fit-Viability Framework refers to 'the fit between mobile technology and the task' [28]. The type of mobile technology being deployed in these case studies (wireless PCs for Yarra Valley Water and wireless PDAs for Kleenheat) are well suited to the task. These equipment issues do not reflect on the unsuitability of the technology to the task, but rather the expense and fragility of the technology generally.

Issue connecting with existing systems, however, may tell a different story. The 'viability' axis of the Fit-Viability Framework includes 'the general economic environment and social infrastructure and the readiness of the organization' [28]. Prolonged difficulties in connecting to existing systems may indicate that an organization is not ready to adapt to a mobile system.

7.3 Security and Privacy

Security of the wireless transactions was a consideration for almost all the projects. For at least one wireless project, it was the first time that their computer network had extended beyond the walls of their building. They needed to establish a demilitarized zone (DMZ) within their computer network to accept incoming information. Some organizations could send 'kill' messages to their equipment, which would render it inoperable if, for example, it was stolen. The IT storage company (case study 15) reported that the built-in security of the BlackBerry devices was a major factor in their initial decision to use those devices.

While security and privacy generally relate to key success criteria F6, Trust, in these cases the issue can also affect key success criteria F9, Initial and Operating Costs. Development of a DMZ will increase the initial costs of building the system, while selecting a device with strong security may affect both the initial set-up costs and the on-going replacement costs.

Trust and privacy were key issues for case study 6, the City of Fremantle. Their project involved providing registered drivers with the ability to pay for parking by mobile phone. In addition, they had provided their parking inspectors with wireless PDAs which interrogated the database in real time to check if a car was parked legally. The inclusion of an mEnterprise aspect to this project had ensured its success when other mobile phone pay parking trials have failed.

However, privacy is paramount with this project because of the details stored in the database. The database stores: personal details, including address and mobile phone number; credit card details; car details, including registration and description; and a history of parking patterns around the city. All of these details together serve to identify people and show where they have been, at what time and for how long.

Users of the City of Fremantle system are very happy, although take up by citizens has not been somewhat disappointing. However, the council has been very happy with the success of the wireless PDA units for infringement officers. These have provided efficiency savings that have allowed staff to be redeployed to other activities. The technology has a strong fit to the infringement officers' task and the organization has embraced the viability of the project.

7.4 Staff Training and Acceptance

Cultural change and training was a key issue for ensuring widespread adoption of the projects. While most staff could see the benefits of reducing paperwork, they were not always computer-savvy, and were often wary of the change. Training was important to ensure that they could adequately cope with the changes. In case study 13, the water supply company was working with maintenance contractors who generally had limited computer skills. As well as offering training and support, the company also found it useful to link a more computer literate employee with a less confident user for the early phases of the project. Marmaridis and Unhelkar remind us that staff training can be a particular challenge for small to medium enterprises (SMEs – less than 100 staff). 'Unlike a large corporation, most SMEs can not afford to have some of their business staff taken out of their productive capacity for days at a time' [29]. All of our mEnterprise projects were being undertaken by large organizations.

While there are economic and cultural differences between Australia and New Zealand, they are sufficiently similar for comparisons to be useful. In their 2005 review of two New Zealand organizations undertaking field force automation, Innes et al reported that both organizations 'identified that training and user acceptance were some of the major challenges that they faced' [25].

While staff training clearly relates to key success criteria F9, Initial and Operating Costs, staff acceptance is somewhat harder to categorize. Where there is a direct link between performance and payment (eg sales bonuses), then key success criteria F3, Business Support, will be very relevant. However, when an organization is implementing cost saving changes, it can be harder for the field worker to be motivated to change. In case study 13, the water supply company will need to pay particular attention to key success criteria F8, User Interface Design, if it seeks to gain staff acceptance.

7.5 Changes to Regulations

In case study 16, the city council was working with the local police station to cut down on crime by installing wireless closed circuit TV (CCTV) cameras in the central business district (CBD). The council installed the cameras, and placed screens and control equipment in the police station. The police would use the cameras to respond to reports of criminal activity. Since the project has been set up, laws regulating to the responsibilities of state police changed and the local police, although very happy with the system, may not be allowed to continue to use it. If that is the case, the council will need to employ someone to respond to calls and pass the information along to police. This is more expensive than anticipated, and probably will be less effective.

While this project is a wireless project, it is not a mobile project. However, the Fit-Viability Framework can still be applied. The technology is an excellent fit for the task. Without wireless CCTV cameras, the cost of digging up streets to lay cable would have made this project too expensive for the council. The council has reported reduced crime rates, which was the aim of the project. The viability aspect of the project relates to the ability of the police to use the information to uphold the law. They have been able to use the cameras very effectively and are very happy with them. However, if the council needs to monitor the cameras and provide reports to the police, this could have a severe impact on the viability of the project.

The payment model issues discussed earlier in this paper required changes to the law. In this instance, the law has been changed in a way that could disadvantage the project. It may threaten its Business Model (F1) and undermine Business Support (F3).

8 Conclusions

These sixteen case studies have shown that the trade and business press has generally exaggerated the success of wireless projects within Australia. In most cases, the implementation of the projects has been much harder than anticipated for a number of reasons. Probably the most important barrier for organizations is that they have been unable or have found it difficult to demonstrate a strong business case for these projects, particularly mCommerce projects. Even the projects that have been successful have yet to achieve critical mass.

For most organizations, undertaking a wireless project is a new endeavor. There are not a lot of systems that can be implemented without a large degree of customization. People with practical implementation experience are still relatively rare and can command premium salaries. This can make it difficult for a small or medium organization that can see an opportunity in the wireless world.

Generally, mEnterprise projects found it easier to demonstrate a strong business case for a wireless project. In most cases, they were seeking to replace a paper-based or existing process with the intention of reducing costs, rather than to increase revenue or to introduce new services. Their main issues related to connecting their new wireless systems with their existing back-end systems. Often, this proved more difficult than first anticipated.

MServices projects were also able to demonstrate a strong business case. Their main objective in starting the project was to add value to existing services to clients and, in most cases, these new services were valued by customers. Where they had been successfully implemented, they were generally finding that the equipment was expensive to maintain and replace. They were also trying to minimize the cost of their wireless transmissions, as these costs were quite significant to both customers and to the organizations.

The mCommerce projects were the ones which had the most difficulty in trying to find a business case. In most cases, the projects were driven by the technology rather than by user demand or need. Even if these projects moved beyond the pilot stage, they usually experienced limited take-up by customers. These mCommerce projects collected a large amount of personal data about customers, well in excess of that needed for the service provided, raising concerns about the potential for privacy breaches.

Most of the case study projects in this category involved using a mobile device to complete a micropayment, usually a non-cash payment. This is an area with a relatively unclear regulatory framework which requires greater clarity. There are no regulatory codes dealing specifically with the wireless economy in Australia but there are over five regulators with possible oversight of the activity. It is hard to know which act applies to some activities, for instance, is a telecommunications company which supplies credit a credit provider? Different laws apply to credit providers while the Telecommunications Act only applies to the sale of telecommunication services, not the provision of credit. So while there is potential for mobile phone operators to develop new billing methods that become new models for issuing credit, they are not covered by existing credit laws.

Similar problems with implementation of wireless projects occur in different industries and sectors but there appears to be no exchange of information about problems across the sectors. These case studies have provided insight into the common challenges facing organizations which are implementing wireless projects in Australia and offer an opportunity to share these experiences.

8.1 Recommendations

These case studies are not comprehensive and do not illustrate the full extent of activity within Australia, much less worldwide. However, some useful recommendations can be drawn from them.

1. Test your business case.
   Discovering the flaws in your business case will take time, and may require repeated trials.

2. Understand the law.
   The law, particularly relating to telecommunications in Australia, is complex. You will need to understand how it affects you and your project. You will also need to understand the impact that changes to the law might have on your project.

3. Understand your business drivers.
   Gaining critical mass will take time. Achieving a return on investment will take time. A clear understanding of your business drivers and your management imperatives will help you to guide your project through that extended development and deployment time.

4. There is no new 'killer app'.
   The key function of mobile devices is communication, either by voice or SMS. That is their killer application, which provides them with penetration rates of over 90%. If there was another killer app, it probably would appeared by now.

5. Invest in training.
   Your staff will need training and support. Your clients may also need training and support. Anticipate that and, if possible, make a feature of it. A 'buddy' system may help new users to understand the system.

6. Understand privacy, security and confidentiality issues.

7. Review your business processes.
   Integration with an existing system will expose irregularities in your business processes. Develop a methodology for dealing with them. If possible, make this process of strengthening existing business processes a feature of the development and deployment process.

8. Anticipate equipment failure.
   Develop a methodology for isolating faults as they are discovered. Budget for replacement equipment. Cultivate your supplier – you will need to work with them to isolate and rectify faults.

All of the people interviewed were enthusiastic about the process of discovery, even when their trials had been abandoned or delayed. Often their solutions related to lessons learned and experience gained, rather than a specific formula for success. As such, the key recommendation is to evaluate the risk carefully and value the process of discovery. Include the value of the experience that will be gained. In a mEnterprise project, include the value of improved business processes. In a mServices project, include the value of improved support for customers. And in a mCommerce project, balance the risk against possible rewards of new products and new customers.

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