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ΔΙΠΛΩΜΑΤΙΚΗ ΕΡΓΑΣΙΑ

Near Field Communications (NFC) – Case Study: Mobile Banking in South Africa

Αικατερίνη Α. Αντωνοπούλου

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ABSTRACT

Mobile phone technology has had a profound effect on our society and Near Field Communication (NFC) has become one of the promising technological developments in IT industry. NFC is one of the latest wireless communication technologies. As a short-range wireless connectivity technology, NFC offers safe yet simple and intuitive communication between electronic devices.

We will review the mobile payments space by giving an overview, examining mobile payments technology, assessing mobile payments in South Africa, analysing the various critical success factors, and examining the various governing legislation that exists.

We will review various mobile payment solutions currently in use that are based on bank accounts, credit cards and mobile telecommunication company billing systems. These technological solutions include Short Message Service (SMS), Unstructured Supplementary Service Data (USSD), General Packet Radio Service (GRPS) or 3G (Third-generation), Wireless Application Protocol (WAP), J2ME, Location-Based service (LBS), Near Field Communication (NFC), and Interactive Voice Response (IVR).

We will then take a look at the mobile payments space in South Africa. This will involve reviewing some of the major stakeholders and players. Popular mobile payments solutions in South Africa include Wizzit mobile banking, MTN Banking, and FNB cellphone banking. The mobile network operators include Vodacom, MTN, Cell-C and the virtual mobile network operator (VMNO) Virgin Mobile. The other important stakeholders include the big four banks, electronic payment network operators Visa and MasterCard, and specific merchants.

Reviewing the various challenges faced by mobile payment solutions will give this research weight. These challenges include critical success factors such as dealing with the dynamics of different stakeholders with conflicting interests, consumer behaviour, costs, trust and security, usability, and lastly legislation governing mobile payments.

Moreover, we we will indicate ways the growth of electronic payments can substantially reduce the social cost of a country's payment system. We provide an estimate of the potential savings in social cost and determine the responsiveness of payment users when relative prices are used to speed up the substitution of electronic and especially mobile-based for paper-based payments.

Then, we will explore the various business models being proposed and applied during the implementation of NFC mobile payments. The various stakeholders that are part of the NFC mobile payment ecosystem will then be studied and lastly the benefits and challenges associated with NFC mobile payments will be noted. Finally, we will review real options methodology to the investment-making process.

SUBJECT AREA: Telecommunications
KEYWORDS: Near Field Communication, m – payments, m – banking

ΠΕΡΙΛΗΨΗ

Η κινητή τηλεφωνία έχει βαθιά επίδραση στην κοινωνία μας. Το τελευταίο διάστημα έχει κάνει την εμφάνισή της μια καινούρια τεχνολογία στο χώρο της κινητής τηλεφωνίας με την ονομασία επικοινωνία κοντινού πεδίου (ΕΚΠ -Near Field Communication - NFC). Ως τεχνολογία ασύρματης επικοινωνίας με μικρή εμβέλεια, η ΕΚΠ προσφέρει ασφαλή και απλή επικοινωνία μεταξύ ηλεκτρονικών συσκευών. Εν ολίγοις επιτρέπει τη χρήση του κινητού τηλεφώνου ως μέσου ασφαλών συναλλαγών και πληρωμής λογαριασμών μετατρέποντάς το κινητό τηλέφωνο ουσιαστικά σε ηλεκτρονικό πορτοφόλι.

Στην εργασία αυτή θα εξετάσουμε το χώρο των πληρωμών μέσω κινητού τηλεφώνου. Θα δώσουμε μια γενική εικόνα, αναλύοντας την τεχνολογία, τους κρίσιμους παράγοντες για την επιτυχία της τεχνολογίας αυτής και το σχετικό νομοθετικό πλαίσιο.

Θα εξετάσουμε διάφορες εφαρμογές των πληρωμών μέσω κινητού τηλεφώνου που χρησιμοποιούνται σήμερα και που βασίζονται σε τραπεζικούς λογαριασμούς, πιστωτικές κάρτες και συστήματα τιμολόγησης των τηλεπικοινωνιακών επιχειρήσεων. Θα αναλυθεί το τεχνολογικό υπόβαθρο που απαιτείται και περιλαμβάνει SMS, USSD, GRPS ή 3G, WAP,J2ME,LBS,NFC,IVR.

Θα δώσουμε έμφαση στην μελέτη της Νότιας Αφρικής όπου υπάρχει πλήρης εφαρμογή τεχνολογιών κοντινού πεδίου. Θα εξετάσουμε τους εμπλεκόμενους φορείς και τους ενδιαφερόμενους από την πλευρά των τραπεζών (Wizzit mobile banking, MTN Banking και FNB cellphone banking), από την πλευρά των φορέων εκμετάλλευσης κινητών δικτύων (Vodacom, MTN, Cell-C και του εικονικού φορέα κινητών δικτύων (VMNO) Virgin Mobile) καθώς και από την πλευρά των εμπόρων.

Κατόπιν, θα δοθεί το βάρος στις διάφορες προκλήσεις που αντιμετωπίζουν οι ηλεκτρονικές πληρωμές μέσω κινητού τηλεφώνου. Θα εξεταστούν οι κρίσιμοι παράγοντες επιτυχίας, όπως η αντιμετώπιση συγκρουόμενων συμφερόντων, η συμπεριφορά των καταναλωτών, το κόστος, η εμπιστοσύνη, η ασφάλεια, η χρηστικότητα, και τέλος η νομοθεσία που διέπει τις πληρωμές μέσω κινητού τηλεφώνου.

Επιπλέον, θα υποδειχθούν τρόποι για την ανάπτυξη των ηλεκτρονικών πληρωμών που μπορούν να μειώσουν σημαντικά το κοινωνικό κόστος του συστήματος πληρωμών της χώρας. Παρέχουμε μια εκτίμηση για τη μείωση του κοινωνικού κόστους και την ανταπόκριση των χρηστών, όταν οι σχετικές τιμές ορίζονται με στόχο την επιτάχυνση της αντικατάστασης των παραδοσιακών πληρωμών με ηλεκτρονικές και ιδίως πληρωμές μέσω κινητού τηλεφώνου.

Θα εξετάσουμε τα διάφορα επιχειρηματικά μοντέλα που προτείνονται και εφαρμόζονται κατά τη διάρκεια υλοποίησης πληρωμών με χρήση κινητού τηλεφώνου. Θα δοθεί έμφαση στα οφέλη, στις προκλήσεις που συνδέονται με την τεχνολογία κοντινού πεδίου και τις πληρωμές μέσω αυτών. Θα αναφερθούμε στα δικαιώματα προαίρεσης κατά διαδικασία λήψης αποφάσεων. Τέλος, θα γίνει αναφορά στο μέλλον της συγκεκριμένης τεχνολογίας και στις πληρωμές μέσω αυτής.

ΘΕΜΑΤΙΚΗ ΠΕΡΙΟΧΗ: Τηλεπικοινωνίες
ΛΕΞΕΙΣ ΚΛΕΙΔΙΑ: Επικοινωνές Κοντινού Πεδίου, πληρωμές μέσω κινητού τηλεφώνου, Κινητή Τραπεζική

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INTRODUCTION

Mobile phone technology has had a profound effect on our society. The ability to communicate from almost anywhere has transformed the way we live our lives as well as the way business is done. This proliferation of mobile phone use has inspired the development of numerous value-added services that have been widely adopted globally. For many this platform has created a new avenue to market, sell and deliver services to consumers across socioeconomic classes.

Beyond the "traditional" e-commerce, a new type of commerce has been growing in the last decade, the mobile commerce (m-commerce). Taking into consideration the tremendous growth in mobile telephony and the evolution of the handheld devices, technologies and applications are beginning to focus more on mobile computing and the wireless web. With the 'wireless internet' becoming a reality, the idea of bridging the traditional e-commerce with mobile devices has naturally shaped up. M-commerce brings forth many advantages like: ubiquity (the use of wireless device enables the user to receive information and conduct transactions anytime, anywhere); flexibility (mobile devices enable users to be contacted at virtually anytime and place); dissemination (most wireless networks support the option of synchronized information transmission to the users); personalization (customized information is enabled, meeting users preferences, followed by payment mechanisms that allow for personal information to be stored, eliminating the need to enter credit card information for each transaction) (Keng et al, 2001).

Near Field Communication (NFC) has become one of the promising technological developments in IT industry. NFC technology is a short-range, high frequency, low bandwidth and wireless communication technology based on Radio Frequency Identification (RFID) technology. It allows us to transfer data within few centimeters. One of the advantages of NFC over other wireless technologies is simplicity (Madlmayr et al. 2008): transactions are initialized automatically after touching a reader, another NFC device or an NFC compliant transponder. Due to its simplicity, it has become a new and exciting area for practitioners, many NFC enabled applications and services are developed which are operating in three different modes; reader/writer, peer-to-peer and card emulation. The integration of NFC technology into mobile devices offers many reliable applications; specifically payment, ticketing, loyalty services, identification, access control, content distribution, smart advertising, peer-to-peer data/money transfers, and set-up services.

Juniper Research (Juniper Research 2008) forecasts that payments done using mobile devices for digital and physical goods, NFC transactions and money transfers will exceed US$600bn globally by 2013. That amount is more than double the entire gross domestic product (GDP) for South Africa (World Bank 2008). Gartner analyst Ken Dulaney (2008, p.12) labels NFC technology as transformational and predicts that it will take two to five years for it to reach mainstream adoption. Internationally, trials have already begun all over Europe and Asia.

Mobile Payments

Mobile devices have been some of the most successful consumer products ever (Mahatanankoon *et al*. 2005, p. 348). This fact is evident from New York to Johannesburg. Carr (2007, p. 1) states that an estimated three billion people will possess a mobile device by the year 2010. A new field study that has arisen from the proliferation of mobile devices is mobile commerce or m-commerce. Antovski *et al.* (2009, p. 1) define m-commerce as

"the use of mobile hand-held devices to communicate, inform, transact and entertain using text and data via connection to public and private networks" while Ngai *et al.* (2005, p. 3) define it as "any transaction with monetary value that is conducted via a mobile network".
M-commerce was derived from electronic commerce and can be "B2B (business to business), P2P (person to person), or B2C (business to consumer) oriented" (Antovski, 2003). M-commerce comprises of mobile e-commerce and Mtrade.
Mobile e-commerce occurs when consumers purchase goods that they are not in physical or eye contact with while M-trade is the opposite, consumers purchase goods that they can see and touch. M-commerce is driven by Mobile Payments or Mpayments, which have a similar definition to that of m-commerce. Carr (2007, p. 1) defines M-payments "as any payment where a mobile device is used to initiate, authorise and confirm an exchange of financial value in return for goods and services". M-payments can then be categorised as micropayments or macropayments that are local or remote in nature.

Chapter 1

Overview

In this section we will review the mobile payments space by giving an overview, examining mobile payments technology. Furthermore, we will indicate the question of what Near Field Communication (NFC) is will be addressed and we will examine how the technology works in detail. It is vital to review these aspects of mobile payments in this research in order to understand NFC based mobile payments.

1. Mobile payment technology

Mobile payment solutions can be implemented using various techniques. The average mobile phone has various ways it can transmit data. These ways include voice, SMS, USSD, and use of the inbuilt Internet connection (3G/GRPS/EDGE). Mobile payment solutions also depend on the client applications that are housed on the mobile device. The client applications can be houses in the mobile phone memory or the mobile network operator (MNO) issued Subscriber Identity Module, most commonly known as the SIM card.

Table 1: Mobile Payment Solutions

Mobile Payment Solutions	Description
SMS	Short Messaging Services used to purchase ring tones, video clips, pictures, and enter competitions.
USSD	Unstructured Supplementary Service Data has faster response rate than SMS.
3G/GPRS/EDGE/	Internet enabled mobile payments allowing the user to enter their credit/debit card details in order to complete a transaction
IVR	Interactive Voice Response technology allows the user to initiate a transaction by dialling a specified number and using their voice to select a specific desired service.

1.1.1 SMS

The most popular mobile payment technology in South Africa is the Short Message Service (SMS). The service was originally designed to allow subscribers to send short message, of up to 160 characters, to other subscribers. The service uses MNO servers called SMS centres that distribute the messages to subscribers on the same network as well as those on other networks. In South Africa SMS is utilised to make remote micropayments for mostly digital content. The MNO billing system is the core solution used to purchase ring tones, video clips, pictures, and enter competitions. To charge for the services premium SMS rates are used. A premium SMS is more expensive than an ordinary SMS that is sent to another subscriber. Other SMS based mobile payments solutions make use of the SMS service in order to transmit information while using bank system to carry out the financial transaction.

1.1.2 USSD

Unstructured Supplementary Service Data (USSD) based mobile payments are also very popular in South Africa. USSD is unique to GSM networks and provides an additional data transmission channel. A USSD string looks like this "*120*777#". USSD is session-based so responses are faster than SMS but this type of solution is more complex to implement because of the fact that the content/service provider needs to be linked into the MNO's internal network. An example of a USSD service is one that provides a menu to the user after they dial "*120*777#". The user will then get a list of services that they can subscribe to and during that USSD session they can then initial the transaction thereby activating the billing cycle.

1.1.3 3G/GPRS/EDGE

Some mobile payment solutions make use of the Internet capabilities of mobile devices. By enabling General Packet Radio Service (GPRS), 3G, or EDGE web-based mobile payment solutions can be implemented. Most of these applications are designed using Wireless Application Protocol (WAP) (Carr 2007, p. 3,4). An example of such a mobile payment solution is one that allows the user to login to a WAP site and purchase tickets to various events using their credit or debit card by entering the card details using the mobile device's keypad.

1.1.4 IVR

Mobile payments can also be carried out using Interactive Voice Response (IVR) technology. IVR technology allows the consumer to use their voice or the mobile phone's keypad in order to initiate a mobile payment. Popular uses of IVR technology include airline ticketing, mobile payments, and mobile banking. (Mallat *et al.* 2004, p. 44)

1.2 Near Field Communication Technology

In order for mobile payments to occur they require an enabling technology such as Near Field Communication (NFC). As mentioned above NFC is "a wireless communication technology [that enables] transfer of data over distances of up to 10 cm" by combining technologies from Radio Frequency Identification (RFID) and contactless smart cards (Madlmayr 2008, p. 563). According to Csapodi *et al.* (2007, p. 1), Strömmer *et al.* (2006, p. 3246), and Benyó *et al.* (2009, p. 1) NFC was the brainchild of two of the largest electronic companies on the planet, Sony and Philips. Together, the electronic giants founded the NFC Forum, an organisation dedicated to the promotion of NFC technology use.

The NFC Forum was formed in 2004 with an "aim for interoperability and compatibility of NFC devices and services" (Ylinen *et al.* 2009, p. 89). Since its existence the membership base has grown from 3 to 150 companies because of the intense interest from various industries such as manufacturing, information and communication technology, medical, and even financial institutions. The NFC Forum has four main goals. The first goal is to develop standards, specifications and parameters for NFC devices and protocols while the second goal is to encourage the use of these specifications. The third NFC Forum goal is to ensure that certified products do indeed comply with specifications while the last goal is to educate the masses about NFC technology (Duverne 2008, p. 5).

Altogether the NFC Forum has released 11 technical specifications. The sespecifications have been adopted as standards by ISO/IEC (International Organisation for Standards/International Electro-technical Commission), ESTI (European Telecommunications Standards Institute) and ECMA (European association for standardisation information and communication systems). Out of these 11 technical

specifications we find two standards that are very important.
These standards include the NFCIP-1 (Near Field Communication, Interface and Protocol - 1) and the NFCIP-2. The NFCIP-1 standard specifies the peer-to-peer data communication between devices and has been adopted as ISO/IEC 21481, ETSI TS 102 190, and ECMA-340. NFCIP-2 deals with automatic selection of the correct mode to operate in before data transmission and has been adopted as ISO/IEC 21481, ETSI TS 102 312, and ECMA-352 (Csapodi *et al.* 2007, p. 1).

	ISO/IEC	ETSI TS	ECMA
NFCIP-1 (P2P Communication)	21481	102 190	340
NFCIP-2 (Mode selection)	21481	102 312	352

Figure 1: NFC Standards

NFC Forum members have been involved in over 65 NFC implementation projects in the USA, Germany, Austria, Netherlands, Finland, Spain, United Kingdom, France, South Korea, China, and Taiwan. To date the strong adoption and positive feedback from users has given substance to Dulaney's (2008, p. 12) claim, in Gartner's 2008 "Hype cycle report for Wireless devices, Software, and Services", that NFC technology contains the properties that can make it transformational.

1.3 NFC Applications

The unique attributes of NFC technology make it possible for it to be used in various industries such as manufacturing, automobile, transport, advertising, medical, information and communication technology and financial institutions. Tagawa (2008, p. 14), chairman of the NFC Forum, states that NFC technology can also be used for a variety of consumer electronics such as personal computers, television sets, point of sale terminals, and posters. Below the author will review some exciting applications and solutions that are using NFC technology such as a NFC enabled location-based service, health monitoring, virtual coupons or mcoupons, transport ticketing system, poster advertising, and manufacturing logistics control.
The first NFC application that will be review is a mobile location based service (LBS) named Friendticker (http://m.friendticker.de/ 2009). Friendticker was first launched at CeBIT 2009, one of the world's largest digital IT and telecommunication solutions trade fair. The LBS is a NFC-based social ticker that enables users to know where their friends are and what they are doing. By initially placing 200 NFC based tags in Berlin, Germany, registered users were able to interact with the Friendticker's online website by simply placing their NFC-enabled mobile devices on the tagsthereby communicating their current location to their friends. This solution created revenue-generating opportunities such as mobile targeted advertising and affiliate marketing (NFC Forum 2009).
Strömmer *et al.* (2006, p. 3246) highlight how NFC technology can be used to help self-care patients manage chronic diseases. The drivers for a NFC-based solution include the high cost of resources, and the associated high power consumption and cumbersomeness of cable based medical communication and monitoring devices. In medical environments

cables also tend to be unhygienic and wear out with time. The value proposition presented by NFC technology includes ease of use, low power consumption, and low-cost. By using NFC-based sensors medical personnel can carry out real-time patient monitoring eg. heart rate, and offline monitoring eg. glucose level, and manage long-term diseases.
There have also been a number of NFC-based consumer products that have been rolled out. NFC-based advertising posters allow moviegoers to touch a NFCtagged poster with their mobile phone initiating the mobile phone to download a movie trailer from the Internet. This solution can be adapted for various advertising campaigns (Michahelles 2007, p. 95). Another solution based on NFC-tagged posters is the distribution of virtual or electronic coupons. Dominikus *et al.* (2007, p.1) define mCoupons as "electronic coupons can be stored and cashed in using a mobile device" and their proposed NFC-based application would allow consumers to collect and use mCoupons without direct human interaction. Information about the consumers can also be collected and assist in direct marketing.
Lastly, Sallinen *et al.* (2008, p. 586) describe how NFC technology can be used in industrial manufacturing environments such as the automotive industry. They present a scenario of a wireless manufacturing plant monitored using NFC technology. The value proposition of using wireless NFC communication is that it is able to function in harsh environment, avoids reflections, has a low power consumption, is unique, and offers a simple user interface based on the "touch and go" philosophy.

NFC technology has two goals, which are simplicity and security. By using near-field electromagnetic waves communication can be initiated by reducing the proximity between electronic devices. According to Evans-Pughe (2005, p. 39) antenna related electromagnetic field patterns can be divided into two regions "the propagating far field and the non-propagating near field". A mobile phone for example seeks to maximise the propagation of its far field in order to achieve coverage while minimising the near field but NFC technology seeks the reserve and that is to maximise the near field while minimising the far field. NFC technology makes use of the 13.56 MHz carrier frequency enabling devices to transfer data at a rate of 424kbps (NFC Forum 2009).
An NFC device can operate in three modes: read/write mode, card emulation mode and peer-to-peer mode (Cheng *et al.* 2009, p. 2009). The read/write mode enables NFC devices to read and change data held on NFC compliant transponders such as tags passively. When the transponder is operating in passive mode it requires no power to initiate data transmission. Card emulation mode enables an NFC device to act as a smart card. This means that an external reader can read the data held by the NFC device. Lastly, NFC devices can operate in peer-to-peer mode allowing the devices to actively or simultaneously send and receive data between each other.

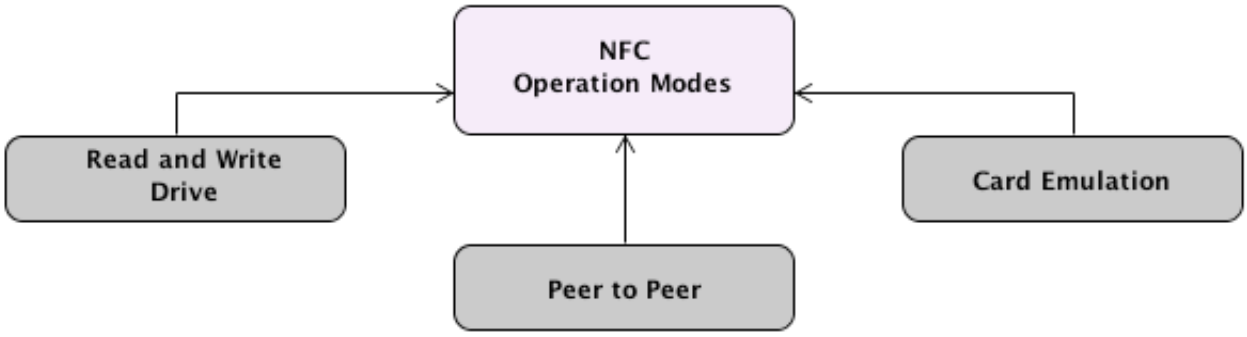

Figure 2: NFC Device Operation Modes

As mentioned above a generic NFC device has the following hardware components: a host computer, interface, and tag. The host computer can be a mobile device, thin-client, personal computer or a consumer electronic device. The host computer stores the NFC application as well as any software that allows for over-theair (OTA) administration of the NFC application to take place. The interface allows the host computer to communicate with the tag and in mobile devices allows the host computer to communicate with the secure element. The secure element can be the MNO issued SIM card. Lastly, the tag carries out the transmission of the data and also includes the near field antenna. The communication components include the connection established between two devices and service discovery were devices find out what the other device is capable of doing (Csapodi *et al.* 2007, p. 2).

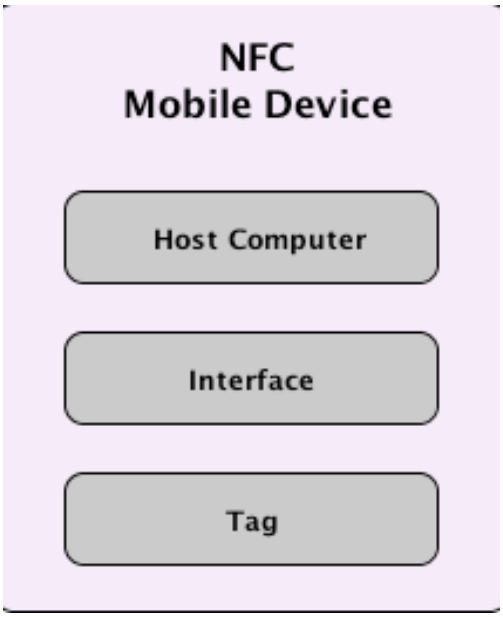

Figure 3: NFC Mobile Device Components

Chapter 2

Overview

In this section we will give an overview some critical factors in order to succeed, shift through some key NFC stakeholders, and lastly study the benefits and challenges associated with NFC technology. Reviewing the various challenges faced by mobile payment solutions will give this research weight. These challenges include critical success factors such as dealing with the dynamics of different stakeholders with conflicting interests, consumer behaviour, costs, trust and security, usability, and lastly legislation governing mobile payments.

2.1 Critical Success Factors

A lot of research had been carried out on mobile payments. In Dahlberg's *et al.* (2008, p. 174) paper titled "Past, present and future of mobile payments research: A literature review" they review some of the research material that has been published on mobile payments and discover a trend. This trend indicated some of the important adoption factors for mobile payments: "ease of use, trust and security, usefulness, cost, and compatibility". These factors can be divided into three groups: contingency factors (social, legal, commercial, technological), user specific factors (consumer adoption), and factors determining value for users (value proposition) (Pihlajamäki 2004, p. 2).

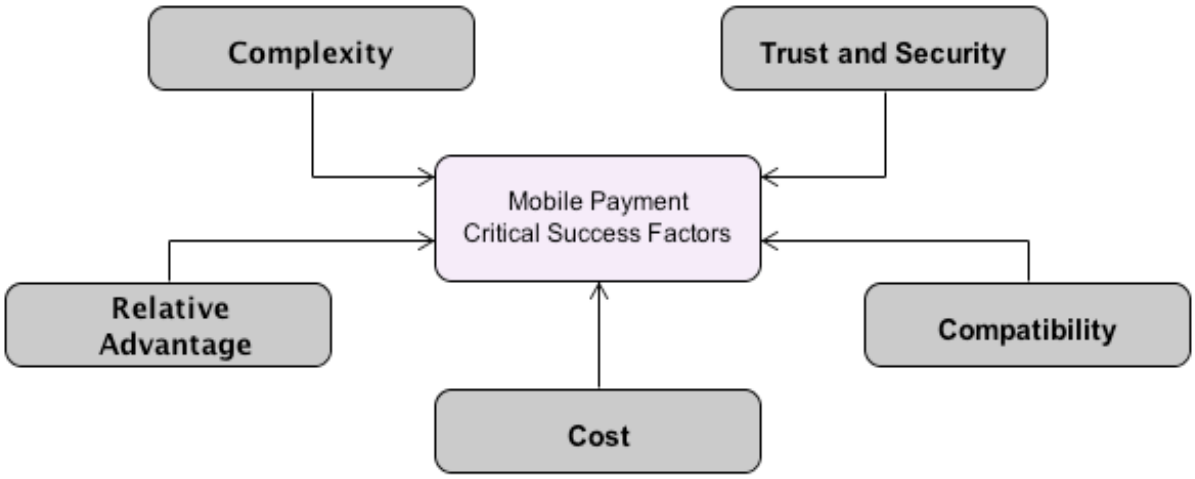

Figure 4: Mobile Critical Success Factors

2.1.1 Complexity

Complexity is an important factor that affects consumer adoption of mobile payments. There are two areas of mobile payments that have the potential of being complex. The first is the complexity of the relationship between the various stakeholders. Carr (2007, p. 9) states that each stakeholder in the mobile payment space has a different strategy and interest. Stakeholders need to get to an understanding in order for the mobile payment solution to be successful. The second factor included in the complexity of mobile payments is the ease of use of the mobile payment applications themselves. Antovski *et al.* (2009, p. 20) make note of a few features that can contribute to the ease of use: intuitive, flexible, easy installation, and few steps/clicks.

2.1.2 Trust and Security

Trust and security is one of the most important critical success factors when it comes to mobile payments. Consumers are aware of the risks involved such as viruses and theft but Varshney (2002, p. 121) makes note of some equally important security challenges faced by mobile payments. These challenges include confidentiality, authentication, integrity, authorisation, and non-repudiation. The consumer's perception of security is very important but the poor quality of service (QoS) that has been provided by South African MNO's will make it harder to convince the consumer (ICASA 2009).

2.1.3 Relative Advantage

Relative advantage refers to the degree to which consumers view an idea is better than the idea it is meant to replace. This means that mobile payments have to be more valuable to the consumers than traditional payment methods. Pihlajamäki, (2004, p. 2) describes the critical success factor of relative advantage by saying that "the value gained [by mobile payment use] needs to be greater than the investment costs for the consumer".

2.1.4 Cost

Cost is another important critical success factor for mobile payments. Varshney (2002, p. 120) mentions two costs that come with mobile payment solutions. The first cost is for the infrastructure that is managed by the MNO, financial institution, or the merchant. The second cost that is also key to this research is the cost that is incurred by the consumers. These costs can be setup fees, transactional fees, and subscription fees. In order to accelerate adoption costs need to be low or non-existent to the consumer.

2.1.5 Regulations

Carr (2009, p. 10) highlights the legal status of mobile payments by saying "it is not legal tender in the sense it lacks the status of other payment instruments such as cash, which is a medium of exchange that is authorised, adopted, and guaranteed by the government". Regulating the mobile payment space is a difficult task because of the different stakeholders involved. Carr (2009, p. 11) goes on to mention a point that is also valid to South Africa that each industry has a standards body to comply to. For instance, MNOs report to the Independent Communication Authority of South Africa (ICASA). ICASA is a product of The Independent Communication Authority Amendment Act of 2000. ICASA acts as the telecommunication industry watchdog dealing with regulations, policies, licences, disputes, complaints and protection of the consumer (ICASA 2009). The South African Reserve Bank Act, the Bank Act, and the National Payment System Act govern the financial institutions and the local mobile payment solutions from Wizzit and MTN Money make use partnering financial institutions (MTN Banking 2009, p. 2). The reason for the above business relationship is because the law usually stipulates that non-financial institutions cannot act as banks. MTN Money is a division of Standard Bank while Wizzit Bank is a division of The South African Bank of Athens.

Conclusion

Since its introduction M-payments have not lived up to the hype but the area still has a lot of potential. The challenge has been to sell the value proposition to consumers. Consumers want to see the relative advantage of using an alternative payment method before adoption. Some unique advantages that form the value proposition of m-payments include ubiquity, reachability, localisation, personalisation, convenience, and identifiability.

The current global economic downturn has also pushed consumers to open up their minds to cheaper alternative payment methods. Cundiff (2009, p. 2) notes that almost 40% of consumers have cut down credit card purchases while alternative payment methods are continuing to grow. Recent technological advancements in the m-payments space have the potential to address the need for cheaper and convenient payment methods for consumers.

Chapter 3

Overview
In this section of research NFC enabled mobile payments will be reviewed. This review will include exploring the various business models being proposed and applied during the implementation of NFC mobile payments. The various stakeholders that are part of the NFC mobile payment ecosystem will then be studied and lastly the benefits and challenges associated with NFC mobile payments will be noted.

3.1 NFC Stakeholders

As mentioned before NFC technology has not been widely implemented in South Africa and because of the fact that no local trials have taken place we find no direct local players. However, many of the important NFC stakeholders and players are multinational organisations with local presence. This group of organisations include Hewlett-Packard, MasterCard, Microsoft, Nokia, Panasonic, Samsung Electronics, Sony Corporation, Visa Inc., LG Electronics, Motorola Inc., Sony Ericsson Mobile Communications AB, Research In Motion, ERICSSON, Intel Corporation, Toshiba Corporation, and the GSM Association (NFC Forum 2009). From the list above it might seem as though none of South Africa's MNOs, Vodacom, MTN and Cell C, are part of the group but they are members of the GSM Association (GSM World 2009). The stakeholders above can be categorised into three groups: original equipment manufacturers (OEM), financial institutions, and mobile network operators (MNO).
One of the largest NFC OEMs is NXP Semiconductors. NXP is based in the Netherlands and was founded by Royal Philips Electronics more than 50 years ago. It also has to be noted that Philips was one of the organisations that initially promoted NFC technology. NXP claims to be in the top 10 largest semiconductor manufacturers in the world and delivers systems and software for various consumer electronics such as televisions, mobile phones, vehicle electronics, and personal media players. NXP manufactures NFC transmission models or transceivers that communicate at the NFC specified frequency of 13.56 MHz. NXP also manufactures NFC controllers and NFC secure modules that host and secure the applications (NXP 2009). Locally the ideal distributor of NFC components would be Altech, one of South Africa's largest technology companies. Altech (2009) are recognised as a world-class electronic component distribution hub for Africa offering products such as semiconductors, electromechanical, connectors, displays, frequency components, batteries, and wireless components.
Above, the following financial institutions were mentioned: MasterCard, and Visa Inc. Both these organisations have a local presence in South Africa. MasterCard operates a global payment network that processes billions of secure payments each year. Some of the local financial institutions that offer MasterCard products include ABSA Bank, Nedbank, and Standard Bank. Through MasterCard local financial institutions have the potential to get exposure to NFC technology by adopting MasterCard's PayPass solution (MasterCard 2009). Visa Inc is also an electronic payment network operator and a direct competitor to MasterCard. ABSA Bank, FNB, Nedbank and Standard Bank provide Visa products locally. Visa has the NFC based payment solution named Visa payWave and through the business relation mentioned above local financial institutions can get exposure to NFC technology (Visa 2009).
Local MNOs such as Vodacom, MTN, Cell C, and Virgin Mobile do not currently have direct exposure to NFC technology but they are part of the GSM Associating that is a member of the NFC Forum. However, the author discovered that some MNOs have been

at the forefront of developing NFC technology for the market. One is these important MNOs is the global mobile telecommunications company Vodafone Group. It has to be noted that local MNO Vodacom is part of the British based Vodafone Group (Vodacom 2009). The Vodafone group has rolled out several NFC based services and in 2008 was involved in the roll out of a NFC based e-ticketing system called Touch&Travel. Vodafone, in collaboration with Deutsche Bahn, implemented the Touch&Travel system that allowed train users to check in and out of the train using their NFC enabled mobile phones (Vodafone 2009).

3.1.1 Consumers

Consumers are always on the look out for ways to save money and this fact is no different to South African consumers. Utilizing mobile payment solutions needs to be cheap, secure, and reliable for the consumers.

3.1.2 Mobile Network Operator

MNOs are interested in increasing revenue by increasing the traffic in their networks. They also see mobile payments as the critical technology that allows the consumer to purchase mobile content. South Africa has four MNOs these are Vodacom, MTN, Cell-C, and the Virgin Mobile. Vodacom (www.vodacom.co.za), founded in 1994, is the leading MNO in the country followed by MTN (www.mtn.com), also founded in 1994. Cell-C (www.cellc.co.za) is third largest MNO and was founded in 2001 and Virgin Mobile (www.virginmobile.co.za), founded in 2006, runs as a virtual mobile network operator on Cell-C's backbone systems.

3.1.3 Financial Institutions

In South Africa we find a group of dominant financial institutions known as the 'Big Four'. The 'Big Four' include Absa, FNB, Nedbank and Standard Bank. The largest of the 'Big Four' is Absa (www.absa.co.za), founded in 1991. FNB (www.fnb.co.za) was founded in 1838, Standard Bank (www.standardbank.co.za) in 1862, and Nedbank (www.nedbank.co.za) in 1951.

Some of these stakeholders have attempted to implement mobile payment solutions with little success but there are a few solutions that have caught the consumer's attention. Wizzit Bank provides a prime example of a mobile payment solution that has been making waves in South Africa. Wizzit Bank, founded in 2004, provides a cellphone-based banking solution (Katz 2005). The solution has been designed for consumers that have no bank accounts and those that are underbanked (Africa Research Bulletin 2008). The solution works across all the MNOs mentioned above and on any mobile phone using the USSD channel (Fisher-French 2005, p. 3). The Wizzit solution also allows consumers to make person-to-person micro and macro payments (Crotty 2005). Another mobile payment solution in South Africa is MTN Banking a joint venture between the MNO MTN and Standard Bank.Accord to Fisher-French (2003, p 3.) the reason why MTN Banking has not been as successful as Wizzit Bank is because "banks are struggling to adapt to the highvolume, low-margin model".

3.2 Benefits and Challenges

NFC technology has several benefits that it offers to the user but also has a number of challenges that have to be overcome. Throughout the author's research into NFC technology similar benefits kept surfacing. Sallinen *et al.* (2008, p. 587), Csapodi *et al.* (2007, p. 2), Strömmer *et al.* (2006, p. 3249), and Madlmayr *et al.* (2008, p. 642) mention: ease-of-use, simple communication setup and the extremely low power consumption as

potential benefits in the mobile payment space, medical industry and manufacturing industry. Madlmayr (2008, p. 563) also indicates NFC technology's ability to be integrated into mobile devices as an important benefit since it allows for remote distribution and over-the-air administration of applications. Another benefit that was observed by the author is the coordinated effort to establish NFC standards, specifications and parameters, helping to drive the refinement process of the core technology creating a stable platform to develop the numerous applications mentioned above.

NFC technology's attribute of ease-of-use comes from its built-in simple approach of physically bringing the two communicating devices together. Other solutions such as Bluetooth and IrDA require some end-user configuration and pairing before communication can take place and this can prove to be very inefficient when hundreds of transactions need to occur every minute.

NFC technology also offers a simple straightforward communication setup procedure. For example when establishing a Bluetooth connection it usually takes the user a couple of seconds to complete the process while it only takes only milliseconds for a NFC connection to be established. This extremely low setup latency is the reason why NFC technology has been dubbed as transformational (Dulaney 2008, p. 12).

NFC technology also has low power consumption. The reason for this is because, in passive mode, communication can be powered from one side. Another reason for the low power consumption is the fact that NFC communicates using the near field. This attribute is extremely advantageous for power sensitive devices such as mobile phones, remote sensors, and monitoring equipment.

NFC technology also comes with several challenges that need to be highlighted. The author will categorise these challenges into two groups: technical challenges and business challenges. The technical challenges include some of the vulnerabilities that NFC technology inherits from RFID technology such as Denial of Service, impersonation, information leakage, and malicious traceability (Madlmayr *et al*. 2008, p. 646). Denial of Service prevents the NFC technology from working as intended, impersonation occurs when attackers are able to relay the information received by one device to a different device, information leakage happens when data is copied from the secure element on the mobile device, and malicious traceability occurs when a false connection is established. Other technical challenges include issues of managing multiple applications on the same device and how to manage them over-the-air (Madlmayr 2008, p. 563). The business challenges include devising the right business model to use with NFC technology and dealing with the various stakeholders involved (Benyó *et al.* 2009, p.2). The author will get into more detail regarding these challenges in the next section of this research.

Conclusion

In conclusion, in order to gain insight into NFC based mobile payments a thorough investigation into NFC technology was carried out. It is clear to see that the NFC Forum has made significant progress towards its goal to promote NFC technology use through out various industries. These various industries are still discovering the potential uses of NFC technology but the prospects appear to be positive. Although none of these trials and implementations are taking place locally, existing business relationships will help South African stakeholders reduce the learning curve. The local adoption of mobile payments can also be accelerated since NFC technology has the capability to address one of the important mobile payment critical success factors of eliminating complexity. This makes NFC technology an ideal candidate when setting a strong foundation for mobile payments in South Africa.

Chapter 4

Overview

In this section we will indicate ways the growth of electronic payments can substantially reduce the social cost of a country's payment system. We provide an estimate of the potential savings in social cost and determine the responsiveness of payment users when relative prices are used to speed up the substitution of electronic and especially mobile-based for paper-based payments. It is a fact that payment users are quite sensitive to relative prices that reflect the relatively lower cost of electronic payments is generalizable. Both production techniques and consumer needs for payment instruments are very similar across developed countries, even though instrument usage differs.

The resource cost of a nation's payment system can account for 3 percent of its GDP (Humphrey, Pulley, and Vesala 2000). Since most electronic payments cost only around one-third to one-half as much as a paper-based noncash payment, it is clear that the social cost of a payment system could be considerably reduced if it shifted to electronics. Surveys consistently report in the absence of direct pricing that electronic payments have greater adoption rates among young adults and individuals with higher incomes.he apparent rationale is that young adults are more open to new products and do not have a history of relying on paper-based payments, such as checks and paper giro payments. As well, high-income individuals have a higher opportunity cost for the often greater time it takes to initiate a paper versus an electronic transaction. When these essentially nonprice factors are relied upon for the adoption of electronic payments, the transition will be slow and the (hidden) discounted value of the unrealized gains can be large. While the answer is to clearly and directly price bankprovided payment services according to their differential costs of production, so users may choose the payment instrument with the lowest net price/nonprice cost, this market approach is typically resisted by suppliers in most countries. Consumer users of payment services have traditionally paid for payment services through lost interest on transaction balances, and banks fear a loss of deposit market share if they are the first (and perhapso nly) supplierst o directlyp rice each transaction.T wo additional factors concern the degree of banking industry concentration (since centralized and nationwidec learing arrangementsa re more amenablet o the application of electronic methods) and the existence of antitrust laws that inhibit cooperation among suppliers to simultaneously adopt a different pricing strategy.

As a partial offset to savings from lower production costs for electronic payments, governments can experience a reduction in seigniorage revenues as electronic payments also replace cash. In addition,f or consumer-to-businessp oint-of-sale and bill payments, electronic payments will reduce the need for business working capital associated with the delay in processing paper-based noncash payments. This reduction permits firms to expand elsewhere with the end result being that greater economic activity can be associated with the same level of measured money or credit supply.

4.1 NFC enabled Mobile Payments

Madlmayr (2008, p. 563) describes NFC as a wireless communication technology that enables data to be transmitted within 10cm of the devices. Carr (2007, p. 1) describes mobile payments as any transaction payment initiated, authorised, and confirmed using a mobile device. NFC based mobile payments can then be described as any contactless payment where a NFC enabled mobile device is utilised to initiate, authorise, and confirm an exchange of financial value in return for goods or services.

As mentioned above mobile phone devices have been the most widely used technology

ever and this tread is also evident in South Africa where we saw market penetration reaching 98% in 2008 (Cellular News 2008). Although the mobile device is popular in South Africa its mobile commerce potential has not yet been fully realised because of limited and complicated mobile payment solutions based on the SMS, USSD, and WAP platforms. However, in Japan, Sony's RFID based contactless mobile payment solution, FeliCa, has amassed 20 million users since its launch in 2004 proving that contactless mobile payments possess the potential to be successful. The NFC Forum's efforts have made it possible for the highly regulated western-world to make use of contactless mobile payment solutions through the standardisation of NFC technology. In 2007, Serrula on behalf of the GSM Association (2009, p. 1) carried out an extensive research in 17 countries across Europe, Asia, and North America asking if the consumer thought paying and buying using mobile devices was a good idea. They discovered that out of the 2500 consumers surveyed 76% would use their mobile phone to pay for mass-transit tickets, 71% would use it for weekly supermarket shopping, 69% would use it to pay their restaurant bills, and 52% expect to adopt the technology within a year of its commercialisation. The great anticipated and projected customer demand has lead Strategy Analytics2 to predict that mobile phone based contactless payments will be the catalyst for over US$36 billion of worldwide consumer spending by 2011 (GSMA 2007, p. 6).

The Booz Allen's (2008, p. 13) Global Mobile NFC Team and the GSM Association (2007, p. 10) mention some key NFC enabled mobile payment business drivers to validate the reason why NFC enabled mobile payments should be adopted. Some of these key drivers include the speed and convenience associated with NFC transactions, differentiation, reduced service delivery time, alternative revenue source, cost of management, and risk management. The speed and convenience of NFC enabled mobile payments has the ability to stimulate additional revenues through increased transactions. Product differentiation can also be a business driver since stakeholders can customise the service offerings of their NFC Applications. Using over the air (OTA) capabilities, mobile payment services can be enabled within minutes instead of the days associated with physical payment solutions such as credit cards. NFC service providers can also charge consumers for the ability to make NFC based mobile payments thereby creating an alternative revenue source. The cost of operating NFC based payment cards has the potential to be lower thant he cost of operating traditional payment cards. Lastly, there is better risk management of NFC based mobile payments since virtual NFC based credit and debit cards can be disabled immediately, using OTA capabilities, limiting fraudulent activities.

4.2 PAYMENT USE, COSTS, AND PRICING

4.2.1 Payment Use

The demand for payment instruments is derived from their use in transactions. The type of transaction and its average value largely determines the types of payment instruments that will be used, although this can differ by country. There are essentially four types of transactions:

1. Point-of-sale payments for food, clothing, transportatione, ntertainment,a nd other retail purchases;
2. Bill payments for rent, mortgage, utilities, insurance, credit cards, etc.;
3. Disbursements for payroll, retirement, social benefits, etc.; and
4. Financial payments for interbusiness transactions, bank funding, government securities, foreign exchange, stock and commodity market transactions, etc. While almost all countries supply the same types of payment instruments, different countries intensively

use different payment instruments to complete the same types of transactions. The cross-country differences are striking.
The choice of which payment instrument to use for a particular type of transaction is governed by the average value of the transaction to be made as well as institutional differences among countries. Cash, credit card, debit card, and (sometimes) check instruments have relatively low average values due to their intensive use at the point of sale while those check and giro payments used for bill payments and disbursements have higher average values. Finally, depending on the country, large-value financial payments are made using highly secure wire transfers or giro payments, but few checks.
Institutional differences also play a role. For example, checks are the dominant instrument in the United States primarily due to historical restrictions on interstate banking and branching which (before electronics) necessitated the physical movement of payment information between banks when payors and payees had accounts at different institutions. With an unconcentrated banking system, it has been more difficult for the United States to cooperate and switch to electronics than in other check-intensive countries (Canada, France, Australia). In contrast, the national postal system in Europe was the first to provide banking services savings and bill payments to the general public, while the banks initially only served the wealthy. With a national paper-based clearing system already in place, European countries have found it easier to shift to electronics. In Japan, a very low crime rate reduces the need to shift from cash to noncash payments, except for bill payments, payroll disbursement, and large value financial payments (where either distances are inconvenient or large values are needed).

4.2.2 Payment Costs

There is remarkably little public information on what it costs to make a payment. Even so, a few cost estimates do exist.
It' s generally agreed that electronic payments are cheaper for banks than their paper-based non cash equivalent. But bank costs are not the only costs involved. Indeed, retailers accepting credit cards face markedly higher costs compared to checks. For instance, each check accepted at U.S. supermarkets generates $0.58 in expenses while a credit card costs the retailer $1.07, an 84 percent increase. This anomaly is due to how credit cards are priced, which raises the whole issue of payment pricing.

4.3 Payment transactions

Successful experiences related to mobile payment can be found in the United States with the use of pay-pal-payment platform for e-bay and in Canada with the use of Obopay. In Philippines, 85% of the mobile phone users make payments using their phone device. In South Africa and other countries in Africa, there have been several similar experiences. Although it is a worldwide phenomenon, the mobile platforms are more developed in countries where there is less access to bank transactions.
In Brazil, the mobile payment concept was applied to the Credit Card Chain. Paggo is the pioneering company in a credit system where transactions between clients and retailers are carried out through mobile phones. The credit card industry has been growing around 20% per year. The main players in the chain are the retail banks that attempt to explore their customer base and the credit card issuers like Visa and MasterCard that operate globally.
We will analyze the competitiveness and the value creation of the mobile payment technology into the credit card chain. An exploratory, descriptive case study was carried out at the Paggo Company in the year of 2007. It aimed to understand the competitive differentials of the company based on two models. The first was proposed by Amit e Zott

(2001) and it is based on the Transaction Cost Theory, Value Chain Analysis, Resource – Based View, Schumpeterian Innovation, and Strategic Network. It attempts to elucidate the sources of value creation in virtual chains. The second model used in the analysis is related to the operation performance criteria, as proposed by Hill (1985). Hence, this study analyzed fully the insertion of the company Paggo and the mobile payment technology in the credit card chain, as well as it raises questions about how they can affect the traditional global players in the chain.

4.4 Value Creation in Virtual Transactions

Amit and Zott (2001) model was used to analyze value creation in the credit card chain. To do that, four value creation dimensions are used: (i) novelty, (ii) lock-in, (iii) complementarities, and (iv) efficiency. The authors argue that value generation in the virtual world goes beyond the value that can be created through the establishment of the value chain (Porter, 1985), the strategic network among companies (Dyer; Sungh, 1998), or through exploring the company resources (Barney, 1991). Such theories could not fully explain the value creation in virtual chains. However, each of them provides an important value creation proposition. Amit and Zott (2001) suggest an integration of the strategy and entrepreneurship models. Some researchers have found significant results by integrating those theories. Gulati (1999) and Afuah (2000) successfully joined Resource-Based View (RBV) and Strategic Network Theory, and highlighted the importance of partners' resources and capabilities to the company performance. Herterly and Borgatti (1997) joined the Strategic Network Theory and the Transaction Cost Theory focusing on a relationship based on reliability and cooperation despite of specific assets, demand uncertainty, complexity and frequency issues.

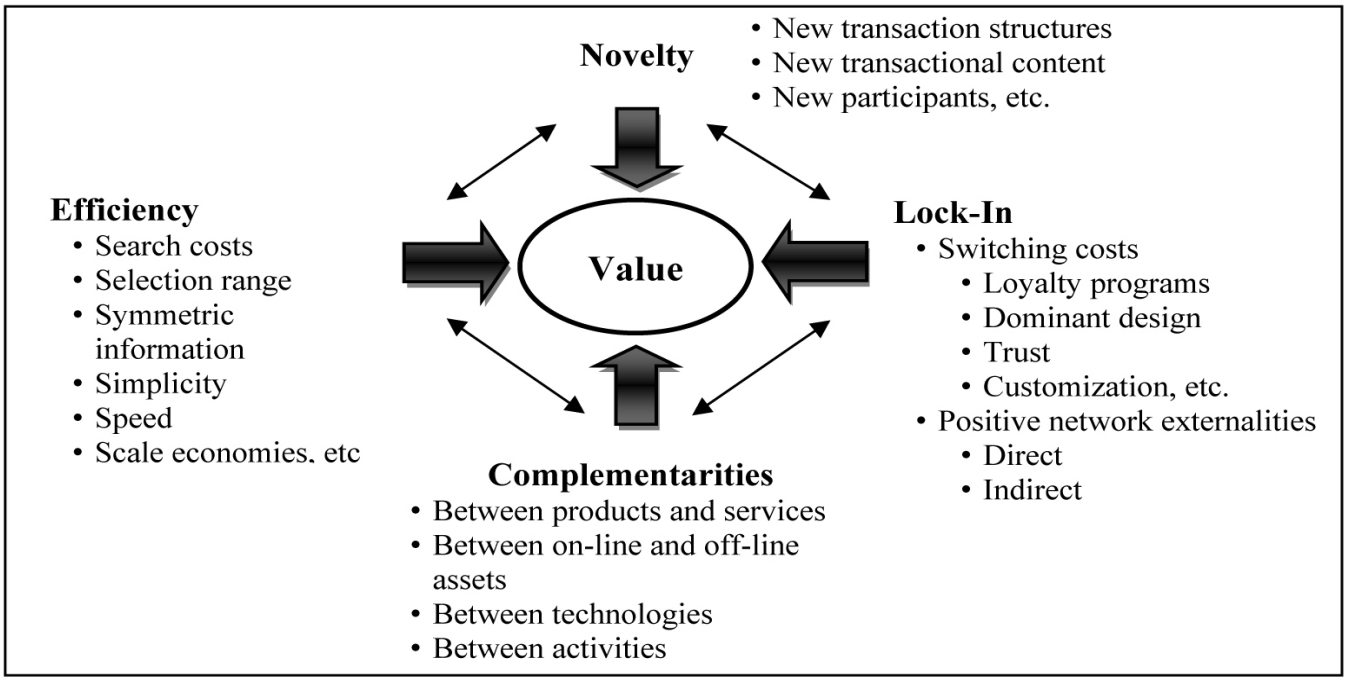

Figure 5 shows the model proposed by Amit and Zott (2001). In this case, *value* refers to the total value created in the virtual transaction; no matter if this value is appropriated by the company, the consumer, or any other participant involved in the business. The four dimensions presented in the model and the theories on which they were based are detailed below.

4.4.1 Eficiency

Amit and Zott (2001) suggest that it is one of the first dimensions able to generate value in virtual businesses, which is related to Transaction Cost Theory. This cost is associated with make-or-buy decision. According to Williamson (1975), transaction costs are defined by uncertainty levels, by the transaction frequency, and by the specific assets involved. One of the greatest effects of transactions on network environments (i.e. virtual networks) is cost reduction (DYER, 1997). Lucking-Reiley and Spulber (2001) exemplify such savings in time spent by managers in the search for consumers and suppliers, communicating with other parts involved in transaction, travel's cost, physical space for meetings, document processing and costs related to inventory.

4.4.2 Complementarities

Complementarity means that a set of resources provides more value working together than working separately (Amit;Zott, 2001). Thus, the RBV highlights the role of complementarity among the strategic assets. The combination of complementary and specialized resources and capabilities (the ones that are heterogeneous, valuable, scarce, difficult to imitate, and have perfect mobility) can lead to value creation. Another theory that contributes to the understanding of complementarity is the Strategic Network Theory, that refers to the importance of complementarity between the participants in the network (Gulati, 1999). Complementarity can occur in two different ways. It can be vertical, a post-sales service for example, or horizontal, the sale of digital cameras or memory card. They can occur by different companies and partnership (Amit;Zott, 2001). In addition, the authors propose the complementarity of the on-line and off-line assets and argue that the consumers want the complementarity of goods that are not directly related. Amit and Zott (2001) model presents the relationship between the value generating resources. The efficiency provided by the information technology leads to exploring the complementarities of e-business. The combination of different resources and capabilities of different companies is particularly interesting when there is low cost transaction.

4.4.3 Lock-in

Amit and Zott (2001) state that the creation of value in the virtual chain is directly related to motivating consumers to repeat the transaction and to the willingness of partners to maintain the partnership. Creating such attributes to generate value can be achieved by lock-in.

Lock-in occurs when the cost of changing a brand or technology is considerable, i.e. when there is some limitation on their free exchanging. Amit and Zott (2001) suggest three types of lock-in: (a) fidelity programs (bonus for purchase repetition); (b) development of a dominant design in the market; and (c) establishing a reliability relationship with the consumers. The definition changing cost is based on the Transaction Cost Theory (Williamson, 1975). Based on RBV, it can be said that the company strategic resources such as the brand name and its relationship with the suppliers can contribute to the lock-in. According to Shapiro and Varian (1999) the value created results from network externalities. The industrial era depended on economies of scale while the information economy depended on network economy. In both of them, failure multiplies failure and success multiplies success, which is the essence of positive feedback loop. The power of the network is on positive feedback from satisfied clients who make recommendations, which is in fact their perception of the best product or technology available in the network and how to aggregate this value to the client.

4.4.4 Novelty

The potential of innovation for creating value was firstly discussed by Schumpeter (1934) while the introduction of new products or services, new methods of production, distribution or marketing, and the discovery of new markets have been reported as the traditional value creation sources. Amit and Zott (2001) suggest that e-business innovation also occurs based on the way the transactions are structured. The e-business companies create value connecting the chain agents that had been isolated eliminating the inefficiencies in the purchase and sale process through innovative transactions satisfying clients' latent needs and/or by creating new markets (Amit;Zott, 2001). Novelty and lock-in, two of the four dimensions of the Amit and Zott (2001) model, are related in two ways. Firstly, the innovative companies have the advantage of attracting and retaining customers, especially by building a strong brand. Secondly, being the first mover is an essential requirement to be successful in markets characterized by crescent return. The company that innovates can start the dynamics of positive feedback cycle which results from the positive the network externalities (Shapiro;Varian, 1999). Novelty is also related to complementariry. The greatest innovation in virtual markets is the combination of complementary elements such as resources and capabilities (Schumpeter, 1934). Lastly, it is worth mentioning the relationship between novelty and efficiency. Productive process innovations, such as in assets, can improve the exploration of resources in the company and thus create value in the virtual chain (Amit;Zott, 2001).

Chapter 5

Overview

In this section we will explore the various business models being proposed and applied during the implementation of NFC mobile payments. The various stakeholders that are part of the NFC mobile payment ecosystem will then be studied and lastly the benefits and challenges associated with NFC mobile payments will be noted.

As mention above NFC enabled mobile payments are made possible by integrating an NFC chip from a semiconductor manufacturer like NXP into a mobile device such as those manufactured by Nokia. Pasquet *et al.* (2008, p. 122) highlight the two approaches of implementing contactless mobile payments such as NFC enabled mobile payments. These approaches include the dual chip approach and the single chip approach. The dual chip approach is when the mobile device contains one chip that handles the communication aspects i.e. the SIM card, while another NFC based chip that handles the mobile payment aspects. The dual approach was mostly utilised in the early implementations of NFC enabled mobile payments. The second single chip approach is the approach that has been gaining traction recently. This single chip approach integrates the NFC chip into the SIM card. The single chip approach is being promoted by the MNO lead GSM Association. GSMA was founded in 1987 and represents over 700 GSM MNOs, 200 manufacturers, and suppliers from all over the world. All of the local MNOs Vodacom, MTN, and Cell C are members of the GSMA. The GSMA (2007, p. 3) has three primary main goals, which are "to ensure mobile phones and wireless services work properly and are accessible, enhancing their value to individual customers and national economies, while creating new business opportunities for the operators and their suppliers". The GSMA has a mobile contactless payment initiative called Pay-Buy-Mobile that is pushing for the use of mobile devices as a tool to use in making secure and fast payments.

The GSMA (2007, p. 8) makes note of several reasons why the single chip approach is the best option for contactless mobile payment solutions. The first reason given by the GSMA as to why the single chip approach should be used is based on the security features integrated into SIM cards. The association states that the SIM card is temper proof enough to allow it to assume the role of the secure element. The second reason given is that SIM cards can be universally deployed easily as a standard since the GSMA currently serves 2 billion consumers that account for over 82% of the world's mobile phone users. The third reason given is the portability of SIM cards from one mobile device to another. The fourth reason is the remote manageability of SIM cards while the fifth reason resides with the fact that SIM cards are standards based. The last reason for adopting the single chip approach has to do with the long operational lifecycle of SIM cards. The GSMA (2007 p 8) mentions that while mobile devices are replaced after a year SIM cards last much longer for example the author has had the same SIM card for 4 years.

5.1Pay-By-Mobile Stakeholders

As some mobile markets begin to reach 100% penetration MNOs will begin to focus their attention on creating new revenue streams. However, MNOs are not the only stakeholders who are interested in NFC enabled mobile payments. Based on the single chip approach the GSMA (2007, p. 14) identifies several key players and stakeholders that are part of the NFC mobile payment ecosytem and value chain. The stakeholders include the customers, merchant, acquirer, card-issuing bank, payment solution company, MNOs, trusted service manager, mobile handset manufacturers, NFC chip manufacturers, SIM card manufacturers, and Terminal/Readers manufacturers. In this section we review of NFC enabled mobile payments and we will analyse the various stakeholders mentioned above.

The consumer's perception of any mobile solution is key to its success. The Booz Allen (2008, p. 6) Global Mobile NFC Team refer to the consumer as the subscriber since they subscribe to the MNO as well as to the card-issuing bank. Cellular News (2008) states that in 2008 South Africa had 43 million mobile phone subscribers out of a population of about 47 million (World Bank 2006). However, according to Finscope (2009) in 2008 the banked population in South Africa only accounted for 68% of the population. This means that the right mobile payment solutions can have a positive impact on the banked population in South Africa.

Another important stakeholder in the single chip approach to NFC mobile payments is the merchant. The GSMA (2007, p. 15) describe the merchant as the provider of goods and service that are purchased by the consumer through the use of a point of sale (POS) device. The largest retail chain in South Africa is Shoprite Holdings although we find other fairly large retail chains such as Edcon, Checkers, and Pick n Pay. To enable consumers to utilise NFC enabled mobile payments merchants will have to equip their stores with NFC POS terminals.

Nav Bains (2008, p. 14), the project director of Pay-By-Mobile, introduces the new role of the trusted services manager (TSM) unique to the single chip approach to NFC enabled mobile payments. The TSM is responsible for managing the secure download and life-cycle of the mobile NFC applications, that reside in the consumer's mobile device, on behalf of the card issuing banks. The TSM is also the single point of contact for the card issuing banks to access the customer base

through the MNOs. This means that the TSM will have a business relationship with both the MNO and the card issuing banks. The various business models around this relationship will be explored in the next section of this research.

The last stakeholder that will be reviewed is the mobile handset manufacturer. One mobile handset manufacturer that has been leading the way in designing NFC enabled mobile devices is Nokia. Currently Nokia (Nokia.com 2009) has two NFC mobile devices the Nokia 6212 Classic and the Nokia 6131 NFC. Both mobile devices allow for fast and secure NFC payments while the NFC applications are Java based. The devices also have over the air management capabilities. Some other mobile handset manufactures that have produced NFC enabled mobile devices include Sagem and Motorola.

5.2 Pay-By-Mobile Business Model

The GSMA (2007, p. 19) suggests four business models to use when implementing NFC enabled mobile payments. These models centre on the TSM role introduced in the previous section. According to the GSMA, the goal of these business models is to create an efficient ecosystem that provides a link between the card issuing banks and MNOs.

The first model is the MNO centric model. Using this model the MNO acts as the TSM. This means that the MNO integrates its network into the TSM component of the business providing a secure and open interface to the card issuing banks. The drawback is that the card issuing banks will need to integrate into each MNO in order to cater to the entire market.

The Second business model is the independent entity model. Using this model a trusted third party invests into the TSM infrastructure and becomes the "go between" for both card issuing banks and MNOs. Using this model card issuing banks will only have to integrate into one independent TSM providing access to the available MNO customer base. The challenge with this model is that the trusted third party TSM will have to have agreements with all the MNOs and the card issuing banks.

The third possible business model is the card issuing bank centric model. In this model the card issuing banks act as the TSM. However, links will have to be established into all the

available MNOs while these MNOs continue to control the allocation of NFC applications on the consumers SIM card.
The forth and last business model proposed by the GSMA (2007, p. 23) is the combination model. In the combination model investment in the TSM can come from the card issuing bank, MNO, or any other interested third parties. The drawback with this model is that MNOs as well as banks might not be too keen to integrate into a TSM that is controlled by the competition.

5.3 Benefits and challenges

Just like any other technological innovation there are benefits and associated challenges and the same applies for NFC enabled mobile payments. In this section of this research the author will outline some of these benefits and challenges that come when implementing NFC enabled mobile payments. The GSMA (2007, p. 9) mention several benefits that NFC enabled mobile payment can offer with the first being ease of use. By utilising the simple user interface based on the "touch and go" philosophy consumers can easily "build up a mental interaction model when working with NFC services for the first time" (Geven *et al.* 2007, p. 235). Massoth *et al.* (2009, p. 207) mention that NFC facilitates faster and convenient payments that are 25% more efficient than tradition payment methods. McElligott (2007, p. 24) proves this point by stating that it takes twenty-two seconds to make a payment using a debit card while it takes three seconds when a NFC enabled mobile device is used. Another benefit of NFC enabled mobile payments based on the single chip approach is the portability of NFC applications from one consumer's mobile phone to another. NFC enabled mobile payments based on the single chip approach also offer the benefit of being globally compliant. Another benefit is its ability to store several payment applications on one device. Morris (2007, p. 7) reviews how Manchester City Football Club ran NFC trials by allowing their season ticket holders to utilise etickets stored on their mobile devices to enter the stadium. The last mentioned benefit offered by NFC enabled mobile payments is the improved security. The overthe-air administration functionality offered by the single chip approach offers the ability to limit the impact of fraudulent activities. Vries (2009) writes of how South African scammers were able to steal R2.4 million from Vodacom clients by circumventing the SMS channel used by many mobile payment solutions. Scammers were able to divert the online banking password SMS by fraudulently creating a temporary dual SIM on the MNO's network.
NFC based mobile payments face several challenges: technological alternatives, implementation, and security. Ondrus *et al.* (2007, p. 4) notes that some of the established alternatives such as cash, magnetic cards, smartcards, contactless cards based on RFID, remote mobile payments (SMS, Premium SMS, USSD, WAP), and proximity mobile payments based on RFID pose a challenge to the adoption of NFC mobile payments. Another challenge associated with NFC enabled mobile payments is implementing a business model that provides value to every player in the ecosystem. Balaban (2008, p. 18) states that before NFC mobile payments become commercialised MNOs and card issuing banks need to sort out their differences. Mistrust and fragmented solutions will result from the issues between these two important players. The last challenge that NFC enabled mobile payments will face are security related. Mulliner (2009, p. 695) and Pasquet *et al.* (2008, p. 123) mention several NFC enabled mobile payment security threats. These threats include denial of service attacks, spoofing or false transactions, and information leakage. In Mulliner's (2009) paper entitled "Vulnerability Analysis and Attacks on NFC-enabled Mobile Phones" he proves that the threats mentioned can be realised in the real world. He goes on to provide a proof-of-concept NFC worm. It is important that all these threats are adequately addressed before commercial rollout of NFC enabled mobile

payments.

Conclusion

In conclusion, it is evident that the NFC enabled mobile payment wave is gaining momentum. The GSMA's "Pay-Buy-Mobile" initiative is working hard to deliver a NFC enabled mobile payment solution to the consumer using the best available business model. The value proposition presented by this type of payment is convincing even though the raised security issues are of concern. Consumers are being lured by the promise of making fast, efficient, and secure payments. The debate is whether or not consumers will be convinced enough to partially or fully adopt NFC enabled mobile payments. In the next section of the author's research we will review consumer reception of NFC mobile payments in trials that have been carried out internationally. This will provide a clearer picture of how South African consumers might view the concept of making NFC enabled mobile payments in the near future.

Chapter 6

Overview

In this section of the research several of these NFC-based mobile payment trials will be reviewed. The first section will include a review of North America based trials. These trials include one carried out in Canada and another carried out in Dallas, Texas, USA. The second section will cover NFC-enabled mobile payment trials that have been carried out in Europe. The two trials reviewed include one in London, and another in Switzerland. The third region that will be covered is Asia, were three trials that have been carried out in Malaysia, Japan and the Philippines will be reviewed. Lastly, the author will review a trial done in the United Arab Emirates (UAE) that represents the Middle East region.

NFC Mobile Payment Trials

Bains (GSMA 2008, p. 7) states “450 million mobile phones will be NFC-enabled by 2011, representing nearly 30% of handsets shipped worldwide in that year”. This prediction is based on the initial positive results from trials that have been conducted around the world. Although various groups have carried out NFC-based mobile payment trials the most prominent, well-coordinated and extensive trials have been done by the GSMA’s Pay-Buy-Mobile initiative. The initiative was launched in 2007 with 14 participating MNOs. The number of participating MNOs later grew to 40. Two other organisations have also been at the forefront of NFC-based mobile payment trials. These organisations are the two largest payment network operators Visa and MasterCard. Both organisations have been attempting to integrate their NFC-based contactless cards into mobile devices in order to exploit the over-the-air management capabilities.

In Europe and the US, other than for the purchase of PRS, there has been limited use of mobile payments to date, despite earlier expectations to the contrary. Expressing widely held frustration, *The Banker* magazine recently carried an article entitled: “When will mobile get moving?” The slower pace of adoption in these countries is perhaps no surprise, however: banked customers have had little reason to move from accessible, trusted electronic channels such as internet or use of card at point of sale, to a new approach which is not yet stable or pervasive.

In Western Europe, in particular, there have been a number of attempts to create m-payment platforms and products. In October 2002, the Joint Vienna Institute identified no fewer than 30 operators offering m-payment solutions of different kinds. There has been limited success to date: several major collaborative m-payment platform ventures such Simpay, a consortium of four major European mobile operators, have failed to get sufficient critical mass to succeed. Fragmentation of the European market into unviable proprietary platforms has been described as one of the biggest risks to the development of the sector here.

In the US, outside of the transport sector, there have few major m-payments products offered, at least until recently. PayPal’s launch of a m-payment offering in March 2006 in the USA and Canada is a significant development which could accelerate take-up due to its critical mass of 100 million clients. Although these clients are mainly in the US, PayPal has clients in 54 other countries, suggesting that diffusion of the service even for international remittances may be rapid once proven and as regulations allow.

M-payments are far more pervasive in parts of Asia than in Europe and the US, reaching early ‘break out’ stage in Japan and Korea.

In Japan, major mobile operator DoCoMo added the functionality of a credit card embedded on the chip of its mobile phones in 2005. Using contactless FeliCa technology,

the account represented by the chip in the phone can be charged by waving the phone in close proximity to a FeliCa point of sale device. FeliCa technology is already in use in mass transit systems in Japan. *The Economist* comments that DoCoMo's ability to integrate the hardware (cell phone) and service offering has enabled it to package its m-banking service in a way which operators elsewhere struggle to emulate, since they control only one of the key pieces but not both.

For m-banking to take off, this level of control by one large player may be helpful, but not necessary. Despite a more conventional configuration of operators and banks, Korea has also experienced seen rapid growth in mobile banking adoption in recent years. Since a cooperative offering across Korean banks was launched in 2003, more than 10m customers (out of 38m mobile subscribers) have taken up mobile banking. In a recent article, *The Korea Times* has an upbeat assessment, although sounding a warning: "Although banking-on the-road services clearly have a bright future with exponential growth potential, there remain some barriers such as security concerns and disputes over standards."

Japan and Korea are both high income countries with already extensive penetration of both internet and mobile phone. They demonstrate that m-payments and m-banking can flourish even where there are already established payment channels. However, especially since both countries have very high levels of banked population, there is no evidence that the m-banking offerings are transformational, nor do they need to be.

In this section we will focus on the approach used, stakeholders involved and report on the outcomes where they are available. The review will be split into five sections according to geographic location. The first section will include a review of North America based trials. These trials include one carried out in Canada and another carried out in Dallas, Texas, USA. The second section will cover NFC-enabled mobile payment trials that have been carried out in Europe. The two trials reviewed include one in London, and another in Switzerland. The third region that will be covered is Asia, were three trials that have been carried out in Malaysia, Japan and the Philippines will be reviewed. The fourth region that will be covered is the United Arab Emirates (UAE) that represents the Middle East region. Lastly, we will review a trial done in Africa.

6.1 North America

6.1.1 Canada

Between August 2008 and November 2008, MasterCard Canada (2009) carried out the first ever NFC-based mobile payment trial in Canada. The trial was carried out in conjunction with Citi Canada and Bell Mobility. Citi bank has been operating in Canada for more than 50 years and has more than 6 million clients. Citi also offers MasterCard products such as the NFC-based contactless cards (Citicards 2009). Bell (Bell Canada 2009) is the largest communication company in Canada and its division, Bell Mobility, was the MNO of choice in MasterCard's trial. MasterCard's decision to coordinate with Bell Mobility is justified since the MNO offers wireless voice and communication products and services with a 90% coverage of the population of Atlantic Canada.

The main goal of the trial was to determine if the technology would satisfy the consumer's need for easy to use, efficient and secure payments. A previous study had shown that 88% of Canadians were interested in a payment solution that would cut transaction times. The MasterCard trial made use of the existing PayPass infrastructure that already had 109 000 point of sale merchant installations around the world. During the trial Canadian consumers could already make use of the PayPass solution at establishments such as Rabba Fine Foods, Cineplex Odeon, and Petro-Canada. The stakeholders made use of the dual-chip approach for the NFC-enabled mobile payment solution that involved MasterCard acting

as the Trusted Service Manager (TSM). The PayPass virtual card was stored on a secure storage area located in on phone instead of the SIM card (Card Technology Today 2008, p. 16). To reward the use of the NFC-enabled mobile payment solution, MasterCard applied the same reward and loyalty programs associated with traditional MasterCard products. In order to give PayPass users peace of mind, MasterCard went a step further and provided zero liability cover for any fraudulent transactions that occur on the PayPass mobile phones (MasterCard 2009).

6.1.2 USA

Between 2006 and 2007, before the launch of the Pay-Buy-Mobile initiative, MasterCard Worldwide, Nokia and 7-Eleven carried out their own six-month NFCenabled mobile payment trial in the American city of Dallas, Texas. 7-Eleven is one of the world's largest chains of convenience stores with close to 30,000 outlets in countries such as Japan, Taiwan, Thailand, South Korea, China, Hong Kong, Malaysia, Mexico, Singapore, Australia, Philippines, Norway, Sweden, Denmark and even South Africa (Card Technology Today 2006, p. 7). For the trial 500 participants received NFC-enabled Nokia 3220 mobile phones. The NFC-enabled Nokia mobile phone is a modified version of an ordinary Nokia 3220 that has a special NFC capable shell (Nokia 2009).
For the mobile payment solution MasterCard Worldwide made use of their PayPass payment functionality with help from the chip manufacturers Giesecke & Devrient (G&D). The solution was based on the dual chip approach that involved storing the PayPass application on a secure area on the mobile device. In this trial MasterCard Worldwide acted as the TSM since data from the G&D chip was sent over the network to the secure payments network provider (Card Technology Today 2006, p. 7).

6.2 Europe

6.2.1 United Kingdom

A large-scale NFC-enabled mobile payment trial was carried out in London between November 2007 and May 2008. The trial involved the following partners O2, Barclaycard, Visa Europe, Nokia, Transport for London, AEG and Transys (Card Technology Today 2008, p. 7). O2 UK is one of the leading mobile and broadband service providers in the UK with an estimated customer base of 40 million as of December 2007 (O2 2009). Barclaycard is a division of Barclays Bank. The UK credit card company was launched in 1966 and has amassed 8.4 million customers in the UK only. Barclaycard offers various Visa based products including the payWave contactless payment solution (Barclaycard 2009).
The NFC-enable mobile payment trial made it possible for 500 participants to make mobile proximity micropayments (£10 and under) for a six-month period. The participants where given a Nokia 6131 NFC mobile device with the O2 wallet application preinstalled. The Oyster and Barclaycard virtual cards were then loaded onto the mobile devices and funds were pre-allocated. An important deviation from other trials has to be noted. This deviation involves the use of both the single chip approach and the dual chip approach. Giesecke & Devrient developed a Single Wire Protocol capable in the single chip approach solution for the trial. Venyon was then used to manage the Over the Air administration of the solution making the company the official TSM (Card Technology Today 2008, p. 7).
According to a representative from O2 (Card Technology Today 2008, p. 7), before this trial was carried out research had showed that people where more likely to return home if they forgot their mobile phones compared to a wallet or pair of keys. This was evidence to show how far the mobile phone has gone in becoming part of the consumer's daily life. Results from the trial showed that the main benefits that were noted by the users included

convenience, ease-of-use and status, which the author of this research likes to describe as the “cool factor”. The trial’s results also revealed that nine out of every ten participants were satisfied with the NFC-enabled mobile payment solution while 78% would consider adopting the solution once it has been commercialised. Lastly, some crucial findings also came to light during the trial. Firstly 85% of the participants felt that the model and make of the NFC-enabled mobile device on offer would influence their decision to adopt NFC-enabled mobile payments and secondly the importance of speed and convince surpassed that of security.

6.2.2 Switzerland

In Switzerland, Visa Europe ran a NFC-enabled mobile payment trial with the help of Credit Suisse, PostFinance, Swisscard, Swisscom, and Telekurs. It has to be noted that Visa Europe was only formed in 2004 but the company already has 360 million active cards transacting over €1.3 trillion as of June 2008 (Visa Europe 2009). Founded in 1856, Credit Suisse is one of Switzerland’s largest private bank and an important financial institution in this trial (Credit-Suisse 2009). Swisscom is one of Switzerland’s telecommunications company with a total of 5.4 million mobile customers. The communication company also offers IP-based voice and data communication services (Swisscom 2009). The trial was based on Visa’s payWave product allowing participants to make payments that are not in excess of €25. The limit allows for proximity macro-mobile payments. No indication was made on the approach used as well as the mobile device used. The unique aspect of this trial was the use of the partners’ employees as the participants.

6.3 Asia

6.3.1 Malaysia

In 2009, Malaysia launched Visa’s first commercial rollout of a NFC-enabled mobile payment solution named Maxis FastTap. The solution was implemented with help from Maxis, Visa, Nokia, Maybank, and Touch ‘n Go (Card Technology Today 2009, p. 1). Maxis (2009) is one of Malaysia’s most admired communication and technology service provider. Founded in 1960, Maybank (2009) is the largest financial service provider in Malaysia with a presence in countries such as Singapore, Philippines, Hong Kong, China, Great Britain, and the United States of America. The bank also offers various Visa products. Touch n’ Go (2009) is a solution provider that operates the Touch n’ Go solution used in the Maxis FastTap product. Touch n’ Go also operates the Central Clearing House System for the Electronic Toll System and the Common Ticketing System.

Maxis FastTap is based on Visa’s payWave solution. Consumers are able to obtain a NFC-enabled Nokia 6212 classic mobile device off the shelf and download their Maybank Visa payWave credit card over the air (Maxis 2009). As of August 2009 the Nokia (2009) 6212 classic mobile device was one of the newer NFCenabled mobile devices available on the market. The device is very basic and cannot be categorised as a smartphone although it sports 3G, email, Bluetooth, camera and NFC. No indication is made as to whether the Maxis FastTap solution makes use of the single or dual chip approach.

Using the Maxis FastTap solution consumers can make both proximity micro and macro mobile purchases at 1800 merchants across Malaysia as well as enjoy the extra functionality of being able to pay for the use of the metropolitan transit system, bus terminals, highway toll gates, and car park facilities (Card Technology Today 2009, p. 3).

6.3.2 Japan

In Japan, Mastercard Worldwide with the help of SoftBank Mobile, Orient, Samsung

Electronic, Gemalto, and Hitachi ran a NFC-enabled mobile payment trial. Mastercard Worldwide is the global arm of the payment solution provider Mastercard. The trial was based on Mastercard's PayPass solution that already had 19 million users in 2007 (Mastercard 2009). An important partner in this trial was Gemalto (2009), the SIM Card developer. Gemalto is one of the world's leading end-to-end security solutions provider designing and producing devices such as smart cards, SIM cards, e-passports, and tokens.
For the trial Mastercard Worldwide used the single chip approach. The NFC application was then embedded onto a NFC-enabled SIM card developed by Gemalto. The NFC-enabled SIM was developed with the help of one of the NFC Forum founders, NXP. The SIM is universal and compatible with traditional mobile devices while the NFC component of the SIM is backward compatible with Japan's existing payment and public transport infrastructure (Gemalto 2009, p. 7). What is unique about the mobile device used in this trial is that a financial institution instead of an MNO branded the device. SoftBank Mobile commissioned Samsung to develop a dedicated NFC-enabled handset for their mobile payment solution. This was a clear measure to block out competition even though the move might prove to be detrimental to the overall promotion of NFC-enabled mobile payments (Card Technology Today 2007, p. 6).

6.3.3 Philippines

More relevant to Africa, is the example of Philippines, a middle income developing country. Both of the major mobile network providers in the Philippines, SMART and Globe, have developed large scale m-banking offerings. Starting in 2000, Smart has offered a range of SmartMoney-branded banking products via the mobile phone, in close association with a large bank, Banco D'Oro. A Maestro debit card is also issued to enable Smart clients to use conventional ATMs and POS devices. Remittances may also be sent from Philippinos overseas, using the Smart Padala product. According to a recent Infodev study (2006), 2.5m people (of a subscriber base of 20 million) now use these Smart money services.
Competitor Globe entered the m-payments market only in 2004 with its G-Cash offering. Described as a mobile wallet, G-Cash is essentially an e-money product. G Cash can be used to make remittances, transfers and payments, and may be encashed or uploaded at a network of some 3500 agents countrywide. In 2006, less than two years after launch, Globe reports 1.2m banking clients, and this number is expected to double by 2007. Globe is now extending the use of its payment platform, for example, to enable loan disbursements and repayments to rural banks. Not enough is yet known about the customer base of these two major providers to assess how genuinely transformational the products have been in reaching customers without bank accounts.
Apart from the Philippines, there are also reports of recent growth in other middle income regions such as Eastern Europe and Middle East, where VISA Mobile has been active in Jordan since 2004. However, the Philippines is one of the few developing countries markets where m-payments and m-banking has moved out of the pioneer phase, identified earlier, to the start of the breakout stage where scale is achieved through rapid growth.

6.4 Middle East

6.4.1 UAE

In the Middle East two companies, Dubai First and du, formed a partnership to launch the first NFC-enabled mobile payment pilot programme in the United Arab Emirates (UAE). du (2009) is a telecommunication company based in the UAE that offers "mobile telephony, broadband connectivity, and IPTV services" to over 3 million consumers. Launched in 2007, Dubai First UAE (2009) is a Dubai based financial services company. The financial

institution is part of the Dubai Financial Group and got a jump-start by acquiring Dubai Bank's credit card portfolio helping it amass 130,000 cards in 2008. Dubai First's aim has always been to offer customerfocused and service-oriented products.
The Middle East NFC trial was carried out for six month in a place called the Jumeriah Beach Residence (JBR). JBR (2009) is a 22 million sq. ft. Beachfront development in Dubai that houses residential towers, hotel towers, and beach cubs. The 250 participants selected for this trial were selected from a pool of Platinum MasterCard clients that are linked to the owners of JBR, Dubai Properties Group. According to representatives from Dubai First the goal of the trial was to examine how participants made use of the new mobile payment technology. However, no mention was made on whether the single or dual chip approach was used and the mobile device used.

6.5 Africa

In sub-Saharan Africa, a number of banks have introduced m-banking products; and a variety of models is now offered. Most are at an early stage, however.
Most of the offerings to date have been additive. In countries with sufficiently large retail banking customer base, such as Kenya (inter alia, by Coop Bank), Nigeria (via GloMobile), South Africa (all four major banks) and Zimbabwe (Kingdom Bank and Econet), banks have added on mobile offerings as additional channels for their existing products. Although accurate numbers do not yet exist at continental level, it is unlikely that there are more than a million m–banking users in early 2006.
There are also emerging models in certain African countries which, though at an early stage, at least have or had the potential to be transformational. Because of the focus of this report, there was further engagement and interaction with each of these providers to understand their models and the barriers which they face to scale roll out:

• *Celpay Holdings,* originally a subsidiary of network operator Celtel, started offering mobile payment solutions in Zambia in 2002. The *Wall Street Journal* at the time dubbed this "Africa's world first in cell phone banking". Although Celpay has retail functionality, enabling funds to be deposited via banks into virtual Celpay accounts from which they can be transferred by mobile phone, the focus of its business model has become business to business payments around the logistics chains of large corporates with far flung distribution, such as breweries and oil companies. It has also extended its coverage to adjacent DRC, where it offers a means of payment for airtime vendors. South Africa's First Rand Banking Group bought Celpay from Celtel in 2005. It operates using software developed by Fundamo.

• *MTN Mobile Money* was launched in South Africa in 2005 as a joint venture between the country's second largest network operator MTN and large commercial bank, Standard Bank. Mobile Money starter packs are available via MTN agents and bank branches; and account opening takes place remotely through an interactive process during which voice recordings are taken as biometric identifiers and the Mobile Money menu is downloaded over the air to a 32 k SIM card. Like Celpay, Mobile Money uses Fundamo software. As of April 2005, Mobile Money reported 15 000 clients.

• *M-Pesa* is a m-payment platform developed by Vodafone Group, with initial support from DFID's Financial Deepening Challenge Fund. M-Pesa was launched on a pilot basis by country operator Safaricom in Kenya in 2005. In the pilot, M-Pesa is used to disburse loans from a microfinance institution (FAULU) to its clients, and then to collect repayments via designated Safaricom airtime agents. Pooled M-Pesa balances are held at a Kenyan bank. In pilot phase, M-Pesa is primarily a payment provider for the MFI, but the functionality exists, and is being explored, for person-to-person transfers of balances which will move the model into e-money issuance.

• *Wizzit* started in 2005 in South Africa, using software jointly developed with Cointel on a USSD platform. Wizzit is formally a division of the Bank of Athens of SA, which is legally liable for the deposits taken. However, the brand is owned and the operations are run by a separate entity started by independent entrepreneurs who believed in the market potential for this type of service. The linkage to a clearing bank provides Wizzit account holders with access to the conventional e-payments system of South Africa, including obtaining cash via ATMs using a Maestro branded debit card which is issued as part of the offering. Wizzit bank accounts are opened remotely by commission paid agents called Wizzkids.

Table 2: Transformational Potential of African m-banking models

Criteria:	Celpay	M-Pesa	MTN Mobile Money	Wizzit
1. Targets unbanked customers	No	Yes	Not specifically, but as part of offering	Yes
2. Product features:				
(i) Safety	Funds in float at bank	Funds of MFI in float at bank	Accounts held at bank	Accounts held at a bank
(ii) Easy access to cash back/in	N/A	Yes—airtime agents	Card access to existing ATMs/ bank branch	Card access to ATMs/ bank branch
(iii) Ability to transfer	Yes	Yes	Yes—to any bank account	Yes—to any bank account
(iv) Specific Hardware requirements	Yes	No	32k SIM	No
(v) Linked to one network operator	No	Yes	Yes	No

These African m-payment providers are all at a relatively early stage; a variety of different models, platforms and approaches is being tested. Most of the technology platforms in use are considered stable, but the sustainability of each of the business models has yet to be proven since none has yet achieved substantial scale or market traction. Unlike the Philippines, the African m-payment market is therefore still in pioneer phase.

Conclusion

In conclusion, most of the NFC mobile payment trials and pilot programs are being lead by the payment network operators VISA and MasterCard. Another very active organisation in these trials is the mobile device manufacturer, Nokia. The author also observes that all of the reviewed trials are based on a strong relationship between a MNO and a financial institution that allows the two parties to focus on their core business without encroaching into another industry. It is also clear from the trials reviewed that there is a shift from the singlechip approach to the dual-chip approach because of NFC enabled SIMs developed by manufactures such as G&D and Gemalto. It also has to be noted that besides the two main NFC benefits, namely convenience and ease-of-use, being highlighted in the trial, status or the ‘cool factor’ is another important benefit mentioned by the participants. Finally, most of the reviewed trials have produced positive results and have also helped in formulating the ideal business model that assures that all parties in the NFC ecosystem benefit.

Chapter 7

Overview
In this section of this research we will review the adoption model that will be used in attempting to predict whether South African consumers are ready to adopt NFC based mobile payments.

7.1 Adoption Model

Dahlberg *et al.* (2008, p. 174) highlight that most adoption and acceptance research done on mobile payments have used traditional acceptance models such as the technology acceptance model (TAM) and diffusion of innovations theory. The author's research will be mostly drawn from the diffusion of innovations theory instead of the technology acceptance model because of the consumer focus that it offers (Mallat 2008, p. 415). The diffusion of innovations theory, made famous by EM Rogers (1983, p. 211), includes five characteristics that affect the adoption of innovations: relative advantage, compatibility, complexity, trialability, and observability. In this research, the author will focus on some diffusion of innovations factors and additional factors important to the field of mobile payments (Dahlberg *et al*. 2008, p. 174). The adoption characteristics the author will examine include complexity, trust and security, relative advantage, cost, and compatibility.

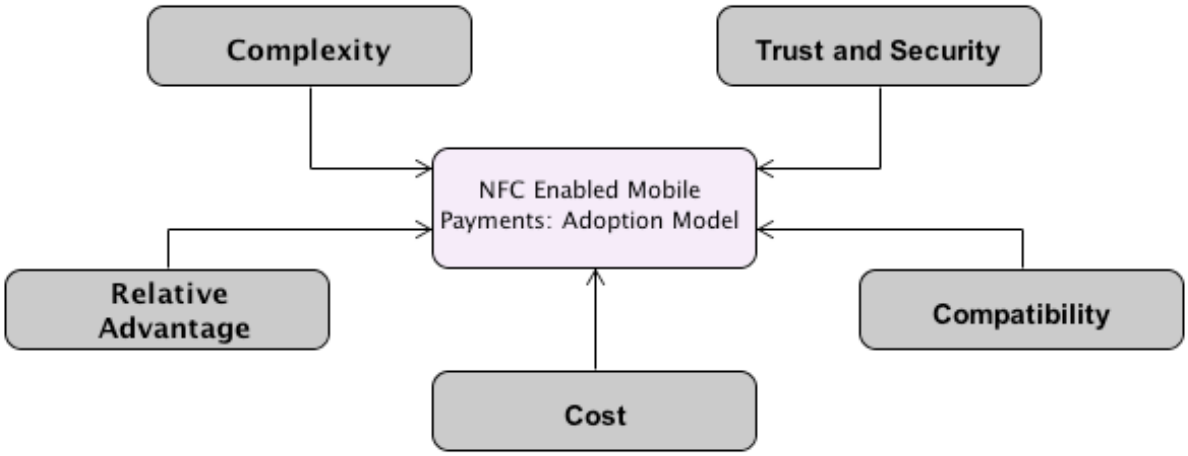

Figure 6: NFC enabled mobile payments adortion model

7.1.1 Complexity

Rogers (1983, p. 230) describes complexity as "the degree to which an innovation is perceived as relatively difficult to understand and use". Mobile payments are meant to increase consumer convenience and the same applies to NFC based mobile payments. Mallat (2008, p. 416) mentions that convenience or ease-of-use has been known to affect the consumer adoption of mobile technology because "the complexity of an innovation, as perceived by members of a social system, is negatively related to its rate of adoption" (Rogers 1983, p. 231). This means that consumers should be able to easily build a mental map of the procedures used in the operation of a certain technology after first use. If these procedures are complex and difficult to master the consumer's chances of adopting the technology are greatly reduced.

7.1.2 Trust and security

Trust and security is undoubtedly one of the most significant determinants that influences consumer adoption of electronic transactions. Mallat (2007, p. 417) mentions “perceived security and trust in vendors and payment systems is a significant determinant of mobile commerce success”. Convincing the South African consumer that NFC based micro and macro payments are safe will be a critical success factor. The high rate of both identity and mobile device theft will deter consumers from extensively making use of NFC based mobile payments unless this is adequate addressed by the stakeholders. Mallat (2007, p. 417) goes on to mention the main trust and security consumer concerns such as authentication, confidentiality, secondary use, and unauthorised access.

7.1.3 Relative advantage

Rogers (1983, p. 213) defines relative advantage as “the degree to which an innovation is perceived as being better than the idea it supersedes”. The “ideas” that NFC based mobile payments will attempt to displace include cash, credit card and bank transfer. Relative advantage has the following sub-dimensions: “economic profitability, low initial cost, a decrease in discomfort, a savings in time and effort, and the immediacy of the reward” (Rogers 1983, p. 217). Another relative advantage is social status. Rogers (1983, p. 217) goes on to state that diffusion experts look at relative advantage as one of the best indicators for the rate of adoption since most consumers firstly seek information regarding the “strength of the reward or punishment resulting from adoption of an innovation”. This is why some offer incentives or subsidies in an attempt to speed up the rate of adoption. Incentives can be described as “direct or indirect payments of cash or in kind that are given to an individual or a system in order to encourage some overt behavioural change” (Rogers 1983, p. 219). Based on research and experience we see that incentives do indeed accelerate the rate of adoption of an innovation (Rogers 1983, p. 222).

7.1.4 Cost

Both Mallat (2007, p. 417) and Dahlberg *et al*. (2008, p. 174) acknowledge that the perceived cost of a mobile payment service is a significant adoption factor that should be examined separately. NFC based mobile payments have the ability to offer cost savings but because of the various stakeholders involved the cost saving will be dependent on the business model adopted. Incentives such as subsidised NFC enabled mobile devices and discounts for transactions done using NFC-based mobile payments might accelerate adoption. The factors that will be examined include the transaction cost which is usually added to the purchase price of the goods and the cost of the enabled NFC-mobile devices.

7.1.5 Compatibility

According to Rogers (1983, p. 223) compatibility “is the degree to which an innovation is perceived as consistent with existing values, past experiences, and needs of potential adopters”. An innovation can run counter to local cultural values of a society. An innovation can also be similar to a preceding idea and that previous consumer experience can have a positive or negative on the rate of adoption. Addressing consumer needs is another indication of compatibility and increases the rate of adoption. In this research we will then have to address the level of consumer need that exists for convenient, easy-to-use, and efficient mobile payments.

7.2 Problem Statement

As mentioned earlier NFC technology is a transformational innovation that will take two to five years for it to reach mainstream adoption. This is evident from the strides that have

been taken by organisations such as Nokia, VISA, and MasterCard as well as the numerous trials and pilot programs that have been carried out in North America, Europe, Asia, and the Middle East. These international developments create the question of how South African consumers perceive an innovation that will enable them to make micro and macro payments using their mobile devices.
In this section we will explore the relation between NFC based mobile payment adoption determinants and South African consumers. The focus of this research will be determining what will make consumers use NFC based mobile payment services were traditionally they would have opted to use cash, credit card or bank transfer.

7.2.1 Consumer Perceptions

In South Africa, consumers have access to various mobile payment solutions based on SMS, USSD and WAP technology. All these payment solutions enabled the consumer to make remote micro mobile payments for digital goods. According to a survey (NZWISISA CHIDEMBO, 2009, University of Pretoria) for the NFC enabled mobile payment consumer indicated that about 40% of the research population make use of premium SMS services, 60% use USSD services, while about 90% use WAP on their mobile devices. These findings show that there isa strong interest in the underlining technology used to rollout existing mobile payment solutions.
In this section we will present the research findings from the survey. A brief overview of the population used for the consumer survey will be given followed by a detailed analysis of the key NFC enabled mobile payment adoption characteristics.
The consumer survey findings show that the majority of the population members that participated in this research are young adults aged between 19 and 35, 68% of participants are male while more than 90% of the population belong to the black or white ethnicity. None of the population members are unemployed confirming the fact that most of the participants come from the upper socioeconomic class of South Africa. About 46% of the consumer participants have made use of mobile banking services before while also most 86% utilise Internet banking services. The average credit or debit card ownership for the entire population was 1.72 per member highlighting the market opportunity for a proximity mobile payment solution.

7.2.2 Complexity Characteristics

As mentioned before complexity is described as the level to which NFC enabled mobile payments are perceived as relatively difficulty to understand and use.
The consumer should be able to easily build a mental map of the procedures used to complete an NFC enabled mobile payment transaction. A simple process of assessing the complexity of an innovation is to count the number of steps that need to be completed in order for the innovation to complete its core function. It has to be noted however that the consumer’s perceived difficulty of understanding or use is relative; therefore it was necessary to evaluate how comfortable the population was with their existing mobile devices.
The consumer survey found that a slight majority of the population, about 66%, use the advanced functions of their mobile devices. This indicated that within the population we find a high level of technology savvy individuals. A significant portion of the population does not utilise the advanced features on their mobile devices highlighting the need for a simple to use NFC enabled mobile payment solution. Both the population and the subject matter experts interviewed in this research reinforce this observation. About 60% of the population confirmed that the simplicity of the NFC enabled mobile payment solution would affect their decision to adopt while all of the subject matter experts agreed that simplicity of

the solution would have a major effect. However, it has to be highlighted that about 29% of the population was unsure if the simplicity of the NFC enabled mobile payment solution would affect their decision while about 10% totally disagreed. It is a fact that simplicity is just part of the equation that affects the decision process to adopt.
From the analysis above it is clear that the simplicity of the NFC enabled mobile payment solution plays a significant role during the consumer's decision making process but the question that arises is what can be categorised as a simple solution. The consumer survey indicated that an overwhelming majority, 91%, of the population are willing to accept a NFC enabled mobile payment solution with 4 or less steps involved when completing a transaction while no one will accept a solution with more than 6 steps.
Therefore, the simplicity of the NFC enabled mobile payment solution will affect the adoption decision process for a majority of consumers but will not be the only factor.

7.2.3 Trust and Security Characteristics

Trust and security is perceived to be a very sensitive issue for South African consumers. The idea of having a credit or debit card integrated into a mobile device is an alien thought for many. Trust is of high importance in mobile payment systems "because of the spatial and temporal separation between buyer and seller when buyers are required to give delicate personal information such as telephone number or credit card number to seller". The new dynamics that are in play when consumers are making proximity macro and micro mobile payments for physical goods presents a new purchasing environment that translates into new challenges. According to the survey only about 27% of the population were comfortable with having a credit/debit card integrated into their mobile phones while about 30% of the population did like the idea at all. However, it has to be highlighted that the majority of the population, about 42%, remained neutral indicating some scepticism towards the idea. The consumer survey also revealed that only about 4% of the population would not let their trust and security concerns affect their decision to adopt NFC enabled mobile payments. Revealing that indeed consumers had significant trust and security regarding a solution that enables for proximity mobile payments. The subject matter experts gave some of the trust and security concerns that they envision will cause problems for NFC enabled mobile payments. These concerns include theft, fraud, and transaction lag. It is clear that two prominent stakeholders in the NFC ecosystem play leading roles in the roll out of NFC enabled mobile payments. These stakeholders are MNOs and the financial institutions. Since South African consumers have direct relationships with both of these key stakeholders it is important to assess which of the two players would mitigate the consumers trust and security concerns. The survey results indicated that about 57% of the population trust the financial institutions more than MNOs to hold their mobile banking accounts while only about 25% of the participants preferred MNOs to hold their mobile banking accounts.
We see that South Africans have serious trust and security concerns regarding NFC enabled mobile payments. Marketing schemes should avoid mentioning credit card and mobile phone together while consumers need to be thoroughly educated that NFC enabled mobile payments are both more convenient and safer than traditional payment methods. In order to build tolerance for NFC enabled mobile payments, solution providers should focus on promoting proximity NFC enabled micro mobile payments backed by financial institutions that can provide the users with zero liability cover in case of fraudulent transactions.

7.2.4 Relative Advantage Characteristics

Relative advantage is "the degree to which [NFC enabled mobile payments are] perceived

[by consumers] as being better than the idea it supersedes", Rogers (1983, p. 213) Existing traditional payment methods such a cash and debit/credit cards can be classified as the ideas or techniques that NFC enabled mobile payments aim to supersede. Rogers goes on to state that relative advantage can be expressed as economic profitability or social status and has a direct impact on any innovation's rate of adoption.
The consumer survey results revealed that about 60% of the population would rather use NFC enabled mobile payments to pay for parking and to pay for groceries at the supermarket counter instead using cash. These results can be attributed to the consumer perception that it is less risky to make NFC enabled micro mobile payments instead of macro mobile payments. However, there was a lot of scepticism among the subject matter experts with only two participants agreeing that consumers would prefer using NFC enabled mobile devices to pay for groceries instead of cash. Some of the scepticism was based on the strong cash culture that exists in South Africa, to current consumer perception that cash is free, and the view that NFC enabled mobile payments might be too complicated for the low-end of the market.
Moreover, according to the survey 40% of the population would rather use a NFC enabled mobile devices to pay for groceries instead of a credit/debit card. Close to 42% of the population remained neutral, a clear indication that the consumers do not see the relative advantage that NFC enabled mobile payments have over traditional credit/debit card.
Therefore, we see that charging a premium on every NFC enabled mobile payment transaction would have a negative impact on the adoption of such a payment solution while subsidising the NFC mobile device purchase has the potential to massively impact the rate of NFC enabled mobile payments positively.

7.2.5 Compatibility Characteristics

Compatibility is "the degree to which [NFC enabled mobile payments are] consistent with the existing values, past experiences, and [mobile payment] needs of potential adopters", Rogers (1983, p. 223). The survey indicates that mobile payment solution makes it possible for consumers to make proximity payments for physical goods using their mobile phones. The results of the survey also indicate that South African consumers have positive past experiences with existing mobile micro payment solutions making them more receptive to a solution such as NFC enabled mobile payments. Lastly, we conclude that the NFC enable mobile payment selling points such as ease-of-use, convenience, and efficiency will resonate with the payment needs of South African consumers

7.3 Cooperation Models for the Development of Mobile Payment Solutions

In this section, we study different cooperation models between the key players that could be involved in mobile payment solutions. We can view a mobile payment solution as based on three key inputs: i) a mobile phone, ii) a bank account, and iii) an acceptation network. Each of these inputs is to some extent controlled by a key player. Mobile network operators (MNOs) and mobile phone manufacturers have control over the design and distribution of mobile phones, as the former commercialize the phones at subsidized prices in their commercial agencies and own the SIM card while the latter produce the phones. Banks have control over their consumers' accounts. And, finally, payment systems like Visa or Mastercard have control over large acceptation networks.

7.3.1 Key inputs of a mobile phone solution

First, a solution can be developed without the cooperation of MNOs and mobile phone manufacturers, as the payment application can be resident on a separate SD card, for instance. Another example is the payment solution developed by the start up Square,

which has been launched by the former CEO of Twitter. This solution is based on a plastic device that plugs into the mobile headphone jack, hence, it is completely independent of MNOs or manufacturers. Second, the mobile payment solution could be based on the payment card of the consumers, in which case the provider does not need the cooperation of the banks to have access to the consumers' bank accounts. For instance, Obopay allows consumers to add money to their Obopay account with their debit or credit cards, and then send money to relatives or merchants with their mobile. Though Obopay proposes its service to banks, it has been developed without their cooperation. Third, a mobile payment service provider could develop a solution without a large acceptation network (like Visa or Mastercard) if it decides to target a niche market. For instance, the provider could limit the acceptation of its payment solution to vending machines (like Mobilkom A1 in Austria) or to a few affiliated merchants (like Obopay, which targets mainly P2P transfers but proposes merchants to affiliate to the system at no fee).
Since each of the three key players (banks, mobile network operators or mobile phone manufacturers, and large acceptation networks) could be bypassed or not for the development of a mobile payment solution, we have a priori six different possible combinations. The table below gives some examples for five combinations. The last combination corresponds to a situation where the mobile payment provider owns a bank or is a bank but bypasses the MNOs and the acceptation network. We consider that this combination is not relevant, as banks have strong incentives to develop a mass market solution, which requires cooperation with the acceptation network.
Finally, the incentives of the different players to develop mobile payments differ. If they develop a mobile payment solution, MNOs would be new entrants in the payment industry. In contrast, banks are incumbents in the payment market, and therefore would view mobile payments as an improvement over other payment solutions that they commercialize (like payment cards). Therefore, banks would face a "replacement effect" for the development of mobile payments. Hence, their incentives to develop mobile payments might be lower than the incentives of MNOs, except that they could have high preemption incentives to protect their market share from an entry threat.

Conclusion

In conclusion, we see that in order for NFC-enabled mobile payments to be adopted successfully in South Africa several aspects have to be addressed adequately. These aspects are included in the diffusion of innovation theory plus several other aspects closely related to mobile payment adoption. Certain aspects of the model such as relative advantage and cost can be leveraged to accelerate the rate of adoption while important aspects of the model like complexity and compatibility can make or break the adoption of an innovation. Lastly, we indicated the significance of consumer perception of trust and security. This aspect is vital in the South African context.

Chapter 8

Overview
In this section, we study regulatory and policy issues as m-banking sits at the intersection of a number of important policy issues. Each issue is complex in its own right, and is often associated with a different regulatory domain: as many as five regulators (bank supervisor, payment regulator, telco regulator, competition regulator, anti-money laundering authority) may be involved in crafting policy and regulations which affect this sector.
The complex overlap of issues creates the very real risk of coordination failure across regulators. This failure may be one of the biggest impediments to the growth of m-banking, at least of the transformational sort. However, even without the additional complexity introduced by m-banking, many of these issues require coordinated attention anyway in order to expand access. It is possible, however, that m-banking may be useful because the prospect of leapfrogging may help to galvanize the energy required among policy makers for the necessary coordination to happen.

8.1 Issues for ICT Policy makers: are e-signatures recognized legally?

M-payments require the accepted use of electronic signatures, such as a PIN number but also including biometric identifiers, to authorize transactions. If the e-signature is not legally valid, the transaction could be subject to challenge, exposing payment agents and payees to the risk of repudiation. There is therefore a need at least to provide status to electronic transactions equivalent to that achieved by physical signature.
PIN numbers are already in widespread use in developing countries—for example, as a security feature on mobile phones—but not yet as e-signatures. Many developing countries have yet to adopt legislation enabling e-commerce. It is unlikely that individuals will accept the risk of accepting or making larger e-payments, or build new business cases on the receipt of e-payments, if their validity may be challenged. Establishing the legal validity of e-signatures is therefore a need for the m-payment/ m-banking market to grow to scale.

8.2 Issues for Financial Regulators

- **Are consumers adequately protected?**

Consumer protection is a traditional concern of policy makers and of most financial regulators. In developing countries, the enforcement of consumer protection measures is often ineffective or lacking. However, in societies with low financial literacy or large numbers of first time customers, the vulnerability to abuse is higher.
The issue for m-banking goes beyond traditional concerns about abuse of consumers. however: in new markets especially, customer adoption depends on growing trust. The experience of consumers at the hands of a few reckless providers may cause them to distrust all similar offerings in the market. Providers may therefore enjoy positive externalities from creating appropriate levels of consumer protection which help create trust, leading to more rapid adoption.
However, there may also be negative externalities from inappropriate protection. By imposing higher costs on providers, certain protective measures may result in small balance accounts becoming unviable and therefore not offered. Those already holding accounts may be better protected by these measures; but those who cannot qualify as a result are without access to the product, and may be forced to use unregulated alternatives.
A balance must be struck on this issue, therefore. The starting point is to identify the risks to which consumers are exposed. In m-payments, these typically include fraud (loss as the

result of unauthorized transactions), loss of privacy (through inadequate data protection) and even loss of service. The level of risks involved vary with the nature of the product offering, and have been analysed in detail by the Mobile Payment Forum. The security issues involved in customer authentication and authorization through all the stages of wireless transmission have been considered in some depth by the main industry fora. These are complex and fast changing.

- **How do m-payments affect the stability of the banking system and national payment system?**

The soundness of the banking system and of the national payments system are central to the mandate of most financial regulators. Fears that stability could be undermined often lead to conservative responses to product or service innovations, especially if they come from outside the banking system. Such conservatism is to be expected, indeed welcomed, when systemic stability is indeed at risk; but not when it leads to innovations being suppressed without regard to real risks: the CPSS includes among the main objectives of payment system regulation that regulators "address legal and regulatory impediments to market development and innovation." Proportionality is therefore a key principle of good regulation, although it is often hard to apply in practice, especially in new and fast evolving markets.

The conventional approach to the regulation of payment systems distinguishes between systemically important and non-systemically important systems. Systemically important is defined as "where, if the system were insufficiently protected against risk, disruption within it could trigger or transmit further disruptions amongst participants or systemic disruptions in the financial area more widely." This determination is made based mainly on the size or nature of individual payments or their aggregate value. At least one of the following should be true for a payment system to be systemically important:

- It is the only national payment system
- It handles mainly payments of high value
- It is used for settlement of financial market transactions.

The more precise definition of systemically important is left to each country regulator. According to the general definition, retail payment systems would usually not qualify, although the CPSS also notes that it may be desirable for non-systemically important systems to comply with some or all principles.

In the 'pioneer' phase of a new retail payment instrument or system, the case to apply full, or even partial, regulation is likely to be weak. However, as the system grows in coverage, it is likely to reach a system-wide usage threshold (in the sense that many people rely on it), even if it is still not considered systemic. It would now warrant much closer oversight by regulators, who may require assurances such as that there is adequate backup procedures in place.

- **Does the law distinguish adequately between payments and deposits?**

Confusion in jurisdiction between payment regulators and bank regulators may be caused by the lack of clarity over the difference between a payment and a deposit. The legal boundaries between the two categories are often vague. Vagueness may result either in legitimate payment developments being stifled through being incorrectly regarded as deposit-taking; or unregulated deposit taking under the guise of being a payment service. Neither is desirable.

Evolving EU law provides an example of growing clarity over the distinction. The proposed EU Payments directive defines a payment transaction broadly as "the act, initiated by payer or payee of depositing, withdrawing or transferring funds from payer to payee, irrespective of underlying obligations between payment system users".37 A deposit is also

a form of payment (from depositor to bank or credit institution) but it significantly different in that it is repayable to the depositor at a future time.
These transaction level definitions then inform the corresponding definitions of payment providers (which enable payments to be made or received) and banks (which take deposits in order to on-lend). Clearly, the prudential risks of each type differ, although more in degree than form: payment providers are usually limited in the maximum time to effect the payment, reducing the amounts at risk in event of failure, although 'funds in transit' may still be substantial for large payment providers. Because of this risk, payment legislation typically requires licensing and supervision of payment providers; and imposes minimum capital requirements, though these are much lower than for banks.

• Does the law provide for e-money issuance? By which entities?

We have already discussed the issues arising from the apparent issuance of e-money by telcos when pre-paid deposits are used to buy services other than airtime. This question has forced clearer definition of e-money in Europe at least. However, given the growing role of telcos in most countries, there is a need everywhere at least to define e-money; and to determine which institutions may issue it—banks only, or others as well?—since prudential (and possibly systemic) risks arise if a large scale issuer fails.

• Is there provision for agencies for cash withdrawal and deposits?

For the foreseeable future, cash will remain the most widely used transaction medium in developing countries. It is therefore necessary that there be sufficient points at which bank money (i.e. in a bank account) or e-money (e.g. at a telco) can be deposited or cashed out.
Traditionally, these transactions happened via a bank teller, but branches are expensive to set up and run; extending branch networks into lower income or less dense areas is unlikely to be a viable means of increasing access to cash. Deployment of ATMs can help, since they may be cheaper than branches to set up and run. However, for developing countries, ATMs are still relatively expensive, and typically require secure premises and ongoing servicing.
Therefore, there is a need to use existing businesses which carry cash anyway, as bank agents or correspondents. They may be linked electronically to the bank or e-money issuer, so that customers can withdraw or deposit cash there. In effect, these arrangements amount to outsourcing the front end of the deposit-taking business. In some regimes, banks may not outsource any material function without regulator permission; in others, the front-end deposit taking function is viewed as being so core to banking business that deposit taking outside secure bank premises is prohibited. Even in regimes where there are no explicit prohibitions, regulators (and banks themselves) may be very cautious about outsourcing the collection of deposits to agents because of the risk of fraud and loss of reputation of the banking sector. However, new technology has greatly improved their ability to manage the risk inherent in agency relationships.

• How do AML/CFT regulations affect account opening and cash transactions

International Anti Money Laundering/ Combating the Financing of Terrorism (AML-CFT) standards set by the Financial Action Task Force require that adequate customer due diligence (CDD) be undertaken on all new accounts and on single payment cash transactions. This process is part of Know Your Customer (KYC) procedures so that suspicious transactions can be identified. National laws and regulations are required to give effect to these standards, and they typically require:

- Verification of identity of the client, using a government issued identity document; and
- Verification of physical address (for example, by production of a bank statement or utility bill in name of the customer).

If this procedure is not followed, the bank or payment agent may be penalized by the relevant authority; or frozen out of international payment systems by other banks concerned about the risk of being associated with illicit activities.
In many developing countries, clients have no formal address: the UPU reports that in Africa, only 22% of households receive mail at home; and some 10% have no mail service at all. Even if they did, there is often no means of verification, other than a bank officer physically visiting the client's home. Isern et al (2005) have warned of the possible perverse consequences for access to financial services if an inappropriate rules-based approach is followed in developing countries. Therefore, transformational models, which target people less likely to have formal addresses, require flexibility in the application of CDD requirements.
This issue applies across all types of bank accounts. In addition, transformational mobile banking models often involve the opening of accounts by agents outside of bank premises, known as remote account opening. This approach reduces the cost of origination considerably. Although there may be higher risks involved, international AML-CFT frameworks do not rule this out, proposing that a risk-based approach be followed.
Clearly, a risk-based approach to CDD has the potential to be sufficiently flexible. However, if national regulators give no guidance on what constitutes acceptable risk-based approaches, banks may be left vulnerable to subsequent reprisal; and this may encourage undue conservatism. In countries which strongly favour a risk-based approach such as the UK, there are fora such as the Joint Money Laundering Steering Group (JMLSG) which establishes guidance for its members on such issues.

8.3 Issues for Competition regulators:

- **What are the acceptable boundaries of co-operation around payments infrastructure?**
- **What are the risks of anti-competitive 'lock in' of a particular service?**

Payments systems have long been recognized as complex 'eco-systems' where competition among providers co-exists alongside co-operation which allows the benefits of inter-operability. The right balance between competition and co-operation will vary as a market develops; and will require careful oversight by relevant authorities. Nonetheless, CPSS suggests that one of the objectives for payment regulators is to foster competitive market conditions and behaviours. The CPSS *General principles for payment system development* go further to encourage regulators to "give more choice to people; extend the coverage and choice of non-cash instruments and services available to end users by expanding and improving infrastructures."
The main concerns are (i) that dominant systems may 'lock out' new players, limiting innovation and allowing anti-competitive pricing; and (ii) that new products may effectively 'lock in' a customer in an anti-competitive manner by reducing the ability to switch at will. The Mobey Forum White Paper Customer Proposition is quite explicit that customer lock in should be avoided: "The consumer should have the freedom to choose banks, operator and Handset, and change them independently of each other".
The boundaries between acceptable competitive behaviour and anti-competitive lock in are often narrow. For example, the effort required to change a long standing mobile phone number may cause a customer to be reluctant to switch providers; and providers may exploit this stickiness through higher pricing. Nonetheless, telcom regulators do typically not require number portability at the early stages of market development; indeed, the concept only becomes relevant once a customer has come to be closely associated with her number. As mobile network markets mature, number portability is often a requirement: for example, it is required in SA in mid-2006.

Bank accounts are arguably subject to the same stickiness as mobile phone numbers, yet bank number portability has not yet been required. M-banking models have different propensity for lock in depending, for example, on the role of SIM as unique security element. Models involving special downloads to the SIM card may limit the customer to the SIM issuing network. Indeed, reducing the churn of customers in the face of increased competition in maturing markets is one of the drivers for telcos who have entered m-banking.
In early stage markets with an existing payments infrastructure, the bigger competitive issue is more likely to be 'lock out' of other players. New entrants to m-payments may be at a considerable disadvantage if they cannot access existing payment systems controlled by incumbents anxious to protect their position.
There is also a balance to be struck here; and regulators play a vital role in achieving this balance. CPSS again provides general guidance on this point: "The system should have objective and publicly disclosed criteria for participation which permit fair and open access." Enforcement may require special legal provision, however.

8.4 Issues for Telco regulators:

- **How does the role of telcos in m-banking affect licensing requirements and their solvency?**

Telco license may preclude or limit telcos from becoming directly involved in m-banking services or e-money issuance. Even if they do not, the risk profile of telco business may change as they become increasingly involved in m-banking, depending on the roles that they play. On the one hand, through generating more traffic on the network, m-banking may make telcos more profitable; on the other, it may bring new risks which may not be properly managed. For example, if pre-paid airtime balances become widely used as e-money, then the carrying time on these balances, before they are used to make calls, will lengthen. This lengthened float period will affect the accounting treatment of income, and the risks and rewards of managing the float. Finally, as telcos enter m-payment or m-banking space, telco regulators will inevitably have to coordinate and share information with bank regulators. Together, they will have to delineate supervisory boundaries so that unnecessary burdens are not placed on providers and the capacity of each regulator is not strained through duplication.

8.5 Developed country financial regulator approaches

The policy and regulatory issues listed above are many and complex. In developed countries, financial regulators have generally acknowledged that m-payments and m-banking are at an early stage, and that the answers to all these are not yet fully known. However, they have generally been reluctant to stifle innovation because the potential benefits, in greater efficiency at least, exceed the new risks. **Helen Allen of the Bank of England** best expresses this stance in several statements from a 2003 article in the Bank's Journal: "Current limited take up of most of these services highlights the importance of maintaining a sense of proportion in considering policy responses, while acknowledging the possibility that the payments market could change significantly…Were e-payments to grow significantly, any resulting changes in the distribution of risks might make it appropriate to adjust the form and extent of payment system oversight in this area."
Particular recurring regulator concerns have included:

- The money laundering risks arising from having new channels for depositing and transferring funds, especially in a post 9/11 world when banks are increasingly vulnerable to civil lawsuits from the families of victims of terror if it can be

established that any funds connected to an incident or even organization flowed through a bank in violation of the law.

- The possibility that central bank will lose control of the money supply as a result of widespread e-money issuance. However, as long as e-money is issued in exchange for central bank money and until e-money is used at large scale so that the demand for central bank money is displaced, this concern is usually exaggerated. After all, issuers like telcos do not create e-money but rather exchange it for bank money; they still ultimately need to settle with each other via accounts held at central bank, over which the central bank retains control.
- The interaction of the new payment systems with existing bank payment systems, with a view to avoiding the transmission of systemic risk. In addition, new payment systems may cause changes in patterns of usage which may affect the viability of existing payment platforms.

In general, financial regulators in developed countries have adopted the approach of monitoring developments in the field closely to assess the risks over time. Many have gone beyond this to facilitate and even coordinate around standards; and some have introduced new legislation as a means of enabling. Each will be discussed in turn.

8.6 Monitoring

Monitoring involves the collection of relevant data on the size of the market, and on the product types involved. The regular CPSS survey of internet and mobile payments across a large group of countries is an example of the use of such data, collected from national regulators.

In addition, many financial regulators in developed countries have formed specialist internal groups to monitor developments, such as the Payment Studies Resource Centre 49at the Chicago Federal Reserve Bank or the Emerging Payments Research Group at the Boston Federal Reserve Bank. These groups host regular conferences which gather industry players with regulators and analysts to discuss latest trends.

Regulators have also played a role in disseminating information to the market. The e-Payments Systems Observatory (www.e-pso.info), supported by the European Central Bank, offers an electronic portal through which information on providers and models in European countries can be easily. Because of its European focus, however, there is little information presently available on developing countries.

8.7 Beyond monitoring: facilitation & co-ordination?

Allen has questioned whether financial regulators should widen their role beyond monitoring only, asking: “Should policy makers promote inter-operability (to get to efficiency and critical mass)? The gains from doing so could be offset by diminished product differentiation and stifled innovation.”

Allen leaves this as an open question, wary that regulators could make the wrong choices, and leave the market worse off for early intervention on these counts. Certainly, there have been a variety of efforts by official bodies, such as the European Commission, as well as industry groupings, such as Mobey Forum and Mobile Payments Forum, to coordinate and promote common standards and interoperability. Financial regulators and policy makers in developed countries have to date encouraged such co-operation on standards but done little more. In developing countries, with fragmented banking sectors, regulators may need to play a much more active role.

8.8 Beyond monitoring: new legislation?

Allen has also raised the question: ”Should public authorities be involved in the security of the means of payment? There are commercial incentives for payment providers themselves to ensure appropriate security…. (but) Inadequate security also has market-wide externalities since problems in just one area could reduce public confidence across the wider payments market.”

Providing greater security would usually require the passage of new legislation, or the application of existing legislation, to bring the new instruments explicitly under official protection and supervision.

As discussed earlier, approaches here have differed: in the case of e-money, for example, the EU has adopted the approach that introducing legislation early can and should enable markets to develop, whereas the US has avoided passing federal legislation in favor of an incremental state-based approach which has evolved over time. However, the uncertainty over possible future regulation may have been an impediment to innovation.

While the passage of e-money legislation in Europe did bring certainty, the recent review of the directive found that it did not fully enable innovation, and has not led to take-off of issuance or usage. In part, this was because legislation passed six years ago could not fully anticipate some of the developments which have enabled new e-money forms today. The case of European e-money issuance is not an argument against introducing or delaying legislation *per se*, however: rather, it is an argument in favour of carefully assessing the need for certainty with the need for openness; and judging carefully both the scope of any legislation and the timing of its introduction.

Philippines

Since m-banking has progressed furthest among developing countries in the Philippines, how has the regulatory regime there evolved? Much is not yet known about the overall approach there, but Lyman et al (2006) provide useful insights.

Clearly, there was sufficient openness to enable the two major mobile operators to start their m-banking and m-payment models, in 2000 and 2004 respectively. Specifically, there was no e-money regulation which prohibited Globe from issuing G-Cash. However, there has apparently been close cooperation between the two major providers and the financial regulators to address their key concerns, such as anti-money laundering. The bilateral agreement between each telco and the Central Bank to limit the maximum size of wallet and transaction has clearly helped: not only to limit the risk of money laundering to acceptable levels, but also to reduce possible systemic risks. It is likely that the large size of the mobile operators, with the associated high brand visibility and high solvency, also allayed fears that customers would not be adequately protected or that account balances were at more risk in Globe than in a much smaller bank. However, because of the significance of the Philippino models, closer examination of how the regulatory approach has evolved, and its options for future evolution would be well worthwhile to guide other developing countries.

Enablement at work

In new market areas such as m-banking, regulators have a delicate task: neither over-reacting and stifling market development, nor under-reacting to potential large scale risks until it is too late. While delicate, the task is not impossible. Managing possible trade-off between innovation and stability is at the heart of good policy and regulation. If policy makers develop a clear market development strategy, this will not only brings greater certainty but also enable regulators to take a sequenced, proportionate response to the risks involved.

In the domain of telco regulation, there are precedents for achieving transformational enablement. For example, in the OECD paper on “Regulatory reform as a tool for bridging the digital divide” shows how the timing of various enabling actions by the Indian telcom regulator has led to a sharp fall in the effective mobile tariff since 1999, and a related large increase in Indian cellular subscribers since 2001. This image is reproduced in Figure 7 below since it presents a picture of what may be achieved through a suitable enabling environment.

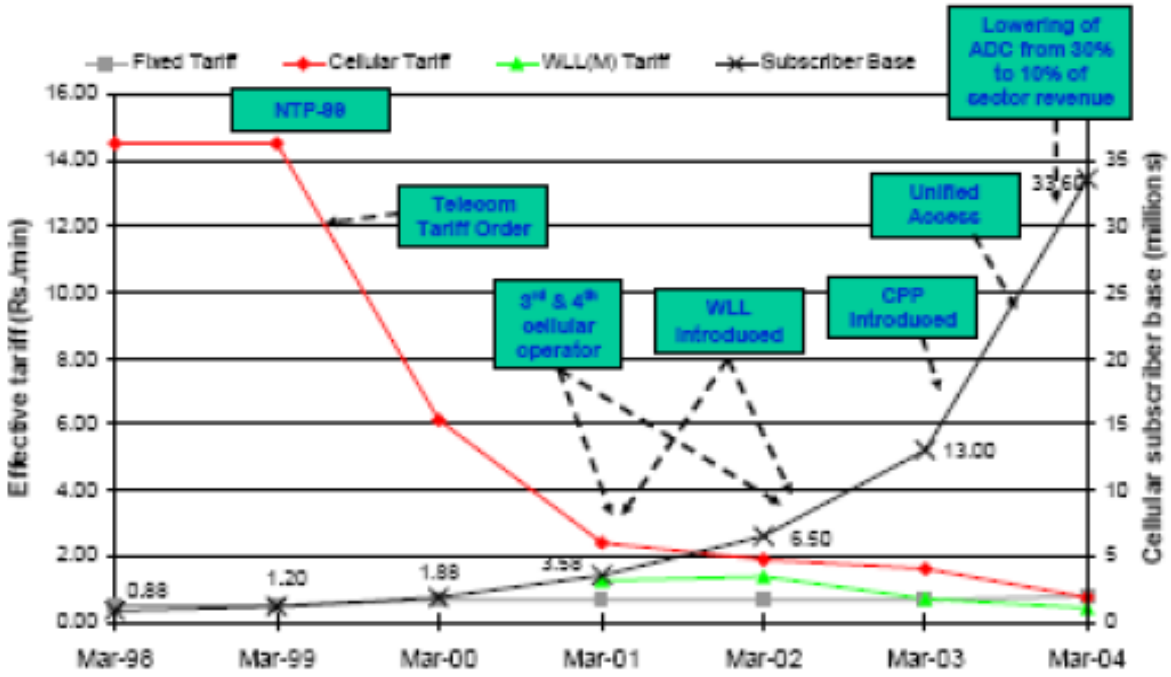

Figure 7: The effect of India's regulatory reforms on mobile usage and price

8.9 Other Regulatory Issues

Finally, the cooperation models for the development of mobile payments could be impacted by the regulation of nonbank players. Bradford et al. identify several risks to the presence of nonbanks in payment systems: operational risk, settlement risk, legal risk, reputational risk, and systemic risk. The provision of mobile payment solutions could increase the presence of nonbanks in retail payment systems, and thus, could require a regulatory intervention to limit the potential risks involved for the economy. So far, in developed countries, regulators have often tolerated the use of mobile phones for small transactions without requiring any banking license. However, this situation could be called into question if the volume of mobile payments were to become important. In Europe, the payment service directive offers to the new entrants the possibility to adopt the status of “payment service provider,” which means that mobile payment service providers will be supervised by the relevant national regulatory authority. In France, for instance, the national supervisor (the CECEI) stated precisely that MNOs must apply for the right to enter the payments market, and it specified minimum capital requirements. If the MNOs were to issue electronic money, they would fall into the regulations of electronic money institutions. Some economic areas and countries such as Europe, Japan, and the Philippines have decided to design a specific status for e-money institutions. In other countries, there are still many regulatory loopholes that could slow down the adoption of

mobile payments, either because the consumers may not trust nonbanks for payments, or because some companies may decide not to run the risk of investing in technologies that do not comply with the regulatory rules (compliance risk).
Thereafter we will consider the specific issues arising in the legal and policy environment in the two pilot countries—Kenya and South Africa; and the obstacles reported by providers there.

8.10 Legal & policy environment

In order to understand the environment for m-payment and m-banking, one aspect of this project involved the collection of information on existing and intended legislation and regulations which impinge on this area. Table 2 below summarizes key aspects from these templates for Kenya and South Africa. Both countries are at an early, pioneering stage of market development, with several models although none yet with critical mass.

Table 3: Summary of country templates

	Kenya	South Africa
1. Are E-signatures recognized by law?	Not yet—bill pending	Yes
2. Are there consumer protection laws/regulations/codes with enforcement?	No—not explicit	Yes for deposit taking (FAIS); not e-banking. Banking industry Codes of Conduct and Ombuds process cover e-banking
3. Is there a competent competition authority?	Yes—however with limited jurisdiction & powers under old Act	Yes
Is there payments system legislation giving authority to a regulator?	Not yet—bill pending	Yes
4.Are AML/CFT CDD/KYC requirements prescriptive or risk based? Are they onerous for small accounts	Apply to banks only; allow for risk basis but with no guidance and will likely be onerous for small accounts	Yes—exemption from address verification on small accounts; risk-based approach to ; but still considered unclear by some providers
5. Can agents can provide cash back/ take deposits?	Not prohibited; no specific rules	Not prohibited; no specific rules
6. Are there specific E-money regulations or guidance?	No	Yes—guidance only

In general, South Africa has a well developed legislative and regulatory environment, which creates relatively high certainty. Areas such as e-commerce, AML/CFT and even consumer protection are fully covered. E-money issuance is covered by a recently updated guidance note. While several of the new models considered here have started up in this environment, it is not necessarily conducive for the rapid growth of transformational approaches, as provider's comments in the next section show.
In Kenya, by contrast, much important legislation in areas like e-commerce, AML/CFT and payment systems is still at the draft or bill stage. The state of legislative and regulatory uncertainty is therefore relatively higher than South Africa, although uncertainty is reduced somewhat by the fact that there is at least draft legislation and accepted policies in areas

such as the national payment system. Consequently, it has not precluded the launch of m-banking products such as M-Pesa discussed here. The lack of specific legislation in various areas has left the Kenyan environment relatively more open. Kenya now has the opportunity to coordinate and integrate its approach to the m-banking sector within and across all the planned new laws before they are passed, thereby avoiding the confusion of any conflict or ambiguity.

In both countries, high level strategy and policy documents have been developed and released for the development of the National Payment Systems. In 2006, the SA Reserve Bank released *Vision 2010,* an updated framework and strategy for the national payment system there. One of the seven main strategic objectives identified is "Facilitate wider usage by the public and broaden the provision of payment services in the NPS", which is further clarified in a footnote to include 'addressing the payment needs of the unbanked community'. The document envisages an active role for the Payment System Division of the Central Bank in monitoring developments nationally, regionally and internationally, as well as facilitating the establishment of an authority which would certify payment system standards. In Kenya, the NPS Framework and Strategy document was issued in 2004. The elements of the vision for the NPS include access-related elements: "Easily accessible to both urban and rural consumers…"; and "Basic NPS features understood by all including the rural populace." These objectives provide openings for regulators to consider transformational offerings more favourably than they might otherwise.

While these relative positions are perhaps to be expected of a middle income and a lower income country, neither Kenya nor South Africa is especially representative of Africa in general: the retail banking systems in each are well developed, and the Central Banks well capacitated, relative to many neighbouring countries. They were chosen for this project because of the new m-banking models emerging in each. However, the checklist represented in Table 5 could also be applied to other developing countries. It could also be developed further into a rating system which could enable better comparison across more countries and across time of the environment for m-banking.

8.11 Provider obstacles reported

The four direct providers who participated in this project completed a questionnaire which asked them to identify barriers to the development of their business models. Three IT providers who provide m-banking systems to providers in Africa were also polled.

The biggest barriers reported by these providers today are not primarily regulatory or legislative. Rather they were customer adoption issues typical for a new product or service, such as:

- How to educate customers in the use of the mobile phone for transactions;
- How to build trust in and awareness of a new financial brand.

These are little different from the general obstacles to m-commerce becoming pervasive ('u-commerce' or ubiquitous commerce) identified by Schapp and Cornelius:

- Security (which generates user trust, essential in financial mechanisms)
- Simplicity (or user friendliness).

They also include the need for common standards, which allow interoperability, and therefore greater utility to clients and greater scale.

These barriers are also similar to those reported by respondents (mainly in developed countries) to the 2006 Mobile Payments study undertaken by consultancy Edgar Dunn: merchant adoption, customer adoption, agreement on common mobile platforms and

security and fraud issues tied as the most commonly reported barriers.
However, while the environment in the relevant countries was by definition open enough to enable them to start up, the providers in SA in particular also reported significant specific regulatory obstacles to the growth of transformational approaches. These included in particular:

- a lack of clarity and consistency over the application of CDD standards to remote account opening procedures, even though the CDD required on low value accounts is already reduced by exemption; for example, it is unclear whether or not a copy of an identity document must be secured from the client in all cases, and if so, in what time period; or whether a biometric identifier (such as a voice imprint) is adequate.

- customer protection laws, designed primarily to cover the inappropriate offering of investment-type products, also extended to the opening of basic transactional bank accounts; as a consequence, a higher level of training, and therefore cost, was required in front line staff.
- access to the national payments system: non-bank providers remarked on the difficulty and cost of obtaining access to the South African payments system infrastructure, for example for ATMs or POS acquiring. Access is in theory open to all banks, but in practice, the major banks which own most of the infrastructure dominate and are wary of models which will ‘piggy back’ on their existing infrastructure. A 2004 National Treasury task group report on competition in SA banking identified that this may constitute a barrier to competitive pricing and innovation; and competition in the payment system is now being further researched.

In addressing these and other regulatory issues, providers generally reported that they had had at least some engagement with financial policy makers and regulators. Engagement was usually related to particular issues rather than market development in general.
In South Africa, there have been some attempts at coordination among providers: a working platform group comprising banks, mobile networks and vendors had convened in the past to consider the most feasible m-commerce model for the country. This group had concluded that the market required a central, trusted infrastructure that housed consumer data away from the actual mobile device and facilitated the authentication, instruction, financial transaction processing and fulfillment of transaction to merchant or retailer.
Discussions in both countries supported the conclusion that a high level roadmap of market development would be useful in promoting certainty and allowing graduated openness. The next section sets out initial principles arising from this project which could be the starting point for discussions about a roadmap.

Chapter 9

Overview

Many commentators have highlighted the rapid growth of mobile phone usage in Africa. Using ITU data, Gray (2005:1) points out, “In 2004 alone, the African continent added almost 15 million new mobile cellular subscribers to its subscriber base, equivalent to the total number of (fixed and mobile) telephone subscribers on the continent in 1996, just eight years earlier.”

The table below compares the trajectories of growth in usage of mobile phone in three places:

- South Africa (SA), where there is some evidence of slow down as the number reaches the mid-forties, compared with:
- the rest of Sub-Saharan Africa (SSA) (i.e. excluding SA), where explosive growth continues, albeit from a lower base; and
- Western Europe, where the market has matured and penetration has exceeded 90% overall.

Wireless coverage continues to rise: although only 8% of people in Africa use a mobile phone, 52% of the population in low income countries as a whole live in areas with wireless reception. This difference fuels the expectation that growth will continue at rapid rates, with some analysts predicting that there will be close to 200 million mobile subscribers in Africa by 2010.

By comparison, the penetration of retail banking systems in most African countries is very low. While no reliable figures for the proportion of people banked yet exist at continental level, national household surveys are providing more reliable information for certain countries. Figure 8 highlights the cases of Kenya and South Africa, which are the focus of further research in this report: within a decade or less of rollout, as many or more people have mobile phones as have bank accounts in many low income countries, even though the latter have been available for much longer. Subscriber numbers in Kenya apparently doubled in 2005 so that mobile penetration now substantially exceeds the percentage banked there.

Table 4: Mobile phone and bank account penetration

	No of mobile subscribers (2004)	Mobile penetration	Adults with bank accounts	Mobile population coverage	Internet access
Kenya	2 546 000	7.9%	10%	70%	1.3%
South Africa	19 500 000	43.3%	45%	96%	9%

In many developed countries, the internet has become the lowest cost most accessible retail banking channel. Relative to mobile phones, internet usage is low: outside of South Africa, barely 1% of Africans access the internet.

The sheer momentum behind the takeup of mobile phones raises the prospect that financial services provided via mobile phones, in other words, mobile payments and banking, will similarly takeoff. This could have positive developmental consequences, including:

- Increasing the efficiency of payment systems and reducing reliance on cash as a transactional medium
- Broadening access to financial services by increasing the accessibility and lowering the cost of offering formal financial services.

The prospect of change as a result of m-banking goes further, however: low income countries may leapfrog the deployment of widespread earlier generation infrastructure such as ATMs or even dedicated Electronic Point of Sale (EFT POS) device s. Some proponents of m-payments go further still: airtime may become a widely accepted form of e-money in developing countries. For example, in a recent article entitled “Money talks”, Simon Batchelor states that “the innovative use of airtime as ‘virtual currency’ promises to provide the poor with a more secure way of transferring money”.
The proposition on which this prospect of acceleration in financial access is based is the following: as unbanked people start to use mobile phones, so they become reachable at lower cost, and therefore more bankable—at least, in the sense that a basic transactional service becomes viable to offer via the phone. More than a quarter of unbanked adults in South Africa already use or have access to a cell phone. The expansion of mobile phone usage will therefore pull in its wake, access to basic banking. Figure 8 depicts this: arrows showing continued growth on the vertical axis (mobile usage) in turn pull more to becoming banked (horizontal arrows). As a result, the proportion of people with access both to formal communications and to formal financial services will rise in excess of the level previously predicted by income levels alone.

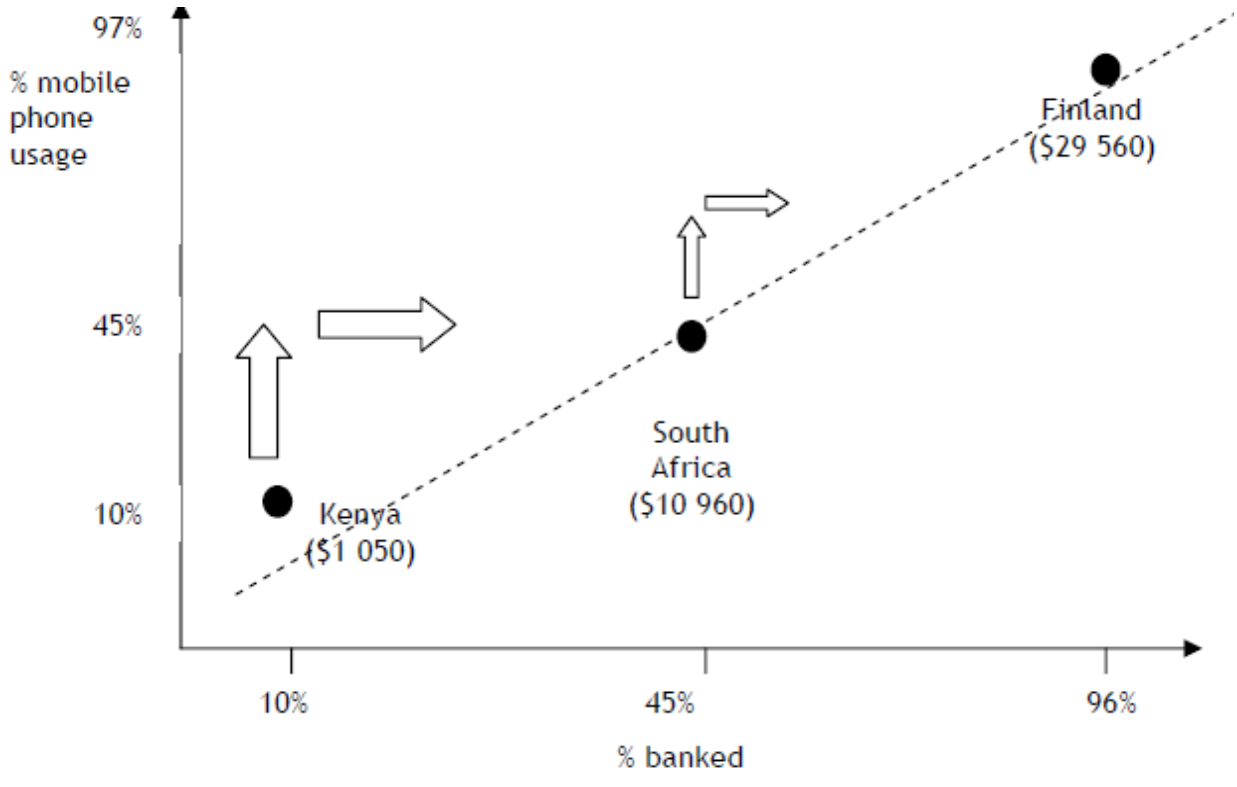

Figure 8: The proposition: Mobile use drives financial service usage

Attracted by the market potential, several m-payment and m-banking services have started up in various African countries in the past five years—including Zambia, DRC, South Africa, Nigeria and Kenya. Most of these are low income countries, a fact which seems to

underline the leapfrogging potential of this technology.

9.1 The Enabling Environment

An enabling environment is defined in this report as a set of conditions which promote a sustainable trajectory of market development in such a way as to promote socially desirable outcomes. These conditions are forged by larger macro-political and economic forces, as well as sector specific policy and laws. However, this report focuses on the latter category as being within the power of policy makers and regulators to control and influence.

What are the socially desirable outcomes? In *Creating an Enabling Environment: towards the MDGs,* the UN ICT Task Force defines them as "Investment, innovation and entrepreneurship" which build the private sector. More specifically, policy makers and regulators in the financial sector usually seek the following key outcomes:

- *Financial stability:* That the safety and soundness of the banking and payments system is not compromised;
- *Economic efficiency:* That the efficiency of the financial system as payments mechanism and intermediation system is maximized and in turn, contribute towards overall economic growth;
- *Access to financial services*: That broader access to appropriate, affordable financial services is promoted;
- *Financial integrity*: That the financial system is not compromised by its abuse for criminal or terrorist financing purposes;
- *Consumer protection*: That consumers, especially vulnerable consumers, are adequately protected against abuse and loss.

Mobile banking offers the prospect of increasing efficiency of the payments system; and potentially, expanding access to financial services. However, these objectives may be in tension with existing approaches which target other objectives, such as financial integrity or consumer protection. While market enablement is often understood as the process of simply identifying and removing regulatory and legal barriers to growth, in fact, it requires the managing these complex trade-offs over time.

9.2 Industry Growth Trajectories

Understanding the dynamic nature of market development is crucial to appropriate enablement. This is because the need for regulation, and the risk of not having appropriate regulation, changes as a market develops: regulation which was unnecessary at an early stage may become necessary in order to stabilize and protect against much larger scale risks to society arising from market failure.

Figure below traces a conventional s-shaped market development trajectory. This has been discussed in more detail in other places. The objective of maximizing access can be understood as ensuring, at least by maturity phase, that the usage line is at the highest level possible.

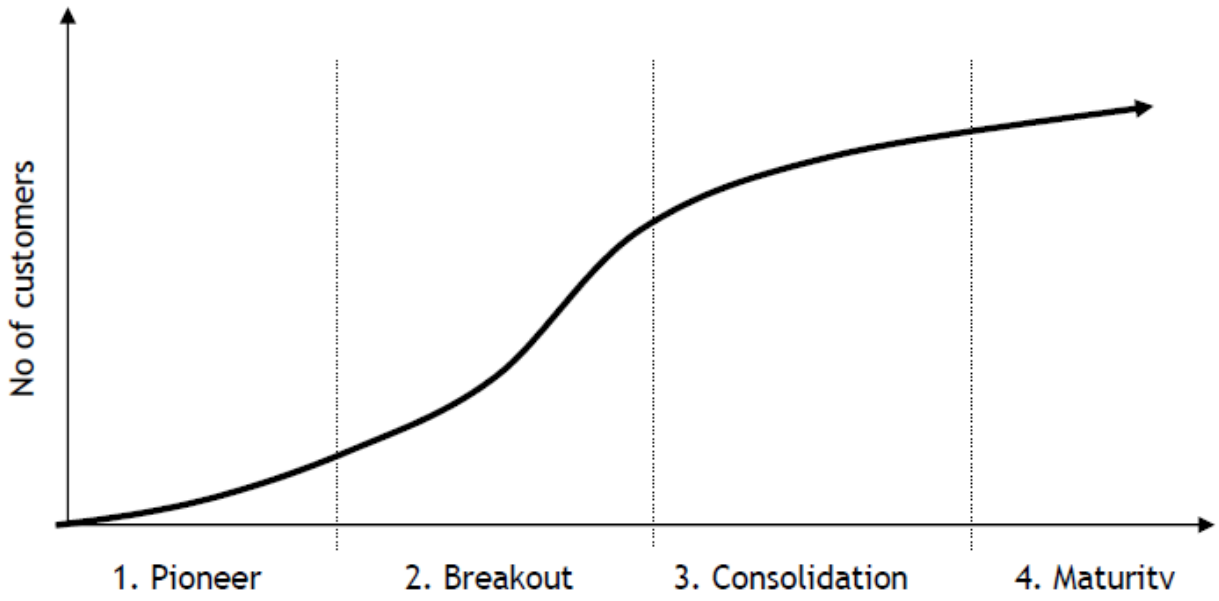

Figure 9: Stages of Market Development :moving up the S-curve

In Figure 9 above, four distinct phases of market growth are delineated:
(i) *The pioneer phase* when a few early entrants launch and test out their products and start to find success;
(ii) *The breakout phase* when the success of the pioneers is noticed, leading to rapid entry of new firms and expansion of the market;
(iii) *A consolidation phase* when a shakeout of firms occurs due to increased competition or external factors such as regulation, although the number of customers continues to grow but at a diminishing rate;
(iv) A final *maturity phase* when the number of firms in the industry and its norms and rules have been settled, and the market grows at a steady, natural rate.

In each phase, providers encounter different barriers to growth; and policy makers and regulators encountered different risks. Table 4 below highlights some of the latter.

	1. Pioneer	2. Breakout	3. Consolidation	4. Maturity
Barriers	• Technology stability • Customer understanding & trust • Business model scaleable	• Interoperability to get to scale & usefulness • Customer trust • Customer education & adoption	• Failures/ shakeout	• Barriers to entry for ongoing innovation and competition?
Public policy				

	• Gaps in	• Fly by night	• Depositor/	• Promoting
issues	current laws? •Contraventions of existing rules vs space for innovation	entrants/ fraud • Interfaces to existing systems •Interoperability	payer losses as a result of failure? • Systemic stability • Emerging market structure	access
Regulatory strategies	• Monitor/ engage • Roadmap	• Facilitate/ Coordinate	• Supervise	• Ensure ongoing competition

Table 5: Barriers and regulatory issues in each Market Development Phase

A phased approach to market enablement requires an understanding of which stage a market is currently; and of the barriers and uncertainties which will shape its possible development trajectories. This understanding itself requires dialogue between regulators and providers, especially in a new market where uncertainties abound.

9.3 Openness and certainty at the early stage

In the early stages of a new market, two dimensions in particular affect the market development trajectory:

1. *Openness*: does the policy, legal and regulatory environment allow for (or better encourage) the entry of new providers and approaches? If not, there is little room for innovation to come to market.
2. *Certainty:* does the policy, legal and regulatory environment provide sufficient certainty that there will not be arbitrary changes in future which may prejudice the prospects of entrants? If not, entrants (at least those with a longer term horizon) will be discouraged from incurring the cost and risk of entry.

Ideally, therefore, an enabling environment is one which is sufficiently open and sufficiently certain; but in reality, there may well be trade-offs between these two dimensions. It is often the case for new markets that one or other dimension is neglected: for example, countries with few laws or regulations and with limited regulatory capacity may be very open to new developments, but, if there is a high level of uncertainty, for example, as result of the possibility of arbitrary action in vague areas of the law, there still may be little market development. Equally, regimes with more certainty are likely to have better defined laws, but the wider coverage may well restrict new entry.

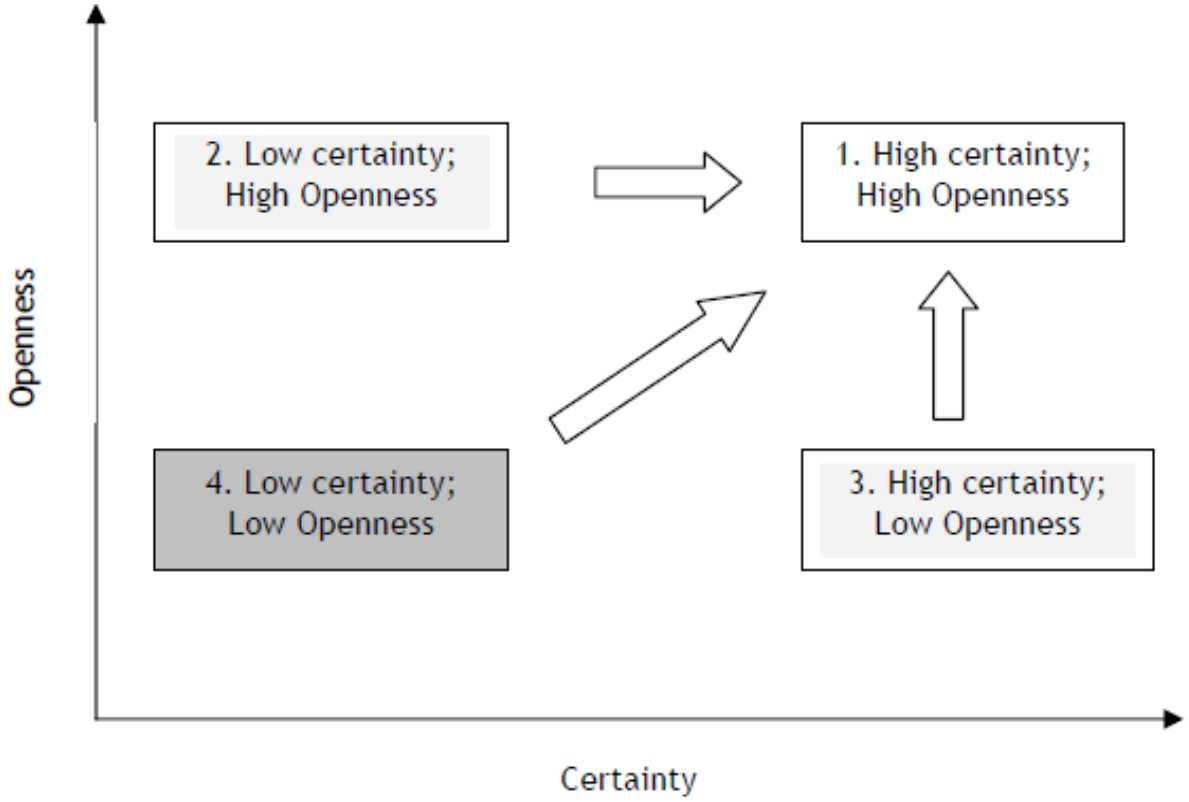

Figure 10:Enabling the Environment :increasing openness & certainty

Enabling a new market may be therefore understood as moving in the direction of the arrows from the starting point, towards greater openness and certainty. To be sure, openness and certainty remain important in later phases of market development too, but are crucial if a market is to develop at all.

9.4 Additive and transformational approaches to banking

Mobile banking holds out the prospect of increasing access to appropriate formal financial services by those who presently lack it. It could also make banking more convenient, possibly even cheaper, for those who already have financial services. The two approaches are not necessarily exclusive—greater convenience for existing clients could also lead more accessible products for current non-clients—but neither are they necessarily linked.

Unbanked people, by far the majority in most developing countries, are in fact a heterogeneous group, including people who may have adequate incomes but from an informal source, as well as poor, rural dwellers. As the result of ongoing research in the field of microfinance, we now have a better sense of the elements required for a basic financial service to meet the needs of unbanked people, and in that sense, to be transformational. A recent *MicroSave* briefing note (Wright et al 2006) lists the elements of transaction banking which constitute a suitable value proposition for poor customers:

- A safe place to keep money
- The ability to cash in and cash out at convenient locations (since cash is still pervasive) at a reasonable fee; and
- The ability to transfer money, both to make payments and to remit money to friends and relatives.

Research by CGAP and others in different contexts confirms the basic elements of this list,

which therefore will be regarded as the essential elements of a transformational proposition.

Can airtime serve as e-money?
Mobile operators in Kenya and SA offer popular airtime transfer services, such as Me2U (from MTN in South Africa) or Sambaza (Safaricom in Kenya). For a small fee, one pre-paid customer may transfer a portion of her airtime to another user on the same network. The characteristics of this service have led some to suggest that airtime is a *de facto* form of e-money or alternative currency. A BBC commentator comments on the launch of the Sambaza service in Kenya: *"What* (Safaricom CEO) *Michael Joseph has actually done is to create a new currency --a cyber currency that can be sent anywhere in the country at the press of a button, without needing a bank account or incurring high bank charges."21 The Economist* magazine in 2005 reported the story of a woman in Democratic Republic of Congo (DRC) who settled a bribe to officials across the country by sending them airtime.
Beyond the increasing anecdotes, there is as yet no systematic evidence that airtime transfers are being used as money on large scale. Survey work is underway in various places which will test usage patterns. However, in the absence of other quick, safe and cheap ways of transferring money, it is at least plausible that airtime transfer could assume some of the characteristics of money transfer or remittances.
This is because airtime shares to some degree the basic characteristics of money:

- It uses a commonly accepted unit of account: it is typically denominated in currency units (not, for example, time units).
- It can be an efficient medium of exchange in societies where the financial system does not allow easy remote transfers, as in the DRC example, provided that the other party can and does accepts it; however, transfers are usually limited to users of the same network, limiting the value for other mobile users.
- It can be a store of value, provided (i) that the telco continues in business, and (ii) the airtime does not expire (the validity window is often short, for example a month, on pre-paid airtime).

Within the constraints of airtime validity and same network usage, airtime is very likely already an alternative currency of sorts. The more interesting question is perhaps how widespread it may become in developing countries.
The biggest constraint here is its real cost: airtime is not redeemable at par into cash. The issuing telco would not be able to offer face value on redemption because of paying away a sizable commission (typically 15%) on the face value of the airtime at first sale. In addition, sales or value added taxes are often levied on the face value of the airtime. However, these cost factors alone do not prohibit the redemption of airtime into cash by vendors or indeed, the network operator itself; they simply translate into a deep discount to face value.
If the relevant comparative price is the cost of a remittance by other formal channels, airtime transfer may still be appealing. For example, an airtime vendor may accept 'second hand' airtime transfers at a discount of 15% to its face value, knowing that he could re-sell it to other users at par and effectively match his usual commission. This could compensate for the loss of network commission on subsequent on-sell. Discounts of this magnitude are quite similar to the add on fees charged in developing countries: to send $100 net through a money transfer service may cost the remitter $120; similarly, a remittance of airtime worth $120 (sent for a network fee of around 30c US) may be cashed out at an airtime vendor at a discount of say 17%, to be worth $100 net.
To narrow or reduce this discount will require different models for cashing out airtime.

Larger volumes of acceptance may in themselves reduce the discount that vendors need to earn. It is therefore much more likely that airtime could function as a de facto e-money in developing countries. Furthermore, mobile operators may even be in a stronger financial position and have a stronger retail brand than banks in many.

9.5 Categorization of m-banking models

The emerging m-payments and m-banking models discussed in the previous section differ according to the roles played by the main providers in an m-banking solution: the bank, the telco and/or a possible third party entity.

Mobey Forum has recently (2006) produced an elegant analysis of the different 'mobile financial services business ecosystems.' This analysis distinguishes the two critical roles as (i) the issuer of the security element (such as the SIM) used to authenticate and authorize; and (ii) the platform manager. Different scenarios exist where banks and telcos fill these basic roles in different configurations. Mobey Forum believes that the biggest potential for international growth of m-banking exists when personalization bureaux (such as chip/SIM card issuers) take on the role of platform manager, which owns the cryptographic keys that enable service providers to download an application to the security element. This analysis adds a useful perspective of what may be necessary for a high level of international operability, but the simpler categorization provided here is operationally more functional for policy makers in developing countries.

Based on the answers to four key questions, four models may be identified:

(a) *Who is legally responsible for the deposit?* Usually, deposit taking is the regulated preserve of banks only, but where this is not prohibited, telcos and other issuers of pre-paid balances can also become issuers of e-money. The legal situation can seemed blurred when telcos pool individual deposits into one aggregated account at a bank, which has no sight of or role in administering the underlying individual accounts; however, when the bank itself does not recognize the individual accounts, deposit pooling is effectively the issuance of e-money.

(b) *Whose brand is most exposed to the public?* This consideration is related to the issue of responsibility for the deposits, through the reputation risk involved. Note that in many developed countries, where there may be small banks with limited penetration, the brands of the few telcos with much larger clients bases may be far more valuable.

(c) *Where can cash be accessed?* The key question here is whether, in addition to conventional banking outlets such as branches or ATMs, additional agent networks brought into the offering for cash back or taking deposits, such as airtime merchants.

(d) *Who carries the payment instruction?* The key issue here is whether the m-banking service is tied to one network operator or is network-independent.

Table 5 shows how the typical clusters of answers to these questions produce four main models, for which examples are given at the bottom.

Moving from column one (the 'pure' bank-driven model), telcos or non-banks introduce key elements to the m-banking offering such as new brands (model 2) and/or the new cash networks (model 3). Hence, as one moves across the spectrum of models to the right, the bank becomes less important to the model even though bank accounts are involved. Model 4 crosses a decisive regulatory line since the telco effectively becomes a depository entity through the issuance of e-money.

Table 6: Transformational Potential of African m-banking models

Criteria:	Celpay	M-Pesa	MTN Mobile Money	Wizzit
1. Targets unbanked customers	No	Yes	Not specifically, but as part of offering	Yes
2. Product features:				
(i) Safety	Funds in float at bank	Funds of MFI in float at bank	Accounts held at bank	Accounts held at a bank
(ii) Easy access to cash back/in	N/A	Yes—airtime agents	Card access to existing ATMs/ bank branch	Card access to ATMs/ bank branch
(iii) Ability to transfer	Yes	Yes	Yes—to any bank account	Yes—to any bank account
(iv) Specific Hardware requirements	Yes	No	32k SIM	No
(v) Linked to one network operator	No	Yes	Yes	No

These African m-payment providers are all at a relatively early stage; a variety of different models, platforms and approaches is being tested. Most of the technology platforms in use are considered stable, but the sustainability of each of the business models has yet to be proven since none has yet achieved substantial scale or market traction. Unlike the Philippines, the African m-payment market is therefore still in pioneer phase.

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(c) *Where can cash be accessed?* The key question here is whether, in addition to conventional banking outlets such as branches or ATMs, additional agent networks brought into the offering for cash back or taking deposits, such as airtime merchants.
(d) *Who carries the payment instruction?* The key issue here is whether the m-banking service is tied to one network operator or is network-independent.

Table 6 shows how the typical clusters of answers to these questions produce four main models, for which examples are given at the bottom.
Moving from column one (the 'pure' bank-driven model), telcos or non-banks introduce key elements to the m-banking offering such as new brands (model 2) and/or the new cash networks (model 3). Hence, as one moves across the spectrum of models to the right, the bank becomes less important to the model even though bank accounts are involved. Model 4 crosses a decisive regulatory line since the telco effectively becomes a depository entity through the issuance of e-money.

Table 7 : Classification of emerging m-banking models

Model →	1	2	3	4
Model name	'Pure' bank driven	Joint venture	Non-bank led	Non-bank driven
(a) Who holds the account/ deposit?	Bank	Bank	Bank	Telco/ Non Bank
(b) Whose brand is dominant?	Bank	Joint—non-bank or telco	Usually non-bank or telco dominant	Telco/Non Bank
(c) Where can cash be accessed ?	Bank	Bank	Bank + alternative agent network	Telco network + other
(d) Who carries the payment instruction?	Any telco (sometimes with 3rd party payment gateway)	Usually specific to one telco	May be one or any	Specific to offering telco
Current Examples	Many additive models e.g. FNB	MTN Mobile Money, Smart	M-PESA, Wizzit	Globe; Celpay

Table 7 shows that a range of approaches is being tried in Africa today, including models similar to the Philippino models which are showing signs of success. Given that all models

in Africa are at a relatively early stage and that some may well fail to reach sufficient scale to be sustainable, it is important that there is such a range.

Conclusion

In the introduction it is described the prospect that mobile banking will enable widespread access to financial services. For this to happen, mobile banking offerings must be in some measure transformational. An enabling environment is defined as a set of conditions which promote a sustainable trajectory of market development in such a way as to promote socially desirable outcomes.

Chapter 10

Overview

In this section we will review real options methodology to the investment-making process. The objective of this chapter is to highlight the strengths of applying the real options valuation approach as adecision-making tool in expanding or delaying mobile payments. Real option methods are in vogue because they provide more accurate valuations in different areas, e.g., equity valuation, mining projects, etc. (Alleman & Noam, 1999; Damodaran, 2002; Mun, 2002; Schwartz & Trigeorgis, 2001; Trigeorgis, 1996). The outcome of real options analysis is heavily dependent on the input parameters and the assumptions made, just as in traditional discounted cash flow (DCF) analysis.

Introduction

Traditional DCF analysis values an investment in present value terms, assuming that future cash flows are known and discounted at a risk-adjusted factor, e.g., the weighted average cost of capital (WACC) of the company (Damodaran, 2002).

For example, consider a project that has a life of five years, and an initial investment cost K. Initial investments in projects generate cash flows during the project life cycles, which are discounted at a respective discount rate. To value an asset, the net present value (NPV) is needed. The NPV is the difference between the present value of the future cash flows and the initial investment cost. Therefore, the NPV today is given as follows:

$$NPV = \sum_{n=1}^{5} F_n(P/F, i\%, n) - K = V - K,$$

where Fn is the expected cash flow at the end of the nth period and i is the discount rate per period (we assume that the discount rate remains constant during the life of the project). The project should commence if V>K, i.e., if it has a positive NPV, and should be abandoned if V<K.

10.1 Financial options

An option is a contract that gives the buyer the right, but not the obligation, to buy or sell an underlying asset, at a specific price, on a certain future date (Hull, 2003). There are basically two types of options: call options and put options. A call (put) option gives the holder the right, but not the obligation, to buy (sell) the underlying asset at a certain date for a certain price. That fixed price in the contract is known as the exercise or strike price; the date is known as the expiration date or maturity. American options can be exercised at any time up to the expiration date, whereas European options can be exercised only on the expiration date itself.

If K is the strike price and S_T is the final price of the underlying asset, the payoff from a long position in a European call option is: max(S_T - K, 0). The payoff to the holder of a long position in a European put option is max(K - S_T, 0). The payoffs of the different positions are shown in Figure 11.

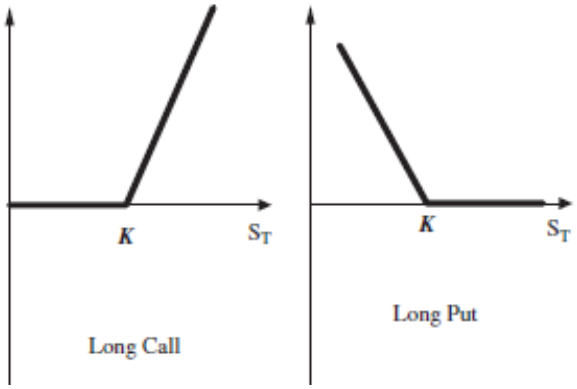


Figure 11: Payoff from options

In order to price options, the Black–Scholes–Merton partial differential equation (PDE) is used. There are several ways to solve this PDE: numerically (lattices), in discrete-time via binomial/trinomial trees, or via the Black–Scholes formula, if it is a European option (Black & Scholes, 1973).

10.2 Real options

Real options theory is a methodological approach within which an investment can be analyzed while factoring in uncertainty and flexibility. Real options have been applied already in valuations in different industries, e.g., pharmaceutical, energy, mining, telecommunications, information technology, etc. (Mun, 2002; Schwartz & Trigeorgis, 2001; Trigeorgis, 1996). In the telecommunications sector, a real options framework has been proposed for several investment decisions: equity and firm valuation, cost analysis, forecast bandwidth demand, etc. (Alleman, 2002; Alleman & Noam, 1999; Alleman & Rappoport, 2002; Athwal, Harmantzis, & Tanguturi, 2005; Harmantzis & Tanguturi, 2004a, b; Tanguturi & Harmantzis, 2005).

The telecommunications sector has historically been a domain where high-cost technological investments have been made; in addition to that, it has become a highly volatile sector, due to increased competition, deregulation, etc. Therefore, it is highly suitable for applying real options in valuations. Valuing a project that requires a significant irreversible investment up-front cost to develop networking equipment or a telecom service is a risky decision due to inherent uncertainty in the field. Traditional NPV analysis proves to be limited for a number of reasons, e.g., lack of capturing uncertainty and lack of changing the course of action when new information becomes available. The real options framework has proven to be suitable for valuations, assuming that the models are calibrated to realistic (e.g., market) conditions.

Pricing techniques developed for financial options can generally be mapped to investment options, as shown in Table 8. Table 8 helps managers identify the parameters in financial options and map them to real options in order to model the investment problem. For example, projects require capital investment, in order for products to be bought or built. This is analogous to exercising an option in which the amount invested is equivalent to the exercise price K, and the present value of the asset is the current stock price S_0. The length of time the firm can wait is the time of expiration T and the riskiness of the project is reflected in the volatility (standard deviation) of the assetts. The time value of the money is given by the risk-free rate rf. Next, two of the real options used here in the analysis are discussed: the option to defer (delay) and the option to expand.

Table 8: Mapping between investment opportunities and financial (stock) options

Investment opportunity	Variable	Stock options
Expenditure required to acquire the assets	K	Exercise price
Present value of the assets	S_0	Stock price
Time to expiration	T	Time to expiration
Riskiness of underlying assets	σ^2	Variance of returns
Time value of money	r_f	Risk free rate

The option to defer (delay) refers to delaying an investment decision for a certain period of time. The firm must have exclusive rights to the license, which gives it the option of deferring deployment. Taking up the project today might have a negative NPV. By exercising the option to defer, the company can commence at a time that maximizes the project value. In other words, the value of waiting can be viewed as a call option on the project, with an exercise price that equals the investment cost. In this case, the uncertainty is due to the number of subscribers adopting the new technology and to market conditions in general.
The option to expand provides the ability and the right to expand into different market segments. In this case, a telecommunication operator has the right to expand its e commerce via internet to mobile commerce. This allows the company to be competitive, hold onto its existing subscriber base, and attract new subscribers.

10.2.1 The Black– Scholes model

Both the above cases can be formulated as an American call option because the option can be exercised any time up to the expiration date. The pricing of the American option is usually done numerically (using finite difference method, trees, Monte Carlo simulations, etc.). The Black–Scholes closed form solution for European options can be used as an approximation. In this paper, the value of the option to defer can be estimated by using a modified Black–Scholes formula (Damodaran, 2002):

$$c = S_0 e^{-yT} N(d_1) - K e^{-r_f T} N(d_2),$$

$$d_1 = \frac{\ln(S_0/K) + (r_f - y + \sigma^2/2)T}{\sigma\sqrt{T}},$$

$$d_2 = d_1 - \sigma\sqrt{T},$$

where S_0 is the current price of the asset, K is the exercise (strike) price, T is the time to expiration, rf is the riskfree rate of return, s is the annualized standard deviation (volatility), y is the dividend yield, or annual cost of delay given by:

$$(y) = \frac{1}{T}, \text{ dividend Yield or Annual Cost of Delay}$$

and N(d) is the cumulative normal density function.
It is not uncommon to use the Black–Scholes formula, as an approximation, in valuations of real options. Amram and Kulatilaka (1999) explain the use of the Black–Scholes model in one of the cases analyzed in their work. Bowman and Moskowitz (2001), as well as Benninga and Tolkowsky (2002) apply Black–Scholes in valuing R&D investments in the pharmaceutical industry. Finally, Basili and Fontini (2003) apply the same model to value the aggregate option value of the South Africa e- payments.

10.3 Real options in telecommunications

In the last decade, the telecommunications industry has experienced high volatility, as evidenced by the Internet bubble and the telecom crash. In this context several cases exist in which real options have been proposed in the wider area of telecommunications, e.g., telephony, broadband, Internet, cable, wireless, etc. (Alleman & Noam, 1999).

Alleman (2002) shows how real options theory can be helpful to the telecommunication industry for issues related to strategic evaluation, estimation and cost modeling. Alleman and Rappoport (2002) use real options analysis in an attempt to quantify regulation issues, demonstrating the impact of regulatory constraints on cash flows, and therefore in the investment valuation process.

Economides (1999) studied the economic principles on which cost calculations should be based. d'Halluin, Forsyth, and Vetzal (2002a, 2002b) studied the risks faced in the bandwidth market using real options to determine optimal times of investing to increase network capacity. In a more recent paper, the same authors apply options methodology to value wireless network capacity (d'Halluin et al., 2002a, 2002b).

Herbst and Walz (2001) adopt real options to analyze the value of auctioned UMTS-licenses in Germany, the largest European market. Their model is based on the option to abandon and the growth option.

Edelmann, Kylaheiko, Laaksonen, and Sandstorm (2002) use real options to shed light on the complicated issues of strategic alternatives in the telecommunications industry. Kulatilaka (2001) explains the current situation in 3G deployment with the help of fundamental critical management questions such as what, why, when and how the real options approach helps in the decision-making process in a comparative manner. Kulatilaka and Lin (2004) find the investment threshold at which the firms are indifferent between investing immediately or postponing the investment. Their analysis shows that the licensing fee plays an important role in technology adoption. High license fees yield to the development of incompatible technologies; low fees to single standard adoption.

Finally, Paxson and Pinto (2004) examine the timing issue of a Portuguese telecom carrier in 3G investment, using real competition option models. They showed that although traditional NPV calculations point to an immediate investment and entry of all the players in the market, this is not the case. Their options models suggest a delay of entry for the follower.

10.4 Pricing Real m-banking Investment Options

We next review the concepts underlying real options analysis, and the fundamental models for analyzing project investment decisions involving real options. We also discuss the economic rationale underlying the use of option pricing models to the evaluation of m-banking investments embedding real options.

10.4.1 Value of Managerial Flexibility and Project Evaluation Methods

Research on real options seeks to address criticism concerning the inadequacy of traditional capital budgeting methods for evaluating a project that offers management the flexibility to take actions which can change traits of the project over time (Dixit and Pindyck, 1994). The term *flexibility* is "nothing more (or less) than a description of the options made available to management as part of the project" (Mason and Merton, 1985, p. 32). This flexibility adds value to the *passive NPV* of a project, where one has assumed that no in-project actions are possible to affect its expected value outcomes. It changes the probability distribution of project payoffs asymmetrically, by enhancing the upside potential

or reducing the downside risk.
This corresponds to the notion of an *active NPV*, whose expected value trajectory is controllable by management. Figure 12 illustrates these changes and provides examples of specific real options that cause them. Real options offering in-project flexibility are termed *operating options*. They differ from so-called *growth options* whose value stems from future investment opportunities that they open up.

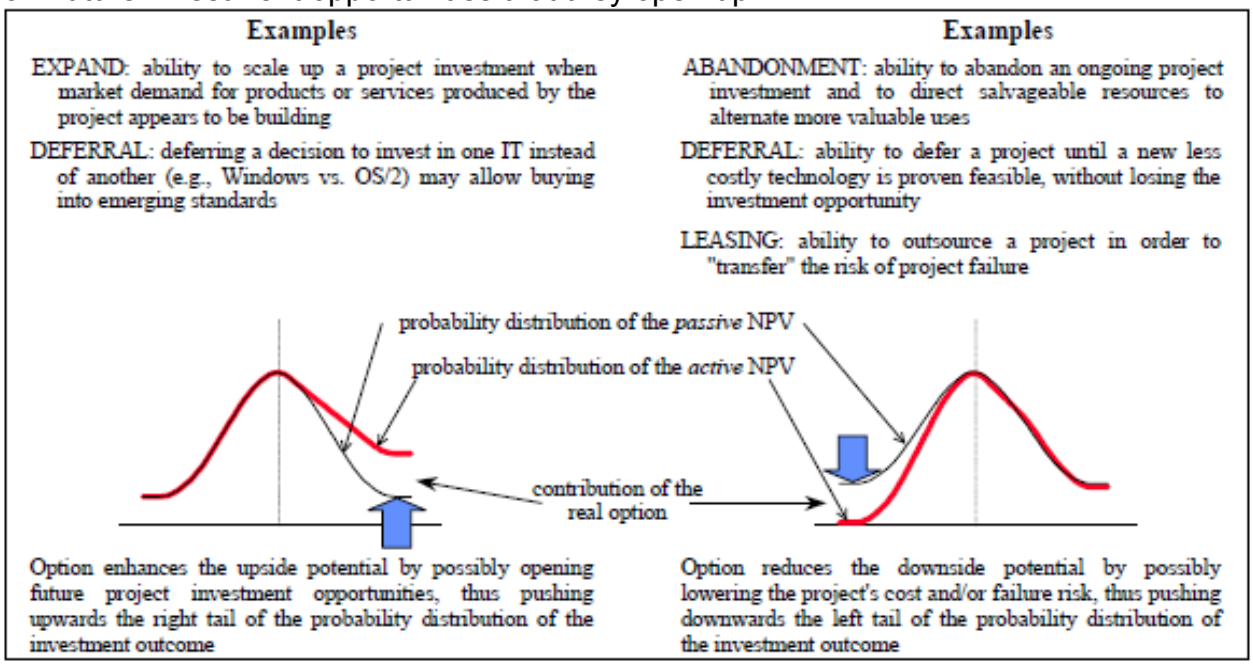


Figure 12: Asymmetry of the probability distribution of project payoffs when real operating options are involved

Two approaches commonly used to evaluate investments are DCF (NPV) analysis and decision tree analysis (DTA) (Figure 13). Besides the theoretical reasons for these approaches being inadequate for investments involving options (Benaroch and Kauffman, 1999), a pragmatic question is: why can't they be adapted to such investments?
The key problem with adapting DCF analysis is that it can evaluate only actual cash flows that a project is expected to yield. DCF analysis does not explicitly recognize that managerial flexibility has a value equivalent to a "shadow", nonactual cash flow. Such flexibility is born by the presence of embedded options and it allows management to adjust traits of the investment (timing, scope, scale, etc.) to changing environmental conditions. Even if DCF analysis were to consider this shadow cash flow, or option value, risk-adjusted discounting remains a problem. Because the risk of an option is not the same as that of actual cash flows, and because this risk changes as a function of time and the uncertain size of actual cash flows, it is neither possible to predict the option risk nor find a risk-adjusted discount rate that applies to it.
DTA provides a significant conceptual improvement over the way DCF analysis handles options. A decision tree shows the expected project payoffs contingent on future in-project actions that management can take over time (e.g., abandon an operational project at time *t*, if the salvage value of resources used exceeds the payoffs arriving after *t*). As
the tree represents each action as a decision node, corresponding to an option, evaluating the project requires working backward from the future to the present, to calculate how much the presence of these actions adds to the project value.
This approach yields useful results only once poor tree branches are pruned. Pruning

means finding out how embedded options alter the range of expected payoffs and then adjusting the discount rate to recognize the change in risk (or variability of payoffs). Unfortunately, DTA provides no direct basis for discount rate adjustment (Brealey and Myers, 1988, p. 228). Only with a proper modification involving an estimation of the investor's (management) utility function DTA could be adequately applied to projects embedding options (see [Smith and Nau, 1995] for details).

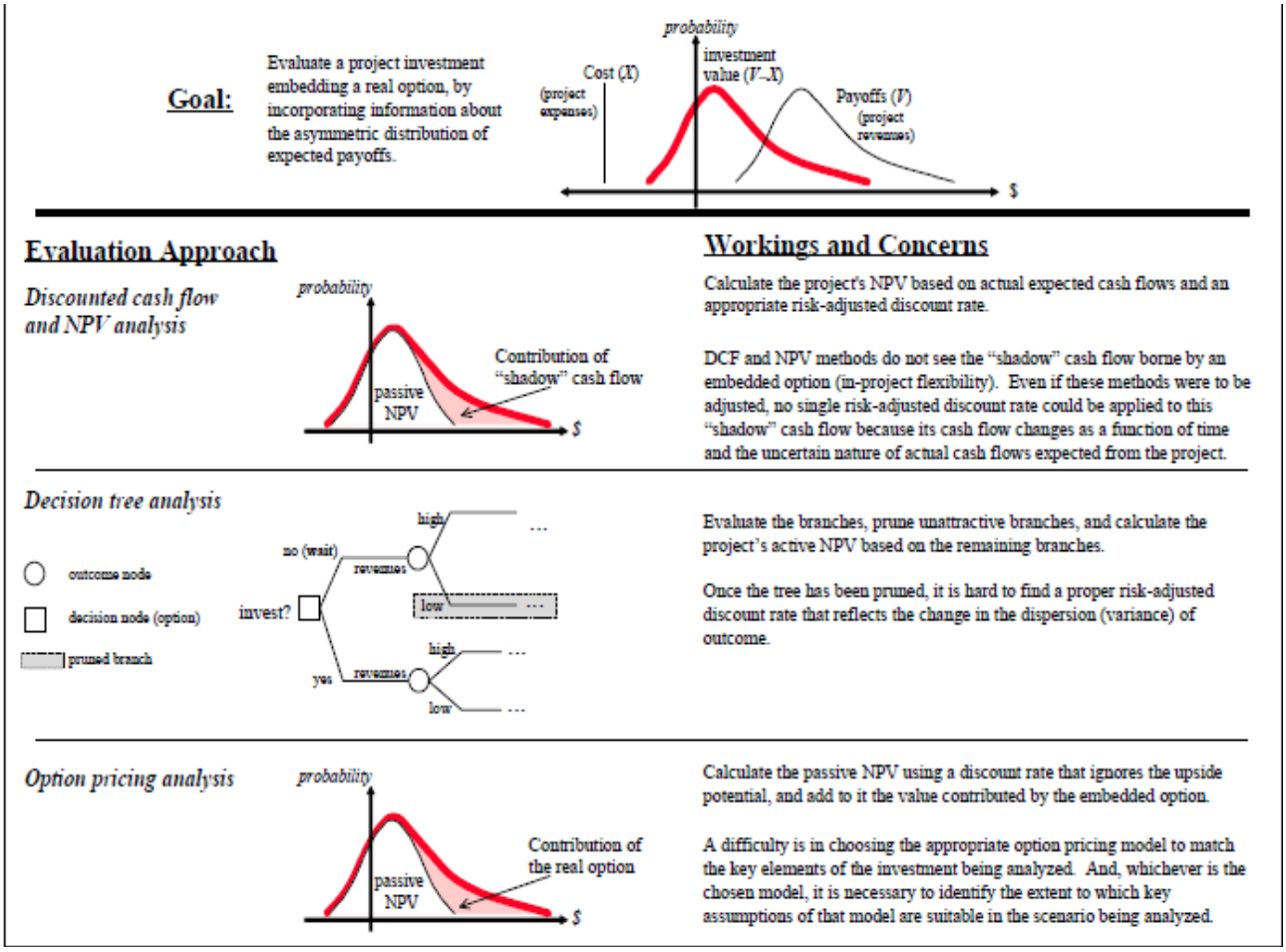


Figure 13: Comparison of common capital budgeting evaluation approaches

Real options analysis strives to complement the other two approaches, in light of the difficulties involved in adapting these approaches to investments embedding options. It looks at the active NPV of a project as the sum of the passive NPV and the value of embedded options. The intuition behind how it evaluates an embedded option resides in two factors. First, it models payoff contingencies using a probability distribution function (e.g., log-normal, binomial), enabling to translate the presence of an option into expectations of shifts in this distribution. Second, it replaces the actual probabilities of payoffs by risk-neutral (certainty-equivalent) probabilities, to facilitate discounting by the riskfree rate, instead of a risk-adjusted rate. This is equivalent to allowing an analyst to prune unattractive branches in a decision tree without having to worry about discount rate adjustment. However, these factors raise two issues. The first requires estimating the variability of uncertain payoffs and costs modeled using probability distributions. As to the other factor, the validity of discounting by the risk-free rate is questionable when options are not traded in a market. We return to these issues later, to show that they do not limit

the applicability of real options analysis to m-banking options.

10.4.2 Option Pricing Concepts Applied to Real Deferral Options

The fundamental options are financial *calls* and *puts*. A *European call* (*put*) on some underlying asset, whose current value is V, gives its holder the right to buy (sell) the asset for an agreed exercise price, X, at a fixed expiration date, T. For instance, a "June 99 call" on IBM stock with a $75 strike price allows its holder to buy IBM shares for $75 on June 15, 1999. This call is worth exercising only if the value of an IBM share on June 15 exceeds $75, in which case it is said to be *in-the-money*. Thus, the terminal value of a call, or its value on expiration, C_T, is $\max(0, V_T - X)$, where V_T is the terminal value of the underlying asset. An *American option* is like a European option, but it can be exercised at any time t, $t \leq T$. We next focus on European calls because they are simpler to understand, and later return to discuss American options.

The current value of a call, C, is partially determined by the volatility (variability) of the underlying asset's value, σ, and the length of time to its maturity, T. Before the option expires, V can go down only to zero (downside risk limit) or up to infinity (unlimited upside potential). This asymmetrical distribution of V means that, the higher σ is, the greater is the chance that V_T will exceed X for the call to end in-the-money, and the higher is the call value. Likewise, the longer is the time to expiration, T, the more chance there is that V will rise above X, so that the call will end in-the-money. So far we see that C depends on parameters V, X, T, and s. We will see that C also depends on the risk-free interest rate.

For a firm facing a project embedding the right to defer investment, the analogy with a financial call is direct. The firm can get the value of the operational project via immediate investment, $V - X$, or hold on to the investment opportunity.

This is akin to a call option to convert the opportunity into an operational project. The option (opportunity) offers the flexibility to defer conversion until circumstances turn most favorable, or to back out if they are not satisfactory. Its value corresponds to the active NPV, equaling the passive NPV plus the value of the deferral flexibility. The option parameters are: (1) the time to expiration, T, is the time that the opportunity can be deferred; (2) the underlying asset, V, is the present value of risky payoffs expected upon undertaking the investment; (3) the exercise price, X, is the irreversible cost of making the investment; and, (4) the volatility, s, is the standard deviation of risky payoffs from the investment. When V can fluctuate, the unexercised option (opportunity) can be more valuable than immediate investment, $\max(V-X) > V-X$. The value of the option depends on how much the decision-maker expects to learn about the way the value of risky payoffs, V, will evolve due to changes that might occur within the firm or in its environment during deferral. The more uncertain is V, the more learning can take place during deferral, and the more valuable is the option. This is consistent with what the Finance theory postulates about the effect of s, the variability of V, on the value of financial options.

Two basic models for pricing financial options are the binomial model and the Black-Scholes model (Hull, 1993). Because these models make similar assumptions and thus compute a similar option value for options maturing in a year or longer (Benaroch and Kauffman, 1999), we rely here only on the Black-Scholes model to price the option identified later in our case study. The Black-Scholes model is a closed-form formula that computes the price of a European call option for a risk-neutral investor. It is written as:

$$C = V\mathrm{N}(d_1) - X e^{-r_f T}\mathrm{N}(d_2), \qquad d_1 = \frac{\ln(V/X) + (r_f + \sigma^2/2)T}{\sigma\sqrt{T}}, \qquad d_2 = d_1 - \sigma\sqrt{T}, \qquad (1)$$

where N(×) is the cumulative normal distribution, V is an underlying asset that is assumed to be log-normally distributed so as to reflect the asymmetric nature of payoffs from an

investment embedding the option, σ is the volatility of *V*, *X* is the option's exercise price, *T* is the time to maturity, and r_f is the risk-free rate. This equation has a simple intuition. As $V_T - X$ is the call's terminal in-the-money value, $V - e^{-rf\,T}\ X$ is the current in-the-money value. To cover the case that the call might be unattractive to exercise, *V* and *X* are weighted by the probabilities N(*d*1) and N(*d*2), respectively.

In light of the similarity of a deferral option to a financial option, we should be able to apply the Black-Scholes model to real IT options. Benaroch and Kauffman (1999) support this assertion by showing that the economic rational for the risk-neutrality assumption of the Black-Scholes model fits in the context of m-banking investment evaluation, even though many IT investments are not traded. However, recall that one goal of this paper is to examine the impact of adjusting the riskneutral option value calculated by this model to the case of risk-averse investors. This examination is meant for address the claim that, because most decision-makers are risk-averse, risk-neutral valuation overvalues options embedded in non-traded investments. Trigeorgies (1996, p. 101) explains this claim as follows: Managers evaluating an investment that is subject to a firm- and/or industry-specific risk not shared by all market investors must discount the option value by a factor corresponding to the investment's unique risk. Analogously, if the asset underlying an option is not traded in limited supply by a large number of investors (so that demand for the asset exceeds supply), the asset's return rate, a, may fall below the equilibrium expected rate of return investors require from an equivalent-risk traded asset, a*. The *rate of return shortfall*, d =a *-a , necessitates an adjustment in the option valuation. A version of the Black-Scholes model that reflects this rate shortfall adjustment is:

$$C = Ve^{-\delta T}\,\mathrm{N}(d'_1) - X\,e^{-r_f T}\mathrm{N}(d'_2), \qquad d'_1 = \frac{\ln(V/X) + (r_f - \delta + \sigma^2/2)T}{\sigma\sqrt{T}}, \qquad d'_2 = d'_1 - \sigma\sqrt{T}, \qquad (1')$$

A simple conclusion follows. Risk-neutral valuation does not pose a roadblock to implementing real options analysis using the Black-Scholes model. Even for a non-traded underlying asset, we can apply risk-neutral valuation using the Black-Scholes model adjusted by an appropriate rate of return shortfall, δ. Following one of our goals, we later check the impact of adjusting the Black-Scholes model by d on the analysis results for the case study presented shortly.

10.4.3 Option-Based Decision Rule for Investment Timing

Having seen why it is reasonable to use the Black-Scholes model in the context of real IT options, the question that a firm must answer for a deferrable investment opportunity is: For how long to postpone the investment up to T time periods?

Economists study many variants of this kind of investment-timing problem (e.g., cyclical demand for goods to be produced by a deferrable project). They use different specialized solution approaches, many of which are isomorphic to the option-pricing approach (Bernanke, 1983). For example, McDonald and Siegel (1986) study the problem for the case of stochastic project costs, showing that under risk-neutrality and non-stochastic project costs their model reduces to the Black- Scholes model. Likewise, Smit and Ankum (1993) say that the general investment-timing problem *"is analogous to the timing of exercising of a call option"* (p. 242), and thus explain how the simplicity and clarity of real options analysis enables them to study the problem under various competitive market structures.

From a real options perspective, the intuition behind the evaluation principle for solving an investment-timing problem like the one we present shortly is as follows. Holding a deferrable investment opportunity is equivalent to holding an American call option. At any

moment, the investor can own either the option (investment opportunity) or the asset obtained upon exercising the option (operational investment). The option parameters are: the present value of risky payoffs from the investment (*V*), the cost of making the investment (*X*), the standard deviation of risky payoffs (σ), the maximum deferral period (*T*), and the risk-free interest rate (r_f). Holding the option unexercised (postponing investment) for time t hast wo competing effects: *V* is lowered by the amount of foregone cash flows and market share lost to competition, and *X* is lowered because it is discounted during the deferral period, t. Depending on the magnitude of these two tendencies, the value of the option exercised at time t, C_t, can be higher or lower. If information arriving during deferral indicates that *V* is likely to exceed original estimates, investment can be justified by the rise in the payoff expected from investing; otherwise, the irreversible sunk cost (*X*) can be avoided by not investing, at a lose of only the cost of obtaining the deferral flexibility. Consequently, the following decision rule leads to the optimal investment strategy, given today's information set.

Decision Rule: Where the maximum deferral time is T, make the investment (exercise the option) at time t*, 0 ≤ t* ≤ T, for which the option, C_{t^*}, is positive and takes on its maximum value.

$$C_{t^*} = \max_{t=0..T} C_t = V_t e^{-\delta t} \mathrm{N}(d'_1) - X e^{-r_f t} \mathrm{N}(d'_2), \qquad (2)$$

where *d*'1 and *d*'2 are defined in equation (1'), and *Vt* equals *V* less the present value of foregone cash flows and market share lost to competition. Of course, this decision rule has to be reapplied every time new information arrives during the deferral period, to see how the optimal investment strategy might change in light of the new information.
Because the Black-Scholes model is suitable for pricing only European options, it is not directly applicable with a decision rule involving an American deferral option. However, we will see later a specific variant of the Black-Scholes model that can be directly applied with the above decision rule.

Based on the above, telecommunications providers and financial institutions make the appropriate investment decisions and risk management in order to enter the market.

10.5 A Planning Retrospective for m-banking

In this section, we discuss the background of mobile banking services in South Africa, to pave the way for our evaluation of an IT investment embedding a deferral option. We examine the investment scenario that Wizzit Bank faced in determining whether to deploy mobile payment services, and conclude by suggesting the elements of the scenario that make real options analysis a useful evaluation alternative.

10.5.1 Moblie operators are starting to offer m-banking

Mobile operators have already started to offer m-payments. Most of these schemes are still pilots or roll-outs at a very early stage. However, it is interesting to note that some operators team up with banks while others prefer to manage m-payments on their own.

10.5.2 Settlement with other Telcos

Many of the billing activities described above involve revenue sharing, i.e. telcos pass some of their revenue on to other telcos. This is usually the case whenever the customer of one network communicates with the customer of another network or when customers roam. Revenue sharing creates financial flows between telcos and makes periodic clearing

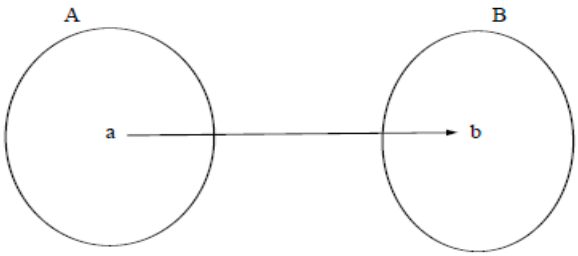
and settlement necessary. This is the “wholesale” side of telcos’ payment related activities.

10.6 M-Payments and competition in reatail payments

The effect of m-payments on competition in retail payments largely depends on the strategy of those non-banks (in particular telcos) that wish to enter the market. They could co-operate with banks or set up an alternative payment network. Finally, there is the possibility that mobile phones become just another access device to the customers’ bank account.

10.7 The Wholesale (Telco to Telco) side: Growing Interdepedence

Provisioning of third party payment services will lead to growing financial interdependence between telcos. In the days of geographical monopolies, clearing and settlement was largely confined to international traffic. All local or national calls were within the same network (A or B) and only international calls made some kind of revenue sharing necessary (figure14). Given the fairly high relative costs of international calls, the share of shared revenues was not very high.



“a” is a customer of network A and “b” is a customer of network B

Figure 14: International traffic

However, deregulation and the rise of mobile telephony have changed the telecommunication landscape fundamentally. Inter-relationships between different telcos have become much more important. The costs of international calls have come down and there is competition within regions. Thus, even a local call may involve two networks (figure15).

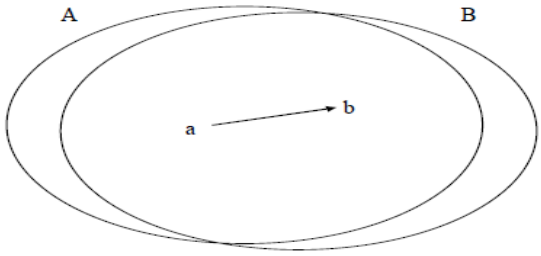


Figure 15: Competing networks

Unless a “biller keeps all” rule applies this increases the fraction of revenues that go into “sharing”. Due to roaming the share of revenue sharing is also likely to increase. For instance, in the example illustrated in figure16, network *A* would charge customer *a* for all calls he makes (assuming “caller pays”). However, since customer *a* uses network *B* to make these calls network *A* has to pass on part of its revenues to network *B*.

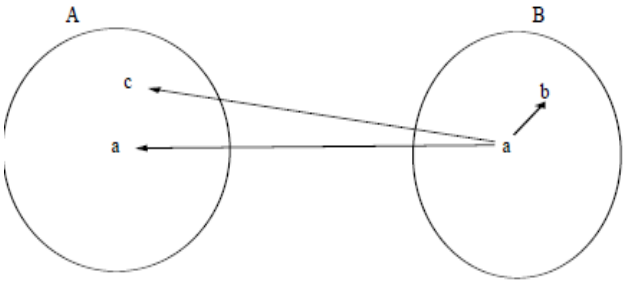


Figure 16: Roaming

Both, the increasing mobility of the population as well as the large number of telcos make roaming and revenue sharing much more important. As will be argued below, the provision of specialised payment activities is likely to further increase the significance of sharing. In all likelihood, there will be structural credit and debit positions of particular telcos. To see why this is the case, one has to look at the difference between voice services and payment services. On a conceptual level, many services, including most payment services, differ from voice traffic. A pure voice network can be described as a **two-way network** (Economides 1996). The upper part of graph 4 displays a voice network with two local switches connected by a long distance line. In this network, anybody can call anybody.
Many forms of payments and many other services differ from communication because they usually create **one-way networks**. One kind of participant, i.e. merchants (*I, II, III* in the lower part of graph 4), receives payments and a different kind of participant, i.e. customers (*a1-a3* and *b1-b4*), makes payments. This difference becomes obvious in the different functions of acquirers and issuers in credit card systems. Acquirers make contracts with merchants and issuers make contracts with customers. While most banks are active on both sides of the market, there is often a clear specialization. Some banks are more active on the acquiring side, others on the issuing side. A similar division of labour is also likely for telcos. Some telcos will be more active on the acquiring side, others on the issuing side. For instance, a telco that has created a highly popular portal will also find it easier to sell payment services to the merchants in this portal. This causescertain asymmetries. Telcos with a large merchant base (like *S1* in figure17) will receive net payments in the settlement process, whereas telcos with a small merchant base will be net payers.

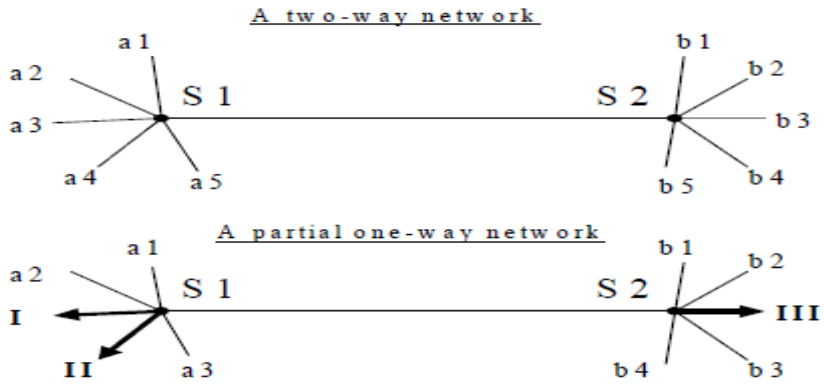


Figure 17: Different Types of Networks

The growth of revenue sharing and the possibility of structural credit and debit positions in

the intercarrier settlement process will require more bank-like approaches to risk management with respect to telco-to-telco payments. In particular, if an increasing share of revenues goes into risk sharing, telcos will also have to consider clearing and settlements more carefully. Telcos will have to be more prudent with respect to counterparts. The settlement systems used should be efficient in terms of costs and designed in a way to minimise risks for the participants. Possible models of clearing and settlement are:
• bilateral
• multilateral (joint clearinghouse)
• using intermediaries

10.8 The bank – dominated model

One possible scenario is that mobile phones or PDAs simply become additional access devices for users to access their bank accounts. Such a solution would require banks to integrate access via mobile phones with voice and Internet access. In this case, payments would be firmly bank-based and telcos would simply perform the task of data transport. Such a situation is illustrated in figure18. Devices marked with an asterisk may require the use of a smart card in order to make payments. In the bank-based case, this card would be issued by a bank.
Smart cards are not essential. It would also be possible to use pass codes and PIN authorisation as in e-banking. However, a smart card based solution would enhance security of data storage and transmission and allow for strong identification. For the consumer it would be more convenient because he would not have to type in pass codes and account information every time he wanted to make a purchase.

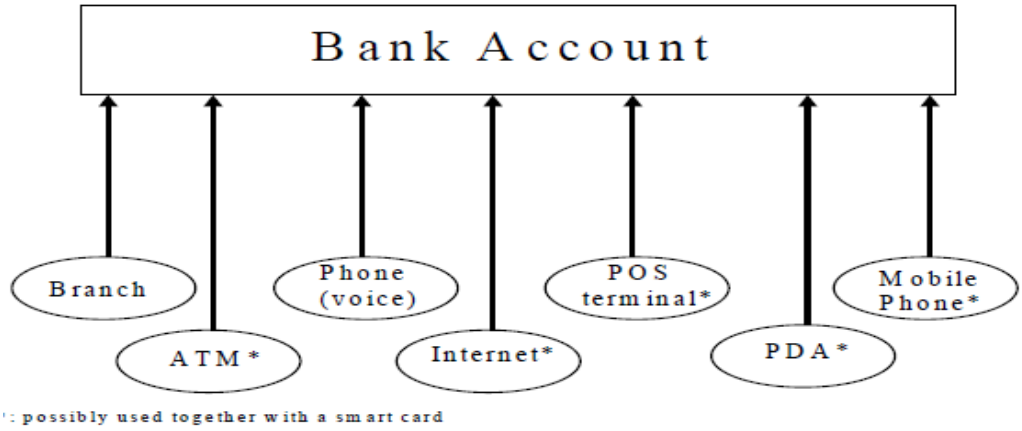


Figure 18: The mobile phone as just another access device

As far as mobile devices are concerned, there are various technical possibilities for implementing a bank dominated smart card based solution. The phone could be a dualslot phone, as in the French system “Paiement CB sur mobile”, where a normal payment card, also suitable for POS terminals or ATMs, can be inserted. Another possibility would involve a separate payment chip embedded in the mobile phone. This is the architecture proposed by the Mobey Forum (2001).
As long as banks are the issuers of the chips that enable the payment function they control the whole payment process and they “own” the customer (essential from the point of view of Customer Relations Management). In this case, banks would have privileged access to customers.

Consumers would benefit from more convenient access possibilities. Since consumers trust banks most they would also welcome the fact that banks continue to be the main payment service providers. However, a bank-dominated set-up would leave the competitive situation in the payment system more or less as it is. Since recent investigations into the payment system found evidence of uncompetitive practices this would be a clear drawback. It must also be remembered that banks have been slow, so far,to come up with efficient solutions for cross-border retail payments and it is not clear that further engagement in m-payments would change this.

10.9 The emergence of new payment service providers

The bank-dominated model is just one possibility. A different scenario is also conceivable. Telcos or other non-banks could offer payment services and use the Internet, the mobile phone, or the PDA as access devices just like credit card companies. As with credit cards, ultimate payment would be via bank transfer. However, banks would no longer be involved in the consumer-to-merchant or consumer-to-consumer side of the payment. Banks would only provide “commodity capabilities” (Rosingh, Seal and Osborn 2001). Customer contact would move to a large extent to the intermediary. In principle, such intermediaries can offer a wide array of payments: pre-paid accounts, pre-paid cards, billing (“post-paid accounts”) as well as traditional payments such as credit card payments or bank transfers (the German m-payment scheme PayBox would be an example of the latter).

The second scenario is much more likely to increase competition in the retail payment system. Even if new players eventually have to become banks, new entry would be beneficial. Furthermore, new intermediaries may be less reluctant to offer services across borders. For instance, telcos that operate internationally may find it easier to offer international payment systems.

While some of these opportunities are open to non-banks, others might require them to acquire an EMI (Electronic Money Institute) licence or even a banking licence. Alternatively, these non-banks could co-operate with a bank. For telcos cooperation would have the advantage of freeing them from concerns with payment regulation. Furthermore, they would lock in a trusted brand and the risk-management know-how of banks. For banks there are two advantages in cooperating with telcos. The banking sector as a whole has an interest in co-operating in order to prevent telcos from entering the market on their own. Individually, banks may see co-operation as beneficial because it helps them to gain customers and keep costs down. Most mobile operators subsidise the price of mobile handsets. If telcos want consumers to use a handset that is suitable for their m-payment schemes (for instance a dual slot phone), they would either have to subsidize handsets themselves or co-operate with telcos.

10.10 The role of network effects

In the longer run, however, competition problems may arise because of network effects. There is little scope in the payment services market for a large number of m-payment solutions. The usefulness of a payment system increases with the number of users. Therefore, users have a high preference for ubiquity. Ubiquity has two dimensions: first, all users want the ability to send (receive) money to (from) any other user; 6 second, a user wants to be able to use the payment function wherever he is (i.e. even beyond the reach of his service provider). The demand for ubiquity favours large providers and ultimately interoperability. (The longer it takes to achieve interoperability, the higher the concentration in the market.) Interoperability, in turn, requires a certain amount of standardization.

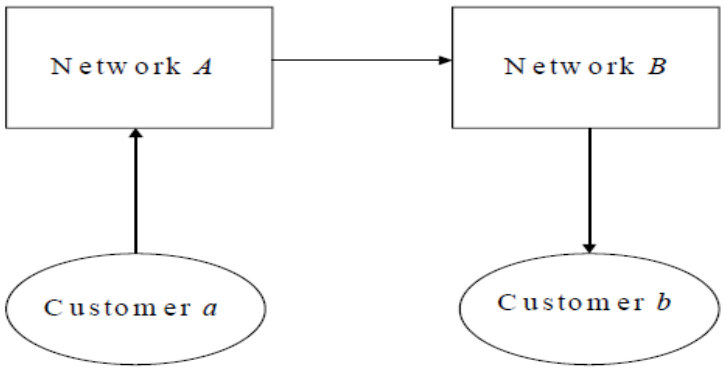


Figure 19: Join production of Network Services

There will be strong pressures from users for co-operative solutions. If users want to make payments to other networks' customers, or if they wish to make payments while travelling beyond the reach of their own network, there will be a demand for "payment roaming". In principle, ubiquity of service can be achieved by a centralised solution (one big provider or one intermediary) or by co-operation. Co-operative solutions might involve a joint clearing house or the use of intermediaries/brokers (at the wholesale level).

Both the centralised and the co-operative solution may lead to reduced competition. The co-operative solution provides opportunities for anti-competitive price setting. In particular, a co-operative solution raises the question of how inter-carrier fees are determined. This problem has a lot in common with the setting of an interchange fee in credit card networks. It basically arises in all schemes where different network operators provide one network good.

Such a case is illustrated in figure 19. Customer *a* can be thought of as an agent who wishes to transact with customer *b* who has a contractual relationship with a different provider. The transaction can be a bank transfer, a phone call or a credit card payment. In each case, customer *a* relies on network *B* in order to complete the transaction. But since network operator *B* does not have a contractual relationship with customer *a,* he cannot charge *a* for the services. So, either *B* has to charge customer *b* or *B* has to charge network *A* (which in turn can charge *a*). The amount that *B* charges *A* may have been bilaterally negotiated, or multi-laterally with other providers (and possibly intermediaries). None of these solutions is without problems.

It is no coincidence that the European Commission and the European Parliament are conducting parallel investigations into roaming charges, charges for cross-border bank transfers and multi-lateral interchange fees. All of these examples involve prices for network services. Particularly interesting is the fact that pricing principles vary considerably in these cases. For credit cards there is a collectively agreed interchange fee (for a particular brand), in the case of roaming there are collectively agreed guidelines on how to set prices, and, in the case of international bank transfers, the two banks involved usually charge their respective customers. The fact that overcharging may be an issue in a system without a collectively agreed interchange suggests that, in the case of network goods, the absence of co-operative price setting does not necessarily benefit consumers.This raises the question of whether competition policy alone is sufficient or whether there is a need for more regulatory supervision.

Once there is a dominant solution in the market, open access becomes of critical importance. For instance, if there is a widely used m-payment system and the customers of a particular mobile operator cannot use this system, it will be difficult for this operator to compete. In the m-payments sector, there has already been one intervention of the competition authorities to ensure open access. In Spain, the Tribunal de Defensa de la

Competencia ruled that Movilpago, the m-payment system developed by Telefonica and BBVA, needs to be an open system that can be used by customers of any bank or any mobile operator.

10.10.1 Case Study Movilpago

Although m-payments are a fairly new field they have already received the attention of the competition authorities. In Spain, Movilpago - a joint venture by Banco Bilbao Vizcaya Argentaria S.A. (BBVA) and Telefonica Moviles S.A. – was scrutinised by the Spanish competition authorities. This joint venture required the approval of the competition authorities (Servicio de Defensa de la Competencia “SDC”). When considering approval of the joint venture, the authorities made the following assumptions. As an m-payment venture, Movilpago affects the market for e-payments as well as the market for mobile telefony.

Whereas there are no important barriers to entry in the market for e-payments, barriers to entry are important in the market for mobile telefony. Barriers to entry in the mobile telefony market may be due to the lack of open standards, patent ownership, a large client base, financial strength, and a large distribution network. M-payments may become the most important payment form in e-commerce. A unified and widely used m-payment system is in the interests of the consumer. BBVA already has a strong position in the e-payment market.

On the basis of these assumptions, the SDC approved the joint venture on the following conditions. Firstly, other mobile operators must be allowed to participate and adapt their technical systems. It must also be possible to use the system with any mobile operator and any financial institution. Contracts with Movilpago may not limit customers in their freedom to choose services of other operators or financial institutions and, finally, interchange fees between the involved financial institutions must be subject to the approval of the SDC.

The decision of the SDC has prompted negotiations between the different mobile operators and a number of banks. These market participants now have to agree on a common platform.

This implies that Spain might get an m-payment scheme that is supported by all major banks and mobile operators. The price to be paid, however, is that the roll-out has to be delayed further – possibly until 2002. (Barrón (2001) and Tribunal de Defensa de la Competencia (2000)).

The expected revenues depended on the market acceptance rate, the market share lost to competition, and the extent to which these revenues might deviate up or down. Relative to the variability of revenues, while the expected revenues could turn out slightly worse or they could turn out to be much higher.

For example, the consumer acceptance rate and the adoption rate by retailers might rise, and the government might decide at any time to start delivering welfare benefits electronically.

On the consumers’ side, it was necessary to understand when sufficient customer demand for m banking services would emerge. The mobile banking system in the Philippines offered a relevant analogy. It was among the earliest and the most successful ones in the world. Some 3.5 million people are currently using mobile banking services, and this number is growing significantly every day.

Retailers' adoption rate is another revenue-related concern. Retailers had to make substantial investments (e.g., in PDAs and training cashiers), unlike in the ATM world where the entire investment is born by the banks. While this meant that the investment required by Wizzit Bank would be relatively small, effectively shifting much of the risk of the rollout to the retailers, it caused many merchants to hesitate.

Chapter 11

11.1 The future of NFC and mobile banking

The growing use of NFC and mobile payments over the coming years is inevitable in most countries. But it's far less certain whether large numbers of the unbanked poor will use these alternative channels for financial services beyond payments, such as savings and credit.

Four forces shaping the future.

Forces are akin to the headwinds or tailwinds that affect a long haul flight. They may change in strength, and sometimes may cause a very turbulent ride, but,
although invisible, they are always present and always affect the speed and comfort of the journey. In this section, we identify four forces affecting mobile banking that may act either as tailwinds, boosting the overall trend of financial inclusion over the next 10 years, or headwinds, slowing it down. While in this section we consider each force in turn, in reality and in the scenarios section that follows, the forces interact, causing uncertainties about the outcome.
The following forces were distilled from a much longer list of forces arising from the research. Is the financial crisis of 2008–2009 a force?
To be sure, the effects of the financial crisis originating in the United States and the United Kingdom have been severe in many countries. However, in most instances the worst predictions have not come to pass. We are confident in saying the financial crisis itself has generally not led to the kind of longlasting impacts on mobile banking that would be necessary for it to qualify as a force over the next decade. But the financial crisis could nontheless exacerbate other forces and have an indirect effect. For example, if fiscal stimuli were to fuel further inflation, already a force squeezing the poor through rising food and energy prices (World Bank 2008b), this would erode the disposable income of the poor yet further, constraining their ability to afford new financial instruments and undermining the real value of formal savings. At the same time, if inflation is high enough, it may also drive demand for efficient real-time payment instruments and systems. This latter factor fuelled the growth of electronic payment systems in Brazil in the 1980s.
More certain is the effect the crisis has already had on the role of government. Governments will likely regulate the financial sector more closely, showing more skepticism toward innovative approaches and new players.
However, from our engagements with regulators, we have been impressed by how strong the goal of financial inclusion remains in developing countries. This objective may temper some of the reaction from the crisis. Governments are also already responding to the global economic downturn by investing more vigorously in extending social safety nets. We discuss these factors further as part of the second force.

Force 1. Demography is changing

1.1 there will be a greater number of younger consumers in most developing countries
1.2 there will be more people moving to cities and across countries
Demography is an ever-present force in most scenarios15—with high impact and certainty. After all, users of mobile banking in 2020 are already alive today. Clients in 2020 will include a large numberof today's youth. Young people have limited capacity to spend on new services, but a higher propensity to adopt new technology.

Another seemingly unstoppable demographic force is the movement of people—both within countries as a result of continued urbanization, and across countries through international migration. The UN Population Division (2007) expects that the developing world will be 51 percent urban by 2020, up from 45 percent now. This alone will fuel rising demand for improved ways to transfer money remotely from urban areas back to family in the countryside.
International migration patterns are harder to anticipate. Demand for labor in developed countries combined with internal displacements in developing countries will likely promote ongoing cross-border migration, even as formal barriers to immigration grow. The nature of these barriers will affect whether the formal remittance market grows as rapidly as it has over the past 10 years—quadrupling to over US$300 billion per annum (World Bank 2008c). For example, the legal status of workers has a material impact on their ability to satisfy customer due diligence (CDD) procedures to qualify for access to formal financial services in the host country.
The force of demography in its various manifestations creates a strong positive pull toward faster adoption of mobile banking, as moreyoung people use new technology and migrants demand reliable, convenient, and affordable ways to make remote payments.

Force 2. Governments will become more activist in this space by:

2.1 extending the safety net through cash transfers or cash for work
2.2 increasing the intensity of regulation on already regulated financial institutions
2.3 encouraging availability of low-cost banking and financial infrastructure
Pushed by the crisis, governments will be increasingly active in three domains that affect the viability of mobile banking: extending the social safety net, regulating more intensively, and at the same time pushing for formal financial inclusion. However, government actions will likely be driven from a variety of motives and different agencies, not necessarily guided by a coherent strategy to support the extension of mobile banking. Some of these motives will be related to the desire of governments to serve (or be seen to serve) poorer citizens through redistribution to mitigate the most dire poverty;
others to use the regulatory power of the state to manage risks in financial markets; and still others related to government interest in encouraging or requiring providers to make basic products and services widely available.
The continued rollout of new and expanded social programs will create strong demand from governments for mobile payment infrastructure that can safely pay funds cost effectively to recipients with less instances of fraud or corruption. Over the past 10 years, cash transfer programs have become an important part of the public safety net especially in middle income developing countries (Fiszbein and Schady 2009). More than 60 countries have such a scheme (World Bank 2009), a majority of which have been launched in the past eight years.Some reach broad swathes of the population: for example, one in four families in Brazil and 22 percent of households in South Africa.
Globally, the reach of government payments to the poor is impressive: at least 170 million poor people worldwide already receive a regular payment of some type from their government (Pickens, Porteous, and Rotman forthcoming).
But making these payments alone will not lead to broader financial inclusion. Governments may be persuaded that providing financial services to recipients can be a win–win–win strategy for governments, beneficiaries, and financial institutions. Recent tenders for payment of social transfers in Colombia and Kenya promoted financial inclusion by requiring providers to offer a basic savings product to beneficiaries.

Card-based bank accounts are already widely used by millions of beneficiaries in India, South Africa, and Brazil (Pickens, Porteous, and Rotman forthcoming).
More evidence is needed on how recipients will use accounts if they are provided.
On the supply side, governments will shape the extent of the opportunity through their policies toward provision, whether using state-owned banks (as in Brazil), by moral suasion and prescribing fee limits (as in India), or tendering more generally (as in South Africa). The large numbers involved in social protection schemes may make low-cost business models viable. The pressure on banks to serve lowincome customers is growing as financial inclusion becomes more important as a policy objective in developing countries. More than 1 in 10 countries already require financial institutions to offer basic bank accounts.16 Banks typically view these accounts as unprofitable, and they have had mixed results so far as a tool of financial inclusion. Since the RBI introduced its policy to encourage “no frills” accounts in 2005, Indian public and private banks have opened 15.8 million accounts (Ramji 2009). However, a recent study determined that, in some districts at least, more than 85 percent are dormant, primarily due to distance from bank branches, low financial literacy, and poor marketing by banks (Thyagarajan and Venkatesan 2008). South Africa’s experience of the Mzansi basic bank account is a more positive example of response to moral suasion, although issuing banks claim to lose money on each Mzansi account, making the product unsustainable in the absence of the suasion (Bankable Frontier Associates 2009).
Governments also function as regulators of the financial sector. The global financial crisis has been attributed in part to lax regulation and inadequate consumer protection, and it seems likely thatregulators will be more wary about supporting, condoning, or approving new financial institutions and innovative products. The forms and extent of this backlash against financial liberalization will differ across countries, but both developing country regulators and regulated entities interviewed as part of the scenarios process expect the intensity of regulation to increase. This will affect the ability to innovate, although innovation often thrives in “cracks” even in strict regulatory regimes.
Some governments may take more vigorous steps to push the pace of financial sector development. For example, regulators’ power over payment systems is growing as more countries pass national payment legislation to cover what has heretofore been an unregulated area if not conducted by banks. Regulators may use new powers to require that new payment systems are interoperable, or they may create central bank-owned national switches to enable this (World Bank 2008d). Some governments may even try to accelerate the arrival of a cashless society. Malawi and Singapore provide cautionary tales of direct government involvement in these spheres.

Force 3. Crime of various types will continue to rise.

The risk and cost of cash crime is an important force on the demand side—driving customer adoption of electronic forms of payment—as well as affecting the business case of providers. Crime varies greatly in its manifestations and incidence across countries. Two types are especially germane to this analysis:
Cash crime, where individuals or institutions (such as banks or merchants) who are known to carry cash are vulnerable to robbery. E-crime, where new forms of crime target electronic delivery channels Cash crime drives up the cost of holding cash (which is often perceived to be “free” by consumers) relative to other alternatives. In Kenya, for example, the cost of insuring cash and transporting it has risen materially in recent years, in part due to central bank regulations mandating increased security after a series of highprofile armored car robberies.

In South Africa, ATM bombings have increased dramatically since 2005 with the effect of frightening and deterring customers from using the machines. As long as cash crimeremains a factor, which seems certain over the next decade in most places, this will boost demand for electronic channels. However, while robberies are still the most visible form of crime, looking ahead, emerging forms of e-crime are at least as worrying to providers and increasingly to consumers. The spread of e-commerce has opened new opportunities for criminals, enabling fraud to be committed more quickly, at larger scale, and across borders (Glaessner, Kellerman, and McNevin 2004). The early days of e-commerce showed both how quickly e-crime can innovate in response to the vulnerabilities in new channels to rise quickly as a threat, but also how it can be managed. The ability to manage e-fraud risks was a major factor in PayPal's early survival and success (Jackson 2004).

Mobile banking in developing countries is at the very early stage of experiencing e-crime, simply because the amount of usage has not warranted the attention of syndicated criminals who have the resources to make this more than a nuisance to the system as a whole. However, as usage grows, so too will e-crime. In July 2009, South African newspapers reported on fraud involving the interception and fraudulent use of Internet banking one-time passwords sent to clients' mobile phones (The Citizen 12 July 2009).

Senior managers of mobile banking schemes interviewed as part of this project displayed a keen sensitivity to the threat of crime, particularly if a massive single episode or a chronic condition of fraud and threat led to loss of consumer trust. One interviewee described it as "the nightmare scenario," and the only thing they could imagine derailing the growth of mobile financial services. Laws that limit the liability of customers arising from unauthorized use of credit cards and other electronic accounts have played an important part in creating consumer confidence that has accelerated the spread of e-commerce in countries like the United States. Similar laws may be warranted and necessary to promote mobile banking elsewhere. A key uncertainty is how well consumer confidence will weather an almost certain rise in e-crime in new channels that may even causesome to fail. We discuss this in the next section as one of the four key uncertainties for the next decade.

Undoubtedly, the competence to manage electronic fraud will determine which providers survive and succeed over the next decade.

Force 4. Internet browsing via mobile phones will change the competitive landscape.

We have taken for granted here that the rollout of mobile communications will continue, albeit at adeclining pace as even low-income markets become saturated. It is likely that there will be few people outside the reach of wireless communications by 2020, and few who do not have connectivity to wireless communications in some form. Indeed, the lack of reliable and affordable energy sources is today increasingly a greater constraint on development in poor and remote areas than is communications.

Devices like mobile phones, which require less energy than PCs and ATMs and which can be recharged by windup or solar power,19 are an increasingly important part of any rollout of mobile channels to off-grid areas.

This much seems obvious. So we have chosen instead to highlight a different force, which is yet not fully recognized by all of today's mobile banking providers. Today's successful payment services in developing countries have been built using certain mobile-specific channels20 that even basic handsets could support.

However, over the next 10 years, the spread of affordable data-enabled phones in developing countries will increasingly enable consumers to have direct access to the Internet. This is made possible by a dramatic fall in the price of mobile devices with basic Internet browsing and falling prices of data services, which are also available on a prepaid basis. Such “enhanced” phones are increasingly the basic handsets of tomorrow. As Figure shows, they already make up half of all phones shipped to emerging markets in 2009. Faster speeds and falling prices of both data-enabled handsets and data-overmobile networks will mean greater usage of data
channels on these phones, effectively making Internet access via mobile pervasive in many developing countries during the next decade. Few mobile banking services have been offered over mobile Internet in developing countries (yet), but social networking content is already driving uptake among segments such as youth. In South Africa, the
mobile instant messaging service MXit has attracted more than 13 million users who send more than 250 million messages per day (in a country of 47 million) (Vecchiatto 2009 and Lombard 2009). Hardware barriers to Internet access are also decreasing.
Microsoft recently announced OneApp, an application that enables phones with slow processors and low memory to surf the Web like more powerful handsets.
Users will be able to access a dozen sites initially, like Facebook and Twitter.23 In August 2009, Nokia announced its intention to provide widespread mobile payment services as part of its desire to promote pervasive Internet that “connects people” (Young 2009). In short, there is much work being done today to make Internet over mobile more widely available in developing countries.
What does this force mean for mobile banking?
First, Web interfaces will improve the user experience compared to today’s services running over USSD or SMS bearer channels, which typically require customers to input alphanumeric sequences or navigate relatively unsophisticated menus. Improved usability could make mobile banking more accessible to a wider swathe of low-income consumers, for example by enabling more icon-based menus for low-literacy clients. Also,
as Internet use expands in general, consumers will become more comfortable with using their handset for increasingly sophisticated purposes, which should also bolster adoption of electronic channels for financial services.
Second, access to the Internet will enable providers to offer solutions that do not depend on the security solutions offered using the chip (SIM card) in the phone. Applications resident on the SIM card can provide end-to-end security for messages but require the cooperation of the MNO. While there is some debate whether java applications24 can provide similar levels of security to applications resident on the SIM card, they are likely to provide higher security than today’s USSD and SMS-based services. This will reduce barriers to entry for new players who are not MNOs—whether banks or others. The growth of the mobile Internet may cause a boom in a new generation of mobile banking providers, raising substantial questions about risks to consumers, as well as the future shape of the competitive landscape, one of the uncertainties taken up in the next section.

11.2 Four uncertainties

Uncertainty1. Who is allowed to play?

Regulators will make key decisions that will determine which entities can legally provide mobile banking services and also which business models are viable.
Two of these decisions will be especially important:
• *Can financial service providers use agents for account opening and cash handling?* A

recent CGAP survey of regulators in 139 countries reported that 40 percent of jurisdictions allow banking agents. But of those that do, only onethird permits agents to open bank accounts for customers, including conducting know your customer (KYC) checks (CGAP 2009). KYC regimes will affect the cost of acquiring new customers. In regimes in which agents are not allowed, mobile banking that relies on agents cannot take off at all.

• *Can nonbanks issue e-money?* Most countries today do not allow nonbanks to take savings deposits. This is unlikely to change, given the regulatory caution toward innovation that is part of the second force described above. However, there is increasingly a division between countries that make explicit provision for a new tier of Union and, from March 2009, the Philippines and those that restrict e-money issuance to existing financial institutions only (e.g., South Africa and India). This issue has obvious significance for the entry by entities, such as MNOs, that often have stronger business cases for going down market with basic financial services than do conventional banks.

The extent to which regulators make more “access friendly” decisions will be determined by their degree of confidence about whether the risks of innovation are manageable. This will be shaped by experience of mobile banking businesses over time. The lobbying power of private sector actors may also affect the outcome. The loudest voices, traditionally banks for financial regulators, may lobby for being less open to new players and services to protect their franchises. At the same time, there is a growing constituency for financial inclusion in many countries that will also try to influence regulators to allow some forms of innovation, provided that these do not place the money of poor customers at risk. Finally, regulators rely heavily on the canon of regulatory solutions acceptable to their peers in other central banks. Increasingly, on issues like mobile banking, the leading edge of regulatory innovation is in developing countries, and central bankers are looking to south–south dialogue as an important part of shaping their decisions.

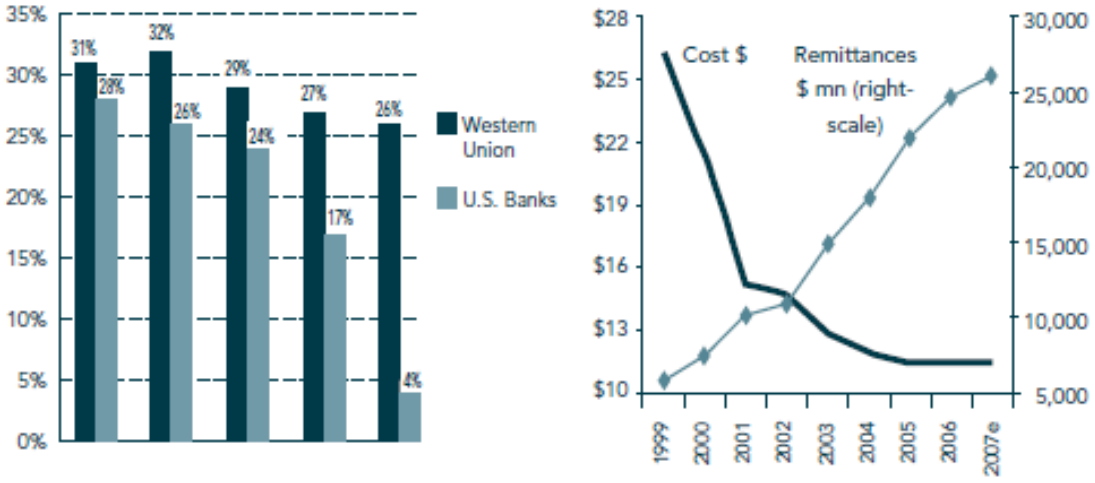
Uncertainty 2. How much will mobile banking go beyond payments into savings and other banking services for unserved people?

Mobile banking schemes to date largely have been built around payments and domestic remittance services. More than half of M-PESA customers use the service primarily for remote person-to-person payments; payments to businesses make up three quarters of transactions at Brazilian correspondents. However, services beyond payments are already on offer and are used by low-income customers. In less than five years, Banco Azteca has opened 8.1 million deposit accounts and 8.3 million loan accounts and has sold 11 million insurance policies, largely to lower income Mexicans (Rhyne 2009). Likewise, in addition to basic banking and paying social transfers, FINO in India offers health insurance services.

Even the payment-only models are being manipulated by customers to serve purposes beyond payments. For example, 21 percent of M-PESA users say they use the service to store money (FSD Kenya 2009b). And the demand for these services is strong. In the Philippines, when asked about additional uses of mobile banking, savings ranked as the most popular among the unbanked, with 53 percent of unbanked mobile money users saying they would consider trying a mobile-based savings service (Pickens forthcoming).

Conventional wisdom suggests that consumers climb a ladder of financial products that starts with payments such as remittances and airtime sales as the first rung. Using these creates the appetite for moving to the next rung—a bank account—and eventually further up to formal credit and insurance. There is ample evidence to support this expectation of increasing demand in the more traditional client–bank relationships with better off

consumers. However, there is also reason to believe it is much weaker with mobile banking and the poor. For example, the experience of Mzansi—with just 11 percent of clients so far buying another financial product from their bank—suggests uptake of additional services is far from automatic (Bankable Frontier Associates 2009).
It is possible that the traditional paradigm around the bank account is changing. Whereas in developed countries banks offer a checking account as a lossleading product because it is highly “sticky” enabling the sale of other profit-making services, this may not be true in developing countries.26 In the prepaid services world (for electricity, water, as well as mobile) in which most poor consumers live, services are provided as part of a pay-per-use relationship between provider and consumer. Where there are multiple providers, there is high churn; this limits the ability to cross-sell, but also makes the cross-sell more important for the business case.
The ability to cross-sell will be determined in part by regulation. The ability of banks to intermediate deposits is almost universally denied to e-money issuers for example, denying them the credit margin. Few would argue against this restriction. But without this margin, business models for small savings will have to be highly cost efficient, therefore, given the economies of scale around IT platforms and networks, probably also very large scale. This factor will affect competitive dynamics.



Sources: Western Union (2008), FDIC, World Bank remittance prices database for U.S.-Mexico corridor

Figure 20: Declining operating margins and prices for banks and remittance companies and consumers

Uncertainty 3. How will competitionplay out?

Competition for customers and agents is likely to grow as more entrants join the field. The germane question for this scenarios exercise is whether competition will spur more services, innovation, and lower margins and prices as it has in the past decade for banks and remittance companies (Figure 20).
Early electronic and mobile business models (such as Google, PayPal, and even M-PESA) suggest success comes from leveraging scalable platforms and widely recognized brands. Early success can lock out competition. In sectors such as banking and communications, market structure is changing as a result of consolidation, even before the financial crisis exacerbated this trend in the banking sector of affected countries. Among MNOs, for example, the largest 20 groups today control more than 70 percent of subscribers.27
Greater scale of providers is not necessarily harmful. It can help reduce costs, which can

advance financial inclusion if these savings are passed onto clients. However, scale in itself may bring greater operational risk. For example, fewer independent payment platforms may mean greater risks when one malfunctions or collapses.
Further, scale has implications for continuing innovation in mobile banking. Comfortable incumbents are unlikely to be the source of innovation in their own market. They may also grow big enough to crowd out potential competitors, particularly in smaller markets where a big early lead in market share could appear insurmountable. This situation may lead new entrants eventually to seek out new pools of unserved customers or financial needs not met by providers who are already established in the market.It may also lead to greater calls for interoperability. Shared IT platforms and infrastructure may enable smaller providers with niche business models to start up and function on the front end, sharing access to existing infrastructure.
However, in all but a few markets, an increasing number of players will offer mobile channels because of the combination of market opportunities and pressures created by the forces listed earlier, such as market potential and the rising use of dataphones. Uncertainties such as who is allowed to play will shape just how contestable the financial services market of the future will be.

Uncertainty 4. How would the failure of a large mobile banking model affect market confidence?

As is common with other new services, customer, provider, and regulator confidence in mobile channels is still fragile. A high-profile failure could diminish the trust of consumers to adopt, the appetite of industry to enter, and the openness of regulators to enable. Consumers, even poor consumers, appear willing to make the transition to using electronic channels as long as they trust the provider. Trust in the brand of the ultimate provider may be sufficient.
Users of mobile banking may not even have to trust the agents (Moracynski 2007). As a side effect of pervasive communications, news and rumors spread faster than ever. A 21st century bank run could happen in hours instead of days as customers learn of problems and move their money electronically. Recently, the Kenyan news reported the effects even of a short-term disruption of the M-PESA service: “A technical hitch in the M-PESA money transfer service caused anxious customers to crowd at service outlets to have their accounts updated…. Customers had initially been barred from accessing the premises on safety fears after their demands for an up-to-date reflection of their accounts got boisterous. Several administration police officers were deployed to the centre to boost the efforts of private guards in calming the angry crowd” (*Business Daily* 4 August 2009).
As mobile banking schemes scale up, the potential ripple effects of failure grow, too. Nonbank e-money models, such as M-PESA, depend on aggregating wholesale deposits within the banking system. In this sense, they redistribute liquidity within the economy—taking thousands or millions of small balances and consolidating them into one or a few large deposits at banks. This aggregation process may increase liquidity risk for the wholesale bank, which is more vulnerable to the movement of a large wholesale deposit account. Hence, even failures of nonbank-based models can spill over to the banking system.
Because mobile banking is relatively new, we have yet to witness the effects of a major failure on domestic users, firms, and regulators. In the field of mobile banking, the closest example of this may be the failure of SK Telecom’s Moneta Cash service in South Korea in 2002 (Mas and Rotman 2008).
Notwithstanding this early high-profile failure, South Korean consumers remain, along with

the Japanese, among the foremost adopters of mobile banking channels worldwide, indicating that consumer confidence can recover.

Apart from these four major uncertainties, we also acknowledge the possibility of low-probability, highimpact events—wildcards or “black swans”—such as the following:

• *War.* If a global conflict were to erupt, it would likely be fought in part in cyberspace by disrupting telecommunications infrastructure, banking systems, and even governments. On the positive side for mobile banking, some have proposed the need for “expeditionary banking” to provide rapid rollout of payment systems in post-conflict societies to deliver humanitarian aid, kick-start commerce, and enable government payments (Kunkel 2008).

• *Pandemics.* Global pandemics may accelerate the need for remote payment systems to avoid face-to-face contact during shutdown periods. The systems would need to be considered essential infrastructure if they are to continue to operate during a health crisis *Can a society eliminate cash by 2020?* The ability to place cash close to consumers in many distributed service points (agents) is a defining feature of mobile banking. But what if one or more governments succeeded in banning cash and substituting a fully electronic currency? The Maldives hopes to reduce cash, Nordic countries have banned checks, and Singapore hopes to substitute a fully electronic currency for paper notes in the near future, though its experience illustrates that challenges to going cashless are still quite strong.

Conclusion

In closing, it is clear to identify the significant potential that NFC enabled mobile payments have just by observing the global implementation initiatives that continue to sprout up. However, it is important not to get carried away thereby focusing only on the exciting new technology. The NFC ecosystem is vast and diverse highlighting the need to assess and examine all aspects, including the consumer, in detail. This research has proved the important role that certain NFC enabled mobile payment adoption characteristics such as cost, relative advantage, complexity, compatibility, trust and security have in the future adoption of this mobile payment method by South African consumers. By making use of these findings solution providers can increase the likelihood of successfully rolling-out NFC enabled mobile payment capabilities to the masses. African NFC enabled mobile payment initiative because of the potential that this technology has to improve the quality of life for citizens across socioeconomic classes.

LIST OF ABBREVIATIONS

NFC	Near Field Communication
RFID	Radio Frequency Identification (technology)
GDP	gross domestic product
B2B	business to business
P2P	person to person
B2C	business to consumer
SMS	Short Message Service
USSD	Unstructured Supplementary Service Data
GRPS	General Packet Radio Service
3G	Third-generation
LBS	Location-Based service
IVR	Interactive Voice Response
WAP	Wireless Application Protocol
GPRS	General Packet Radio Service
WAP	Wireless Application Protocol
ECMA	European association for standardisation information and communication systems
ESTI	European Telecommunications Standards Institute
NFCIP-1	Near Field Communication, Interface and Protocol - 1
LBS	mobile location based service
ICASA	Independent Communication Authority of South Africa
OEM	original equipment manufacturers
MNO	mobile network operators
OTA	over-theair
GSMA	Global Scheduling Multiple Access
UAE	United Arab Emirates
TSM	Trusted Service Manager
JBR	Jumeriah Beach Residence
MNOs	Mobile network operators
CPSS	The Committee on Payment and Settlement Systems
AML-CTF	Anti Money Laundering/ Combating the Financing of Terrorism

CDD	customer due diligence
KYC	Know Your Customer
OECD	Organisation for Economic Co-operation and Development
SA	South Africa
SSA	the rest of Sub-Saharan Africa (i.e. excluding SA),
ISO/IEC	International Organisation for Standards/International Electro-technical Commission
EFT POS	Electronic Point of Sale

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