

# **ADOPTION OF SMART CARD TECHNOLOGIES IN KENYAN BANKING INSTITUTIONS**

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## DECLARATION

This Project is my original work and has not been submitted for a degree to any other University.

Signed: 

Date: 02-MAR-2005

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This Research Project has been submitted for examination with my approval as the University Supervisor.

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## **DEDICATION**

Dedicated to my father and mother - the late Ambrose Mwalo and the late Domtila Mwalo and to my family - my wife Betty and children, Cathy and Ian.

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# **TABLE OF CONTENTS**

DECLARATION.....	ii
DEDICATION.....	iii
ACKNOWLEDGEMENT.....	iv
LIST OF TABLES.....	vii
LIST OF FIGURES.....	viii
LIST OF ABBREVIATIONS.....	ix
CHAPTER ONE: INTRODUCTION.....	1
1.1 Background.....	1
1.2 Statement of the Problem.....	4
1.3 Objectives of the Study.....	6
1.4 Significance of the Study.....	6
CHAPTER TWO - LITERATURE REVIEW.....	8
2.1 Introduction.....	8
2.2 Theoretical Background.....	8
2.3 Smart card - a new paradigm for banks.....	10
2.4 Smart Card's place in Payment System.....	12
2.5 Growth of Electronic money.....	13
2.6 Past Adoptions of Smart Card Technology.....	15
2.7 Factors Relevant for Adoptions.....	18
2.8 Challenges of Adoption of Smart card.....	20
2.9 Payment System in Kenya.....	21
CHAPTER THREE: RESEARCH METHODOLOGY.....	26
3.1 Research framework.....	26
3.2 The Population.....	26
3.3 Data Collection.....	26
3.4 Data Analysis.....	28
CHAPTER FOUR: DATA ANALYSIS AND FINDINGS.....	30
4.1 Analysis of general information on the banking Institutions.....	30
4.1.1 Size of the Banks in terms of Number of Branches.....	30
4.1.2 Size of the banks in terms of number of employees.....	31
4.1.3 Number of Automated Teller Machines (ATMs).....	31
4.1.4 Ownership of banks.....	32
4.1.5 Level of Capitalisation (Ksh billion).....	33
4.1.6 Customer base.....	33
4.1.7 Presence in East and Central African region.....	34
4.1.8 Level of Information Technology (IT) sophistication.....	34
4.2 Level of adoption of Smart card Technology among the Banking Institutions.....	35
4.2.1 Awareness of Smart card technology.....	35
4.2.2 Benefit to Customers.....	36
4.2.3 Competitiveness in the Kenyan Market.....	36
4.2.4 Scope of services.....	37
4.2.5 Implementation of Smart card technology.....	38
4.2.6 Support for smart card transactions done from other business institutions.....	38
4.2.7 Plan for future implementation of the technology.....	39

4.2.8	Priority on smart card adoption by banks .....	41
4.2.9	Policies that support smart card adoption .....	41
4.2.10	Current Telecommunication regulation in Kenya.....	42
4.2.11	Collaboration with International Payment Card business companies .....	43
4.2.12	Membership of smart card promoting associations .....	43
4.2.13	Dedication of a team for adoption of smart card technology.....	44
4.2.14	Level of Understanding of the technology in the bank.....	44
4.2.15	Training of staff on smart card technology.....	45
4.2.16	Equipment – hardware and Software for Smart card adoption.....	46
4.2.17	Programmes for educating the consumers and merchants on the technology .....	47
4.3	Analysis of factors critical to smart card readiness among the Banking Institutions.....	47
4.4	Challenges facing Banking Institutions in Kenya in adopting smart card technology....	59
	CHAPTER FIVE – SUMMARY AND CONCLUSION.....	62
5.1	Discussions .....	63
5.1.1	Level of adoption of smart card technology .....	63
5.1.2	Factors critical to smart card readiness among banking institutions in Kenya.....	66
5.1.3	Challenges facing banking institutions in adoption of smart card technology .....	68
5.2	Conclusions .....	71
5.3	Limitations of the study and Suggestions for future research .....	73
5.3.1	Limitations .....	73
5.3.2	Suggestions for further research .....	74
	APPENDIX .....	75
6.1	Appendix 1 - LIST OF BANKING INSTITUTIONS IN KENYA.....	75
6.2	Appendix 2 - QUESTIONNAIRE.....	76
6.3	Appendix 3 - LETTER TO RESPONDENTS.....	83
	BIBLIOGRAPHY .....	84

## LIST OF FIGURES

2.10.1	2001 Geographical breakdown figures of card shipments.....	16
2.10.2	2001 Card Shipments figures per sector.....	17
2.10.3	2000 Card Shipments figures per sector.....	17
2.10.4	2000 Geographical breakdown figures of card shipments.....	17
2.10.5	1999 Geographical breakdown figures of card shipments.....	18
2.10.6	1999 Card Shipments figures per sector.....	18
4.3.1	Scree Plot.....	52

## LIST OF ABBREVIATIONS

e-money -	Electronic money
EDI -	Electronic data interchange
POS -	Point of sale
ICT -	Information and communication technologies
e-commerce -	Electronic commerce
B2B –	Business to Business
B2C –	Business to Consumer
GSM -	Global System for Mobile communications
PIN –	Personal Identification Number
SVC -	Stored Value Cards
ACH -	Automated clearing-houses
ATM -	Automated teller machines
SIM -	Subscriber identity module
STK -	Subscriber identity module Toolkit
EFT –	Electronic Fund Transfer
S.W.I.F.T -	Society for Worldwide Inter-Bank Financial Tele-communication



# CHAPTER ONE: INTRODUCTION

## **1.1 Background**

In the past several years technological advances have redefined how, where and when consumers can make payments for goods and services and get banking services. Today millions of people all over the world rely on a variety of payment cards to pay for everything from college tuition and medical bills to supermarket purchases. We are in the middle of a transition from a paper-based money world (including cash, cheque, and other traditional forms of payments) to an e-money world (including credit/debit cards, electronic cheque, as well as online and offline electronic purses, among others) Andrieu (2001).

Since the invention of money itself, each of its successive incarnations has provided opportunities for major changes, not only in the way transactions are carried out, but also in the way wealth is measured and stored and, more generally, in the nature and scope of economic activities (Andrieu, 2001). Electronic money (e-money) refers to electronic payment instruments that include credits card, debit card, electronic data interchange (EDI) and smart card. E-money has already brought about substantial changes.

Further inroads of e-money instruments in the paper money world will provide additional benefits, notably in terms of efficiency and convenience. Indeed, the widespread adoption of these instruments could also generate a restructuring of economic activities and result in the emergence of a broad range of new services (Andrieu, 2001). Payment cards are instruments of e-money. Puri (1997) says that payment cards have been around for along time and with them the convenience has been discovered and enjoyed and that the next generation of the transaction card is being brought in by smart cards.

Smart card is the latest of payment card technologies and has been implemented by major organizations and banks in many countries in the world, particularly in Western Europe, North America and Australia. The smart card industry came of age in 2000, with open platforms achieving significant volumes for the first time. Despite substantial silicon shortages, smart card world shipments grew by 27 per cent to reach 1,790 million in the year 2000 (Schlumberger, 2001).

The power of smart card to hold large amounts of information and programs and to be interactive with Point of sale (POS) terminals and its ability to facilitate relationship banking enables financial service providers to offer differentiated products to their customers (Worthington, 1998). That power means that potentially all the different types of payment functions could be held on the one piece of plastic. Thus it is conceivable that instead of having to hold separate pay later, pay now and pay before cards, possibly issued by different card issuers, the smart card will enable all three functions to be held on the one card, issued to the card holder by the one issuer. The card holder would then decide at the POS whether he/she wished to pay later, pay now, or pay before. Loyalty schemes could be added to the same piece of plastic and the loyalty points collected and redeemed through the card (Worthington, 1998).

Andrieu (2001), say that in coming years, paper money world is likely to lose ground as existing and new e-money instruments receive broader acceptance for a growing range of transactions. He says that although such instruments will have to overcome strong obstacles, notably at the initial stage of their development, they are bound to gain ground gradually under the double thrust of technological and economic forces.

Increasing globalization, liberalization and advancement in Information and communication technologies (ICT) is rapidly influencing the business environment of many firms in Kenya. Their effect is causing turbulence in the external environment of these businesses thereby giving rise to increased threats and opportunities. As a result, more and more of these firms in Kenya are turning to Electronic commerce (e-commerce), just as other firms in other parts of the world, notably USA and Western Europe. (Muganda, 2003). In view of the threats and opportunities some firms have introduced smart card technology for providing their services to their customers and one would expect many more to follow suit and banking sector to play key role in this new technology that define the way people pay for goods and services, by either getting other non-financial organisations to use their (bank's) cards for proving their (non-financial organisations) services or by supporting the financial transactions performed through smart cards introduced by such organisations.

According to Dawes (1996) harsh market environment has led to fierce levels of competition within the personal financial services sector, where banks, building societies and other providers of financial services have been criticized for offering sophisticated consumers undifferentiated products. With customer retention becoming increasingly significant for institutions within the sector, strategies that provide them with competitive advantage are becoming of paramount importance (Dawes, 1996). Farrance (1993) say that lacking clear strategic direction and being undifferentiated, banks find themselves competitively disadvantaged, particularly in cost terms, against the building societies. He suggests that relationship banking may offer a way forward but this requires a better understanding of marketing, organizational flexibility and a clearer customer focus.

## **1.2 Statement of the Problem**

With customer retention becoming increasingly significant for institutions within the financial services sector, strategies that provide them with competitive advantage are becoming of paramount importance (Dawes, 1996). One of the options available to organizations to enhance customer retention is to use smartcard technology. Smart card technology provides banking institutions with opportunity to establish, maintain and enhance relationships with the consumers who choose to hold such cards. They gather information about the customer thus makes the issuer better placed to serve the customer's needs and thus have a competitive edge.

A number of business organizations in Kenya including oil companies, supermarket chains and other organizations have introduced smart cards for providing their services. The key question for banking institutions in Kenya is, who will hold that relationship with the cardholder – the banks or the merchants? The banking institutions need to adopt the technology to control this relationship for competitive advantage.

Smart card technology offers a threat of new entrance to banking institutions. With the introduction of this technology among non-financial institutions in Kenya banking institutions would suffer the threat of new entrance into their industry and loss of some services hitherto provided by them (banks). Smart cards, with other changes in technology of electronic payments, provide non financial networks with ease of conversion to financial networks thus offer opportunities for non-financial businesses to enter the financial service industry by targeting such specialized areas as payment and settlement without needing any longer the synergies traditionally obtained by banks from accepting deposits and extending loans (Andrieu, 2001). By

adopting and adapting Smart Card too slowly financial services organisations risk major losses in market-share, and even contraction or outright failure (Clarke, 1997).

Kenyan Banking Institutions have in the past invested heavily in Treasury bills during the years when Kenya did not receive donor aid from external donors like International Monetary Fund (IMF) and World Bank. The Government therefore relied heavily on domestic borrowing (Kenya's domestic debt in the years (1999/2000, 2000/2001 and 2001/2002) were over Ksh. 200 billion every year (Central Bank of Kenya, Statistical Bulletin June 2003)). This had offered the commercial banks in Kenya a line of business from which to make profits. But this was a temporary situation that is bound to change and Kenyan banks would have to look elsewhere to sustain their profit performance. Use of smart card technology offers banking institutions with an opportunity to expand scope of their services.

Considering the business opportunities and benefits that smart card technology seeks to offer to financial institutions and their customers respectively and the competitive pressures it would provide to the banking sector one would expect that banking Institutions in Kenya would spearhead smart adoption in the country. However it is important to establish this phenomenon.

The study is an exploratory one that seeks to establish the extent of adoption of smart card technology among banking institutions in Kenya, the factors they consider critical for adoption of the technology in the country, and the challenges they are facing in adopting the technology.

### **1.3 Objectives of the Study**

The study has the following objectives:

1. To establish level of adoption of smart card technology among Kenyan Banking Institutions.
2. To establish what factors are critical to smart card readiness among Kenyan Banking Institutions.
3. Identify challenges facing Banking Institutions in Kenya in adopting smart card technology.

### **1.4 Significance of the Study**

From the research, the status of the development towards adopting smart card technology as a payment system would be established.

The findings of this study would help draw the way forward to tap the benefits of this useful technology. By establishing the smart card readiness of Banking Institutions the study helps to provide the readiness of Kenya to provide growth in business transactions through smart card payment system.

With the findings of this study the government could place smart card technology, in partnership with Banking Institutions and other stakeholders, in its national economic plan and explore the benefits that can be derived from the technology. The research would therefore be important to both the Ministry of Trade and Industry and Ministry of Planning in formulation of Policy and Strategy for economic growth.

The research would be of significance to investors interested in taking up the enormous business opportunities that smart card technology provides.

The research will also be substantially significant to the Banking Institutions since it will show them their shortcomings and achievements towards their ability to remain competitive in the global market in changing technological trends. That would help them draw a better way forward.

The study will also add to the existing body of knowledge in the field of smart card technology and provide a basis for further research on related subjects.

## **CHAPTER TWO - LITERATURE REVIEW**

### **2.1 Introduction**

This chapter discusses available information on smart card technology, its adoption in other parts of the world in terms of developments, factors that were critical to such implementation, experiences and challenges.

### **2.2 Theoretical Background**

The smart card has been defined by Worthington (1998) as a payment card that carries an embedded computer chip with memory and interactive capabilities that allow it to exchange data at an electronic point of service/sale (POS) terminal. Smart cards come in two varieties: memory and microprocessor. Memory cards simply store data and can be viewed as a small floppy disk with optional security. A microprocessor card, on the other hand, can add, delete and manipulate information in its memory on the card. Similar to a miniature computer, a microprocessor card has an input/output port operating system and hard disk with built-in security features.

Smart cards help businesses evolve and expand their products and services in a changing global marketplace. Some of the areas in which smart card are used include the following:-

#### **1. Information Technology**

Businesses, the government and healthcare organizations continue to move towards storing and releasing information via networks, Intranets, extranets and the Internet. These organizations are turning to smart cards to make this information readily available to those who need it, while at the same time protecting the privacy of individuals and keeping their informational assets safe from hacking and other unwanted intrusions (Lambrinoudakis, 2000). Smart cards can provide extensive support for implementing state-of –the-art



mechanism for protecting the main security attributes of information namely confidentiality, integrity and availability (Lambrinouidakis, 2000). In this capacity, smart cards enable:

- Secure logon and authentication of users to PCs and networks
- Secure B2B and B2C e-commerce
- Storage of digital certificates, credentials and passwords
- Encryption of sensitive data

## **2. Mobile Telecommunications**

People using the Global System for Mobile communications (GSM) standard for mobile phones use smart card technology. The smart card is inserted or integrated into the mobile handset. The card stores personal subscriber information and preferences that can be PIN code protected and transported from phone to phone (Lambrinouidakis, 2000). The smart cards enable:

- Secure subscriber authentication
- Roaming across networks
- Secure mobile value added services

## **3. Commercial Applications**

Smart cards also provide benefits for a host of commercial applications in both B2B and B2C environments. The smart card's portability and ability to be updated make it a technology well suited for connecting the virtual and physical worlds, as well as multi-partner card programs. The cards store information, money, and/or applications that can be used for:

- Banking/payment
- Loyalty and promotions

- Access control
- Stored value
- Identification
- Ticketing
- Parking and toll collection (Lambrinouidakis, 2000)

Multiple applications can be stored on the card, enabling partnering on card programs and providing added convenience to the card reader.

A smart card carries more information than can be accommodated on a magnetic stripe card. It has a computer chip with memory and can make a decision, as it has relatively powerful processing capabilities that allow it to do more than a magnetic stripe card.

The price of a smart card depends upon its capacity. The average price for all microprocessor cards is \$3.79 (Ksh 272.90) each, whereas, the average price for a memory card is estimated at 47 cents of a Dollar (Ksh 33.90) (Smartcard forum, 2002)

### ***2.3 Smart card - a new paradigm for banks.***

Roland Moreno, father of the microchip, filed the first patent on 25 March 1974 for the Smart Card. The first cards were issued a few years later but the initial reception was unenthusiastic. These first cards were highly advanced but very expensive to manufacture. The miniaturization of electronic components in 1978 made it possible to mass produce Smart Cards for general release. Since then, the demand has inextricably grown, to a stage where Smart Cards can now be found on every continent throughout the world (Chance, 1998).

Smart cards technology provides consumers with a new method of paying for goods and services and banks with a technology that define how business is done in their sector. According to Worthington (1998) the power of smart card to hold large amounts of information and programs and to be interactive with Point of sale terminals and its ability to facilitate relationship banking enables financial service providers to offer differentiated products to their customers.

During the last two decades, the plastic payment card has been introduced as another element in the distribution mix for financial services and the introduction of chip-based plastic card (smart cards) opens up the possibility that in future decades the plastic card will be a key channel for distributing a wide range of financial services (Worthington, 1998). The chip card would offer card holder access to management of their other financial affairs. The power of the chip would enable card holders to authorise and access true home banking, by placing their card into a reader attached to their screen, keyboard or telephone. The card would enable access to savings, investments and borrowing accounts and facilitate the transfer of funds between accounts, the drawing down of lines of credit and/or the deposit of funds into the card holders' accounts. The chip card would also be the link between home banking and home shopping by providing the payment mechanism which enables secure payments to be made across the electronic infrastructure, again in either pay later, pay now, or pay before mode (Worthington, 1998).

Smart card has a variety of security features through the execution of cryptographic algorithms. This type of supported functionality is ideal for extending information systems with portable data files of any kind that the smart card owners can carry with them, thus supporting the required distributed nature (Lambrinoudakis, 2000). Lambrinoudakis, (2000) say that smart cards can provide extensive support for implementing state-of-the-art mechanisms for protecting the main

security attributes of the information; namely confidentiality, integrity and availability. They also offer several different ways for managing authorization privileges, in respect to who has the right to read, write or erase the information, as well as for classifying data depending on whether they are public or they need a certain level of protection.

The use of smart cards as stored value cards to replace cash in such everyday transactions as transport and telecommunication also offers the issuers of these cards an early "critical mass" of cardholders, which then makes easier the recruitment of other providers of goods and services to accept these cards as payment mechanisms. Traditional suppliers of financial services may find themselves excluded from such developments, unless they can form partnerships, alliances and joint ventures with the organisations that have the products to access these markets (Worthington, 2000).

## ***2.4 Smart Card's place in Payment System***

In defining the place of smart cards in payment system it is important to consider what type of payment the card represents in comparison to other payment methods that exist in the market.

Credit-cards are appropriate in particular circumstances. They are, however, very expensive. This is primarily because of the low level of security (which relies on embossing, magnetic-stripes, signatures and stop-lists), and the resultant high and increasing cost of fraud. In addition, transaction-processing costs are significant (Clarke, 1997).

Debit cards are relatively highly secure, because they require the customer to confirm that they know something that only the card-owner should know: the PIN. But whereas the costs from

error and fraud are very low, the communication costs associated with fully on-line transactions are high (Clarke, 1997).

Unlike 'pay-later' credit-cards and 'pay-now' debit-cards, Stored Value Cards (SVC) are a 'pay-before' mechanism. Their great advantages are relative security, and simple, off-line operation. Together, these translate into low transaction costs (Clarke, 1997).

The resultant effect could be a 'pyramid' of payment transactions. At the top are relatively small numbers of 'pay-later', credit card transactions, each of relatively high-value (say, above \$100), which justifies reasonably high transaction costs. In the middle, moderate volumes of moderately-sized (\$20-\$200) 'pay-now', debit-card transactions (Clarke, 1997).

At the bottom of the pyramid are myriads of low-value transactions too small to justify even debit-card costs. At present these are mostly performed using cash, which has high hidden costs for merchants and banks. This is the target area for low-cost SVC transactions (Clarke, 1997).

Smart card use in Payment system is equally important in marketing by proving data that would be important for marketing initiatives for various organisations (Byrom, 2001).

## ***2.5 Growth of Electronic money***

Electronic money (e-money) refers to a number of electronic payment instruments that include credits card, debit card, electronic data interchange (EDI) and smart card. Even though financial services industry pioneered the automation of back office information handling processes in the 1950s and 1960s, the widespread use of electronic currency did not begin until automated

clearing-houses (ACH) were set up by central banks in North America and in Europe in the early 1970s to provide commercial banks with an electronic alternative to cheque processing (Andrieu, 2001). As a result of these innovations, money is becoming 'virtual' in the sense that it is increasingly expressed as an assemblage of ones and zeros which can be displayed on millions of computer screens throughout the world, can be transferred at the speed of light and yet is located nowhere and needs no vault for safekeeping (Andrieu, 2001).

Electronic currency has been widely used throughout the world on an institutional level for more than three decades. It is present today in many segments of the payment system in the guise of electronic data interchange (EDI) systems, inter-bank payment networks (e.g. Fedwire in the USA), automated clearing-houses, automated teller machines (ATM), point of sale debit card and credit card networks. These electronic systems are highly automated and efficient forms of payment that provide services on physically closed networks of computers, where access is highly restricted (Andrieu, 2001). EDI is estimated to support about \$3 trillion in economic activities in the USA alone. About 80 per cent of the dollar value of inter-company transactions among Fortune 500 companies in the USA is conducted through EDI systems (Andrieu, 2001).

Smart card technology was developed over 20 years ago but its low acceptance into mainstream markets has been blamed upon a lack of supporting infrastructure and universally accepted standards. However, there is little doubt that smart cards have huge potential in terms of their application and recent evidence seems to show that predicted growth rates will continue as more application of smart card technology to electronic commerce is realised (Szmigin, 1999).

The star application sector for smart cards has been SIM (subscriber identity module) cards for mobile phones which has been expanding due to strong demand from consumers for mobile

phones and intensive drive by operators to roll out value-added services based on SIM Toolkit (STK) (Schlumberger, 2001). Banking cards is the next largest market sector for microprocessor smart cards and has also continued to grow (Schlumberger, 2001).

## ***2.6 Past Adoptions of Smart Card Technology***

Past adoptions of the smart card include, Mondex, a multi-application chip card in Swindon, United Kingdom, which commenced in July 1995 (Worthington, 1998). The card is an electronic purse, which can be loaded with value from an ATM or a public telephone and subsequently downloaded if value is to be transferred back into its supporting deposit account. Value can also be transferred person to person, using two Mondex cards and the Mondex wallet to effect the transfer. In Swindon the card can be used to purchase a wide range of goods and services, from newspapers, parking and transport, to meals, books and even the placing of bets (Worthington, 1998).

Danmont card, in Denmark has been in operation since December 1993 (Worthington, 1998). It can be purchased in banks and convenience stores, with values of between 100 and 500 Danish Kroner. The Danmont card can be used in certain telephones, parking places, newspaper vending machines and self-service laundries, the latter throughout Denmark, while the other service providers are located primarily in Copenhagen. The chip on the Danmont card is not rechargeable, so when the amount on the card has been used up, the card is disposable (Worthington, 1998).

An EU-supported project called CAFE (Conditional Access for Europe) has been put together to come up with an advanced payment device that can function as an interoperable cross-border electronic purse for Europe (Puri, 1997).

Other smart card adoptions include a multi-purpose national electronic purse called the “Porta Moedas Multibanco” (MEP) has been developed jointly by 32 banks in Portugal, “Proton” in Belgium by the Belgian banks (Puri, 1997) and American Express Blue smart card program in the USA and Canada.(Schlumberger, 2001).

Other countries which have adopted smart card technology in the past include France which has had chip-based payment cards since the early 1990s; Australia, Hong Kong and Singapore have had successful pilots of chip card technologies (Worthington, 1998).

### World figures on Smart Card Consumption

EUROSMART, an international association located in Brussels representing the Smart Card Industry for multi-sector applications has given the following figures on Smart Consumption from their shipment figures.

Figure 2.10.1: 2001 Geographical breakdown figures of card shipments

	2001 (Mu)			
	Memory	%	Microprocessor	%
EMEA	440	38,2	346	57,8
ASPAC	239	20,7	208	34,7
AMERICAS	473	41,1	45	7,5
Total	1152		599	

Mu – Million Units. Source: eurosmart.com on 22-May-2003



Figure 2.10.2: 2001 Card Shipments figures per sector

	Memory (MU)	Microprocessor (MU)
Government / Healthcare	16	16
Telecom	1050	390
Transport	27	8
Pay TV	0	25
IT / Security	0	5
Financial Services	2	140
Loyalty	37	11
Others	20	4
Total 2001	1152	599

Source: eurosmart.com on 22-May-2003

Figure 2.10.3: 2000 Card Shipments figures per sector

	Memory (MU)	Microprocessor (MU)
Banking	0	120
Healthcare	7	30
Telecom	1020	370
Transport	10	3
Pay TV	0	20
IT	0	5
Others	25	3
Total 2000	1062	545

Source: eurosmart.com on 22-May-2003

Figure 2.10.4: 2000 Geographical breakdown figures of card shipments

	2000 (Mu)
EMEA	888
ASPAC	424
South America North America	291
Total	1603

Source: eurosmart.com on 22-May-2003

Figure 2.10.5: 1999 Geographical breakdown figures of card shipments

	1999 (Mu)
EMEA	903
ASPAC	262
South America North America	264
Total	1429

Source: eurosmart.com on 22-May-2003

Figure 2.10.6: 1999 Card Shipments figures per sector

	Memory (MU)	Microprocessor (MU)
Banking		108
Healthcare	27.5	30
Telecom	913	200
Transport	40.5	3
Pay TV / IT	1	29
Others	49	28
Total 1999	1031	398
	1429	

Source: eurosmart.com on 22-May-2003

The figures show an increase in consumption of smart cards in most of the sectors and in most geographical regions over the years.

## 2.7 Factors Relevant for Adoptions

In many of the past adoptions several factors have been mentioned as relevant for successful adoption of the technology as a payment system. Worthington (2000), notes that enhanced functionality of card is one of the reasons for its success as a means of payment in both Australia and UK and will be a source of its continued growth of popularity in the future. Puri (1997), say that Development of application-based business specifications that promote inter-operability of

cards, terminals, networks and security system is important for world wide adoption of smart card. He says financial smart card has memory and processing capabilities, but must be capable of operating in an open system. For that, he says, worldwide standards are needed.

Puri (1997) also notes others factors as adoption of industry standards and provision of public policy positions with regard to issues surrounding applications and the technology such as privacy and regulation. He singles out anonymity and auditability as features of electronic purse that need to be considered in adoption of smart cards for financial transactions. Another one he considers is regulatory issues that electronic purse raise. One of these is to ensure integrity of the firm holding the money. Japan issued special regulations for prepaid card firms to ensure that the firm retained enough capital to pay its obligations.

Andrieu (2001) singles out some of the factors as regulation of payment systems, security, privacy, and consumer protection. He says these issues are likely to have a bearing on adoption of these technologies.

Worthington (1996), argues that that acceptance of the smart card as a new payment option depends heavily on retailers' attitudes and these will be formed by the so-far unquantified balance of costs and benefits that will accompany the introduction of the smart card. The financial institutions, which are supporting the introduction of the smart card have their own agenda and a business case based on a cost and benefit analysis. They would, however, do well to consider fully the other players in the payment system supply chain, the retailers and the consumers (Worthington, 1996).

Clarke (1997), basing his arguments on Australian schemes, say that technical feasibility and reliability is a factor of adoption but he argues that achievement of sufficiently high adoption rates and hence economic feasibility, depends on the ability to achieve critical mass across several dimensions. In Australia, until the 'any-card/any-terminal' condition was fulfilled, consumers and merchants alike regarded the technology with scepticism, and early-adopter institutions had their fingers burnt. Consumers and merchants needed the assurance that SVC schemes will not be fragmented through unhelpful forms of competition (Clarke, 1997). Another concern, he says, was the breadth of usability of the card.

Szmigin (1999), in his study of the Mondex singles out security, speed and complexity of use as some of the factors important for adoption of smart card. Kapoor (2002) argues that another major challenge is establishing an extensive infrastructure for smart cards, so that consumers can use them effectively

Andrieu (2001) notes that e-money would have to operate in an economic environment where its use is particularly suitable and which is sufficiently dynamic to overcome obstacles to its development. Moreover, a number of regulatory and institutional stumbling-blocks that could slow considerably its widespread acceptance as a payment instrument will need to be removed.

## ***2.8 Challenges of Adoption of Smart card***

Like any other innovation past adoptions of smart card have experienced several challenges. For Danmont of Denmark, the initial marketing challenge was to convince service providers to accept the card as a means of payment. Another challenge was to get a critical mass of cards in

use (Worthington, 1996). Worthington (1996) argue that the first challenge in new adoptions is how to educate and entice cardholders away from their existing payment media on to the use of just one piece of plastic.

According to Andrieu (2001), large presence of cash (notes and coins) in retail transactions is a challenge to e-money adoptions that financial service providers would need to contend with. A study of the Committee on Payment and Settlement Systems of the Bank of International Settlements (BIS) suggested that the share of cash in the GDP (Gross domestic product) of OECD countries was not declining. The share of notes and coins in GDP remained relatively stable during the 1990s in OECD countries. Indeed, in the three largest OECD economies (USA, Japan and Germany), it increased.

Andrieu (2001) also mentions other challenges to e-money adoption as large cost of migration from current payment instruments, fast speed of technology – too fast to cope with for some financial service providers, and uncertainty of standards.

## **2.9 Payment System in Kenya**

The Central Bank of Kenya (CBK), aware of the numerous benefits of an efficient payment system, especially in its role in the effective implementation of the monetary policy operations, and financial stability, is jointly collaborating with Kenya Bankers Association in co-ordinating the modernisation and the reform programme of the payment systems in Kenya (CBK, 2001).

### **General Legal framework for Electronic payments**

In Kenya, there is no law that explicitly and exclusively deals with payment systems (CBK, 2001). However, in its current form, Central Bank of Kenya (CBK) Act, as amended in 1996

gives the Bank powers to oversee and regulate the payment systems. Section 4A of the Central Bank of Kenya Act provides that the bank shall “promote the smooth operations of payments, clearing and settlement systems”. Section 4A further stipulates that the Bank has the sole right to “issue currency notes and coins”. The new statutes recognise these two tasks as fundamental responsibilities of the Central Bank (CBK, 2001).

The CBK is exploring the need for an explicit legal framework to support the payment systems modernisation process. This includes introducing regulations and laws in relation to Electronic Funds Transfer, E-Banking, E-Money Schemes and Products, Money Laundering Law etc. (CBK, 2001).

### **Kenyan Financial Institutions**

Major institutions that provide payment services in Kenya are Commercial Banks, Non-Bank Financial Institutions, Post Office Savings Bank, Specialised Financial Institutions, Building Societies and Mortgage Finance Companies. There are 43 commercial banks, 40 forex bureaus, 13 non-bank financial institutions and 2 mortgage finance companies. There is also a large number of non-bank financial institutions segment comprising 4 Building Societies, 37 insurance companies, 57 hire-purchase companies, and some 2,670 Savings and Co-operatives Credit Societies, (CBK, 2001).

There are 10 or so specialised organisations set up by the Government to assist the specific sectors of the economy; these include the Agriculture Finance Corporation, Agriculture Development Corporation, Industrial and Commercial Development Corporation, Kenya Industrial Estates, and the Industrial Development Bank.

There are about 1300 registered administrators of pension schemes in Kenya with an estimated portfolio of Kshs 140 billion which is 27% of GDP. Kshs 59 billion is held by the National Social Security Fund (NSSF) which is a mandatory pension scheme. There are about 1100 other private registered pension and provident fund providers countrywide. The Retirement Benefits Authority Act, 1997 governs operations within the sector (CBK, 2001).

### **Payment Media in Kenya**

Cash is the most common form of payment because it is readily accepted, no need for authorization and provides instant value. It has the major disadvantage of insecurity, hence the need for other media.

Cheque is the main paper based mode of payment accounting for 48% of non-cash payments. Banker's cheques are used for large value payments. In the year 2000, the average daily volume of cheques cleared through the Nairobi Clearing House amounted to 1,127,090 cheques or Kshs 10.1 billion. Kenya is currently on 2 day clearing period for high value payments (Kshs. 10m and above) and 3 day period for low value payments. (CBK, 2001)

According to (CBK, 2001) Payment cards have taken a significant leap within Kenya's non cash payment instruments segment. There are credit cards, debit cards and pre-paid cards. The Credit Card is the most common of the category although debit cards are taking root very fast. Credit cards enable the holders to make purchases and draw cash up to a pre-arranged ceiling. The credit granted could be settled in full by the end of a specified period. Charge Cards are also in use.

**Electronic Funds Transfer (EFT):**

Used for transferring value between banks on behalf of customers. Kenya uses electronic files, which are delivered to the Clearing House by diskette every day. Value is given on a same day basis while finality and irrevocability of the payment is guaranteed. (CBK, 2001)

Direct Debits -These are pre-authorized by the paying customer who gives permission for his bank to debit his account upon receipt of instructions initiated by the receiving customer e.g. insurance or mortgage companies. Direct debits account for about 9% of non-cash payments. (CBK, 2001)

Pre-Paid Cards (Smart cards) - In Kenya there are single purpose cards such as phone cards, Game Park Cards and smart cards. Examples of companies that have introduced smart cards for transacting business include Nakumatt Chain of Supermarkets for loyalty scheme, Kenya Wildlife Services for loyalty scheme, Family finance for banking services, Total Kenya Ltd for payment of services, BP Kenya Ltd for payment of services.

ATM Cards - Automated Teller Machine Cards allow cardholders to withdraw money from their bank accounts. Holders can also debit their bank accounts through EFT POS Terminals. Several banks in Kenya offer this service.

S.W.I.F.T (Society For World-Wide Inter-Bank Financial Tele-communication) - Only 20 out of 43 banks are members SWIFT. CBK is encouraging banks to use SWIFT for High Value Payments because messages are encrypted and cannot be read or amended or tampered with while in transit. SWIFT also assumes liability for late or non-delivery of messages. (CBK, 2001)



Since membership is costly, CBK have encouraged non-SWIFT bank members to utilise a secured SWIFT-derivative (Bureau) called African Commerce Exchange – (ACE) Facility which supplies the full range of SWIFT Services at a lower cost. (CBK, 2001)

Inter-Bank Money Market - 20 Banks relay information by SWIFT while others use messengerial and courier services to deliver instructions to CBK. Value is on same day basis. CBK provides clearing and settlement services on a net-multilateral arrangement at the Nairobi Clearing House, which is domiciled at the CBK Headquarters. This is done in collaboration with Kenya Bankers Association. (CBK, 2001)

## **CHAPTER THREE: RESEARCH METHODOLOGY**

### ***3.1 Research framework***

The primary objective of this study is to investigate the level of adoption of smart card technology among banking institutions in Kenya. The study therefore investigates level of awareness, factors perceived by banks as critical to adoption of the technology in the sector, and challenges therein in the adoption. The study is an exploratory one and is expected to lay ground to any future study on the area of the target population.

### ***3.2 The Population***

The target population of the study consists of all Banking Institutions in Kenya as at 30-June-2003 as registered by Central Bank of Kenya. There were 43 such Institutions. The list the banking institutions is given in Appendix 1.

The study is a census. Because the population was small enough, the entire population was studied. The unit of analysis in this study is the bank as represented through the respondents.

### ***3.3 Data Collection***

Data was collected using a questionnaire (Appendix 1) to the Banking Institutions. The questionnaires were distributed to the Banking Institutions in person and through email and collected later in person. Follow up on the questionnaires were done via telephone calls and emails. The questionnaires were distributed to card centres (for those banks that have one), to the Technical/Information Technology/Information Systems Manager. Being an Information technology solution, the Information technology managers and card centre managers were

deemed better placed to provide the required information or identify the department of the bank that would provide the required information.

The questionnaire has four sections (Appendix 1). Section A has questions that seek information on the Banking Institutions bio data. Section B has questions that seek information on level of awareness of smart card technology among Banking Institutions in Kenya. Section C has questions that seek information on factors considered critical for adoption of smart card technology among Banking Institutions in Kenya. A five-point likert scale was used to collect responses from the Banking Institutions on factors critical for adoption of the technology. Section D has questions that seek information on challenges experienced by Banking Institutions in Kenya in adoption of smart card technology.

The questions were simplified as much as possible so that all the respondents have a clear meaning of each of the questions. The questionnaires were filled by staff in charge information systems or those in charge of card development projects in the banks, in consultation with other parties within the bank. These were mainly information technology/system managers, card centre managers.

Out of the 43 questionnaires sent out 10 banks did not accept the questionnaires on internal policy reasons and out the 33 banks that accepted the questionnaires 22 provided the required response, which is a response rate 66.7% of the accepted questionnaires and more than 50% of the population. This was considered satisfactory for this study in view of time constraint.

### **3.4 Data Analysis**

Descriptive statistics was used to analyse awareness of smart card technology. Awareness of smart card technology among banking institutions was analysed in terms of what they have done or plan to do to adopt this technology. Each bank was considered in terms of whether or not they have put in place the required Infrastructure, have developed capacity for the business, and promotes the technology among their customers and merchants, have developed legislative framework that support smart card adoption, collaborates with stakeholders in smart card adoption, has implemented smart card technology for some of its services, number of smart cards in operation/number of consumers using their services on smart card technology, and whether it believes that the technology is beneficial to its business. The awareness of each bank against these items was presented in both tabular and graphical representation. The awareness was also analysed against banks bio data like customer base, number of countries of operation, level of capitalisation, ownership, Number of ATMs, and Number of branches.

#### **Factor Analysis**

Factor Analysis was used to analyse the variables given in section C of the questionnaire. The purpose of factor analysis is to reduce the multiple variables to a lesser number of underlying factors that are being measured by the variables. Factor analysis is a statistical technique used to uncover the latent relationships among a set of variables. This part of the study seeks to investigate the major factors that are critical for smart card readiness in Kenya without any prior theory on nature or number of these factors. Therefore exploratory factor analysis was found to be suitable for this analysis. In an exploratory factor analysis, one wants to explore the data to discover and detect characteristic features and interesting relationships without imposing any definite model on the data (Fabrigar, 1999).

Principal Component Analysis with varimax rotation was used to summarise the variables into factors that are deemed critical, by the banks, for smart card readiness in the sector. In factor analysis, if ones purpose is to reduce the information in many variables into a set of weighted linear combinations of those variables, then Principle Components Analysis (PCA) is most appropriate (Fabrigar, 1999). Factor rotation is used to re-orient the factor loadings so that the factors are more interpretable. Varimax rotation attempts to achieve loadings of ones and zeros in the columns of the component matrix (1.0 & 0.0).

Statistical package for social science (SPSS) version 10 for windows 10 was used to perform factor analysis on the variables. Major challenges facing Banking Institutions was analysed using frequency table.

## CHAPTER FOUR: DATA ANALYSIS AND FINDINGS

The data in this section from completed questionnaires has been summarized and presented using tables, percentages and factor analysis. The presentation of the analysis was captured in three parts. The first part captures the general characteristics of the banking institutions, in section A of the questionnaire. Sections B, C and D attempt to address the earlier stated objectives of this research project.

Section A and B was analysed using proportions in terms of percentages. Section C was analysed using factor analysis. Factor analysis was used to uncover the underlying factors from the set of variables items. Exploratory factor analysis was used since there was no prior theory/hypothesis on number of factors or factor loadings (factor structure). Section D was analysed using a frequency table.

### 4.1 Analysis of general information on the banking Institutions

#### 4.1.1 Size of the Banks in terms of Number of Branches

From Table 1 below, 90.9% of the respondent banks have at most 20 branches each i.e. 45.45% of the respondent banks have less than 5 branches and 45.45% have between 5 and 20 branches. Only 9.1% of the respondent banks have between 21 and 100 branches.

**Table 4.1.1: Size of the Banks in terms of Number of Branches**

Scale (Number of branches)	Number of Banks	Percentage
Less than 5	10	45.45%
Between 5 and 20	10	45.45%

Between 21 and 100	2	9.1%
More than 100	0	0%

**4.1.2 Size of the banks in terms of number of employees**

From table 2 below, 45.45% of the respondent banks have less than 100 employees, 45.45% have between 100 and 500 employees and only 9.1% have more between 501 and 1000 employees. No respondent bank has more than 1000 employees.

**Table 4.1.2: Size of the banks in terms of number of employees**

Scale (Number of employees)	Number of Banks	Percentage
Less than 100	10	45.45%
Between 100 and 500	10	45.45%
Between 501 and 1000	2	9.1%
More than 1000	0	0%

**4.1.3 Number of Automated Teller Machines (ATMs)**

From table 3 below, 50% of the respondent banks have no ATM, 36.4% have less than 10 ATMs, 9.1% have between 10 and 50 ATMs, 4.5% have between 51 and 100 ATMs and no respondent banks have more than 100 ATMs. From these figures 86.4% of the respondent banks have less than 10 ATMs each out of which 50% of the respondent banks have no ATM. ATM being one of the latest technologies, before smart card technology, through which banks across the world have provided their services to their customers, these figures show a low adoption of the ATM technology among the respondent banks.

**Table 4.1.3: Number of ATMs**

Scale (Number of ATMs)	Number of Banks	Percentage
None	11	50%
Less than 10	8	36.4%
Between 10 and 50	2	9.1%
Between 51 and 100	1	4.5%
More than 100	0	0%

**4.1.4 Ownership of banks**

From table 4 below, 72.7% of the respondent banks are locally owned, 18.2% are partially foreign owned and partially locally owned and 4.5% are Foreign owned. This indicates that most banks among the respondent are locally owned. 90.9% of the respondents are either locally owned or partially locally owned.

**Table 4.1.4: Ownership of banks**

Scale (Ownership)	Number of Banks	Percentage
Foreign owned	1	4.5%
Locally owned	16	72.7%
Partially Foreign, Partially Locally owned.	4	18.2%%
No response	1	4.5%



#### 4.1.5 Level of Capitalisation (Ksh billion)

From table 5 below, 63.6% of the respondent banks have 1 billion and less level of capitalization i.e. 31.8% with less than half a billion capital and 31.8% with between 0.5 and 1 billion capital.

This indicates a low level of capitalization for most banks.

**Table 4.1.5: Level of Capitalization of the banks**

Scale (Ksh billion)	Number of Banks	Percentage
Less than 0.5	7	31.8%
Between 0.5 and 1	7	31.8%
Between 1 and 2	3	13.6%
More than 2	3	13.6%
No response	2	9.1%

#### 4.1.6 Customer base

From table 6 below, 59.1% of the respondent banks have customer base of 50,000 customers and less i.e. 40.9% with less than 10,000 customers each and 18.2% with between 10,000 and 50,000 customers each.

**Table 4.1.6: Customer base of banks**

Scale ('000)	Number of Banks	Percentage
Less than 10	9	40.9%
Between 10 and 50	4	18.2%
Between 50 and 100	1	4.5%
More than 100	6	27.3%

No response	2	9.1%
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#### 4.1.7 Presence in East and Central African region

From table 7 below, 86.4% of the respondent banks operate in only one country in East and Central African region i.e. in Kenya. This indicates that most banks in Kenya operates only in Kenya and thus their market and interest is mainly Kenyan market. This implies that they have to do what it takes to compete in Kenya including introducing new technology.

**Table 4.1.7: Presence of the banks in East and Central African region.**

Scale (Number of countries)	Number of Banks	Percentage
1	19	86.4%
2 to 4	1	4.5%
More than 4	1	4.5%
No response	1	4.5%

#### 4.1.8 Level of Information Technology (IT) sophistication

From table 8 below, 100% of the respondent banks have Medium to high level of IT sophistication - 50% have high level of IT sophistication while 50% have medium level of IT sophistication.

**Table 4.1.8: Level of IT Sophistication among banks**

Scale	Number of Banks	Percentage
High	11	50%
Medium	11	50%

Low	0	0%
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## **4.2 Level of adoption of Smart card Technology among the Banking Institutions**

This section below provides the analysis of data and findings of the study on the level of adoption of smart card technology among the banking institutions in Kenya. This has been analysed in terms of level of awareness, acceptability of the technology by the sector and what the banks have done or expect to do to adopt the technology.

### **4.2.1 Awareness of Smart card technology**

As given in the table below 90.9% of the respondent banks are aware of the technology. This indicates that most of the respondents are aware of the technology, what it is, how it is used and what it provides. It therefore indicates that the technology is not a new concept among the respondent banks.

**Table 4.2.1: Awareness of Smart card technology**

Scale	Number of Banks	Percentage
Yes	20	90.9%
No	2	9.1%
Total	22	100%

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### 4.2.2 Benefit to Customers

From the table below 81.8% of the respondents agree that the smart card technology is beneficial to their customers i.e. 31.8% strongly agree and 50% agree. This indicates that most of the respondents are of the view that smart card technology would provide better service to its customers by offering offline services, and by providing the ability to use the same card for multiple services.

**Table 4.2.2: Benefit to Customers**

Scale	Number of Banks	Percentage
Strongly Agree	7	31.8%
Agree	11	50%
Disagree	1	4.5%
Strongly Disagree	1	4.5%
No response	2	9.1%
Total	20	100%

### 4.2.3 Competitiveness in the Kenyan Market

81.8% of the respondents agree that smart card technology would promote the bank's competitiveness in the Kenyan market, 22.7% strongly agree and 59.1% agree. This indicates that most of the respondents consider smart card technology as one that would enable the bank to compete favourable in the Kenyan market by providing the bank with the customers with more information on the customer banking habits, consumer habits and enable the banks to tailor their services to the customers' individual needs.

**Table 4.2.3: Benefit of Smart card on promotion of competitiveness**

Scale	Number of Banks	Percentage
Strongly Agree	5	22.7%
Agree	13	59.1%
Disagree	0	0%
Strongly Disagree	2	9.1%
No response	2	9.1%
Total	20	100%

#### 4.2.4 Scope of services

72.8% of the respondent banks agree that technology would enhance the scope of its products to its customers, 27.3% strongly agree and 45.5% agree. This indicates that most of the respondents are consider smart card technology as one that offers them with opportunity to increase their services to customers and open other markets for their products.

**Table 4.2.4: Scope of services**

Scale	Number of Banks	Percentage
Strongly Agree	6	27.3%
Agree	10	45.5%
Disagree	0	0%
Strongly Disagree	2	9.1%
No response	4	18.2%
Total	22	100%

### 4.2.5 Implementation of Smart card technology

But only 9.1% of the respondents have implemented the technology for some of its services. This indicates that even though most of the respondent banks agree that technology is beneficial to their businesses most of them have not implemented it. This may be an indication that the technology is still new among them and given time they would implement it or that there are hindrances or challenges that delay them from implementing the technology.

The two banks among the respondents have implemented the technology for banking services, stored value services, Loyalty and promotion services, Identification services and Access control services. Of the two banks that have implemented the technology, one has between 1000 and 5000 cards in operation and the other has more than 10,000 cards in operation.

**Table 4.2.5: Implementation of Smart card technology.**

Scale	Number of Banks	Percentage
Yes	2	9.1%
No	20	90.9%
Total	22	100%

### 4.2.6 Support for smart card transactions done from other business institutions

18.2% of the respondents banks support smart card transactions done from other business institutions, 68.2% don't, which the above finding that even though most of the respondent banks agree that the technology would improve their business just a small percentage of them have implemented it.

Each of the respondent banks that support smart card transactions from other institutions support between 10 and 50 such institutions.

**Table 4.2.6: Support for smart card transactions from other business institutions.**

Scale	Number of Banks	Percentage
Yes	4	18.2%
No	15	68.2%
No response	3	13.6%
Total	22	100%

#### 4.2.7 Plan for future implementation of the technology

Out of the respondent banks that have not implemented smart card technology 60% plan to implement it, 30% do not plan to implement it, and 10% had no response on this. This is an indication of expected growth of the technology in this sector. If the current and the expected investments in this technology yield good returns then one would expect that even those banks that currently do not intend to implement it may consider implementing the same.

These figures also indicate some respondent banks (9.1%) have taken risk and gone ahead to implement the technology ahead of others, some (54.5%) plan to implement it but would want to take their time, while 27.3% of the respondents do not want to implement the technology and 9.1% have no response on the whether they would implement the technology.

**Table 4.2.7.1: Future Implementation of smart card technology.**

Scale	Number of Banks	Percentage
Yes	12	60%
No	6	30%
No response	2	10%

Total	20	100%
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Of the respondent banks that plan to implement the card all them (100%) plan to implement it for banking services, 41.7% of them plan to implement it for access control services, 33.3% plan to implement it for stored value services, 25% for loyalty and promotion services, and Identifications services.

**Table 4.2.7.2: Services for which respondent banks plan to implement smart card.**

Scale	Number of Banks	Percentage
Banking Services	12	100%
Access control	5	41.7%
Stored value services	4	33.3%
Loyalty and Promotion services	3	25%
Identification	3	25%

Of the respondent banks that plan to implement the technology, 58.3% plan to implement it in less than 2 years' time, while 33.3% plan to implement it in 2 to 5 years' time. This indicates that 58.3% plan to implement the technology by the next two years and 91.6% by the next five years. This further indicates the rate at which we may expect growth of this technology in the sector in Kenya.

**Table 4.2.7.3: Future Implementation time span.**

Scale	Number of Banks	Percentage
Less than 2 years	7	58.3%



Between 2 to 5 years	4	33.3%
In more than 5 years	1	8.3%
Total	12	100%

#### 4.2.8 Priority on smart card adoption by banks

18.2% of the respondent banks give a high priority to smart card adoption, 54.5% do not, while 27.3% did not respond to this question. This indicates that even though most of the respondent banks agree that the technology would improve their business just a small percentage of them have taken it as a priority programme.

**Table 4.2.8: Priority on adoption of smart card technology.**

Scale	Number of Banks	Percentage
Yes	4	18.2%
No	12	54.5%
No response	6	27.3%
Total	22	100%

#### 4.2.9 Policies that support smart card adoption

Policies that support adoption of smart card technology would act as a guiding tool for management of smart card transactions. It would therefore be important that players in smart card business put up internal policies that support this business.

Only 18.2% of the respondent banks have put policies in place support adoption of the technology, 68.2% have not while 13.6% did not respond to this question.

**Table 4.2.9: Policies that support smart card adoption.**

Scale	Number of Banks	Percentage
Yes	4	18.2%
No	15	68.2%
No response	3	13.6%
Total	22	100%

#### 4.2.10 Current Telecommunication regulation in Kenya

This business is also subject to Information and Communication regulations and thus suitable regulations would promote adoption. 50% of the respondent banks agree that current telecommunication regulations in the country promote adoption of the technology, 4.5% strongly agree and 45.5% agree. This indicates that the currently regulations fairly supports the business though may need review to obtain acceptance by a wider population of the banking sector.

**Table 4.2.10: Relevance of current Telecommunication regulation to smart adoption.**

Scale	Number of Banks	Percentage
Strongly Agree	1	4.5%
Agree	10	45.5%%
Disagree	5	22.7%
Strongly Disagree	1	4.5%
No Response	5	22.7%
Total	22	100%

#### 4.2.11 Collaboration with International Payment Card business companies

Collaboration with International Payment Card business companies like Visa and MasterCard, who are the key leaders international smart card business, to promote the business in Kenya would definitely provide the much needed impetus and support in terms of experience, proven systems and expert knowledge. However only 13.6% of the respondent banks collaborate with the International payment card business company to promote smart card adoption in Kenya. 77.3% of the respondent banks do not collaborate with such companies.

**Table 4.2.11: Collaboration with International Payment card business companies.**

Scale	Number of Banks	Percentage
Yes	3	13.6%
No	17	77.3%
No response	2	9.1%
Total	22	100%

#### 4.2.12 Membership of smart card promoting associations

Joining hands in adoption of new technology would promote the growth of such a technology. Only 27.3% of the respondent banks are members of associations whose objective is to promote adoption of smart technology, 54.5% do not belong to any such associations. This result and the one above is an indication that the initiative to promote this technology among the respondent banks is still low, with 13.6% in collaboration with International Payment card business companies and only 27.3% in membership of associations that promote adoption of the technology.

**Table 4.2.12: Membership of associations that promote smart card adoption.**

Scale	Number of Banks	Percentage
Yes	6	27.3%
No	12	54.5%
No response	4	18.2%
Total	22	100%

#### **4.2.13 Dedication of a team for adoption of smart card technology.**

Set up of a dedicated team for smart card adoption would indicate a bank's commitment to implementation of the technology.

18.2% of the respondent banks have either a department or a team whose responsibility is to ensure smart card adoption, 68.2% have no such dedicated team while 13.6% did not respond to this question.

**Table 4.2.13: Number of banks that have dedication of a team for smart card adoption.**

Scale	Number of Banks	Percentage
Yes	4	18.2%
No	15	68.2%
No response	3	13.6%
Total	22	100%

#### **4.2.14 Level of Understanding of the technology in the bank**

59.1% of the respondent banks perceive their understanding of the technology as high, 13.6% as very high and 45.5% as low. This indicates that more than half of the respondents already have

the knowledge on the technology and thus would identify the features of the technology that would benefit their business and how it would benefit it. Knowledge is also a step in the direction of adoption though a preliminary one.

**Table 4.2.14: Level of understanding of the technology among banks.**

Scale	Number of Banks	Percentage
Very High	3	13.6%
High	10	45.5%
Low	6	27.3%
Very Low	1	4.5%
No response	2	9.1%
Total	22	100%

#### **4.2.15 Training of staff on smart card technology**

Banks would need training for its staff on the technology to build capacity for implementation and operation. It also indicates a sign of commitment to adoption of the technology. 22.7% of the respondent banks have trained its staff on smart card technology, 68.2% have not. This indicates that even though only 9.1% of the respondents have implemented the technology 22.7% have trained its staff, which is a sign that more banks would implement the technology in the near future.

**Table 4.2.15: Training of staff on smart card technology**

Scale	Number of Banks	Percentage
Yes	5	22.7%
No	15	68.2%
No response	2	9.1%
Total	22	100%

**4.2.16 Equipment – hardware and Software for Smart card adoption**

Implementation of any type of technology requires equipment. Smart card implementation would require hardware and software programs to implement any of the services it is capable of providing. 18.2% of the respondent banks have put in place all equipment – hardware and software to support smart card adoption, 68.2% have not.

Only 9.1% of the respondent banks have implemented the technology but 18.2% have put in place the required equipment – hardware and software. This indicates that even though only 9.1% of the respondent banks have implemented the technology more banks would be expected the same in the near future.

**Table 4.2.16: Preparation of Equipment for smart card adoption**

Scale	Number of Banks	Percentage
Yes	4	18.2%
No	15	68.2%
No response	3	13.6%
Total	22	100%

#### 4.2.17 Programmes for educating the consumers and merchants on the technology

Educating consumers on benefits of smart card technology and merchants on opportunities available to them from smart card technology would promote adoption of the technology in the banking sector. Only 9.1% of the respondent banks have programmes for educating their consumers and merchants on benefits and opportunities of smart card technology.

**Table 4.2.17: Programs for educating consumers and merchants on smart card technology.**

Scale	Number of Banks	Percentage
Yes	2	9.1%
No	18	81.8%
No response	2	9.1%
Total	22	100%

#### 4.3 Analysis of factors critical to smart card readiness among the

##### **Banking Institutions**

For investigating factors critical to smart card readiness among banking institutions, a list of twenty variable items relevant for smart card adoption, as argued by various scholars given in the literature review, were used. A five-point Likert scale was used to collect responses from the

Banking Institutions on the variable items.

Given below is the correlation matrix among the variable items.

**Table 4.3.1: Correlation Matrix for the twenty variables**

	VAR01	VAR02	VAR03	VAR04	VAR05	VAR06	VAR07	VAR08	VAR09	VAR10	VAR11	VAR12	VAR13	VAR14	VAR15	VAR16	VAR17	VAR18	VAR19	VAR20
VAR01	1.000	.197	.208	.388	.351	.334	.033	.238	.175	.369	.328	.399	.262	.403	.370	.240	-.030	.281	.171	.332
VAR02	.197	1.000	.028	.298	.221	.153	.445	.438	.319	-.015	.294	.300	-.064	.216	.240	.020	.269	.084	-.156	-.071
VAR03	.208	.028	1.000	.012	.344	.211	-.009	-.056	.045	.725	.136	.004	.123	.147	-.009	-.118	-.109	-.198	.199	.032
VAR04	.388	.298	.012	1.000	.242	.204	.308	.406	.509	.278	.405	.131	.411	.466	.289	.212	.060	.363	.136	.478
VAR05	.351	.221	.344	.242	1.000	.400	.198	.479	.123	.239	.648	-.023	-.049	.215	.383	.333	.023	.031	-.060	.480
VAR06	.334	.153	.211	.204	.400	1.000	.018	.462	.353	.241	.049	.034	-.107	.157	.414	.134	-.042	.080	.207	.081
VAR07	.033	.445	-.009	.308	.198	.018	1.000	.251	.100	.017	-.020	-.020	.299	.500	.250	.503	.626	.098	.074	.267
VAR08	.238	.438	-.056	.406	.479	.462	.251	1.000	.664	.035	.243	.107	-.145	-.003	.296	.179	-.019	.159	.203	.224
VAR09	.175	.319	.045	.509	.123	.353	.100	.664	1.000	.438	.233	.063	-.123	.000	.379	.000	-.058	.059	.419	.150
VAR10	.369	-.015	.725	.278	.239	.241	.017	.035	.438	1.000	.211	.154	.329	.388	.317	.084	-.175	-.070	.402	.136
VAR11	.328	.294	.136	.405	.648	.049	-.020	.243	.233	.211	1.000	-.038	.073	.197	.265	.036	-.049	-.023	-.285	.439
VAR12	.399	.300	.004	.131	-.023	.034	-.020	.107	.063	.154	-.038	1.000	.275	.192	.530	.117	.047	.501	.418	-.223
VAR13	.262	-.064	.123	.411	-.049	-.107	.299	-.145	-.123	.329	.073	.275	1.000	.752	.169	.356	.009	.319	.060	.176
VAR14	.403	.216	.147	.466	.215	.157	.500	-.003	.000	.388	.197	.192	.752	1.000	.425	.594	.262	.308	.031	.275
VAR15	.370	.240	-.009	.289	.383	.414	.250	.296	.379	.317	.265	.530	.169	.425	1.000	.500	.063	.453	.464	.027
VAR16	.240	.020	-.118	.212	.333	.134	.503	.179	.000	.084	.036	.117	.356	.594	.500	1.000	.113	.193	.142	.402
VAR17	-.030	.269	-.109	.060	.023	-.042	.626	-.019	-.058	-.175	-.049	.047	.009	.262	.063	.113	1.000	.062	-.043	.264
VAR18	.281	.084	-.198	.363	.031	.080	.098	.159	.059	-.070	-.023	.501	.319	.308	.453	.193	.062	1.000	.522	.068
VAR19	.171	-.156	.199	.136	-.060	.207	.074	.203	.419	.402	-.285	.418	.060	.031	.464	.142	-.043	.522	1.000	-.110
VAR20	.332	-.071	.032	.478	.480	.081	.267	.224	.150	.136	.439	-.223	.176	.275	.027	.402	.264	.068	-.110	1.000

a Determinant = 8.812E-10



This indicates that some of the variables are fairly correlated e.g. variable 10 and 3, 11 and 5, 17 and 7, 14 and 7, 9 and 8, 15 and 12, 18 and 12, 14 and 13, 16 and 14, 16 and 15, 19 and 18. The matrix is therefore factorable.

### **KMO and Bartlett's Test of Sphericity**

The *Kaiser-Meyer-Olkin (KMO)* measure of sampling adequacy and Bartlett's test of sphericity were used to determine if one can comfortably proceed with factor analysis of the 20 variables. The Kaiser-Meyer-Olkin measure of sampling adequacy tests whether the partial correlations among items are small. Bartlett's test of sphericity tests whether the correlation matrix is an identity matrix, which would indicate that the factor model is inappropriate.

**Table 4.3.2: KMO and Bartlett's Test**

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.174
Bartlett's Test of Sphericity	Approx. Chi-Square	281.471
	df	190
	Sig.	.000

As given in Table 4.3.2, Bartlett's test indicates that the variables are correlated because it gives a value of 0.000, which is less than level of significance at 0.05. It also shows further that factor analysis can be used to analyze the data. This means the correlation matrix is not an identity matrix. The problem therefore is to identify what the correlated factors are measuring in common.

### **Communalities**

The table below shows the communalities of the variables. Communalities show how much of the variance in the variables has been accounted for by the extracted factors. The table indicates that the variables have fairly high communalities i.e. except for three variables, the rest of the

variables have a communalities of more than 72%. This means that most of the variance in the variables have been accounted for by the extracted factors.

**Table 4.3.3: Communalities**

	Initial	Extraction
VAR01	1.000	.583
VAR02	1.000	.898
VAR03	1.000	.858
VAR04	1.000	.854
VAR05	1.000	.865
VAR06	1.000	.576
VAR07	1.000	.901
VAR08	1.000	.789
VAR09	1.000	.905
VAR10	1.000	.931
VAR11	1.000	.809
VAR12	1.000	.822
VAR13	1.000	.828
VAR14	1.000	.847
VAR15	1.000	.772
VAR16	1.000	.778
VAR17	1.000	.646
VAR18	1.000	.726
VAR19	1.000	.856
VAR20	1.000	.776

Extraction Method: Principal Component Analysis.

### Results of the Initial Solution

The table below shows all the factors extractable from the analysis along with their eigenvalues, the percent of variance attributable to each factor, and the cumulative variance of the factor and the previous factors. To determine the number of factors, the Kaiser criterion was applied. This criterion, also known as the "eigenvalue-greater-than-1" criterion, considers components whose eigenvalue greater than 1 to be significant and that one can extract as many factors as those components with eigenvalue greater than 1. Notice the first seven components each have eigenvalues greater than 1 and are thus significant.

Notice also that the cumulative % of variance explained by the seven factors is 80.102%, in other words 80.102% of the common variance shared by the 20 variables can be accounted for by the 7 factors. This is an indication that the seven factors would effectively explain the 20 variables.

**Table 4.3.4: Total Variance Explained**

Component	Initial	% of	Cumulative	Extraction	% of	Cumulative	Rotation	% of	Cumulative
	Eigenvalues			Sums of Squared Loadings			Sums of Squared Loadings		
	Total	Variance	%	Total	Variance	%	Total	Variance	%
1	5.078	25.391	25.391	5.078	25.391	25.391	2.754	13.771	13.771
2	2.488	12.440	37.831	2.488	12.440	37.831	2.494	12.472	26.243
3	2.413	12.065	49.896	2.413	12.065	49.896	2.446	12.229	38.472
4	2.087	10.437	60.333	2.087	10.437	60.333	2.151	10.757	49.229
5	1.429	7.147	67.480	1.429	7.147	67.480	2.082	10.408	59.638
6	1.301	6.503	73.983	1.301	6.503	73.983	2.069	10.345	69.982
7	1.224	6.119	80.102	1.224	6.119	80.102	2.024	10.120	80.102
8	.887	4.433	84.535						
9	.764	3.820	88.355						
10	.599	2.996	91.350						
11	.567	2.833	94.183						
12	.331	1.653	95.837						
13	.261	1.307	97.143						
14	.208	1.042	98.185						
15	.138	.688	98.874						
16	9.743E-02	.487	99.361						
17	7.053E-02	.353	99.713						
18	3.114E-02	.156	99.869						
19	2.410E-02	.120	99.990						
20	2.070E-03	1.035E-02	100.000						

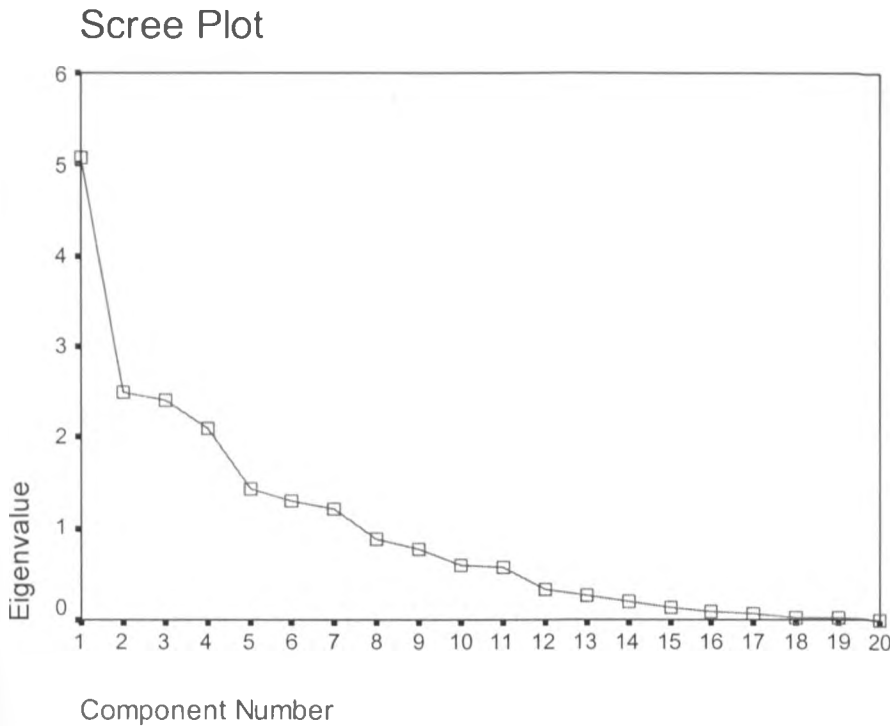
Extraction Method: Principal Component Analysis.

### Scree Plot

The scree test was also examined to determine the number of common factors necessary to represent the data. The scree test advocated by Cattell (in Kim, 1978, p. 44), directs one to examine the graph of eigenvalues, and stop factoring at a point where the eigenvalues begin to level off forming a straight line with an almost horizontal slope. According to Kim and other authorities like Tucker, Koopman and Linn (cited in Kim, 1978, p. 45), this method is often superior to other tests where the interest is in locating only the major common factors.

The graph for the scree test is presented in Figure 4.3.1 below: It can be seen that the curve begins to flatten between factors 7 and 8. We note also that factor 8 has an eigenvalue of less than 1, so only seven factors have been retained.

**Figure 4.3.1: Scree Plot**



### **Rotated Component Matrix**

The component matrix indicates the correlation of each variable with each factor. Factor rotation clarifies factor pattern thus making interpretation of the analysis easier. The table below shows the loadings of the twenty variables on the seven factors extracted. The higher the absolute value of the loading, the more the factor contributes to the variable. All loading less than 0.5 were suppressed by the researcher to make the reading the table easier.

**Table 4.3.5: Rotated Component Matrix**

	Component						
	1	2	3	4	5	6	7
VAR01							
VAR02					.598		
VAR03						.915	
VAR04	.597	.636					
VAR05				.712			.550
VAR06				.604			
VAR07					.872		
VAR08		.740					
VAR09		.928					
VAR10						.866	
VAR11							.825
VAR12			.903				
VAR13	.828						
VAR14	.731						
VAR15			.619	.545			
VAR16	.507			.630			
VAR17					.787		
VAR18			.640				
VAR19							-.640
VAR20	.557						

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.  
a. Rotation converged in 56 iterations.

### Analysis and Interpretation of the Seven factors

From Table 31 above the variables that load significantly on Factor 1 are VAR4; VAR13, VAR14, VAR16, and VAR20.

Variables that load significantly on Factor 2 are VAR4, VAR8 and VAR9

Variables that load significantly on Factor 3 are VAR12, VAR15 and VAR18

Variables that load significantly on Factor 4 are VAR5, VAR6, VAR15 and VAR16.

Variables that load significantly on Factor 5 are VAR2, VAR7, and VAR17.

Variables that load significantly on Factor 6 are VAR3 and VAR10.

Variables that load significantly on Factor 7 are VAR5, VAR11, and VAR19.

#### Factor 1

- Customer base of the bank - factor loading of 0.597

- Breath of usability of the card (multi applications on one card) - factor loading of 0.828
- Simplicity of use of the card - factor loading of 0.731
- Appreciation of validity of smart card business transactions among individuals, merchants and organisations - factor loading of 0.507
- Support from the large card payment organisations like Visa and MasterCard - factor loading of 0.557

Factor 1 accounts for 25.391% of the total variance. Five variables loaded on this factor as represented in table 31 above. Their factor loadings range from 0.507 to 0.828. Two variables (13, 14) which loaded on this factor describe usability of the smart card i.e. *Breath of usability of the card (multi applications on one card), Simplicity of use of the card respectively.*

Variable 16 describe acceptability of the card by the bank's customers (merchants and service consumers) i.e. *Appreciation of validity of smart card business transactions among individuals, merchants and organisations.*

Variable 4 describe the size of customer base of the bank, the customer base that would accept new technology introduced by the bank with little effort from the bank: *Customer base of the bank.*

Variable 20 describe support, for successful implementation, from international organisations that have successfully implemented the technology before, support for all aspects of implementation of the technology in the sector, including usability and acceptability of the card: *Support from the large card payment organisations like Visa and MasterCard.*

This factor can thus be referred to as *Usability and Acceptability of smart card among a large customer base.*

## Factor 2

- Customer base of the bank - factor loading of 0.636

- Collaboration between stakeholders - factor loading of 0.740
- Retailers' attitude on costs and benefits associated with adoption of smart card technology - factor loading of 0.928

Factor 2 accounts for 12.440% of the total variance. Three variables loaded on this factor as represented in table 31 above. Their factor loadings range from 0.636 to 0.928. Two variables (8, 9), which loaded on this factor, describe the involvement of various stakeholders in the implementation of the technology so as to include their concerns. i.e. *Collaboration between stakeholders, Retailers' attitude on costs and benefits associated with adoption of smart card technology.*

Variable 16 describe acceptability of the card by the bank's customers (merchants and service consumers) i.e. *Appreciation of validity of smart card business transactions among individuals, merchants and organisations.*

Variable 4 describe the customer base of the bank, another stakeholder in the implementation in the implementation of the technology among the banks: *Customer base of the bank.*

This factor can thus be referred to as *Stakeholders Involvement.*

### Factor 3

- Public policy positions with regard to issues surrounding consumer privacy, consumer rights, and protection and security of value - factor loading of 0.903
- Consumer awareness of the smart card technology - factor loading of 0.619
- Performance of the economy - factor loading of 0.640

Factor 3 accounts for 12.065% of the total variance. Three variables loaded on this factor as represented in table 31 above. Their factor loadings range from 0.619 to 0.903.

Variable 12 describe public policy on consumer rights and safety of consumer's value i.e. *Public policy positions with regard to issues surrounding consumer privacy, consumer rights, and protection and security of value.*

Variable 15 describe awareness of the consumer on benefits and problems of the technology i.e. *Consumer awareness of the smart card technology.*

Variable 18 describe performance of the economy as it affects the adoption of the technology. One of the key effect of the performance of the economy on the adoption would be in terms of consumer purchasing power: *Performance of the economy.*

This factor can thus be referred to as *Consumer interests and purchasing power.*

#### Factor 4

- The country's innovativeness - factor loading of 0. 712
- Payment culture of Kenyan consumers - factor loading of 0. 604
- Consumer awareness of the smart card technology - factor loading of 0. 545
- Appreciation of validity of smart card business transactions among individuals, merchants and organisations - factor loading of 0. 630

Factor 4 accounts for 10.437% of the total variance. Four variables loaded on this factor as represented in table 31 above. Their factor loadings range from 0.545 to 0.712.

Variable 5 describe how progressive the country is on technology i.e. how first the country adopt new technology: *The country's innovativeness.* Variable 16 describe response of the various consumer segments of smart card technology (individuals, merchants, and organisations) to introduction of the technology i.e. *Appreciation of validity of smart card business transactions among individuals, merchants and organisations.* Variable 6 describe payment culture of the



country's consumers – how they pay for goods and services and how they from modes of payment over period of time: *Payment culture of Kenyan consumers.*

Variable 15 describe awareness of the consumer on benefits and problems of the technology i.e. *Consumer awareness of the smart card technology.*

This factor can thus be referred to as *The country's response to new payment system technologies.*

#### Factor 5

- Capacity for the smart card business opportunity - factor loading of 0. 598
- Best practises to learn from - factor loading of 0. 872
- Cost of changing from current payment system utilities such as magnetic stripe cards - factor loading of 0. 787

Factor 5 accounts for 7.147% of the total variance. Three variables loaded on this factor as represented in table 31 above. Their factor loadings range from 0.598 to 0.872. Two variables (2, 17) which loaded on this factor describe ability of the banks to implement the technology in terms of capacity and cost of changing from their current payment system utilities i.e. *Capacity for the smart card business opportunity, Cost of changing from current payment system utilities such as magnetic stripe cards.* Variable 7 describe the ability of the banks to implement the technology in terms of availability of best practises to learn from i.e. *Best practises to learn from.*

This factor can thus be referred to as *Capacity of the bank to implement the technology.*

## Factor 6

- Legislative framework - factor loading of 0.915
- Universally accepted Industry Standards - factor loading of 0.866

Factor 6 accounts for 6.503% of the total variance. Two variables loaded on this factor as represented in table 31 above. Their factor loadings range from 0.866 to 0.915. The two variables (3, 10) which loaded on this factor describe set-up of suitable legislation and standards for the smart card industry i.e. *Legislative framework, Universally accepted Industry Standard*.

This factor can thus be referred to as *Legislation and Standards*.

## Factor 7

- The country's innovativeness - factor loading of 0.550
- Balance of costs and benefits of smart card technology - factor loading of 0.825
- Enabling government policies - factor loading of -0.640

Factor 7 accounts for 6.119% of the total variance. Three variables loaded on this factor as represented in table 31 above. Their factor loadings range from 0.550 to 0.825. The three variables (5, 11, 19) which loaded on this factor describe business environment for the smart card technology in terms of the country's response to new technologies, balance of costs and benefits for technology, and enabling government policies i.e. *The country's innovativeness, Balance of costs and benefits of smart card technology, Enabling government policies*.

This factor can thus be referred to as *Favourable business environment*

In summary, the seven factors and their names are presented in the table below:

**Table 4.3.6 – Summary of Identified factors**

<b>Factor</b>	<b>Factor Statement</b>	<b>Percentage of Variance explained</b>
1	Usability and Acceptability of smart card among a large customer base.	25.391
2	Stakeholders Involvement	12.440
3	Consumer interests and purchasing power	12.065
4	The country's response to new payment system technologies.	10.437
5	Capacity of the bank to implement the technology	7.147
6	Legislation and Standards	6.503
7	Favourable business environment	6.119
	<b>Total</b>	<b>80.102</b>

Of the 20 variables investigated, 19 were retained after factor analysis. Only one was deleted because it did not load on any factor. Factor analysis showed that 4 variables loaded on 2 factors.

No variable loaded on more than 2 factors.

#### **4.4 Challenges facing Banking Institutions in Kenya in adopting smart card technology**

Information to help investigate challenges of adoption of smart card technology facing banking institutions in Kenya was sought using predefined challenges identified from the literature

review as experience in other parts of the world where such technology has been adopted. Analysis of the responses of the respondent banks on these challenges is as given in the table below:

**Table 4.3.7: Challenges of adoption of smart card technology facing banking institutions in Kenya**

<b>Factor</b>	<b>Number of Respondents</b>	<b>Percentage</b>
Lack of comprehensive policy framework on smart card business	15	68.2%
Changing nature of consumer behaviour	12	54.5%
Cost of migrating from the current technology e.g. magnetic stripe cards to smart cards	10	45.5%
Retailers attitude on costs and benefits associated with adopting the technology	10	45.5%
Slow pace in appreciating and adopting change in technology among Kenyan consumers	9	40.9%
Lack of appreciation of validity of smart card business transactions among individuals, merchants and organisations	8	36.4%
Getting critical mass of cards into use to achieve its benefits	7	31.8%

Changing political environment	1	4.5%
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As given by the table the major challenges of adoption of smart card technology facing banks in Kenya, as given by the respondent banks, are Lack of comprehensive policy framework on smart card business and changing nature of consumer behaviour.

## **CHAPTER FIVE – SUMMARY AND CONCLUSION**

The study is an exploratory one that sought to investigate adoption of smart card technology among banking institutions in Kenya. Specific interest was on level of adoption of this technology in the sector, factors that the banks consider critical for readiness of this technology in the sector, and challenges facing them in adopting this technology.

The literature review focused on theoretical information on smart card as a technology; diverse viewpoints on the place and impact of smart card technology with particular reference to the banking sector; and growth of electronic money. This was done to provide background information on the technology. The literature review also focused on past adoptions of smart card technology in other countries in the world and identified some of the challenges, factors deemed critical for successful adoption of the technology and world smart card consumption figures. The literature review also outlined payment system in Kenya and its developments as given by Central Bank of Kenya whose role includes effective implementation of monetary policy operations and financial stability and who under Central Bank of Kenya (CBK) Act, as amended in 1996, has powers to oversee and regulate payment systems in Kenya.

The literature review indicates that smart card technology is a development of electronic money technologies that seek to refine payment system. The literature also indicates that there are several successful adoptions of this technology in other countries of the world including Malawi in Africa. Examples of smart card implementations include Mondex of United Kingdom, Danmont card of Denmark, European Union supported Conditional Access for Europe (CAFÉ) card, Porta Moedas Multibanco (MEP) of Portugal, Proton of Belgium, American Express Blue in United States of America (USA) and Canada. World consumption figures show increase in

consumption of the card over the years in most sectors of business and in most geographical regions of the world.

Some of the factors argued out by various scholars as critical for adoption of this technology include Enhanced functionality of the card, adoption of industry standards, provision of public policy position on security, privacy and consumer protection, regulatory framework, retailers attitude on balance of costs and benefits of the technology, ability to achieve critical mass across several dimensions, security and simplicity of use and economic environment where its use is particularly suitable and which is sufficiently dynamic to overcome obstacles to its development.

Some of the items recorded from various implementations as challenges of adoption of this technology include convincing service providers to accept the card as a means of payment, getting critical mass of cards in operation, and educating and enticing card holders away from their existing payment media.

## **5.1 Discussions**

From the research findings as presented in section four of the report, several conclusions can be drawn. These are discussed in light of the objectives of the study.

### **5.1.1 Level of adoption of smart card technology**

According to summary statistics on adoption of the technology, 90.9% of the respondent banks are aware of the technology, 81.8% agree that smart card technology would improve their service to their customers, 81.8% agree that the technology would improve their competitiveness in the Kenyan market, and 72.7% agree that the technology would enhance scope of their services to

their customers. This finding indicates that at least 72% of the respondent banks are aware of the technology and agree that it would improve their business performance in terms of service delivery to its customers, scope of services and competitiveness in the market.

However on implementation of the technology, only 9.1% of the respondent banks have implemented the technology for some of its services and 18.2% support transactions done through smart cards issued by other business organisations (e.g. from merchants, other banks and other business institutions). 31.8% plan to implement the technology in less than 2 year's time. Another 18.2% plan to implement the technology in 2 to 5 years' time. This indicates that in less than two years' time over 40% of the respondent banks are expected to have implemented the technology for some its services and the growth is expected to continue.

The services for which the banks have implemented smart card technology include Banking services, Stored value services, Loyalty and promotion services, Identification services and Access control services. The statistics also show that the respondent banks that have implemented the technology have a total of at least 11,000 smart cards in operation.

Of the respondent banks that plan to implement the technology, all of them plan to implement it for banking services, 41.7% of them plan to implement it for access control services, 33.3% plan to implement it for stored value services, 25% for loyalty and promotion services, and Identifications services.

On information communication regulation front, 50% of the respondent banks agree that the current information communication regulation in Kenya promotes adoption of the technology.



This is an indication that the regulation fairly supports the business but may need review to take care of divergent views of the other players in the market.

On preparedness of the banking institutions for the adoption of the technology, 59.1% of the respondent banks perceive their knowledge on the technology to be high, 18.2% of the respondent banks have given a high priority to adoption of the technology, 18.2% have put in place policies that support adoption of the technology, 13.6% collaborate with other International Payment cards business organisations to promote the card's adoption, 27.3% are members of associations that promote adoption of smart card, 18.2% have a department or team whose responsibility is to ensure the card's adoption, 22.7% have trained their staff on the technology, 18.2% have put in place required equipment, hardware and software, to support adoption of the card technology, 9.1% have programmes that educate consumers on benefits of the card and merchants on opportunities of the technology. This indicates that there is a fairly low level of preparedness for adoption of the technology among the banking institutions.

In summary, even though most banking institutions in Kenya agree that the technology is significant to their business performance just over half have high knowledge on the technology, only 9.1% have implemented the technology, 18.2% support transactions on smart cards issued by other organisations and 31.8% plan to implement in less than two years' time and less than 27.3% have put in place some of the necessary preparations for implementation of the card technology.

## 5.1.2 Factors critical to smart card readiness among banking institutions in Kenya

Using Factor analysis seven factors were identified, from the variable items, as critical for smart card readiness among banking institutions in Kenya. These were Usability and Acceptability of the card technology, Stakeholders involvement, Customer Interests and purchasing power, The country's response to new payment system technologies, Capacity of the bank to implement the technology, Legislation and standards, Favourable business environment.

The variable items loaded on the factors as follows:

Usability and Acceptability of smart card among a large customer base. {Customer base of the bank; Breadth of usability of the card (multi applications on one card); Simplicity of use of the card; Appreciation of validity of smart card business transactions among individuals, merchants and organisations; Support from the large card payment organisations like Visa and MasterCard}. This indicates that for the banking sector to be smart card ready i.e. achieve an environment capable of comprehensive adoption of the technology, the banks must ensure that the smart cards are simple to use, have multiple applications, and achieve acceptability of the card among large numbers of consumers, merchants and organisations as a means of payment.

Stakeholders Involvement {Customer base of the bank; Collaboration between stakeholders; Retailers' attitude on costs and benefits associated with adoption of smart card technology}. This indicates that to be smart card ready the banking sector must involve all stakeholders so that all stakeholders are equally ready for the card business. Customers base of the banks must be ready to transact business using smart card, retailers must have a positive attitude on balance of costs

and benefits associated with smart card business and all stakeholders must collaborate to steer the business in positive direction and cope with changing needs of the business.

Consumer interests. {Public policy positions with regard to issues surrounding consumer privacy, consumer rights, and protection and security of value; Consumer awareness of the smart card technology; Performance of the economy}. A banking sector that is smart card ready must take care of consumer interests such as privacy, consumer rights, protection and security of value, awareness of the technology's issues such as benefits and risks and must consider consumer purchasing power.

The country's response to new payment system technologies {The country's innovativeness; Payment culture of Kenyan consumers; Consumer awareness of the smart card technology; Appreciation of validity of smart card business transactions among individuals, merchants and organisations}. For the banking sector to achieve and sustain readiness for smart card business our country should be able to respond positively to the new technology – be able to easily change over to the new media of payment. The country should be sufficiently dynamic to overcome obstacles to the development of the card business.

Capacity of the bank to implement the technology {Capacity for the smart card business opportunity; Best practises to learn from; Cost of changing from current payment system utilities such as magnetic stripe cards}. To achieve comprehensive adoption of the technology banks must have the capacity to implement the technology and must have best practises to learn from so that performance levels of the business could be at their best.

Legislation and Standards {Legislative framework; Universally accepted Industry Standards}. A comprehensive adoption of the technology must have an exhaustive legislative framework and accepted standards for industry players to follow.

Favourable business environment {The country's innovativeness; Balance of costs and benefits of smart card technology; Enabling government policies}. To achieve a comprehensive adoption of the technology, the banks, merchants/retailers, and other players must find the business environment favourable and one capable of return of investment.

Other factors considered critical for smart card readiness by the banks include:

- Active participation by Central Bank of Kenya government in promoting and enhancing smart card technology in collaboration with other government bodies like Kenya Revenue authority government parastatals like Kenya power and lighting and Kenya Telecom..
- Awareness of benefits of smart card technology such as reduction in cost.

### **5.1.3 Challenges facing banking institutions in adoption of smart card technology**

The study provided eight items considered as challenges of adoption of smart card technology, as given by experiences elsewhere from the literature review. Out of the eight items, the respondent banks identified seven as major challenges facing the banking sector Kenya in adoption of the technology. These are as follows:

### **Lack of comprehensive policy framework on smart card business**

68.2% of the respondent banks consider this as a major challenge to adoption of the technology in the sector. CBK (2001) paper says there is no law that explicitly deals with payment systems and that CBK is exploring the need for an explicit legal framework to support payment systems modernisation process which includes introduction of regulations and laws in relation to electronic money.

### **Changing nature of consumer behaviour**

54.5% of the respondent banks consider this as a major challenge to adoption of smart technology in the sector in Kenya. This implies that consumer behaviour in the country is unpredictable causing banks to fail to reliably come up with strategies that would meet consumer needs.

### **Cost of migrating from current technologies**

45.5% of the respondent banks consider this as a major challenge to adoption of the technology in the banking sector. This indicates that the cost of migrating from the current payment media e.g. magnetic stripe cards, cash and cheques is high and is therefore a challenge to some banks.

### **Retailers attitude on costs and benefits associated with the technology**

45.5% of the respondent banks consider this as a major challenge to adoption of the technology in the banking sector. This indicates that a fairly large number of retailers consider the balance of costs and benefits associated with smart card business as negative and therefore are hesitant to embrace the technology. This limits chances of success of the technology among the banks. This may be due to lack of published success stories in this business.

### **Slow pace in appreciating and adopting change in technology among Kenyan consumers**

40% of respondent banks consider this as a major challenge to adoption of the technology in the banking sector. This indicates that some respondent banks consider the pace of response to technological changes among Kenyans to be slow and as a barrier to adoption of this business. This may be due to perceived advantages of the current payment media by consumers.

### **Lack of appreciation of validity of smart card business transactions among individuals, merchants and organisations**

36.4% of the respondent banks consider this as a major challenge to adoption of the technology in the banking sector. This is may be due to the fact that smart card transactions are not tangible and due to consumer concerns on security of value.

### **Getting critical mass of cards into use to achieve its benefits**

31.8% of the respondent banks consider this as a major challenge to adoption of the technology in the Kenyan banking sector. This may be because most banks in Kenya have not considered integrating their services with everyday transaction services such as transport, telecommunication, and household shopping that would offer easier achievement of critical mass of cards.

Changing of political environment was not considered by as many respondent banks as a major challenge. Only 4.5% of them consider it as a challenge. This may be because Kenya has enjoyed a fairly stable political environment favourable for business.

### **Other challenges, identified by the respondent banks include:**

- The settlement system for financial transactions on smart card

- Skill gaps within the operating and managing staff of banks on the technology
- Data security issues
- System integration issues with various systems
- Costing/charging for various smart card services

## **5.2 Conclusions**

The study sought to investigate adoption of smart card technology among Kenyan banking institutions. According to the summary statistics, the banking sector in Kenya agree that smart card technology is highly significant for their business performance, however, implementation of the technology is in its early stages. A small proportion of the sector has either implemented the technology or support transactions performed by smart cards issued by other organisations and a very small proportion has made some preparations for adoption of the technology. From the very positive response on significance of the technology to the banks' business and the statistics on those banks that plan to implement the same one would expect growth in this business towards a comprehensive adoption.

It also indicates that while all banks, that plan to implement or have implemented the technology, plan or have implemented the same for its banking services just a few of them plan to implement the technology for stored value services. This contrasts with many implementations elsewhere discussed in the literature review most of which have primarily focused on stored value services. This may indicate limited business opportunities in stored value services in Kenya.

The study also sought to establish the factors critical to smart card readiness among banking institutions in Kenya. Factor analysis identified seven factors which can be outlined to as the following:

**1. Usability and Acceptability of smart card among a large customer base.**

To be ready for smart card business the banking sector in Kenya require a card that is usable and acceptable among a large customer base.

**2. Stakeholders Involvement**

For a comprehensive and a sustainable smart card business for the banking sector all stakeholders must be involved in implementation and development of the business.

**3. Consumer interests.**

To be smart card ready the banking sector in Kenya must take care of consumer interests such as privacy, consumer rights, protection and security of value, awareness of the technology's issues – benefits and risks and consumer purchasing power.

**4. The country's response to new payment system technologies**

For the banking sector to achieve and sustain readiness for smart card business our country must be respond positively to the new technologies. The country must be sufficiently dynamic to overcome obstacles to the development of the card business.

**5. Capacity of the bank to implement the technology**

To achieve comprehensive adoption of the technology in the sector banks must have the capacity to implement the technology



## **6. Legislation and Standards**

A comprehensive adoption of the technology in the sector must have an exhaustive legislative framework and accepted standards for the technology.

## **7. Favourable business environment**

For a comprehensive and sustainable adoption of the technology in banking sector the business environment must be favourable and rewarding in terms of returns of investment.

The major challenges of adoption of this technology in the banking sector include lack of comprehensive policy framework on smart card business and changing nature of consumer behaviour.

## ***5.3 Limitations of the study and Suggestions for future research***

This part of the study discusses the limitations of the study and includes suggestions for further research.

### **5.3.1 Limitations**

Resources and time constraint were the major limitations for this study. This is because even though the study intended to collect data from the entire population, just over 50% responses were received within the time frame. A study with responses from the entire population would have been more preferable taking into account the size of the population.

There were no known local studies on the subject and thus the study relied majorly on studies from other countries which operate in different cultural and business settings.

Smart card technology is fairly a new technology in the country and thus it was very difficult to find credible local literature on the subject. The study therefore relied on local literature general to the subject such as electronic money and payment systems.

### 5.3.2 Suggestions for further research

Since the study was a ground breaking one on the subject of smart card technology for the banking sector in Kenya it paves the way for studies on relationships of variable factors in play in this business in the industry. Examples of such relationships include the balance of costs and benefits associated with the technology; value of smart card technology to banks that implement it. Others could be on who, between merchants and banks, would gain most from this technology.

The study can also be extended to include adoption of the technology among organisations in Kenya to include the various sectors of the economy.

Despite the limitations, given the significance of the technology to the banking sector and the growth it promises, the study provides ground for further contributions that would enable academicians, managers and smart card investors to better understand various concerns of adoption of the technology in the country.

## APPENDIX

### **6.1 Appendix 1 - LIST OF BANKING INSTITUTIONS IN KENYA**

1. AFRICAN BANKING CORP. LTD
2. AKIBA BANK LTD.
3. BANK OF BARODA (K) LTD.
4. BANK OF INDIA
5. BARCLAYS BANK OF KENYA LTD.
6. CFC BANK LIMITED
7. CHASE BANK (KENYA) LTD.
8. CHARTERHOUSE BANK LTD.
9. CITIBANK N.A.
10. CITY FINANCE BANK LTD.
11. COMMERCIAL BANK OF AFRICA LTD.
12. CONSOLIDATED BANK OF KENYA LTD.
13. CO-OPERATIVE BANK OF KENYA LTD.
14. CREDIT AGRICOLE INDOSUEZ
15. CREDIT BANK LIMITED
16. DAIMA BANK LTD.
17. DEVELOPMENT BANK OF KENYA LTD.
18. DIAMOND TRUST BANK KENYA LTD.
19. DUBAI BANK KENYA LIMITED
20. EQUATORIAL COMMERCIAL BANK LTD
21. FIDELITY COMMERCIAL BANK LTD.
22. FINA BANK LIMITED.
23. FIRST AMERICAN BANK OF KENYA LTD.
24. GUARDIAN BANK LIMITED.
25. GIRO COMMERCIAL BANK LIMITED
26. HABIB BANK A.G. ZURICH
27. HABIB BANK LTD.
28. IMPERIAL BANK LTD.
29. INDUSTRIAL DEVELOPMENT BANK LTD.
30. INVESTMENTS & MORTGAGES BANK LTD.
31. KENYA COMMERCIAL BANK LTD.
32. K-REP BANK LIMITED
33. MIDDLE EAST BANK KENYA LTD.
34. NATIONAL BANK OF KENYA LTD
35. NATIONAL INDUSTRIAL CREDIT BANK LTD.
36. PARAMOUNT UNIVERSAL BANK LTD.
37. PRIME BANK LTD.
38. SOUTHERN CREDIT BANKING CORP. LTD.
39. STANBIC BANK KENYA LIMITED.
40. STANDARD CHARTERED BANK (K) LTD.
41. THE DELPHIS BANK LTD.
42. TRANS - NATIONAL BANK LTD.
43. VICTORIA COMMERCIAL BANK LTD.

## 6.2 Appendix 2 - QUESTIONNAIRE

### Section A

1. Name of Banking Institution.....
2. Location of the Institution's Head Office.....
3. Number of Branches
  - ( ) Less than 5
  - ( ) Between 5 and 20
  - ( ) Between 21 and 100
  - ( ) More than 100
4. Number of Employees
  - ( ) Less than 100
  - ( ) Between 100 and 500
  - ( ) Between 501 and 1000
  - ( ) More than 1000
5. Number of ATMs
  - ( ) Less than 10
  - ( ) Between 10 and 50
  - ( ) Between 51 and 100
  - ( ) More than 100
6. Ownership
  - ( ) Foreign owned
  - ( ) Locally Owned
  - ( ) Partially Foreign, partially Locally owned
7. Level of Capitalization (Ksh billion)
  - ( ) Less than 0.5
  - ( ) Between 0.5 and 1
  - ( ) Between 1 and 2
  - ( ) More than 2
8. Customer base ('000)

- Less than 10
- Between 10 and 50
- Between 50 and 100
- More than 100

9. Operating in how many countries in East and Central Africa region?

- 1
- 2 to 4
- More than 4

10. What is the level of IT sophistication

- High
- Medium
- Low

## **Section B**

11. Is the Bank aware of Smart card technology?

- Yes
- No

**If Yes, then please answer the rest of the questions in Section B.**

12. Smart card is beneficial to your customers

- Strongly Disagree
- Disagree
- Agree
- Strongly Agree

13. Smart card technology would promote the bank's competitiveness in the Kenyan market?

- Strongly Disagree
- Disagree
- Agree
- Strongly Agree

14. Smart card technology would enhance the scope of bank's services to its customers?

- Strongly Disagree
- Disagree

- Agree
- Strongly Agree

15. Has the bank implemented smart card technology for some of its services?

- Yes
- No

If No then skip to question 18

16. If Yes, for what services has the bank implemented smart card technology?

- Banking services
- Stored Value services
- Loyalties and promotion services
- Identification
- Access control
- Ticketing
- Parking
- Others (please specify).....

17. How many smart cards does the bank have in operation?

- Less than 1,000
- Between 1,000 and 5,000
- Between 5,000 and 10,000
- More than 10,000

18. Does the bank support transactions done by smart cards from other business institutions?

- Yes
- No

19. If Yes, how many customers are on this service?

- Less than 1,000
- Between 1,000 and 5,000
- Between 5,000 and 10,000
- More than 10,000

20. If your answer to question 15 is "No" then does the bank plan to implement smart card technology for some of its services

Yes

No

21. If yes, for what services

Stored Value services

Loyalties and promotion services

Identification

Access control

Ticketing

Parking

Others (please specify).....

22. When does the bank plan to implement smart card for these services?

In less than 2 years' time

In between 2 to 5 years' time

In more than 5 years' time

23. Smart card adoption is given a high priority in the bank

Yes

No

24. Has the bank put in place any policies that would support smart card adoption?

Yes

No

25. Current telecommunication regulation in Kenya promotes adoption of smart card technology by adoption?

Yes

No

26. Does the bank collaborate with any International Payment card business company to promote smart card adoption?

Yes

No

27. Is the company a member of any association whose objective is to promote adoption of smart card technology?

Yes

No

28. Does the bank have a Department or team whose responsibility is to ensure Smart Card technology adoption?
- Yes
  - No
29. What is the level of understanding of the technology in the bank?
- Very high
  - High
  - Low
  - Very Low
30. Has the bank trained its staff on smart card technology?
- Yes
  - No
31. The bank has put in place all equipment, hardware and software to support smart card adoption?
- Yes
  - No
32. Does the bank have programs for educating the consumers and merchants on benefits and opportunities of smart card technology?
- Yes
  - No



### Section C

33. One would expect Kenya and its environs to fully adopt smart card for business transactions in future. To what extent are the following critical, from the bank's perspective, to smart readiness among banking institutions in Kenya? (Place a tick in the column of your answer for each factor. The options are rated from Very Critical to Least Critical; 1 stands for Very Critical and 5 for Least Critical)

		Very Critical				Least Critical
S/N	Attributes	1	2	3	4	5
1	Extensive Infrastructure					
2	Capacity for the smart card business opportunity					
3	Legislative framework of smart card technology transactions					
4	Customer base of the bank					
5	The country's innovativeness					
6	Payment culture of consumers					
7	Best practices to learn from					
8	Collaboration between stakeholders					
9	Retailers' attitude on costs and benefits associated with adoption of the technology.					
10	Universally Accepted Industry Standards					
11	Balance of costs and benefits of smart card technology					
12	Public policy positions with regard to issues surrounding consumer privacy, consumer rights and protection and security of value.					
13	Breadth of usability of the card. (Multi applications on one card)					
14	Simplicity of use of the card					
15	Consumer awareness of the smart card technology					
16	Appreciation of Validity of smart business transactions among individuals, merchants and organisations.					
17	Cost of changing from current payment system utilities as magnetic stripe cards.					
18	Performance of the Economy					
19	Enabling Government policies					

20	Support from large card payment organisations like Visa and Master card.					
----	--------------------------------------------------------------------------	--	--	--	--	--

34. What other factors do you think would determine your competitiveness in the Global market in the future.....

**Section D**

35. What are the major challenges that the bank faces/has faced on adoption of smart card technology? (Please tick as appropriate)

- 1.  Lack of appreciation of validity of smart card business transactions among individuals, merchants and organisations.
- 2.  Getting critical mass of cards into use to achieve its benefits.
- 3.  Changing nature of consumer behaviour
- 4.  Changing political environment
- 5.  Lack of comprehensive policy framework on smart card business
- 6.  Changing nature of consumer behaviour
- 7.  Cost of migration from the current technology e.g. magnetic stripe cards to smart cards
- 8.  Retailers attitude on costs and benefits associated with adopting the technology

Specify any others

- 1.....
- 2.....
- 3.....
- 4.....
- 5.....
- 6.....
- 7.....
- 8.....
- 9.....
- 10.....

**Thank you for your assistance in having taken your time to answer these questions.**

## 6.3 Appendix 3 - LETTER TO RESPONDENTS

University of Nairobi  
Faculty of Commerce  
Department of Management Science  
P.O. BOX 30197  
NAIROBI  
5-SEP-2003

Dear Sir/Madam,

### **RE: REQUEST FOR SURVEY INFORMATION**

I am a post graduate student, pursuing a Master's degree in Business Administration at the University of Nairobi.

In partial fulfillment of the course requirements, I am conducting a research project on "*Adoption of smart card technology among Banking Institutions in Kenya*". Your bank is one of those selected for this research. I therefore kindly request you to provide the required information by filling in the attached questionnaire to the best of your knowledge.

This exercise is purely for academic research. All information you give will be treated in strict confidence, and in no instance will your name or that of the bank be mentioned in the report.

Your assistance and cooperation will be highly appreciated.

A copy of the research report will be availed to you on request.

Yours faithfully,

PETER MWALO  
MBA Student  
D61/P/8230/2000

J. K. KIPNGETICH  
LECTURER/SUPERVISOR  
MANAGEMENT SCIENCE DEPT

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