

**KWAME NKRUMAH UNIVERSITY OF SCIENCE AND
TECHNOLOGY, KUMASI**

INSTITUTE OF DISTANCE LEARNING

PROSPECTS AND CHALLENGES OF MOBILE BANKING IN GHANA

BY

BAWA GAFFAR

**A THESIS SUBMITTED TO THE INSTITUTE OF DISTANCE
LEARNING, KWAME NKRUMAH UNIVERSITY OF SCIENCE AND
TECHNOLOGY, KUMASI, IN PARTIAL FULFILMENT OF THE
REQUIREMENT FOR THE AWARD OF THE COMMONWEALTH
EXECUTIVE MASTER OF BUSINESS ADMINISTRATION (CEMBA)
DEGREE**

SEPTEMBER, 2009

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DECLARATION

I hereby declare that this submission is my own work towards the CEMBA conducted between October, 2008 to April, 2009 and that, to the best of my knowledge, it contains no material previously published by another person nor materials which has been accepted for the award of any other degree of the University, except where due acknowledgement has been made in the text.

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ABSTRACT

Today, the advancement of mobile technologies has provided an opportunity for financial service providers in introducing new financial innovations. One of the emerging financial innovations introduced by financial providers is mobile banking or m-banking. This study evaluates the customer's perspective of the adoption or introduction of m-banking in Ghana. Questionnaires were administered to customers of banks to obtain their perspective on m-Banking. A sample of 100 students (customers) selected at random were employed for this study. The customer's perception was found to be overwhelmingly positive. The most appreciated feature was ubiquity and the overview over bank account. Fast reaction to market developments often cited as one of the most attractive feature of mobile banking did not find high appreciation. Several factors including technical and security standards, regulatory and supervisory issues and business and legal issues were found to be the main factors that might hinder mobile banking implementation in Ghana. Connectivity and secure communication platform and encrypted messaging system were found to be the factors that would enhance mobile banking implementation in Ghana.

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ABBREVIATIONS

ATM/s Automatic Teller Machine/s

CEMBA Commonwealth Executive Master of Business Administration

CIO's Chief Information Officers

CIO's Chief Technical Officers

GPRS General Packet Radio Services

HTML Hypertext Mark-up Language

i.e. that is to say [*Latin: id est*]

ICT Information Communication Technology

IDL Institute of Distance Learning

KNUST Kwame Nkrumah University of Science and Technology

KWG The Bank Act [Germany]

mPIN Mobile Personal Identification Number

PDA Personal Digital Assistant(s)

PIN Personal Identification Number

R&D Research and Development

SMS Short Message Service

TAN Transaction Number

USSD Unstructured Supplementary Service Data

WAP Wireless Application Protocol

xHTMLMP eXtensible Hypertext Mark-up Language Mobile Profile

DEDICATION

This work is dedicated to my sweet loving parents Mr. & Mrs. Bawa through whose efforts and inspirations, I have come this far.

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In preparing this research and analysis report, many people have given a considerable amount of assistance to me. I wish to acknowledge my indebtedness to the students of Accra campus of Kwame Nkrumah University of Science and Technology who devoted their limited time to answer my questionnaires.

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CHAPTER ONE

INTRODUCTION

1.1 Background

Technological developments particularly in the area of Telecommunication and Information Technology are revolutionizing the way business is done. Electronic Commerce is now thought to hold the promise of a new commercial revolution by offering an inexpensive and direct way to exchange information and to sell or buy products and services. This revolution in the market place has set in motion a revolution in the banking sector for the provision of a payment system that is compatible with the demands of the electronic marketplace (Journal of Internet Banking and Commerce, 2008).

In line with global trends, banking business in Ghana too has been undergoing tremendous changes Since independence in 1957. The first step in the evolutionary process was the gradual deregulation of the financial sector, which commenced in the 1989. Then, in the 1990s the introduction of Automated Teller Machines (ATMs) was considered as the first and most visible piece of evidence of the emerging electronic banking in Ghana (Abor, 2008). This was then followed by the introduction of Telebanking, PC-banking and Internet-banking. The next imminent step in this evolutionary process inevitably appears to be mobile banking (M- banking). The use of a mobile phone to conduct payment and banking transactions (M- banking) is at an early stage in a number of developing countries. Because mobile banking uses the existing rapidly expanding mobile phone infrastructure, it has the potential to be deployed rapidly and affordably to expand access to financial services among

unbanked people. Access to financial services is one of the necessary ingredients to fight poverty (Otabil, 2008). Poverty alleviation is at the heart of most donor-supported programmes in Africa, and improving banking services through technology-driven initiatives could be part of pro-poor policies necessary to change the plight of the poor. A study by Bankable Frontier Associates (2006) has identified mobile banking as critical to poverty alleviation in developing countries.

In Asian countries like China, Bangladesh, Indonesia and Philippines, where mobile infrastructure is comparatively better than the fixed-line infrastructure, and in European countries, where mobile phone penetration is very high (at least 80% of the consumers use a mobile phone), mobile banking is likely to appeal even more (Wikipedia, 2008). This opens up huge markets for financial institutions interested in offering value added services. With mobile technology, banks can offer a wide range of services to their customers such as doing funds transfer while traveling, receiving online updates of stock price or even performing stock trading while stucked in traffic. According to the German mobile operator Mobilcom, mobile banking will be the ``killer application `` for the next generation of mobile technology (Wikipedia, 2008).

In the last four years, banks across the globe have invested billions of dollars to build sophisticated Internet banking capabilities (Wikipedia, 2008). As the trend is shifting to mobile banking, there is a challenge for Chief Information Officers (CIO's) and Chief Technical Officers (CTO) of these banks to decide on how to leverage their investments in internet banking and offer mobile banking, in the shortest possible time.

However, there are several issues including the lack of adequate legal framework and security of mobile transactions which tend to hamper the continued progress of developing this sophisticated mobile banking application.

Due to the issues raised in this section and the importance of mobile banking, it is important that a study is carried out to identify the prospects and challenges of mobile banking in a developing country like Ghana.

1.2 Statement of the Problem

Banking is a centuries old industry, yet, in a country like Ghana, there is still a large proportion of the populations that have no bank account, or do not have any formal banking relationship, like accessing credit-loans or overdraft with any bank. It is estimated that this proportion could top 80% of the population (Otabil, 2008).

But, technology, as one of the forces behind globalization, has driven mobile phone usage to impressive levels in Ghana. There are now more mobile phone users in the country than bank account holders (Otabil, 2008).

The relationship between the telecoms operators and banks could therefore drive down transaction cost and improve customer service for both industries. Customers will also benefit from efficient and effective services rendered by both the telecoms and the financial institutions.

Holding cash comes at a high price to poor people because of the risk of crime in many poor countries (Bankable Frontier Associates, 2006). Therefore appropriate financial services help poor people to access usefully large lump sums of money, which may either enable a pathway out of poverty through investment in income generating activities (such as microenterprises) or asset creation (such as housing) or may reduce vulnerability to cashflow, as a result for example, of illness or climate conditions, mobile banking therefore has a major role to play in this area.

As poor people in many countries are forced to rely on informal financial services, which may be unsafe, or fringe formal financial product which may be expensive as well as unsafe, it is important that mobile banking is improved in these countries by the banks so that customers will make informed decisions about their finances. In other words, their exclusion from formal financial services has economic and social impacts which may exacerbate their poverty (Otabil, 2008).

Nonor, (2009) reports that most banks in Ghana now employ very innovative and cutting edge technologies to offer accessibility to their customers. One of such innovations which is fast catching up with a lot of Ghanaians in the banking sector is Mobile banking, also known as M-Banking, SMS Banking, etc.

In the opinion of managers, though education of the service was limited across the country, a lot more of their customers may be willing to change the traditional banking way of queuing in banking halls to avail the convenience of mobile banking services.

It is therefore important that a study be carried out to find out the prospects and challenges of mobile banking since it may enhance the socio-economic development of Ghanaians.

1.3 Significance of the Study

This study has numerous significance. Firstly, improved information communication technology (ICT) could help Ghana leapfrog development challenges, and mobile banking through ICT could soon reflect general economic improvement among people through lower transaction cost. Secondly, it is also hoped that the results of this study will extend current knowledge on mobile banking technology. Furthermore, the study will provide deeper insight into what is needed in order for bank customers to accept this emerging technology and, thus, allow for improvement in banking strategies to attract potential users of mobile banking.

1.4 Objectives of the Study

The objectives of this study were to:

- (1) find out the perceived advantages and disadvantages of mobile banking to the customers.
- (2) find out expectations regarding future development of mobile banking.
- (3) identify factors that may hinder its implementation in Ghana.
- (4) identify factors that may enhance its implementation in Ghana.

1.5 Scope of the Study

For the purpose of simplicity, this study refers to all providers of banking business and financial services as *banks* and does not differentiate between credit institutions and financial services institutions. Thus all the customers of these institutions were targeted.

1.6 Structure of the Study

This study consists of five main chapters. Chapter one dealt with the introduction to the topic, problem statement and significance of the study. In addition, objectives and limitations of the study were also covered here. Chapter two gave a review of relevant literature on the topic. In particular this chapter looked at definitions, services offered in mobile banking, various mediums employed and key challenges of mobile banking. Chapter three provided the methodology adopted for the study. It included the number of participants and their characteristics. The test, scales, interviews or questionnaires schedules and how resulting data was analyzed. Chapter four presents the analysis of information gathered. Conclusion of the study, a Summary and recommendations to enable banks that are thinking of introducing mobile banking were covered in chapter five.

1.7 Limitations

Data for this study was collected from Students of KNUST (Accra Campus). This is because of the costs involved and the limited amount of resources available in collecting data from the general public.

CHAPTER TWO

LITERATURE REVIEW

2.1 Scope of Banking Business

Banking has traditionally been defined as: “ the accepting, for the purpose of lending or investment, of deposits of money from the public, repayable on demand or otherwise, and withdrawal by cheque, draft, order or otherwise” (The Banking Regulation Act of India, 1949).

Banks, in the meantime, are no more institutions involved exclusively in the business of lending and investing money. They now offer a much wider range of services. This modern reality is mirrored in the following definition of “banking business” provided by the Sixth Amendment of the Banking Act of Germany (“*Gesetz über das Kreditwesen*”, known as KWG).

According to this definition the banking business comprises of:

1. *Deposit business*: the acceptance of funds from others as deposits or of other repayable funds from the public unless the claim to repayment is securitized in the form of bearer or order debt certificates, irrespective of whether or not interest is paid;
2. *Lending business*: the granting of money loans and acceptance of credits;
3. *Discount business*: the purchase of bills and exchange of cheques;
4. *Principal broking services*: the purchase and sell of financial instruments in the credit institution’s own name for the account of others;

5. *Safe custody business*: the safe custody and administration of securities for the account of others;
6. *Investment fund business*: all activities that are permitted to investment companies;
7. *Guarantee business*: the assumption of guarantees and other warranties on behalf of others;
8. *Giro business*: the execution of cashless payment and other clearing operations;
9. *Underwriting business*: the purchase of financial instruments at credit institution's own risk for placing in the market or the assumption of equivalent guarantees;
10. *E-Money business*: the issuance and administration of electronic money; and
11. The incurrence of the obligation to acquire claims in respect of loans prior to their maturity.

The KWG defines the term “credit institution”, in accordance with this approach, as following: “Credit institutions are enterprises which conduct banking business commercially or on a scale which requires a commercially organized business undertaking.”

2.2 Scope of Financial Services

In addition to banks there are some other institutions that provide a limited range of similar services. Instead of offering classic banking services such as deposit- or giro business they specialise in services relating primarily to stock markets.

The scope of financial services, as defined by the KWG, includes:

1. *Investment broking*: the brokering of business involving the purchase and sell of financial instruments or their documentation;
2. *Contract broking*: the purchase and sell of financial instruments in the name of and for the account of others;
3. *Portfolio management*: the administration of individual portfolios of financial instruments for others on a discretionary basis;
4. *Own-account trading*: the purchase and sell of financial instruments on an own account basis for others;
5. *Money transmission services*: the execution of payment orders;
6. *Foreign currency dealing*: dealing in foreign notes and coins;
7. *Credit cards business*: the issuance or administration of credit cards and travellers' cheques unless the card issuer also provides the service underlying the payment transaction.

The KWG defines the term “financial services institution” in accordance with this approach as following: “Financial services institutions are enterprises which provide financial services to others commercially or on a scale which requires a commercially organised business undertaking, and which are not credit institutions.”

2.3 Scope of Mobile Banking

Mobile Banking is usually defined as carrying out banking business with the help of mobile devices such as mobile phones or personal digital assistant(s) (PDAs) (Georgi and Pinkl, 2005)

The offered services may include transaction facilities as well as other related services that cater primarily for informational needs revolving around bank activities. Considering these factors and in keeping with the just defined scope of this study mobile banking can be defined as the provision of banking and financial services with the help of mobile telecommunication devices.

The scope of offered services may include facilities to conduct bank and stock market transactions, to administer accounts and to access customised information.

2.4 Services Offered in Mobile Banking

Mobile Banking, as defined above, includes a wide range of services. These services may be categorised as follows (Georgi and Pinkl, 2005).

1. Mobile Accounting
2. Mobile Brokerage
3. Mobile Financial Information

These sub-applications of Mobile Banking are discussed below in detail.

2.4.1 Mobile Accounting

Georgi and Pinkl (2005) defined Mobile Accounting as transaction-based banking services that revolve around a standard bank account and are conducted and/or availed by mobile devices. Not all Mobile Accounting services are however necessarily transaction based. Mobile Accounting represents basically that part of Mobile Banking which deals with

utilising account-specific banking services of non informational nature via mobile telecommunication devices.

Mobile Accounting services may be divided in two categories to differentiate between services that are essential to operate an account and services that are essential to administer an account. Additionally, services are required that inform a customer of transactions and other activities involving his or her account. It is for this reason that Mobile Accounting is offered – almost invariably – in combination with services from the field of Mobile Financial Information.

Table 1: Services in Mobile Accounting

Mobile Accounting	
Account Operation	Account Administration
Money remittances & transfers	Access administration
Standing orders for bill payments	Changing operative accounts
Money transfers to sub-accounts	Blocking lost cards
Subscribing insurance policies	Cheque book requests

2.4.1.1 Account Operation

The term Account Operation, as used in this study, refers to activities that involve monetary transactions. Such transactions may involve an external account, e.g. when paying bills, or an internal (sub-) account, e.g. when transferring money from own savings account to own

securities account held with the same bank. Mobile services that are used to operate an account are:

1. *Money remittances*: Mobile devices may be used to instruct the bank to remit money in order to conduct one-time transactions, such as paying bills or transferring funds. This service can also include the facility to cancel an ordered remittance.
2. *Issue standing orders for bill payments*: The house bank may be entrusted with standing orders for payment of regularly recurring bills, e.g. payment of monthly rent or telephone bill.
3. *Transfer funds to and from sub-accounts*: Funds from one sub-account may be transferred to another as and when needed, for instance from savings account to securities account and vice versa.
4. *Subscribing insurance policies*: Standardized, low-cost insurance policies, e.g. a travel insurance policy may be purchased via mobile devices. This service could be particularly attractive in time-critical situations, for instance if a bank customer has to set out on an urgent, unplanned journey, he may still be able to subscribe to a travel insurance policy offered by his house bank.

2.4.1.2 Account Administration

The term Account Administration, as used in this study, refers to activities that are undertaken by an account-holder to maintain his or her account. This may involve activities like access administration and cheque book requests. Mobile Accounting services that are used to administer the account are:

1. *Access administration:* Mobile devices may be used to administer the access to an account, e.g. to change the individual PIN or to request new Transaction Numbers (TAN).
2. *Change operative accounts:* Through this service a customer can change his default operative account and do transactions using a different account. This option is attractive for customers holding several sub accounts. Funds of sub-accounts may be hereby utilized in a targeted manner without first transferring the amount to the default account.
3. *Blocking lost cards:* Mobile non-voice telecommunication systems e.g. Wireless Application Protocol, Short Message Service (WAP, SMS) can be used round the clock to speedily block lost credit and debit cards irrespective of the current geographic location.

WAP is a non-proprietary (open), global standard that was introduced in its first version WAP 1.0 in 1998. It has been developed by the WAP Forum, a consortium of leading manufacturers of mobile phones including Ericsson, Motorola and Nokia. The objective of developing WAP was to provide an industry-wide specification for developing applications that operate on mobile telecommunications network and transmit Internet contents on mobile devices independent of the transmission technology used by network carriers (WAP-Forum, 2001).

The term “SMS Banking” refers to the provision and availment of banking and financial services via means of text messaging service, known as SMS. SMS Banking services are availed via text messages that are carried by SMS. The customer sends a customised SMS to the bank with predefined commands for each offered service. The server of the banks

receives the SMS, decodes the commands and executes the instructions, if the request is found to be authorised. The authentication is carried out with the help of a special Mobile Banking Personal Identification Number (MPIN). Furthermore, the requests are only accepted from a mobile phone number that has been registered as authorised number for operating that particular bank account. This service uses “account keys” instead of account numbers so that the number does not need to be typed in and remains confidential (Citibank Philippines, 2005).

4. *Cheque book request:* Customers using cheque books can order new cheque books via mobile devices, as and when required.

2.4.2 Mobile Brokerage

Brokerage, in the context of banking- and financial services, refers to intermediary services related to the stock exchange centre, e.g. sell and purchase of stocks, bonds, funds, derivatives and foreign exchange among others. Mobile Brokerage, thus, refers to mobile financial services of non informational nature revolving around a securities account (Georgi and Pinkl, 2005)

Mobile Brokerage, too, may be divided in two categories to differentiate between services that are essential to operate a securities account and services that are essential to administer that account. As is the case with Mobile Accounting, Mobile Brokerage requires informational services in order to facilitate brokerage activities. For this reason, Mobile Brokerage is invariably offered in combination with services related to Mobile Financial Information.

Table 2: Services in Mobile Brokerage

Mobile Brokerage	
Account Operation	Account administration
Selling & purchasing financial instruments (e.g. securities)	Access administration
	Order book administration

2.4.2.1 Account Operation

Operating a securities account is primarily concerned with selling and purchasing of financial instruments. Mobile Brokerage allows placing and cancellation of orders to sell as well as purchase securities and other financial instruments. Mobile Brokerage facilitates full-scale orders with all necessary details such as price limits and the desired stock exchange centre.

2.4.2.2 Account Administration

The following mobile services can be utilised to administer a securities account.

1. *Access administration:* As with Mobile Accounting mobile devices may be used to administer the access to an account, e.g. to change the individual PIN or to request new TANs.
2. *Administer order book:* Orders to sell or purchase stocks, which are not yet carried out, can be modified via mobile devices that are allowed to access the customer order book. Additionally, new standing orders may be placed to sell/purchase a particular stock on reaching a predefined threshold value.

2.4.3 Mobile Financial Information

Mobile Financial Information refers to non-transaction based banking- and financial services of informational nature (Georgi and Pinkl, 2005). This sub-application may be divided into two categories:

1. Account information
2. Market information.

Table 3: Services in Mobile Financial Information

Mobile Financial Information	
Account Information	Market Information
Balance inquiries / Latest transaction	Foreign exchange rates
Statement requests	Market and bank-specific interest rates
Threshold alerts	Commodity prices
Returned cheques / cheque status	Stock market quotes and reports
Credit card information	Product information & offers
Branches and ATM locations	-
Helpline and emergency contact	-
Information on the completion status	-

2.4.3.1 Account Information

The term Account Information, as used here, refers to information that is specific to a customer and his bank, even though it does not necessarily involve a monetary transaction.

Mobile services that belong to this category are:

1. *Balance inquiries*: Mobile devices may be employed to check the current financial status of own bank or securities accounts.
2. *List of latest transactions*: Mobile devices may be used to request a list of latest transactions performed on an account. This service works with a standard, pre-specified number of latest transactions that are reported, as and when demanded. Most of the banks provide a list of up to five latest transactions.
3. *Statement requests*: A statement request – unlike the request for a list of latest transactions – generates a list of all transactions in a given period, for instance in a week or in a month. Statements may be requested either manually, as and when needed. Alternatively the bank may be asked to automatically send statements regularly in pre-specified intervals, e.g. weekly. In Mobile Banking the account statements can be requested via and/or delivered on mobile devices.
4. *Transaction thresholds*: The bank may be instructed to automatically alert the customer via SMS whenever transactions (credits as well as debits) exceeding a certain amount are performed on the account.
5. *Balance thresholds*: A similar threshold alert may be activated for the balance status of the account. The customer may be informed via SMS whenever the balance falls below a certain predefined level. This service may be useful to help the customer avoid unpleasant situations of not being able to honour his commitments.

6. *Threshold alerts for stock prices:* The bank may be instructed to send an alert on mobile devices, via SMS, when prices of some particular stocks fall or jump to a predefined threshold value and ask for further instructions.
7. *Returned cheques/cheque status:* The customer may be informed without time-delay if one of his deposited cheques has not been honoured and corrective steps are required.
8. *Credit cards information:* The customer may check anytime and anywhere the current status of his credit cards and the amount that he may utilise at that given point of time.
9. *Branch and ATM locations:* Mobile devices may help finding the nearest branch or ATM affiliated to a bank. The current location of the customer may be determined by positioning the mobile device. This service may be particularly useful while travelling.
10. *Helpline and emergency contact:* Mobile devices may be provided with content that is required in emergency situations, for instance to block a lost credit card. The information may be either embedded in the telephone menu, e.g. in cooperation with a network carrier or the information may be provided on a WAP page analogue to a web page.
11. *Information on the completion status of an order:* The bank may use “push” services to inform the customer via his mobile device regarding whether or not his orders could be carried out. This ensures that urgent information can be provided to the customer while on the move.
12. *Product information and offers:* The bank can provide information about its products and new offers to a customer on the move. A customer can “pull” the information that he wishes to access. On the other hand the bank can “push” the information/offers that the customer has identified as interesting and is willing to receive.

2.4.3.2 Market Information

The term Market Information – as opposed to Account Information – refers to information with a macro-scope. This information is not directly related to the customer account. It is generated either externally, e.g. exchange rates or central bank's interest rates, or internally by the individual bank, e.g. bank-specific interest rates. The individual bank-customer does not play a direct role in this process. The information may be later sorted out to cater to the individual needs and preferences of a particular customer, if so desired by him, and subsequently delivered on a mobile device of his choice, e.g. a mobile phone or a PDA. Information in this category generally concerns:

1. Foreign exchange rates
2. Interest rates
3. Stock market news and reports
4. Commodity prices (e.g. gold and raw materials)

2.5 Mobile Banking Offers & Employed Mediums

Mobile Banking services should fulfil certain safety criteria in order to ensure customer acceptance as well as business viability. The safety criteria, as described by Mustafa et al. (2002) for conducting secure mobile communication services are certainly as much valid for Mobile Banking:

1. *Confidentiality*: The data must be protected in a way that prohibits any unauthorized access from taking place.
2. *Authentication*: Access to data may be granted only when the user identity has been ascertained and authenticated.

3. *Integrity*: Encryption techniques must be employed to avoid manipulation of the data during transmission. The bank and the customer, should be able to verify the integrity of the transmitted data by crosschecking the validity of certain pre-stipulated attributes.

4. *Non-disputability*: Transactions must be documented, e.g. by generating detailed log files and preserving them for a reasonably long time to allow the customer to take note of the transaction and to report discrepancies, if any, to the bank. So that the non-disputability of customer instructions can be ensured, if needed before a court of law. These data protection/safety standards must be met by technologies that are employed by banks to offer Mobile Banking services. Applications based on three different types of technologies are used for these purposes:

1. Browser-based applications
2. Messaging-based applications
3. Client-based applications

2.5.1 Browser-based Applications

Browser-based applications generate the user interface on the server and transport it subsequently to the mobile device. This interface is then presented to the user graphically with the help of a browser. Primary examples of browser-based banking applications are services based on WAP and i-mode. The main advantage of a browser-based application is that data processing is conducted solely on and by the server. There is, thus, no requirement for the presence of additional software or of significant processing power on the mobile device. Browser-based applications are hence suitable for mobile devices with low memory- or processing power, e.g. mobile phones (Dilg et al., 2004). Secondly, the user does not need

to be technology savvy to install software on his mobile device. Finally, the predefined user interface simplifies the interaction with the application and encourages the user to shed his inhibitions. In the following, some important forms of browser-based applications are described. Since the browser-based applications include solutions based on two prominent protocols WAP and i-mode, we describe banking services offered via these protocols individually.

2.5.2 Messaging-based Applications

In messaging-based applications the communication between the bank and the customer is carried out via text messages. These messages may be triggered automatically by the bank whenever certain predefined events occur, for instance whenever a transaction is performed on the account. Alternatively, the messages may be sent by the bank as a response/confirmation to customer requests. A customer message may contain either an instruction, e.g. to carry out a transaction, or an information request, e.g. for the account status (Dilg et al., 2004).

2.5.3 Client-based Applications

Client-based Mobile Banking applications are those which require software to be installed on the mobile device. Transactions can be prepared offline (e.g. entry of necessary details). Once all necessary data have been keyed in, a connection to the server is established and the data transmitted. Before the data is transmitted a security check takes place by means of PIN and TAN. Client-based applications are attractive because a significant part of banking process is conducted offline reducing online connection time and costs (Dilg et al., 2004).

It is conceivable that the possibility of entering data offline triggers a positive psychological effect for a customer as he does not feel the psychological pressure to be particularly fast during data-entry in order to save costs. This reduces the probability of typing errors getting transmitted thereby helping Mobile Banking win greater acceptability.

The various types of client-based applications are described below:

2.6 Challenges for Mobile Banking

Wikipedia (2008) identified Key challenges in developing a sophisticated mobile banking application. These are:

1. Interoperability
2. Security
3. Scalability and Reliability
4. Application distribution
5. Personalisation

2.6.1 Interoperability

There is lack of common technology standards for mobile banking. Many protocols are being used for mobile banking – Hypertext Mark-up Language (HTML), Wireless Application Protocol (WAP), to name a few. It would be a wise idea for the vendor to develop a mobile banking application that can connect multiple banks. It would require either the application to support multiple protocols or use of a common and widely acceptable set of protocols for data exchange.

There are a large number of mobile phone devices and it is a big challenge for banks to offer mobile banking solutions on any type of device. Some of these devices support WAP browser or only SMS.

2.6.2 Security

Security of financial transactions, being executed from some remote location and transmission of financial information over the air, is the most complicated challenges that need to be addressed jointly by mobile application developers, wireless network service providers and the banks IT departments. Wikipedia (2008), identified the following aspects that need to be addressed in order to offer a secure infrastructure for financial transaction over wireless network:

1. Physical part of the hand-held device. If the bank is offering smart-card based security, the physical security of the device is more important.
2. Security of any thick-client application running on the device. In case the device is stolen, the hacker should require at least an ID/Password to access the application.
3. Authentication of the device with service provider before initiating a transaction. These would ensure that unauthorized devices are not connected to perform financial transactions.
4. User ID / Password authentication of bank's customer.
5. Encryption of the data being transmitted over the air.
6. Encryption of the data that will be stored in device for later / off-line analysis by the customer.

2.6.3 Scalability & Reliability

Another challenge for the CIOs and CTOs of the banks is to scale-up the mobile banking infrastructure to handle exponential growth of the customer base. With mobile, the customer may be sitting in any part of the world (true anytime, anywhere banking) and hence banks to ensure that the systems are up and running in a true 24 x 7 fashion. As customers will find mobile banking more and more useful, their expectations from the solution will increase. Banks unable to meet the performance and reliability expectations may lose customer confidence.

2.6.4 Application distribution

Due to the nature of the connectivity between banks and its customers, it is impracticable to expect customers to regularly visit banks or connect to a web site for regular upgrade of their mobile banking application. It will be expected that the mobile application itself check the upgrades and updates and down load necessary patches (so called Over The Air updates).

However, there could be many issues to implement this approach such as upgrade / synchronization of other dependent components.

2.6.5 Personalisation: It would be expected from the mobile application to support personalization such as:

1. Preferred Language
2. Date / Time format
3. Default transaction
4. Amount format

5. Standard Beneficiary list

6. Alerts

CHAPTER THREE

METHODOLOGY

3.1 Research Methodology

This study relied on only primary data. The survey instrument used was a questionnaire. It was used to obtain both explicit and implicit information. The implicit information was generated by analysing the explicit information provided by the participant in some another context and without a direct relevance, in the participant's eyes, to issues that are of primary interest to the researcher. The implicit information was, thus, used to cross-check the validity of the explicit information provided by the user. The customer's perspective for Mobile Banking was surveyed between 17.01.2009 and 31.01.2009 largely in Accra campus of Kwame Nkrumah University of Science and Technology. A total of 100 persons in the age-group of 18 to 51+ years were randomly selected to answer the 3-page long questionnaire. The questionnaire was administered to students, of the faculty of Engineering, Business Administration and Industrial Mathematics with the prior notification of the teaching staff before the classes began. The researcher was then introduced after collecting the filled questionnaire and explained the purpose of the study.

The researcher read textbooks and articles in journals in order to build a good knowledge of the subject. These serves as a guide in structuring the questionnaires which also enabled the researcher to adopt the appropriate methodologies for the study.

The data was analyzed in a descriptive, multi-dimensional manner using SPSS, so as to illuminate various aspects of Mobile Banking. Frequencies and percentages were computed to analyze the research questions.

CHAPTER FOUR

ANALYSIS OF DATA

4.1 Introduction

This research was done using a sample of 100 students to assess mobile banking in Ghana: the prospects and challenges. Responses obtained from questionnaires distributed are summarized in this chapter in the form of tables and charts.

4.2 Background Information

Age of Respondents: The age of the respondents range from 21 to 51 years. Most of the respondents representing 50% were between the ages of 31 to 40 years. This is followed by those between 21 to 30 years (35%), 41 to 50 years (9%) and 51 years or more (6%) respectively. See table 4 for details.

Table 4: Age of Respondents

	Frequency	Percent
21-30	35	35.0
31-40	50	50.0
41-50	9	9.0
51+	6	6.0
Total	100	100.0

Source: Data from field

Having half of the respondents falling within the age of 31 to 40 years, followed by 35% falling within the age of 21 to 30 years confirms eResults, (2004), study which refers to

members within these segments as technology and innovation friendly. Members of these groups are generally well educated and economically well-off. They are often on the move for professional reasons. Therefore, they carry mobile devices to ensure accessibility. For this reason they are ideal candidates to use services offered via mobile devices.

Gender of Respondents

Most of the respondents representing 89.5% were males and the rest (10.5%) were females as shown in table 5.

Table 5: Gender of Respondents

	Frequency	Percent
Male	85	85.0
Female	15	15.0
Total	100	100.0
Total	100	100.0

Source: Data from field

This discrepancy was generated by a relatively low share of female participants in the engineering and industrial mathematics departments.

Level of Education

Most of the respondents representing 62.0% were Masters Degree students. 37% of them were Bachelors Degree students and the rest (1%) were a diploma Students. Table 6 below shows the results.

Table 6: Level of Education

	Frequency	Percent
Masters	62	62.0
Bachelor	37	37.0
Diploma	1	1.0
Total	100	100.0

Source: Data from field

Faculty/Department of Respondents

Table 7 shows that, most of the students representing 45% are with Industrial Mathematics Department. This is followed those with Engineering Faculty (31%) and the rest are with Business Administration Department.

Table 7: Faculty/Department of Respondents

	Frequency	Percent
Business Administration	24	24.0
Industrial Mathematics	45	45.0
Engineering	31	31.0
Total	100	100.0

Source: Data from field

When asked whether they owned a mobile phone, most of the respondents representing 98% own mobile phones whereas the rest (2%) do not as shown in table 8 below.

Table 8: Do you own a mobile phone?

	Frequency	Percent
Yes	98	98.0
No	2	2.0
Total	100	100.0

Source: Data from field

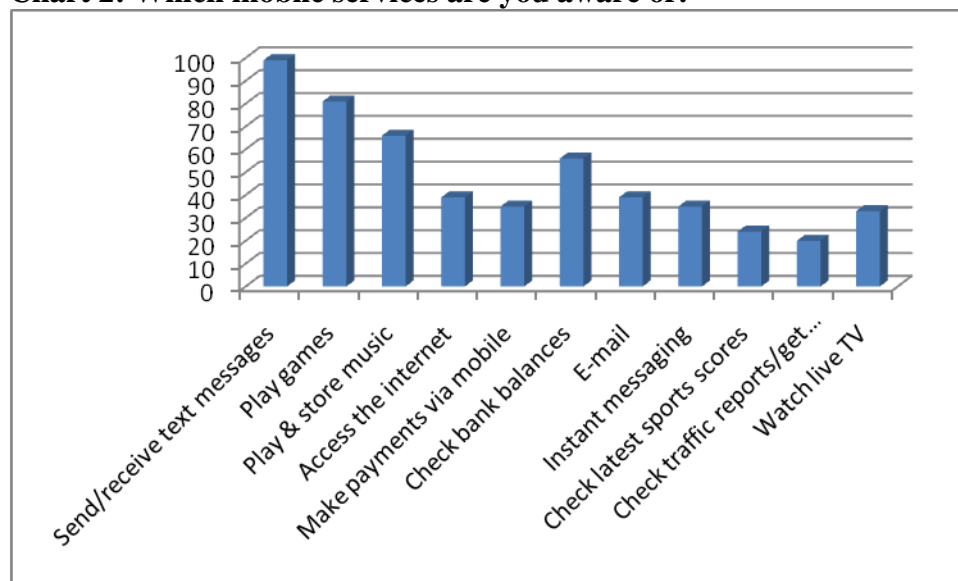
More than half of the respondents own a mobile phone. This is consistent to a study by Bankable Frontier Associates (2006), which identified mobile banking as a critical to poverty alleviation in developing countries. Mobile phone usage has reached critical mass numbers in countries with few banked individuals. This means that because mobile banking uses existing rapidly expanding mobile phone infrastructure, it has the potential to be deployed rapidly and affordably to expand access to financial services among unbanked people.

Again when asked which mobile services are they aware of, most of the respondents representing 99% are aware of send/receive text messages. This is followed by those who are aware of playing games using a mobile phone (81%), playing and storing music using mobile phones (66%) and Check bank balances using mobile phones (56%) respectively . 39% of the respondents are aware of accessing the internet using a mobile phone. Another 39% are aware of the usage of mobile phones to send emails. The rest are using mobile phones to make payments (35%), Instant messaging (35%), watch live TV using a mobile phone (33%), Check latest sports score (24%) using a mobile phone and check traffic reports using a mobile phone (20%). Note that sum of percentages exceed 100% because multiple responses was permissible for this question. See table 9 and chart 2 below for details.

Table 9: Which mobile services are you aware of?

	Frequency	Percent
Send/receive text messages	99	18.8
Play games	81	15.4
Play & store music	66	12.5
Access the internet	39	7.4
Make payments via mobile	35	6.6
Check bank balances	56	10.6
E-mail	39	7.4
Instant messaging	35	6.6
Check latest sports scores	24	4.6
Check traffic reports/get directions	20	3.8
Watch live TV	33	6.3
Total	527	100.0

Source: Data from field

Chart 2: Which mobile services are you aware of?

This suggest that there is an opportunity to boost uptake of mobile banking services since the communication between the bank and the customer will be carried out via text messages.

These messages may be triggered automatically by the bank whenever certain predefined events occur, for example whenever a transaction is performed on the account. Alternatively, the messages may be sent by the bank as a response/confirmation to customer requests. A customer message may contain an instruction, example to carry out a transaction or an information request example for an account status. This message can come in the form of SMS as explained in section 2.4.1.2. It is therefore important to note that familiarity of this mobile service present a great prospect for banks.

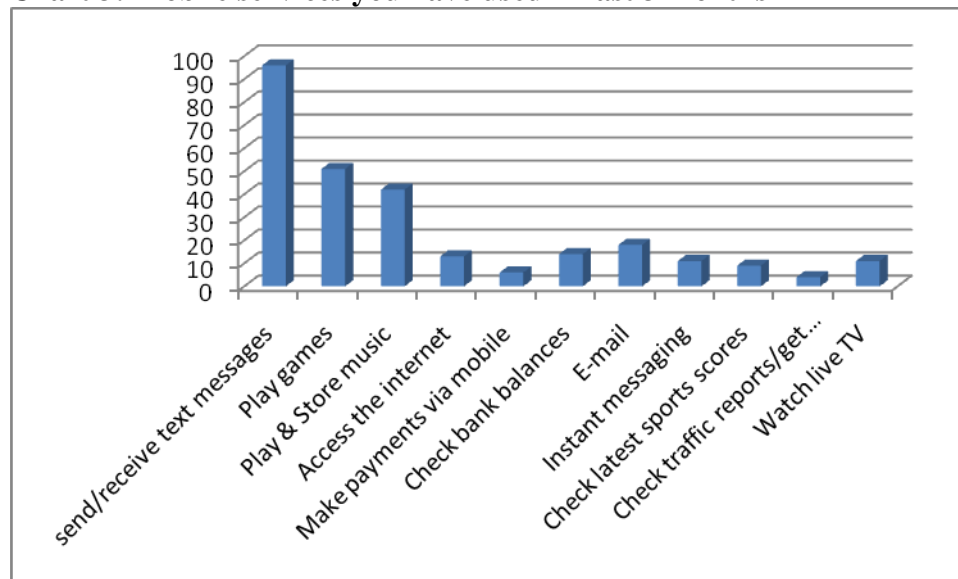
Table 10 and chart 3 below provides the details, when further asked which mobile services have they used for the last three (3) months, most of the respondents representing 96% have used send/receive text messages within the past 3 month. This is followed by those who have played games using a mobile within the past 3 months (51%), those who have played and stored music using mobile phones (42%) and those who have sent emails using mobile phones (18%) respectively within the past 3 months . 14% of the respondents have checked bank balances using a mobile phone.. The rest have used mobile phones to access the internet (13%), instant messaging (11%), watch live TV (11%), check latest sports scores (9%), make payments (6%) and check traffic reports/get directions (4%) within the past 3 months. Note that sum of percentages exceed 100% because multiple responses was permissible for this question.

Table 10: Mobile services you have used in last 3 months

	Frequency	Percent
Send/receive text messages	96	34.9
Play games	51	18.5
Play & Store music	42	15.3
Access the internet	13	4.7
Make payments via mobile	6	2.2
Check bank balances	14	5.1
E-mail	18	6.5
Instant messaging	11	4.0
Check latest sports scores	9	3.3
Check traffic reports/get directions	4	1.5
Watch live TV	11	4.0
Total	275	100.0

Source: Data from field

Chart 3: Mobile services you have used in last 3 months



The respondents representing 6% indicated have used mobile phone to make payments elsewhere outside Ghana.

When asked whether they own a bank account and also whether their banks offer mobile banking, all the respondents claims they own a bank account. 35% of them claim their banks offers mobile banking services. 30% of them claim their banks do not offer mobile banking services whereas the rest of the respondents representing 35% claim they do not know whether their banks offers mobile banking service or not. Table 11 below provides details of this result.

Table 11: Does your bank offer mobile banking?

	Frequency	Percent
Yes	35	35.0
No	30	30.0
Don't Know	35	35.0
Total	100	100.0

Source: Data from field

4.3 Mobile Banking

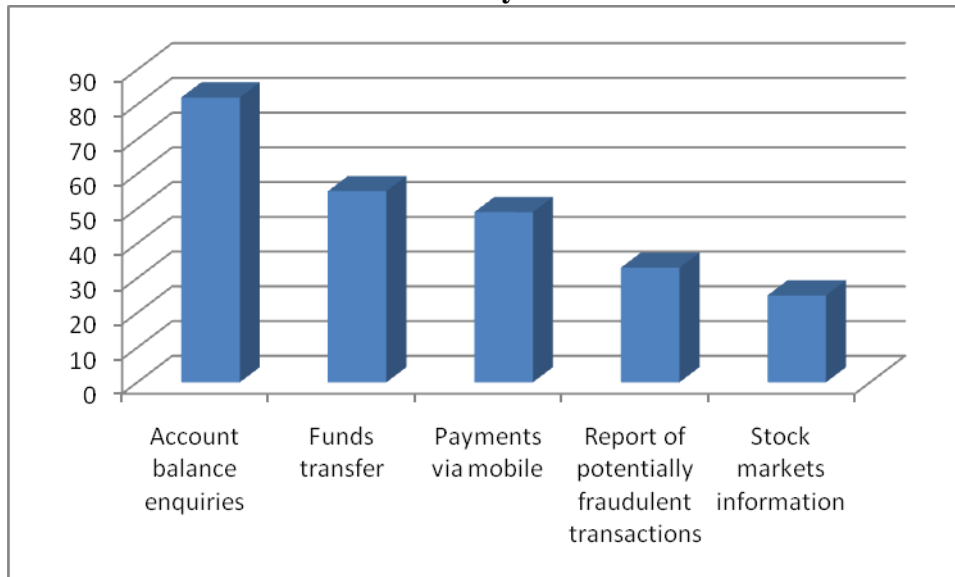
When asked which mobile services they will be interested in most of the respondents representing 82% were interested in account balance enquires. This was followed by those who want funds transfer using a mobile phone (55%), payments via mobile phones 49%, reports of potentially fraudulent transactions (33%) and stock markets information (25%) respectively. Note that sum of percentages exceed 100% because multiple responses was permissible for this question. Table 12 and chart 4 below summarises these results.

Table 12: Which mobile services will you be interested in?

	Frequency	Percent
Account balance enquiries	82	33.6
Funds transfer	55	22.5
Payments via mobile	49	20.1
Report of potentially fraudulent transactions	33	13.5
Stock markets information	25	10.2
Total	244	100.0

Source: Data from field

Chart 4: Which mobile services will you be interested in?



The results of the study indicate that respondents are interested in accessing a wide range of banking services via mobile phone. This is consistent with the definition of mobile banking by Georgi and Pinkl, (2005). They defined mobile banking to include a wide range of services categorized as mobile accounting, mobile brokerage, and mobile financial information. It is therefore, imperative that banks thinking of introducing mobile banking

services should have these priorities in mind. Balance enquiries via mobile phone as the most compelling consumer banking service, followed by mobile fund transfers.

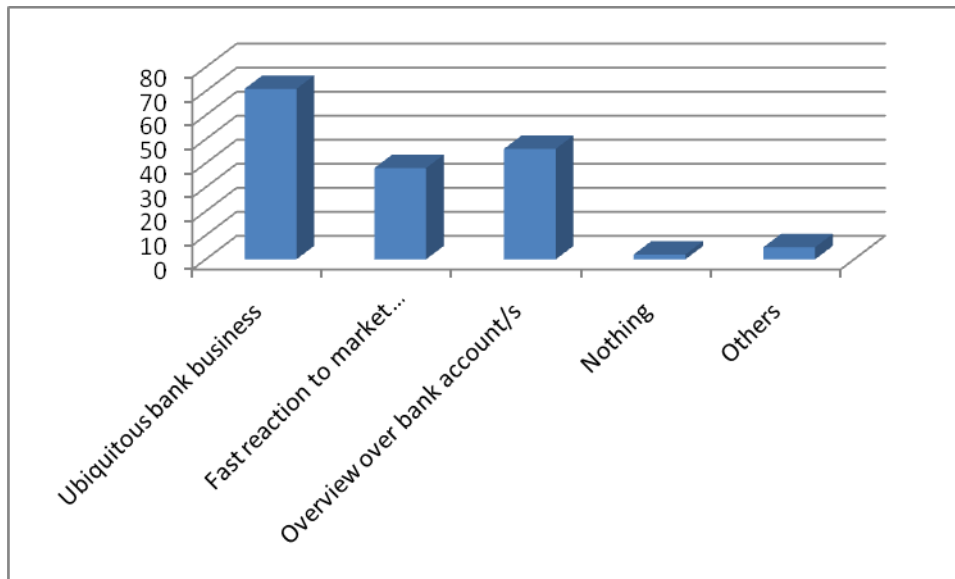
When asked of the advantages of mobile banking, most of the respondents representing 71% believe the biggest advantage of mobile banking is ubiquity (i.e. conducting of bank business anytime, everywhere). 46% of them claim the main advantage is overview over bank accounts. 38% of them are of the opinion that fast reactions to market developments is the main advantage of mobile banking. 2% of the respondents claim mobile banking has no advantages whereas the rest (5%) stated other forms of advantages of mobile banking. Note that sum of percentages exceed 100% because multiple responses was permissible for this question. Table 13 and chart 5 gives you the summaries of the above findings.

Table 13: What are the advantages of mobile banking?

	Frequency	Percent
Ubiquity("anywhere, anytime") conducting of bank business	71	43.8
Fast reaction to market developments	38	23.5
Overview over bank account/s	46	28.4
Nothing	2	1.2
Others	5	3.1
Total	162	100.0

Source: Data from field

Chart 5: What are the advantages of mobile banking?



The respondent's perception was found to be overwhelmingly positive. These outcomes are consistent with previous studies by Luber, (2004), on how mobile banking may help a bank increase the customer satisfaction ratio. Mobile banking may help increase customer satisfaction ratio by adopting the following means:

- Innovative “anywhere, anytime” services customized for individual preferences and the current geographical location of the customer provide value-added to the customer.
- More attention and better consulting for individual customers due to automation of routine processes.
- Streamlining of business processes to increase efficiency.

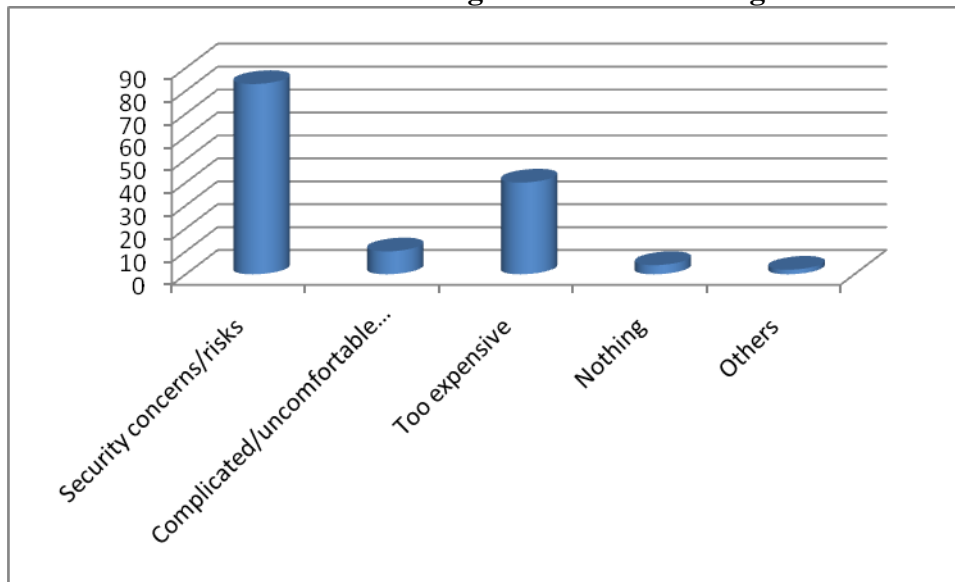
Table 14 and chart 6 shows the results, when asked of the disadvantage of mobile banking. Most of the respondents representing 83% claim the biggest disadvantage of mobile banking is security concerns or risk. 40% of them think the main disadvantage is the expensive nature of the service. 10% of them were of the opinion that complicated or uncomfortable usage of mobile service is the main disadvantage of mobile banking. 4% of the respondents claim mobile banking has no disadvantage whereas the rest (2%) stated other forms disadvantages of mobile banking. Note that sum of percentages exceed 100% because multiple responses was permissible for this question.

Table 14: What are the disadvantages of mobile banking?

	Frequency	Percent
Security concerns/risks	83	59.7
Complicated/uncomfortable usage of mobile devices	10	7.2
Too expensive	40	28.8
Nothing	4	2.9
Others	2	1.4
Total	139	100.0

Source: Data from field

Chart 6: What are the disadvantages of mobile banking?



The result is consistent with previous studies by Bank Systems and Technology, (2008), on mobile banking in America. They identified that security of handheld device, security for the application running on the device, authentication of the device with the service provider before initiating a transaction, password authentication of the customer, encryption of data being transmitted over the air, encryption of data that will be stored in the device for later review by the customer is a complex process.

Again the result is consistent with the previous studies by Wikipedia, (2008), which identified security of financial transactions as the most complicated challenge that needed to be addressed jointly by mobile application developers, wireless network providers and banks IT departments. Therefore, banks should take this security concerns seriously and device measures to handle such risks.

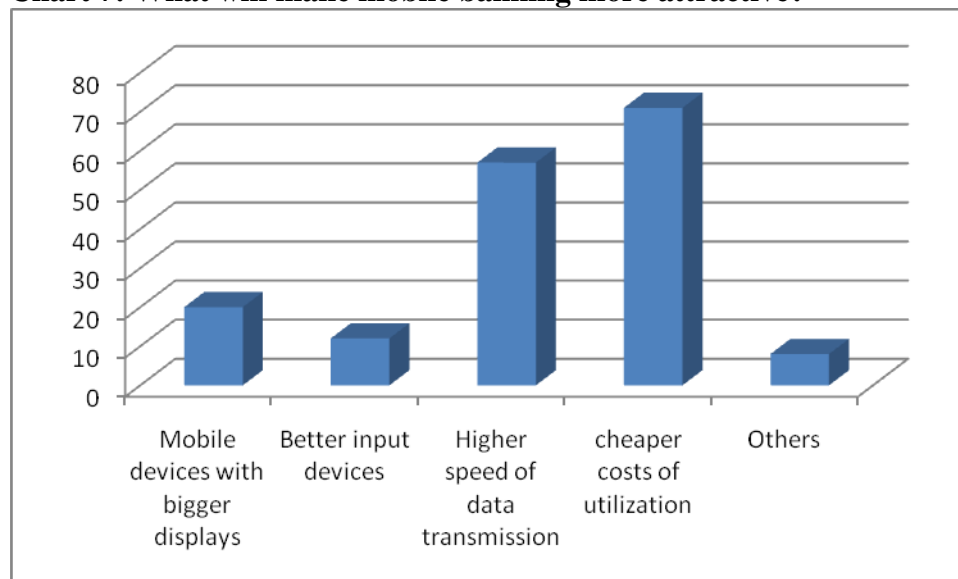
Table 15 and chart 7 shows the results, when asked of what will make mobile banking more attractive. Most of the respondents representing 71% are of the opinion that cheaper costs of utilization will make mobile banking more attractive. This was followed by those who suggested higher speed of data transmission (57%), mobile devices with bigger displays 20%, better input devices (12%) and others (8%) respectively. Note that sum of percentages exceed 100% because multiple responses was permissible for this question.

Table 15: What will make mobile banking more attractive?

	Frequency	Percent
Mobile devices with bigger displays	20	11.9
Better input devices	12	7.1
Higher speed of data transmission	57	33.9
cheaper costs of utilization	71	42.3
Others	8	4.8
Total	168	100.0

Source: Data from field

Chart 7: What will make mobile banking more attractive?



The result is consistent with previous studies by Atkins, (2005), on Nordea Bank. Nordea Bank, one of the pioneers in the field of mobile banking grew by 30% in 2004. Nordea reported cost reduction by motivating customers to shift to electronic / mobile forms of banking. Nordea's customers have been persuaded to take the net banking and mobile routes because these are cheaper and more convenient ways of banking. Therefore, the introduction of mobile services in Ghana should not be so expensive in order not to deter customers from patronizing the services.

When asked of their opinion are the factors that may hinder mobile banking implementation in Ghana, most of the respondents representing 79% were of the opinion that technical and security standards was the main factor affecting the implementation of mobile banking in Ghana. This is followed by those who think regulatory and supervisory issues (46%) is the main hindrance to mobile banking implementation and the rest (25%) think business and legal issues is the main obstacle to the implementation of mobile banking in Ghana. Note that sum of percentages exceed 100% because multiple responses was permissible for this question. Details of the results are shown in table 16 and chart 8 below.

Table 16: What factors will hinder mobile Banking implementation in Ghana?

	Frequency	Percent
Technical and security standard	79	52.7
Business and legal issues	25	16.7
Regulatory and supervisory issues	46	30.7
Total	150	100.0

Source: Data from field

Chart 8: What factors will hinder mobile Banking implementation in Ghana?



This means that banks must deploy only secure channels that provide a non-repudiable platform to transact. It also means that the technology used must be secure, and at the same time convenient to deploy, and cost effective.

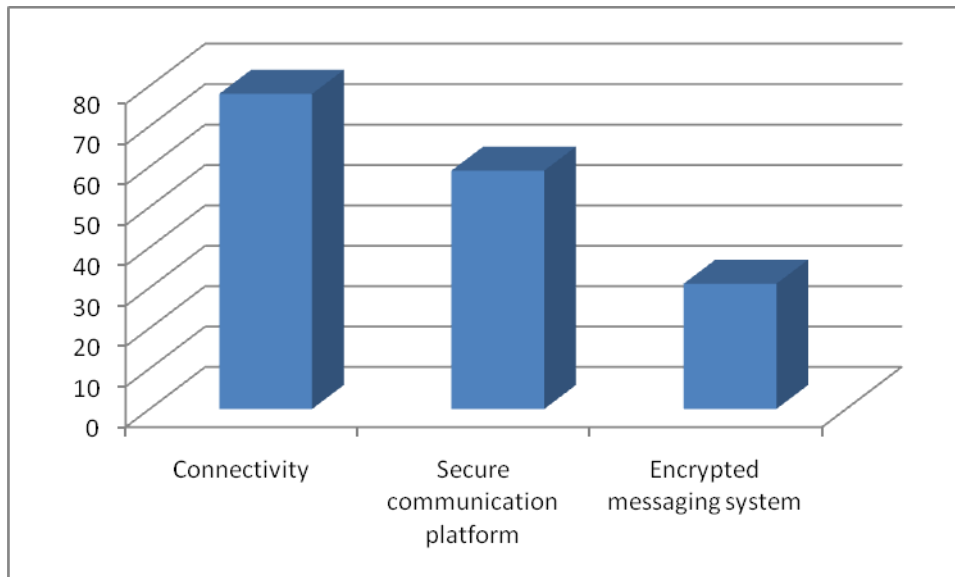
When asked of their opinion on factors that enhance mobile banking implementation in Ghana, most of the respondents representing 78% are of the opinion that connectivity is the main factor enhancing the implementation of mobile banking in Ghana. This is followed by those who think secure communication platform (59%) is the main factor enhancing the implementation of mobile banking and the rest (31%) are of the view that encrypted messaging system is the main factor enhancing the implementation of mobile banking in Ghana. Note that sum of percentages exceed 100% because multiple responses was permissible for this question. Table 17 and chart 9 gives details of this finding.

Table 17: What are the factors that will enhance mobile Banking implementation in Ghana?

	Frequency	Percent
Connectivity	78	46.4
Secure communication platform	59	35.1
Encrypted messaging system	31	18.5
Total	168	100.0

Source: Data from field

Chart 9: What are the factors that will enhance mobile Banking implementation in Ghana?



This means that more users should get connected to at least one mobile network. Given the mobile tele-density and the development of secure mobile technology solutions, banks are well – positioned to bridge the digital divide and introduce the unbanked sector to the financial mainstream.

Additional comments on mobile banking in Ghana

Some of the respondents also provided additional comments on mobile banking in Ghana.

The comments are as follows:

Whereas 53% of them are of the opinion that mobile banking is a better way of assessing account, 20% of them think high charges by banks may make mobile banking unattractive. 10% of the respondents think mobile banking makes life easy. Another 10% of the respondents are also of the opinion of fear of double charges by banks if they subscribe to mobile banking. Also, 4% of the respondents think mobile banking is not different from telephone banking. 3% are of the opinion that the questionnaire was well arranged. Refer to table 18 for details.

Table 18: Additional Comments

	Frequency	Percent
Fear of double charges by Banks	10	10.0
High charges by banks make mobile banking unattractive	20	20.0
It is a better way of assessing accounts	53	53.0
Mobile banking is not different from Telephone banking	4	4.0
Mobile banking makes life easy	10	10.0
Well arranged questionnaire	3	3.0
Total	100	100.0

Source: Data from field

The comment by the respondents on mobile banking as a better way of assessing an account is very high. This contradicts with the cheaper cost of utilization which the respondents selected as the factor that that will make mobile banking more attractive. Perhaps the

respondents think it is better to have a convenient way of assessing an account before thinking of the cost associated with it. The respondents also commented that high charges by banks will make mobile banking unattractive. This means that the respondents may need good services but at a lower or affordable rate. It is therefore, important that banks should be able to provide more attractive mobile banking services and the consumers themselves will be willing to pay for the service. Some respondents think mobile banking will make life easy. That is customers can do business anywhere, anytime. Again, some respondents think mobile banking is not different from telephone banking. Perhaps, these respondents either did not understand the question or are confused of the difference between the two. Some respondents also think that the questions are well arranged. Even though, this comment has no bearing on the topic, but it goes a long way to show how the researcher has systematically arranged the questions to be able elicit response. Some respondents did not comment at all. These respondents either are reluctant to write or did not have something in mind.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary and Conclusion

This study was undertaken to create a better understanding of the prospects and challenges concerning the implementation of mobile banking services in Ghana. As mobile banking is still relatively new in Ghana, an understanding of the prospects and challenges to use mobile banking may influence its implementation. The findings of this study offer insight to commercial banks in Ghana in promoting the use of mobile banking among bank customers. In order to achieve this it is important for commercial banks to take into account the factors that this study had found on the use of mobile banking. These very factors can be utilized to formulate good promotional strategies in enhancing the use of mobile banking among the clientele of Ghanaian banks.

The study results indicate that consumers are interested in assessing a wide range of banking services via mobile phone. The ability to access account balance enquiries via a mobile phone is the most compelling consumer banking service, followed by mobile fund transfers. A second-tier of mobile banking opportunities includes reports for potentially fraudulent behavior, which reflect some of the security concerns around mobile banking and stock market information.

The customer's perception was found to be overwhelmingly positive. The most appreciated feature was ubiquity and the overview over bank account. Fast reaction to market

developments often cited as one of the most attractive feature of mobile banking did not find high appreciation.

Security concern was found to be widespread followed by the cost of using mobile banking services. This means that the technology used must be secure and at the same time convenient to deploy and cost effective.

The plea for lower cost was found to be the preferred factor that will make mobile banking more attractive. This is followed by high speed of data transmission.

Several factors including technical and security standards, regulatory and supervisory issues, and business and legal issues were found to be the main factors that may hinder mobile banking implementation in Ghana.

Connectivity and secure communication platform and encrypted messaging system were found to be the factors that will enhance mobile banking implementation in Ghana.

5.2 Recommendations

The findings of this study have implication for mobile banking system implementation. Research and development (R and D) associated with mobile banking system involves investment of millions of Ghana Cedis. It is important to ensure that bank customers use mobile banking as a new form of banking. In order to achieve this goal, the following suggestions may render ways to attract bank customers to utilize mobile banking.

- Banks should keep preferences of mobile financial information admirers in sight when determining technical and pricing issues related to this service.
- Banks should develop the belief of perceived benefits by providing sufficient information on the advantages of mobile banking. In order to achieve this, banks should provide user manual that contains details on mobile banking, including the ability to assess wide range of banking services such as account balance enquiries, funds transfers via mobile phone. Banks should also have counters for mobile banking customers. These counters can offer advice and assistance to bank customers, focusing on the advantages of the use of mobile banking. By having these counters, bank customers will be able to learn about mobile banking prospects and challenges. This, in turn, will influence customers decision to adopt mobile banking
- Banks should also consider making mobile banking services more affordable to customers in order to make it more attractive. This will go a long way to increase the number of customers who hitherto may not have any account with any bank. Again this helps eradicate poverty and the risk of holding cash, such as theft. It will also give the banks greater competitive advantage.
- Banks can be more focused on the development of self-efficacy. Compeau and Higgins (1995) defined self-efficacy as the belief that one has the capability to perform a particular function. In the context of mobile banking, therefore, perceived self-efficacy can be defined as the judgment of one's ability to use mobile banking. In

order to promote a bank customer's perception of self efficacy in mobile banking, banks should organize training courses in various mobile commerce applications. This will increase bank customers' familiarity of mobile banking.

- Banks should ensure safety measures such as firewalls, intrusion detection and other related security devices are properly developed and enforced in the mobile banking systems. In addition, banks should also stress the importance of confidentiality of personal identification number (PIN) in mobile banking.
- The technology used must be secure and at the same time convenient to deploy and cost effective. That is banks must deploy only secure channels that provide a non-repudiable to transact.
- The existing regulatory framework over banks should be extended to mobile banking.
- The Bank of Ghana should issue guidelines on mobile banking operation and act as a supervisor over the entire risks associated with mobile banking as a part of its regular inspection of banks.
- The Bank of Ghana should demand the strengthening of the risk management practices from the banks in the advent of the use of mobile banking systems as an innovative means to provide services to their clients.

- The Bank of Ghana should also urge banks to put in place a robust technological and information control and security measures to ensure confidentiality and integrity of financial transactions while limiting operational risks and build confidence in such mobile banking services.
- As a regulator, the Bank of Ghana should continue to exercise firm oversight of the payment system as needed to safeguard the soundness of the financial system.

The overall security framework should ensure.

- Encrypted messaging / session between consumer's phone and third party service provider / Telecom Company. Minimum encryption standards to be specified to make the transaction banking grade.
- All subsequent routing of messages to the bank's servers must be with the highest level of security with dedicated connectivity like leased lines.
- All transactions that affect an account (those that result in to an account being debited or credited, including scheduling of such activity) should be allowed only after authentication of the mobile number and the mPIN associated with it. Transactions only for information such as balance enquiry, mini statements, registered payee details, etc may be allowed with either mobile number or PIN.

- All accounts, credit or debit cards allowed to be transacted through the mobile phones should have the mobile phone number linked to the account, credit or debit card. This mobile number should be used as the second factor authentication for mobile transactions.
- Proper level of encryption should be implemented for communicating from the mobile handset to the mobile payments service provider's server.
- Provided the above security recommendations are reviewed, the mobile payment service could use any of the preferred modes of communication viz., SMS, WAP/GPRS, and USSD. There are couple of security issues in some of these modes of communications, which are listed below:
 - a. SMS is the simplest form of communication, but is vulnerable to tampering. As long as there is a second level of check on the details of the transaction so as to guard against data tampering and the mPIN does not travel in plain text, this mode of communication can be used.
 - b. USSD communication uses its inbuilt encryption technology to talk between the cell phone and the operator's server. However, the decryption of the information happens at the cell phone operator's server. Vulnerability of data may exists at this point. This information should be re-encrypted and transmitted to the service provider.
- Any of the following modes of user interface may be used, provided the above listed

security measures are taken into consideration:

- a. SMS
- b. Menu driven application
- c. Menu driven USSD application
- d. WAP/GPRS website

A number of issues remain to be addressed. First, this study looks at the implementation of mobile banking from the customer's perspective. However, this study can be integrated with the bank's perspective to provide a more comprehensive understanding. The location of this study is only confined to Accra campus of Kwame Nkrumah University of Science and Technology. The sample and its responses may not be a representation of the prospects and challenges of mobile banking implementation in Ghana. Future research can improve on this limitation by increasing the sample size and performing future research across different cities in Ghana. Despite these limitations, the present study serves as a pilot study to explore bank customer behavioral intention to use mobile banking. The study will be able to add to the limited knowledge available on mobile banking studies in Ghana.

APPENDIX A : QUESTIONNAIRE

Dear Respondent,

Please this questionnaire is to be used for a research on **PROSPECTS AND CHALLENGES OF MOBILE BANKING IN GHANA**

I should therefore be very grateful if you could fill them as sincerely as possible to ensure successful research.

Thank you very much.

Bawa
CEMBA
KNUST

A : Background Information

1. Please, how old are you (tick one)?

Less than 20 ☐

21-30years ☐

31-40 years ☐

41-50 years ☐

51 or more ☐

2. Gender

☐ Male ☐ Female

3. Please, which level are you (tick one)?

☐ PHD ☐ Master ☐ B.Sc. ☐ Diploma

4. Faculty/Department

Please, which faculty or department do you belong to ?

☐ Business Administration ☐ Industrial Mathematics ☐ Engineering ☐

5. Possession of mobile phone and services offered

Do you own a mobile phone (tick one)? ☐ Yes ☐ No

6. Which of the following mobile services are aware of?

☐ Send/receive text messages ☐ Play games ☐ Play & store music ☐ Access the internet ☐ Make payments via mobile ☐ check bank balances ☐ E-mail ☐ Instant messaging ☐ Check latest sports scores ☐ Check traffic reports/get directions ☐ Watch live TV ☐

7. Which of the following mobile services have you used in the last 3 months

☐ Send/receive text messages ☐ Play games ☐ Play & store music ☐ Access the internet ☐ Make payments via mobile ☐ check bank balances ☐ E-mail ☐ Instant messaging ☐ Check latest sports scores ☐ Check traffic reports/get directions ☐ Watch live TV ☐

8. Possession of Bank account

Do you own a bank account (tick one)? ☐ Yes ☐ No

9. Does your bank offer mobile banking (tick one)? ☐ Yes ☐ No ☐ Don't know

B: Mobile Banking

10. Which of the following mobile Banking services would you be interested in if offered by your bank?

☐ Account balance enquiries ☐ Funds transfer ☐ Payments via mobile ☐ Reports of potentially fraudulent transactions ☐ Stock markets information ☐

11. What in your opinion are the advantages of mobile banking?

☐ Ubiquitous (“anywhere, anytime”) conducting of bank business

- ☐ Fast reaction to market developments (e.g. in case of turbulences in stock market)
- ☐ Overview over bank account/s (e.g. SMS alerts for large transactions)
- ☐ Nothing
- ☐ Others (please specify:)

12. What in your opinion are the disadvantages of mobile banking?

- ☐ Security concerns / risks
- ☐ Complicated / uncomfortable usage of mobile devices
- ☐ Too expensive
- ☐ Nothing
- ☐ Others (please specify:)

13. What in your opinion will make mobile banking more attractive?

- ☐ Mobile devices with bigger display
- ☐ Better input devices (e.g. an external keyboard for mobile phones)
- ☐ Higher speed of data transmission
- ☐ Cheaper costs of utilization
- ☐ Others (please specify:)

14. What in your opinion are factors that may hinder mobile Banking implementation in Ghana?

- ☐ Technical and security standard
- ☐ Business and legal issues
- ☐ Regulatory and supervisory issues

15. What in your opinion are factors that may hinder mobile Banking implementation in Ghana?

☐ Connectivity

☐ Secure communication platform

☐ Encrypted messaging system

16. Any comments.....)

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