

MOBILE PAYMENTS SYSTEM

**The Challenges To Its Adoption In Ghana and What Can Be Done To
Make It Catch On?**

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Dissertation submitted to the Department of Computer Science,
Ashesi University College

In partial fulfillment of Bachelor of Science degree in
Management Information Systems.

May 2010

Declaration

I hereby declare that this dissertation is the result of my own original work and that no part of it has been presented for another degree in this university or elsewhere.

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I hereby declare that the preparation and presentation of the thesis were supervised in accordance with the guidelines on supervision of thesis laid down by Ashesi University College.

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Acknowledgments:

First and foremost, I want to give thanks to the Almighty God for His grace bestowed upon me to successfully undertake this dissertation.

Secondly, I would like to express my deepest gratitude to Kevin Staley of Charlotte, North Carolina, U.S.A., his wife Susan and family, for giving me all the necessary support that I needed for my educational experience, as well as spiritual, moral and financial support that I needed for this dissertation.

Thirdly, I would like to appreciate my mother Josephine Dovi Aryee, for being there for me and being a good mother. And also thank my brothers and sisters, especially my elder brother Michael Kofigah for his support in my education.

Again, I will like to thank Mr. Anthony Douglass Osei, the M.D. of Feedback Consulting, for his spiritual, financial and fatherly support in my life and education.

Again, I will like to thank my supervisor, Dr. Nathan Amanquah, for his advice and encouragements that made this project a success.

Lastly, I wish to acknowledge with gratitude, all the people who supported me one way or the other in my educational experience and to make this dissertation a possibility. Especially to my brother-in-law, Mr. Adams Yahaya.

Finally, I would like to say a big "Thank You" to Mr. Kojo Bimpong-Buta, a member of the pioneering class of 2005, for introducing Ashesi to me, which marked a new beginning in my life.

Abstract:

Mobile Payment System (MPS), which is the use of mobile phone as a “wallet” to make payments through a General Packet Radio Service (GPRS) connectivity or Short Message Service (SMS), or through a Near Field Communication (NFC), is increasingly becoming widely used in many countries globally, such as Japan, Korea, United States of America, South Africa and Kenya. The aim of this thesis is to use various research techniques, including questionnaire, interviews, observations and case studies to find out the challenges to the adoption of Mobile Payment Systems in Ghana, and propose solutions to encourage the wide acceptance of this platform, as a convenient alternative payment system in the country. Also, an application for Mobile Payments, named SikaPay is developed.

Mobile phones present an enormous opportunity for use as a platform for a “Payments System.” Traditionally in Ghana, financial transactions are made using physical cash or checks. However, from the survey conducted as part of this project, people are willing to use Mobile Payment system on their phones. Also, the application developed as part of this project simulated the flexibility of how a Mobile Payment System should be, by allowing user to create their own account and update their account at any time.

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Chapter 1: Introduction

1.1 Introduction and background information

Mobile phones can substitute for travel, allow quicker and easier access to information on prices, enable traders to reach wider markets, boost entrepreneurship and generally makes it easier to do business [1]. Mobile phones have become devices for paying merchants, receiving time sensitive information such as stock quotes, and aid in critical business processes in many countries [2]. Mobile Payment System (MPS) is an innovative application on the mobile phone platform that allows a person to initiate a transaction and make a payment using a mobile phone. MPS as an emerging payment system allows commercial transactions to be carried out anytime, anywhere and by anyone [2].

MPS is a new payment platform in Ghana. The services offered by E-tranzact [3], Afric Xpress [4], MTN[5], Zain [6], Zenith Bank[7], CoreNett [8] are among the few MPS service providers in Ghana. The *TxtnPay* platform introduced in 2008 by Afric Xpress, allows its users to pay bills, bank and transfer money using their mobile phones. MTN's recent introduction of Mobile Money Transfer also allows its users to transfer money using their mobile phones [9].

In Ghana, as elsewhere in Africa, the common payments system used by the majority of the population is a cash payment system, where physical cash is used to pay for transactions. However, elsewhere in the world, there are

other payment systems such as Card Payments System, Online Payments System, and Mobile Payments System, as well as payment by checks. Apart from payment by checks, these payments systems are yet to gain wide acceptance in Ghana. The focus of this thesis is centered on the Mobile Payments System – the ability to use a mobile phone to make financial related transactions or using a mobile phone as the “wallet” of the future.

1.2 The Problem

In Ghana, the cash payment system dominates the forms of payments in the country. This involves carrying physical cash to make payments. Cash gives people instant purchasing power, which makes them rely on the use of cash for their transactions, but it also has a carriage burden. For instance, to complete a transaction involving a large sum of money exchanged between a buyer and a seller, the buyer needs to carry a large sum of money to the point of sales. Elsewhere, in places such as Japan, Korea, Kenya, and South Africa, MPS is often used. It enables people to transfer money through Short Message System (SMS), as in the case of M-Pesa in Kenya [10]. Users can also scan their phones through a device, such as a Point-of-Sales terminal (POS) for payments at shopping malls, as is the case in Japan and Korea [10].

When it comes to payment systems in Ghana, MPS has yet to gain a widespread acceptance in the country, unlike Kenya, South Africa, and some developed countries, where the use of the mobile phone as a “wallet” is used [10]. Developing a payment system, such as Mobile Payment System in

Ghana, will help solve problems such as carrying large sums of money around for making payments, and it will reduce the rate at which our currency gets worn out due to the high circulation of cash among the populace. It will also increase the neatness and durability of our currency, provide convenience in making payments, and increase e-commerce and m-commerce transactions in the country. The focus of this paper is to find out the challenges to the adoption of the use of mobile phone for money related transactions in Ghana and what can be done to address these. The populace mostly depends on cash for transactions, and as the world's payment systems are changing due to technological improvements, there is the need for Ghana to adapt to these changes in order to be a global player when it comes to payment systems.

The Bank of Ghana defines a payment system as "the entire matrix of institutional infrastructure arrangements and processes in a country for initiating and transferring monetary claims in the form of commercial and central bank liabilities" [11]. Currently, the payment systems in place in Ghana include: cash payments, checks payments, card payments, and mobile payments. These payment systems are the instruments through which financial transactions are carried out. However, the use of a non-cash payment systems such as a card or mobile payment systems are not in a widespread use in the country, as cash payment dominates the forms of payment in the country. As can be said, Mobile Payment System, which is a new platform in Ghana, has low patronage, as it has not yet gained wide

acceptance among the populace, for various reasons, that would be explored in this paper. Compared to the traditional cash or check payment system, mobile payment system is a bit complicated as it requires knowledge in the use of a mobile phone and there are security related issues that come with it.

1.3 Potential Benefits

The solution to moving Ghana towards a cashless society through the use of MPS, when widely accepted, would have a great impact on the economic outlook of the country. This impact may be felt in areas such as a reduction in the use of a cash system and in the cost of printing money, Micro-financing, banking and financing, business efficiency and employment opportunities, and in many other areas.

1.4 Objective

Given all the potential benefits above, the objective for this paper is to identify the challenges to the adoption of Mobile Payments System in Ghana, investigate the reasons behind those challenges and develop plans for the successful implementation and wide acceptance of Mobile Payments System as a suitable alternative payment system in Ghana, and also to develop a prototype application named **SikaPay** to simulate the real world Mobile Payments applications.

1.5 Overview of the Paper

Chapter two reviews the literature and looks at existing payment systems in Ghana and globally, and looks at the benefits and risks associated with

Mobile Payment Systems. Chapter three and five is where the methods used for gathering and analyzing the data collected for this project is described.

Chapter four gives a detailed description of ***SikaPay***, a proposed mobile payment application developed as part of this project by looking at the functional and nonfunctional requirements. In chapter six and seven, the implementation and testing of ***SikaPay***, and the challenges and benefits of the project are presented respectively. Chapter 8 is a conclusion on the project.

Chapter 2: Review of Literature

2.1 Money

Money is the medium through which financial transactions are carried out. The term "Money" is an important issue discussed in Economics today. Money has evolved from natural money, coin money, paper money and to the present symbolic-system money, says Heinz Kreft [1212121312]. According to Naaman Helfield, money is the mechanism that allows parties to engage in an indirect exchange of goods and services, and that, the three main purposes and functions of money are medium of exchange, storage of value and unit of account [13].

Money acting as a medium of exchange means that it is usable for buying and selling of goods and services, says McConnell et al [14]. The retention of purchasing power of money overtime is the function of money as a store of value [13]. Money, as a unit of account, provides the terms in which prices are quoted and debts are recorded [15].

There are various types of money in use today for financial transactions, which include: coins, paper currency, cheques, bank drafts, money orders and many more. Coin and paper money fall under the currency category of money or are called fiat money. Cheques, money orders and bank drafts fall under fiduciary money or "demand deposits", also known as "checkbook money", which are the funds people hold in their checking or current account [15].

The proper circulation of money (including coin, paper, check and electronic money) is very important in every economy as the various functions of money helped solve the problem of barter trading, where one has to find someone who has what he wants and who also wants what he has before an exchange could take place.

In Ghana, it is the central bank, Bank of Ghana that has the sole responsibility of circulating money in the economy. The other banks, mostly commercial, also play a role in the retail payments system, where cash is mostly used. The role of the central bank is crucial in developing various payment systems, especially the non-cash payment systems which include electronic payments such as a card payment system and a mobile payment system.

2.2 Payment Systems Globally

The World Bank, in its 2008 Global Survey report stated that a “payment system is the infrastructure (comprised of institutions, instruments, rules, procedures, standards, and technical means) established to enable the transfer of monetary value between parties discharging mutual obligations” [16]. One can deduce from this definition that a payment system is simply a system that provides the physical and electronic means that is used to settle financial transactions in many forms. This can take the form of cash, cheques, and electronic payments. According to Dr. Philip M. Hallam-Baker of the World Wide Web Consortium, cash is made up of a token and it may be authenticated without the influence of the issuer, and that cheques are

“payment instruments whose validity requires reference to the issuer” [17]. Dr. Hallam-Baker also stated that existing credit card payment facilities are the platform through which card payment schemes provide payment mechanisms.

2.2.1 Cash Payment System

A cash payment system is simply using physical cash to make payments. This is the most common form of payment prevailing in most developing countries. The majority of African countries still have cash and cheque economies [18]. Cash is the popular form of payment with customers as transactions are completed immediately and it can also be used for another transaction [19].

Also, people’s reliance on cash can be partly attributed to the perceived instant purchasing power that cash gives them, and partly due to the fact that cash requires no authentication, as in the case of cheques and card payments where an authentication has to be carried out before a transaction is approved. There is also no transaction fee on cash payment, unlike cheques and card payment where a fee is charged by the bank that issued the card.

However, with the cash system, people stand a great risk of insecurity, such as theft or robbery, with the slimmest hope of retrieving that money back. This is one of the great disadvantages of a cash system. Also, too much cash in circulation causes inflation to rise, and as inflation rises, it diminishes the purchasing power of consumers, making it undesirable to hold cash. The use

of Mobile Payment System can address these disadvantages associated with cash payment system.

2.2.2 Cheques Payment System

A cheque payment system is a type of payment made by a bill or draft on a bank, payable on presentation [20]. Unlike cash system, where physical money is used for making payment, with the cheque system a person can issue a cheque as a form of currency for payments which is withdrawn from a bank. Recent developments in the cheque payment system, such as the introduction of Cheque Codeline Truncation by the Bank of Ghana, is to ensure easy clearance of cheques, thus reducing the long period used to clear cheques at the banks. Even though, the cheque system sounds organized, as it involves the use of banks as the point of collection and is safer than cash, and it is evolving as there are on-going developments in the cheque system. Just as the cash system, there are also various risks or disadvantages associated with the use of cheques.

The numerous limitations associated with the cheque system include, dishonoring of cheques (which makes it undesirable), forgery of signature, and many others. Over the years there have been numerous cases of cheques signature forgeries in Ghana, with a recently arrest of a gentleman who was caught at Barclays bank in an attempt to withdraw GHC 48,500[21].

It is worth mentioning that over the years there have been numerous conferences held by bankers, entrepreneurs and many others for an

alternative payment system that is more flexible than cash and cheque – a payment system that would lead to a “cashless” and “chequeless” society [22].

2.2.3 Card and Electronic Payment Systems

A card payment system is the use of a plastic card that contains a Personal Identification Number (PIN) that is linked to one’s account that can be used to withdraw money from the appropriate terminal. Most cards have a magnetic stripe on which data is stored, and has a Card Verification Value (CVV), which is used to verify the genuineness of the card. The existing card payments globally include: credit cards, debit cards, and smart cards. With a credit card, the issuer (in this case a bank or other card issuers) gives a credit line to the card holder, who can then buy goods and services from that credit line using their card. Here, card holders are charged interest on the credit line, and also charged on the use of the card as well. The debit card payment also works similarly to the credit card, with the difference being that payments are directly deducted from the card holder’s account, instead of a credit line.

Aside the magnetic stripe cards, there is a more secure card system known as Smart Card [23]. A smart card looks like a credit card, and can keep private keys secured [24]. It has a chip on which data for transactions are stored. A smart card works on many networks, such as Automated Teller

Machine (ATM)¹ and Point of Sales devices. An example of this is the e-zwich card introduced recently by Bank of Ghana. The benefits of smart cards include: the ability to have more than one application resident on the card plus the ability to use it off-line most of the time, thus reducing online validation cost, and many others [23].

Electronic payment, popularly known as e-money, is a payment platform where users pay money in advance into their e-money account or create an e-money account that is linked to their credit card or bank account. An example of this is PayPal, which allows users to create an account by filling in a form on their website and providing their credit card or bank account details, from which money will be drawn for payments. This payment system makes more use of computer networks and internet access.

Card and electronic payment systems have certain advantages when compared to cash and cheque payment systems. For instance, unlike the cash payment system, where once the physical cash is stolen one's hope of getting that money back is minimal, with a card payment system, there is greater amount of security. Visa or MasterCard for instance have authentication and authorization features such as a card number, a CVV and a secured PIN. The PIN is only known to the card owner, so in the case

¹ An Automated Teller Machine (ATM) is a computer terminal with cash and a system that keeps the bank records from which cardholders can withdraw money from their accounts.

where the card is stolen, it will be difficult for an unauthorized person to withdraw money.

With the biometric card, such as the E-zwich card in Ghana, where the card owner's finger- print is embedded into the system, without which a transaction cannot be approved, gives a high level of security and trust among its users.

However, one of the limitations of the card payment system is that to withdraw money or to make payment, one has to look for the appropriate terminal, such as an ATM or a POS before their transaction can be effected. This is a disadvantage, especially in a situation where there are not many ATMs deployed, or where the ATMs machines are out of service.

2.2.4 Mobile Payment System (MPS)

MPS consists of using mobile devices such as Mobile Phone, PDA, Wireless Tablet and Other devices connected to a Mobile Telecommunication Network, to initiate a transaction, such as a purchase request, and finalizing that transaction by authorizing payments for the exchange of goods and services. This makes MPS a form of electronic payment, with the exception that the transactions are carried out on the mobile phone. Instead of paying using cash, cheques or credit/debit cards, a person can use his/her mobile phone to make payments. "Cell phones with Mobile Payment technology were first introduced in Singapore in 2001 and in Japan in 2004 with over 5 million wallet phones sold the first year on the market" [25]. The vision of MPS is to

transform the mobile phone into a “future wallet” holding credit card, debit account information and mobile “cash” for transactions [2].

MPS mode of operation can be described in five models, namely: SMS, Direct Mobile Billing, Mobile Web Payment (WAP), and Contactless Near Field Communication (NFC) [26].

- As an SMS operation, to make payment, a consumer has to send their request in a form of text through an SMS to a short code or to a particular number (this number being the merchant’s or the other recipient’s number), the recipient will then be informed about the payment’s success and then finalize the transaction [26]. In the case of M-Pesa in Kenya, which was developed by Vodafone and Safaricom and first piloted in 2005, customers use their mobile phones like a bank account or a debit card, where they credit their account at a local air-time dealer, and can then transfer money to a recipient simply using SMS [27].
- The Direct Billing operation of MPS is prevalent in Asia, and does not require the linkage of a credit/debit card or bank account to the MPS account. It is simply using the direct billing option, where the Mobile Network Operator acts as an MPS service provider as well. A person on the Direct Billing option is billed periodically for MPS transactions initiated, as part of the service bill. This option uses a two-factor authentication to make purchases. The two-factor authentication used here are: a PIN and a one time Password [26].

- As an application developed in programming languages such as Java 2nd Micro Edition (J2ME), Python or Wireless Application Protocol (WAP), MPS transactions are initiated through an interface application with a walk-through menu from which the appropriate transaction type is selected. This requires the creation of a virtual currency account that is linked to the sources of finance of the consumer such as a bank account, credit card and virtual-money through a vouchers upload. A list of types of transaction is also provided in the menu from which a user must select one before authorizing a transaction.
- As an NFC application, a user uses a mobile phone equipped with a smartcard or a microchip that is embedded in the phone, and waves his/her phone near a reader module, such as a credit card scanner to make payment. Most transactions do not require authentication, but some require authentication using PIN, before a transaction is completed [26].

Figure 2.1: NFC – Nokia and Visa Cooperation for MPS in Malaysia



Some analysts believe that the mobile phone will replace smart cards as a means of payment, due to the fact that, mobile phones have an embedded chip that can be used to store value or provide secure authorization and identification, and does not have to rely on a card reader [2]. This makes MPS such a powerful alternative payment system, as it has the potential of driving an economy toward a cashless society. It is also worth noting that MPS can be cheaper to afford. MPS deployment in various countries such as Kenya, the Philippines, South Africa, Japan and many more, has clearly shown that one does not necessarily have to own a mobile phone before they can benefit from MPS services such as Mobile Money Transfer (MMT), as they can send their money through an authorized dealer of the MPS service provider.

2.3 The Advantages/Benefits of Mobile Payment System

The benefits of Mobile Payment System can be listed as follows:

- Reduction of cash system
- Easy facilitation of Micro-financing
- Efficient banking and finance services
- Business efficiency
- Increase employment opportunities

2.4 Risks, Challenges and Limitations of Mobile Payment System

Experts in the Silicon Valley say many hurdles still need to be cleared to move the mobile payment system into the mainstream. These include technology challenges as well as high up-front costs, security and enough of the right type of phone [28].

2.4.1 Security

Mobile Payment System security requirements needs can be grouped as follows:

- Confidentiality

Confidentiality relates to how to protect transaction information, such as PIN, Password, and others being exchanged during a transaction.

- Authentication

Authentication ensures that both parties in the MPS system flow are who they claim they are. i.e.: MPS service provider, Customer, Merchants, Banks, and others.

- Integrity

Integrity also deals with protection by ensuring that there is no data modification between the time data was sent and the time data was received by any eavesdropper.

- Authorization

Authorization is to ensure that only authorized parties can access the MPS system.

- Non-repudiation

Non-repudiation ensures that no party in the MPS transaction negotiation can falsely claim they did not participate in a transaction.

Even though the adoption of the GPRS and WAP 2.0 allows for end-to-end encryption and decryption between the mobile device and the service provider, there is still more to be desired, when it comes to security. MPS may also increase physical insecurity in some communities or nations in the

form of mobile phone snatching – as mobile phone users will be seen as targets for robbery. The wide acceptance of MPS is closely related to security – how low the fraud rate is? [29]. "The big hurdle on everyone's mind is how to ensure that the payments are secure and as secure as possible" says Jim Pitts of the Financial Services Technology Consortium (FSTC) [28]. The two main areas of relevance to MPS security are: networking technology and the mobile payment process [29].

2.4.2 Technological Challenges

Challenges in technological advancement and the high cost of adoption to both consumers and service providers, are other challenges facing MPS as well. Acceptance is another challenge facing MPS. Despite the unique features of MPS it is not widely accepted in Ghana. There are no guarantees that MPS technology will catch on in Ghana, as it has in places such Japan, Korea, Malaysia, Kenya, South Africa and the rest. Thus, the survey to be conducted as part of this project to find out the challenges to the adoption of MPS in Ghana, will evaluate this challenge in more in-depth. Other issues are that of compliance procedures between the banks, operators and regulatory authorities, and interoperability of the system [28].

2.4.3 Data Traffic Jams

A potential problem to Internet access on mobile is "data traffic jams". Due to the projection of an increase in the number of people to be using their mobile phones to access the net, make payments and do other things by 2012 [30], it means hackers, cyber criminals and eavesdroppers will now

shift their attention to mobile phones. According to Doug Gross of CNN smart phones security threats are likely to rise due to Worms, spam, viruses and hackers, aimed at targeting individuals for personal, financial information [31], and this may adversely affect people's confidence in Mobile Payment System.

2.5 MPS Addressing The Limitation(s) of: Cash, Cheque and Card Payment

MPS reduces the need for coins and cash in small and large transactions. With MPS, one is not burdened with the carrying of large amounts of money on him/herself for making payments. Unlike the cash system, with MPS there is some level of security through the utilization of secured PINs. Even when the mobile device is stolen, it cannot be used for payments, unless the secured PINs are known by the unauthorized user. These advantages, such as security, convenience and efficiency provided by MPS, make it more desirable than cash and will reduce the overreliance on cash when it is widely accepted by the masses. With Mobile Payment System, situations of cheques signature forgery would not arise, as there would be no need for check presentation.

Also, MPS facilitates a quick and secured movement of money across great distances for making purchases or for transferring money to others. MPS is independent of time and place, regardless of where one is. With MPS a transaction can be carried out at anytime and anywhere. Even in a remote location such as a village, provided there is access to mobile communication,

transactions could still be carried, unlike the lack of easy access to banks or ATM machines in such remote places. With MPS, there is also the avoidance of queuing at a bank for transaction to be carried out.

2.6 Payment Systems In Ghana

In Ghana, the two main types of payment systems are cash and cheques. These two have dominance over the other payment systems like card and mobile, with cash taking the most dominance, as the majority of the population does not have bank accounts. Even though accurate numbers are not available, it is likely that more than 80% of the population uses cash to pay for basic needs like food, medicines, clothing, transportation, and many others, and less than 15% of the population uses bank and cards, with less than 2% using MPS. However, more than half of the population (approx 12.6m) uses mobile phones for communications [32]. Thus in analyzing the payment systems in Ghana, the focus in this work is on the non-cash payment system, such as card and MPS, with a lot of emphasis on MPS as the alternative payment system, considering the mobile phone user population in Ghana. However, it is worth noting that the Bank of Ghana, the responsible authority for payment systems in the country, is improving the payment systems through various implementations such as a National Electronic Payments System (NEPS) which is made up of Electronic Fund Transfer (EFT), Automated Clearing House (ACH), and a SmartCard payment system [18].

2.6.1 Card Payment System in Ghana

In Ghana, local brands dominate the market for card payments, that is, cards issued by banks operating in the market for local transaction, other than those of international brands such as Visa or MasterCard. Nowadays, most banks are issuing international payment cards.

The Bank of Ghana's introduction of a biometric smart card known as E-zwich enables customers to load money on the card and use it at any POS terminal and some ATM machines in the country. The Bank of Ghana, in partnership with banks operating in Ghana, aim to reduce the unbanked population through this system, where an individual does not necessarily need to have a bank account in order to use the system.

The E-zwich card and the recent introduction of the inter-bank transfer system are all efforts put in place by the central bank of Ghana to compliment the use of paper-based cheques and banker's drafts as a means of payment, and also to reduce the over dependence on cash based transactions [33].

However, with the increase in the number of mobile phone users in Ghana, a smarter approach to financial transaction would be the use of mobile phones for payments, thus reducing the appeal for card payments for transactions.

2.6.2 Mobile Payment System in Ghana

TextnPay

The *TxtnPay* system is a secured mobile phone payment system that allows a user to send money to any person using a mobile phone, and also could pay for bills, buy pre-paid airtime, and purchase goods or services. The system also allows users to check their bank account balance. Many organizations in Ghana are partnering with Afric Xpress to use their *TxtnPay* payment system and this has minimized the traffic at their corporate offices, as consumers can now make payments on their mobile phones [33]. Afric Xpress also has a web based payment system, which makes it convenient for businesses and individuals to make financial related payments [34]. However, one of the setbacks to this platform is the low subscriber base, as the system has yet to gain wide acceptance, and efforts are being made by Afric Xpress to make this system accessible to as many Ghanaians as possible [33].

MTN Mobile Money Transfer

MTN, a mobile telecommunication operator in Ghana, in July 2009 launched its mobile money services which will allow its users to store and transfer money, and pay for goods from their mobile phones [35]. The telecommunication giant, in partnership with nine banks operating in Ghana, will allow MTN subscribers and non-subscribers alike, to perform a range of financial transactions using their mobile phone, plus the advantage of accessing their money beyond the normal banking hours in Ghana [35].

As a new payment platform, the MTN Mobile Money also faces the challenge of gaining wide acceptability. However, the MTN Mobile Money has the potential of gaining wide acceptance and capturing the unbanked population

of Ghana, through its platform that allows non-bankers and even people without mobile phones to send money by visiting any of the Authorized MTN Mobile Money Transfer Merchants to make their payments [36].

E-Tranzact

eTranzact also provides mobile payment services such as top up airtime purchase, banking services, subscription payments, bill payments and other services using a mobile phone. Registered eTranzact card holders get to enjoy all these services on their mobile phones.

Chapter 3: Methodology

3.1 Introduction

The focus of this project is finding out whether MPS is a desired payment method in the country, and if it is, then to find out the challenges to the adoption of MPS in Ghana and the steps that can be taken to make it catch on, and also to develop a sample MPS application for deployment. To do the first two parts of the focus requires using an appropriate research methodology to gather the necessary information for accurate analysis of the situation. This chapter describes the methodology used in gathering the required data.

3.2 Data Collection Methods

3.2.1 Questionnaire

The focus of questionnaire administered was to identify the awareness level of people concerning MPS in Ghana, whether they would like such a system and how beneficial it would be to them. The scope of the questionnaire included assessing people's knowledge on mobile phone usage, mobile payment system and assessing people's observations and reservations about the mobile payment platform.

The questionnaire also aimed at obtaining information about people's opinions on what the factors are that are hindering the widespread use of MPS in Ghana. And also, obtained information about the services or features desired of the MPS system in Ghana, and what would facilitate the wide

acceptance of the system as a convenient alternative payment system in the nation.

3.2.2 Interview

Here, person-to-person interviews with some respondents with special knowledge, such as business consultants, experts in the mobile communication industry, finance experts and many others, was carried out in order to gain a professional perspective into the mobile payment system operation in Ghana and elsewhere.

3.2.3 Case Sources

Case source is the use of case study as a way of collecting data for a project. Various case studies relating to Ghana were used, and also that of M-Pesa, the study of the MPS implementation in Kenya.

- **SikaPay Testing And Feedback**

The aim is to build the SikaPay Mobile Payment System and test it with the survey respondents to get immediate feedback that will aid in redesigning the services and features desired for MPS in Ghana [See Chapter 6].

- **Sample Frame**

The target population includes all users of mobile telecom service providers in Ghana.

- **Sample Size**

35 samples were sought for data.

- **Population Size**

As an exploratory research which seeks to uncover variables associated with the problem of MPS adoption in Ghana, the stratified sampling technique was used for this research, and a population size of between 50 was targeted, out of which 35 responded, for the gathering data for analysis and the addressing of the research objectives.

- **Selected Participants**

The selected participants from which data was collected consisted of professionals, students, self-employed persons and others.

3.3 Data Analysis Tools and Methods

Tools to be used in sorting out the data to be collected, listed in order may include pie charts, bar charts and other graphical notations. Appropriate statistical methods such Microsoft Excel and other statistical tools were be used in the analysis of the data.

Chapter 4: SikaPay System Requirements Specification

SikaPay mobile payment system requirement specification describes in detail, the requirements of SikaPay as a mobile payment system – how it should operate: what it should do or not do.

4.1 About SikaPay

SikaPay is a mobile application to be installed on mobile phones to function as a payment system. A user simply starts the application on his/her mobile phone, creates an initial virtual currency account through a step-by-step registration process, enters password and a PIN is generated automatically upon completion and used for authorizing payments. Customers can then log into their SikaPay account using their phone number and password. From their SikaPay account, customers can pay bills, make purchases both online and at merchants' stores, transfer money and receive money into their virtual accounts, and carry out other payments transactions. SikaPay is a JavaTM technology MIDlets based application and uses General Packet Radio Service (GPRS) for communication which supports Https for secure transactions and Short Message Services (SMS) for sending successful transaction details to customers as a "receipt".

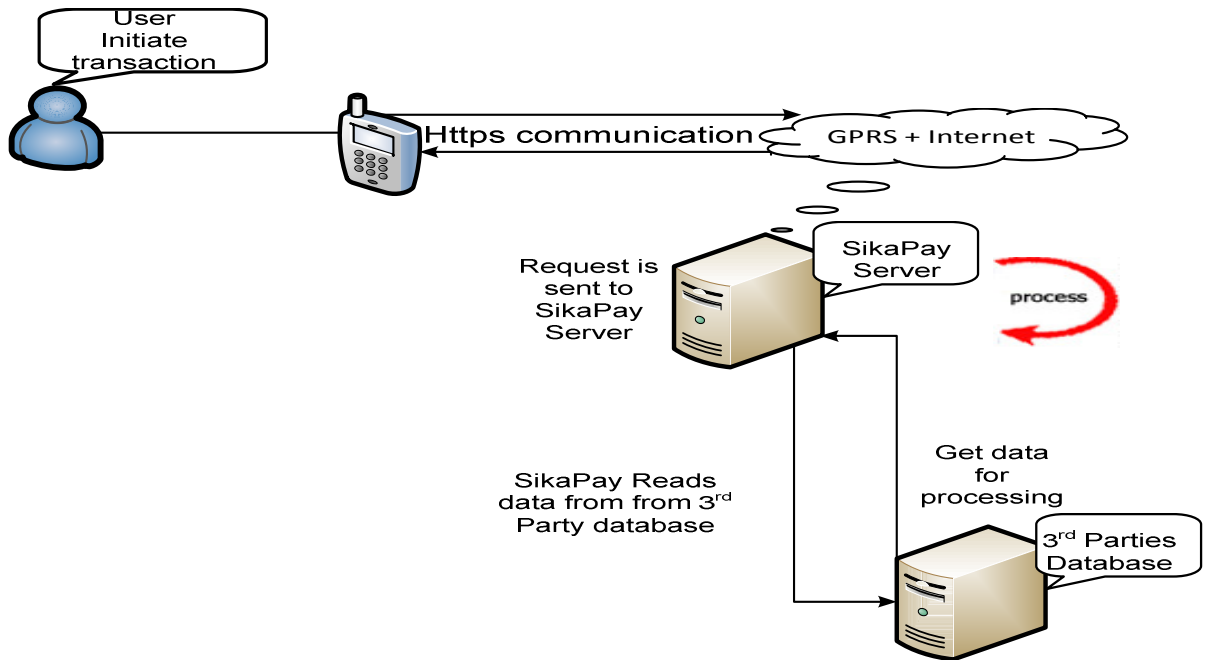


Figure 4.1

4.2 SikaPay Functional Requirements

This section states the functions of the system – what it should do and what it should not:

i.) SikaPay Start-Up

On start-up, ask for user's phone number and password or ask user to create an account. If user clicks on "Create Account" the system takes the user through the initial registration process [Please see SikaPay Data Requirements below]. On the other hand, if user enters phone number and password, that user is allowed into the SikaPay system by loading user's account details.

This functionality makes it possible for a SikaPay account holder to use the account details on any phone (whether owned or not) that has SikaPay on it, and also on SikaPay website.

ii.) Authorization

Upon registration, the PIN generated would be used for confirming any payments, when a user accesses her account and initiates a transaction.

iii.) Payment Options

SikaPay will be made up of five subaccounts [Please see SikaPay Data Requirements]. To make payments, the user must choose which sub account from which to make payment [this is done for accounting purposes].

iv.) Balance Look-Up

When making payment, the user shall specify which account to debit. When an account is selected a quick check is made to find out whether there are sufficient funds available for the payment amount.

v.) Balance Checking

The system will support balance checking in two ways. One, the user can check the total balance in the SikaPay Virtual account. Second, the user can check the balance of each subaccount, as it is in the third party database. Third party databases are banks and other external databases.

vi.) Bill Payment

The system shall support bill payments by providing a list of service providers to be selected and give user the option to add a service provider to pay bill to.

vii.) Online Purchase

When a user selects "Purchase Online" or visits an online shop directly, the user pays for the Internet services using the user's top-up credit. The user must visit a content provider that is set up specifically for easy mobile access and payment. When the user opts to pay using her mobile payment, SikaPay should prompt the user to confirm payment by asking user to enter PIN.

viii.) Money Transfer and Receipt

- SikaPay should support both the transfer of monetary amount to Person-to-Person (P2P) and Business-to-Business (B2B).
- SikaPay should also facilitate both the receipt of monetary amount from Person-to-Person (P2P) and Business-to-Business (B2B).

4.3 SikaPay Non-Functional Requirements

Response time of SikaPay should be less than 3 seconds most of the time. The system must be reliable, be robust enough to have a high degree of fault tolerance, be easy to use, be efficient enough to support a large number of concurrent transactions. The system must be available 24 hours a day and 7 days a week.

4.4 SikaPay Interface Requirements

SikaPay will provide an easy-to-use user interface (UI) as part of the average user's mobile environment, which will be used for collecting user inputs and processing those inputs. The system will provide an interface for the user to enter registration information, account creation information and transaction processing information. The system will

provide interface in human language for interaction with the system and not system language. The user interface consists of J2ME GUI components like Forms, Buttons, Canvas, TextBox, TextField, AlertBoxes and Lists. The system will provide user freedom such as to cancel a transaction, adding or deleting a service provider from the "Bill Payment List" and others.

4.5 SikaPay Data Requirements

i.) Registration

a.) General Information

b.) SikaPay Virtual Account Creation

User's mobile phone number is used as the SikaPay virtual money account. The account is further subdivided into three (3) sub accounts:

- Cash account → this is direct deposit through authorized agents, and also to receive money that is transferred to the recipient's mobile phone.
- Cards account → this hold card details of the user such as: credit cards, prepaid cards, postpaid cards, and others.
- Direct debit Bank account → this accesses the user's bank account directly.

c.) Users' information gathered through registration shall be stored in SikaPay database. User inputs for transaction initiation shall be kept in a log.

ii.) Third-Party Database Access

Access to third party database shall be made either directly or through XML.

4.6 SikaPay Connection Requirements

This section states the connection requirements base for the application:

SikaPay is a General Packet Radio Service (GPRS) based application, it uses Https for secure transaction processing and uses Short Message Service (SMS) as a "receipt" for the customer's records.

4.7 SikaPay Security Requirements

This section describes the security requirements included in SikaPay application. The security requirement is divided into Authentication and Data protection.

4.7.1 Authentication

Password Authentication:

Authentication is the technique for proving identity between two processes. SikaPay employs Password authentication to identify the parties in a transaction. A user, when creating a SikaPay account shall choose a password which is secret to alone. User's phone number and password shall be supplied when logging in to their account. SikaPay server will check the user's phone number and password against a database, if the supplied data is correct the user is authenticated.

PIN Authorization:

Upon successfully creating a SikaPay account, a PIN shall be automatically generated for that user, which the user shall keep secret and use it to authorize transactions. This is to ensure that, even if someone is able to guess the user's password through a *dictionary attack*, they would not be

able to initiate any transaction, as a prompt would request for the PIN to be entered.

4.7.2 Data Protection

Data Integrity:

Data integrity is to ensure the data being exchanged between user's handset and SikaPay server is not getting modified or corrupted in any way. This would be done using *Digital Signatures*. RSA algorithm would be used for Digital signature.

Confidentiality:

Confidentiality is ensuring that when data is being exchanged over the internet, other people should not be able to view that information. This would be done through encryption. Data being exchanged would be encrypted, using RC4, 128-bit Key.

4.8 SikaPay Development Scope

SikaPay would be written in Java ME, a Java mobile programming language and NetBeans 6.8 would be used as the development platform for the application. Registration on the SikaPay web site would be based on HTML and PHP. The HTML would be used for the client side and PHP would be used for the server side. Apache and MySQL would be used for server services and database management services respectively. GPRS and SMS are the two communication platforms for SikaPay.

4.8.1 Tools Used

- i. Java ME Wireless Tool Kit
- ii. Netbeans IDE
- iii. PHP
- iv. Oracle / MySQL database
- v. Apache web sever

4.8.2 Justification for Development Choices

- i. Mobile programming language: Java ME

Java Micro Edition (Java ME) is the Java programming language for mobile application development. Java ME was the choice for SikaPay development, a considerable number of mobile phones and embedded devices have Java Virtual Machine. Java ME also, provide a robust, flexible environment for application running on mobile phones, and has a flexible user interfaces, robust security, built-in network protocols and support for networked and offline applications [37]. Connected Limited Device Configurations (CLDC) and Mobile Information Device Profiles (MIDP) [38], which provides support for Https connection and SMS messaging which are key features of SikaPay application. Java ME is easy free and easy to use as well.

- ii. Server Side language: PHP

PHP Hypertext Processor is used for server side scripting designed for web and mobile applications. PHP, compared to Microsoft's ASP, Java Server Pages (JSP), has high performance strength, built-in libraries

and easy integration with database. PHP is free and easy to use, and there is availability of source codes, hence my choice for using PHP as the server side language for SikaPay.

iii. Database language: MySQL

There are several relational Database Management Systems (DBMS), however, between MySQL and Oracle, MySQL was chosen for the SikaPay project. MySQL was chosen for the reason being that it supports relational databases which is used for SikaPay project. Also, another reason for choosing MySQL is due to the familiarity with this DBMS. It is also free and so does not place any financial constraints on SikaPay project development. MySQL does not require a lot of memory, unlike Oracle. MySQL is available for a range of operating systems, and therefore can be used on any operating system without any changes, unlike MS Access which runs only on the Windows operating system. These reasons sum up the choice for MySQL.

iv. Web server: Apache

Apache server is a commercial grade, open source web server available for most operating systems [39]. Apache is a modular web server, one can add the functionality that is required. Functions, such as programming language support, authentication modules, SSL and

TSL support, proxy modules, custom log files, compression modules, security modules and filtering support [39]. PHP is part of the languages Apache supports. Apache is free to use, easy to configure, and very suitable for SikaPay project, hence the choice of Apache.

v. Communication platform: GPRS

General Packet Radio Service (GPRS) provides an efficient and fast means of transmitting data over the Internet. GPRS provides faster data transfer rate, and also provides many receiving and transmitting channels. With GPRS, users may always be online, and may be charged only for the amount of data that is transported. GPRS is more reliable in ensuring the integrity of data received through the implementation of Radio Link Control (RLC) acknowledged and Logical Link Control (LLC) acknowledged [40]. GPRS is also cheaper, compared to SMS, hence the choice of the use of GPRS in SikaPay.

vi. NetBeans 6.8

NetBeans is an IDE, and the version 6.8 is much better for developing applications. NetBeans 6.8 is not only an IDE, but also an application server and an integrated database, making development easier and fast. With NetBeans 6.8 performance is high and it is very responsive, hence the choice of NetBeans 6.8 for SikaPay development.

Chapter 5: Data Analysis

5.1 Research Result Analysis

Microsoft Excel was used in analyzing the data, and pictorial graphs are mostly used to reflect the frequencies or magnitude of the responses. Respondents of the questionnaire were chosen from Vodafone café at the Vodafone head office, and two selected offices. The café was chosen to represent the general public, as a diverse group of people visit there to surf the net. The two selected office were So Energy Ghana and Feedback Consulting, and they were chosen to represent the banking population.

5.2 General Data

5.2.1 Respondents Gender Distribution

Twenty eight of the respondents were males and seven were females, representing 80% approx and 10% approx, respectively. Figure 5.2.1 shows the result.

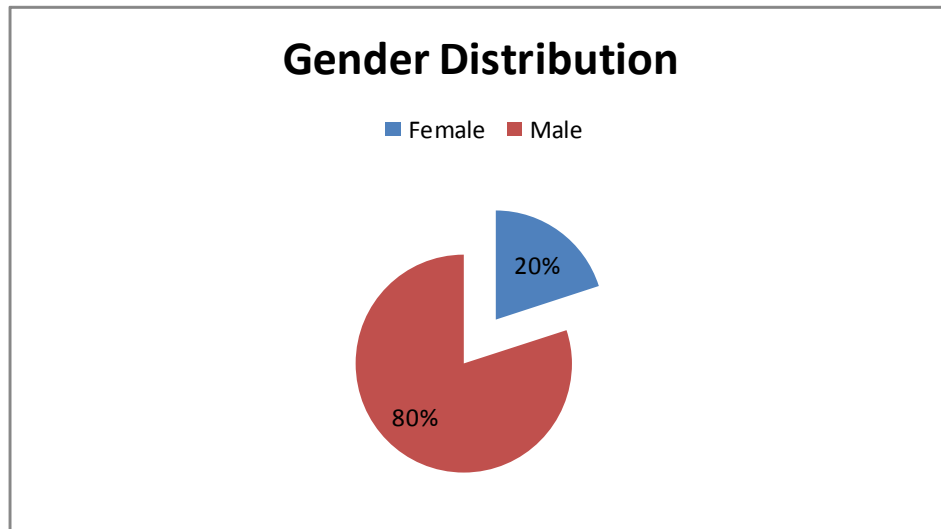


Figure 5.2.1: Gender Distribution

5.2.2 Respondents Age

From the responses, the age range with the highest frequency was between the ages of 18-25, this representing approximately 29% of the sample size that responded to the questionnaire. 26% of the respondents were between the ages of 25-30, and also 26% of the respondents were between the ages of 30-40. 11% of the respondents were between the ages of 40-50, and 8% of the respondents were between the over 50. None of the respondents were less than 18. Figure 5.2.2 shows the result.

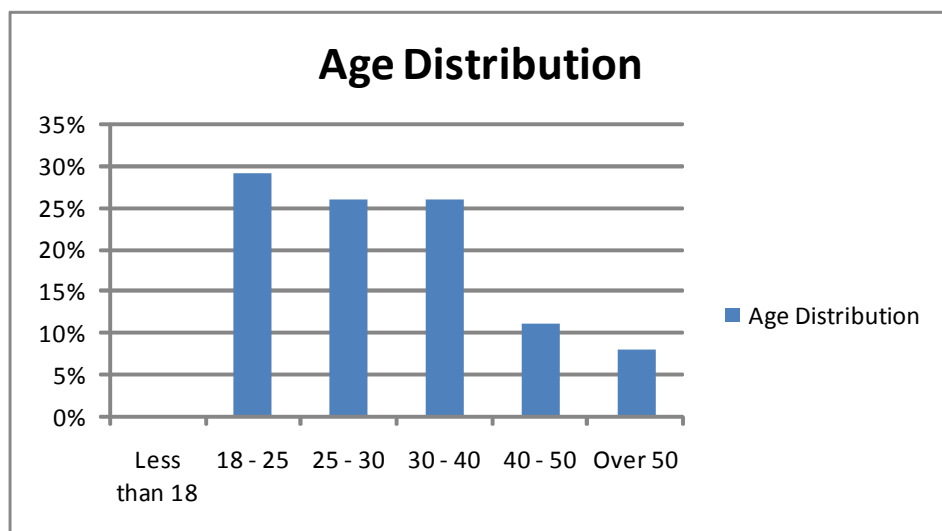


Figure 5.2.2: Age Distribution

5.2.3 Respondents Occupation

37% of the respondents are office workers, while only 6% were civil servants. 14% of the respondents were self employed and another 14% were doing other things like National Service, etc. 29% of the respondents were

students, while none of the respondents was a trader. Figure 5.2.3 shows the result.

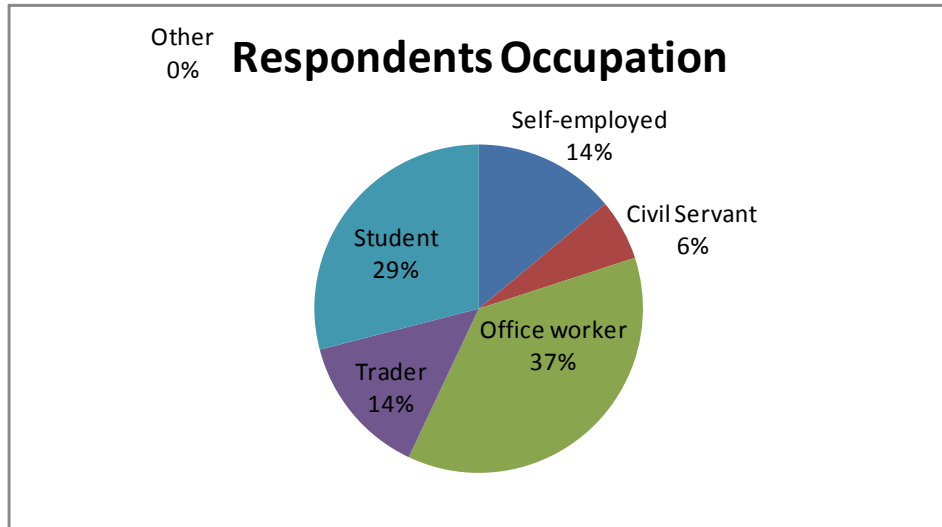


Figure 5.2.3: Respondents' Occupation

5.2.4 Respondents Education

Out of the 29% of the respondents who were students, 60% of them, their education level is that of Diploma or Certificate, while 40% are High School students. In total, out of the 35 respondents, 2 of the respondents' education level is that of Masters education, 14 of the respondents' level of education is a Bachelor's Degree, 13 of the respondents' level of education is that of a Diploma or Certificate, and 6 of the respondents' level of education is that of a High School. None of the respondents' education level is that of PHD, Junior High, primary or no formal education. Figure 5.2.4 shows the result.

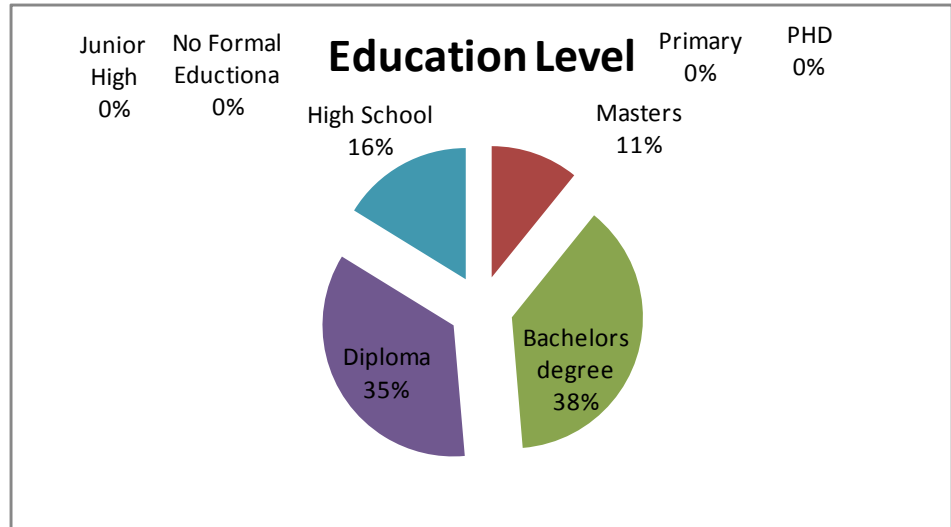


Figure 5.2.4: Education Level

5.3 Mobile Usage Data

This section examines responses relating to mobile phone usage.

5.3.1 Mobile Phone Ownership

33 of the respondents own a mobile phone representing 94% of the respondents, while only 2 of the respondents who do not own a mobile phone, this representing 6% of the respondents.

5.3.2 Mobile Phone Usage

In terms of mobile phone usage, the analysis from the responses shows that most of the respondents use their phone to make calls, receive calls, send SMS and receive SMS, "Bluetoothing", surfing the net and playing games. The number of the respondents who can receive and send SMS are 33 this representing 94% of the respondents. This is highly important as it may affect their ability to use an MPS system. Also, majority of the respondents

are tech savvy users, mostly due to the features that their phones have, such as games, Bluetooth, Internet, etc. The numbers of tech savvy mobile phone users are 24 representing 69% of the respondents.

5.3.3 Willingness to Explore New Services

When asked to rate the willingness to explore new services on their phones, 46% indicated High willingness to explore new services. This is identical to the number of the respondents who are tech savvy when it comes to mobile phone usage. 49% indicated an average willingness to explore new services, while only 6% of the respondents indicated low willingness to explore new services on their mobile phones.

5.3.4 GPRS Support and Usage

When asked whether their phones support GPRS, 25 of the respondents' phones support GPRS, 8 of the respondents' phones do not support GPRS, and 2 of the respondents do not know whether or not their phones support GPRS. Out of the 25 respondents who have GPRS on their phone, only 7 do not use the GPRS functions on their phones. Those who use the GPRS function on their phone, use it to surf the net, view and send emails, chat, read news, and do banking on their phones.

5.4 Mobile Payment System Data

5.4.1 Mobile Service Providers

Nine of the respondents use MTN, six of the respondents use Tigo, nine of the respondents use Vodafone, three of the respondents use Zain. There

were no Kasapa users from the respondents. Also, there were two respondents who use both MTN and Vodafone, one Tigo and Zain user, two Vodafone and Zain users, one MTN and Zain user, and one respondent who uses MTN, Tigo and Vodafone. This result shows that, 37% of the respondents are using MTN which provides MPS services, and 14% who use Zain which also provides MPS services. Figure 5.4.1 shows the results.

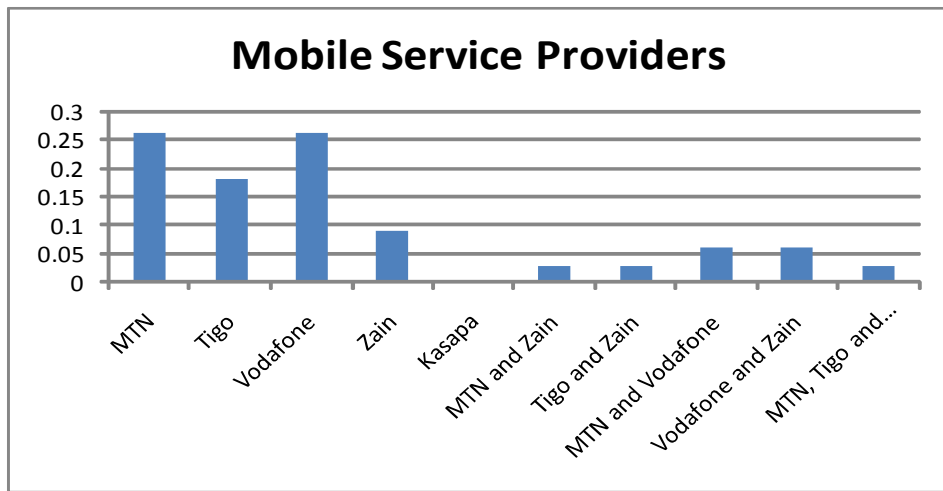


Figure 5.4.1: Mobile Service Providers

5.4.2 Awareness of MPS

From the responses, the awareness level of MPS services in Ghana is high. From Figure 5.4.2, 19 of the respondents are very well aware of MPS, 7 are not really aware, 4 are somehow aware, and only 5 are not aware of MPS service, this represents 14% of the respondents.

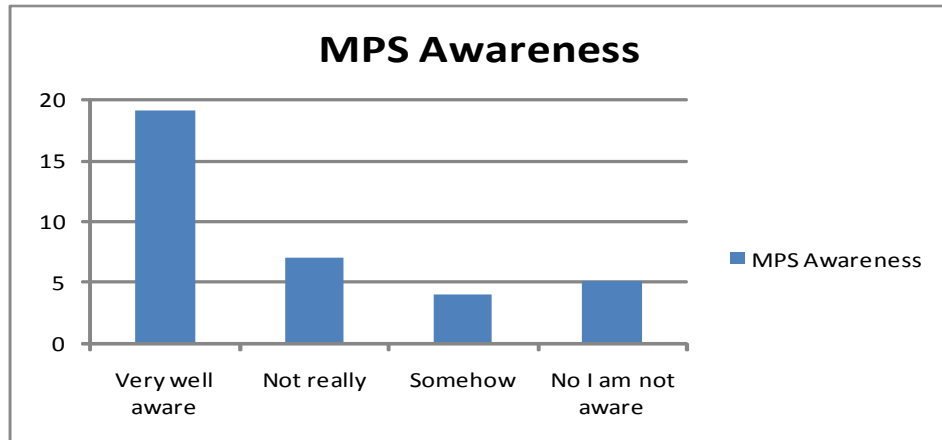


Figure 5.4.2: MPS Awareness

5.4.3 Willingness to Use MPS

Due to their ability to receive and send SMS, most of the respondents are willing to use a mobile payments system on their phone. The number of respondents willing to use MPS amount to 19 and representing 54% of the respondents and that of those who are not willing to use MPS amounts to 40%. 2 of respondents did not specify whether or not they would like to use MPS. Those who are not willing to use MPS stated that lack of awareness and security among other reasons are the reasons for not willing to use MPS. Figure 5.4.3 shows the result.

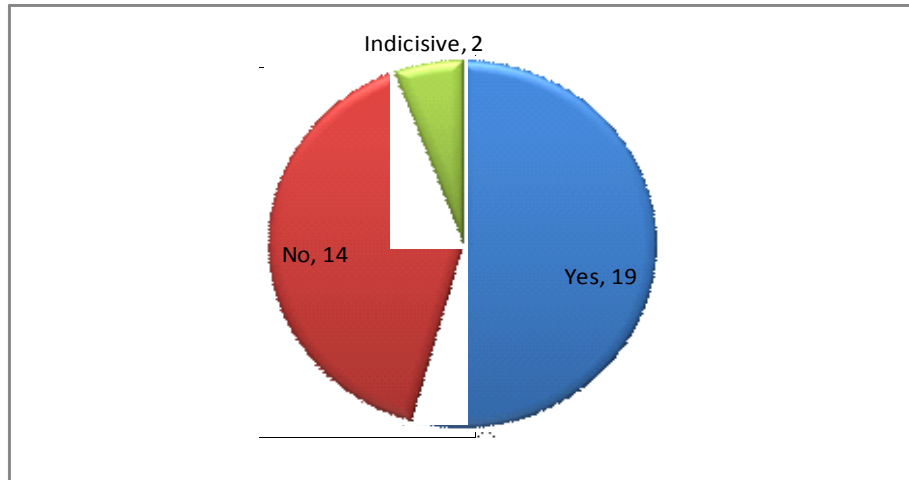


Figure 5.4.3: Respondents' Occupation

5.4.4 E-zwich Card Usage Drawbacks

When asked whether they have the E-zwich card, and what their attitude toward MPS would be like as compared to E-zwich, 20% have the E-zwich card but have never used it, and 80% do not have the E-zwich card. The number of the respondents who have the E-zwich card and have never used it claimed they have not loaded money onto it, not all merchants accept it, others also claimed they have even forgotten that they have it, among other reasons. However, most of the respondents indicated "Full participation" in terms of their attitude when it comes to MPS.

5.4.5 MPS Charges

When asked how they would like to pay for MPS services, 16 of the respondents wanted MPS services to be free of charge, 4 respondents wanted it to be a Flat rate charging scheme, 9 of the respondents want it to be a percentage charges, and 6 of the respondents did not indicate any preferred

charging method. Out of this 6 people, 5 indicated they are not willing to use MPS services on their phone. Figure 5.4.5 shows the result.

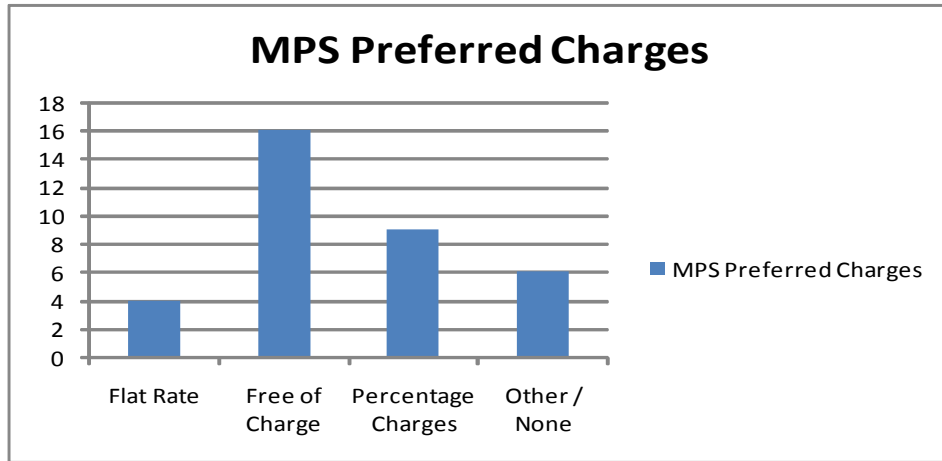


Figure 5.4.5: MPS Preferred Charges

5.4.6 Deterrent(s) of MPS Usage

When asked to indicate which payment system they prefer most of the respondents prefer Cash and Card payment system, representing 14 (40%) and 11 (31%) respectively. Among the reasons given for this choices are that they are easy to use, they are readily available, and they can be used to purchase at most places. Three persons indicated they prefer Card and Mobile payment system, and two persons indicated they prefer Cash and Card payment system. One person did not indicate his preference. Only 4 people indicated they prefer Mobile Payment System, representing 11% of the respondents. Figure 5.4.6 shows the result.

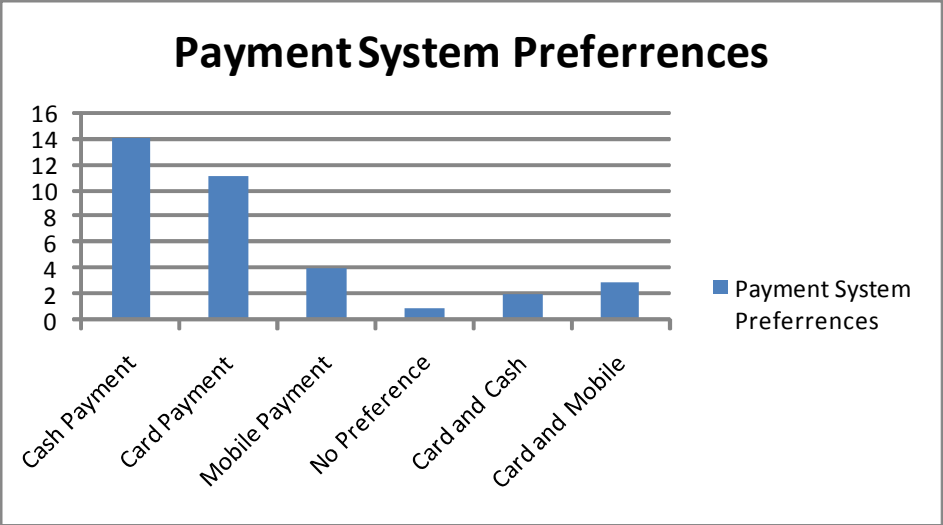


Figure.6: MPS Preferred Charges

Chapter 6: Coding, Testing and Implementation of SikaPay

6.1 Mobile Interface

This section gives a diagrammatic explanation of SikaPay interface.

6.1.1 Basic Menu Structure

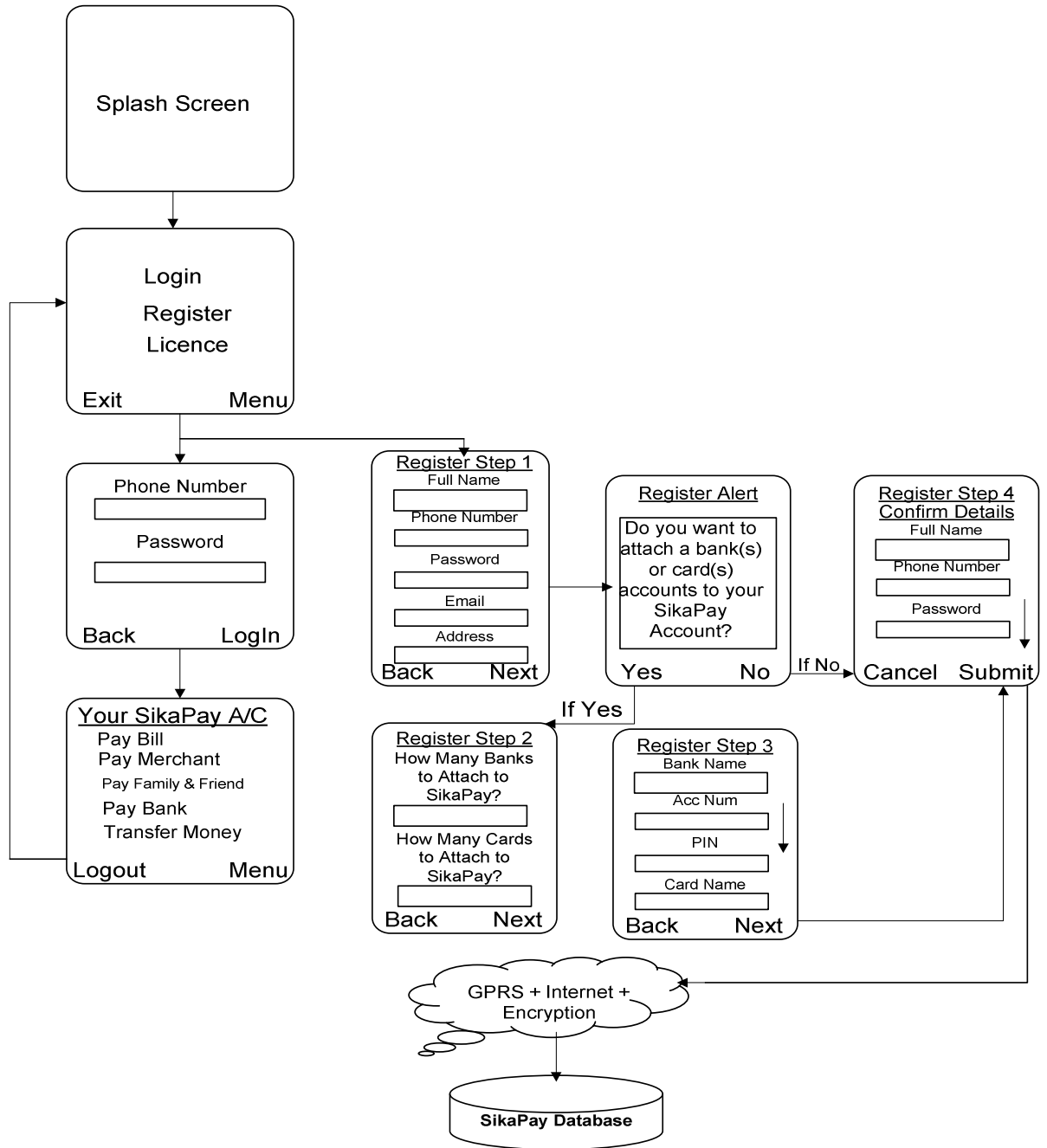


Figure 6.1

6.2 SikaPay Testing and Implementation

Testing of SikaPay was done in two ways:

- i. SikaPay was first tested by two students from Ashesi University: one Business student and one Management Information Systems student. Both students made similar recommendations on changes to a section of the application as follows:
 - a. Make more use of drop-down list instead of letting the user input details of certain information such as the number of bank or card accounts to attach to SikaPay, since most people may be willing to attach one or two accounts to the system, this number can be provided in a drop down list.

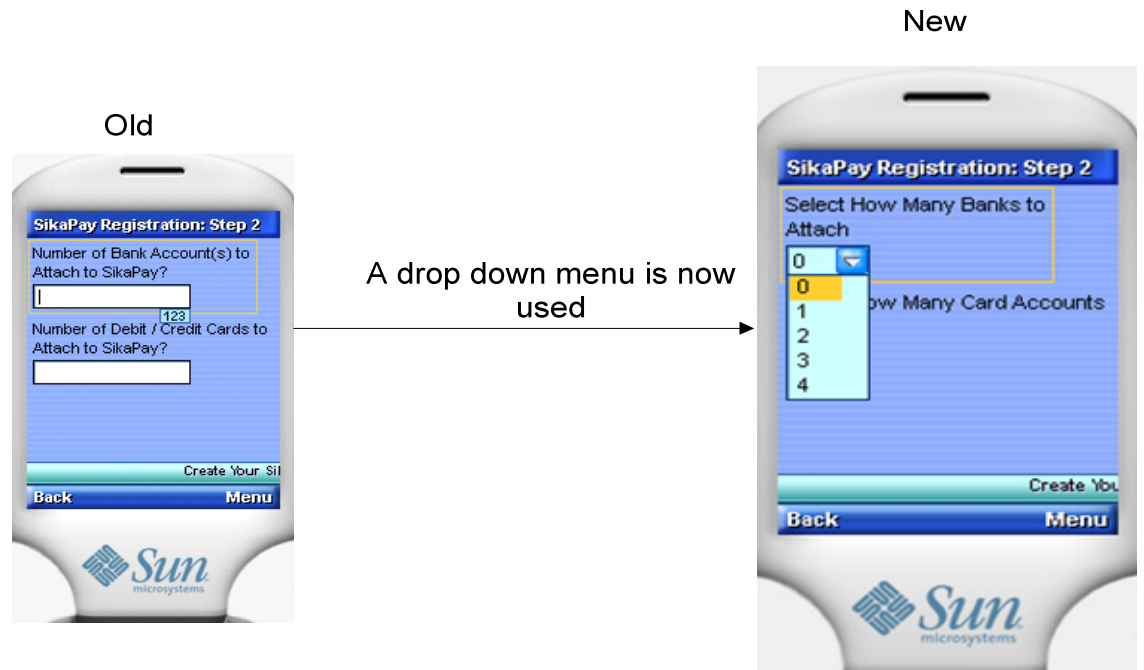


Figure 6.2.1: SikaPay Testing Change 1

- b. The removal of the PIN request for bank accounts when a user opts to attach his/her bank account to SikaPay. The reason being that, when a customer opens an account with a bank, the bank does not give the customer a PIN for that account. What identifies a customer of that account are the bank account number and the signature of the customer. PIN is only given to card users. This change, however, poses a challenge to SikaPay as explained in Chapter 7.

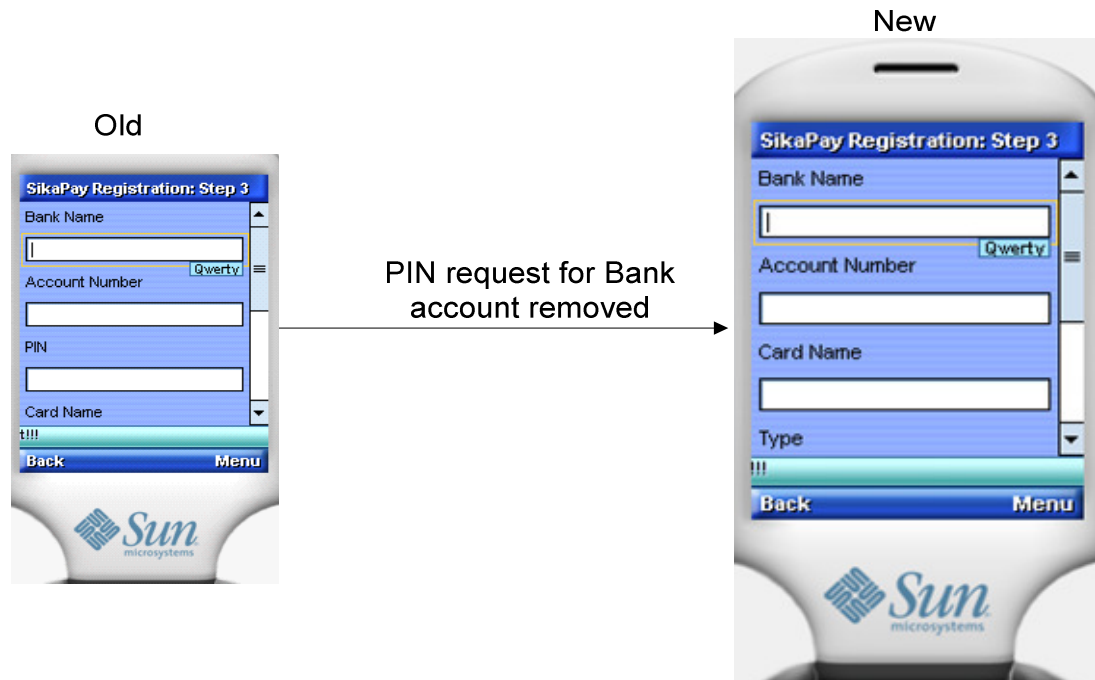


Figure 6.3.2: SikaPay Testing Change 2

c. Credit Card / debit card information:

Another recommendation was on the request for the user's card account's PIN. Their argument was that, when buying online, the user is only asked for Card Verification Value (CVV) a number at the back of the card. Why ask for the PIN? Would people be willing to give out their PIN? This change also poses a challenge, which is explained in Chapter 7.

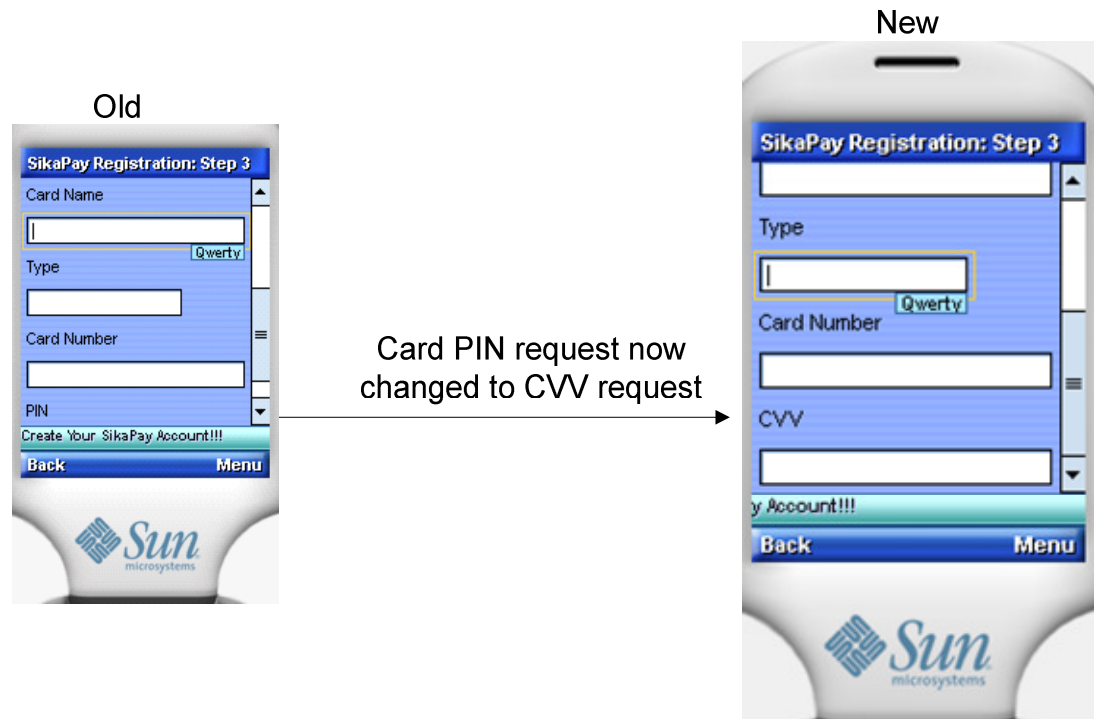


Figure 6.3.3: SikaPay Testing Change 3

ii. Participant of the questionnaire

A lot of the participants were mainly concern with security. They posed a lot of security questions, during the explanation section of what MPS is and how it works. One participant noted on his questionnaire "The more people feel secured about a system, the more comfortable they are to using it."



Figure 6.2.4

From figure 6.2.4, some participants suggested that the recipient's legal identity should be included when sending money to family or friends. The current information that identifies the recipient is the recipient's phone number. However this is of a security concern as anyone in possession of that handset can go and cash that money. Therefore one input box should be added for recipients legal Identification Number. This is a security measure to ensure that only the rightful recipient of the money can cash that money.

Chapter 7: Comments, Benefits & Challenges

7.1 Benefits of Mobile Payments System

7.1.1 Reduction of Cash System

MPS will reduce the amount of cash people carry on them to transact businesses, as people will in the comfort of their homes, offices or wherever they may be, use their mobile phones as virtual money to make payments for transactions. MPS has the potential of capturing the unbanked population of Ghana (those without a bank account), thereby reducing the amount of physical cash in circulation – leading to a cashless system in Ghana, that has the effect of also reducing money related theft issues in the country. This will also save the government some money as it will reduce the cost of printing and reissuing of money in the event where money is worn out and needs to be replaced.

7.1.2 Micro-Financing

Micro-financing involves the advancement of loan and the repayment of loan to individuals, institutions and community for developmental purposes. With MPS, the ability to transfer cash to people, as a form of a loan advancement or a loan repayment, using Short Message Services (SMS) or a Java 2 Platform Micro Edition (J2ME) application is made easy – all of which fall within the functions of micro-financing. MPS can bring financial freedom to people living in the remote part of the country, provided there is access to mobile communication [9].

7.1.3 Banking and Financing

MPS allows mobile banking, as a safe, cashless and all time access to one's personal account. With this, customers can make payments for transactions as well as they are in the position to receive instant and up-to-date information about their bank transactions as they occur. This alerts users of the activities going on in their accounts, and has the effect of reducing the threat of fraudulent activities and unauthorized withdrawals from the users' bank accounts. This system mostly uses Short Message Services (SMS), popularly known as SMS Banking.

7.1.4 Business Efficiency

With mobile payment systems, there is efficiency in business transactions. For instance, MPS provides people with efficient way of transferring money from their mobile phones instead of going to the bank to queue. People can conveniently make their utility payments, without having to go all the way to their utility service provider's office to make those payments. This platform will save them time and ensure value for their money.

7.1.5 Employment Opportunities

A mobile payment platform has the effect of creating indirect employment by way of giving individuals and businesses the opportunity to register as agents for the mobile payment services. Just as individuals and businesses act as agents to sell top-ups units, in the same way they could register, for instance, to be the payment point for mobile money transfer or become the

outlet through which consumers can load cash onto their mobile phones, by earning interest on every transaction they deliver.

7.2 The Challenges Encountered

This section examines the challenges encountered during the testing of SikaPay application by respondents in the questionnaires' administration.

7.2.1 SikaPay Deployment Challenge

Developing the SikaPay application was divided into three parts:

- i. The Front end

This section is mainly concerned about the user interface – what the user sees on their phone.

- ii. The middle layer

This section is concerned with data transmission back over a secure network between the handset and the server.

- iii. The back end side

This section is concerned with receiving data and processing data on the server side.

A systematic approach and time constraints were the main challenges to the development of SikaPay. Learning J2ME for the development of the application was time consuming, hence the delay in the completion of the middle and the back end layers of SikaPay.

7.2.2 SikaPay Testing and Field Notes

Attaching a Bank Account to SikaPay:

Bank account PIN request from the user is for verification with the banks to ensure that the SikaPay user is the rightful owner of the bank account. However, since there is no PIN attached to opening a bank account, this purpose is defeated. The challenge, therefore, still remains: How can one know that this is the rightful owner of the bank account? If the input required is the bank account number and holder's name, anyone who knows someone else bank account information can use it as their own.

Credit/Debit Cards PIN Request:

The request for credit card or debit card PIN is for security purposes, to ensure that the card holder is the rightful owner, as the PIN is only known by the owner. Since the CVV the last three digit number at the back of the card, anyone in possession of the card can easily provide that. This is similar to the challenge with the bank account PIN request.

Appointments Challenges:

Getting appointments with experts and managers in charge of e-business and mobile business at some banks in the country could not take place due to time constraints on my part on one hand, and lack of response from the experts on another hand. Similarly, appointments with Third-party mobile payment service providers could not take place for similar reasons.

The Target Group: Non-bankers:

One of the limitations of the data collection and analysis is that it did not represent the views of non-bankers and illiterates in the country. Even though, the project aimed at targeting the non-banking population in the country, it failed to include their views on the use of MPS in the country. This was due to the time constraints, which prevented field interviews with the market women, farmers, hawkers, and those considered to be non-bankers and mostly illiterates.

Chapter 8: Conclusions and Recommendations

8.1 The Way Forward for Mobile Payment Systems in Ghana (The Plan)

With the increased number of mobile users in Ghana, and the large number of the banking population in Ghana, Mobile Payment System, which provide the ability for a person to use his/her mobile phone to undertake money related transaction securely, is the new trend in payments systems globally. Given the awareness level of MPS among the respondents of the questionnaire undertaken as part of this project, there is a tremendous opportunity for mobile phones to be used as a payment system in Ghana, provided that users are educated about Mobile Payment System, ensure adequate Security infrastructure, and address charging related issues.

Education

The illiteracy rate in Ghana is high and so is the non-banking population as well. This means that for MPS to catch on in Ghana intensive education needs to be undertaken to educate people (both literates and illiterates) about what MPS is, how it works and how to use it.

Security

During interaction with most of the respondents of the questionnaire, one of the questions that came across over and over again is Security. MPS systems should be friendly to use, but very secured as much as possible to increase people's trust in the system.

Charges

During interaction with most of the respondents of the questionnaire, another question that came across was on Charges. They were concerned about the fee charges that come along with using MPS services. They want it to be free. Therefore, for MPS to catch on in Ghana, more Merchants should come on board to bear most of these charges, to increase the usage of MPS services in Ghana.

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Appendix A



Ashesi University College Department of Computer Science

Questionnaire

Mobile Payments System (MPS): What Are The Challenges To Its Adoption In Ghana, and What Can Be Done To Make It Catch On?

Dear Participant,

I am a final year student at Ashesi University, Labone, Accra, and in partial fulfillment of the award of Bsc. Degree in Management Information Systems, I am conducting research on the above topic. The information gathered with this questionnaire is wholly for academic purpose and will be treated with utmost confidentiality.

Thank you for your co-operation.

Yours sincerely,

Solomon Kwashie Kofifah

Section A – General information

A1. Gender: Male Female

A2. Age:

- | | |
|---------------------------------------|----------------------------------|
| <input type="checkbox"/> Less than 18 | <input type="checkbox"/> 18 – 25 |
| <input type="checkbox"/> 25 – 30 | <input type="checkbox"/> 30 – 40 |
| <input type="checkbox"/> 40 – 50 | <input type="checkbox"/> Over 50 |

A3. Occupation:

- | | |
|----------------------------------------|----------------------------------------|
| <input type="checkbox"/> Self-employed | <input type="checkbox"/> Trader |
| <input type="checkbox"/> Civil Servant | <input type="checkbox"/> Student |
| <input type="checkbox"/> Office Worker | <input type="checkbox"/> Other (please |

specify):.....

A4. Education (the highest status currently attained)

- | | |
|------------------------------|-----------------------------------------------|
| <input type="checkbox"/> PHD | <input type="checkbox"/> High School or (SHS) |
|------------------------------|-----------------------------------------------|

- | | |
|------------------------------------------------|------------------------------------------------------|
| <input type="checkbox"/> Master | <input type="checkbox"/> Junior High School or (JHS) |
| <input type="checkbox"/> Bachelor degree | <input type="checkbox"/> Primary |
| <input type="checkbox"/> Diploma / Certificate | <input type="checkbox"/> No formal education |

Section B – Mobile Payment System in Ghana

B1. Do you own/ use a mobile phone? Yes No

B2. What do you use your mobile phone for? (Please tick as many as apply to you)

- | | |
|---------------------------------------------|-----------------------------------------------------------|
| <input type="checkbox"/> Make calls | <input type="checkbox"/> Send SMS |
| <input type="checkbox"/> Receive calls | <input type="checkbox"/> Receive SMS |
| <input type="checkbox"/> Listening to Radio | <input type="checkbox"/> Play Games |
| <input type="checkbox"/> Download Ringtones | <input type="checkbox"/> Use Bluetooth |
| <input type="checkbox"/> Surf the Internet | <input type="checkbox"/> As my “Wallet” to make payments. |

Supplementary comment: _____

B3. Rate your willingness to explore new service on your mobile phone:

- | | | |
|-------------------------------|----------------------------------|------------------------------|
| <input type="checkbox"/> High | <input type="checkbox"/> Average | <input type="checkbox"/> Low |
|-------------------------------|----------------------------------|------------------------------|

B4. Rank your ability to use a mobile phone:

- | | |
|----------------------------------|----------------------------------------|
| <input type="checkbox"/> Poor | <input type="checkbox"/> Tech Savvy |
| <input type="checkbox"/> Average | <input type="checkbox"/> Other (please |

specify):.....

B5. Does your mobile phone support General Packet Radio Service (GPRS)?

- | | | |
|------------------------------|-----------------------------|---------------------------------------|
| <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> I don't know |
|------------------------------|-----------------------------|---------------------------------------|

If you answered “no” to B5, proceed to B8.

B6. Do you use your GPRS to access the Internet?

- | | |
|------------------------------|-----------------------------|
| <input type="checkbox"/> Yes | <input type="checkbox"/> No |
|------------------------------|-----------------------------|

B7. What is your reason for using the Internet access on your phone?

- | | |
|-----------------------------------------------|------------------------------------------------------|
| <input type="checkbox"/> View and send emails | <input type="checkbox"/> Checkout stocks information |
| <input type="checkbox"/> Chat or socialize | <input type="checkbox"/> Banking |
| <input type="checkbox"/> News | <input type="checkbox"/> Online purchase |
| <input type="checkbox"/> Other (Please | |

state):.....

- a. Very satisfied b. Somewhat satisfied c. Not satisfied

B16. Which other functions would you like to have on your MPS services?

.....
.....
.....

B17. Why wouldn't you like to have or use a Mobile Payment System on your phone?

- a. Trust issues b. Security issues c. Personal reasons

- d. I am not a mobile savvy e. Other

Supplementary comment:_____

B18. Are you satisfied with the cash and card payment systems in Ghana?

- a. Very satisfied b. Somewhat satisfied c. Not satisfied

B19. Which one do you prefer?

- a. Cash payments system

- b. Card payment system

- c. Mobile payment system

Any reason(s) for your preference? Please

state:.....

.....
.....

B20. In 2008 the Bank of Ghana introduced the E-zwich card, do you have one?

- a. Yes b. No

NB: If you answered "no" to B20, please proceed to B23

B21. Have you ever used your E-zwich card?

- a. Yes b. No

NB: If you answered "yes" to B21, please proceed to B23

B22. Why have you not used your E-zwich card? (Please state)

.....
.....
.....

B23. Comparing the E-zwich card to Mobile Payment System, what will be your attitude towards MPS?

- | | |
|---------------------------------------------|------------------------------------------|
| <input type="checkbox"/> Full participation | <input type="checkbox"/> Reluctant |
| <input type="checkbox"/> Lukewarm | <input type="checkbox"/> Will not use it |

B24. How would you like to pay for the services of MPS?

- | | |
|-----------------------------------------|------------------------------------------------------------|
| <input type="checkbox"/> Flat rate | <input type="checkbox"/> Percentage charge per transaction |
| <input type="checkbox"/> Free of charge | <input type="checkbox"/> Other |

Supplementary comment:_____

NB: If you answered "free of charge" to B24, Please state any reasons why MPS services should be free of

charge:.....

.....
.....

Section C – SikaPay Feedback

C1. Do you have SikaPay on your mobile phone or have you tested it?

- a. Yes b. No

NB: If you answered "no" please proceed to C6.

C2. Do you find the interfaces user friendly?

- a. Very friendly b. Not friendly c. Just Ok

C3. Do you find the various functions useful?

- a. Yes b. No

C4. How easy was it to use SikaPay functions?

- a. Very easy b. Difficult c. Average

C5. How might SikaPay be

improved?.....

.....
.....
.....

C6. In your own words, please state “what can be done” to make MPS catch on in Ghana, and towards a cashless society:.....

.....
.....
.....
.....

Thank You For Taking Time to Fill This Questionnaire

Solomon Kwashie Kofigah