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SMS Based Information Systems

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ABSTARCT

The Short Message Service (SMS) allows text-based messages to be sent to and from mobile telephones on a GSM network. Each message has a maximum length of 160 characters. The possibility of using SMS in Africa is growing rapidly high. It is mostly used for things such as medicine awareness and warning notifications. In Mozambique health workers can support diagnosis & treatment through Bulk SMS and even in Uganda, Malawi and Benin health education messages are sent by text messages. SMS-based transactional alerts are SMS's sent each time a change occurs in a bank account, for example, or when your credit card is used then you will get an SMS on your mobile phone. Marketing on a mobile phone has become increasingly popular ever since the rise of SMS in the early 2000s in Europe and some parts of Asia when businesses started to collect mobile phone numbers and send off wanted (or unwanted) content. Many applications need the ability to do real-time notification when events occur. Often the people who need to be kept aware of events are in a remote location. Cell phones have recently started being used in Africa for sending SMS-based information. These simple systems have already had a major impact. The reason why SMS gets through: With the massive growth and inadequate infrastructure in many countries, voice and where available IP are just not feasible unless there is massive investment to bring up the networks. SMS will get through even when the 'network is busy' for hours. Some of the possible services that exist are: car parking systems, M-learning, market information via SMS, automated agricultural answering system and many others. SMS messaging has already shown great potential. The FAO is using SMS messaging as a data transmission system for field workers wishing to send in agricultural reports. The Zambian farmer's union uses SMS messages to distribute market prices. The SMS system has been more beneficiary for farmers in some part of African countries where they can send SMS through mobile and get the instant message reply for taking the decision for selling the crops at good price. A local management information system for small farmers and traders gives information on prices, trade volumes, market flows and growing conditions in local language via SMS on mobile phones. In this thesis the main finding is about in which of the respective areas the SMS system is being used and how does it help the human life to be more comfort.

CERTIFICATION

The undersigned certifies that he has read and hereby recommend for acceptance by the University of Eastern Finland a thesis entitled: **SMS-Based Information Systems,** in fulfillment of the requirements for the degree of Master of Science (MSC) in University of Eastern Finland.

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(Supervisor) **Date**

…….. **……**

(Co-Supervisor) **Date**

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ACRONYMS AND ABBREVIATIONS

WLAN……... wireless local area network

SMS…….. Short Message Service

SMPP……Short Message Peer-to-Peer

ICT…….. Information and communication technologies

FM……..Freqeuncy modulation

TCRA…….Tanzania Communication Regulatory authority

IAB……...Interactive Advertising Bureau

MMA……. ……...Mobile Marketing Association

UGX……..Ugandan shillings

AMIS……..……Agricultural Marketing Information System

UNDP……. United Nations Development Programme

MT…….Mobile Terminate

MO…….Mobile originate

GSM…… Global System for Mobile Communications

MMS……... multimedia messaging services

IMC…….. Integrated marketing communications

MACE……Malawi Agriculture commodity Exchange

HKIED…… Hong Kong Institute of Education

NAFIS……...National Farmers Information Service

IVR……...Interactive voice response

PDA……Personal digital assistant

MCSP……. Multi Channel Service Platform

INFSS…….. Integrated Nutrition and Food Security Surveillance

UNICEF…….. United Nations Children's Fund

SHEMP…….Smallholder Enterprise and Marketing Programme

ZNFU…….Zambia National Farmers Union

ICTARD…..…….Information Communication Technology for Africa Rural development

M-PESA…….……..Money Transfer

GPRS……General packet radio service

WAP……...Wireless application protocol

ESME…….External Short Messaging Entity

VPN…….Virtual private network

NECTA……The national examination council of Tanzania

CHAPTER ONE: INTRODUCTION

1.1 Background and Definition

Mobile Marketing is a set of practices that enables organizations to communicate and engage with their audience in an interactive and relevant manner through any mobile device or network. Mobile marketing is commonly known as *wireless marketing*. However wireless is not necessarily mobile. For instance, a consumer's communications with a Web site from a desktop computer at home, with signals carried over a wireless *local area network* (WLAN) or over a satellite network, would qualify as wireless but not mobile communications. Marketing on a mobile phone has become increasingly popular ever since the rise of *Short Message Service* (SMS) in the early 2000s in Europe and some parts of Asia when businesses started to collect mobile phone numbers and send off wanted (or unwanted) content [67].

The past decade has witnessed a revolution in the use of ICT in Developing countries. Many people and offices as well as rural farmers own ICT facilities such as personal computers and mobile phones [60]. The largest increases in the use of ICT has been in mobile telephony where subscriptions in developing countries increased from about 30 percent of the world total in 2000 to more than 50 percent in 2004 and to almost 70 percent in 2007 [1]. While internet use has not increased as rapidly as mobile communication, it increased tenfold in developing countries in the same period [60]. Other ICT facilities such as telecast, radio FM and information centers have also increased remarkably in number during the same period.

ICT in 53 African countries were revealed the wide use of ICT in the region with countries such as Algeria, Egypt, South Africa and Botswana leading in ICT use [60]. In East Africa, Rwanda is probably the most advanced country in terms of ICT use with 65% of its population being covered by mobile telephony. The country has also a high level of internet use and access to television and radio broadcasts. In Kenya, Uganda and Burundi the use of ICT is also well advanced, especially for

mobile phone subscribers, TV and radio listeners [3]. This high use of ICT is likely to stimulate economic development in developing countries, including the agricultural sector where a high proportion of the African Population derives their livelihoods.

Before 1990, ICT use in Tanzania was mainly limited to radio and landline telephones. New ICT started in the mid 1990s, and by 2001 it was estimated that Tanzania's ICT industry had generated USD 300–350 million per year. There are now a number of ICT development initiatives in the country funded by the government, donor countries and the private sector. Such initiatives range from *telecenters* and mobile phones in rural Tanzania to e-Government initiatives being implemented in the major cities and towns of Tanzania. Currently, the following ICT providers are in the market [4]:

- Tanzania Telecommunication Company Limited
- Internet Service Providers (ISPs)
- Web Content Providers (ASPs)
- Mobile phone companies (Vodacom, Zain, Tigo and Zantel)
- Radio, TV and Newspapers
- NGOs

By 30th June 2009, about 13.9 million Tanzanians owned voice telephone lines [61]. Mobile voice telecommunication leads the market by having more subscriptions (98%) than to fixed line services (2%) (TCRA, 2007). The use of the internet is also increasing, especially in cities and towns. Being one of the poorest countries in the world, ICT in Tanzania is acknowledged as having the potential to accelerate the socio-economic development of the country [2]. The cost of such technologies has declined steadily, making it possible for the 21st century farmers in developing countries to own mobile phones, as well as accessing other ICT facilities such as the Internet, radio and television to mention a few [11].

The question, however, is to what extent has this ICT revolution helped rural farmers in Tanzania to access market information for their farm products? Knowing this is

important. While the liberalization of agricultural markets has brought many opportunities, nevertheless it has also introduced new challenges to farmers, especially poor smallholder farmers in rural areas. Accessing market information has proved difficult for many. The lack of market information represents a significant impediment to market access, especially for smallholder poor farmers in rural areas; it substantially increases transaction costs and reduces market efficiency.

For any one crop, the marketing chain consists of multiple middlemen, each taking a margin at every stage of the chain, and price variations in space and time are often large and erratic [63]. But despite having this ICT revolution in Sub-Saharan Africa are rural farmers any better at accessing market information and what has been the impact on farm incomes, new technologies and/or the adoption of new crops? Over the past few years SMS has become a legitimate advertising channel in some parts of the world. This is because unlike email over the public Internet, the carriers who police their own networks have set guidelines and best practices for the mobile media industry (including mobile advertising). The IAB (*Interactive Advertising Bureau*) and the Mobile Marketing Association, as well, have established guidelines and are evangelizing the use of the mobile channel for marketers. While this has been fruitful in developed regions such as North America, Western Europe and some other countries, mobile *SPAM* messages (SMS sent to mobile subscribers without a legitimate and explicit option by the subscriber) remain an issue in many other parts of the world, partly due to the carriers selling their member databases to third parties.

Short codes (also known as *short numbers*) are special telephone numbers, significantly shorter than full telephone numbers that can be used to address *SMS* and *MMS* messages from certain service provider's mobile phones or fixed phones. There are two types of short codes: dialing and messaging.

Short codes are designed to be easier to read and remember than normal telephone numbers. Like telephone numbers, short codes are unique to each operator at the technological level. Even so, providers generally have agreements to avoid overlaps.

In some countries, such as the United States, some classes of numbers are inter-operator (U.S. inter-operator numbers are called *common short codes*) [73].

Short codes are widely used for value-added services such as television program voting, ordering ringtones, charity donations and mobile services. Messages sent to short code can be billed at a higher rate than a standard SMS and may even subscribe a customer to a recurring monthly service that will be added to their mobile phone bill until they text, for example, the word "*STOP*" to terminate the service.

In Europe the first cross-carrier SMS short code campaign was run by Txtbomb in 2001 for an Island Records release, In North America it was the Labatt Brewing Company in 2002. Over the past few years mobile short codes have been increasingly popular as a new channel to communicate to the mobile consumer. Brands have begun to treat the mobile short code as a mobile domain name allowing the consumer to text message the brand at an event [74].

SMS services typically run off a short code, but sending text messages to an email address is another methodology. Short codes are 5 or 6 digit numbers that have been assigned by all the mobile operators in a given country for the use of brand campaign and other consumer services. Due to the high price of short codes of $500-$1000 a month, many small businesses opt to share a short code in order to reduce monthly costs. The mobile operators vet every short code application before provisioning and monitor the service to make sure it does not diverge from its original service description. Another alternative to sending messages by short code or email is to do so through one's own dedicated phone number. Besides short codes, inbound SMS is very often based on long numbers (international number format, e.g. +44 7624 805000), which can be used in place of short codes or premium-rated short messages for SMS reception in several applications, such as product promotions and campaigns. Long numbers are internationally available, as well as enabling businesses to have their own number, rather than short codes which are usually shared across a number of brands. Additionally, long numbers are non-premium inbound numbers.

One key criterion for provisioning is that the consumer opts in to the service. The mobile operators demand a double opt in from the consumer and the ability for the consumer to opt out of the service at any time by sending the word STOP via SMS. These guidelines are established in the MMA (*Mobile Marketing Association*) Consumer Best Practices Guidelines which are followed by all mobile marketers in the United States.

For definition associated with mobile-based advertising, we adopt classification that is derived from general principles of direct marketing, namely the *push type* and *pull type* strategies. SMS mobile advertising has typically been considered an application of a push strategy in the mobile environment [62], meaning that information and marketing flow from the producer and to the consumer [62]. In a push campaign, the marketer takes the initiative and send messages directly to the consumer regardless of whether the consumer has agreed to receive the message. Pull strategies involve sending the information that is requested by the consumer. [62].

Historically, push strategies have been associated with efforts to boost sales in the short term. In fact, most early mobile messages were promotional in nature, focusing on including an immediate purchase.

At one time in Africa mobile phones were underutilized, heavy and pain to carry around. But today most of the people are having a mobile phone. In Sub-Saharan Africa, has not seen to much infra-structure development for various reasons. For example, only 29 % of roads are paved, 25 % of the population has access to electricity and there are 3 landlines per 100 people, most of them function poorly. But now there are 10 times as many mobile phones as landlines and 60% of the population has mobile. Especially the farmers in African continent covering the places like Tanzania, Uganda, Kenya and many other places have a large benefit from SMS based market information systems[72].

The earlier method of product selling had the following steps:

1) The farmer was selling his/her agricultural products to the middleman from his/her place at very low price either in received or to be received payments.

2) The middleman was transporting the sold agricultural products to the market and sells them to buying agents in reasonable profit in received or to be received payments.

3) The buying agent could sell the agricultural products either in small amount to consumers in received or to be received payments or to other buying agent in cash in high profit.

The deficiencies of this method were to reduce the income to farmer whereas the middleman or buying agent gains a lot in short time.

In context of Asian continent, Bangladesh is primarily an agrarian economy, generating export earnings not only from farming but also by an agricultural manufacturing sector. Rural development has become a function of agricultural growth. But as there are many small farmers and less than perfect information for stakeholders in the sector, the market is volatile to manipulation and uninformed actions. Farmers' participation in market and transport management is so poor that most of the time they are being forced to sell their products to local middlemen at dumped prices. Under these circumstances, experts opine that this deprivation on part of the growers may greatly be reduced if they would have been empowered with information. Timely and unbiased agricultural marketing information will help farmers to bargain with the middlemen for a fair price and gain profitable decisions in the short term with regard to what price to produce and what price to expect [63]. In addition to farmers this information is also important to the wholesellers, retailers, consumers, ministry of agriculture, researchers and policy makers. Like farmers, wholesalers may have the opportunity to locate their profitable market whereas retailers can buy and sell their products at market prices from the wholesellers and to the customers respectively. In the light of the above, the Government of Bangladesh has taken a number of steps in order to disseminate agricultural market information to the concerned stakeholders, specifically farmers, traders, policy makers and the media. However, progress has been scarce as technology used has been over the top and as local organization for information capture and input has been problematic. SMS system will improve that as mobile technology is readily accessible in rural Bangladesh, and as the Village phone organization also provides expertise in use.

While mobile technology is generously available in rural Bangladesh, as in many other developing countries, innovations in its use for commercial applications have been surprisingly slow to materialize. The designed system used actual agricultural data and took into account both the low literacy levels of farmers as well as the limitations of the mobile screens and text capacities. The system provides full awareness of all parties of prevailing market prices and provides farmers with timely and reliable information.

In Uganda, the market information service provides the real time, concise and trusted information to the users or the marketers to make the business decision. The user gets SMS text of reliable market intelligence generated from the network of their trade agents, buyers and sellers and plus a contact person to follow up for more information. Their network allows them to be at the front of the moving market on user behalf and keep the user informed in time. They provide today's market price for commodities they want to sell to or buy from the market. It provides selected market prices of your choice for 3-5 commodities that interest you three times a week. Even it provides information whenever somebody is buying or selling the commodities you are interested in and what price they offer through SMS. It provides the trade alerts you want from our network of trusted trade agents, buyers and sellers of commodities you are interested in as and when they occur. Even the marketers make their product or service known to potential customers throughout Uganda or only in particular regions through SMS systems. It provides SMS advertisement push for the product or service to wide network of trusted trade agents, buyers and sellers making product or service known to many through information boards at shops and market places. There is some subscription rate like 300 UGX per SMS for Ugandans to send message. In figure 1 there is a diagram of an SMS based market information system.

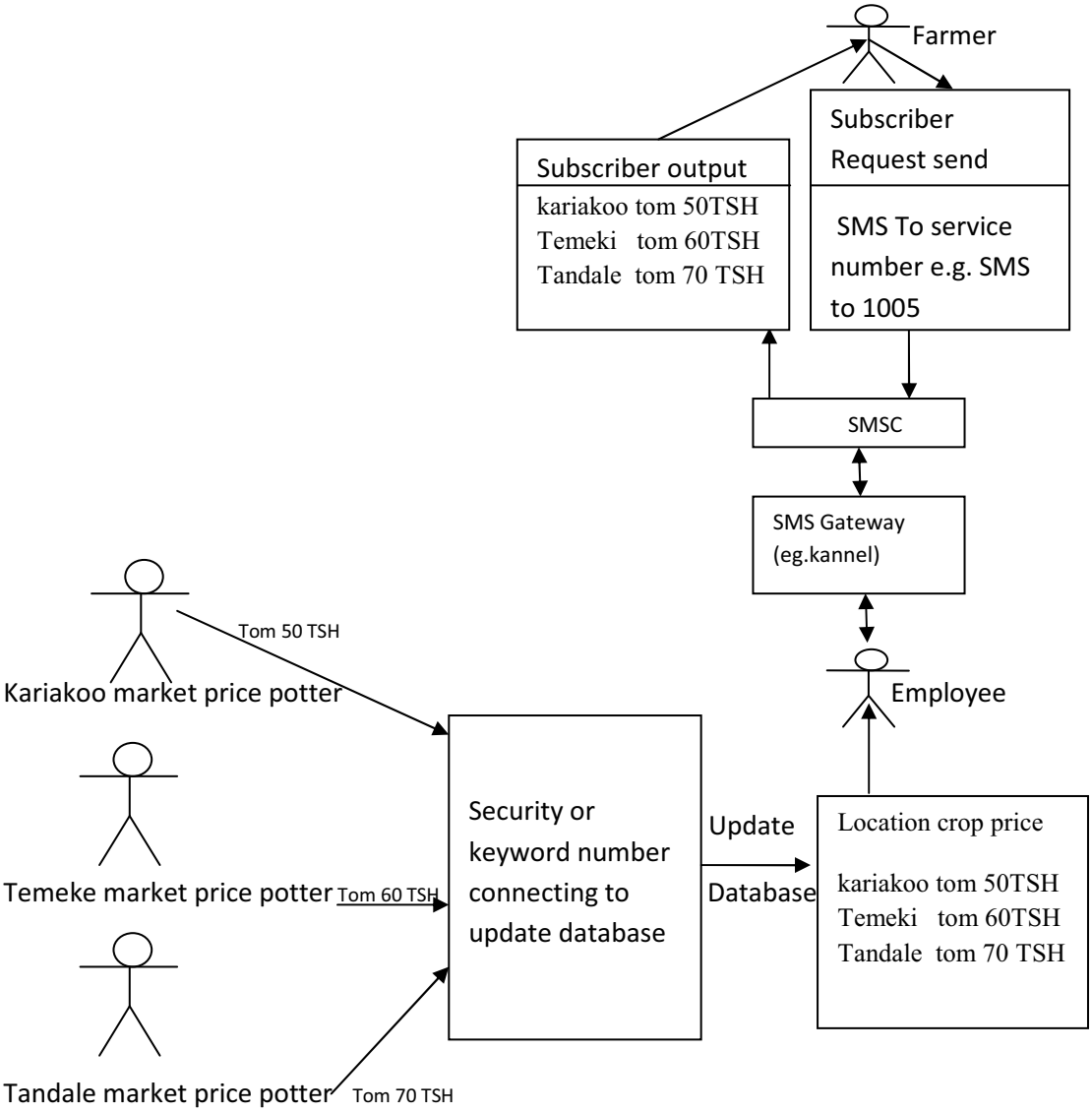


Figure 1 .Diagram of an SMS-based market information system

There should be *price porter* from each market he/she can use SMS to update the database let say Tom 60 TSH, the system should be able to recognized the validity and source of SMS for updating the price information. For example in this case Tom 60 TSH should update only Kariakoo price information, the same applies to other cases.

The farmer should send a commodity name using 3 initial letters to a certain code e.g. Tom to 1005 and get price information for tomatoes from different markets.

SMSC: SMSC is the Short Message Service Center that is available in each service provider to pass the user SMS for the required service.

SMS Gateway: A SMS gateway would receive and process incoming SMS from users, extracting the data required to take the appropriate action, and sending the response message back to the user. *Kannel* as an open SMS gateway- for sending/receiving SMS can be more preferable to use because of its strongest and free software.

Database: Database can be attached to service provider or can be located some where else also and connected to the service provider

1.2 Statement of the problem

This study investigates the problem that faces smallholder farmers in price setting of their products in Tanzania and also other African countries, to investigate the best option for establishment of SMS-based market information system that would help the farmers to know the market price and hence increase their negotiation power to get the right price.

1.3 Benefit of SMS based marketing systems

Modern societies have established different market information systems such as Mobile application and Web-based applications. Marketing of products is a big challenge to many small scale farmers. There is information service company, M-Farm which offers an SMS based solution for selling their products in Kenya and it uses a module for price information service which runs on code 3535. The farmers rely on the system to get information on price for their produce. This enables the farmers to get the real time market price information, and so they don't have to deal with the shrewd middleman. Through this, farmer can compare the price of products at various markets and make up their minds on where their produce will fetch the best price. Later on with the growing popularity of this SMS service, the farmers were facilitated with two other components that allow farmers to come together and buy inputs in bulk. With higher volumes, famers can buy in bulk and transport costs are lower. In this component, farmers send SMS specifying the input needed quantity and location. *M-Farm* identifies the companies that deal with the stated input. If the farmers like the offered price, they place an order. Farmers can also sell in bulk.

Already, farmers are using the services. They have some SMS format for price enquiry:

SMS Format:

SMS: Price Tomatoes Nairobi

SEND TO: 3535

The SMS is not case sensitive and crop name can either be in Kiswahili or English. One may for example write mahindi instead of maize.

1.4 Objectives of establishing and networking of agricultural market intelligence through SMS

The main purpose of Agricultural Marketing Information System (AMIS) is to disseminate accurate and timely marketing information so as to support in marketing decision making and marketing efforts of entrepreneurs, farmers, government and development organizations.

To disseminate timely, comprehensive, current and future price intelligence on agricultural commodities for better scientific decision-making by farming community, traders, firms and researchers. More specifically, providing price forecasts well in advance of sowing of major commodities and during harvesting helps the farmers in taking better sowing and selling decisions;

Objectives may be listed as follows:

- Providing other market intelligence such as product qualities, high price markets for the different commodities.
- Dissemination of the above market intelligence through different mass media like news papers in regional languages, English, Television, Radio, agricultural magazines, voice SMS, so as to reach the maximum number of farmers;
- Training the farmers and agricultural extension officials in the state regarding use of the above intelligence;

- Studying different market intelligence aspects being made available to farmers in different countries and explore possibilities of replicating the same in India; and
- Developing commodity market outlook for selected commodities at state level besides providing commodity market research reports.

1.5 ICT, market access and its implications for rural farmers

The importance of the role of market information in terms of economic efficiency and performance as well as equity is widely acknowledged. It was observed in [61] that accurate and timely market information enhances market performance by improving the knowledge of market actors. An equal balance of knowledge provides a more equal distribution of the gains from efficient market price formation. [6]

Access to ICT can help farmers in a number of ways. Traditional media and new ICT have played a major role in diffusing information to rural communities and now have much more potential [4]. The pre-paid credit has enabled mobile phone users to send relatively cheap SMS text messages across distances that would otherwise take days to travel, hence changing life for the better [61]. By using mobile phones and messaging technology, farmers get access to valuable market data [5]. Studies in Pakistan show that widely available information on prevailing market prices for seed cotton strengthened farmer's position when bargaining with traders [66]. The availability of market information also enables farmers to check on the prices they receive *vis-à-vis* the prevailing market prices.

In Indonesia, for example, vegetable farmers fixed prices following the rate that was being broadcast by their local radios and lower prices than that broadcast were not accepted by these farmers [35]. The broadcast prices were subsequently used as a starting point in negotiating with traders the following day. Studies in Chile show that an internet network among farmer organizations has dramatically increased farmers' incomes by providing information about crop status, weather, global market prices and training (UNDP, 2001).

1.6 Issues concerning SMS-based systems

The *Short Message Service* (SMS) allows text-based messages to be sent to and from mobile telephones on a *GSM* network. Each message has a maximum length of 160 characters. SMS messages are divided into two categories: *Mobile Terminate* (MT where the SMS message originates from the network provider) and *Mobile Originate* (MO where the consumer can send messages to other consumers). In the context of MO and MT messages, the consumer refers to the end-user, the person with a cell phone. Typically, SMS messages are sent and received by cellular consumers using cellular telephone handsets. Cell phones have the ability to send and receive SMS messages. Here we are try to interface a computer with the GSM network. Anything that is capable of talking to a GSM network, in theory, has the ability to send and receive SMS messages and not only the device which has capability to connect [71].

The internet-enabled mobile phone has spread rapidly in many markets. Following the first release of *wireless application protocol* (WAP) in 1998, firms began to send the SMS alerts and location–sensitive ads to mobile users. Because of the very personal nature of mobile phone the use of *short message services* and *multimedia messaging services* (MMS) for marketing purposes has drastically changed in many parts of the world. For example, a report issued by portion research indicates that the annual sales revenue of the SMS market will reach $50 billion worldwide by 2010, with some 2.38 trillion text messages sent [5]. According to the recent survey, 36 % of marketers operating in Europe have used SMS advertising for more than one year. Some of them are taking advantage of this growth by incorporating SMS advertising as a part of an *integrated marketing communications* (IMC) strategy [6]. The rapid growth of mobile devices has made the mobile phone ubiquitous in nearly all parts of the world. The majority of the mobile devices are still simple mobile phones that use SMS for search (searching the information through by mobile by texting in the query into Google short code like 4664), so the global market for SMS search is growing. SMS based search imposes interesting constraints on the problem. First bandwidth is extremely limited; it is not beneficiary to user and even tedious to find the market information. Especially in the context of African environment the farmers are using the mobile which does not need to be powerful smart phones with different features

but in fact having the facility of sending the message to the server database from where they can get information back regarding the price of different commodities in market. The unavailability of the mobile phone network can affect the availability of the market price information. Still mobile phone technology is relatively more available in Tanzania. The awareness of the farmers is needed during the use of market information system so that farmers can benefit from it.

With the intention of multinational corporation operating in Europe there is great implementation of SMS service in marketing or advertising. This medium is related to four factors (1) the ability to build brand image (2) the ability to use location based marketing (3) the perception of how the consumers accept SMS advertising ; and (4) the perception of technological infrastructure .

The Europeans have responded positively to receiving to SMS advertising messages. The acceptance of SMS advertising is beginning to grow and may have potential to become an important new model of interactive marketing communication.

Some issues concerning SMS-based systems are:

1) Branding building effect
2) Privacy/security concerns
3) Location based marketing
4) technological condition

Branding building effect:

The mobile advertising has considerable potential to contribute to brand building. Research on the Internet's has shown that the perceived level of interactivity is a major determinant of a user's attitude towards a website, and is more important than the number of features on a particular site. The Internet's most studding features is its ability to build brands with customers and prospects. As with the internet, SMS advertising can introduce shopping in a specific store, or driving in close proximity to a retail outlet. Because of this potential, we can predict that the ability to use location-specific messaging will also drive firm's intention to engage in mobile

advertising. This prediction holds for firms based on European Union, Japan, and United States.

Privacy/security concerns:

As several studies observes, the potential of mobile devices is growing throughout much of the developed world. However, the ownership of these devices does not guarantee that the consumers will readily accept mobile advertising. Clearly, consumer's privacy concerns are an important issue to be taken into account. High levels of enthusiasm for SMS advertising and the consumers consents to receive the message [66]. So I am hypothesizing that firm's intention to use mobile advertising is negatively associated with perception of privacy and security concerns of mobile messaging.

Location-based marketing:

Location-based services, such as the ability to provide features like weather forecast, restaurants guides, hotels maps, address finders, and traffic update have been cited as consumer friendly features of new media.

Technological condition:

A related idea is the extent to which a country's technological environment allows a sufficient high volume of consumers to adopt the technologies that would allow them to be reached by SMS advertising messages. So clearly, appropriate technology is more available in some countries than in others, a fact that is often determined by level of economic development.

1.7 SMS Advertising

One of the first mobile communication technologies to be applied in marketing, SMS is a new technology buzzword for transmitting business-to-customer message. SMS advertising is now a substantial source of revenue for many operators, particularly because it has been incorporated in the instant messaging culture among different group of people. One key advantage of SMS is that it can capitalize on the "always on" trend, in which people have access to the internet virtually the entire day. SMS

also allows for more interactive communication with the consumer than traditional media: many firms deliver alerts, news update, traffic information, or promotional coupons via SMS. In the future, global positioning system may also incorporated in SMS advertising for those who seek timely information at the right place. For example, in Japan, agencies are conducting experimental transmission of location-based restaurant information to public transport users

Direct marketing and contract farming can also be other good strategies. For example, farmers may also be able to supply direct hotels and restaurants. Taking advantage of such opportunities is often easier if farmers work as a group, since this makes it easier to guarantee availability and delivery of products at exact time when it is needed the importance of empowering farmers, both through provision of information and by working as a group. With the rapid spread of mobile phone network and growing frequency of farmer's organization, both of these are now realistic options of Africa's rural small-scale farmers.

Information and communication technologies (ICTs), in particular mobile phones, email and the Internet, are transforming how marketing is carried out in some part of Africa. One example are Internet-supported market information systems, which collect and distribute information about market prices and enables sellers and buyers to make contact. 'Market spies' are another innovation. These people base themselves in agriculture markets and work on behalf of farmers, using mobile phones to inform them of prices and to make deal with traders. Market information system may also work to link farmers and buyers. For example in Malawi Agriculture commodity Exchange (MACE) farmers and buyers are linked through SMS messaging. Some approaches such as use of Internet or newspaper-based market information, may only be accessible to farmers who are literature in English. The network for farmers Groups in Tanzania, has found that using mobile phones is the best approach for those who cannot read English. In Kenya progress has been made towards the development and deployment of an agriculture information system using the SMS-based system using the English as well as borrowed Kiswahili language. Identifying the farming as the sector where it would be easiest to make a direct impact on Kenyan society, since as much as 75% of the population is involved

in farming in some way. A recent UN survey of e-agriculture has identified information exchange and communication processes as critical, highlighting among other things the following areas:

- Enhancing farmers and producers access to market and information on farming techniques and practices.
- Improving dissemination of and access to scientific and technical information.

SMS based mobile marketing benefits:

Consumers all over the world have come to rely on their mobile phone as an essential communications tool. They personalize it, take it everywhere they go, and many cannot imagine living without it. According to international researches, with over 1 billion SMS exchanged per month worldwide, 81% of enterprises surveyed identified SMS as key to satisfying customer needs. SMS messaging is a powerful tool because:

• Instant upgrade of one's market.
• SMS messages can be sent and read at any time.
• SMS messages can be sent to an offline mobile phone.
• SMS messaging is not intrusive.
• 100% of GSM mobile phones support SMS messages.
• Two –way SMS messages allows customers to reply to messages.

CHAPTER TWO: LITERATURE REVIEW

2.1 Mobile Marketing

Many scholars have investigated SMS based systems and their use in real time. They have found that there are different usage of these *SMS* systems according to the needs of the users in different environments and necessities. A review explains how the *SMS* system was introduced, what was the need of it, how it was advantageous in different environments for different users [46].

According to [47] "Marketing management is the process of planning and executing the conception, pricing, promotion and distribution of goods, services, and ideas to create exchange that satisfy individual and organizational goals". The American marketing Association suggest sequential marketing stages as well as temporal and spatial separation of buyers and sellers. Mobile devices blur these boundaries and distinctions by extending traditional marketing's time-space paradigm. Text messaging in UK or short message service (SMS) in other European countries, the US and Australia, lets user send and receive text message via cell phones. According to Global system for mobile management, users send more than 10 billion SMS messages each month. This makes SMS the most popular mobile data application [48]. In 2002, 580.2 million mobile messaging users sent 430.8 billion SMS's [49]. Current technologies limit each message to a maximum of 160 characters. With *SMS* as a best effort service, all messages are delivered as long as there is not enough free capacity in the network. If the mobile phone is off, the message arrives when the user turns the mobile on. Cell phones let users of all ages easily maintain business and social contact. A key mobile marketing use is advertising, in a push or pull model.

2.1.1 Example of SMS services

The car parking technique is being implemented using the *SMS* services on cellular phone in Vienna (Austria). We describe how useful these advanced car parking system are in providing drivers with information about the structure of the car park systems and the space available for them to park their cars. The availability of the

vacant parking space is calculated by means of sensors installed in the parking areas, which count the number of cars that enter to and exit from the parking areas. Also, the number of parking tickets issued at the tickets counter can be used to calculate the vacant spaces. All this information from the sensors and tickets counters is used to update a central database which stores all the information about the areas of the parking space which is vacant or occupied. The advanced parking system also provides advanced, electronic payment options for the customers. The idea behind this electronic payment option is to prevent the customer for having to wait in long queues to buy a ticket. Queues can cause congestion in areas within and outside of parking facilities [50].

Under this m-parking technology, customers initially register their mobile number, the license plate number of the car and their credit card number with the car park authorities, to create what is called a virtual parking ticket account. This completes the initial, one-time registration process. Whenever the customer needs to park, they send an SMS text message to the number provided by the car park authorities. The SMS message consists of the license plate number of the car, the location code of the parking area where they want to park and the time duration (in minutes) for which the customer wants to park. In return, the customer would then receive a text message from the car park message centre, with the confirmation and the expiry time of their electronic parking ticket. The customer would be sent a reminder SMS, 10 minutes before the parking time expires. The bill for the parking ticket would come up on the customer's mobile bill. The bill is paid by both credit card and from mobile bill as well.

There has been an increasing interest in academic institutions using mobile devices to support teaching and learning. Different mobile devices can be used in mobile learning. The most ubiquitous and stable mobile technologies namely *Short Message Service* (SMS) texting [13] on cellular phones has great potential in education. For the last 10 years, many SMS projects for teaching and learning were reported in the literature. These projects are categorized into (a) communication and administrative support, and (b) teaching and learning support, as described below:

2.1.2 Communication and Administrative Support (Administrative communication in higher education)

According to [52] from the University of Birmingham reported that an e-mail to text message service called Study Link is employed to support Administrative communication in higher education. Text messaging can be "effectively integrated into both the student and staff experience". Administrative staff members were able to integrate the service into their current means of communicating with students while students were able to effectively receive and act on text messages. Message types include notices of changes and cancellations (e.g., class cancellations), reminders to submit and collect assignments, notices of relevant lectures/activities, individual administration (e.g., warning messages to absentees), instructional messages (e.g., instructions for submitting assignments), and greeting/courteous messages.

According to the [53] development of education services based on short message services. The education information such as the enrollment information, grade release, university announcement, and internship opportunity can be retrieved and/or sent by the students via SMS through a login system. This research points out that administrative support to students via short message services is ideal.

2.1.3 Library Applications

Library services can be improved through SMS-based administrative support. Libraries can reach out and serve students ubiquitously by sending and receiving SMS-based library information. There are a number of areas in library services for which SMS-based messages can be helpful. Basic information alerts such as notices of book reservations, and renewals and overdue reminders are well tailored with this communication medium. One example is the *SMS* alert services offered by the Hong Kong Institute of Education. Further library services can also be provided via SMS-based systems. For example, extended text messaging reference can send SMS messages to and receive answers from librarians as reported in research at

Southeastern Louisiana University as a way to further enhance the quality of services provided by libraries in higher education [64].

2.1.4 Teaching and Learning Support (Classroom interaction and discussion)

A SMS-based classroom interaction system is presented in [65]. They called this the *TXT-2-LRN* system. The system allows students to send questions or comments to the instructor's laptop via *SMS*. The instructor can read the messages on the screen and decide to respond immediately or wait for later action. The instructor can also provide a quiz to the students and collect results. Students can look at the projector's screen in real-time graphics showing the results. Short message services encourage interactivity in the classroom [51].

2.1.5 Mobile Ticketing

The mobile ticketing is implemented on smart machine in United Kingdom. The smart machine is a machine which monitors and controls multiple processes utilizing special service providers, delivering to any destination network, independent from the mobile operator. Thus, we can optimize value for money, depending on the content that is provided (e.g. high quality routing for tickets, standard routing for text messages with mere information). This system enables the user to buy ticket for major events like rock concerts and football matches from his mobile phones. The ticketing technology was successfully tried for the first time at the Aston Villa v West Bromwich Albion match on April 10th, 2005.

With the help of this technology, consumers can send an SMS to order their tickets via mobile phone. They then receive a return SMS which has an image with a 2-dimensional matrix-code. This SMS contains details such as the ticket number, the mobile phone number and the seat number. On entering the stadium, the consumers have to hold their mobile phone with this image SMS open, in front of the scanners installed by Smart machine systems at the venue of the event. These scanners validate the users and allow them to enter inside the venue. The consumers are charged for their tickets by the mobile service provider once the 2-D code is scanned at the scanning machines. Figure 1 shows what the 2-D code looks like.

Figure 2. Example of 2-D BAR code

2.1.6 E-parking system

An on-going E-parking project being funded by multinational companies in five countries of the European Union, to help drivers buy parking tickets using their mobile phones [13]. Once the project is complete, it will allow drivers to pay for the parking space in advance, using their mobile phones. After the payment has been made, an access code will be sent back to the driver which will act as a validation code when he enters the car park. On reaching the car park, the driver sends the validation code to the main database server using the Bluetooth technology and is granted access to the parking area. Figure 2 shows how the whole system has been integrated and is expected to work.

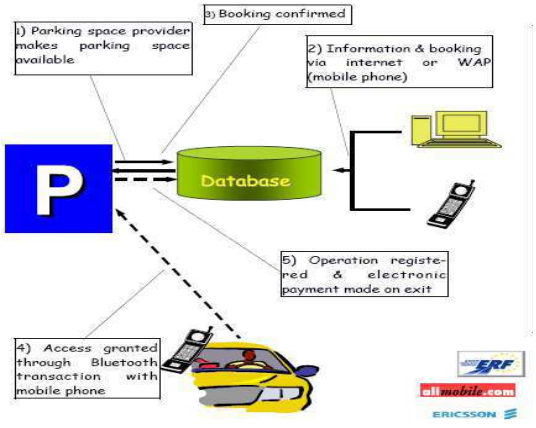


Figure 3. E-parking system

In this section we describe the various mobile communication tools along with mobile technology generation; these tools are used as communication channels in different type mobile marketing campaigns. The review of mobile technology generations also indicates research interest for mobile marketing in different stages.

2.1.7 M-Learning system

M-learning systems, which are subset of e-learning systems designed to be used from mobile devices, have thus the opportunity to become deeply penetrated in the market due to the huge popularity of mobile devices. Probably the oldest and most widely used push technology is email. Given the ubiquitous nature of mobile phones, a likely alternative to pushed emails [32] is the use of their messaging services, i.e. *SMS and MMS*. The most common and frequently used mobile service and form of message communication is Short Message Service (*SMS*), which is present in every kind of mobile device and offers the possibility of reaching all mobile users. Text messaging seems to provide an opportunity for intimate personal contacts while at the same time offers the detachment necessary to manage self-presentation and involvement [27]. These two reasons have made *SMS* extremely popular. SMS-based applications are suitable for all user terminals and *SMS* scenarios; as they do not require extended handset functionality, they can perhaps provide the simplest form of m-learning. The primary advantage of the use of mobile phones and the *SMS* language is that teaching and learning can take place also outside a classroom situation. In fact, previous research [28] shows that it is possible to take mobile phone users on a complex "journey", implying situations where a series of interactive *SMS* exchanges may be required to achieve the completion of a task or goal.

There exist examples of prototype systems allowing students to do their work (i.e. to study) using an SMS-based interaction, with courses composed of SMS "pills" – i.e. short textual learning objects – together with multiple-choice tests delivered by the same SMS service [29]. The learner can answer the tests by simply replying to the test SMS question with a corresponding *SMS* containing the answer. The system tracks the answer, verifies the results and replies her/him with a new *SMS* containing the test results along with possible suggested improvements. This approach allows

learners with the least sophisticated mobile phones to take part in some mobile learning and can be a useful and entertaining addition to any kind of classroom lesson or e-learning. *SMS* has also been tested in language learning systems for mobile phones [31] as part of English language courses, where students were sent frequent vocabulary messages also acting as reminders to be revised. Similar m-learning Systems are developed for SMS-based Italian language courses. Both described systems provide ubiquitous just-in-time *SMS-based knowledge*, including also an SMS searchable database. SMS is also used in m-learning systems for healthcare, where users can query specific subject knowledge bases through a content specialist, in order to gain the information they need. Patient communication is enabled via SMS, allowing a patient community to share valuable insights and experiences [33].

An important component in SMS-based interactive systems is parsing of SMS dictionary queries. In the SMS reference service [30], users structure their queries so that the server can parse it easily, look up the answer, and immediately send it via SMS back to them. Reference options include dictionary, thesaurus, reverse dictionary, language translations (Italian-English or English-Italian) and abbreviated encyclopedia reference. Other references can be added to meet user interests. The success of m-learning systems depends on their ability to support various presentation and communication capabilities available in multiple learning channels. It is also important for successful m-learning service architecture to be open, flexible and scalable in order to promote creativity and expressivity, as Internet do.

2.1.8 Mobile phone (SMS) systems transforming African agriculture

Throughout Africa, ICTs have become increasingly integrated into the dissemination of information to farmers. For decades “traditional” forms of ICTs have become more prevalent in advisory service provision. Radio and TV programmes feature agricultural information. Rural *telecentres* provide information on education, agricultural and health issues and equip rural citizens with skills on how to use computers and provide basic literacy. Currently, most farmers’ information is provided either by extension workers, through libraries or via websites. Most other

initiatives are web-based such as INFONET *www.infonet-biovision.org*, a web-based service promoting organic farming which is supplemented by *The Organic Farmer* publication. Seeking information from these and other platforms becomes an onerous task for the farmers as it entails ploughing through many publications or surfing a large number of web-pages. Furthermore, for the illiterate farmer this becomes impossible right from the onset. Web-based solutions also bring challenges because Internet infrastructure in Africa is still very sparse. Nevertheless, these are very useful resources and all that is needed is to provide an easy way for the farmers to navigate them. With the widespread use of mobile phones, voice and SMS solutions should find more use as they offer easy accessibility. However, they also face the following challenges: the SMS carries only a limited amount of information and requires a basic level of literacy. Voice-based solutions are complicated to develop because they require machines to produce natural speech, or in technical terms, good speech synthesis. They also do not offer detailed information such as pictorial illustrations as in web solutions. Nonetheless, the voice solution is still by far the most promising platform for the farmer as it can be customized for language, is readily accessible and very natural, as it entails using the mobile phone through direct responses to specific questions.

The *text-to-speech* (TTS) telephone service has provided farmers in Kenya with information related to how to plant, grow, and harvest bananas, in either English or Kiswahili. According to the organizers, because anyone with a land line or mobile phone can access the information line, communities that are more difficult to reach by traditional means can more easily access agricultural information. A TTS service bypasses the need for literacy, as well as the problem of reaching farmers living in very remote areas, and can easily be kept up-to-date by extension workers. Farmers could call the line any time of day, every day. This project ran as a pilot for several months in 2006, but has now been superseded by the recently-launched *National Farmers Information Service* (NAFIS) information line which covers a wider range of crops and livestock [24].

Kenya launched, in May 2008, a farmers' information service where the country's farming community will receive and exchange timely news and information on agriculture, weather patterns and other related issues through their mobile phones. The service will allow 4.5 million farmers access to agricultural extension information through the web and telephony. The system will be updated through the web by field extension officers and the same information will be updated on the *interactive voice response* (IVR) to be accessible by any kind of phone. [25]

Manobi, in Senegal, developed the *T2M*, a system that enables producers, exporters and the public regulatory agency to use a mobile telephone, a *personal digital assistant* (PDA) or the Internet in order to know in real time both the price and arrival status of their products at the markets, and the availability of the same products in the production sites. The price and arrival changes of the products on the markets are collected by *Manob*i market researchers twice a day on a PDA application. The data, which is sent via the mobile network to the Manobi Multi Channel Service Platform (MCSP) and stocked at a centralized database, is analyzed in real time before it is broadcast to the users through a multi-channel platform specially developed by *Manobi* to provide value added data services at lower cost with the mobile telephony operators' first generation classical vocal networks [26].

The information made available to traders reduces the price difference across markets. In Albania, for example, studies show that information that is available to different markets has reduced price differences across markets [35]. The adoption of mobile phones by fishermen and wholesalers in South India was associated with a dramatic reduction in price dispersion and near-perfect adherence to the Law of One Price [34]. Study of three countries (India, Tanzania and Mozambique) finds significant correlations between telecommunications and indicators of socio-economic development [60].

ICT can accelerate agricultural development by facilitating knowledge management [36]. Farmers can take full advantage of ICT to enhance productivity and generate

more income by adopting new technologies, including new varieties, adding value and marketing their products. Timely access to market information via communication networks also helps farmers make well informed decisions about what crops to plant and where to sell their produce and buy inputs. The benefit of ICT extends to economic aspects such as better earnings or production [38]. The adoption of modern industrial inputs in agricultural production relies on the information and communication infrastructure [37]. ICT capital has contributed positively and significantly to output and productivity for large US firms [54] while radio programmes in the Philippines have increased business and agricultural productivity [UNESCO, 1996].

But the literature also warns about the likely negative impact of ICT on the rural poor and disadvantaged groups if not well planned and implemented. ICT can result in the marginalization of economically disadvantaged groups within both developing and even developed countries [42]. One of the reasons is that different communication methods and different information sources are valued differently by rural farmers [41]. Also policy and infrastructural issues play a key role in ICT adoption by rural farmers and by gender [41]. The issue here is when, where, how and which ICT should be used for rural farmers to access market information.

In Zambia, 90% of the 21,000 farmers who were interviewed testified that information given by radio was relevant, and more than 50% credited radio programmes with having increase their crop yields through extension and education [40]. Studies in rural Thailand and Columbia [ITU, 1999] show that the introduction of telephones enabled farmers to check prices regularly which led to a doubling of farm incomes while in Columbia, community telephone access increased trade, employment and government service delivery [ITU, 1999].

When Nigeria embarked on the largest insecticide-treated bed-net (protection net from different insect) distribution project in history, it used mobile phones to check that the nets got to the places where they are needed. That meant the supply chain, from staff at state stores to distribution points, used text messages to confirm the

arrival of shipments and record how many nets were subsequently distributed. In two weeks, 283,546 nets were delivered to 226 different places. But importantly, the authorities were able to calculate that 69% of the projected demand in Kano State had been met. With that information, it was possible to identify and follow up on delayed shipments and other irregularities. The same text messaging software has also been used [13] to help community health workers to send data on the height and weight status of rural children to Malawi's Integrated Nutrition and Food Security Surveillance (INFSS) system. In return, the health workers receive information on their patients' nutritional status and have been able to identify more children with moderate malnutrition, who were previously missed [44].

Figure 4. Field teams synchronize their mobile devices before travelling to clinics and households to gather vital health data.

The mobile health programme is organized by the *UN* Foundation and Vodafone Foundation, DataDyne.org, the World Health Organization and national health ministries. Previously, the same process could take more than a month, because it was done via paper forms and by post. Erica Kochi, innovation specialist at *UNICEF*

Innovations, which developed the underlying technology, says the quicker this information is passed on, the more that can be done to save lives.

The projects in Nigeria and Malawi are exciting examples of *mHealth* – the use of mobile phones in improving the health care available to people in the world's poorest countries. A multitude of innovative *mHealth* applications are being tried out all over the world, funded by agencies including the Rockefeller Foundation and *WHO*. "There's so much potential because so many people have mobile phones." says Kochi. "We are exploring many applications" [43].

Grameen Foundation's AppLab has released a new suite of mobile phone applications developed in Uganda, using Google SMS Search and in partnership with MTN Uganda as the mobile operator which is new SMS service in Uganda from Grameen, Google & MTN by HASH on June 29, 2009. The services include [55]:

- Farmer's Friend: a searchable database with both agricultural advice and targeted weather forecasts
- Health Tips: provides sexual and reproductive health information
- Clinic Finder: helps locate nearby health clinics and their services

Google Trader: buyers and sellers of agricultural product and commodities as well as other products. Local buyers and sellers, such as small-holder farmers, are able to broaden their trading networks and reduce their transaction costs. (Known locally as "*Akatale SMS*").

In Zambia the IFAD supported *Smallholder Enterprise and Marketing Programme* (SHEMP) which introduces an innovative way to address the Lack of access to reliable and up-to-date market price information. Under its agribusiness component (one of three components, alongside road access and group formation), it put in place an SMS Market Information Service in cooperation with the *Zambia National Farmers Union* (ZNFU). The service provides up-to-date market prices, listing buyers for 12 major commodities in a cost-effective, accessible and reliable manner.

Fig 5. Users in Zambia sending SMS for latest maize price

The *SMS* system, which was launched in August 2006, is very simple to use. To obtain the best prices for a commodity, farmers simply send an *SMS* message containing the first four letters of the commodity name to 4455. Within seconds, they receive a text message with the best prices by buyer using abbreviated buyers' codes.

In Uganda, there is growing demand for market information as farmers strive to sell their commodities. On a fact finding mission as FOODNET offices in Bugolobi, staff of *information Communication Technology for Africa Rural development* (ICTARD) were happy to learn the processes through which market information is collected, analyzed and disseminated [57].

ICTARD AN NGO using solutions to eradicate rural poverty is intended to harness information and communication technology for Uganda National farmers Federation and its districts association. It does so by setting up websites where the farmers can download agriculture information, accessing information from the world space radio and by using the village phone.

The most vital information for farmers today is market opportunities and commodity prices, which is offered by FOODNET through trainings, radio broadcasts and through the telephone SMS media. Hellene karamaji, the Director of ICTARD, said

that her organization would like to use information from FOODNET especially in training farmers on using market information and weekly prices.

Mobile phone technologies are presenting Africa's smallholder farmers with an unprecedented opportunity to run their operations more productively and to grow their own income levels. Private companies, budding IT entrepreneurs, *non-governmental organizations* (NGOs) as well as governments are all involved in a variety of mobile phone-based products, services and applications (small software programmes that users can access on their handsets) aimed at boosting small-scale agriculture.

One of the largest challenges traditionally experienced by Africa's smallholder farmers has been a lack of transparent information about the market prices of crops. A number of new mobile phone-based services is, however, addressing this problem by giving farmers access to market prices, enabling them to negotiate better deals with traders and improve the timing of getting their crops to market. These services typically include a function where farmers can send a SMS text message to a specific number which then gives them wholesale and retail prices of crops.

Fig 6. Ghana-based market information service Esoko provides farmers with crop prices directly to their phones.

Earlier in Ghana, the pilot phase of a programme called Cocoa Link was launched by the *Ghana Cocoa Board* (COCOBOD), chocolate manufacturer The Hershey Company and the *World Cocoa Foundation* (WCF). The programme uses mobile technology to connect cocoa farmers with useful information about improving farming practices, farm safety, crop disease prevention, post-harvest production and crop marketing. Through voice and SMS messages delivered in their local language or English, cocoa farmers will receive the information at no charge. They also will be able to share information and receive answers to specific questions relating to their cocoa farming livelihoods.

Mobile phones are also being used to distribute agricultural insurance products to farmers, most of whom cannot afford conventional insurance. A product called *Kilimo Salama*, Swahili for 'safe agriculture', enables smallholder farmers in Kenya to insure their agricultural inputs against adverse weather conditions, such as drought or too much rain. Developed by *UAP* Insurance, the *Syngenta* Foundation for Sustainable Agriculture and mobile operator Safaricom, Kilimo Salama allows smallholder farmers to ensure as little as one kilograms of maize, seed or fertilizer. To be covered under the scheme, farmers only need to pay an extra 5% for a bag of seed, fertilizer or other inputs.

Mobile technology plays a central role in the scheme as it is used both for registration of new policies as well as for payouts. *Kilimo Salama* is distributed mostly through agro dealers that have been equipped with a camera phone that scans a special bar code at the time of purchase, which immediately registers the policy with UAP Insurance over Safaricom's mobile data network. This innovative application then sends a SMS message confirming the insurance policy to the farmer's handset. Payouts are determined by automated weather stations that monitor the rainfall. Based on the stations' measurements and a predefined formula of crop rainfall needs, payouts are automatically made to farmers using Safaricom's mobile money transfer service *M-PESA*. Farmers don't have to fill out any claim forms. Since its official launch in 2010, the scheme has already made payouts to numerous farmers. Other insurance companies have since also introduced similar products.

It is expected that products like *Kilimo Salama* will increase productivity since only about half of Kenyan farmers invest in improved seeds and soil inputs. A key reason for the low demand is the fear among farmers that poor conditions, such as drought, will render their investment worthless, robbing them of both their crops and their savings.

Nowadays, in globalization era, Malaysia achieves high level of economy growth with *3G* technologies besides another technology such as *WAP* service, *GPRS* service and also SMS information services. Mobile as a device which has many applications and can make much service such as online game, information services and inquiry of more services. At Malaysia, many government departments use SMS services to make easy for user to get information and make inquiry. For Example, *Jabatan Pengangkutan Jalan* (JPJ) uses SMS system for blacklist inquiry. Other than that, some game application can be running properly just using *SMS* application. For example, Penalty Game which was famous game during Euro 2004 session. Therefore, when SMS information services publish at our campus, the student and lecturer can take advantages of it. Students and lecturers can receive any information just type on hand phone button.

The *SMS* information service was also published at the university *kolej'universiti teknikal kebangsaan malaysia* (*kutkm)*, where the student and lecturer can take advantage of this service by receiving any information by typing with hand phone button.

Multimedia University in Malaysia is now providing *SMS* services to the Multimedia University community. The purpose of providing these services is to allow students and *Multimedia University* community an effective means of getting information from *MMU* at their fingertips. Some example of their services is mentioned below with input format.

SMS: MMU8X OR MMU1 OR MMU3 OR MMU4 OR MMU6 OR MMU21 OR MMU22
PRICING: RMO.50
SEND TO: 32322

Retrieve *MMU Administrative Directory*: MMU8X and send it to 32322.

Retrieve *MMU Faculty Directory*: MMU9X and send it to 32322.

Retrieve *Examination Results Retrieval*: MMUI <studentid> <password> <last/current> and send it to 32322.

Retrieve *Notification of Class Schedules*: MMU21 < studentid > < password > <mon/tue/wed/thu/fri/sat/sun> send it to 32322 and MMU22 <studentid> <password> <courseid>" and send it to 32322 for class schedule by course..

Check *Registered Course Detail*: MMU3 <studentid> <password> and send it to 32322.

Check *Application Status*: MMU4 <ICnumber> <omr/online> and send it to 32322.

Check *MMU Radio SMS*: MMU6 <comments/dedication> send it to 32322.

There are so many services an application can use hand phone via SMS such as MMU Faculty Directory, Examination, and Notification of Class Schedules and so on.

Based on this reference, we find it that SMS services allow easily access to the information without using Internet connection laptop or desktop. *MMU SMS* services are very detailed and powerful services because their SMS system service include Radio SMS which acts as a server as their base.

2.2 Mobile technology generation

In *Mobile Voice* (1st Mobile Generation) the main communication was via voice. During the 1st generation, the costs of the use of mobile technology to perform telemarketing related activities were greatly decreased. This has encouraged the brand owners to perform telemarketing over the mobile platform. The advantages of mobile telemarketing are threefold. Besides inheriting all the properties from the traditional fixed-line telemarketing manner, mobile telemarketing also has the added advantages of personalization. A mobile device can serve as a personal identity. The mobility of the device also means that marketers can reach the consumer at any point in time.

Mobile Messages (2nd Mobile Generation) using 2nd generation mobile phone technology, *SMS /MMS* services were successfully designed to be complementary to the voice communication of mobile phones. By having this service, mobile users can not only communicate by voice, but also send messages in text. This helps to reduce or eliminate the chance of getting incorrect information through voice, especially in cases when the message contains important information such as email addresses, names or physical addresses that are not easy to remember or that could be spelt wrong by voice communication [17]. The mobile messaging marketing approach also provides a cost-effective way to send messages to the receiver, compared to the standard voice communication [18]. In fact, mobile message is a successful replacement marketing tool for the traditional pager-based service [19]. SMS/MMS enable full automation of the message sending process, whereas the pager service requires a call made to the control center to initiate the message sending. Therefore, although other more advanced mobile features exist, SMS is still an important and popular feature for simple text communication [14]. Thus, the advantages of using mobile messaging marketing are higher by four times. Firstly, the cost of sending the message is the lowest for both the brand owners and consumers compared to other mobile marketing approaches [18]. Secondly, the lifetime of the message delivered to the consumer is substantially longer than for voice communication because the message is stored in memory so that the consumer could retrieve the message again when needed [20]. Thirdly, messages can store information that is difficult to communicate by voice, such as voucher number, name of contact and address [21]. Finally, since the *SMS/MMS* system is based on digital communication, it is very easy to allow the computer system to recognize the contents of the messages, enabling full automation for the sending and receiving processes [22].

Mobile Internet / Web (3rd Mobile Generation) using 3rd generation mobile phone technology, mobile internet marketing was introduced. Mobile Internet marketing is quite different from Internet marketing. The regulations for the use of mobile communication are well defined. These regulations are expected to be able to resolve the issues in privacy and security that exist for Internet marketing [23]. First of all, the costs of use of mobile Internet are higher than the normal Internet. Although it

may prevent quite a few brand owners from participating in this area, it ensures that the players who have joined are powerful enough to enforce control over the content and the processes [15]. Additionally, not all of the web resources are able to be displayed on mobile devices. In fact, due to screen size limitations, mobile web resource must be designed specifically for that device to very strict standards [16]. There are multiple ways on the Internet platform to perform marketing activities. The most popular way is marketing through subscription of email newsletters, which the topics are specified by the subscriber. There are also other advertisement approaches, such as embedded advertisement on instant messenger applications (e.g. *MSN Messenger, Yahoo Messenger*), website advertisement, forums and blogs. [16]. Furthermore, the seriousness of spamming on the Internet platform has become so unfavorable that it is so difficult for consumers to trust this kind of communication approach, and brand owners may simply avoid the usage of the Internet to maintain their reputation [23]. Brand trust is very important to mobile Internet marketing deployment. In New Zealand, mobile service provider (e.g. *Vodafone*) use web portals to market their own or third party products. Vodafone Live is a well-implemented mobile Internet marketing campaign.

Mobile Television (4th Mobile Generation) the promise of true 4th generation mobile technology is television delivered to the mobile phone. There are some limitations on the traditional television marketing approach, due to its one-way broadcasting channel. The content of the TV marketing approach through broadcasting media is usually dynamic and volatile, and therefore it is necessary to repeat the contents of these marketing messages several times in order to assist consumers in remembering or understanding [14]. TV marketing allows hi-tech involvement in the marketing processes and, in addition, it hits the consumers' psychological perception [15]. The dynamic feature of such a communication channel allows the sellers to update the contents of their messages in real time; therefore the contents are more valid and accurate [16]. In addition, it also introduces new elements such as animation and sounds, which can further deepen the consumers' impressions [15]. Furthermore, the

correctness of the message delivered to the consumers could also be increased by using live verbal and visual communication.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Methodology

The method which was followed to carry out the study is interview according to the study topic. The interview method was carried on in a discussion environment in which both the interviewee and interviewer were able to get more clarification of the question and response.

The interview was covered with some farmers, some mobile service providers and big markets in Dar-es Salaam city. Basically the study involves those areas; Tigo service provider, Zain service provider, Kariakoo Market Corporation, Tandale Market Corporation and Temeke Stereo Market Corporation.

The study consumed total of three months starting from proposal, literature review, data collection, report writing and submission of the thesis. In order for the research to be successful, the study required materials, time and other things like that which can be encountered during researching process. The area of the study for this research was conducted in Dar es Salaam found in eastern part of Tanzania. Dar es Salaam is one of the 26 administrative regions in Tanzania. Dar es Salaam region has two boundaries with Pwani region and Indian Ocean. It has been divided into three districts which are Temeke, Kinondoni and Ilala.

3.2 Research Approach

The study follows a qualitative approach. The aim was to find best options of technology which the farmers are using for selling their commodity in different parts of the world and mostly in developing countries and also compare various service providers, and make recommendations regarding the most viable option for achieving long-term sustainability. The data obtained helped to write a report to know if SMS-based market information system for smallholder farmers is best option or not.

3.4 Population, Sample Size and Sampling Techniques

3.4.1 Population

The population included all mobile service providers and all market corporations in Tanzania at Dar es Salaam region and small group of farmers. This choice has been made as it affects the objective of the study and this group of people was interviewed for data collection.

3.4.2 Sample Size

The research comprises of farmers who are the users of the technology and help to make decision which option is best and easy for them to access and the sample size of 2 people from service providers (zain and tigo), 1 person from Dar es Salaam Institute of Technology DIT, 3 people from Kariakoo Market Corporation, 3 people from Temeke Stereo Market Corporation and 3 people from Tandale Market

Corporation**.**The selection was influenced by the technical people from service providers, technical people from institution with SMS service knowledge, business people and officials from markets and the accessibility of those areas by a researcher.

3.4.3 Sampling Techniques

The study areas are very vast, it was difficult to collect information from each person, and thus it was important to be sampled in such a way that all characteristics shall be presented. Generally the study used purposive, simple random sampling and stratification. The purposive sampling technique used in identifying technical people from service providers, technical people from institution with SMS service knowledge and business people and officials from markets and the end users (farmers). The study used simple random sampling when respondents were picked randomly without any considerations/mixing papers with names in the small bucket and choosing one paper among different pieces of paper which has a name of the person. The study used stratified sampling when big markets were chosen from each district in Dar es Salaam. This is how sampling was applied to extract respondents technically and balanced.

3.5 Methods of Data Collection/Research Instrument

According to [68], research instruments refer to the technique or methodology used in collection of data. According to [69] methodological approach in conducting a study is envisaged to offer proper pursuit to the truth that is determined by logical consideration of facts. The study of this project used interview technique to collect required data and information.

3.5.1 Interview

According to [70], interview is a method of gathering information in the physical presence of the respondent. The technical people, businessmen and officials were asked oral questions during the interview related to the topic. The interview method was selected because it helped the researcher to observe and verify the data

according to voice expression and gestures of the respondents. Also the respondents had a chance to fully explain what they had concerning the topic and also asked for clarification when needed

3.6 Methods of data analysis

Analysis refers to the computation of certain measures along with searching for patterns of relationship that exist among groups of data [69]. Actually in this study, data analyzed through the text format with help of illustration drawing and tables. Qualitative analysis used to interpret the qualitative result and responses from the interviewed persons.

In this chapter the research findings and analysis of data are presented according to research objectives. The general objective of this study was to find out all best options for the sustainable SMS-based market information system for smallholder farmers and also know how SMS system are used in different fields. The data for this study was gathered and analyzed through qualitative perspective.

3.7 Data from markets, users (farmers) and service operator

Sample questions used during interview for *markets* and *farmers*

1) Who are the main buyers for different commodity like e.g. tomatoes?

2) Current price of any commodity?

3) What is the variation of different commodity price in a year?

4) How do you get the price information from other markets?

5) What do you think about alternative ways of getting price information very easily?

6) How does the business process take place currently?

7) Is there any other way used by market administrators to help the farmers to get the right price at the particular time?

Sample questions used for *SMS service operators* providing mobile SMS service

1) What are different options for SMS service that has been used in the particular company?

2) What are the circumstances/criteria that make you choose a certain option to be used for a particular service?

3) How has service oriented SMS service been implemented technically (For e.g. like asking balance *102#)?

4) Best way for updating the database?

CHAPTER FOUR: RESULTS

In this chapter the findings and analysis of data are presented according to the objectives. The general objective of this study was to find out all possible viable options being used and benefited for SMS-based market information system for smallholder tomato farmers and also in general how the SMS systems is working. The data for this study was gathered and analyzed through qualitative perspective. In the following, we list the answers given by the interviewees. All these answers are from question survey.

4.1 DATA FROM SERVICE OPERATOR

4.1.1 Different options for SMS service that has been used in service providers

Accessibility of price information in two ways. Sending the text message is one of the fastest and easiest way (price for different commodities/crops). Subscriber is supposed to register to the system to receive price alerts from the system and once he get register the price information will be updated each time he gets login to the system.

Protocols, Short Message peer to peer protocol: The *Short Message Peer-to-Peer* (SMPP) protocol is a telecommunications industry protocol for exchanging SMS messages between SMS peer entities such as short message service centers and/or External Short Messaging Entities. *External Short Messaging Entity* (ESME) is a term which describes an external application that connects to an SMSC to engage in the sending and/or receiving of SMS messages. It is often used to allow third parties (e.g. value-added service providers like news organizations) to submit messages, often in bulk. SMPP protocol is recommended for large number of subscribers per second. So SMPP protocol can be used in case multiple accesses at a time are required.

Modem protocol is suitable for limited number of subscribers about 8 subscribers per second.Two ways of sending SMS: The SMS can be sent by either phone or by computer using modem(*From tigo, zain*)

4.1.2 Circumstances/criteria that might lead to choose a certain option to be used for a particular service.

Number of subscribers at a particular SMS service: If the number of subscribers is small than modem protocol can be used otherwise SMPP Protocol can be more suitable. *Targeted group:* If all people are required to access information then Mobile based SMS service is better because of its better accessibility than Web based SMS service which is more accessible in towns only.*The form of service:* If the subscribers are registered then received price alert can be more applicable, else sending a text message requesting the price information is more applicable.

4.1.3 Implementation of service oriented SMS?

A mobile user sends an SMS message to a service number (For example *102#). The mobile connection provider's SMSC receives the SMS message and should ensure that database is communicated with SMSC (short message service center). When the mobile operator receives the SMS message from the SMSC then processing has to be done for the message so that the reply can be sent back to the SMSC. So a query to database is done according to the SMS string and returns the results to the SMSC. An *SMS gateway* is a way of sending a text message with or without using a mobile (cell) phone. Specifically, it is a device or service offering SMS transit by either transforming messages to mobile network traffic from other media or by allowing transmission or receipt of SMS messages with or without the use of a mobile phone. Typical use of a gateway would be to forward simple email to a mobile phone recipient. It can also be useful in developing web applications that we can interact with via SMS (Short Messaging Service). Gateway is required between SMS application and SMSC to allow communication in between.

There are different technologies that can be used for *Gateway* including privately own and an open SMS gateway - for sending/receiving SMS. ZAIN and TIGO service providers have been working with *Kernel* gateway and SMPP protocol which allow large number of users at a time.

If the subscriber (071-9716463) text “tomato” to 1002, then he gets prices of different markets instantly from service operators.

The SMS application has code number so that it could be recognized by service operators. Normally SMS application can be settled physically. A virtual private network (VPN) is a method of computer networking typically using the public internet that allows users to share information privately between remote locations, or between a remote location and of a business' home network. A VPN can provide secure information transport by authenticating users, and encrypting data to prevent unauthorized persons from reading the information transmitted. VPNs are frequently used by remote workers or companies with remote offices to share private data and network resources. VPN can be used for inter-service operator’s connection. (***From zain***)[58]

SMS application (Database) is the strategic part of the service owner to implement and to put all controls of how could the service works. Normally an SMS application can be attached to either of SMSC from either of the service operators or somewhere else but it should be able to connect to the SMSC. Gateway is required between SMS application and SMSC to allow communication in between e.g. Kannel. (***From tigo***)The scheme is summarized in the following diagram.

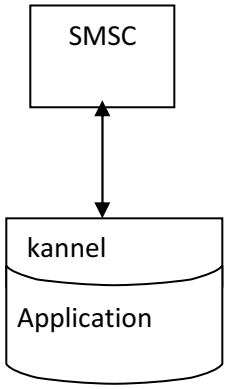


Figure 10. Gateway connecting SMSC and SMS application

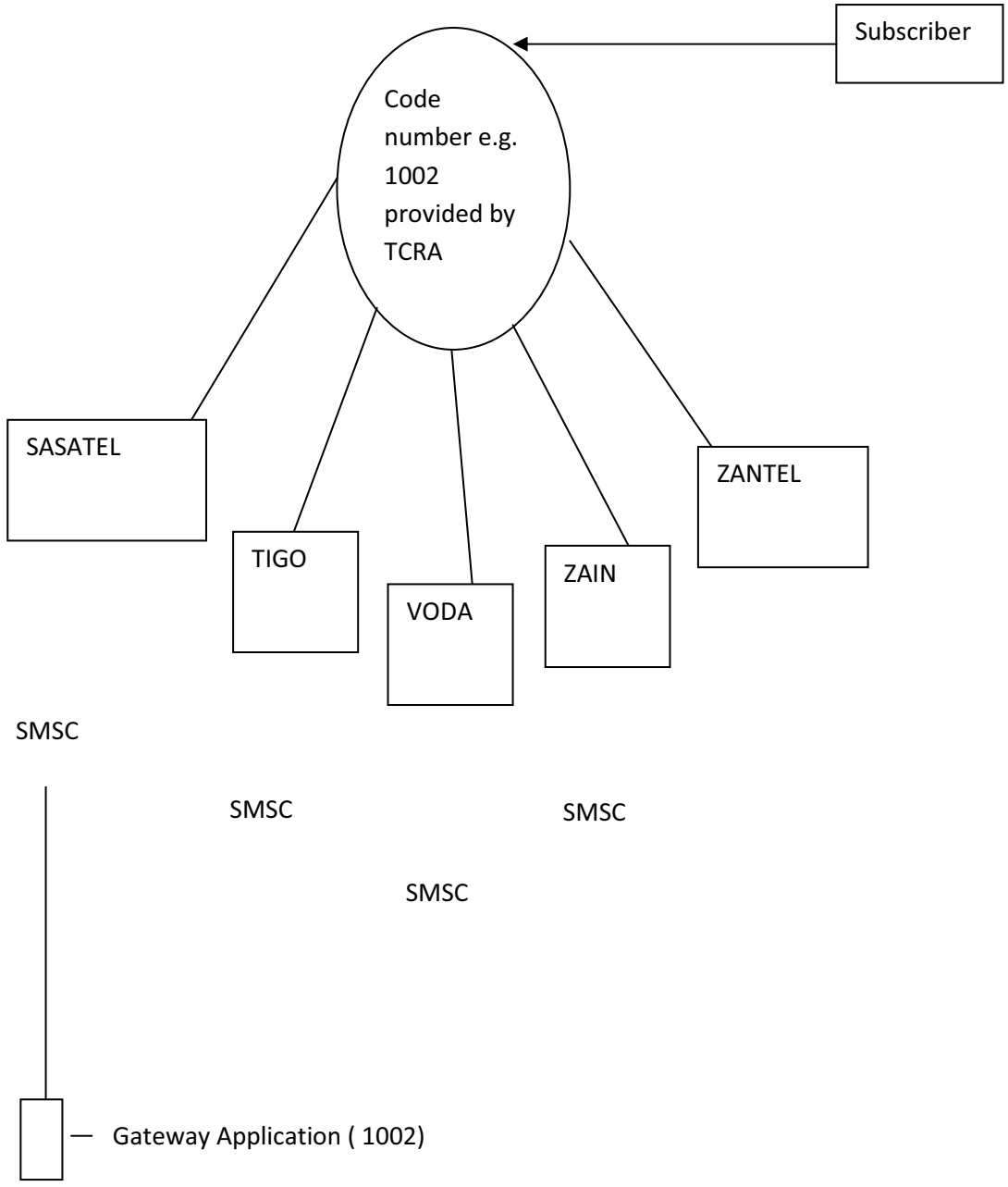


Figure 8. The concepts can be summarized in the diagram.

4.3.4 Best way for updating the database

There can be phone application from each market price porter for updating the price information directly each time required or a call or SMS from special price information porter to the database application operator to insert that price

information each time they are needed.There are two ways for updating database: either through SMS or via Web application. There should be keywords or special format check by the application to recognize the right SMS/Web application for updating the database and not for asking price information. (***From zain***)

Table 2 Number of the respondents from sample size responded in each question.

Questions number	Service operators			
	Tigo market sample size	Zain market sample size	Sample size responded	Sample size responded in (%)
1	2	2	2	100
2	2	2	1	33.3
3	2	2	2	100
4	2	2	2	100

Ok = responded question

No = responded question

4.2 DATA FROM MARKETS, USERS (FARMERS)

4.2.1 The main buyers of commodities e.g. tomatoes

There are internal consumers, Middlemen (who buy and sell within the country) and external traders who export to other countries (*From Kariakoo, Temeke and Tandale*) and the farmers who sell their commodities to the market.

4.2.2 Current price of commodities (tomatoes)

The price of the commodity is not stable, it changes every time depending on the demand and the supply of the product at the particular time. Also the price of tomatoes is not uniform depend on where they come from because of different taste.

For example range of current price of Tomatoes 20,000Tsh from farmer, 30,000Tsh from middle man and 40,000Tsh from agent to retailer/customer in terms of Box (about 50kgs).For example range of current price of Avocadoes 20,000-25,000Tsh from farmer, 25,000-30000Tsh from trader to retailer/customer in terms of sack**.** So the price goes on increasing where the data shows that the farmers are not getting benefit which they are supposed to get. The commodities when reach the market or finally to customer there is big margin of difference in price. The farmers are supposed to get more benefit according to the market price fixed by the committees of markets. When they are selling the commodities to middleman in large quantity than there is loss of big money to farmers.

4.2.3 Variation of tomatoes price in a year

From January to March and from June to August is low supply so price at least is stable and high. The rest of months is high supply so low price and at most variable.

4.2.4 How do price information conveyed from one market to other markets

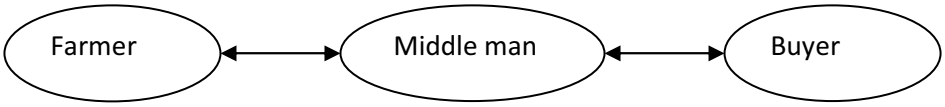
The traders know the price information from different markets through mobile phones and sometimes they can move to any market. But farmer due to lack of information and communication they don't get actual price cost of commodities and they sell the crops at any rate they get which may be not be so profitable business for him instead the traders are making the actual benefit.

4.2.5 Alternative ways of getting price information very easily

Using mobile phones to get price information is a quick way either by calling or SMS to someone you know.

4.2.6 How business process is currently taking place in Tanzania

Existing process of running business is summarized in the figure



Commodities are sold by a farmer to middleman from the farm or in the market, the middleman sells to trader/agent and finally agent sells to the retailer/customer/consumer. But sometimes shortcut ways are done like retailer/customer could go direct to the farmer and bought commodities and vice versa.

4.2.7 Ways used by market administrator for farmers to get the right

Administrative Scope: Administrators of the markets could work only with the traders/agents and there is no direct communication with the farmers.

Table 1 Number of the respondents from sample size responded in each question

Question number	Market Name				
	kariakoo market sample size	Temeke market sample size	Tandale market sample size	Sample size responded	Sample size responded in (%)
1	3	3	3	3	100
2	3	3	3	3	100
3	3	3	3	3	100
4	3	3	3	3	100
5	3	3	3	3	100
6	3	3	3	3	100
7	3	3	3	3	100

Ok = responded properly

CHAPTER FIVE: CONCLUSIONS AND RECOMMENDATIONS

To get the information flow faster and correctly, SMS have been great advantage in this area. In business world, everything is about designed towards, effective and cost saving.

The assignment of this thesis was mainly to find all viable options for SMS-based market information system for smallholder horticulture farmers and to find out the SMS systems being benefited in different cases. Different options have been found out during the study to achieve these goals

Two options of accessing price information via SMS have been investigated either he receives price information or he receives price alert. *Two Protocols* have been investigated either to use Short Message *peer to peer protocol* or *Modem protocol*. Two ways of sending *SMS,* The SMS can be sent by either phone or by computer using modem. Gateway is required between SMS application and SMSC to allow communication in between. There is an open source e.g. kannel and proprietary software. The cost options from different service providers depend on how the owner of the service presents his/her work to the particular service operator. If the service seems to just to help farmers the cost can be reduced as much as possible like (50 - 30) TSH. SMS systems being benefited in different cases like car parking systems, M-Learning, administrative communication in higher education, Library Applications, Classroom interaction and discussion and mobile ticketing.

According to the data collected from different markets and service providers there is high demand of SMS-based market information systems. Those should consider some of the factors such as the language to be used, service type (business or serving community service). Since the technology is changing day by day so the best option to be used is on-going process. The research will help to get the best option at particular time and environment. Therefore more time is required to collect data, analyze and come up with the best solution depending on the objective in this case SMS based market information system.

From the above different reviews and ideas on how the SMS service can be implemented and the kind of technology to be used from different service providers and experts, I would suggest the following things for the SMS based market information systems to be more advantageous for farmers:

My recommendation is that the language should be preferable to the local markets and users.

My second recommendation is that SMS service should be community based service because than there would be less charges for registration code number and for running that service and the farmers can send SMS less cost. One of the possibility that I see is farmers can bear less price is if there is community of farmers who can get *quantity discount* on negotiation with service operators and it would also depend on the service provider how much he would fix the price per SMS. In one of the African country, there is an existing system where the user can send SMS (sender) to the other user (receiver) for free. There is private company who owns the code number which the user uses it to send messages. This private company also is responsible for sending the advertisement to the sender and receiver via mobile company. It pays mobile company half the amount of SMS cost and half for its own company. The amount which it receives is from advertiser. One of a example in India is the sms service for farmers has been very cost effective.

Nokia life tools which is aimed at emerging market focus on agriculture information and education service with additional entertainment. It is reliable and delivers regular information to the user in their mobile devices in one package. It is potential to earn more with regular updates of locally relevant market price. Nokia has launched this Nokia life tools which is very market specific. There is Basic Agriculture service Priced at 30 rupees (US$0.65) per month, this provides farmers with tips on agriculture techniques and news. The service was rolled out commercially in India on June 12, 2009, after a pilot trial in the state of Maharashtra. There is Premium Agriculture service which Costs twice as much, offers the full suite of information including market prices, weather updates and news and tips. With Nokia Life Tools, one of the farmer said that he even managed to earn a profit of 6,000 (US$130)

rupees using information provided by the service compared with previous occasions when he had to go through an agent. In this case the Maharashtra state agriculture marketing board has a deal with Nokia to make this service available to the subscribers. The involvement of such government factors plays vital role for farmers to provide the quality service and make the reasonable price.

My third recommendation is that according to review, in term of technical point of view Short Message peer to peer protocol SMPP protocol is mostly used to serve large numbers of subscribers per second than GSM modem.

Finally Price porter should be available in each market so that it makes the market price update and farmers can get per day market price through SMS service.

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