M-commerce Breakthrough in Developing Countries

The Role of M-commerce in Wealth Creation and Economic Growth in Developing Countries

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- The role of M-commerce in Wealth Creation and Economic Growth in Developing Countries

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Luleå, January 2006
M-commerce has attracted a growing amount of attention in the last few years in the advanced countries whiles the developing world attempt to ‘leapfrog’ by taking advantage of the explosive growth in mobile phone usage. Currently the growth in the number of mobile phones in most developing countries has exceeded the growth in the number of fixed lines. M-commerce continuous to change the face of business by introducing new business models as well as offering unique advantages such as immediacy, localization, personalization, data portability and connectivity. The capabilities and prospects of M-commerce vary across the developed and developing countries. Research into the impact of M-commerce on socio economic activities has mostly been conducted in the developed nations. This master thesis looks at how M-commerce is influencing the economic or business activities and wealth creation in some farming and fishing communities in the rural areas of some developing countries.

Keywords: M-commerce, Mobile Devices, Business Model, Commerce, Developing Countries, Business Relationships, Cost, Convenience, Communication.
I wish to dedicate this master thesis to the two special women in my life. My lovely wife Dina, for the many sacrifices and incredible support, and my mum Elizabeth. I really love you.

-------------- Raymond

I dedicate this piece of work to my parents for their invaluable support that made it possible for me to achieve my dream pursuing a master’s study abroad.

-------------- Avez
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Shaik Avez Gouse
# CONTENT

<table>
<thead>
<tr>
<th>Section</th>
<th>Page. No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>INTRODUCTION</td>
</tr>
<tr>
<td>1.1</td>
<td>Background</td>
</tr>
<tr>
<td>1.2</td>
<td>Traditional and Digital Commerce</td>
</tr>
<tr>
<td>1.3</td>
<td>Problem Area</td>
</tr>
<tr>
<td>1.3.1</td>
<td>The Case of Ghana</td>
</tr>
<tr>
<td>1.3.2</td>
<td>Poverty and Economic Activities by Small Businesses</td>
</tr>
<tr>
<td>1.4</td>
<td>Purpose and Research Question</td>
</tr>
<tr>
<td>1.5</td>
<td>Objectives of the Study</td>
</tr>
<tr>
<td>1.6</td>
<td>Delimitation</td>
</tr>
<tr>
<td>1.7</td>
<td>Disposition of the Thesis</td>
</tr>
<tr>
<td>2</td>
<td>THEORETICAL FRAMEWORK</td>
</tr>
<tr>
<td>2.1</td>
<td>A Sociotechnical Systems Approach</td>
</tr>
<tr>
<td>2.1.1</td>
<td>Some Characteristics of Sociotechnical Systems</td>
</tr>
<tr>
<td>2.1.2</td>
<td>Principles behind adaptation and societal Change for new technology</td>
</tr>
<tr>
<td>2.2</td>
<td>Socio-economic systems</td>
</tr>
<tr>
<td>2.2.1</td>
<td>Wealth Creation</td>
</tr>
<tr>
<td>2.2.1</td>
<td>Economic Growth</td>
</tr>
<tr>
<td>2.3</td>
<td>Evolution of Commerce</td>
</tr>
<tr>
<td>2.3.1</td>
<td>Traditional Commerce</td>
</tr>
<tr>
<td>2.3.2</td>
<td>E-Commerce</td>
</tr>
<tr>
<td>2.3.3</td>
<td>M-commerce</td>
</tr>
<tr>
<td>2.4</td>
<td>Business Models</td>
</tr>
<tr>
<td>2.4.1</td>
<td>Types of Business Models</td>
</tr>
<tr>
<td>2.4.2</td>
<td>MTech Business Model</td>
</tr>
<tr>
<td>2.4.3</td>
<td>Impact of IT on Commerce</td>
</tr>
<tr>
<td>2.5</td>
<td>Main features of M-commerce</td>
</tr>
<tr>
<td>2.5.1</td>
<td>Definition and Scope of M (Mobile) Commerce</td>
</tr>
<tr>
<td>2.5.2</td>
<td>Characteristics of M-commerce</td>
</tr>
<tr>
<td>2.5.3</td>
<td>Mobile Commerce Systems</td>
</tr>
<tr>
<td>2.5.4</td>
<td>Requirements of a Mobile Commerce System</td>
</tr>
<tr>
<td>2.5.5</td>
<td>Relationships in the M-commerce value chain</td>
</tr>
<tr>
<td>2.6</td>
<td>M-Commerce Services and Applications</td>
</tr>
<tr>
<td>2.7</td>
<td>Issues regarding M-commerce Adoption and Diffusion</td>
</tr>
<tr>
<td>2.8</td>
<td>M-COMMERCE TECHNOLOGY</td>
</tr>
<tr>
<td>2.8.1</td>
<td>Mobile Stations</td>
</tr>
<tr>
<td>2.8.2</td>
<td>Mobile Middleware</td>
</tr>
<tr>
<td>2.8.2.1</td>
<td>WAP (Wireless Application Protocol)</td>
</tr>
<tr>
<td>2.8.2.2</td>
<td>I-mode</td>
</tr>
</tbody>
</table>
5 Discussion and Analysis

5.1 Introduction ............................................................................................................. 52
5.2 Within Case Analysis ............................................................................................. 52
  5.2.1 The case of vegetable farmers ............................................................................ 52
  5.2.1.1 Costs .................................................................................................................. 53
  5.2.1.2 Communication ............................................................................................... 53
  5.2.1.3 Convenience ..................................................................................................... 54
  5.2.2 The case of Mireku Farms Limited .................................................................... 54
  5.2.2.1 Costs .................................................................................................................. 54
  5.2.2.2 Communication ............................................................................................... 54
  5.2.2.3 Convenience ..................................................................................................... 55
5.3 The case of Fishermen ......................................................................................... 55
  5.3.1 Cost ...................................................................................................................... 55
  5.3.2 Communication ................................................................................................. 55
  5.3.3 Convenience ....................................................................................................... 56
5.4 Importance of the Business Models ...................................................................... 56
  5.4.1 Seller-Buyer (Farmers – Customers) relationship ............................................ 57
  5.4.2 Farmers-Bank relationships .............................................................................. 57
  5.4.3 Buyer-Bank relationship .................................................................................... 57
  5.4.4 Inter-Banks relationship .................................................................................... 58
  5.4.5 Relationship with the Network Operator ............................................................ 58
5.5 Cross case analysis ............................................................................................... 58
  5.5.1 Comparisons based on Cost .............................................................................. 59
  5.5.2 Comparisons based on Communication ............................................................ 59
  5.5.3 Comparison based on convenience .................................................................. 59
5.6 Theoretical Discussion ......................................................................................... 59

6 Future of M-commerce in Ghana ........................................................................... 61

6.1 Mobile Network and Payment Operators ........................................................... 61
  6.1.2 Mobile Network Operators .............................................................................. 61
  6.1.3 Payment Operators .......................................................................................... 61
6.2 Awareness of M-commerce Applications and Services ...................................... 62
6.3 Factors affecting M-commerce diffusion in Rural Settlements ......................... 62
  6.3.1 Economic Factors ............................................................................................... 63
  6.3.2 Cultural factors .................................................................................................. 63
6.4 M-commerce Potential sectors for wealth creation ............................................ 63
  6.4.1 Rural Development ............................................................................................ 63
  6.4.2 Commerce ......................................................................................................... 63
  6.4.3 Education .......................................................................................................... 64
  6.4.4 Job Creation ....................................................................................................... 64
  6.4.5 Health Delivery .................................................................................................. 64
7 Conclusion .......................................................... 65

7.1 Business Growth .................................................. 65
7.2 Economic Growth and Wealth Creation .................... 66
7.3 M-commerce and wireless communication infrastructure .... 67
7.4 M-Payment .......................................................... 67
7.5 Methodological reflections ...................................... 67
7.5.1 The single case study .......................................... 68
7.5.2 Continuous research .......................................... 69

REFERENCE

APPENDIX A: INTERVIEW QUESTIONNAIRE TEMPLATE

APPENDIX B: Figures and Tables

APPENDIX B1: Top 10 global investors and operators by proportionate equity subscribers (March 2005)

APPENDIX B2: Specifications of some major mobile stations

APPENDIX B3: Major WAN Standards

APPENDIX B4: Issue Analysis Framework (Network Operators)

APPENDIX B5: Major Cellular wireless networks

APPENDIX B6: Issue Analysis Framework (Logistics Providers)

APPENDIX B7: Issue Analysis Framework (Payment Operators)
LIST OF FIGURES

Fig.1    Disposition and action plan of thesis                    7
Fig.2    Map of Ghana (Political Regions)                        8
Fig.2.1  Typical B2C enabled by internet                         14
Fig.2.2  Transition from Traditional Commerce to M-commerce      15
Fig.2.3  Role of Business Model                                  16
Fig.2.4  Relationship between wealth creation and business models 17
Fig.2.5  MTech business model                                    18
Fig.2.6  3C Framework                                          19
Fig.2.7  M-commerce space                                      22
Fig.2.8  Customer-Operator relationship                          24
Fig.2.9  Seller-Buyer-Operator relationship                      24
Fig.2.10 Phases in mobile payment transaction                   29
Fig.4.1  Business Model of Non-MTech                             40
Fig.5.1  S2S operator doing business                           53
Fig.5.2  MTech Business Model                                   56
Fig 6.1  Mobile coverage in Ghana (Areeba and Buzz GSM)       62

INDEX OF TABLES

<table>
<thead>
<tr>
<th>Table No</th>
<th>Table Number</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table 2.1</td>
<td>Definitions of M-commerce</td>
<td>21</td>
</tr>
<tr>
<td>Table 2.2</td>
<td>Major M-commerce applications</td>
<td>24</td>
</tr>
<tr>
<td>Table 2.3</td>
<td>Comparisons of two major kinds of mobile middleware</td>
<td>26</td>
</tr>
<tr>
<td>Table 3.1</td>
<td>Features of Qualitative and Quantitative Approach</td>
<td>31</td>
</tr>
<tr>
<td>Table 3.2</td>
<td>Contrast between Positivist and Naturalist Axioms</td>
<td>32</td>
</tr>
<tr>
<td>Table 3.3</td>
<td>Methods of data collection in Case Study</td>
<td>33</td>
</tr>
<tr>
<td>Table 3.4</td>
<td>Degree of standardization and structuring</td>
<td>35</td>
</tr>
<tr>
<td>Table 4.1</td>
<td>Average prices for mobile devices</td>
<td>43</td>
</tr>
<tr>
<td>Table 4.2</td>
<td>Services and Prepaid Scratch Cards</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Denominations/ and Price</td>
<td>43</td>
</tr>
<tr>
<td>Table 4.3</td>
<td>Initial setup investment analysis</td>
<td>44</td>
</tr>
<tr>
<td>Table 4.4</td>
<td>Mobile operators in Ghana (Nov, 2005)</td>
<td>47</td>
</tr>
<tr>
<td>Table 4.5</td>
<td>Mobile Network Penetration by Operators</td>
<td>47</td>
</tr>
<tr>
<td>Table 4.6</td>
<td>Mobile network diffusion (Districts)</td>
<td>47</td>
</tr>
<tr>
<td>Table 4.7</td>
<td>Mobile Phone diffusion (Subscribers)</td>
<td>48</td>
</tr>
<tr>
<td>Table 4.8</td>
<td>Payment Operators services for M-commerce</td>
<td>51</td>
</tr>
</tbody>
</table>
1 INTRODUCTION

This chapter provides a background of our study or thesis and gives the reader an overview of the subject. Among the contents here include a problem description, our research question, and the purpose of our study. We also present our delimitations of this thesis, expected results and the thesis disposition.

1.2 BACKGROUND

One of the greatest challenges currently facing the United Nations, the developing countries and the world at large is the fight against poverty and diseases in the world’s poor and developing countries. A lot of efforts are therefore being made to device appropriate tools and models from all disciplines to help address the problem of poverty in these countries.

The current fast growth in information technology makes it imperative for researchers and stakeholders to explore how the ever growing and new technologies in ICT could bring its influence in poverty alleviation. Africa is classified as the world’s poorest continent having most of the poorest nations.

According to the UN Secretary General Kofi Annan, Globalization and the world’s economy and the impact of the emerging new information age characterized by Information and Communication Technologies would undoubtedly provide new challenges for developing countries. According to the United Nations report on E-Commerce and Development 2002, the growth in the number of telephone users worldwide, in the last four years, has exceeded the growth in the number of fixed lines, expanding from 50 million to almost 1 billion in 2002. By 2004, over 90% of countries have mobile and nearly one in every six of the world’s inhabitants has a mobile telephone. By year 2000, almost 100 countries have more mobile than fixed-lines telephone subscribers and this has become a global phenomenon today. The use of mobile phones is actually increasing exponentially all over the world and the euphoria around it in developing countries is simply unimaginable.

Until quite recently the use of mobile phones penetrated rapidly in the advanced countries which subsequently widened the digital divide between the developed and developing countries (UNDP2001). The trend is however changing. The introduction of wireless communication has not only expanded telephony in many developing countries, but also introduced wireless data services which are essential for conducting M-Commerce. Mobile handset has now become the first and main access route to information and communication technologies to many people in developing countries.

By mid-2002, there were 300 million mobile telephone users in the Asia-Pacific region. China has the largest number of mobile telephone users in the world: More than 170 million in mid-2002, with over 400 million forecast by 2005-2006(G. Srinivasan 2004).

Economic development is an important factor in reducing poverty and in generating the resources necessary for human development and environmental restoration. The real per capita output is an indicator that defines the real output per person in a nation. According
to the United Nation, every country with per capita output of less than US $750 is classified as a low income nation. In general, countries with per capita incomes less than US$1,000 per year are referred to as the less developed countries. The poverty income threshold is defined as the income level below which a person or family is classified as being poor. The poverty threshold used by the World Bank to measure poverty in the developing nations is US$370 per person per year. Today, it is estimated that 1.3 billion people in less developed countries are living on less than one dollar a day. In Africa, for example, the per capita income in some very poor countries is less than US$200 per year.

When the Web first became well-known among the general public in 1994, many journalists and pundits forecast that e-commerce would soon become a major economic sector. However, it took about four years for security protocols (like HTTPS) to become sufficiently developed and widely deployed (during the browser wars of this period). Subsequently, between 1998 and 2000, a substantial number of businesses in the United States and Western Europe developed rudimentary Web sites. A look therefore at the euphoria surrounding this new technology and its associated influences on the socio-economic activities in developing countries provide a lot of interesting topics for study.

1.2 Traditional and Digital Commerce

One of the profound consequences of the information revolution is its influence on how economic value is created and extracted. Information is more easily accessed and absorbed, and arranged and priced in different ways. This is a jarring transition from an industrial economy to an electronic economy. Markets are expanding from regional to global. Knowledge is replacing land, labour and capital as the key value driver. Intelligent networks and virtual spaces are limiting the need for surface and air travel. Inter- and intra-industry alliances are being formed. This is the electronic economy (the "click here" economy). Within the electronic economy, electronic enterprises (business enterprises that have the capability to exchange value - money, goods, services or information - electronically) conduct electronic commerce.

The Internet has truly changed the way business is being done so much so that the traditional companies are referred to as “brick- and- mortar companies” and classified as belonging to the old-economy, while the businesses leveraging the power of Internet are being classified as belonging to “New-economy.” According to Seeth Seethram and Reno Bosetti 2003, the Net is changing the fundamental nature of business transactions blurring the traditional roles of manufacturers, distributors, and suppliers. They believe that the image of a linear channel is rapidly becoming obsolete and the chain that links the buyer and the seller can be taken apart in myriad ways to satisfy the needs of the moment. They point out that much commerce already operates in a seamless and transparent multidimensional network and further say that new market intermediaries (market makers, seller agents, buyer agents, context providers, fulfillment enablers, etc.) will replace the conventional intermediaries (warehouses, wholesalers, distributors, etc.).
1.3 PROBLEM AREA

It is evident that most studies and researches on M-commerce have been conducted in the advanced and western countries. (HERMES Newsletter, Issue No.11: Special Issue on Mobile Commerce, August – September 2001). The situation is however different in the developing nations. Developing countries, like the Developed ones have also had their fair share in the explosion of mobile phone usage in recent years (UNCTD, E-Commerce and Development Report 2002). The extent to which the penetration of mobile phones and PDA’s usage has influenced the socio-economic activities and the prospects of this emerging technology and business model for supporting the quest for wealth creation and economic growth in the world’s poor countries are however yet to be ascertained. The case of Ghana, one of the world’s poorest and developing country which is currently making big waves in the usage of mobile phones and PDAs would be studied. Attempt would also be made to explore the situation in other countries such as Bangladesh, Senegal, the Philippines and others.

1.3.1 The case of Ghana

Ghana, like most other developing countries has recorded an appreciable expansion in the coverage of her telecommunication infrastructure (fixed lines, mobile phones and electricity) since 1996. Although Ghana’s ICT landscape in the last decade or two has undergone a vast transformations which to some extent is facilitated by a number of institutional and regulatory initiatives including the liberalization of the communication sector to encourage competition, the countries telecommunication and communication infrastructure is still far from being developed. (Prof. Dedunu, GIMPA) Most or the rural areas are still ‘virgin’ as far as mobile communication penetration is concerned. Ghana still have a low teledensity of 2 telephone line per 100 and low teleaccessibility (a measure of household access to telecommunication service)

Ghana which is also a member of the Heavily Indebted Poor Countries (HIPC) initiative of the World Bank and the IMF is always seeking for ways to alleviate poverty and diseases, which are the major, societal problems facing the country. In the country’s Five year Poverty Reduction Strategy Paper (PRSP) submitted to the World Bank in year 2004, the Government highlighted on the improvement of Information and Communication Technology (ICT) infrastructure in the country to enhance economic growth. It is however ironical how both the government of Ghana and the private sector or the business community have failed to take advantage of the ever-increasing use of mobile phones as well as the huge potential in the M-Commerce industry to transform the economy and their businesses respectively.

This master thesis is therefore an attempt to break into the developing economies and to reveal how farmers, fishermen and small scale entrepreneurs in the rural and deprived communities, as well as public institution are benefiting from M-commerce. The study would also seek to establish how M-commerce can contribute to the fight against poverty and diseases in developing countries.
1.3.2 Poverty and economic activities by small businesses

Ghana’s per capita output at the end of 2000 stood at $330 which is below the World Bank poverty threshold. With a huge budget deficit and debt burden hanging on its neck, the government of Ghana opted for the World Bank / IMF’s Heavily Indebted and Poor Countries’ (HIPC) initiative in 2001. The country currently has a framework, Ghana’s Poverty Reduction Strategy (GPRS) which represent a policy framework to support growth and poverty reduction over a period of time (3 years) (National Commission on Planning & Development NCPD, 2003). It has its role as ensuring: sustainable and equitable growth, an accelerated poverty reduction and the protection of the vulnerable and excluded within decentralized democratic environment. The broad objective of the GPRS is to ensure economic stability for accelerated growth, increase production and gainful employment, facilitate equitable human development and provision for the vulnerable and the excluded, ensure good governance and partner with the private sector as the main engine of growth (NCPD, 2003).

According to ISSER 2000, poverty rate is however higher in the rural areas of the country where the basic economic activity is fishing and peasant farming. These people form about 55% of the Ghanaian population. The pattern is no different from other developing countries where poverty rate ranges between 50 and 85 percent. In order to address the canker of poverty, developing countries in partnership with the World Bank/ IMF has pursued several schemes such ERP, PAMSCAD, SAP and HIPC. Though some progress has been made over the years the expected results from these programs are far from reached. Most of these countries continue to explore new channels for wealth creation particularly in the poverty zones and other sectors of their economies as a whole.

1.4 PURPOSE AND RESEARCH QUESTION

The purpose of this master thesis is to access the impact that the evolution of M-commerce and the explosive use of mobile communication devices is making on wealth creation and economic growth in developing countries. To be able however to achieve the objective of this study, we would need to explore further the extent to which developing countries have embraced M-commerce by exploring the adoption and diffusion of mobile commerce and wireless communication, inquire into barriers affecting the spread of M-commerce and also document new empirical findings in the area of M-commerce and wireless communication diffusion as well as the future benefits and prospects of M-commerce in these countries.

Defining the research problem is perhaps the most important responsibility of the researcher. (Dillon et all, 1993: 23). From the above discussion therefore, our major research question which would be examined in this thesis would be as stated below:

How has M-commerce and wireless communication influenced wealth creation and economic growth in Developing Countries?
There are enough evidence and statistical data to suggest that mobile networks are reaching quickly into locations where operators of fixed lines are struggling to reach in developing countries. Even though each country may have peculiar factors and forces that drive M-commerce, the success of a viable M-commerce model will very much depend on a number of factors shaped by economy, politics, technology and culture.

In a broader perspective, the forces underpinning the emergence of M-commerce can be put into four categories (Sadeh, 2002). These include:

- Proliferation of mobile gadgets and devices
- Convergence of mobile telecommunication networks and the internet
- Transition to 3rd generation telecommunication technologies and higher data rates they support.
- The emergence of broad set of highly personalized location-sensitive and context aware applications and services.

1.5 OBJECTIVES OF THE STUDY

This study is to contribute to our knowledge on how developing countries are taking advantage over the proliferation of mobile phones and personal data assistance (PDA) in commercial transactions. In particular, our interest would be on how this emerging business model is being used to enhance the business activities of people in deprived areas and small scale entrepreneurs. The study would seek to analyze and evaluate the level and rate of m-commerce adoption and diffusion in Ghana. An M-commerce model would also be suggested based on the study and literature available. Generally, the following objectives would be sought to achieve.

- To assess issues regarding M-commerce diffusion and Trends shaping the M-commerce industry in Ghana.
- To investigate the M-commerce adoption and practices and its socio-economic impact on farmers, fishermen and other small scale businesses in Ghana.
- To investigate the barriers and other challenges affecting the penetration of M-commerce in Ghana.
- To investigate the challenges facing stakeholders (Mobile network providers, service operators, Government and Users) of M-commerce in Ghana.
- To provide a baseline study for further exploratory studies on the impact of M-business on the Ghanaian economy.
1.6 DELIMITATION

Mobile Commerce encompasses technologies, applications and services which involve several stakeholders. According to Norman Sadeh (M-Commerce – Technologies, Services and Business Models, 2002) M-Commerce is generally characterized by a variety of business partnerships often involving a large number of organizations, from content providers to WASPs to mobile network operators. M-commerce applications and services involves a number of players who fall into either Infrastructure equipment vendors, Software vendors, Content providers (including advertisers), Content aggregators, Mobile network operators (including virtual ones), Mobile portals, Third party billing providers, Mobile device manufacturers, Wireless Application Service Providers(WASPs) or Location Information brokers.

This master thesis would attempt to focus on the players at the tail (consumers) of the value chain, the mobile network operators and service providers. We will not delve into the technology aspect as well as manufacturing, software and equipment vendors. We will try to interview primary stakeholders (Farmers, Fishermen and small business entrepreneurs) and a cross section of mobile devices users. Mobile Network operators and service providers as well as policy makers (government and agencies) would complete the list of our interviewees.
1.7 DISPOSITION OF THE THESIS

Our thesis consists of seven chapters as illustrated in figure 1 below. The numbered circles show the chapters in the thesis while the lines indicate the direction in which the information goes.

Fig.1 Disposition and action plan of thesis
Chapter 1: Introduction – In our opening chapter, we provide the background to our thesis and also introduce the subject. The chapter also highlight on the problem area, research question and the purpose and objectives of the thesis. The chapter ends on the delimitations and disposition of our thesis.

Chapter 2: Theoretical framework – We present relevant theoretical findings in this chapter. We begin with theoretical underpinnings commerce and economic growth, evolution of commerce and the transition from traditional commerce to m-commerce. We continue to look at business models, enumerate the definition and scope of m-commerce, applications and services of m-commerce and conclude the chapter on mobile security and payments.

Chapter 3: Methodology - In this chapter, we explain how we conducted our study and how this thesis was made.

Chapter 4: Empirical Study – The results of our empirical study would be presented here. The M-commerce and mobile communication landscape in Ghana and our respondents’ opinions and views about the M-commerce industry would be presented.

Chapter 5: Discussion and Analysis - In the discussion and analysis, we discuss the theoretical and empirical findings and compare them with each other.

Chapter 6: Future of M-commerce in Ghana – Here we present an overview of the M-commerce potentials in Ghana. This is based on part of the empirical data collected.

Chapter 7: Conclusions – Here we present the answer to our main question and the findings from this thesis.

Fig.2 Map of Ghana (Political Regions)
2. THEORETICAL FRAMEWORK

This chapter presents relevant theoretical findings in this thesis. We look at the theoretical underpinnings of the study, evolution of Commerce and its transition to M-commerce, Definition and Scope of M-Commerce and follow up with Business Models, Issues regarding M-Commerce adoption and diffusion. The latter part of the chapter looks at mobile payment and security.

The deployment of mobile technology in the design of business models for the delivery of economic outputs involves a rather complex systems and structures. The delivery of successful M-commerce model is, in part, a technical issue. It is, however, inherently a sociotechnical issue whiles wealth creation or economic growth has its roots firmly planted in economics and business disciplines. There are therefore two fundamental theoretical underpinnings or approaches that one must consider in such studies. These are sociotechnical systems and socioeconomic systems approaches.

2.1 A Sociotechnical Systems Approach

‘A Sociotechnical system would be said to be successful when it generates the projected socio-economic changes, i.e. the sought after human life improvement and the politico-economic payoffs for the stakeholders and firms that sponsor and implement the system’ (Churchman C.W 1960; Jackson 1997).

Sociotechnical systems (STS) theory originated in the 1950s (Emery and Trist 1960; Klein L 1994) and has developed as a rich and useful body of the theory and practice used in many countries since that time. The central tenet of the approach is that the technical system and the social system have to be co-optimised for the whole system to be successful. One of the key tenets of STS theory is the principle of joint optimization (Van De Ven and Joyce, 1981; Pasmore, Francis, Haldeman and Shani, 1982). According to Dahlbom (1995, 88) people and technology cannot even be understood without each other. Therefore, IS designers are obliged to understand human behavior and characteristics. This is important because people adapt to their environments over time (Isomäki 2002, 20). Nowadays that information technology is used by people exchanging services more than as control mechanisms in production systems, computer engineers will also have to become experts in human technology use (Dahlbom, 1996, 30).

2.1.1 Some Characteristics of Sociotechnical Systems

Ian Sommerville, 2003 also underscored that there are essentially three characteristics that an STS must fulfilled:

- They have emergent properties that are properties of the system as a whole rather than associated with individual parts of the system. Emergent properties depend on both the system components and the relationships between them. As this is so complex, the emergent properties can only be evaluated once the system has been assembled.

- They are often non-deterministic. This means that it cannot be guaranteed that, when presented with a specific input, they will always produce the same output. The system’s behavior depends on the human operators and people do
not always react in the same way. Furthermore, use of the system may create new relationships between the system components and hence change its emergent behavior.

- The extent to which the system supports organisational objectives does not just depend on the system itself. It also depends on the stability of these objectives, the relationships and conflicts between organisational objectives and how people in the organisation interpret these objectives. New management may reinterpret the organisational objective that a system is designed to support and a ‘successful’ system may then become a ‘failure’.

2.1.2 M-commerce as a sociotechnical system

M-commerce system is a very complex one involving many other different subsystems. A look at a typical M-commerce value chain shows that none of the components or subsystems works in isolation. There is a strong relationship between sellers, buyers, logistic providers, mobile network operators as well as payment operators. Thus an M-commerce system would depend on the individual subsystems or components and the relationship between them. For instance, a break in the network operator-buyer relationship would definitely disturb the seller-buyer relationship. This demonstrates the emergent properties (a typical characteristic of STS) of M-commerce.

M-commerce is also non-deterministic in that the success of any M-commerce system would be influenced by so many other factors such as culture, level of education, government policies etc. Thus it cannot be guaranteed that a mere assemblage of the various subsystems or components in M-commerce would produce the desired or expected outputs in all environments. It is however established that the introduction of an M-commerce would change the relationships between business processes (Nanshi 2005) as well as the components and for that matter its emergent properties.

The extent to which M-commerce would impact on business activities in any organization will not depend solely on the technology or the model alone. M-commerce system involve both technology and human beings and the appreciation of the humans for the system as well as the relationships that exists between the organizational goals, objectives and the perception of people in the system would all influence how M-commerce could support the business objectives.

2.1.3 Principles behind adaptation and societal change for new technology

There are questions to be examined in the way society change and adapt to use the technology. There are also many questions about the respective roles of national and local agencies in formulating both technology policies and the administrative policies governing how the technologies will be used. Amongst the set of sociotechnical principles formulated by Cherns AB, 1987; Churkland P & Scholes 1999 are three that are particularly pertinent to the delivery of M-commerce services and applications:

- Minimum Critical Specification. This principle states that only the minimum should be specified by designers and policy makers in order that the human agents in the sociotechnical system have maximum freedom to tailor the
system to local demands. The establishment of national policies and practices for the delivery of M-commerce will need to adopt this principle if M-commerce technology, services and application providers are to have the discretion to tailor technology to the needs of the client or user.

- **Power and Authority.** This principle establishes the requirement that if people are given responsibility for work tasks they should have power and authority over the resources, information etc needed to complete those tasks. M-commerce will create a set of new tasks and who undertakes them and what resources they need are important design questions for the new social system.

- **Incompletion or the Forth Bridge Principle.** This principle recognizes that the system is never finished and that it is necessary to ensure that the people in the system have opportunities to continue its development. M-commerce is in its infancy and policies will be needed to learn from the experience of its delivery and seek progressive improvements. Building 'action research' into the delivery of M-commerce application models in order that from technology designers through services and applications providers continue to collect and evaluate evidence of its usefulness is a mechanism by which this principle can be met.

**2.2 Socio-economic systems**

Socioeconomic systems identify the social and economic impacts of any product or service offering, market intervention or other activity on an economy as a whole and on the companies, organisation and individuals who are its main economic actors. These effects can usually be measured in economic and statistical terms, such as growth in the size of the economy, the number of jobs created (or destroyed), or levels of home ownership or Internet penetration; and in measurable social terms such as life expectancy or levels of education (Amitai Etzioni., 1982).

Socioeconomics generally uses economic theories to understand impacts. The combination of economic and social factors that influence how an intervention is likely to change a society will be unique to each situation, but generally may include, for example: Prevailing economic conditions, race or ethnicity, The level of economic development and the extent of disparities within a society, Political stability and the relationship between government and judiciary, Levels of education, literacy and familiarity with technology, Maturity and openness of markets, Propensity for entrepreneurial activity, Strength of tradition in terms of beliefs and behaviours.

Causes of socioeconomic impacts include new technologies such as cars or mobile phones, changes in laws, changes in the physical environment (such as increasing crowding within cities), and ecological changes (such as prolonged drought or declining fish stocks). These may affect patterns of consumption, the distribution of incomes and wealth, the way in which people behave (both in terms of purchase decisions and the way in which they choose to spend their time), and the overall quality of life. These can further have indirect effects on social attitudes and norms.

The goal of socioeconomic system is generally to bring about socioeconomic development, usually in terms of improvements in metrics such as GDP, life
expectancy, literacy, levels of employment, etc.. Although harder to measure, changes in less tangible soft factors should also be considered. These include issues such as personal dignity, freedom of association, personal safety and freedom from fear of physical harm, and the extent of participation in civil society.

### 2.2.1 Wealth Creation

According to Adam Smith the *Wealth of a Nation* was not in the accumulation of commodities or in the resource reserves that a nation may happen to possess. But rather wealth exists in the productive knowledge of its people. The ability to efficiently transform resources (factor inputs) into desired goods and services represents the true source of a nation's wealth.

Physical and human capital represents the true embodiment of wealth. This wealth is used to generate factor income as a payment for the production of desired goods and services and income to be used to purchase these same goods and services. Thus wealth may be measured in terms of the future stream of income discounted at some generated by the use of physical and human capital.

The numeric value of wealth is really less important than what it represents. The members of a given society are interested in living standards such that growth in output will at a minimum, equal or exceed the rate of population growth. Thus they are interested in a stock of human and physical capital sufficient to produce desired growth in income.

The creation of wealth is based on knowledge -- the ability to take raw inputs and convert them into output with value greater than the sum of the individual parts. This knowledge is captured in the way other factors such as technology and other models are used to transformed the business processes for optimum performance. Additionally, this value is determined by correctly assessing the demand for the output -- how it will satisfy needs and wants.

### 2.2.2 Economic Growth

Economic growth is the increase in the value of goods and services produced by an economy. It is generally considered to be an increase in the wealth, or more precisely the income, of a nation or entity. It is conventionally measured as the percent rate of increase in real gross domestic product, or GDP. (The Economist, October 2005). Growth is usually calculated in real terms, i.e. inflation-adjusted terms, in order to net out the effect of inflation on the price of the goods and services produced. In economics, "economic growth" or "economic growth theory" typically refers to growth of potential output, i.e., production at "full employment," rather than growth of aggregate demand.

At the lower level however, different parameters such as increase in a company or business net income, social developments in terms of infrastructure, the purchasing power of the citizens, accessibility of basic needs such health, education, shelter etc can be used to measure the economic growth of a society.
Economic growth is thus the sum of the rate of growth in technology in addition to a weighted average of the rate of population growth and the rate in which capital accumulates. An interesting implication of this is that, holding other factors constant, a population growth rate of 1% leads to a less than one percent growth rate in output—a decline in the Standard of Living. In order to maintain or improve these Living Standards, there must be an accumulation of capital and/or technological progress.

2.3 Evolution of Commerce

2.3.1 Traditional Commerce

Commerce is the trading of something of value between two entities. That "something" may be goods, services, information, money, or anything else the two entities consider to have value. Commerce is the central mechanism from which capitalism is derived. The process of transforming something into a commercial activity is called commercialization.

Traditional Commerce has its origins from the very start of communication in prehistoric times. Trading was the main facility of prehistoric people, who bartered what they had for goods and services from each other. According to Peter Watson 1921, the history of long-distance commerce is dated from circa 150,000 years ago. Later, currency was introduced as standardized money to facilitate a wider exchange of goods and services. Over the years, the faces of commerce has revolutionalized tremendously with the advent of new technological infrastructure, particularly the Internet. The traditional commerce has to some extent metamorphosised into E-commerce with the birth of the Internet, out of which has emerged the M-commerce.

Not every commerce transaction is identical, and not every transaction is the same type of transaction. In many instances one could find roughly five types of commerce transaction offline. These include retail store, retail special order, catalogue store, phone order from catalogue and bargaining. Retail store is by far the most common commerce experience world over, where you walk into a store that is stocked with merchandise for immediate sale -- bookstores, grocery stores, hardware stores -- and find what you want, then purchase it. You leave the store with the product, assuming immediate ownership.

2.3.2 E-Commerce

The birth of the internet brought in its wake another dimension of e-(electronic) commerce, which in itself does not constitute a new phenomenon. Electronic commerce, e-commerce or ecommerce consists primarily of the distributing, buying, selling, marketing, and servicing of products or services over electronic systems such as the Internet and other computer networks.

The information technology industry might see it as an electronic business application aimed at commercial transactions (Chaudhury, Abijit & Jean-Pierre Kuilboer [2002]). It can involve electronic funds transfer, supply chain management, e-marketing, online marketing, online transaction processing, electronic data interchange, automated inventory management systems, and automated data-collection systems. It
typically uses electronic communications technology such as the Internet, extranets, e-mail, Ebooks, databases, and mobile phones. In practice, this term and a newer term, e-business, are often used interchangeably. For online retail selling, the term e-tailing is sometimes used. Different types of e-commerce have emerged. According to Epraim Turban 2004, Business-to-Business (B2B), Business-to-Consumer (B2C), Business-to-Government (B2G), Government-to-Consumer (G2C), etc. are but a few of the various types of e-commerce that have been in practice for sometime now.

![Flow of tangibles between Business and Consumer](Image)

**Fig. 2.1 Typical B2C enabled by internet**

Though any e-commerce solution is unique, it is generally possible to categorize them as either business-to-consumer (B2C) or a Business-to-business (B2B). B2B commerce is a model where transactions are between one company business and another company/business. A B2C e-commerce is a model where transactions are between a company and consumers. B2C applies to any business or organization selling products/services to consumers over the Internet or using m-commerce for their own use. It should be understood that these two categories are only a user’s view of e-commerce sites. From a ‘solution-oriented’ perspective, a business-to-consumer site is just the end point of business-to-business –to-consumer supply chain.

The meaning of the term "electronic commerce" has changed over time. Originally, "electronic commerce" meant the facilitation of commercial transactions electronically, usually using technology like Electronic Data Interchange (EDI, introduced in the late 1970s) to send commercial documents like purchase orders or invoices electronically (Seybold, Pat 2001). Later it came to include activities more precisely termed "Web commerce", the purchase of goods and services over the World Wide Web via secure servers with e-shopping carts and with electronic pay services, like credit card payment authorizations.

E-business and e-commerce are terms that are sometimes used interchangeably, and sometimes they're used to differentiate one vendor's product from another. But the terms are different, and that difference matters to today’s companies. In both cases, the e stands for "electronic networks" and describes the application of electronic network technology - including Internet and electronic data interchange (EDI) - to improve and change business processes. E-commerce covers outward-facing processes that touch customers, suppliers and external partners, including sales, marketing, order taking, delivery, customer service, purchasing of raw materials and supplies for production.
and procurement of indirect operating-expense items, such as office supplies (Ephraim Turban, 2004). It involves new business models and the potential to gain new revenue or lose some existing revenue to new competitors. E-business strategy is more complex, more focused on internal processes, and aimed at cost savings and improvements in efficiency, productivity and cost savings.

2.3.3 M-commerce

M-commerce (mobile commerce) is the buying and selling of goods and services through wireless handheld devices such as cellular telephone and personal digital assistants.

The technology enables the business processes to be simplified improving productivity, reducing costs dramatically and providing quicker, more accurate service to the customer with higher satisfaction levels. The emerging wireless and mobile networks have extended electronic commerce to another research and application subject: mobile commerce. A mobile commerce system involves a range of disciplines and technologies. Fig. 1 illustrates the revolution that commerce has gone through due to the emergence of new technologies in recent years. Today's commerce involves a complex system of companies that try to maximise their profits by offering products and services to the market, which consists both of individuals and other companies, at the lowest production cost. Globalization marks the rhythm of business.

![Diagram of Traditional Commerce, E-Commerce, M-Commerce]

Fig. 2.2 Transition from Traditional Commerce to M-commerce

2.4 Business Models

The ways and manner commercial activities are performed differ in several capacities depending on the type of commodity or product, as well as the goals and vision of the partners involved in the trade. These led to the introduction of business models.
A business model is the method of doing business by which a company (or trader) can generate income to sustain itself/herself (Michael Rapper 2002, Ephraim Turban, 2004). It involves both strategy and implementation. It is the totality of:

- How it will select its customers
- How it defines and differentiates its product offerings
- How it creates utility for its customers
- How it acquires and keeps customers
- How it goes to the market (promotion strategy and distribution strategy)
- How it defines the tasks to be performed
- How it configures its resources
- How it captures profit

The structure of business models varies because the methods used by businesses to generate revenue to sustain itself vary widely. Over the years, the face of commerce has changed and keeps on doing so with the emergence of new technologies, changes in social matrices, politics and cultural systems. The advent of e-business has transformed traditional business by 24 hours a day, seven days a week”, Global business while eliminating the middle man who acts like a broker and a distributor.

A business model, or commerce model, is the basic process flow indicating how a business operates. It indicates how business functions are linked together. Internet based business models requires fewer hard assets (bricks and mortar assets). Brick and mortar businesses have tangible physical assets such a factory, office building, warehouses, etc. New information technologies are allowing businesses to redesign business models and change business practice. According to Henry Chesbrough and R. S. Rosenbloom 2004, Business models convert new technology to economic value (fig.2.3). They stated that: The business model focus is on value creation and also addresses how that value will be captured by the firm.

The business model is architecture for converting innovation to economic value for the business. However, the business model does not focus on delivering that business value to the shareholder. For example, financing methods are not considered by the business model but nonetheless impact shareholder value. The business model assumes a limited environmental knowledge and could be said to be indispensable for every organization that seeks to survive or make progress in the world of keen competitions. The role of business can be summed up with the figure below.

Fig.2.3 Role of Business Model
From fig 2.3, it is we can say that the business model is the fulcrum of any business establishment. The kinds of the economic outputs or returns on investments that the organization would rip to a very large extent depend on the type and effectiveness of the business model deployed. Business model play a very vital role and it is seen as the pivot of any growing or future organization. The success or otherwise of any business organization had been found to have direct relationship with its business models and strategies. It is therefore imperative for ‘organizations of tomorrow’ who want to remain in business to adopt the appropriate business models and strategies.

In finding a way to measure the level of economic growth in this study therefore, we would use the business model as the fundamental parameter with reference to fig 2.3. Thus the sequence of events leading to Wealth Creation or Economic Growth (EG) would be defined by fig 2.4 below

![Relationship between wealth creation and business models](image)

**Fig. 2.4 relationship between wealth creation and business models**

### 2.4.1 Types of Business Models

Many business models have emerged in different business environments. The oldest and most basic business model is the shop keeper model. (Russell L. Ackoff, 1974) This involves setting up a store in a location where potential customers are likely to be and displaying a product or service. Generally, the business models of service firms are more complex than those of manufacturers and resellers. Over the years, business models have become much more sophisticated. The *bait and hook* business model (also referred to as the "razor and blades business model" or the "tied products business model") was introduced in the early 20th century. This involves offering a basic product at a very low cost, often at a loss (the "bait"), then charging excessive amounts for refills or associated products or services (the "hook").

Notable models such as the *subscription business model*, the *razor and blades, business model (bait and hook)*, the *pyramid scheme business model*, the *multi-level marketing business mode*, the *network effects business model*, The *monopolistic business model*, the *cutting out the middleman model*, the *auction business model*, the *online auction business model*, the *bricks and clicks business model*, the *Loyalty business models*, the *Collective business models*, the *industrialization of services business model*, the *servitization of products business model*, the *low-cost carrier business model* and the *online content business model* have been tested in different businesses with mixed results.

### 2.4.2 MTech Business Model

Business models are classified as Direct or Indirect based on the functions associated with the model. Traditional or modern (electronic) businesses are all fashioned along some business models. Over the years different types of business models have emerged and different companies or business enterprises within the same sector have employed diverse models in their businesses.
The model is a hybrid of already established and long used models of the collective business model and the cutting out the middleman model, with the incorporation of mobile technology. The case of the MTech model is rather complex. Here apart from the mobile technology being used, there are a lot players involved such as banks, mobile network operators and others. A simplified model is as illustrated in fig 2.5 which describes the relationship between the core partners in the model.

In the ‘MTech’ model, the main players include the farmers/fishermen, buyers, mobile service providers and the payment operators, which in this case is carried out by banks. Banks in the model (fig 2.5) represent one or more banking institutions i.e. the seller’s bank, buyers’ bank and in some cases the mobile operator’s bank or business partner. The ‘MTech’ business model has created a new relationship between the sellers, buyers and the other partners such as the mobile services providers and the banks as shown. This model fundamentally seeks to improve

A collective business system or collective business model is a business organization or association typically comprised of relatively large numbers of businesses, tradespersons or professionals in the same or related fields of endeavor, which pools resources, shares information or provides other benefits for their members. In the past, collective business systems such as the trade association, the cooperative and the franchise were created to allow groups of independently owned businesses with common interests to successfully compete in the marketplace (Ephraim Turban, 2004).

Cutting out the middleman is a business model that involves reducing costs by removing layers from a distribution network. (Fenn J., A. Linden 2001) Cutting out the middleman may become possible as a result of better technology or economies of scale. This is sometimes referred to as 'disintermediation'. It reduces transaction costs, processing time and brings the producer or manufacturer of the product/service that much 'closer' to the customer, arguably making them more responsive to the customers' needs both by delivering the products/services faster and more accurately to meet the customers' tastes and preferences.
2.4.3 Impact of IT on Commerce

The impact of IT (M-commerce and Internet in specific) on business can also be understood from the 3C framework (Figure 2.6) or theory developed by Ravi Kalakota and Andrew Winsten (2002) and Duck 1976, 1998. This framework depicts three competencies namely; Cost, Communication and Convenience having direct impact on business performance which Internet and more recently mobile technology have revolutionized. The new web plus IT paradigm merges the standards, simplicity and connectivity of the mobile communication with the core processes that are the foundation of business. The new ‘driving’ applications are interactive, transaction-intensive, and let people do business in more meaningful ways.

Fig 2.6 3C Framework

- **Cost**

The cost of doing a business is critical in every aspect of any organization. The cost factor is a major determinant in assessing the business performance which is also has a direct influence on the economic growth of an establishment. In adopting a new technology or business model, the cost factor would influence the overall decision to be taken. For an optimum output therefore cost must be reduced to the barest minimum. (The Economist, August 2004)

- **Communication**

According to the Europe-based IMP Group a dyadic relationship has to be seen in the context of a larger set of inter-firm relationships forming the business context of the focal dyad. The actions of the buyer and seller and the longitudinal development of their relationship are very important.

Relational issues cannot be separated from communicational occurrences. According to Duck (1976, 1998), relationships are a substantial part of structuring, evaluating and understanding messages in interpersonal settings. For example, business relationships (dyads) or sets of relationships (networks) are assumed to evolve as a result of interpersonal communication which occurs situationally in communicative and cognitive processes between interactants within various collective actor structures.

When it comes to long-term relationships, one can draw a parallel between the concepts “communication” and “social exchange episodes” which are intertwined with other types of exchange episodes (economic, legal, information), and also with ongoing adaptations and coordination processes. Interlinked exchange episodes of
various types, together with adaptations and coordination, form the interaction process between the parties.

Consequently, interpersonal communication is a substantial part of the interaction process and can therefore be regarded as a processual element of relationships and networks. In other words, relationships and networks are essentially formed by interpersonal communication processes which, in turn, are affected by their contextual and structural factors. On the other hand, communication processes may cause changes in the contextual and structural characteristics of the relationship or the network. Furthermore, a business relationship also involves processes of adaptation and coordination. Adaptation processes refer to the modification of resources or of the ways of operating in order to benefit more from the relationship. Coordination refers to the development and the use of mechanisms that facilitate the control of interorganizational exchange processes (Möller and Wilson, 1988, 1995)

- **Convenience**

Convenience is a key factor in evaluating the adoption of new models in business. It should therefore be the barest minimum and essential condition when devising technologies as well as models to improve business performances. For instance cashless and signature-free operations are effective for improving customer convenience in M-commerce payments. According to the mIT forum, user convenience will continue to be the greatest challenge to confront network operators, service and logistics provider as well as manufacturers in the M-commerce industry.

### 2.5 Main features of M-commerce

The lower costs of mobile systems relative to fixed networks, the provision of short message services (SMS) and the enabling of wireless internet connections make wireless communications the long sought after platform that can make digital data transfer possible in the deprived locations. M-commerce represents the extension of e-commerce to a mobile environment (UNCTAD – Report on E-commerce and Development, 2002). The main types of e-commerce i.e. B2B, B2C, B2G and P2P still remain. Some writers are however of the opinion that m-commerce is quite different from traditional e-commerce. (Norman Sadeh, 2003). Mobile phones and PDAs are seen to impose very different constraints than desktop computers do. Mobile phones and PDAs introduce new applications and services. They are easily carried around and therefore make it possible to access the Internet no matter where one is. Most m-commerce models are B2C where micro-purchases are involved. Larger transactions continue to enjoy massive employment of the usual e-commerce methods.

#### 2.5.1 Definition and Scope of M (Mobile) Commerce

M-commerce is seen as a new and emerging discipline as a result of the explosive and rapid growth of wireless communication. Consequently, several definitions have been coined for the term. Among the widely use of these definitions is stated in table 2.1 below:
Table 2.1 Definitions of M-commerce

<table>
<thead>
<tr>
<th>Definition</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>M-Commerce is “any transaction with a monetary value that is conducted through a mobile communication network”</td>
<td>(Durlacher, 2002)</td>
</tr>
<tr>
<td>M-Commerce is defined as “Business transactions conducted while on the move”</td>
<td>(Ravi Kalakota and Marcia Robinson, 2001)</td>
</tr>
<tr>
<td>M-Commerce (Mobile Commerce) refers to access to the internet via a mobile station or device, such as a cell phone or a PDA.</td>
<td>(Learnheart, 2004)</td>
</tr>
<tr>
<td>M-Commerce is the use of mobile handheld devices to communicate, inform, transact and entertain using text and data via connection to public and private networks.”</td>
<td>(Lehman Brothers, 2002)</td>
</tr>
<tr>
<td>The use of mobile handheld devices to communicate, interact via an always on, high-speed connection to the Internet.</td>
<td>(Forrester Research Institute, 2001)</td>
</tr>
<tr>
<td>The use of wireless technology to provide convenient, personalized and location-based service to your customers, employees and partners.</td>
<td>(Mobility)</td>
</tr>
<tr>
<td>The buying and selling of goods and services using wireless handheld devices such as mobile phones and Personal Data Assistants (PDAs)</td>
<td>(UNCTAD, 2002)</td>
</tr>
<tr>
<td>Mobile-commerce is “Using smart phones and handheld computers with wireless connections to place orders and transact business over the Web.”</td>
<td>(PC World, 2002)</td>
</tr>
<tr>
<td>M-commerce is “the buying and selling of goods, services and information without any location restrictions by mobile devices which uses a wireless connection to establish communication between all the necessary parties to complete the transaction”</td>
<td>(J. Jonker, M-Commerce and M-Payments – Combining technologies, 2003)</td>
</tr>
</tbody>
</table>

From the above definitions, M-Commerce is seen to encompass three basic components based on the mode of operation and the infrastructure and or the equipment deployed.

- It involves transactions of monetary value
- It involves mobile or wireless communication devices and services
- It involves wireless telecommunication operators

From the above definitions, the ones most closely aligned to our thinking are those provided by J. Junker and UNCTAD, 2002.

M-commerce is not the transaction itself. According to Vicente Bertrand et all, 2002 M-commerce extends beyond this core to provide services and information, which can trigger a future transaction. The scope of M-commerce therefore goes beyond the initial one time commercial transaction. The main areas of m-commerce use are in text messaging or SMS (short messaging service), micro-payments, financial services, logistics, information services and wireless customer relationship management.

As many savvy communications service providers (CSPs) are discovering, m-commerce comprises a host of products and services they can offer customers. CSPs are expanding their definition of m-commerce to include a range of mobile data
services, such as short message service (SMS), multimedia messaging service (MMS), applications developed using Sun Microsystems' J2ME platform technology, mobile video streaming, mobile games, and location-based service. (Forester Research Institute, 2003)

Mobile commerce encompasses more than just making a purchase using a portable device. As many savvy communications service providers (CSPs) are discovering, m-commerce comprises a host of products and services they can offer customers — and even resell to other carriers. An example could be Philippines-based wireless carrier Smart Communications. The company has developed a service called Smart Money Mobile Commerce Platform that links credit cards to account holders' mobile phones. Each time the card is used, a message is sent to the phone with the purchase details. Cardholders then confirm each transaction, helping their banks combat fraud more effectively. This is the first electronic credit card application of its kind (Vicente Bertrand et all, 2002) Text messaging has been by far the most successful m-commerce application in developing countries, where rates of low fixed-line connectivity and Internet access have made it an e-mail surrogate. Operators in China and other Asian developing countries are gearing up for m-commerce applications for financial services in particular

2.5.2 Characteristics of M-commerce

Unlike Electronic Commerce, Mobile Commerce has three unique characteristics:

**Convenience and Accessibility:** In an m-commerce world, people are not constrained by time and place.

**Localization:** With technologies like Global Positioning System (GPS) or Time of Arrival (TOA), m-commerce will enable users to access information and services specific to their location.

**Personalization:** Where the PC is often shared across multiple users, mobile devices are typically operated by and configured for a single user.

These three characteristics of M-commerce are intertwined and form the m-commerce space. This is as illustrated below. M-commerce transaction consequently involves a unique combination of Time, Location and Personalization of the Service. (Vicente Bertrand et all, 2001).

*Figure 2.7: m-commerce space*

![Diagram](source: Wedbush Morgan Securities)
2.5.3 Mobile Commerce Systems

With the introduction of the World Wide Web, electronic commerce has revolutionized traditional commerce and boosted sales and exchanges of merchandise and information. (Nansi Shi, 2004). In just a few years, mobile commerce has emerged from nowhere to become the hottest new trend in business transactions. It is estimated that 50 million wireless phone users in the United States will use their handheld devices to authorize payment for premium content and physical goods at some point during the year of 2006. This represents 17% of the projected total population and 26% of all wireless users ("The Yankee Group", 2001). Mobile commerce is an effective and convenient way to deliver electronic commerce to consumers from anywhere and at anytime. Understanding or constructing a mobile commerce system is an arduous task because the system involves a wide variety of disciplines and technologies. (mIT forum, 2002). It requires a tremendous effort to understand or construct a mobile commerce system because it involves such a wide range of disciplines and technologies (Nansi Shi, 2004). In order to lessen the difficulty however, efforts have been made by researchers to divide a mobile commerce system into six components: (i) Mobile commerce applications, (ii) Mobile stations or devices, (iii) Mobile middleware, (iv) Wireless networks, (v) Wired networks, and (vi) Host computers. (Varshney 2000, Vetter 2001, Kalakota 2000 and the Yankee Group", 2001)

2.5.4 Requirements of a Mobile Commerce System

It is first necessary to examine what kind of features a mobile commerce system is expected to have in order to conduct effective and efficient mobile commerce transactions and what kind of challenges may be faced in the process of developing new mobile commerce systems (Nansi Shi, 2004, Norman Sadeh 2003). The requirements for a mobile commerce system are:

1. It should allow end users to perform mobile commerce transactions easily, in a timely manner, and ubiquitously.
2. It should allow products to be personalized or customized upon request.
3. It should fully support a wide range of mobile commerce applications for content providers. (Tanenbaum, A. S. 2002)
4. Maximum interoperability is desirable because so many technologies are now available and new techniques are constantly being invented for the use of mobile commerce systems. (Borisov, N., Goldberg, I., & Wagner, D. 2001)
5. Program data independence is held, that is, changing the system components will not affect the existing programs/data.
6. End-to-end security is rigorously enforced.

2.5.5 Relationships in the M-commerce value chain

There is a range of different relationships established in different M-commerce transactions. These relationships become more complex when a third-party credit provider becomes involved and additional service providers, who have emerged to specifically provide application services. Fig 2.7 illustrates a relationship that exists
between the user and the mobile service provider, who provides content and bills the customer for the service.

![Customer-Operator relationship](image)

**Fig. 2.8 Customer-Operator relationship**

In fig. 2.9 the buyer has a relationship with the mobile services provider, who charges a fee for the buyer using it for purchases and adding the cost of the products to the mobile phone bill. The mobile service provider charges the buyer a surcharge for using the service. The buyer also has a relationship with the seller.

![Seller-Buyer-Operator relationship](image)

**Fig. 2.9 Seller-Buyer-Operator relationship**

### 2.6 M-Commerce Services and Applications

The applications of electronic commerce are already widespread; mobile commerce applications not only cover these but also include new ones. For example, some tasks that are not feasible for electronic commerce, such as mobile inventory tracking and dispatching, are possible for mobile commerce. Table 2.2 lists and summarizes some of the major mobile commerce applications.

<table>
<thead>
<tr>
<th>Mobile Category</th>
<th>Major Applications</th>
<th>Clients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commerce</td>
<td>Mobile transactions and payments</td>
<td>Businesses</td>
</tr>
<tr>
<td>Education</td>
<td>Mobile classrooms and labs</td>
<td>Schools and training centers</td>
</tr>
<tr>
<td>Enterprise resource planning</td>
<td>Resource management</td>
<td>All</td>
</tr>
<tr>
<td>Entertainment</td>
<td>Games/images/music/video downloads and online gaming</td>
<td>Entertainment industry</td>
</tr>
<tr>
<td>Health care</td>
<td>Accessing and updating patient records</td>
<td>Hospitals and nursing homes</td>
</tr>
<tr>
<td>Logistics</td>
<td>Product tracking and dispatching</td>
<td>Delivery services and transportation</td>
</tr>
<tr>
<td>Traffic</td>
<td>Global positioning, directions, and traffic</td>
<td>Transportation and auto</td>
</tr>
<tr>
<td>Mobile Category</td>
<td>Major Applications</td>
<td>Clients</td>
</tr>
<tr>
<td>----------------------</td>
<td>-----------------------------------------</td>
<td>--------------------------------</td>
</tr>
<tr>
<td>Travel and ticketing</td>
<td>Travel management</td>
<td>Travel industry and ticket sales</td>
</tr>
<tr>
<td>SMS</td>
<td>Txt Messaging</td>
<td>All</td>
</tr>
<tr>
<td>Financial Services</td>
<td>Transaction management systems</td>
<td>Banks, Financial Institutions</td>
</tr>
<tr>
<td>Information Services</td>
<td>Accessing and delivering information</td>
<td>IS industry, General public</td>
</tr>
</tbody>
</table>

Source: (Sadeh 2003, Nansi Shi 2005)

2.7 Issues regarding M-commerce Adoption and Diffusion

According to Mobile IT Forum, 2002, the major issues with regards to the task for diffusion are pertinent to all the major players in the m-commerce industry. With the issues adoption and diffusion, all the key players such as Content Providers, Service Providers, Mobile Network Operators, Payment Operators, Logistics Providers and Manufacturers would all have consider four major factors. (See Appendix B4, B6 & B7)

- User Convinience and Usability
- Security
- Profitability and
- Marketability or Business Potential

Convenience is the barest minimum and essential condition when spreading m-commerce and difficulty in using directly hinders diffusion. Cashless and signature-free operations are effective for improving customer convenience. Adequate measures for when a customer encounters theft or loss of her mobile device are essential. To prevent unauthorized transactions using a stolen or less handset or PDA, it is desired to establish a mechanism or structure in which content providers, as well as carriers can surely grasp the information on theft and loss when needed. As one of the issues plaguing the Internet over the past few years, until security issues are resolved, m-commerce may fall short (Kellogg Tech Venture 2001 Anthology). “Security should be strong enough to make the effort to fraud more expensive than the potential profit and the cost of securing should be lower than the potential loss” (J. Jonker, 2003).

Service providers, Network Operators, Payment operators as well as all other major players in the m-commerce value chain have employed one method or other to enhance their business profits, which is the bedrock of any business establishments.

In the advanced countries, one method that payment operators have adopted is the “point system”. Point system for in-house membership organization have been introduced at many firms in Sweden, Norway, Germany, Finland, Japan and a host of developed nations. This system is identified as an effective means of attracting users.
According to the mITF (2002), one of the significant issues service providers may have to grapple with is expensive packet communication fees. In Japan for instance, it cost about 20-40 Japanese yen (between $0.18 and $0.36) to go to a specific site on the internet, go through the links and browse a specific page. (Ravi Kalakota, M-Business - The Race to Mobility, 2003). There is however the possibility that many users are ignorant about the packet communication charges that generate from such. Should customers grasp the actual picture of packet communication fees and become cautious about the use of packet communication, this could slow the diffusion of m-commerce. In the situations where telecommunication carriers provide fixed packet charges, such risk could be averted and the use of packet communication will be activated.

2.8 M-COMMERCE TECHNOLOGY

2.8.1 Mobile Stations

A mobile station or a mobile handheld device, such as a PDA (personal digital assistant) or Web-enabled cellular phone, may embrace many of the features of computers, telephone/fax, e-mails, PIM (personal information managers) such as calendars and address books, and networking features. A mobile station differs from a PC or notebook due to its limited network bandwidth, limited screen/body size, and mobility features. The limited network bandwidth prevents the display of most multimedia on a microbrowser, while the limited screen/body size restricts the mobile stations of today to either a stylus or keyboard version.

2.8.2 Mobile Middleware

The term middleware refers to the software layer between the operating system and the distributed applications that interact via the networks. The primary mission of a middleware layer is to hide the underlying networked environment's complexity by insulating applications from explicit protocol handling disjoint memories, data replication, network faults, and parallelism (Geihs, 2001). Mobile middleware translates requests from mobile stations to a host computer and adapts content from the host to the mobile station.

WAP and i-mode

According to an article at Eurotechnology.com (Eurotechnology, n.d.), 60% of the world's wireless Internet users use i-mode, 39% use WAP, and 1% use Palm middleware. Table 2.3 compares i-mode and WAP along with details of each.

<table>
<thead>
<tr>
<th>Developer</th>
<th>WAP</th>
<th>i-mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function</td>
<td>A protocol</td>
<td>A complete mobile Internet service</td>
</tr>
<tr>
<td>Host Language</td>
<td>WML (Wireless Markup Language)</td>
<td>CHTML (Compact HTML)</td>
</tr>
<tr>
<td>Major Technology</td>
<td>WAP Gateway</td>
<td>TCP/IP modifications</td>
</tr>
<tr>
<td>Key Features</td>
<td>Widely adopted and flexible</td>
<td>Highest number of users and easy to use</td>
</tr>
</tbody>
</table>

Table 2.3 Comparisons of two major kinds of mobile middleware
2.8.2.1 WAP (Wireless Application Protocol)

WAP is an open global specification that allows users with mobile stations to easily access and interact with information and services instantly. The most important technology applied by WAP is probably the WAP Gateway, which translates requests from the WAP protocol stack to the WWW stack, so they can be submitted to Web servers. WAP also supports WMLScript, which is similar to JavaScript but makes minimal demands on memory and CPU power because it does not contain many of the unnecessary functions found in other scripting languages.

2.8.2.2 i-mode

I-mode is the full-color, always-on, and packet-switched Internet service for cellular phones offered by NTT DoCoMo. Introduced in February 1999, it has attracted over 36 million subscribers worldwide. With i-mode, cellular phone users can easily access more than 62,000 Internet sites, as well as specialized services such as e-mail, online shopping and banking, ticket reservations, and personalized ringing melodies that can be downloaded for their phones. The i-mode network structure not only provides access to i-mode and i-mode-compatible contents through the Internet but also provides access through a dedicated leased-line circuit for added security. It is the only network in the world that now allows subscribers continuous access to the Internet via cellular phones. Users are charged based on the volume of data transmitted rather than the amount of time spent connected.

2.8.3 Wireless Networks

Network infrastructure provides essential voice and data communication capability for consumers and vendors in cyberspace. Evolving from electronic commerce (EC) to mobile commerce (MC), it is necessary for a wired network infrastructure, such as the Internet, to be augmented by wireless networks that support mobility for end users. Wireless networking technologies are advancing at a tremendous pace, and each represents a solution for a certain phase, such as 1G, 2G, and 3G, in a particular geographical area, such as the United States, Europe, or Japan. Networks are often categorized from the perspective of radio coverage: wireless local area networks, wireless metropolitan area networks, and wireless wide area networks.

2.9 Mobile Security and Payment

Mobile security and payment are crucial issues for mobile commerce. Without secure commercial information exchange and safe electronic financial transactions over mobile networks, neither service providers nor potential customers will trust mobile commerce systems. From a technical point of view, mobile commerce over wireless networks is inherently insecure compared to electronic commerce over wired networks. The reasons are as follows:

- Reliability and integrity: Interference and fading make the wireless channel error prone. Frequent handoffs and disconnections degrade the security services.
Confidentiality/Privacy: The broadcast nature of the radio channel makes it easier to tap. Thus, communication can be intercepted and interpreted without difficulty if no security mechanisms such as cryptographic encryption are employed.

Identification and authentication: The mobility of wireless devices introduces an additional difficulty in identifying and authenticating mobile terminals.

Capability: Wireless devices usually have limited computation capability, memory size, communication bandwidth, and battery power. This will make it difficult to utilize high-level security schemes such as 256-bit encryption.

2.9.1 Mobile Security

Security has become one of the most urgent issues for many commercial transactions and businesses. It is an essential requirement for doing business in a globally networked economy and for achieving desired goals and mission. The technical and environmental complexity of today’s business and the ever-increasing dependence on technology to drive and automate processes and create competitive advantages make security a challenging activity. Adding to this complexity is a growing list of vulnerabilities and increasingly sophisticated threats to which organizations are subjected on a daily basis.

Security lives in an organizational and operational context, and thus cannot be managed effectively as a stand-alone discipline. Because security is a business problem, the business partners and all stakeholders must activate, coordinate, deploy, and direct many of its existing core competencies to work together to provide effective solutions. The encryption method or security should be strong enough to make the effort to fraud more expensive than the potential profit and the cost of securing should be lower than the potential loss. If system security is breached, the seller loses credibility. For a bank the indirect cost would be infinite high, this depends on the service provided.

The algorithm used by a company on the chosen method depends on the business it is in and the product it secures. Moreover, counter measures against spooling are essential and technologies such as Public Key Infrastructure (PKI), Wireless Identity Module (WIM), Wireless Application Protocol (WAP) and Wireless Network Encryption (WNE), sender’s number terminal ID, SSL, and figure-print authentication have already appeared as structure for personal authentication. It is however possible that complicated operations shall be necessary on the handset side or cannot be used immediately due to maintaining security on the handset side and this in simultaneous pursuit with convenience is an urgent issue.

2.9.2 Mobile Payment

M-payment is defined as payments through the mobile phone (Krueger, 2001). M-payment is a point-of-sale (POS) payment made through a mobile device, such as a cellular telephone, a smart phone or a personal digital assistant (PDA).

Developed by Visa International and MasterCard International, the Secure Electronic Transaction protocol (SET) is likely to become the global standard in the domain of electronic commerce over the Internet. It is a technical standard designed to provide
security for payment transactions among cardholders, merchants, payment gateways, and certification authorities in wired networks. The SET mechanism is complex and thus is mostly used in desktop computers and servers. In a mobile commerce system, a WAP client device normally does not have sufficient processing and memory capability to utilize SET software. A "thin" SET wallet approach (Jin, Ren, Feng, & Hua et al., 2002) has thus been proposed to adapt the SET protocol for WAP clients. Fig 2.10 illustrates the many phases involved in an m-payment transaction, despite the environment. Transaction dynamics are identified to be similar in mobile environment although the form factor that contains the transaction credentials is different.

Wireless cellular system operators have an advantage as they become primary mobile payment system providers because their existing service infrastructures already contain mature subscriber authentication and billing sub-systems such as SIM.

The main payment methods used to enable m-commerce include: Premium-rate calling numbers, charging to the mobile telephone user's bill and deducting from their calling credit, either directly or via reverse-charged SMS.

Fig.2.10 Phases in mobile payment transaction (Source: Telecom Media Network, 2002)
3.0 METHODOLOGY

In this chapter, we present the method we used to conduct our research and also attempt to justify the basis for the selection of the method. General overview of approaches for such scientific studies is presented.

In the chapter one of this thesis, we outlined or stated our research question. To be able to answer this question required the use of a method. The type of method to employ is based on the form and nature of the research question.

3.1 Research Methodology

According to Dan Harnesk (2004), a researcher who wants to investigate a phenomenon, finds himself thinking about issues such as, why it is necessary to study the phenomenon, what kind of knowledge is to be developed, what the best way to gain knowledge is and who will benefit from the study. Our study would be exploratory one and according to (Robson, 1993), exploratory studies are a valuable medium to help find out ‘what is happening; to seek new insights; to ask questions and to assess phenomena in a new light’. Sauders et al., 2000 state that exploratory studies are particularly useful approach when a researcher wishes to increase the understanding of a problem.

Within scientific theory, two different methodological approaches have been identified; Positivism and Phenomenology. The positivism view has two main sources for knowledge, the things that we can observe with our senses and what we can reason with our logic. The scientist or researcher should according to the Positivistic approach focus on facts and search for casual connections and basic laws. Esterby-Smith et al (1991) maintain that the aim of phenomenology is to study human phenomena without considering questions for their causes, their objective reality or even their appearances.

3.2 Research Approaches

3.2.1 Deductive and Inductive

This research dichotomy, pointed out Sanders et al (2000) is the outcome of how the researcher wants to use the theory. Thus depending on the literature and the way the researcher wants to use it, research can be inductive or deductive (R.O.Ankomah, 2005). The deductive approach takes a standpoint in the general principles in the theory to make more specific conclusions of single events in the empiric. The premise of the inductive approach is the empiric information. This means that scientists can formulate their own theories from collected empirical data without first having to find support from an already established theory (Patel & Davidson).

3.2.2 Quantitative and Qualitative Approach

Qualitative and Quantitative approach offers two distinct procedures for the methodological course of action. A distinction is made between these two approaches. Qualitative research is distinguished from Quantitative research in that, while
Quantitative research is concerned with frequency; Qualitative research is concerned with abstract characteristics of events. Miles & Huberman (1994, p. 40) provide several features to contrast the two approaches as illustrated in table 3.1 below.

<table>
<thead>
<tr>
<th>Qualitative</th>
<th>Quantitative</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;All research ultimately has a qualitative grounding&quot;</td>
<td>&quot;There's no such thing as qualitative data. Everything is either 1 or 0&quot;</td>
</tr>
<tr>
<td>- Donald Campbell</td>
<td>- Fred Kerlinger</td>
</tr>
<tr>
<td>The aim of qualitative analysis is a complete, detailed description.</td>
<td>In quantitative research we classify features, count them, and construct statistical models in an attempt to explain what is observed.</td>
</tr>
<tr>
<td>Recommended during earlier phases of research projects.</td>
<td>Recommended during latter phases of research projects.</td>
</tr>
<tr>
<td>Researcher may only know roughly in advance what he/she is looking for.</td>
<td>Researcher knows clearly in advance what he/she is looking for.</td>
</tr>
<tr>
<td>The design emerges as the study unfolds.</td>
<td>All aspects of the study are carefully designed before data is collected.</td>
</tr>
<tr>
<td>Researcher is the data gathering instrument.</td>
<td>Researcher uses tools, such as questionnaires or equipment to collect numerical data.</td>
</tr>
<tr>
<td>Data is in the form of words, pictures or objects.</td>
<td>Data is in the form of numbers and statistics.</td>
</tr>
<tr>
<td>Qualitative data is more 'rich', time consuming, and less able to be generalized.</td>
<td>Quantitative data is more efficient, able to test hypotheses, but may miss contextual detail.</td>
</tr>
<tr>
<td>Researcher tends to become subjectively immersed in the subject matter.</td>
<td>Researcher tends to remain objectively separated from the subject matter.</td>
</tr>
</tbody>
</table>

Table 3.1 Features of Qualitative and Quantitative Approach

Although some social science researchers (Lincoln & Guba, 1985; Schwandt, 1989) perceive qualitative and quantitative approaches as incompatible, others (Patton, 1990; Reichardt & Cook, 1979) believe that the skilled researcher can successfully combine approaches. The argument usually becomes muddled because one party argues from the underlying philosophical nature of each paradigm, and the other focuses on the apparent compatibility of the research methods, enjoying the rewards of both numbers and words. Because the positivist and the interpretivist paradigms rest on different assumptions about the nature of the world, they require different instruments and procedures to find the type of data desired.

This does not mean, however, that the positivist never uses interviews nor that the interpretivist never uses a survey. They may, but such methods are supplementary, not dominant. Different approaches allow us to know and understand different things about the world. Nonetheless, people tend to adhere to the methodology that is most consonant with their socialized worldview.
Quantitative and Qualitative have their merits and demerits. It is however possible to employ both approaches in the same study. Both methods have their merits and demerits and when used in the right way, can strengthen each other.

### 3.2.3 Contrasting Positivist and Naturalist Axioms (Beliefs and Assumptions)

In table 3.2 below, Lincoln and Guba (1985) summarize the axiomic differences between the positivist paradigm (Quantitative) and the Naturalist paradigm (Qualitative).

#### Table 3.2 Contrast between Positivist and Naturalist Axioms

<table>
<thead>
<tr>
<th>Axioms About</th>
<th>Positivist Paradigm (Quantitative)</th>
<th>Naturalist Paradigm (Qualitative)</th>
</tr>
</thead>
<tbody>
<tr>
<td>The nature of reality</td>
<td>Reality is single, tangible, and fragmentable.</td>
<td>Realities are multiple, constructed, and holistic.</td>
</tr>
<tr>
<td>The relationship of knower to the known</td>
<td>Knower and known are independent, a dualism.</td>
<td>Knower and known are interactive, inseparable.</td>
</tr>
<tr>
<td>The possibility of generalization</td>
<td>Time- and context-free generalizations (nomothetic statements) are possible.</td>
<td>Only time- and context-bound working hypotheses (idiographic statements) are possible.</td>
</tr>
<tr>
<td>The possibility of causal linkages</td>
<td>There are real causes, temporally precedent to or simultaneous with their effects.</td>
<td>All entities are in a state of mutual simultaneous shaping, so that it is impossible to distinguish causes from effects.</td>
</tr>
<tr>
<td>The role of values</td>
<td>Inquiry is value-free.</td>
<td>Inquiry is value-bound.</td>
</tr>
</tbody>
</table>


According to the Association of Qualitative Research, Qualitative research is a powerful invaluable tool enabling researchers, marketers and other professionals to explore people’s motivation, behavior, desires and deeds.

From the above discussion, Qualitative method is seen to be characterized by flexibility. The advantage in flexibility is that it makes it possible to obtain a better and more understanding of the research question. The advantage here is that, it can be difficult to compare the information obtained.

### Our Approach

We would follow the qualitative (interpretative) approach in this thesis. Our motivation stem out from the fact that this approach is characterized by flexibility, which makes it possible to change the study by adding questions and changing the order. Moreover the purpose has also been to gain in-depth knowledge in the problem area by creating understanding through the interpretation of the theory. Qualitative research is an inquiry process of understanding based on distinct methodological
traditions of inquiry that explore a social or human problem. The researcher builds a complex, holistic picture, analyzes words, report detailed views of informants, and conducts the study in a natural setting. Creswell (1998).

Our main domain is Mobile Commerce applications and services which is quite complex based on the fact that it is an emerging discipline and therefore literature on the various segments are currently few. We therefore felt that qualitative approach suited our study very well because the purpose of qualitative approach is to seek deep knowledge, where the understanding of the whole is paramount.

The thesis shall use a hybrid of deductive and inductive approaches. In our analysis and studies, we will draw conclusions based on collected information, which comes from existing theories and our empirical study. In making our empirical study, the theories will serve as our base. The empirical study would be tested against the ‘fact’ that are stated in the theory which eventually would illuminate our findings and thoughts.

3.2.4 Arguments Supporting Qualitative Inquiry

Disciples of the qualitative research methodology have argued and propounded several propositions to support the method. The following are but a few points that support the strong belief of qualitative method as a powerful and incisive method for research.

- Human behavior is significantly influenced by the setting in which it occurs; thus one must study that behavior in situations. The physical setting e.g., schedules, space, pay, and rewards and the internalized notions of norms, traditions, roles, and values are crucial contextual variables. Research must be conducted in the setting where all the contextual variables are operating.
- Past researchers have not been able to derive meaning...from experimental research.
- The research techniques themselves, in experimental research, can affect the findings. The lab, the questionnaire, and so on, can become artifacts. Subjects can become either suspicious or wary, or they can become aware of what the researchers want and try to please them. Additionally, subjects sometimes do not know their feelings, interactions, and behaviors, so they cannot articulate them to respond to a questionnaire.
- One cannot understand human behavior without understanding the framework within which subjects interpret their thoughts, feelings, and actions. Researchers need to understand the framework. In fact, the "objective" scientist, by coding and standardizing, may destroy valuable data while imposing her world on the subjects.
- Field study research can explore the processes and meanings of events.

3.3 Research Strategy

Yin, (2003) enumerated five major research strategies viz, experiment, survey, archival analysis, history and case study. All of them have different advantages, and are chosen depending on the type of research question(s), if control over behavioral events is needed, and/or if the focus is on contemporary events or not (ibid). We
formulated our research questions for this study on ‘how-questions’. When research questions focus mainly on ‘why’ or ‘how’ – questions, the best research strategy will most probably be case studies, histories or experiments (Yin, 2003). The appropriate strategies for contemporary qualitative research are either experimental study and/or case study (Yin, 2003). Experiment requires control over the behavior of the subjects under study, while case study is preferred when the relevant behavior cannot be manipulated (ibid). Since this study aimed at exploring and describing a phenomenon, the case study research strategy was judged to be the most appropriate for this research which we subsequently employed.

3.3.1 Data Collection & Analysis

Our research study is a case study. The main goal of selecting a research strategy is to however avoid misfit between the research purpose and the research strategy. Considering the fact that M-commerce usage and adoption in all developing countries cannot be studied, we will conduct a study on one, thus Ghana.

"Those who are not familiar with qualitative methodology may be surprised by the sheer volume of data and the detailed level of analysis that results even when research is confined to a small number of subjects" (Myers, 2002).

According to Yin (1994) there are three main methods of data collection in case study. This is as shown in the table 3.3 below.

<table>
<thead>
<tr>
<th>Interactive interviewing</th>
<th>People asked to verbally describe their experiences of phenomenon.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Written descriptions by participants</td>
<td>People asked to write descriptions of their experiences of phenomenon</td>
</tr>
<tr>
<td>Observation</td>
<td>Descriptive observations of verbal and non-verbal behavior</td>
</tr>
</tbody>
</table>

Table 3.3 Methods of data collection in Case Study

We primarily used interactive interviewing as the method to collect our data. Analysis begins when the data is first collected and is used to guide decisions related to further data collection. Myers stated that "In communicating--or generating--the data, the researcher must make the process of the study accessible and write descriptively so tacit knowledge may best be communicated through the use of rich, thick descriptions".

Interviews

We shall structure our interviews in two different sets. The initial set of interviews would be used to gain understanding and broader view of the mobile commerce and Wireless Communication landscape in Ghana. This also will afford us the opportunity to select the right people to interview in the main interview. Through this we will be able to establish the key players in the mobile service value chain in Ghana. With our research questions as our focus, we will categorize our respondents into four major categories. These would include M-commerce adopters (Farmers and fishermen) who
would also form the central focus on the study, Mobile Network Operators, Payment Operators, Government and Communication Officials.

**Mode of Interview**

We will conduct the interviews in three different forms. In the first stage, we will recruit ten field assistants who will use our prepared questionnaires to conduct personal face-to-face interviews with the respondents. The second batch shall consist of questionnaires to be sent through e-mails. The targets of this batch shall consist mainly of respondents in managerial positions with busy schedules who may not be reached by our field assistants. The third set of interviews would be conducted by phones. The advantage here is that the respondents would be immediate.

The basis of our interview questionnaire would be our theoretical framework, and the case studies considered. Kvale (1996) writing about the thematic views which suits well when the interview appear to center around a subject stated that, the interview gets structured but that the respondent despite this gets the opportunity to answer simultaneously.

This view also suited us because in some situations we wanted to catch the general opinion of the respondent. According to Patel and Davidson (1994) when conducting an interview, two primary aspects have to be considered. These are the degree of standardization and the degree of structuring. Degree of standardization describes how much freedom the interviewer has to change the order of the questions, add new questions or remove questions during the currency of the interview. The degree of structuring describes how freely the interviewee can answer. For example in situations where the interviewee can only answer fixed alternatives like ‘Yes’ or ‘No’ the degree of structuring is high and low where otherwise.

<table>
<thead>
<tr>
<th>Table 3.4 Degree of standardization and structuring (Patel and Davidson, 1994, p.62)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>High degree of standardization</strong></td>
</tr>
<tr>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>Enquiry with fixed alternatives</td>
</tr>
<tr>
<td>Interview when qualitative analysis of the result is desired</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>A medical doctor’s recording of a patient’s previous medical condition</td>
</tr>
<tr>
<td>Focused Interview</td>
</tr>
</tbody>
</table>

In our study, we opted for a low degree of structuring and a higher degree of standardization. We tried as much as possible to be open to the respondent, to focus on the question asked and also to allow the respondent talk freely around the main issue in the interview. The interview also had a descriptive part. The purpose was to catch the opinions, attitudes and knowledge the respondents possessed in the problem area.
3.3.2 Sampling

According to Holme and Solvang (1997) we can obtain more information if we use respondents with knowledge about the area of interest. We realized from our initial set of interviews that there are organized farmers and fishermen groups in various parts of the country. We will therefore select four fishing communities and two farming communities where some form of M-commerce is adopted which we will describe as ‘MTech Fishing’ and ‘MTech Farming’ resp). Two other farming and fishing communities where no telecommunications (M-commerce) currently exist, dubbed ‘Non-MTech Fishing’ and ‘Non-MTech Farming’ would also be looked at. The groups of farmers and fishermen would be selected from different locations in the country. They include:

- Gomoa fishermen association – Central region
- Lomnava progressive fishermen association – Volta Region
- Efutu fishermen co-operative association – Central region
- Kpone fishermen group – Greater Accra Region
- Akomadan Vegetable farmers – Ashanti Region
- Mireku farms ltd – Eastern Region

We also established from the initial study that currently four mobile network operators are in Ghana (Areeba, Buzz GSM, OneTouch, and Kasapa). We will approach and use all of the four companies. Here we would target the operations and technical managers for the interview. Two people would be interviewed from each company, one each from the operations, technical, finance and administration.

In the service area, the focus would be on mobile payment and the players here are the banks. The leading banks in the country namely; Agric. Dev. Bank, Backlays, Carl-Merchant, ECOBANK, GCB, NIB, SG-SSB, Standard Chartered, Prudential Bank, Trust Bank, UNIBANK would be approached for interview. Another dimension we would attempt to study at a later stage will be the M-commerce scenario in a leading firm. Volta River Authority a leading Power Producer and Distributor with a subsidiary in telecommunication, currently providing about 90% of the fiber-optic infrastructure to other companies would be considered. This became necessary after a discussion with our supervisor.

Leaders of farmers and fishermen groups in various parts of the country would be interviewed. This group forms the central part of our thesis. We will interview at least one farmers’ or fishermen group in six regions out of the ten regions of Ghana. Regions covered are Central, Greater Accra, Eastern, Volta, Ashanti and Northern regions. Officials in the position of Director at the Ministry of Communication and the Executive Secretary of the National Communication Authority (NCA) would be approached to solicit for the necessary data.

All respondents would be interviewed once in their offices with the exception of some randomly selected farmers, fishermen and small business operators. These groups would be interviewed in their homes. According to Trost (1993), it is important to
consider that a respondent should feel secure in the environment where the interview should take place.

3.4 Literature Study

Our empirical study would be preceded by a literature study. This study will enhance and facilitate our understanding in the area of interest. It will also enable us to get a wider view of the subject and an insight into earlier researches conducted within the problem area. Our problem area is perceived to be an emerging discipline which is also under a rather dynamic technological evolution. We shall therefore seek for articles and materials in the technology, scientific and business arenas. Our literature study will serve both as the foundation for our theoretical framework and a base for the design and development of the questionnaire for the empirical study. The knowledge and understanding obtained from the literature study would be the guiding precepts during the formulation of the purpose of our study and the research questions. The literature consists of books, articles, white papers and journals on M-Commerce applications, services and technology, wealth creation, economic growth and business models. These materials would be obtained from the Luleå University of Technology Library.

Among the databases that we would concentrate on include Emerald, Social Sciences Citation Index, and Pro Quest Science Journals. Articles would be also obtained from scientific Journals and newsletters such as the Journal of Information Technology, Journal of Information Management, Electronic Journal of Information Systems Evaluation, Electronic Retailing and e-Marketing NEWSLETTER – HERMES, the World Bank, the ELTRUN, IEE Xplore and Journal for the Association for Information Systems (IS World). We will also fall on some e-books such as M-Commerce - What is it? What will it mean for consumers? By Consumer Affairs & Victoria. Words that we will use to narrow our search for articles in databases shall include words like M-Commerce, M-Commerce in developing countries, wealth creation, Poverty Reduction Strategy and Business Models and Economic growth.

Our empirical data would predominantly come from the interviews; however some vital external and internal documentation will be collected from some of the Network and Service Providers as well as the Ministry of Communication and the National Communication Authority (NCA) of Ghana. The Government of Ghana and the Ghana Web Websites will also be used. ISSER shall serve as a very reliable source of statistical data.

3.5 Reliability and Validity
Reliability and validity are pivots in qualitative research. The accuracy of conclusions and judgments made in the research depends on the accuracy of the data collected. According to Thusen (1991) reliability means that the measurements are made in a correct way. This thesis would be carried out using a qualitative approach. According to Trost (1993), the idea about reliability is driven by the quantitative method and that it is inappropriate in qualitative studies. We would therefore deploy other methods such as follow up calls and e-mails to respondents for authentication and confirmation. A cross check would also be made with other people in the same company, business or sector.
Validity has for a long time, been a key issue of debate over the appropriateness of qualitative research (Miles and Huberman, 2002). Validity in qualitative research addresses the influence of the researcher on the study, the principles and consequences of sampling as well as the process of organizing and interpreting the data gathered. In order to increase the validity, we shall critically examine both the theoretical and empirical materials to ascertain their relevance to our research question and the problem area. Furthermore we will rely on authoritative books and research materials to enhance the validity. In most situations, we will use ‘original’ sources for our secondary data. We will try to increase validity by using sources that are reliable as much as possible.
4. Empirical Study

In this chapter, we present the overview of M-commerce trends in Ghana and the research findings from our study.

4.1 Mobile Technology Development in Ghana

The first mobile communication hit Ghana in August 1992. This was initiated by Millicom Ghana limited with a brand name Mobitel. This analog service was tremendously welcomed by the Ghanaian subscriber. In that year alone, 19,000 Ghanaians owned mobile phones. In 1998 the number of mobile phone users in the country increased to 43,000 and by the middle of 1999 the number increased to 68,000.

The country has since seen a major improvement and development in both the mobile technology industry and the Internet. At the end of October, 2005, the number of subscribers to mobile phones country wide has reached over 2.8 million.

By the end of 2002, Ghana’s mobile phone subscribers had exceeded the number of fixed line subscribers. This is attributed to the fact that most new Ghanaian mobile subscribers have no fixed lines available and very few own or can access a computer. The Government of Ghana liberalized its economy in 1993 and put in place an Accelerated Plan for Telecommunication Development. This has resulted in vast improvement in the quality and quantity of telecommunication services in the country.

There are currently five major companies providing services and support in the mobile communication as well as internet services. Among these include the Ghana Telecom (GT) being run by Telenor, Norwegian telecommunication giant. GT which is the largest telecommunication provider (fixed and mobile combined) in terms of coverage provides both fixed, mobile and internet services. Its mobile product One-touch currently comes next after Scancom Ghana Limited’s spacefon brand (Currently, Areeba) which is the leading mobile and wireless communication service provider. Other mobile communication operators are Buzz GSM and Kasapa. Buzz GSM has its fair share of the market whiles the activities of Kasapa are concentrated in the capital city and few areas. Another company Westel (ACG Telesystems), with American Wireless, a US company as its majority share holder provides fixed line and pay phone services.

4.2 Findings from Fishing communities

Four fishing groups selected from four different districts from three different regions (see 3.3.2). The four fishing communities and two farming communities where some form of M-commerce is adopted (described as MTech Fishing and MTech Farming resp). Two other farming and fishing communities where no telecommunications (M-commerce) currently exist (described as Non-MTech Fishing and Non-MTech Farming). All the fishermen in the various communities belong to a local fishermen co-operative group or an association. The farmers unlike the fishermen did not present a unified front.
4.2.1 Business Models and Activities

Majority of the farmers and fisherman has been practicing their trade for over thirty years now. Some started to accompany their parents fishing and farms at a tender age of eight years. Others also stated that the business was passed onto them by their aged parents or relatives. The models that have been used all these years until the emergence of the mobile phone could be described as the traditional commerce model. In this model, a farmer or fisherman has several buyers who are themselves resellers. There are times also these farmers have to carry their produce to the markets after several days with no buyers coming around. In the remote communities too there are no cold stores or storage devices and therefore make them incur a lot of post-harvest losses. The buyers have taken advantages of such situation to purchase the produce at rather low prices.

Fig 4.1 typically illustrates the business model for the non-MTech category of farmers and fishermen. In this model there are intermediaries between the farmers or fishermen and the markets which prevent them from having direct interaction with the markets most of the time. Market in this case refers to other competitive buyers, big fish mongers and physical markets in the cities. Some of the communities where these models are currently in use have bad roads and therefore require longer traveling hours. In some other places, they are virtually ‘cut-off’ and therefore do not encourage prospective buyers to take the risk in reaching them. The other issue is the lack of communication infrastructure (both mobile and fixed lines) in these areas to facilitate the communication.

Farmers/Fishermen  Buyers (intermediaries)  Markets

Fig 4.1 Business Model of Non-MTech

The Fetteh fishermen association at Gomoa in the central region as well as the vegetables farmers in Akomadan, in the Ashanti region is currently in this web. The model as shown in fig.4.1 is unidirectional where the intermediaries form the main pivot. The buyers (intermediaries) actually dictate the pace and trends in the business. Though in certain cases, there are different buyers involved, the processes remain the same. This is a classical case of a traditional B2B commerce deploying the loyalty business model at the low level.

In the following section, we present some of the responses we got from the farmers/fishermen without access to communication in their communities and thereby using the above business model (Non-MTech).

A respondent stated:
'There are times the middlemen deliberately come without money and carry our produce away to sell before they send our money to us. Sometimes it takes two weeks to one month before they return to pay us’. (A vegetable farmer at Akomadan)
‘Here we catch a lot fish but there are some days too you go and come home empty handed. When we wait for sometime and the buyers are not coming, we smoke the fish but the smoked ones don’t get higher value like the fresh so we would always prefer to sell our catches fresh which apart from the price also save us time to mend our nets, go to the farms and do other things. – Chairman, Gomoa Fishermen Association

Another respondent stated that ‘The biggest challenge we have at the moment is post-harvest losses. Here we don’t have any storage facilities and there is also no means of communicating with our customers and prospective buyers so by the time some of them get here about half of our harvested produce are gone bad. It is also not easy to leave the farms and travel to the cities to sell which means deserting your farm for three to four days’.

As to how the use of mobile phone has benefit their business, one respondent stated,

‘Indeed it’s not only that the mobile phones have enabled us to reach the bigger buyers but it has enabled us to have more market options. Now we are able to monitor prices daily from all the major markets and then contact buyers in the areas where prices are higher. There are a lot of prospective buyers who want to come to buy but the problem is that they first needed to get information about what we have harvested (tomatoes, carrot, pepper, garden eggs, okro etc) and the quantity so that they don’t travel all this long distance only to arrive here to find little or nothing to buy. The added advantage with the mobile phone is that we can call and negotiate even from our farms so I think in the future if we get such a facility here our business can grow’.

Another respondent (vegetables farmer) stated that ‘for nearly five years I have not witnessed any appreciable increase in the returns on his investments. Yields have sometime gone up but by the time the customers arrive from the city, about half of my harvest had gone bad. I cultivate only tomatoes, cabbage, carrot and pepper.

The fishermen groups in the central region of Ghana have adopted the scheme where they use mobile communication between them, the buyers and their banks to facilitate their business operation. In this scheme, the fishermen call or send SMS messages to the buyers about their catches and the value and the fish is sent immediately. The buyers pay through the banks. Below we present a summary of the responses we received from users or adopters of the MTech Business model.

‘Now, when my people are far on the sea, I am able to get information on the volume of the catch and also get information about the prices in the city. I can quickly arrange and discuss with buyers without they coming over here’, stated the Keta ‘Lomnava’ fishermen association chairman

A respondent (buyer) indicated that;

“I have been in this business for over 15 years. I traveled several kilometers from Accra to these areas and back sometimes about twice a week on these terrible roads, sometimes carrying huge sums of money on me. The introduction of the mobile scheme has brought a big relief to me. I now stay at home and my goods are brought
to me. As soon as I get the information I call my bank and the money is paid to the fishermen”.

According to the chairman of the Effutu Fishermen Co-operative Association, the advent of the mobile phone has brought a new ‘life’ into the fishing industry in their district. He maintained that their net incomes have more than tripled over the past few years. This is due to the fact that, they have now cut off a lot of the ‘middlemen’ and could sell the proceeds directly on the big markets by reaching competitive buyers with the aid of their mobile devices. This has enabled them to expand their businesses by acquiring new fishing inputs and also employing more people.

4.3 Economic Growth and Wealth Creation

Economic growth as defined in the theory (see 2.2.1) is generally considered to be an increase in the wealth, or more precisely the income, of a nation or entity. It is conventionally measured as the percent rate of increase in real gross domestic product, or GDP.

Our study agree to this theory however the parameters used to measure and accessed growth since the introduction of mobile technology and for that matter the new business model had included new employments generated, increase in personal and family status, acquisitions over the period and cash flows. Growth is usually calculated in real terms, for instance inflation-adjusted terms in the case of nation, in order to net out the effect of inflation on the price of the goods and services produced. In this study we measured growth by way of business expansion, net income, and personal assets or liabilities.

4.3.1 Investment in the Business model (MTech) and Returns

The adoption of the new business model or technology involves some investment. In order to access the level of growth and the impact on the business activities of the users, it is imperative to consider the initial and recurrent cost in the acquisition and maintenance of the system as against the net income over a period of time. In doing this we considered the cost of the mobile device (mobile phone or PDA), the line rental charge, subscription fees, service fees and reload cards value. Table 4.1 and table 4.2 provide a summary of the base prices of mobile devices and service charges which form the main elements that go into the cost of using m-commerce by the fishermen and farmers. The other cost factor is payment charges. Payment of the goods sold concludes a cycle of transaction and according to the MTech business model involves banks and inter-bank transfers. All these factors informed our analysis and discussion in the next chapter as well as our final conclusions.
Two types of various phones are found on the Ghanaian market. These are new phones and used ones often described as second hand phones. Brands of mobile phones include Motorola, Nokia, Samsung, Seamens, Sony Ericsson and LG. Prices for the new devices range from $110 to $440 whereas the used phones vary from $45 to $175. In table 4.2, we produce the summary of other basic charges that goes into the use of m-commerce in Ghana. Though postpaid services provide some flexibility in usage most of the subscribers in the rural areas prefer the prepaid services. None of the respondents from the fishing and farming communities was found using the postpaid due to its higher fees and additional charges.

Table 4.2 Services and Prepaid Scratch Cards Denominations/ and Price

<table>
<thead>
<tr>
<th>Service Value</th>
<th>Prices</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Areeba</td>
</tr>
<tr>
<td>Line Rental</td>
<td>$22.15</td>
</tr>
<tr>
<td>Subscription/mon</td>
<td>$ 1.8</td>
</tr>
<tr>
<td>Service charge</td>
<td>free</td>
</tr>
<tr>
<td>Reload Cards</td>
<td></td>
</tr>
<tr>
<td>75 Units</td>
<td>-</td>
</tr>
<tr>
<td>100 Units</td>
<td>$ 3.34</td>
</tr>
<tr>
<td>150 Units</td>
<td>$ 5.00</td>
</tr>
<tr>
<td>250 Units</td>
<td>$ 8.33</td>
</tr>
<tr>
<td>400 Units</td>
<td>$ 12.89</td>
</tr>
<tr>
<td>600 Units</td>
<td>$ 9.34</td>
</tr>
</tbody>
</table>

4.3.2 Validation of investment and cost

In assessing the benefits derived from the system as against this section we look at the investments that go into the use of the M-commerce system. From the above, we observed that the basic cost or investment incurred in the adoption of the M-commerce system include the following:
• Cost of mobile device – fixed (one time cost)
• Connection fee – fixed (one time cost)
• Line rental charges – monthly
• Service charges – monthly
• Pre-paid cards – 30 – 60 days
• Postpaid – monthly
• Subscription fee – monthly
• Bank charges – quarterly

Table 4.2 provides the details of the charges and fees that go into the acquisition, installation and maintenance of the equipment needed for adopting M-commerce. In the case of Ghana, the cost involved depend basically on the type of device (mobile phone or PDA) selected and the mobile network operator connected to. All the four mobile network operators have different charges for the various products, services and support they provide.

In our analysis therefore, average values were used in most calculations. To determine the average cost of a user, we considered two hypothetical scenarios. In the first scenario,(upper class) we look at customer A, who decides to buy a new expensive LG mobile phone and connect to Areeba’s postpaid service. In Scenario 2, customer B selects a second hand Motorola phone and connects to Buzz GSM prepaid services. We assume that in this case both customer A and customer B used 75 units of call in the first month. We present the startup cost and subsequent months in table 4.3.

Table 4.3: Initial setup investment analysis

<table>
<thead>
<tr>
<th>Cost ($ USD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phone</td>
</tr>
<tr>
<td>Deposit</td>
</tr>
<tr>
<td>Connection Fee</td>
</tr>
<tr>
<td>Line Rent</td>
</tr>
<tr>
<td>Call /mon</td>
</tr>
<tr>
<td>Subscription</td>
</tr>
<tr>
<td>Service</td>
</tr>
<tr>
<td>Total</td>
</tr>
<tr>
<td>Customer A</td>
</tr>
<tr>
<td>Customer B</td>
</tr>
</tbody>
</table>

4.3.3 Cost against Net Income

The initial investment that go into the adoption of M-commerce here ranges between USD $ 58.50 and USD $ 626.47. In the subsequent months however, if a subscriber continue to subscribe to the postpaid service, the deposit fee, connection fee and the cost of the phone are taken out. This leaves the minimum fee to USD $ 14.50 (Buzz GSM) and the maximum at USD$ 31.80

In the case of the prepaid service, the operators do no charge for deposit fee, connection fee and the line rental charge is a one time cost which is described as the SIM card cost. The initial minimum investment for the prepaid service is USD 35.68.

The net average income of an average fisherman (Canoe fisherman) with no employee is about USD $ 200, whiles that of a fishermen with a minimum of four
employees and two fishing boats ranges between USD $ 600 and USD $ 2000 (in a bumper harvest)

4.4 Findings from Mobile Network Operators

Beginning from the emergence of Mobitel into the Ghanaian market in 1992, the mobile communication has undergone a tremendous revolution. Currently, there are five major network operators currently competing for cellular users. There is a convergence however between the network operators and service providers as four out of the five of these network operators provide services themselves.

4.4.1 Ghana Telecom (GT)

The Ghana Telecom which used to be a state owned organization was privatized in 1995. Prior to this it had enjoyed the monopoly of national carrier in the fixed line communication. In terms of fixed line and cellular phones combined, GT is currently the largest communication operator in Ghana.

Products and Services

GT provides a wide range of products and communication services. Prominent among these products are Fixed Cellular Terminal (FCT), Mobile Accounts (PPC), ISDN Lines, Digital Leased Lines, GT FastNET, International Leased Lines, V-SAT, ADSL Broadband, Internet and Co-Location & Operator Access. Among the communication services that the GT’s operating license allows it to render include, Voice telephony, Cellular communication, Telex, Telegraph, Satellite communications, Value added services, Paging, and the sale, lease and maintenance of subscriber premise wiring.

GT Mobile Network

Ghana Telecom provides a GSM service with the generic brand name ONEtouch. ONEtouch, which was introduced in 1998, is one of three GSM brands Ghana Telecom operates. Utouch and Itouch are the two other brands. Each brand has innovative packages targeted at different segments of the population in Ghana. Utouch is specially designed for the youth. It has been packaged such that customers can enjoy making calls in the evening at reduced charges.

ONEtouch is ideal for business customers who need to make a lot of calls during the day. It has been packaged such that customers can make calls at reduced rates during the peak period which is between 7am to 9pm. Itouch is a postpaid service tailor-made for top executives and corporate organizations. Customers will be required to settle their bills at the end of the month by paying a rental charge in addition to calls made. GT have international roaming agreements with many mobile phone service providers in the world.

4.4.2 Scancom Ltd

Scancom Ltd is a limited liability company incorporated under the laws of Republic of Ghana on April 14, 1994. Scancom, now operating under the Areeba brand, is a subsidiary of Investcom Holdings, an international holding company that specializes
in telecommunication products and services and holds interests in several networks around the world. In November 1996, Scancom became the first GSM mobile service provider in the Republic of Ghana, launching its service under the name Spacefon. The company operates a nationwide mobile phone network using GSM technology. The Spacefon brand has evolved into a new brand called Areeba. Areeba's coverage and customer base made it the market leader in mobile telephony in Ghana for the past eight years and Areeba is by far the largest mobile phone operator in Ghana with over 1.4 million subscribers. Areeba has alliances with 193 Operators spread in 101 Countries in the 5 Continents to provide roaming facilities to its most valued customers.

**Services and Products**

Areeba provide three major products with several value added services. The products on the market under the Areeba brand are the Prepaid, Postpaid and the Roaming. All the three products are powered by the GSM-900 system. Prepaid is a prepaid product that has been one of Areeba’s driving products since October 1998 due to its convenience and easy to use functionality. *The Areeba Prepaid Card* offer users the ability to use the card immediately with any GSM 900 compatible cellular phone and a benefit from an initial communication credit. This makes it possible to immediately make national and international calls. With the prepaid, there is no Connection Fee, The Areeba Postpaid product is designed to enable its subscribers to benefit from continuous and interrupted services. It offers a line that operates 24 hours a day and 7 days a week. Services provided under the postpaid product are fax and data services, voice message services, calling line identity restriction (CLIR), Smartclip; short message services (SMS), voice mail and the roaming service.

**4.4.3 Millicom GH Limited**

Millicom Ghana. Limited, the pioneers in the mobile telecom industry in Ghana operate two networks. Millicom started operation in Ghana in 1992 under the brand name mobitel, which uses the TACS, an analog network. Mobitel swiftly got down well with the subscribers which saw 19,000 users subscribing to the service in the first year of operation. In 2000, Millicom introduced her GSM service under the brand name Buzz GSM. By June 2002, the subscriber base of Buzz has risen to 74,000. The company with the introduction of her Buzz GSM product has recorded a fast growth in both her subscription base and territorial penetration.

**4.4.4 Kasapa Telecom**

Kasapa Telecom started in a small way with her services and operations centered within the Accra–Tema metropolis. Operating under the brand name celtel, the company which started on the AMPS network is now gaining grounds and fast penetrating into the other regions. Kasapa has now moved into three regions in the southern sector of the country, though her services are still concentrated in the regional capitals and its environs. The brand name was changed from Celtel into Kasapa in 2003 when they moved their network to GSM.
Table 4.4 Mobile operators in Ghana (Nov, 2005)

<table>
<thead>
<tr>
<th>Operator</th>
<th>Network (Brand Name)</th>
<th>System</th>
<th>On Air</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kasapa Telecom</td>
<td>KASAPA</td>
<td>AMPS</td>
<td>June 1995</td>
</tr>
<tr>
<td>Ghana Telecom</td>
<td>Onetouch</td>
<td>GSM-900</td>
<td>Oct 2000</td>
</tr>
<tr>
<td>Millicom</td>
<td>Mobitel Buzz</td>
<td>TACS</td>
<td>Jun 1992</td>
</tr>
<tr>
<td></td>
<td></td>
<td>GSM</td>
<td>June 2002</td>
</tr>
<tr>
<td>ScanCom Limited</td>
<td>Areeba</td>
<td>GSM-900</td>
<td>Nov 1996</td>
</tr>
</tbody>
</table>

4.5 Diffusion of Network Operators

4.5.1 Regional Penetration

Table 4.5 summaries the penetration of the mobile operators in terms of land size. This does not include the coverage of fixed or landlines.

Table 4.5 Mobile Network Penetration by Operators

<table>
<thead>
<tr>
<th>Operator</th>
<th>G.Accra</th>
<th>Eastern</th>
<th>Central</th>
<th>Western</th>
<th>Ashanti</th>
<th>Volta</th>
<th>B/A</th>
<th>Northern</th>
<th>U/East</th>
<th>U/West</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kasapa Telecom</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>3</td>
</tr>
<tr>
<td>Ghana Telecom</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>10</td>
</tr>
<tr>
<td>Millicom</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>6</td>
</tr>
<tr>
<td>ScanCom Limited</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>10</td>
</tr>
</tbody>
</table>

Out of the ten regions forming the political blocks of Ghana, two operators, GT’s Onetouch and Scancom’s Areeba are represented in all. Buzz GSM of Millicom currently has about 60% coverage in terms of regional distribution whereas Kasapa whose operations are currently concentrated in the southern part of the country are in three regions, representing 30%.

4.5.2 District Penetration

The ten political regions of Ghana are further divided into districts and there are currently 136 districts each headed by a district chief executive appointed by the president of the country. In order to obtain a broader view of the mobile penetration in terms of land distribution, we narrowed the study down to the districts which are ‘closer’ to the people. This is as illustrated in table 4.5 below. The detail of each district covered by the various mobile operators is captured in appendix B.

Table 4.6 Mobile network diffusion (Districts)

<table>
<thead>
<tr>
<th>Operator</th>
<th>District Coverage</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kasapa Telecom</td>
<td>42</td>
<td>30.8</td>
</tr>
<tr>
<td>Ghana Telecom</td>
<td>128</td>
<td>94.1</td>
</tr>
<tr>
<td>Millicom (Buzz GSM)</td>
<td>96</td>
<td>70.6</td>
</tr>
<tr>
<td>ScanCom (Areeba)</td>
<td>126</td>
<td>92.6</td>
</tr>
</tbody>
</table>
In terms of land penetration, Mobile and wireless communication operators in Ghana has worked hard in extending services to about 95 percent of the area. It must however be noted that the fact that service has reached a district does not mean that the entire area of the district could access the service. In some cases the facility hardly goes beyond the district capital.

4.5.3 Diffusion by User subscription
Ghana’s current population is not certain. However, figures obtained from the statistical services department, for the year 2000 census put the figure at 20.3 million. It is therefore estimated that with the current annual population growth rate of 1.7%, Ghana’s population is now estimated at 24.2 million. Table 4.7 shows that about 14.34% use mobile stations.

Table 4.7 Mobile Phone diffusion (Subscribers)

<table>
<thead>
<tr>
<th>Operator</th>
<th>No. of Subscribers</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kasapa Telecom</td>
<td>64,328</td>
<td>0.32</td>
</tr>
<tr>
<td>Ghana Telecom</td>
<td>864,152</td>
<td>4.32</td>
</tr>
<tr>
<td>Millicom (Buzz GSM)</td>
<td>316,228</td>
<td>1.58</td>
</tr>
<tr>
<td>ScanCom (Areeba)</td>
<td>1,628,418</td>
<td>8.14</td>
</tr>
<tr>
<td>Total</td>
<td>2,873,126</td>
<td>14.34</td>
</tr>
</tbody>
</table>

4.6 Other M-Commerce Applications and Services in Ghana

‘Providing the platform for our customers to conduct business or private transactions with their mobile stations anytime at anywhere is currently the greatest challenge and aspiration we seek to pursue.’ – Deputy Operations manager, Areeba

4.6.1 Fon Banking

Three banks, SG-SSB, Standard Chartered Bank (GH) Limited and Barclays Bank, Ghana, in partnership with two telecommunication operators Areeba and Buzz GSM offer their subscribers and clients of the banks the opportunity to conduct some limited banking transactions with the aid of their mobile phones. A classical example is the SG-SSB Sikatext. “The Sikatext is a simple application designed to allow Areeba subscribers who are also SSB customers to easily connect to the bank via the Areeba TXT Feature and subscribe to services that allows them to:

1. Get their latest bank balances.
2. Request Mini Bank Statement
3. Enquire latest Foreign Exchange (FOREX) Rates
4. Recharge their Prepaid Areeba line with units

All or a Select of these features are available to SG-SSB customers who also have Areeba Subscription by simply registering themselves with the Bank. Once registered, appropriate features can be accessed by sending a simple TXT (Short Message) to Areeba service number following the guidelines mentioned by the Bank”.

-Respondent (SG-SSB Bank Limited)
This product is becoming common among users and similar applications are being implemented between the network operators, Areeba and Buzz GSM and Barclays Band and Standard Chartered Bank

4.6.2 Sports and Entertainment

Sporting activities in the country offer employment to quite a number of people. Apart from the huge direct sponsorship provided by the mobile communication companies to support sports, mobile technology has enabled people all over the country to have access to live telecast on all games and matches. Football is the current dominant sport in Ghana.

“Here football is described as “the passion of the nation” Currently, the premiership league is sponsored by GT to the tune of about 2billion cedis (about $ 22.2 Million USD). Areeba is the main sponsor of the two leading football clubs, Accra Hearts of Oak and Kumasi Asanti Kotoko. Areeba has also been a major financier of the Top-4 league which is an annual mini football league involving the top four clubs from the premiership”.

- Respondent (Logistics manager, Scancom Limited) stated

In entertainment, several programmes on television continue to enjoy sponsorship from the mobile communication companies.

“Innovative packages such as ‘Predict and Win’ introduced into some of the TV programmes where patrons are allowed to send txt messages before and during the programmes to either predict a winner or answer a specific question enjoy tremendous patronage. Contestants have always won handsome prices ranging from mobile phone credit units through mobile devices to cash”.

– A respondent from Scancom Communications

4.6.3 Information Services

Information Services enjoys about 60% of current M-commerce applications in Ghana and the contribution of wireless communication in the area of information services or delivery is phenomenon.

– Respondent (Ministry of Communication)

“There are 256 local FM radio stations spread across the country and six TV stations with 4 located in Accra, the capital and 2 in Kumasi the second largest city. Reporters of all these stations are provided with mobile stations to enable them file online reports from all over the country and abroad”.

– PRO (National Communication Authority)

Users of 2G to 3G mobile phones are also able to receive weather reports, news flashes and security warnings. The running of live commentary on football matches from even the remotest areas of the country where hitherto, people used to get scores several days after matches has brought a big relieve to football enthusiasts and administrators. Betting on matches is now becoming popular and a good source of income to some people.
4.7 Small Businesses in M-commerce

The Ghanaian mobile industry has introduced some unique and innovative businesses which are fast catching up across the length and breadth of the nation. These are few areas that have seen a lot of jobs emerging in recent times in Ghana. One sector that has benefited so much in this business is the telecommunication industry. In Ghana, small businesses in the telecommunication are called comm centers who offer call services. Modern models that have sprouted out in this sector with the advent of wireless communication are explained in the ensuing section.

4.7.1 Space-2-Space (S2S) (now Areeba-2-Areeba)

The Space-2-Space or S2S, now Areeba-2-Areeba, is a unique model which was introduced by Scancom Ghana Limited, operators of the Areeba mobile network in the year 2002. The pilot program which was started in the Accra metropolis was a huge success and within the spate of one year, provided 2,740 direct jobs. In this scheme, Areeba provides a specialized handset with free connection to the vendors and all that the vendor does is to get a small table, a chair and an umbrella to provide a shield from the scorching sun. People are able to send or receive calls and text messages to or from all Areeba lines. This means that one does not need to have a mobile handset in order to enjoy this service. The call cost is also lower.

According to one respondent (a vendor), initially he was skeptical about the prospects in the business but because he was unemployed and the startup cost of the S2S business was low, he decided to give it a try and within two and a half years of operation, he has been able to purchase a taxi cab.

He stated ‘In this business, we don’t pay rent and neither do we pay electricity. In the daytime, we put our table and desk in the open and in the night we shift under the street lights or in front of people’s shops after they have closed and gone home. Currently, we also don’t pay tax on our income so everything you get at the end of the day goes to your pocket.

Another vendor also stated that ‘I started working for a lady, but after a few months, I had enough money to acquire mine own set and table to start my business. I procured two sets later on and brought in my younger brother and a friend and as at now I have twelve sets so I have employed 12 more people. Now the business has slowed down because a lot of people have entered into it, yet we get our fair share everyday.

‘The impact of the S2S on both economic and social activities across the country has been tremendous. This is a ‘multi-chain’ business that had opened avenue of job opportunities not only to the vendors but also to ‘wood technicians’ who manufacture the tables and chairs as well as the industry that produces the umbrellas and the sellers. S2S has brought families and the communities closer together as obviously those who cannot afford to have their personal handset can easily reach family members and friends by using the S2S. Nowadays, the vendors keep radio sets around them and people who listen to programs on the airwaves are able to call during phone-ins to share their thoughts and opinions.’

- The Operations Manager, Areeba communications
“Apart from our contribution in terms of taxes to the state as a good co-operate organization, we are in the forefront of providing other social amenities and community services to help eradicate poverty and diseases. We build schools for deprive communities and also provide scholarship to needy and brilliant students from the primary to the tertiary levels “stated the Managing Director, Areeba Communications.

4.7.2 Mobile Van

The mobile van model is an extension of the S2S model. In this model, the pH-phone system is installed in vehicles which move around to enable people easily have access to phones to make calls. PH systems are installed on the vans to draw public attention. When someone wants to access the service, she beckons the van to stop and go ahead to ‘buy’ the service. The van also carry along other Areeba products such as the pre-paid cards, mobile phones, etc, The Operations manager stated that, with these innovative products, Areeba’s vision of bringing telecommunication services to the doorstep of every Ghanaian is being realized. Now what we need to do is to extend the services to the rural areas where people find it difficult to buy their personal mobile phones

4.8 Findings from Payment Operators

Banks are the only institutions in Ghana currently providing services involving payment transaction. About 98% of payment transactions are local transactions. Remote transactions which are necessary for mobile payments are not supported by the banks and thereby making mobile payments non-operational in Ghana. Banking products and services that support M-commerce were investigated from twelve out of the sixteen banks currently operating in the country. The results is as tabulated below

<table>
<thead>
<tr>
<th>BANKS</th>
<th>Mobile Banking</th>
<th>Internet Banking</th>
<th>M-Payment</th>
<th>Credit Card</th>
<th>Debit Card</th>
<th>Payment at Real Store</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agric. Dev. Bank</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Backlays</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Carl-Merchant</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>ECOBANK</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>GCB</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>NIB</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Prudential Bank</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>SG-SSB</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Standard Chatered</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Standard Trust</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Trust Bank</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>UNIBANK</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

Among the industries that stand to benefit from M-commerce are the financial services, which include mobile banking (when customers use their handheld devices to access their accounts and pay their bills) as well as brokerage services, in which stock quotes can be displayed and trading conducted from the same handheld device. In partnership with the mobile network operators, the financial institutions can brink personal banking to the doorstep of the customer through M-commerce. This in turn provides another source of revenue to both partners whiles the customer get convenience.
5. Discussion and Analysis

In this chapter, we link the theory and empirical findings through discussions and analysis to answers of main questions and other statistical data obtained. We proceed further to provide an appropriate model developed from contextual factors influencing M-commerce growth in developing countries.

5.1 Introduction

‘People and technology cannot even be understood without each other. Therefore, IS designers are obliged to understand human behavior and characteristics’. -Dahlbom

Human beings by nature are not comfortable with change and would adopt or accept changes in their environment, work, culture or habits with some room of hesitation. However, the level of acceptance of mobile phone and its application world over has indeed been phenomenon. Mobile phone usage has been rapidly adopted in developing countries. In Ghana, prices of handsets and services keep on to drop with each passing week as more operators and service providers find their way into the Ghanaian mobile market.

To date however, mobile phones continue to enjoy higher rate of voice traffic in Ghana. SMS is now catching up with a surprising speed. This could be attributed to the relatively marginal charges for the services for SMS, currently being provided by almost all the operators. SMS is greatly patronized by the youth in Ghana.

We must emphasize that various writers and researchers have had varying opinions about M-commerce potential and usage. There have been the optimistic view and the pessimistic views. None of the methods in this study could therefore be the only way to reach an expected result. Our study has Ghana as the case study where we applied the theoretical thought.

5.2 Within Case Analysis

In this section we look at the empirical data from the various cases in the study and analyze them against the frame of reference as presented in chapter 2. The 3C framework provided by Ravi Kalakota and Andrew Wisten (see section 2.4.2) would feature prominently in our analysis here. Three components i.e. Cost, Convience and Communication are identified as the pivots in achieving the desired business performance.

5.2.1 The case of vegetable farmers

There are also two cases of farmers groups that were studied. The first case is that of farmers in the Akomadan area in the Ashanti region. They cultivate vegetables including cabbages, tomatoes, carrots, pepper, garden eggs and okro. Sometimes, buyers from the cities and various markets go to these farms to buy the produce. This group of farmers belongs to our MTech farmers who conduct about 90% of their selling and marketing operations with the aid of mobile phones. They usually call to
their customers and prospective buyers to arrange for sales of the produce before the
go out to harvest.

5.2.1.1 Costs

The fundamental cost of M-commerce to all the participants in the M-Tech scheme
has been in the area of acquisition of the M-commerce infrastructure such mobile
phones and PDA’s as well as monthly rental, subscription and maintenance. In some
cases cost are incurred in the form of bank charges.

The theory state that for optimum output, cost must be reduced to the barest
minimum. These rural farmers also incurred heavy losses through post harvest losses
in situation where there are ‘delayed buyers’. One of the fundamental reasons the
MTech farmers assigned for the adoption of M-commerce is cost reduction in the
interactions between their business operators which include the sales and marketing of
their produce. This reflects in the business models (MTech) they adopt.

5.2.1.2 Communication

Communication drives the organization. Telecommunication services reached the
district in 1999. Since then communication and business activities has taken different
dimension. Mobile communication, operated by Areeba reached the district in June
2003 which has further boasted the business communication and co-ordination in the
selling chain of the farm produce from the district. Currently about 35% of the farmers’
uses business model similar to the MTech model we describe in 5.2.2 and illustrated in
figure 5.2 below.

The S2S technology introduced by Areeba communications has also
reached the district and farmers who have no mobile devices find it
convenient to use the S2S facility. This however does not bring any
significant change in the business model they have adopted.

The extent to which these improved communication and associated relationships
between the farmers and their business partners has influenced wealth creation and
economic growth in the district could not be quantify or analyzed in numerical terms.
However, between 2003 and 2005, post harvest losses have reduced by about 70%.
This is significant because post harvest losses used to be one of the greatest
challenges confronting farmers and fishermen in the remote areas of developing
countries (UNDP 2004).
5.2.1.3 Convenience

According to the 3C framework Convenience is a key factor in evaluating the adoption of new models in business. It should therefore be the barest minimum and essential condition when devising technologies as well as models to improve business performances.

About 65% of respondent here considered convenience over transaction cost reduction and communication in deciding to adopt M-commerce. The ease of use and the ability to reach customers and markets anytime anywhere has actually been a dominant factor that has led many of the farmers to go in for M-commerce.

In this section we look at the empirical data from the various cases in the study and analyze them against the frame of reference as presented in chapter 2. The parameters that is used here in line with the theory as stated by Nansi Shi (2005), Paul Candace Dean (2003) and would be the link of business relationship and business model in wealth creation and economic growth.

5.2.2 The case of Mireku Farms Limited

The case of Mireku Farms Ltd near Juapong in the Eastern region is that of commercial farming. They cultivate cereals and vegetables as well as poultry. The focus of the poultry section is rising of day-old chicks and eggs for sale. Activities in this company are quite organized and well structured. They have four different sections, Administration and Finance, Sales & Marketing, Crop Operations and Poultry Operations. Each of these sections is headed by a manager with a managing director as the head of the company. The focus on our study here was on the Sales and Marketing section and questions were answered by the Marketing Manager.

5.2.2.1 Costs

At the Mireku Farms limited cost cutting in all aspect of their operations are strictly enforced. Cost featured highly in deciding for the adoptions of M-commerce in the sales and marketing operations of the company. Management’s decision to adopt the technology therefore underscores their confidence in the potentials of M-commerce. Among the areas that the introduction of M-commerce has succeeded in cutting down cost include fuel, advertising and travel allowances for sales and marketing staff. The sales and marketing staff previously used to travel an average of 240 km daily to take orders and visit prospective customers. Risk and traveling allowance alone for a month is about five times the total maintenance cost of the mobile service per sales representative. Instead of the daily routine visits by sales representatives to their customers, now customer visitation is once per week. Fuel cost, car maintenance and services have reduced.

5.2.2.2 Communication

Communication flow between the company and her partners is analyzed. According to the theory, the 3C framework (Duck 1976, 1998), relational issues cannot be separated from communicational occurrences.
Relationships are a substantial part of structuring, evaluating and understanding messages in interpersonal settings. By introducing the MTech business model, relationships between the company and their business partners, thus the customers, banks and network operators. Communications in the company keep improving and the company is on the verge of installing internet and intranet facilities to boost the drive for efficient communication system.

5.2.2.3 Convenience

Convenience on the part of the company as well as customers and others who do business with the company is a priority of the management. Currently Sales representatives are able to contact their customers and take orders or customer concerns from their homes at anytime. SMS messages are sent out by marketing officers to customers and sections of the general public.

5.3 The case of Fishermen

The three fishermen group i.e. The Lomnava Fishermen association, the Efutu fishermen co-operative association, Gomoa fishermen association and the Kpone fishermen group selected for this study has adopted M-commerce and using seemingly similar business models in their operations. The business model is not any different from the MTech business model mentioned earlier and illustrated below. Their major business partners include cold-store proprietors who buy and preserve fish, small fish mongers, banks and mobile network operators.

The fishing in these areas is done several kilometers from the coast to deep sea using out-board motors and smaller fishing trolleys. Some of the fishermen have employees between three and fifteen. The fishermen who employ others to handle their trolleys and fishing activities are called ‘Chefs’

5.3.1 Cost

In the fishing communities, most of the fishermen chefs themselves do not go to sea. These chefs have small offices in the communities and in certain cases their homes. Their fishermen usually spend between 18 hours and 3 days on sea. This has therefore made them incurred additional cost. A chef who doesn’t go fishing himself has to acquire two handsets of mobile devices, one for the fishermen who go fishing and he himself maintain one. Regular communication is maintained between the chef and his employees on the see until they return ashore. The chefs with the information they receive from the sea contact the markets and customers and arrange to sell the catches. The chefs spend more call time in interacting with the employees and customers. They communicate with their fishermen whiles on sea with their mobile devices

5.3.2 Communication

The flow of communication is between the chefs, their employees, and the buyers. While the fishermen are on sea, the chef with the aid of mobile technology maintain communication with them to monitor their progress. This is mostly a uni-directional in that almost always the communication is initiated by the chefs unless there is an emergency on sea. At the selling side, communication is bi-directional. Both the chef
and the buyers are able to initiate communication. The operations of the farmers groups typically depict the MTech business model. The model as discussed below demonstrates the communication relationships between the farmers and the other partners.

5.3.3 Convenience

Convenience in doing business rated higher than all other considerations among the farmers. The fact that they could be far away on the high seas and still conclude transactions with buyers has brought so much relief to the farmers. They previously had to travel long distances to the markets which was a source worry to them because dealing with intermediaries was also.

5.4. Importance of the Business Models

The role business models play in the success of business entities cannot be over-emphasized. The farmers and fishermen described earlier as the MTech farmers and fishermen, thus those who have evolved their business models from the traditional models to adopt M-commerce have by the system improved relationships with their customers and other business agents. Relationship is also a cardinal factor in a business that involves several players in its value chain. Mireku Farms Ltd has since the introduction of M-commerce has gained some trustworthy customers who now see themselves as ‘partners’ in the business. The fishermen in Effutu now do not see themselves as ‘cut-off’ since they are now able to reach their customers and business 24 hours a day. Here we recap the business models described in section 4.2.1 as the ‘MTech’ model to analyze the business relationships that has emerged out of that model. Information flow and relationships between all the parties have taken shape as illustrated in fig 5.2. each headed by a manager however due to poor nature of road infrastructure, such case at people have been sea fishing and

Fig. 5.2 MTech Business Model
5.4.1 Seller-Buyer (Farmers – Customers) relationship.

In the traditional commerce model, interaction between sellers and buyers has mostly been by formal face-to-face meetings. This form of interaction normally takes place only when the buyer visits the seller to buy or the seller follow up on the buyer to collect payment of produce previously purchased. The frequencies of such interactions are rather low ranging between once per week and once within a month. This has not encouraged the relationships between these partners and in situations where credit buyers have failed to turn up on agreed dates, the relationship has even suffered. During the off-seasons interaction is virtually cut off.

In the M-commerce environment however, Seller-Buyer interactions has been one of the key success components. The use of mobile stations or devices has enabled these partners to keep in touch easily. In the MTech model, communication between the partners is conducted on mobile phones and PDAs. Test messages are sent among themselves just to say hullo in situations where no business transactions are involved. This has in no small way has brought the seller and the buyers closer together in their relationships. It has also promoted trust and confidence which is a vital component in business transactions amongst partners.

5.4.2 Farmers-Bank relationships.

The farmers and fishermen typically do businesses with rural or community banks. Over the years the interactions between the banks and these clients have been cordial. This is due to the fact that the bank, staff and the clients all live in the same community. The other dimension that M-commerce has introduced which has subsequently promoted the bank-client relationship is the bringing in of other bigger banks. Business activities of the rural banks have expanded and the new association with the bigger banks has offered new opportunities such as revenue from money transfers.

5.4.3 Buyer-Bank relationship

The banks always look for means in satisfying their clients and the same time generating income through those services. We established from the study that the few banks who have introduced phone banking to enable customers conduct some transactions have over the last two years increased their customer base average of 30%. This is in sharp contrast to the other banks where no phone banking exists. Some of the banks where no phone banking exists have over the same two year period lost between 10 and 15% of their customers. Though it is difficult to explain whether the introduction of the phone banking or otherwise has been the fortune or bane of these banks, the consensus from clients are that it has afforded them enough flexibility in banking transaction. One of the banks stated that nothing in terms of products and services has changed within the last two years apart from the introduction of the phone banking and some minor promotional activities and are therefore of the view that the increase in their customer base of in recent times is due to the phone banking.

Previously, for a simple transaction like checking on balances require the customer to sometimes travel over several kilometers to the bank. This situation still prevails in the banks who do not offer phone banking services. Clients’ confidence in the phone
baking banks is higher. They also see such services and developments as signs of growth in their banks.

5.4.4 Inter-Banks relationship

In the traditional commerce models, banks had no or very little role to play. In M-commerce however, the banks and other payment operators such as credit card issue companies are major players or partners. All commercial transaction usually end with payment where the payment operators functions become crucial. As illustrated in fig 5.1, (MTech model) there could be more than one banks involved in any single transaction. In the MTech model there are two banks i.e. the seller’s bank and the buyer’s bank. Where as the farmers and fishermen usually deals with the rural and community banks, the buyers on the other hand deals with the bigger banks which are located in the cities. For a successful M-commerce system to work in models such as the MTech, the relationship between the buyer’s and seller’s banks is also important. (See also 5.2.2.3 and 5.2.2.2)

5.4.5 Relationship with the Network Operator

The MTech model shows that the network operator is in the very center of the model. All the other players such as the seller, farmer/fisherman and the banks have direct relationship with the network operator. A breakdown in communication disturbs the whole system. Though there might not be direct communication between the other partners and the network operators, we believe that both the background and front end services the provide to ensure uninterrupted information within the system from one and to another will generate some trust and confidence between them and the other players.

5.5 Cross case analysis

In this section we present a further analysis conducted on our empirical data by considering the similarities and differences of the various cases. In our study we looked at four cases of fishermen groups and two of farmers. However we realized from our previous analysis that there are strong correlations between all the fishing groups and therefore will consider them as a single case for the purpose of this analysis. In the same vein we established that apart from the administrative structures the two farming groups appear to have a lot in common and would therefore categorized them as farmers.

This analysis is based on the Ravi Kalakota and Andrew Winsten’s 3C framework presented earlier in chapter two. The parameters in this framework are cost, communication and convenience in relation to the MTech business model. Both farmers and fishermen fall under the same sector, the Agricultural sector and it is therefore not ironic to find a lot of simililarities between them.
5.5.1 Comparisons based on Cost

Cost here is defined to include all investments made in the acquisition of the mobile technology infrastructure for M-commerce. Both the farmers and fishermen procure the devices from the same market and operator service charges all over the country remain the same. Depending on the mobile network operator one chooses and the frequency of calls out the cost incurred are bound to be same.

The difference that normally arises is due to the multiple information flows in the case of the fishermen who maintain links with their employees who go to sea as well as the other business partners.

5.5.2 Comparisons based on Communication

Both groups have similar business model, the MTech business model explained earlier which explain the communication flow and relationships between them and their customers, network operators and bankers.

There is no major difference in the management of communications and the relationships between them and business partners.

5.5.3 Comparison based on convenience

From the camp of both farmers and fishermen groups we observed that they all placed a higher priority on convenience as one of the major components that influenced their decision in adopting M-commerce. At both case sites the flexibility and increase of reach from anywhere is seen to offer convenience.

Here again no major differences are identified.

5.6 Theoretical Discussion.

Finding appropriate theoretical framework for this study has rather been difficult. We believe that M-commerce this is due to the fact that M-commerce is new and emerging discipline with different writers providing varying definitions and scope for it. The scope of M-commerce is very broad which embraces a cross range of players from several disciplines.(Norman, 2003). In its holistic view, M-commerce is classified as a Socio-technical system (STS) with heavy doses of economic hypothesis and derivatives. This forms the underpinning of our theoretical frame of reference. Socio-technical systems include one or more technical systems but, crucially also include knowledge of the system should be used to achieve broader objective. This means that STSs have defined operational processes, include people as inherent part of the system, are governed by organizational policies and rules and may be affected by external constraints such as national laws and regulatory policies.

We believe that Churchman assertion that a sociotechnical system would be said to be successful when it generates the projected socio-economic changes, i.e. the sought after human life improvement and the politico-economic payoffs for the stakeholders and firms that sponsor and implement the system is quite appropriate. Previous research and studies into M-commerce has established that Japan and some European
nations have indeed reaped ‘windfalls’ from M-commerce technology, applications and services. Forrester research institute (USA, 2004) has predicted that the end of 2006, M-commerce would generate USD $ 12 billion worldwide.

One of the key tenets of STS theory is the principle of joint optimization. This means that an organization can perform optimally only if the social and technical dimensions are designed to fit the demands of each other and of the environment. Attempts to optimize the technical or social dimension alone will result in the sub-optimization of the socio-technical system.

Thus, STS is a method of viewing organizations that emphasizes the interrelatedness of the functioning of the social and technical dimensions.

A common difficulty in studies of STS is that the meanings of “technical system” and “social system” have not always been well-defined. One of the pioneers of STS, Emery, suggested that the technical dimension was related to aspects of the natural sciences, whereas the social dimension included occupational roles and structure, methods of payment, supervisory relationships, and work culture.

We believe that their framework is inconclusive because there are several players or stakeholders in M-commerce who have employed different methods and technologies in their operations. Being categorical on the requirements of an M-commerce system and M-commerce structure may lead to ‘chaos’ in certain situations.
6 Future of M-commerce in Ghana

In this chapter we provide an overview of the future of M-commerce potentials in Ghana’s development. A look at the mobile network operators and payment operators are examined. The chapter also looks at the factors that are affecting diffusion and the potential areas where the adoption of M-commerce could bring generate wealth.

6.1 Mobile Network and Payment Operators

The services provided by the mobile network and payment operators is a major driving force behind the sustenance of the M-commerce industry. In this section we examine how the products and services of these institutions are promoting or influencing M-commerce.

6.1.2 Mobile Network Operators

The issue of diffusion and adoption by the mobile network operators in Ghana is studied in line with the theory from chapter 2. From the theory, issues regarding theory must be considered from the perspective of both the user and the network operator. Among the factors that the user will consider before adoption are convenience and security whereas the operator looks at profitability and the business potential.

From the empirical data, we observed that in terms of area coverage, the four network operators combined have reached about 94% of the districts. A district comprises so many towns and villages sometimes sparsely located. On the broader sense, for example the regional data, they seem to have covered the entire nation but a different picture is captured as one goes down into the districts and towns. The trend seems all the operators have focused their activities on the cities and district capitals that. The penetration to the various towns and villages therefore need further investigation.

In terms of subscription, it was observed the total subscriber base of the four operators stand at 14.34% (November, 2005) of the total Ghana population of 24.2 million. Of the total population, adults (above 18 years) are estimated at 10.6 million. This implies that currently mobile products and services has reached 27% of the adult population. Considering the fact that mobile communication reached Ghana 13 years ago, the current penetration would just be seen as average, though the rise in the last three years has been sharp.

6.1.3 Payment Operators

Mobile payment is one area in the M-commerce industry that is still young even in the advanced nations. As at the close of 2004 only Japan has been able to breakthrough with a technology to enable users to pay for goods and services at real shops with their mobile devices. Traditional forms of payment especially the use of credit and other online cards continue to dominate.
In Ghana however, card payments are not common. Internet banking is also in non-existence. Currently less than 1% of bank clients have access to credit cards. These are issues that require accelerated push if M-commerce is to thrive successfully in the country. The banks must be innovative and look for better alternatives for online payment as the internet continue to expand all parts of the country.

Fig 6.1 Mobile coverage in Ghana (Areeba and Buzz GSM)

6.2 Awareness of M-commerce Applications and Services

There is so much euphoria about the acquisition and usage of mobile station in the rural and remote areas. This notwithstanding knowledge of M-commerce applications and services is rather low. People in these areas have varying perceptions about acquiring a mobile station, ranging from economic factors and culture to security.

Analysis from the mobile penetration in terms of area coverage (Table 4.3) and real subscription (Table 4.4) shows that where as about 94% of the land is covered (total coverage by all four network operators) the total subscription is 14.34% (2.5% in rural area).

6.3 Factors affecting M-commerce diffusion in Rural Settlements

Mobile technology is having a some impact on the social and economic lives on the people in some rural communities in Ghana, the current level of adoption of mobile stations and M-commerce in general (about 2.5%) is on the lower side. Our study established several factors behind this low adoption rate some of which vary from community to community. Factors such as affordability fear of insecurity and cultural beliefs are unanimous and therefore need to be given more attention in strategizing for
carrying M-commerce into these areas. We believe a deeper understanding of the mechanisms by which these factors influence the degree of adoption of mobile stations usage would help formulate appropriate policies to increase the M-commerce penetration to enable Ghanaians experience the full impact of the benefits.

We believe the goal of any proposed model is ‘successful’ when it creates the needed socioeconomic changes thus the sought after wealth creation and economic growth, as well as generates politico-economic payoffs for the stakeholders who partake and implement the model.

6.3.1 Economic Factors

Economic factors is identified as one of the major barriers influencing the diffusion of M-commerce and even the type of mobile station that one chooses in Ghana. Affordability is rated as the number one priority and indeed the purchasing power of the people is an important determinant of the mobile penetration rate. This is evident from the low percentage of adoption of mobile stations in the rural as compared to the cities. Ghana does not produce any mobile equipment domestically. Imported phones are expensive due to the tariffs on these products.

6.3.2 Cultural factors

Cultural factors were identified as one of the factors that influence people preference and usage of mobile stations. For instance in Asia, the people have higher affinity for mobile stations than their counterparts in Europe. In some communities in Ghana, the people are of the view that mobile phones are for the rich and affluent people and they would never acquire one even when it falls within their means and no matter the gains it would bring to their small businesses. There is also the culture of sharing in certain societies is influences the adoption rate. Here if one person is able to acquire the handset, it automatically becomes the property of the family or community.

6.4 M-commerce Potential sectors for wealth creation

6.4.1 Rural Development

M-commerce and wireless communication can play a major role in the extension of services such health, education, social services, administration and civic participation, as well business investments to better the lots of the rural population. According to 1.2.2, wireless communication is been used in South Africa, China and India to enhance rural development and improve the delivery of services through emerging M-commerce models and schemes. This suggests that M-commerce has a major role to play in poverty and diseases alleviation. The potential impact of M-commerce on development can be enormous, particularly in terms of improved health, education, hygiene and nutrition.

6.4.2 Commerce

Mobile technology has been used to achieve global competitiveness in the area of commerce and as M-commerce grow and gradually takes over from E-commerce, the
competition in commercial activities such online bidding and auctions would even become intense.

6.4.3 Education

It is becoming increasingly clear that M-commerce and wireless communication would provide the panacea for improve access to limited educational resources to a larger population. Mobile communication has made it possible for students to access and participate in lectures and discussions from different locations sometimes, several kilometers away.

6.4.4 Job Creation

New jobs keep on emerging from the initiatives that mobile network operators are taking. Apart from the rise in employment by the network operators, service providers and vendors of various equipment for m-commerce due to the expansion of mobile services, more jobs have emerged from the ‘Space 2 Space’ business (See 4.7.1) as well sales of pre-paid cards. The S2S in its first year of operation created about 2,700 jobs with a turnover of 10 billion cedis (USD $1,098 million).

6.4.5. Health Delivery

Ghana currently faces acute shortage of doctors and other paramedical professionals. Currently the doctor-patient ratio is estimated at 1:20000. Moreover, the cost of health care is high and mobile commerce can help to reduce it. By using the technology of mobile commerce, physicians and nurses can remotely access and update patient records immediately, a function that has often incurred a considerable delay in the past. This improves efficiency and productivity, reduces administrative overheads, and enhances overall service quality. Telecare has taken off in the advanced nations and there is every probability that Ghana and other developing countries also can adopt the technology to address their health needs.
7 Conclusions, reflections and limitation of study

In this chapter we give our conclusion to the question this master thesis seeks to address. We also provide methodological reflection and ended the chapter on the limitations of the study.

The goal of this master thesis has been to inquire into the role of M-commerce in wealth creation and economic growth in developing countries. Our finding established that though Ghana is making waves in the expansion of mobile technology infrastructure, more barriers would have to be overcome at several levels.

The failure of developing countries to take advantage of the new information and technological revolution to aid its socio-economic development process will continue to marginalize and make it difficult if not impossible for them to achieve the high growth rate required to achieve the middle income status.

Research Question

The aim of this chapter is to find answer to our research question “How has M-commerce and wireless communication influenced wealth creation and economic growth in Developing Countries?”

Our discussion has been focused on the areas of business growth, increase in turnover, job creation as well as ‘indirect’ income through taxes and communities support from players in the mobile industry.

7.1 Business Growth

The adoption of M-commerce by the fisherman in the Effutu area is one case of success for M-commerce. The impact of M-commerce on the business activities of the fishing folks as well their business partners is seen as a positive development. According to the chairman of the Effutu Co-operative Fishermen Association, most of their members have been able to renovate or acquire new fishing boats in recent times, a situation which hitherto used to happen once in five years. Post-harvest losses, which used to be major concern previously, because communication between the farmers and fishermen was difficult has now been reduced to the barest minimum. One tomatoes farmer intimated that previously, the time a buyer arrived, about 40% of their produce had gone bad. Mobile technology has indeed brought transformation and increase in the businesses of the adaptors of the technology in rural Ghana.

At the Mireku farms limited in the Eastern region, it was confirmed that sales and marketing activities have been improved by the introduction of a new business model necessitated by the adoption of mobile technology. The communication and interaction between suppliers has also improved which has enabled the company now to maintain the appropriate stock levels of inputs such poultry feed.

M-commerce has helped reduce costs, significantly improved the manner and speed of communication between various business components (internal and external) and in doing so, it also has added convenience in the way businesses and the processes are performed.
7.2 Economic Growth and Wealth Creation

From the background statistics in chapter one and the theory in chapter two, the influence and potential of M-commerce in wealth creation and economic growth has been underscored in many sectors. M-commerce has brought about improvements in business processes with workable business models like the MTech business model earlier discussed in this study. Our studies have also shown that m-commerce has brought about customer satisfaction, cost savings, and new business opportunities. Relationships between business partners have improved which are all healthy development for business growth which would subsequently produce the needed economic growth.

It is evident from our study that M-commerce has made some gains on the economic activities and improves the social life of the adopters. In the informal sector of the economy of Ghana, M-commerce and wireless communication has generated a lot of jobs for the people. Extending these services to all the other deprived areas of the country will in by no means generate an avenue for wealth creation. This will undoubtedly continue to raise the living standards of the poor and the disadvantage. In order to maximize business value or net income, there are two fundamental measurable issues that must be considered. These are:

- **Cost reduction and**
- **Increased productivity or efficiency.**

Another useful yardstick here is elimination of waste which is both necessary in the element of cost reduction as well as increased efficiency.

**How M-commerce has reduced cost.**

By adopting M-commerce in using the new business model (MTech) as explained above, the MTech farmers and fishermen have been able to reduce cost in three ways.

- **Immediate market for their produce.**
- **Traveling of long distances to collect their moneys or send their produce to the markets.**
- **Long Storage and the tendency of their produces and catches going bad.**

The new technology has enabled both individual as well as co-operative farmers/fishermen the opportunities to do business with big customers in the cities and various markets who have cold stores and other storage facilities. These customers were hitherto buying from the middlemen or intermediaries. These customers are always ready to buy anytime information get to them about the catches.

**Community Services**

The two leading mobile network operators in Ghana support in diverse ways in poverty alleviation schemes in Ghana. GT and Areeba mobile communications provide social infrastructure such schools, good drinking water and scholarships for needy and brilliant children. These activities have direct impact on the social lives of the rural folks. Areeba is currently the number one company on the ‘Ghana Club 100’ which is the chart of the 100 top leading business organizations (based on annual
7.3 M-commerce and wireless communication infrastructure

Although Ghana’s telecommunication landscape in the last decade has undergone vast transformations which to some extent facilitated by a number of institutional and regulatory initiatives including the liberalization of the communication sector to encourage competition, the countries telecommunication and communication infrastructure is still far from being developed. Most or the rural areas are still ‘virgin’ as far as mobile communication penetration is concerned. Ghana still have a low teledensity of 2 telephone line per 100 and low teleaccessibility (a measure of household access to telecommunication service).

_The urban areas which have witnessed some explosion in the use of mobile phones services are currently suffering from poor quality of service as a result of the limited infrastructure of the mobile network operators and over subscription in these areas._

_Government must be in the forefront in providing support for the development, expansion and modernization of the nation’s communication infrastructure in order to achieve universal service and access to basic and value added telecommunication services, support and development of the local M-commerce industry._

In order to achieve the desired results in the fight against poverty and diseases alleviation and also to create wealth, M-commerce can play the role of enabler and with the needed attention granted by government and all stakeholders the results would be very encouraging. Among the areas that require urgent support are as outlined below.

7.4 M-Payment

There are still some dark clouds around the use of mobile stations to effect payments at both real and virtual stores. According to J.Jonker, 2003, Japan is the only country that has so far implemented effective mobile payment systems. In Ghana, though there is the use of debit cards, their functions are currently limited to withdrawing of cash from ATM machines. ECOBANK used to be the only institution that operated in credit cards until recently when SG-SSB introduced her trump-credit card product. There is currently only 0.2% bank clients that have access to credit card that could be used for online transactions. Internet banking in Ghana is virtually non-existent. Cash Payments forms about 95% at real stores whereas payments at virtual stores are about 0.15%. These statistics are however not encouraging for global business.

7.5 Methodological reflections

In this section we present our reflections on our thesis work. A look at that the methodological discourse pursued in our study as well as the limitations of the study and its implications on our results are further reviewed. In as much as we deem this thesis work consistent and logical in relation to our choice of theories, sampling and subsequently the highlights on the vital role of M-commerce on wealth creation and economic growth in certain deprived areas in Ghana, we also find it expedient to
discuss other aspects considered to be limitations which inadvertently might have influenced our results in different ways.

7.5.1 The single case study

Our intention or purpose has been to undertake a study on developing countries to ascertain the role of M-commerce in wealth creation and economic growth. We believe that we could have obtained a better results which could also had reflected some form of generalized view if our study had covered a minimum of four developing countries. Alternatively, we could also have considered one developed country as against a developing country. This would also have provided us a sound ground for better analysis. Though most developing countries share certain things in common and have similar challenges confronting them, it is also evident that no two countries can be treated same. Presented with a similar problem different countries may end up finding solution by deploying similar or different approach. This is sometimes influenced by national policies, technological growth, culture, education and the state of ones economy.

Thus one major factor in the design of our case study that might have limited the validity of our result is the selection of only one country. Even here, only four out of the ten regions were considered and this does not represent a good reflection on the whole country. Though a pre-study pilot research was done on the Philippines, South Africa, Senegal and Bangladesh, all developing countries where some form M-commerce schemes are being operated, information obtained were rather scanty and the sources which were all literature materials and journals could not be reached for authentication and further information.

The master thesis was necessitated by our deeper interest and our initial background knowledge in the perennial difficulties and problems such as poverty, diseases and stagnant economic growth confronting developing countries. Our choice of Ghana was motivated by our initial research carried out on the World Bank website to solicit information on the poverty levels and economic growth in developing countries. The highlights obtained on Ghana and also the fact that one of us is a native Ghanaian convinced us that by selecting Ghana we would be able to overcome some of the difficulties and barriers normally associated with this kind of study in the area of data collection.

In carrying out the empirical study, we obtained the assistance of a PhD student at the University of Ghana who intend recruited ten graduates to conduct the field interviews at our expense. All the costs involved in respect of allowances and bonuses were solely borne by us which was one major factor that affected our sampling selection or case study design.

In validating our data, we did a random follow-up on some of the respondents through telephone and e-mail. We must emphasize again that some of the results used might not be accurate due to our inability to authenticate the data obtained in any way.
7.5.2 Continuous research

Our research is not in any way exhaustive. There is still need for much research concerning this subject. Even in Ghana there are different conditions in different locations that could influence the adoption or otherwise of M-commerce. Extending the studies therefore to other locations and developing countries is needed in other to draw firm conclusions. It is evident that as of now very little research have been carried out on the role M-commerce in addressing social and economic problems in areas such as health, poverty alleviation and economic growth and it will therefore be very interesting to undertake further research there. The three segments of M-commerce thus services, applications and technology are all broad and therefore called for deeper research.
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APPENDIX A: INTERVIEW QUESTIONNAIRE TEMPLATE

Farmers and Fishermen (General)

A1. For how long have you been in this farming / fishing industry?

A2. How many employees do you have?

A3. How do you sell your produce?

A4. Which of the following influenced your decision to adopt M-commerce?
   a. Convenience
   b. Communication
   c. To reduce operational cost
   d. Just for fun

A5. Which of the following was a barrier in deciding to adopt M-commerce?
   a. Affordability
   b. Security
   c. Cultural Practice
   d. Other (Specify)

A6. What specifically do you use your mobile phone for?

A7. What has changed in your business since you started using the mobile device in business?

A8. Have you seen any significant improvement in your net income since you started doing business with your mobile handset? a. YES  b. NO

A9a. The M-commerce has improved your business relationships (choose one)
   a. Strongly agree  b. Agree       c. Don’t Agree       d. Strongly Don’t agree  e. Don’t Know

A9b. How has M-commerce influenced your business relationship? A9 Would you like to change operator in the future if others reach this area

A10. The M-commerce has helped to address one the problem of post harvest losses. (choose one)
   a. Strongly agree  b. Agree       c. Don’t Agree       d. Strongly Don’t agree  e. Don’t Know

A11. What were your main concerns before you started to adopt M-commerce?

Business Model

B1. How do you sell your produce?

B2. How do you receive payment for your sales?
B3. How do you interact with your customers and other business partners?

B4. What has changed in your relationship with your customers and bankers since you adopted mobile transactions

**Investment in M-commerce**

C1. What type of mobile device do you use? (Mobile phone or PDA)

C2. How much did you purchase the device?

C3. How often do you call your customers?

C4. How much do you spend monthly on your mobile device?

C5. What additional costs do you incur since you started using the new technology?

C6. Which network operator do you subscribe?

C7. What influenced your decision in selecting your operator?

**Economic Growth and Wealth creation**

D1. How many employee have you recruited for the past….X years (see A4)

D2. What was your average income before?

D3. What is your average monthly income now?

D4. What do you think has brought up this change?

D5. How do you see the future of M-commerce (Using mobile devices in your trade?)

D6. In all what impact if any, have M-commerce had on your business

**Payment Operators (Banks)**

E1. Do you support phone banking?

E2. Since when did you introduce phone banking?

E3. How does it work?

E4. What transactions can the customer conduct with the phone banking?

E5. What contribution has the phone banking made on your business since introduction?
E6. How has phone banking affected your customer base?

E7. How much do you charge for this service?

E8. What other online product or service do you provide or support (e.g., internet banking, online payment, credit and debit cards)

**Mobile Network Operators**

F1. When did you start operation in Ghana?

F2. How would you describe M-commerce in Ghana?

F3. What products/services do you provide?

F3a. Can you name them?

F4. How many regions/districts have you penetrated?

F5. Do you support any M-commerce scheme?

F6. Name the scheme and location

F7. How many subscribers do you currently have?

F8. What do you think are the main factors for your inability to penetrate the rural areas as the cities?

F9. Do you support any mobile banking?

F10. Which bank(s) do you collaborate with in this service?

F11. How is the customer response like?

F12. How much do you charge for the service?

F13. How do you see the future of M-commerce in Ghana?
## APPENDIX B

### Appendix B.1 Top 10 global investors and operators by proportionate equity subscribers (March 2005)

<table>
<thead>
<tr>
<th>Company</th>
<th>Africa</th>
<th>Americas</th>
<th>Asia-Pacific</th>
<th>Europe: Eastern</th>
<th>Europe: Western</th>
<th>Middle East</th>
<th>USA/Canada</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>China Mobile</td>
<td>0</td>
<td>0</td>
<td>161,645,969</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>161645969.2</td>
</tr>
<tr>
<td>Vodafone</td>
<td>7,288,849</td>
<td>0</td>
<td>25,997,189</td>
<td>4,634,736</td>
<td>87,347,550</td>
<td>0</td>
<td>20167051.5</td>
<td>145,435,376</td>
</tr>
<tr>
<td>China Unicom</td>
<td>0</td>
<td>0</td>
<td>118,033,000</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>145,435,376</td>
</tr>
<tr>
<td>Deutsche Telekom</td>
<td>14,586</td>
<td>0</td>
<td>15,005,351</td>
<td>42,580,100</td>
<td>0</td>
<td>18,271,000</td>
<td>75,871,037</td>
<td></td>
</tr>
<tr>
<td>America Movil</td>
<td>0</td>
<td>61,174,786</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4,763,682</td>
<td>65,938,468</td>
</tr>
<tr>
<td>France Telecom</td>
<td>4,144,502</td>
<td>1,261,272</td>
<td>395,008</td>
<td>10,914,884</td>
<td>39,366,489</td>
<td>176,000</td>
<td>0</td>
<td>56,258,155</td>
</tr>
<tr>
<td>Telefonica</td>
<td>963,079</td>
<td>36,066,948</td>
<td>0</td>
<td>0</td>
<td>19,099,894</td>
<td>0</td>
<td>0</td>
<td>56,129,921</td>
</tr>
<tr>
<td>NTT DoCoMo</td>
<td>0</td>
<td>49,676,541</td>
<td>0</td>
<td>725,184</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>50,401,725</td>
</tr>
<tr>
<td>Telecom Italia</td>
<td>0</td>
<td>12,057,974</td>
<td>0</td>
<td>24,803,692</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>36,861,665</td>
</tr>
<tr>
<td>SBC Communications</td>
<td>0</td>
<td>5,640,279</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>30,221,400</td>
<td>35,861,679</td>
</tr>
</tbody>
</table>

## APPENDIX B.2: Specifications of some major mobile stations

<table>
<thead>
<tr>
<th>Vendor &amp; Device</th>
<th>Operating System</th>
<th>Processor</th>
<th>Installed RAM/ROM</th>
<th>Input Method</th>
<th>Key Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compaq iPAQ H3870</td>
<td>MS Pocket PC 2002</td>
<td>206 MHz Intel StrongARM 32-bit RISC</td>
<td>64 MB/32 MB</td>
<td>Touchscreen</td>
<td>Wireless E-mail/Internet</td>
</tr>
<tr>
<td>Handspring Treo 300</td>
<td>Palm OS 3.5.2H</td>
<td>33 MHz Motorola Dragonball VZ</td>
<td>16 MB/8 MB</td>
<td>Keyboard/Stylus</td>
<td>CDMA network</td>
</tr>
<tr>
<td>Motorola Accompli 009</td>
<td>Wisdom OS 5.0</td>
<td>33 MHz Motorola Dragonball VZ</td>
<td>8 MB/4 MB</td>
<td>Keyboard</td>
<td>GPRS network</td>
</tr>
<tr>
<td>Nokia 9290 Communicator</td>
<td>Symbian OS</td>
<td>32-bit ARM9 RISC</td>
<td>16 MB/8 MB</td>
<td>Keyboard</td>
<td>WAP</td>
</tr>
<tr>
<td>Palm i705</td>
<td>Palm OS 4.1</td>
<td>33 MHz Motorola Dragonball VZ</td>
<td>8 MB/4 MB</td>
<td>Stylus</td>
<td>Wireless E-mail/Internet</td>
</tr>
<tr>
<td>SONY Cje PEG-NR70V</td>
<td>Palm OS 4.1</td>
<td>66 MHz Motorola Dragonball Super VZ</td>
<td>16 MB/8 MB</td>
<td>Keyboard/Stylus/Touchscreen</td>
<td>Multimedia</td>
</tr>
<tr>
<td>Toshiba E740</td>
<td>MS Pocket PC 2002</td>
<td>400 MHz Intel PXA250</td>
<td>64 MB/32 MB</td>
<td>Stylus/Touchscreen</td>
<td>Wireless Internet</td>
</tr>
</tbody>
</table>
In Appendix B.3, major WLAN technologies are compared in terms of maximum data transfer rate (channel bandwidth), typical transmission range, modulation techniques, and operational frequency bands.

### APPENDIX B.3: Major WLAN standards

<table>
<thead>
<tr>
<th>Standard</th>
<th>Maximum Data Rate</th>
<th>Typical Range (m)</th>
<th>Modulation</th>
<th>Frequency Band</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bluetooth</td>
<td>1 Mbps</td>
<td>5 – 10</td>
<td>GFSK</td>
<td>2.4 GHz</td>
</tr>
<tr>
<td>802.11b (Wi-Fi)</td>
<td>11 Mbps</td>
<td>50 – 100</td>
<td>HR-DSSS</td>
<td>2.4 GHz</td>
</tr>
<tr>
<td>802.11a</td>
<td>54 Mbps</td>
<td>50 – 100</td>
<td>OFDM</td>
<td>5 GHz</td>
</tr>
<tr>
<td>HyperLAN2</td>
<td>54 Mbps</td>
<td>50 – 300</td>
<td>OFDM</td>
<td>5 GHz</td>
</tr>
<tr>
<td>802.11g</td>
<td>54 Mbps</td>
<td>50 – 150</td>
<td>OFDM</td>
<td>2.4 GHz</td>
</tr>
</tbody>
</table>

### APPENDIX B.4 Issue Analysis Framework (Network Operators)

<table>
<thead>
<tr>
<th></th>
<th>Compatible User Merits</th>
<th>Communication Operators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Convenience</td>
<td>Cash-less (diversification of payment methods)</td>
<td>• Improved operability of terminal, hardware, screen flow, etc.</td>
</tr>
<tr>
<td></td>
<td>Easy operation of mobile phones</td>
<td>• Measure for instant disconnection</td>
</tr>
<tr>
<td></td>
<td>Easy operation of vending machines, terminals, etc</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Desired products can be purchased immediately</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Global availability</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Compatibility (not dependent on models)</td>
<td>• No dependence on models and restrictions within communication operators,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Compatibility within carriers).</td>
</tr>
<tr>
<td></td>
<td>Easily handle when starting service and changing models</td>
<td>Transferring information is possible when changing models</td>
</tr>
<tr>
<td></td>
<td>Many places and occasions to use the service</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Remote charging available</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Refer to Use history</td>
<td>• Can establish countermeasures when line is cut off.</td>
</tr>
<tr>
<td>Security</td>
<td>Countermeasures against theft and loss</td>
<td>• Suspension of use is possible</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Linkage with payment service providers</td>
</tr>
<tr>
<td></td>
<td>Countermeasures against spoofing</td>
<td>• Structure of individual authentication</td>
</tr>
<tr>
<td></td>
<td>Handling failures</td>
<td>• Clarification of point where responsibility changes</td>
</tr>
<tr>
<td></td>
<td>Measures of minors</td>
<td>• Filtering service (Limitation of access to contents for adults, etc)</td>
</tr>
<tr>
<td></td>
<td>Protection and control of personal information</td>
<td>• Protection of personal information</td>
</tr>
<tr>
<td></td>
<td>Safer than (or as safe as) existing cards</td>
<td>• Precisely grasping information on theft and loss</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Setting of credit limits. etc</td>
</tr>
<tr>
<td></td>
<td>Payment is securely approved (not seen by others, etc)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Products are bought safely</td>
<td>• Securing trust from users</td>
</tr>
<tr>
<td>Profitability</td>
<td>Granting points, coupons and giveaways</td>
<td>• Formulation of business model</td>
</tr>
<tr>
<td></td>
<td>Mutual use of points</td>
<td>• Enabling use of points gained at other stores</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Packet communication fee is expensive</td>
</tr>
</tbody>
</table>
APPENDIX B.5: Major cellular wireless networks

<table>
<thead>
<tr>
<th>Generation</th>
<th>Radio Channels</th>
<th>Switching Technique</th>
<th>Standards (Examples)</th>
<th>Percentage (cellular phone)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1G</td>
<td>Analog voice channels Digital control channels</td>
<td>Circuit-switched</td>
<td>AMPS TACS</td>
<td>12.1</td>
</tr>
<tr>
<td>2G</td>
<td>Digital channels</td>
<td>Circuit-switched</td>
<td>GSM TDMA CDMA</td>
<td>78</td>
</tr>
<tr>
<td>2.5G</td>
<td>Digital channels</td>
<td>Packet-switched</td>
<td>GPRS EDGE</td>
<td>9.6</td>
</tr>
<tr>
<td>3G</td>
<td>Digital channels</td>
<td>Packet-switched</td>
<td>CDMA2000 WCDMA</td>
<td>0.3</td>
</tr>
</tbody>
</table>

APPENDIX B.6 Issue Analysis Framework (Logistic Provider)

<table>
<thead>
<tr>
<th>Compatible User Merits</th>
<th>Logistics Firm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Convenience</td>
<td></td>
</tr>
<tr>
<td>Cashless (diversification of payment methods)</td>
<td>Realization of dedicated payment terminal (low cost, easy operation)</td>
</tr>
<tr>
<td>Easy operation of mobile phones (compared to cards)</td>
<td></td>
</tr>
<tr>
<td>Easy operation of vending machines, terminals, etc</td>
<td></td>
</tr>
<tr>
<td>Desired products can be purchased immediately</td>
<td>Smooth linkage from placing orders to shipment</td>
</tr>
<tr>
<td>Global availability</td>
<td></td>
</tr>
<tr>
<td>Compatibility (not dependent on models)</td>
<td></td>
</tr>
<tr>
<td>Easily handle when starting service and changing models</td>
<td></td>
</tr>
<tr>
<td>Many places and occasions to use the service</td>
<td>Realization of handheld dedicated payment terminal that is usable everywhere</td>
</tr>
<tr>
<td>Remote charging available</td>
<td></td>
</tr>
<tr>
<td>Security</td>
<td></td>
</tr>
<tr>
<td>Reference to use history</td>
<td></td>
</tr>
<tr>
<td>Countermeasures against theft and loss</td>
<td></td>
</tr>
<tr>
<td>Countermeasures against spoofing</td>
<td>Measures for signature free service to replace receiving signatures</td>
</tr>
<tr>
<td>Handling failures</td>
<td></td>
</tr>
<tr>
<td>Measures of minors</td>
<td></td>
</tr>
<tr>
<td>Protection and control of personal information</td>
<td></td>
</tr>
<tr>
<td>Safer than (or as safe as) existing cards</td>
<td>Face-to-face confirmation is possible</td>
</tr>
<tr>
<td>Payment is securely approved (not seen by others, etc)</td>
<td></td>
</tr>
<tr>
<td>Products are bought safely</td>
<td>Delivery of products to right address</td>
</tr>
<tr>
<td>Profitability</td>
<td></td>
</tr>
<tr>
<td>Granting points, coupons and giveaways</td>
<td></td>
</tr>
<tr>
<td>Mutual use of points</td>
<td></td>
</tr>
<tr>
<td>Merits generated by new service</td>
<td>Realization of new service including list cleaning</td>
</tr>
<tr>
<td>Low cost use of charge service</td>
<td>Promotion of delivery efficiency through applying of SCM</td>
</tr>
</tbody>
</table>
## APPENDIX B.7: Issue analysis framework (Payment Operator)

<table>
<thead>
<tr>
<th>Users</th>
<th>Credit card Companies</th>
<th>Banks</th>
<th>Communication Operators</th>
<th>Third Parties (Point conversion)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cashless</td>
<td>Diffusion of real Store terminals</td>
<td>Diffusion of real Store terminals</td>
<td>Simultaneous billing with telephone bills (agent)</td>
<td>Diffusion of real Store terminals</td>
</tr>
<tr>
<td>Easy operation of mobile phones (compared to cards)</td>
<td>Countermeasures for lowered security due to decrease in individual authentication patterns</td>
<td>Countermeasures for lowered security due to decrease in individual authentication patterns</td>
<td>Countermeasures for lowered security due to decrease in individual authentication patterns</td>
<td></td>
</tr>
<tr>
<td>Easy operation of vending machine terminals, etc</td>
<td>Reinforcement of local communication security</td>
<td>Reinforcement of local communication security</td>
<td>Reinforcement of local communication security</td>
<td></td>
</tr>
<tr>
<td>Global compatibility</td>
<td>Securing interoperability</td>
<td>Building payment infrastructure</td>
<td>Building overseas infrastructure</td>
<td></td>
</tr>
<tr>
<td>Compatibility (not dependent on models, etc.)</td>
<td>Not dependent on models Formation of application</td>
<td>Not dependent on models Formation of application</td>
<td>Integration of specification</td>
<td></td>
</tr>
<tr>
<td>Easily handles starting of service and changing of models</td>
<td>Realizes payment information management at the server</td>
<td>Realizes payment information management at the server</td>
<td>Sharing members among communication operators</td>
<td></td>
</tr>
<tr>
<td>Many places and scenes to use services</td>
<td>Expansion of merchants using debit service</td>
<td>Expansion of merchants using debit service</td>
<td>Simultaneous billing with telephone bills (agent)</td>
<td></td>
</tr>
<tr>
<td>Remote charging available</td>
<td></td>
<td></td>
<td>Expansion of compatible merchants</td>
<td></td>
</tr>
<tr>
<td>Countermeasures against theft and loss</td>
<td>Suspension of use shall be possible Linkage with communication service providers</td>
<td>Suspension of use shall be possible Linkage with communication service providers</td>
<td>Suspension of use shall be possible</td>
<td></td>
</tr>
<tr>
<td>Countermeasures against spoofing</td>
<td>Reinforcement of personal authentication and card authentication</td>
<td>Reinforcement of personal authentication</td>
<td>Diversification of personal identification methods via mobile phone</td>
<td></td>
</tr>
<tr>
<td>Countering failures</td>
<td>Recovery means shall be prepared Clarification of contact numbers</td>
<td>Recovery means shall be prepared Clarification of contact numbers</td>
<td>Recovery means shall be prepared</td>
<td></td>
</tr>
<tr>
<td>Measures for minors</td>
<td>Expansion of cards for minors Segmenting of upper limits when screening entrance</td>
<td></td>
<td>Checking used sites</td>
<td></td>
</tr>
<tr>
<td>Protection and control of personal information</td>
<td>Securing security of network and terminal</td>
<td>Securing security of network and terminal</td>
<td>Securing security of network and terminal</td>
<td></td>
</tr>
<tr>
<td>Safer than (or as safe as) present card</td>
<td>Preparing operations such as countermeasures against loss</td>
<td>Preparation of disbursement limits</td>
<td>Suspension of use using network</td>
<td></td>
</tr>
<tr>
<td>Payment shall be securely approved (not seen by others)</td>
<td>Countermeasures against card counterfeiting</td>
<td>Reinforcement of local communication security</td>
<td>Prevention of PIN leakage</td>
<td></td>
</tr>
<tr>
<td>Goods can be bought safely</td>
<td></td>
<td></td>
<td>Checking of used sites</td>
<td></td>
</tr>
</tbody>
</table>

**Convenience**

**Security**

**Profitability**