The Adoption and Diffusion of Information and Communication Technology in the Base of the Pyramid Population of Sub-Saharan Africa: A Study of Nigerian University Students

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A dissertation submitted to the faculty of the University of North Carolina at Chapel Hill in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the School of Information and Library Science.

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ABSTRACT

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The Adoption and Diffusion of Information and Communication Technology in the Base of the Pyramid Population of Sub-Saharan Africa: A Study of Nigerian University Students

Under the direction of Dr. Evelyn Daniel

The global environment is a complex network of people who are grouped using different types of information. In each country, people are grouped based on such information as age, race, ethnicity, educational qualification, income, occupation, and net worth. These socioeconomic descriptions of people have relevance in our current Information Age. This dissertation addresses a socioeconomic group, the Base of the Pyramid (BOP) population of Sub-Saharan Africa and investigates a sub-set of that population, the university students in Nigeria on their adoption of modern information and communication technology (ICT). The ICT tools and services that were looked at in this study were computers, Internet and mobile phones. Prior to conducting the study, theories and models of human needs, poverty, information seeking behavior, technology acceptance and diffusion as well as the literature on these topics was analyzed. Six research questions were asked and used to explore issues of ICT access, affordability, acceptance and adoption. The survey method was used to collect data from a self-selected sample of 300 students at the University of Uyo, Akwa Ibom State, Nigeria. Two focus group interviews were used to further examine the results of the survey. The data were analyzed and reported. The findings were that students accepted ICT and despite their extreme economic poverty, basic Nokia mobile phones diffused successfully. However, computer

technology, the Internet and smart mobile phones did not diffuse because the students could not afford expensive forms of ICT tools and services. The cost of computers was a significant factor that limited its adoption. A large proportion (79 percent) of study participants who could not afford to own computers accessed them at fee paid Internet cafés. The students used their basic mobile phones mostly for voice communication in part because advanced tasks like e-learning or Internet access were not supported by these basic phones. They desired their mobile phones to provide better support for their information seeking behavior. They desired additional features to their basic mobile phones – Internet access, music, longer battery life, location/logistics intelligence, support for their educational/field research and television. It was also established that factors in the mobile phone technology adoption model (MOPTAM) – personal factors (including technology advancement and technology orientation), perceived ease of use and facilitating conditions such as cost and quality of service influenced attitude towards the use of mobile phones. Overall, the students perceived mobile technology as an innovation that they could no longer live without and that it had the potential to help improve their lives.

DEDICATION

To my heroes: My late parents, relatives and grade school teachers for instilling in me the passion for academics and the love of learning. I am eternally grateful to them. Your dreams and labor of love live on.

ACKNOWLEDGEMENTS

A dissertation of this nature is a project that spans several years and it is never the work of one person. As a young physicist many years ago at the Polytechnic (now the University of Science & Technology), Calabar, Nigeria, I studied famous scientists such as Sir Isaac Newton. I can say that I have come to agree with Newton's famous saying that "If I have seen farther it is by standing on the shoulders of giants." My dissertation adviser, committee members and the writers, whose works that I have cited, are the shoulders on which I stand.

I thank the Lord Almighty for giving me the ability to embark on this study. He gave me an inner strength and wisdom to work on each piece at a time.

My utmost gratitude goes to my adviser, Dr. Evelyn Daniel, for being very supportive of me and the dissertation. She was always there to guide, discuss, answer questions, and read every draft. I requested weekend meetings a few times and she was always accessible. I thank Dr. Daniel also for working with the Dean of School of Information and Library Science (SILS), Dr. Barbara Moran, to provide a small grant that helped with my travel to Nigeria for the data collection. I could not have done this work without such interest and support from my adviser. Thank you so much, Dr. Daniel!

I am grateful to Dr. Paul Solomon for showing interest in me and my research ideas when I arrived at UNC Chapel Hill. He agreed to continue in my Dissertation Committee even when he took a new assignment at the University of South Carolina. I sincerely thank Dr. Jane Greenberg, Dr. Claudia Gollop and Dr. Valentine James for serving on my Dissertation Committee and working with

me through the different phases of the dissertation. I want to express my gratitude to other faculty members and staff at SILS and UNC Chapel Hill for suggestions, discussions and for helping move my research proposal through the UNC IRB process. I commend my fellow doctoral students at SILS and my social network for pointing me to relevant reading resources. My shout goes out to Dr. Stephen Bassey and my new friends at the University of Uyo, Nigeria who helped me with data collection. I am grateful to Dr. Cathy Zimmer of the Odum Institute, UNC Chapel Hill for providing valuable time to look at my data and for working with me through the data analysis phase. I thank Dr. Ita Ekanem, a retired official of the United Nations Economic Commission for Africa (ECA) for providing valuable insights on the socioeconomic issues confronting Sub-Saharan Africa.

Last, but not least, I thank my husband, Dr. James Etim, and our son, David. They provided the love and support that I needed to help me stay focused on completing the dissertation work.

PREFACE

This dissertation is a culmination of many years of education, experience, reflections, observations and research. Two internship opportunities, one at Shell Petroleum, Nigeria and the other at Cross River Television, Nigeria enabled me to develop interest in information and communication technology (ICT) research.

Another major opportunity that contributed to my interest in ICT and most importantly, how students in underserved communities perceived ICT in their small world was during the mid 1990s when I worked as a school teacher at the Mississippi Public Schools. I was teaching business and computer applications but without any computer in my classroom. As difficult as it was to do this, I did it for two semesters before help came from the State government. I represented my high school on a pilot program that was provided through a grant-funded project with the University of Southern Mississippi. I was trained to come back and teach a third course to my students, and that course were called technology discovery. The goal for adding the course to the curriculum was to help prepare students for job placement through the cooperative learning and work study program. With the new program, my classroom was fully equipped with computers and specialized tools that are used in different industries. My students' attitude toward school and learning changed. They came to class on time, paid attention during lessons, and enjoyed being on task through the 90 minutes of block schedule. Their interest in computers and other digital equipment like cameras was beyond belief. The students did more work than before, became very enthusiastic about the lessons and showed creativity in their work. Some of them shared with me their career goals, interests and the desire to go to college to further their studies. There were fourteen modules that

represented different fields/industries – computing/electronic communications, engineering designs via CAD/CAM, photography, the medical, oil drilling, etc. A student spent one week on a module and rotated through the fourteen modules during the fourteen weeks of a semester. A student's work and interest in each module was tracked and the data was used to provide career path recommendations to the program leads. My recommendations helped the students to be placed on jobs. This experience made me conclude that technology was highly needed by students and should be integrated into every classroom.

Other experiences that factored into having the motivation for an ICT research such as this included my ten and half years of work in software engineering with IBM Corporation, volunteering, the articles that I have written and coming to UNC to pursue a PhD at SILS. While I was at IBM, I volunteered each year through a statewide Engineers' Week (the new name is EWeek) program with local schools in order to encourage students to consider career paths in math, science and engineering. I volunteered in a middle school in Durham, North Carolina. I drew from my observations to write an article on integrating technology and the Internet in middle school classrooms. My recent publication (published in 2009) is an article that was written while in the SILS PhD program. It was done through a book project that was directed by one my dissertation committee members, Dr. Valentine James. That study has served as a guide and pilot for this dissertation because it looked at the role of ICT in impacting change in Africa.

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CHAPTER ONE

INTRODUCTION

Overview

The global environment is a complex network of people who can be grouped by their use of different types of information. In each country, people are also grouped based on such information as age, race, ethnicity, educational qualification, income, occupation, and net worth. These socioeconomic descriptions of people have relevance in our current information age. This dissertation addresses a socioeconomic group, the Base of the Pyramid (BOP) populations, their current information poverty conditions, and how modern ICT tools/services – computers, mobile technologies such as cell phones and the mobile Web, the Internet, and digital libraries - can be used to develop these underserved populations in order to alleviate their extreme poverty.

The Base of the Pyramid is an economic grouping that is used to refer to the four billion people in the world who live on less than two United States dollars ($2.00) per day (Prahalad and Hart, 1999; Prahalad and Hammond, 2002; Prahalad, 2006). The Sub-Saharan Africa (SSA) BOP region has between 900 million to one billion people who constitute the poorest one billion population of the world. This particular BOP group has been nicknamed, "The Bottom Billion" (Collier, 2007; Sachs, 2005; The United Nations, 2008).

The BOP and the Bottom Billion populations are wide-spread across many regions of the world. Several countries have people who fit into the description

of the BOP population. The World Resources Institute (*What BOP markets look like,* http://www.wri.org/publication/content/7941) identifies the largest BOP regions to be those in the developing countries of Africa, Asia, Eastern Europe, and Latin America. There are pockets of BOP groups also in the developed societies. In the United States for example, the Katrina-affected areas of Louisiana form part of the BOP population of the world.

Why is the development of the BOP communities an important global problem that must be examined in our current high technological and information society? The Secretary–General of the United Nations (UN), Ban Ki-Moon, in his January 7, 2008 Press Conference, *Off the Cuff*, declared 2008 as "the year of the bottom billion." He spoke about two powerful concepts, *global commons* and *global public goods,* as the building blocks of modern globalized information society. He went on to say that these concepts can only have meaning when we address the needs of the weak and the disadvantaged - the BOP people who have been excluded from the mainstream of our international community. They are the ones who suffer the most from grinding poverty (UN Secretary-General Off the Cuff, 2008).

In his book, *The End of Poverty*, Sachs (2005) describes how a country ascends the ladder of economic development. Using economic development to represent the rungs on a ladder with the higher rungs representing the path to economic well-being, about one billion people in the world, one sixth of humanity are described by Sachs as "too ill, hungry, or destitute even to get a foot on the first rung of the development ladder" (p. 18). These are people Sachs describes as the "poorest of the poor or the extreme poor of the planet" (p. 18).

BOP Grouping - Economic and Historical Perspectives

The Base of the Pyramid is also referred to as the *Bottom of the Pyramid* in some literature. Boyer (2003) refers to it as *B24B (business-to-4-billion)*. This research refers to it as the *Base of the Pyramid* or *BOP* for short. The historic use of the *Bottom of the Pyramid* concept is associated with President Franklin D. Roosevelt who governed the United States during the great depression. In his radio address to the nation about *The Forgotten Man*, he declared on April 7, 1932*:*

> *These unhappy times call for the building of plans that rest upon the forgotten, the unorganized but the indispensable units of economic power, for plans like those of 1917 that build from the bottom up and not from the top down, that put their faith once more in the forgotten man at the bottom of the economic pyramid.*

In recent literature, the development of the BOP concept is linked to three business strategists and influential academics: C.K. Prahalad, Stuart Hart and Allen Hammond. Prahalad and Hart, working together, released one of the first concept papers about the BOP in 1999. The paper, *Strategies for the Bottom of the Pyramid: Creating Sustainable Development,* helped to strengthen the logic for why and how the corporate sector might focus its effort on understanding and serving the four billion poorest people of the world who, according to Prahalad and Hart, were at the "bottom" of the economic pyramid. The BOP forms the vast untapped multi-trillion dollar marketplace in their view (Prahalad and Hart, 1999; Boyer, 2003). In 2006, Prahalad published *The Fortune at the Bottom of the Pyramid: Eradicating Poverty through Profits*. These management strategists (Prahalad, Hart and Hammond) proposed that corporations stop thinking of the BOP as victims, but instead conceptualize them as creative entrepreneurs as well as value-demanding consumers. These

strategists support the position that tremendous benefits can accrue to multinational corporations (MNCs) who choose to serve the BOP markets. They also advocate that the poor of today are the middle class of tomorrow. Hart's work is published as *Capitalism at the Crossroads* (2005, 2007 – 2nd edition). Hammond co-authored *The Next 4 Billion: Market Size and Business Strategy at the Base of the Pyramid* (Hammond, et al, 2007).

A colleague of Prahalad at the Ross School of Business, University of Michigan differs in his views about the BOP markets. Karnani (2007) argues that there is no fortune at the BOP, that for most multinational corporations (MNCs), the BOP market is actually very small. His position is that the only way to alleviate the conditions of the BOP populations is to focus on helping them to become producers, rather than seeing them as a market of value-added consumers.

I support Karnani about helping the BOP populations become producers and entrepreneurs but differ about his projection of the size of the BOP markets for MNCs investments. Despite the fact that most BOP people live on less than two U.S. dollars ($2.00) per day, I agree with Prahalad, Hart and Hammond that there is economic potential in most BOP markets, which are large enough to attract both large and small-scale investments as well as partnerships with the local entrepreneurs, businesses, government and educational institutions. Successful investments and partnerships, however, call for understanding the BOP people and operating under a willingness to seek out the mutual values that will allow all parties to benefit. Simanis *et a*l (2005) provide several operating guidelines for MNCs and other foreign investors in the BOP regions, some of which include:

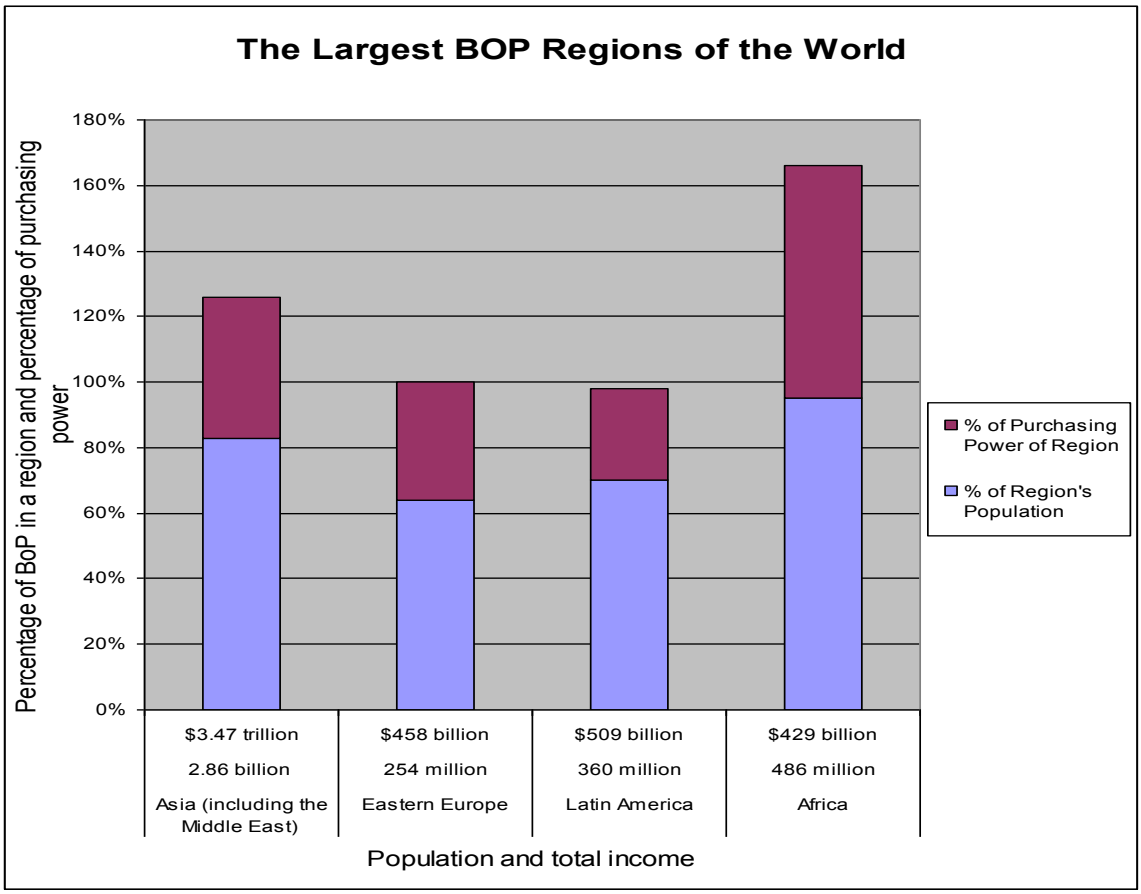
- Show respect and humility because all parties have something important to contribute
- Accept divergent views

- Recognize the positive, people that live on one U.S. dollar ($1.00) per day must be doing something right
- Co-develop solutions – mutual learning among MNCs, partners and BOP members
- Begin with a pilot test and scale using a modular pattern
- Be patient to win the trust of the indigenous BOP people
- Ensure that wealth generated through business activities in the BOP is shared equitably with the local community.

Distribution of BOP Markets and Populations

The World Resources Institute (2007) provides economic facts that tend to support Prahalad, Hart and Hammond's position that there is economic opportunity at the BOP markets. The BOP group is potentially an important global market with a total household income and spending of five trillion U.S. dollars a year. Prahalad and Hammond (2002) declare that the BOP consumers represent a vast, untapped, multi-trillion dollar market. This population is significant to global development and sustainability. Figure 1 below shows the distribution of the BOP markets by population, income, percentage of total regional population and percentage of purchasing power.

Figure 1: The Distribution of the BOP Region by Population & Income, 2007



Adapted from data provided by the *World Resources Institute*:
http://www.wri.org/publication/content/7941

From Figure 1-1, the following facts are determined:

- Africa is a smaller BOP market with a population of 486 million people and income of $429 billion. However, this BOP is the poorest, constituting about 95 percent of Africa's consumers with 71 percent of total purchasing power of all the people in the region.
- Asia (including the Middle East) is by far the largest BOP region with income of $3.47 trillion and population of 2.86 billion people. This BOP group records the most usage of information and communication technology (ICT) for sustainable development. It is also experiencing success in using ICT for economic development. Eze (2007)

interviewed Sangeeta Gupta, the vice president for India's National Association of Software and Services who stated that India's information technology sector employs over 1.5 million people and contributes 25 percent to the nation's gross domestic product (GDP). Eze also reported that India's GDP is over 700 billion dollars and the country has an annual growth rate of about eight percent. The BOP people in this region represent 83 percent of the Asian and Middle East population, and 42 percent of the purchasing power of the region.

- Eastern Europe is a BOP region with 254 million people with an income of $458 billion. It makes up 64 percent of the region's population, with 36 percent of the total purchasing power of the region.
- Latin America is a BOP market of 360 million people with income of $509 billion. The BOP represents 70 percent of the region's population and 28 percent of total household income.

Information and Communication Technology

Information and communication technology (ICT) is a term that is used to consolidate an array of technologies into one group. Kling et al (2005) provide the following definition and description of ICTs:

> Artifacts and practices for recording, organizing, storing, manipulating, and communicating information. Today, many people's attention is focused on new ICTs, such as those developed with computers and telecommunication equipment. But ICTs include a wider array of artifacts, such as telephones, faxes, photocopiers, movies, books and journal articles. They also include practices such as software testing methods, and approaches to cataloging and indexing documents in the library (p.11).

Information and communication technology plays an important role in development. It has economic, educational, social, institutional, and technical impact. One important factor about the educational and the social roles of ICT tools is that they are interpreted and used in different ways by different people. Social informatics researchers have found that people frequently interpret and interact with ICT tools in more complex and different ways (Kling et al, 2005; Newell et al, 1998). ICT tools are used in unpredictable ways, such as providing a mobile or land line telephone calling service, creating a computer-based search service via a desktop or a laptop client to access an Intranet or the Internet, the use of an e-mail tool, a digital library, or an indexed database.

ICT is Vital for Development

There is a need to use ICT tools and services to develop the BOP regions. One of several reasons is to help eradicate extreme poverty. A starting point is to look at ways to use ICT to build the infrastructure of the BOP countries. Such

infrastructural needs cover all industries including aviation, chemical, food processing and preservation, manufacturing, oil refinery, transportation, and waste management. Other areas where ICT has relevant applications are corporate governance, financial services, human capital development, education and literacy, libraries, hospitals, and governmental systems.

Castells (1996, 1997 & 1998) posits that information technology has combined with capitalistic market structures to create an Information Society. The paradox is that the transition to the new paradigm of the Information Society has created the world of the BOP or the "Fourth World". According to Donner (2008), the Fourth World is a world of marginalized peoples and regions that have been bypassed by information technologies. The people and the regions are not integrated nor are they able to participate effectively in information networks and exchanges, as well as the advanced production and consumption of the Information Age. This dissertation examines the use of ICT tools and services to help in the development and integration of a region of the Fourth World, Sub-Sahara Africa into the Information Age.

An extended analysis, including use cases about mobile technology innovation adoption in Sub-Sahara Africa is provided. The research investigates whether mobile technology offers an affordable way to access information as it has in the Asian (China, India, Bangladesh, Malaysia and Singapore) BOP regions. Does mobile technology innovation, now showing an exponential growth in the Sub-Sahara BOP region, offer a solution to the extreme poverty at the region? Are these ubiquitous devices more affordable and easier to use than the costly personal computers (PCs) and fixed land lines? These are some of the questions that are raised to guide the development of the theoretical framework (chapter 2) and the exploration of the literature (chapters 3 and 4).

Organization of the Chapters

The framework and literature review are grouped into four chapters. This chapter has introduced the topic and explained the BOP socioeconomic grouping. Information and Communication Technology (ICT) is also introduced and discussed.

Chapter two is devoted to the theoretical framework for the research. A few well-known theories or frameworks in social science research – poverty, information poverty, human needs and diffusion of innovation - are used to examine the information needs, extreme poverty and information poverty of the BOP populations. A World Pyramid that highlights information needs as core to human needs is developed. An aspect of diffusion theory – the diffusion of technology innovation, is extended to include the barriers or hindrances to mobile technology diffusion and adoption in Sub-Sahara Africa. Chapter two ends with the research questions that are raised for this study.

Chapter three examines the literature on the adoption of ICT tools, services, and ICT policies in the Sub-Sahara African BOP regions. Chapter three also delves into the diffusion of mobile technology innovation in the African BOP regions.

Chapter four discusses two types of electronic services (e-Services) in the Sub-Sahara BOP: e-business and e-learning. E-learning includes cases of digital library initiatives. The discussion is tailored to analyzing the state of these services, citing the technical and resource challenges that have impeded growth, as well as looking at breakthrough efforts to use these services for extreme poverty and information poverty reduction.

Chapter five, the research design describes the region and the location of the study as well as the population and sample. The methods that have been selected for the study – survey and focus group are discussed. The research model and the research questions that were developed in chapter two are used

to explain the variables in the study. The questionnaire items are developed for the survey.

Chapter six is the data analysis and discussion. The results of the survey and focus group interviews are reported and discussed based on the research questions that were raised for the study. PASW Statistics Version 18 (same as SPSS Statistical Package Version 18) is used to analyze the survey data. Descriptive statistics like frequency counts, percentages, and cross-tabulation of data items are provided followed by detail analyses using correlation and regression analysis statistics.

Chapter seven is the final chapter of the dissertation. This chapter provides a summary of findings, conclusion, recommendations and areas of further research. The summaries of findings are presented for each research question followed by the conclusion and recommendations that are based on the research findings. This study is ground breaking ICT research in Nigeria; there is much still to be done both in Nigeria and other Sub Saharan African countries. The chapter therefore ends with suggestions for further research studies that could expand this work. Some of the areas that are suggested for further studies include the use of longitudinal studies that use mixed methods like surveys, interviews, case studies, etc. to investigate patterns and trends of ICT adoption and use among university students, as well as among traders and merchants, professionals, university faculty, legal and health professionals in different parts of Sub-Saharan African regions. These studies are needed in order to support the people with the right set of technologies that could help improve their lives or help to sustain the development of the region.

CHAPTER TWO

THE THEORETICAL FRAMEWORK

Research Objective

In chapter one, the key concepts, the Base of the Pyramid (BOP) populations, information and communication technology (ICT), Sub-Sahara Africa (SSA), and the Bottom Billion were introduced and defined. In this chapter, the research framework is developed. The intent of the investigation is to examine theories and models that can help to explain how to use ICT to empower the Bottom Billion in order to reduce its extreme poverty.

Four important academic research areas are examined as the pillars and structures for developing this research framework.

1. The *poverty concept*, which includes extreme and information poverty is discussed and linked to the Bottom Billion in SSA.
2. Since extreme poverty has its roots in lack and survival needs, the *theory of human needs* as developed by Abraham Maslow and augmented by Clayton Alderfer is used as the underpinning theory to understand the BOP physiological needs and extreme poverty. The focus is on the bottom tier of Maslow's pyramid (his hierarchy of human needs) that addresses the physiological or existence needs. A World Pyramid of needs is developed for this study to show that the BOP populations are not only preoccupied with existence needs, but also that satisfaction of

information needs could help to meet other needs. A World Pyramid of Needs that includes information needs, other human needs and income is developed.

3. After the existence needs and poverty discussion, the technology structure is examined. The *mobile phone adoption model (MOPTAM)* and diffusion of ICT innovation are examined.
    - The MOPTAM is the selected technology model because it helps to explain the perceptions of individuals in adopting or not adopting a technology such as the mobile phones.
    - It will guide the investigation into what motivates the Bottom Billion, despite compelling economic needs and extreme poverty, to be willing to invest resources in owning and using mobile phones. MOPTAM is developed from a group of models including the technology acceptance model (TAM) and a unified theory of acceptance and use of technology (UTAUT) model. Both TAM and UTAUT could apply to computers and other technologies such as the Internet. Both TAM and UTAUT have been widely used in predicting acceptance of computers in developed societies. MOPTAM is a new model that has been tested in Southern Africa. This study intends to test MOPTAM in the Western African region.
4. *Diffusion of technology innovation*, as first developed by Everett Rogers, is brought into the framework to explain the process for the diffusion of modern ICT tools and services such as computers, fixed or land lines, mobile phones, libraries and the Internet within the Bottom Billion of SSA.
    - An attempt is made to understand technology innovation diffusion and information seeking behaviors of people in the SSA BOP - how the SSA university students use ICT to seek information for different purposes.

- Specific barriers or challenges that have been found in the literature as restricting adoption and diffusion in the region are identified and explained.

A model for this research is developed after reviewing relevant ICT research in the SSA region. I conclude the research framework with the research questions that will guide the investigation, data collection, analysis and discussion.

What the Research Excludes

Before continuing with the discussion of the various items that are outlined in the research objectives, it is needful to provide boundaries. The supply side of ICT in SSA, which encompasses an array of activities and the policies of the different nations for licensing the Internet service providers (ISPs) or restricting entry of international as well as local telecommunication companies (TELCOs), are excluded from this research. What is discussed in a later section of this research framework are some of the barriers to ICT adoption such as infrastructure and regulation.

A policy discussion in chapter three addresses the crafting and implementation of ICT policies by some of the countries. In no way does this research intend to investigate each country's ICT policies, but only summarizes a few cases that are found in the literature. This research explicitly targets the demand side, which looks at the actions of individual consumers who subscribe to telecommunication services. User goals like education, sources of income for livelihood and motivation for ICT adoption are important to this research.

The Poverty Framework

Since this research is conducted within a region in SSA, extreme poverty is discussed based on the literature written about the region by several development economists. There is general agreement in the literature that the SSA region, with exception of South Africa, is plagued with extreme poverty. The writers (Ayittey, 1992, 1998 & 2005; Collier, 2007; Easterly, 2007; Sachs, 2005; the United Nations, 2008; World Bank, 2008), however, lack consensus on what the causes of extreme poverty are and how it should be tackled. Some of the perspectives are discussed and emphasis is placed on using ICT to address critical needs, including information needs in order to alleviate both extreme and information poverty.

The issue of poverty has been studied by many economists and social scientists over time. In his book, *Towards a credible poverty framework: From income poverty to deprivation*, Saunders (2004) summarizes several definitions of poverty as part of his effort to develop a credible poverty framework. A few of these definitions are provided (italics added).

Seebohm Rowntree (1899):

> A family is counted as poor if their *total earnings* are insufficient to obtain *the minimum necessities of merely physical efficiency.*

Peter Townsend (1979):

> Individuals' families and groups in the population can be said to be in poverty when they *lack the resources* to obtain the types of diet, participate in the activities and have the living conditions and amenities *which are customary, or at least widely encouraged or approved, in the societies to which they belong.*

Joanna Mack and Stewart Lansley (1985):

> Poverty is an enforced lack of socially perceived necessities.

Amartya Sen (1992):

> Poverty is the *failure of basic capabilities* to reach certain *minimally acceptable levels*. The functioning relevant to this … can vary from such elementary physical ones as being well-nourished, being adequately clothed and sheltered, avoiding preventable morbidity, etc., to more complex social achievements such as taking part in the life of the community, being able to appear in public without shame, and so on.

The following is the World Bank (2008) definition of poverty and call to action:

> Poverty is hunger. Poverty is lack of shelter. Poverty is being sick and not being able to see a doctor. Poverty is not having access to school and not knowing how to read. Poverty is not having a job, is fear for the future, living one day at a time. Poverty is losing a child to illness brought about by unclean water. Poverty is powerlessness, lack of representation and freedom. Poverty has many faces, changing from place to place and across time, and has been described in many ways ... So poverty is a call to action -- for the poor and the wealthy alike -- a call to change the world so that many more may have enough to eat, adequate shelter, access to education and health, protection from violence, and a voice in what happens in their communities.

When the different definitions of poverty are examined, they fall into three main categories: *income poverty* which is the lack of sufficient income to meet needs; *capability poverty*, which is the lack of needed goods and services; and *participation poverty*, which is the lack of a range of things that can be done by individuals in a community (Ssewanyana, 2007). I propose a fourth category, *information poverty*. Childers and Post (1975) define information poverty as an *information void*. Chatman (1996) who examined information poverty from the social aspect, agrees with the Childers and Post definition. In recent years,

income poverty and information poverty have been associated with the lack of ICT tools and services to meet different needs (Bishop et al, 1999; ADB, 2003; Fisher, et al, 2004; Elijah & Ogunlade, 2006; Ssewanyana, 2007). My research focus lies in this area and I am therefore motivated by works of these authors to define information poverty as scarcity of tools and services such as ICT tools/services that can enable an individual or community to have access at any point in time to needed information. Such ICT tools include computers, telephones (land lines and mobile), radios, televisions; and services such as access to the Internet, telecommunication services and libraries.

From the different definitions raised, it is also evident that poverty is a socioeconomic and a multidimensional problem that has no racial or ethnic boundary. Indeed, poverty occurs in levels and has many causes. The World Bank (2008) discusses three levels – extreme, moderate and relative poverty.

Before discussing extreme poverty, part of the focus of this research, it is helpful to explain briefly moderate and relative poverty. Moderate and relative poverty are milder forms of poverty. With moderate poverty, Sachs (2005) explains that basic human needs are met, but barely.

Relative poverty is often identified and described in developed nations. Relative poverty can be measured using income levels. In the United States for example, the 2006 official Poverty Thresholds are provided in Table 1.

Table 1: The United States Census Bureau Poverty Threshold, 2006

One person (unrelated individual)	$10,294
Under 65 years	$10,488
65 years and over	$9,669
Two people	$13,167
Householder under 65 years	$13,569
Householder 65 years and over	$12,201
Three people	$16,079
Four people	$20,614
Five people	$24,382
Six people	$27,560
Seven people	$31,205
Eight people	$34,774
Nine people or more	$41,499

Source: **U.S. Census Bureau, Weighted Average Poverty Thresholds 2006**.

Extreme Poverty

According to the World Bank (2008), living in extreme poverty on less than two U.S. ($2.00) a day, means that a person is not able to afford the most basic necessities to ensure survival. Sachs (2005) defines extreme poverty as a situation that "… households cannot meet basic needs for survival. They are chronically hungry, unable to access health care, lack the amenities of safe drinking water and sanitation, cannot afford education for some or all of the children, and perhaps lack rudimentary shelter – a roof to keep the rain out of

the hut, a chimney to remove the smoke from the cook stove – and basic articles of clothing, such as shoes," (p. 20).

Sachs adds that unlike moderate and relative poverty, extreme poverty occurs mostly in developing countries. In his book, *The end of poverty: Economic possibilities of our time*, Sachs (2005) identifies the causes of extreme poverty as primarily hunger and disease such as malaria; and he says that it afflicts more than a billion people with most of them in Sub-Saharan Africa. Sachs cites many examples from his visits to the African BOP regions such as Malawi and Zambia to argue that prolonged destitution might put people at risk of not being able to recover from extreme poverty. According to Sachs, breaking the poverty trap will require foreign aid and investment to improve state planning, agriculture, technology, infrastructure, and health care, such as providing anti-malaria bed nets to combat malaria.

Another viewpoint on extreme poverty is presented by Paul Collier, an Oxford University Professor and Director of the Center for the Study of African Economies. In his book, *The bottom billion: Why the poorest countries are failing and what can be done about it*, Collier (2007) discusses an undisclosed list of fifty-eight countries that fall into his extreme poverty definition. According to him, 980 million people who live in "trapped" countries are heading toward a "black hole." This is a sub-set of the BOP population that is attracting most of the World's attention. Although his list is not published, he identifies some of these countries in many sections of the book. Some of the countries mentioned are Zimbabwe, Malawi, Ethiopia, Sierra Leone, Haiti, Laos, Burma, Central African Republic, Bolivia, Cambodia, Kenya, Nigeria, Yemen, and the Central Asian countries. The per capita income of these countries is very low and they are not the countries that companies are eager to invest in. According to Collier, many of the countries are not only falling behind in development but they are falling apart. They coexist with the societies of the 21st century but their reality is the 14th century because they are battling civil wars, plague, and ignorance.

While the rest of the world is developing, these extremely poor countries, the Bottom Billion are trapped. Collier identifies four traps – the conflict trap, the natural resource trap, landlocked trap (the trap of bad neighbors), and the bad governance trap. The countries in Collier's list are distinctive not only in being the poorest, but having also failed to grow. These countries are not following the development pathways of other developing countries. Collier agrees with Sachs on the issue of traps, but disagrees with him on how to approach the problem. Unlike Sachs who recommends foreign aid and investments, Collier sees foreign aid as a "headless heart syndrome". According to him, a headless heart syndrome with respect to aid is regarded as some sort of reparation for colonialism. It is a statement that shows that Western society is giving to the Bottom Billion countries because of the guilt feeling that these countries are victims of past colonial practices. Collier states that the key to ending extreme poverty rests in the Bottom Billion itself. He advocates the use of tools that have worked in other places for these extremely poor countries. In discussing the range of solutions for the landlocked trap, Collier pleads with the trapped countries not to be e-locked but to encourage e-services and telecommunication infrastructure investments because both have potential for economic growth.

> E-services now have the potential to deliver rapid economic growth. This is the story of recent economic development in India. Because India is a coastal economy, it has many options for global integration. The landlocked do not have such a range of options. E-services are attractive because distance is irrelevant. The twin pillars of being competitive in e-services are having good telecommunications infrastructure and having workers with post-primary education. Good telecommunications depend upon getting regulatory and competition policies right. It is a relatively simple matter to tell when they are wrong: prices are too high relative to global benchmarks and coverage is inadequate (p.60).

Other solutions that Collier puts forward include the need to strengthen the reformers in the Bottom Billon, engage in international standard-setting, and develop trade policy - that to date have been used for other purposes. He laments the fact that the agencies that control these standards do not have much knowledge or interest in the problems of the Bottom Billion.

Easterly (2007), a professor of Economics at New York University and a one time colleague of Collier at the World Bank, agrees with him on the headless heart syndrome analogy, and criticizes Sachs' aid and investments fix to the Bottom Billion populations. Why has development failed for the most part? Easterly attributes failed development to issues such as lack of accountability, emphasis on large plans instead of small with measurable goals, corrupt governments at the Bottom Billion countries, and the mindset of donor government and organizations. Taking the last item, for example, Easterly puts out a strong argument that development has failed largely because of the mind-set of donor governments, the World Bank, International Monetary Fund (IMF) and other donor/lending organizations. The donors, who in their home countries' economies no longer believe in central planning, continue to impose central planning on the recipient countries.

Easterly contrasts the activities of "Planners" and "Searchers". Planners are those who believe in command and control economics while Searchers are those who look for ways to make something work. In foreign aid, Easterly sees Planners as announcing good intentions but who do not motivate others to follow through while Searchers find ways to get things to work. Planners apply global blueprints while Searchers adapt to the local environmental conditions. Planners lack knowledge of the bottom of the pyramid while Searchers find out if clients are satisfied. In sum, Easterly's position is that the present day Western philanthropists are more likely to fail in the BOP regions like their predecessors because they are mostly Planners who lack knowledge about the BOP disposition.

The perspective provided by Ayittey (1992, 1998) links extreme poverty in Africa to past colonial exploitation and bad governance by the "African elites" who took over power from the colonial masters in the 1960s. In his *Africa betrayed* (1992), Ayittey describes how Africans were happy when they received independence in the 1960s from different foreign governments. Africans were hoping for a better future after independence but instead the African elites (leaders of the African countries) betrayed the people's hopes. These African elites were supposed to defend and protect the peasants' interests but instead, they are responsible for the institutionalized looting and capital flight that has plagued the African economy. An estimated 15 billion U.S. dollars equivalent leaves Africa annually to foreign bank accounts; this amount is more than what all African countries combined receives in foreign aid annually.

Unlike most of the other development economists, Ayittey uses a rich historical perspective to trace the problems to the present. He argues that Africa is rich in many natural resources such as oil, gold, manganese, copper, etc. However, the continent, despite its abundant natural endowment, is now in chaos, poverty and endless cycles of conflicts.

In *Africa in chaos* (1998), Ayittey says:

> By the beginning of the 1990s, it was clear something had gone terribly wrong in Africa. The continent was wracked by a never-ending cycle of civil wars, carnage, chaos, and instability. Economies have collapsed. Poverty, in both absolute and relative terms, had *increased*. Malnutrition was rife. In addition, censorship, persecution, detention, arbitrary seizure of property, corruption, capital flight, and tyranny continually plagued the continent…Infrastructure had decayed and crumbled in much of Africa [p. 8].

In his latest book, *Africa Unchained* (2005), Ayittey takes a less pessimistic approach to argue for solutions to a troubled continent. He proposes as part of the solution an indigenous development effort and entrepreneurship - a solution

that he is spear-heading in his home country of Ghana in West Africa. Professor Ayittey also makes a call to the younger generation of Africans, "the Cheetah generation," to rise up and take their continent back from "the hippo generation" (the group that he called the "African elites" in his previous works).

Approaches taken by Ayittey, Collier, Easterly, and Sachs, to the problem of poverty, economic development and foreign aid in the BOP have generated arguments among scholars. A mixed review of Easterly's book for example, is presented by Sen (2006) who sees Easterly's argument as helping us to realize why many grand schemes fail but who criticizes him for lacking a plan to fix the problem. According to Sen, Easterly has overblown his conclusions against aid in general and failed to recognize that some international aid has worked, such as the use of oral hydration therapy for diarrheal diseases, indoor spraying to control malaria and several other programs that have helped to slow down the spread of HIV AIDS.

According to the World Bank (2008), illiteracy and poor nutrition are major hindrances to the BOP populations. These BOP populations are also the agricultural laborers, and their illiteracy and poor disposition might prevent them from breaking out of extreme poverty. Karnani (2007) emphasizes his belief that the way out for the poor BOP groups is for society to help them to become producers who can enhance their own income.

The United Nations (UN) uses a perspective of goal settings and projects to attempt to tackle extreme poverty. During one of the largest gathering of world leaders at the Millennium Summit in September 2000, the leaders adopted the United Nations (UN) Millennium Development Goals (MDGs). These are a total of eight specific goals and the very first goal is to "Eradicate Extreme Hunger and Poverty." The MDGs are time-bound, with a target of 2015 (UN, 2002).

The UN Millennium Project that is overseeing the achievement of the MDGs has data showing that the world has made some progress but such progress remains to be seen in Sub-Sahara Africa:

> Sub-Saharan Africa is the epicenter of crisis, with continuing food insecurity, a rise of extreme poverty, stunningly high child and maternal mortality, and large numbers of people living in slums, and a widespread shortfall for most of the MDGs (UN Millennium Project, http://www.unmillenniumproject.org/goals/index.htm).

My position in discussing these different perspectives on extreme poverty is not to take sides but rather, to propose a refocus of attention on what is going on today in SSA; particularly with ICT acceptance and adoption by the populace. Although there are very few studies to validate it, ICT has been discussed generally as an important vehicle for poverty alleviation in impoverished communities (Bishop et al, 1999; ADB, 2003; Fisher, et al, 2004; Butler, 2005; Best, et al, 2006; Elijah & Ogunlade, 2006; Ssewanyana, 2007; Economist, 2008). With the current world economic meltdown, aid from the European Union (EU) and the United States to the poor nations is bound to decrease and these countries will have to utilize ICT to develop indigenous industries and grow important groups like the youth, students, entrepreneurs and women. The big question that I have for this research and it will dominate the literature review and the study is: Can Sub-Sahara Africa use ICT tools such as computers, mobile phones and ICT services such as digital libraries and the Internet to support development and tackle extreme poverty? Before I examine the next layer of the framework, I conclude this first segment on poverty with a discussion on how to measure it.

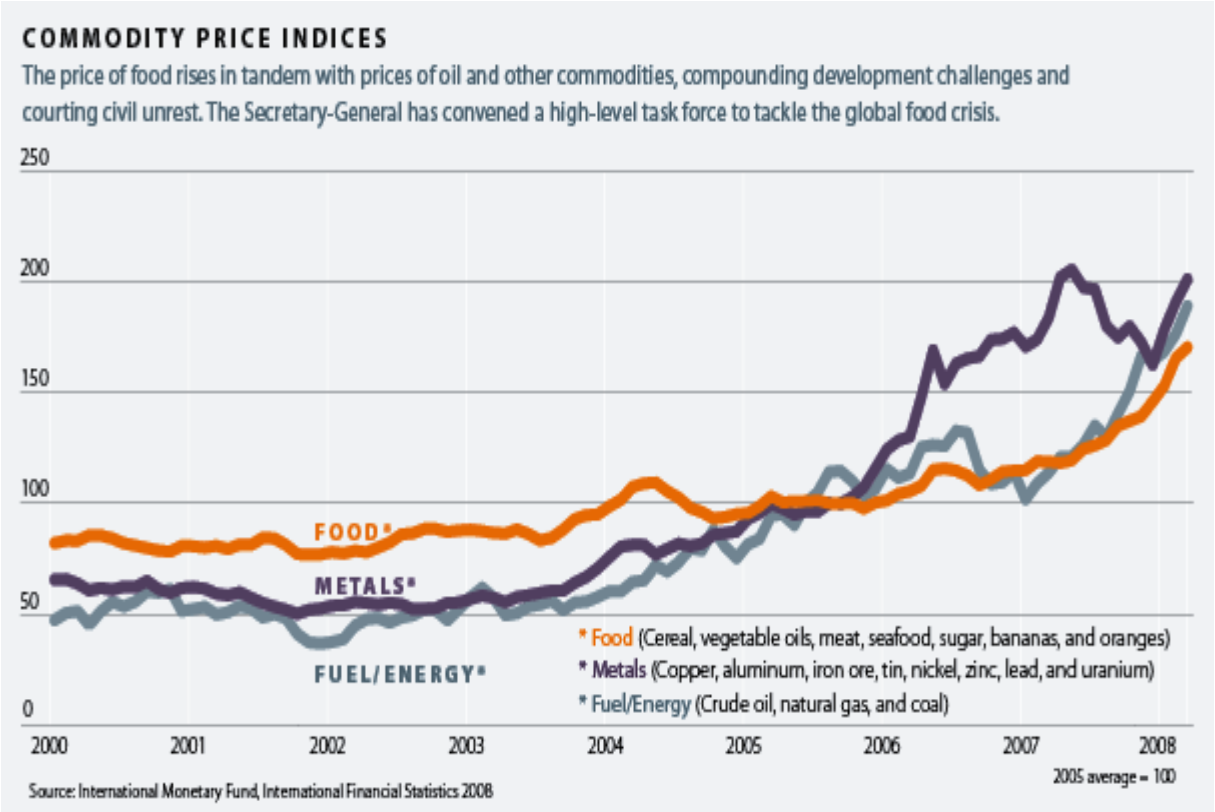
How to Measure Poverty

Saunders (2004) explains that any poverty measure must include two key ingredients of poverty – (1) that resources are inadequate to meet basic needs and (2) needs are only defined relative to prevailing community attitudes and

standards. This implies that human needs, including their information needs are pivotal when measuring poverty, particularly the BOP extreme poverty. According to the World Bank (2008), in order to know what helps to reduce extreme poverty overtime, we must define, measure, study, and even experience it.

Poverty can be measured using different indicators. The most popular ones are commodity prices, levels of income, consumption, and unemployment. Figure 2 shows the International Monetary Fund (IMF) commodity prices indices for 2008.

Figure 2: Commodity Price Indices for Measuring Global Poverty, 2008



I intend to measure extreme poverty in the study using the operational definition – living on less than two U.S. dollars ($2.00) a day (World Bank, 2008). As discussed in chapter one, living in extreme poverty, less than two

U.S. ($2.00) a day means that a person can barely meet the most basic necessities of life including an ICT tool or service for information access. This measure will allow information poverty to be measured in economic terms.

When *information* is combined with *poverty* as in information poverty, Haider (2006) infers that such combination portrays a sense of information being a *scarce commodity* and that many distinct groups of individuals, organizations, or even countries are perceived by their lack of information. The underlying assumption has to be that there is a "right kind" of information. Haider's proposition could be extended to include the fact that information poverty is scarcity of ICT tools and services that a person can use to access needed information.

Human Needs and Information Poverty

In addition to the poverty framework, the human needs theory as proposed by Abraham Maslow and Clayton Alderfer is discussed. An attempt is made to extend Maslow's pyramid of needs to include information needs. A World Pyramid of Needs framework is developed to situate information needs in a general human needs framework. Information poverty is linked back to the poverty framework and the BOP experience with respect to both information and human needs, is discussed.

Maslow's Hierarchy of Needs Framework

Abraham Maslow, in an effort to add to the theoretical understanding of his time in the field of psychology, laid out *A Theory of Human Motivation*. His theory was first published in the *Psychological Review* of 1943. In it, Maslow (1943) supported and extended one of his unpublished (earlier) conceptual papers. He arguably wanted to shift focus from the animal-centered motivation research of his era to human-centered motivation research. He first summarized the thirteen concepts or ideas that he considered vital for any theory of human

needs and motivation before he moved forward to discuss his theory of the hierarchy of human needs. The following list summarizes the concepts that were part of Maslow's human needs theory.

- The integrated wholeness of the organism must be one of the foundation stones of a motivation theory.
- The hunger drive (or any other physiological drive) is not the model for a definitive theory of motivation.
- The focus of a motivation theory should be on ultimate or basic goals rather than partial or superficial ones. It should center on ends rather than the means that are used to arrive at the ends.
- Various cultural paths to the same goal are usually available. Therefore conscious, specific, local-cultural desires are not as fundamental in motivation theory as the more basic, unconscious goals.
- Any motivated behavior must be understood to be a channel through which many basic needs may be simultaneously expressed or satisfied. Typically an act has more than one motivation.
- Human needs arrange themselves in hierarchies of pre-potency. That is to say, the appearance of one need usually rests on the prior satisfaction of another, more pre-potent need. Man is a perpetually wanting animal. Also no need or drive can be treated as if it were isolated or discrete; every drive is related to the state of satisfaction or dissatisfaction of other drives.
- Not only the integration of the organism must be taken into account, but also the possibility of isolated, specific, partial or segmental reactions.
- Motivation theory is not synonymous with behavior theory. The motivations are only one class of determinants of behavior. While behavior is almost always motivated, it is also almost always biologically, culturally and situationally determined as well.

Maslow's theory shows that people all over the world are motivated by the same universal needs even though they might use different *approaches* to fulfilling or

meeting the needs. As shown in Figure 3, Maslow ranked these universal needs in a hierarchy using a pyramid. According to Maslow, needs in themselves are far more universal than the paths that we take to meet those needs, for the paths are determined locally in the specific culture. Human beings are more alike than one would think at first. He explained that human needs cannot be fully satisfied because as one need is satisfied a new and higher need emerges. The basic needs of survival and security must first be gratified before a person seeks to meet higher needs such as love and esteem, and self-actualization.

Figure 3: Maslow's Hierarchy of Needs

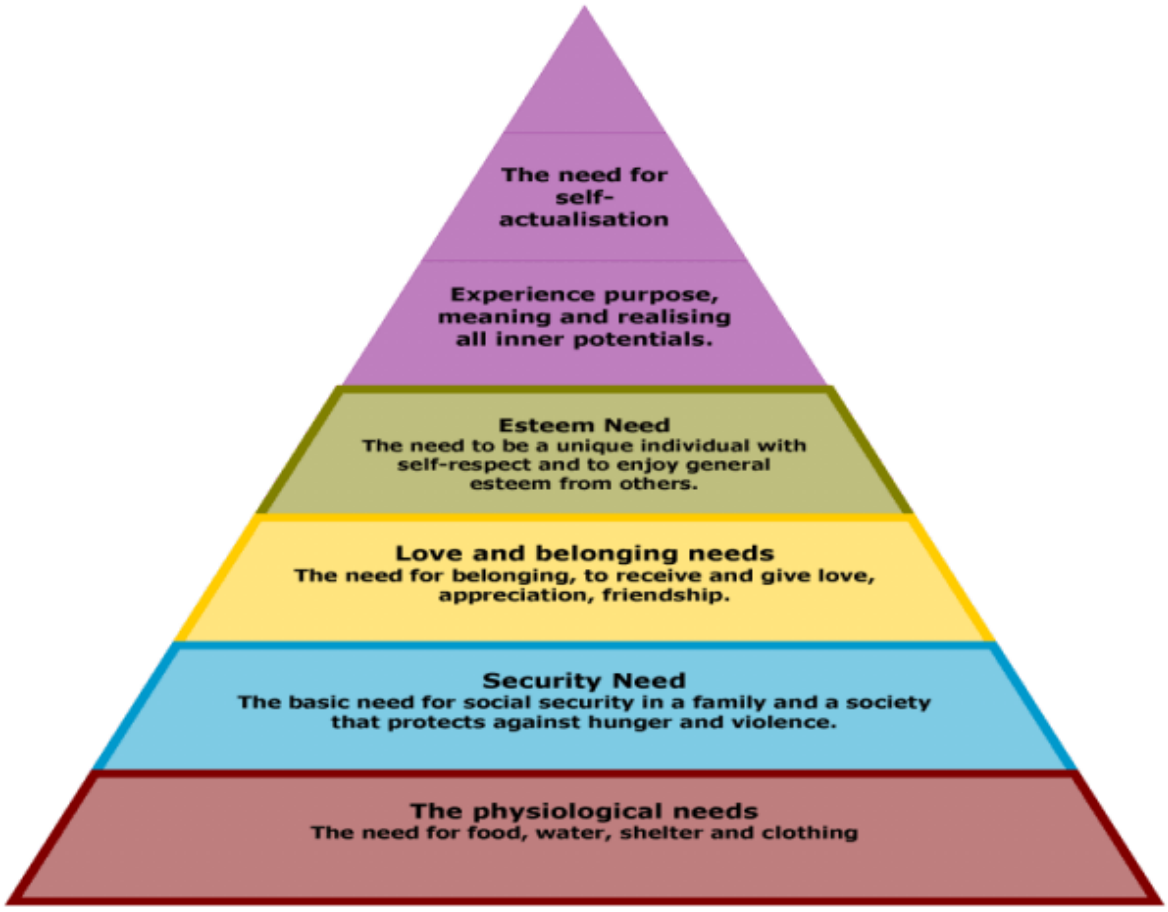


Image source: http://two.not2.org/psychosynthesis/articles/maslow.htm

According to Maslow, the appearance of one need usually rests on the prior satisfaction of another - "a more pre-potent need." He considered physiological needs as the most pre-potent of all needs. This means that if all the needs are unsatisfied, an organism is then preoccupied by the physiological needs while the other needs become non-existent or are pushed out of one's immediate consciousness. When the physiological needs of food, clothing or shelter are lacking, an organism tends to appear as though it is missing everything else in life. A person who is lacking food, shelter, safety, love, and esteem would most probably hunger for food and make every effort to satisfy that need before considering the other needs. When the physiological needs are relatively satisfied or gratified, then a new set of needs emerges – the safety or the security needs. This process continues until the self-actualization needs are gratified.

The emphasis on the physiological needs appear to indicate that human consciousness can be pre-emptied by these lower level needs. Maslow continued to argue that the receptors and effectors of the human brain that control functions such as intelligence, memory, habits, would be defined by the hunger-gratification principle.

> The urge to write poetry, the desire to acquire an automobile, the interest in American history, the desire for a new pair of shoes are, in the extreme case, forgotten or become of secondary importance. For the man who is extremely and dangerously hungry, no other interests exist but food. He dreams food, he remembers food, he thinks about food, he emotes only about food, he perceives only food and he wants only food. The more subtle determinants that ordinarily fuse with the physiological drives in organizing even feeding, drinking or sexual behavior, may now be so completely overwhelmed as to allow us to speak at this time (but only at this time) of pure hunger drive and behavior, with the one unqualified aim of relief (Maslow, 1943:374).

Another important fact that was raised by Maslow is that when a human being is preoccupied by a certain need, his whole philosophy of the future tends also to change until that need is met. A satisfied need ceases to motivate and is replaced by a higher level need.

One of the studies that has tested Maslow's theory in a business work environment was conducted by Clayton Alderfer (1969). Although this test was done in a workplace setting, it is important to understand that his findings have a general impact on human needs and motivation. He proposed the ERG theory to describe how human needs influence worker behavior. Alderfer proposed the ERG theory (1969) to support some facts and to address what he considered were the limitations for Maslow's theory. His ERG (Existence, Relatedness, Growth) is a three-fold conceptualization of human needs. In an empirical study of the needs of 110 employees at different job levels in a bank, Alderfer explains that although employees had needs that could be grouped into a hierarchy; there were only three hierarchies or levels and not necessarily the five levels that Maslow proposed in 1943. He mapped the three levels of needs to Maslow's five levels accordingly.

Existence needs > Maslow's Physiological/Safety needs
Relatedness Needs > Social and "external" Esteem needs
Growth Needs > Self-actualization and "internal" Esteem needs

Contrary to Maslow's proposition, Alderfer also argued that people could pursue different levels of needs simultaneously and that the order of satisfying human needs was not necessarily the same for every person. However, if higher level needs remain unfulfilled, individuals tended to regress to lower level needs that were easier to satisfy. This, he called the *frustration-regression principle.* The relevance of this principle to the world of work is that if an employee seeks to achieve upper-level needs but is unable to do so, the person becomes frustrated and regresses to focus on just performing the job to obtain wages that will help to satisfy the lower level needs.

Maslow's theory has undergone some empirical scrutiny but is still widely accepted in part because it was the start of a major shift from the behaviorists and reductionist study approaches to a more humanistic approach on motivation. A recent critic of Maslow, however, has been Steven Reiss, a professor of Psychology at Ohio State University. Reiss (1998) argues that there are only sixteen basic desires (needs) that motivate people's actions and define their personality. Using a questionnaire instrument, Reiss surveyed over 10,000 people from different backgrounds in the United States. He asked his subjects to rate which desires they found the most and least important to them at a point in time. Based on such desires, people could make sense of their conflicting behaviors.

Reiss' 16 basic needs include:

Power	the need for influence of will
Independence	the need for individuality
Curiosity	the need to think
Acceptance	the need for approval
Order	the need to be organized, to be stable, and to be part of a predictable environment
Saving	the need to collect
Honor	the need to be loyal to the tradition and values of one's clan
Idealism	the need for social justice
Social Contact	the need for friendship and peer relationships
Family	the need to raise children
Status	the need for social standing/importance
Vengeance	the need to strike back
Romance	the need for sex
Eating	the need for food
Physical Activity	the need for exercise
Tranquility	the need to be safe

What was unique about Reiss study was the fact that each person prioritized his or her basic needs. Such prioritization is unique for a person and could be used to determine or predict that person's behavior. Reiss also confirmed what was already known from Alderfer's 1969 study (ERG theory) that needs do not

necessarily tier as given in Maslow 's Pyramid of Needs, but that people's dispositions, actions and other factors define their needs. A limitation to Reiss study is that information was not provided about people's income level in order to determine their poverty level.

Information Poverty

Information poverty is closely linked to human needs and poverty. The human needs theory as developed by Maslow (Hierarchy of Needs, 1943), embellished by Alderfer (ERG theory, 1969) and recently extended by Reiss (16 basic needs, 1998) did not include information needs. Wilson (1981), in his research on human information-seeking behavior, developed an information seeking model that showed that information is needed to help tackle the different human needs. He illustrated his point by broadening health needs to include health information needs.

Wilson's work (1981) extends the human needs theory to the field of Information Science by identifying three types of information needs: (1) need for new information; (2) need to elucidate the information held; and (3) need to confirm information held. He argues that needs are subjective and various types of needs have been defined through deduction. For example, he cites Morgan and King (1971) who proposed that what motivates people to perform or behave in a certain way could be linked to three kinds of motives – physiological motives (hunger, thirst, shelter); unlearned motives (curiosity and sensory stimulation); and social motives (desires for affiliation, approval, and status). The concept of motive, though not the focus of this research, is very much linked to human needs theory and is implicit in the information poverty concept.

In recent literature, especially articles from the BOP regions, writers view lack of ICT tools and services as a form of information poverty (Elijah & Ogunlade, 2006; Ssewanyana, 2007). Therefore, the definition for information poverty can also be based on ICT. As stated earlier in this research framework, I define information poverty as *scarcity* of tools and services such as ICT tools/services that can *enable* an individual or community to have *access* at any *time* to *needed information*. Such ICT tools include telephones (land lines and mobile),

and services include access to the Internet, telecommunication services and libraries.

Information poverty has also been viewed from a social perspective by other information scientists such as Elfreda Chatman. In her ethnographic studies of information impoverished populations of women between 1983 and 1999, Chatman suggests that it was more than economic factors that led to the women's separation from needed information.

Using an earlier work by Merton (1972), Chatman identified social factors that constitute a small world being "lived in the round" and used groups that she called the *outsiders* and *insiders* to explain that world. This is the backbone of her information poverty research. Merton's study of worldviews identified two types of individuals and the networks they use for support and advice: *cosmopolitan* and *local.* When Merton's work is modified to fit Chatman's research among women in prison, *A Theory of life in the round* (1999), Merton's cosmopolitans became Chatman's *outsiders*, so called because they had an orientation and social behavior that was directed at keeping up with the interest and values of life outside the prison; that knowledge helped them to stay in touch with that other life. The *locals* were the *insiders*, the controllers of information networks within the prison because their interests were centered on the everyday reality of their immediate environment, the prison.

What does Chatman mean by "living life in the round" and how does that link to being information poor? Chatman states "Simply put, it's life with an enormous degree of imprecision and, surprisingly, accepted levels of uncertainty… Life lived in the round (like a prison or an elderly residential home) is a life in which certain things are implicitly understood. Played out in small world, it is composed of *language*, *worldview*, and *codes*" (pp. 212). Solomon (2005) opines that life in the round is making life manageable. To put it in the context of his *Rounding and Dissonant Ground* theory, "the way we manage information

in our lives is by *rounding* what we consider to be information, what strategies we employ to find information, what conditions lead us to seek information, and so on" (309).

Chatman (1996) summarizes her research with the worlds of janitors, single women in prison, and the aging population in a residential home by describing the impoverished life-world of the *locals* (insiders); impoverished because their interests were centered on the everyday reality of their immediate small world. She found that the existence of the two worlds of insiders (locals) and outsiders (cosmopolitan) created barriers to information seeking and sharing behaviors. She also found that *insiders* reinforce information poverty by not accepting sources of information that were not created or originated from themselves. Based on her findings in the ethnographic studies, Chatman concluded that the life experience of poor people is characterized by shielding needed information from outsiders; risk-taking and situational relevance. These social behaviors she observed were negative to information seeking. It is important to state that there were no statistical measurements applied because Chatman conducted qualitative ethnographic studies with her sample groups.

The relevance of Chatman's theory of *living life in the round*, Solomon's *rounding* and Chatman's *information poverty* theories to my BOP research is that it is worth the effort to examine how economically impoverished populations such as the Bottom Billion of SSA react to outside information – new information and technologies that do not originate from their insider world. Because of their economic poverty, the SSA lives are characterized by imprecision and uncertainties. The literature (see chapter three) raises awareness that despite their economically disadvantaged position, there is fast acceptance and adoption of the new mobile technologies. Are needs, including the need for information sharing and communication with the rest of the world, the motivating factor for the adoption of these technologies especially when the adopters are very economically poor and lack the basic infrastructure that supports effective use of

the technologies? Are the adopters educationally skilled enough to operate the technologies effectively? If the rate of adoption and penetration continues in the rapid fashion as it has to date, does it mean that the SSA information poor are willing to accept new realities with information and technologies to help meet their everyday communication/information needs? What are the influences of culture and the belief system in their acceptance of this innovation? These are questions; some will be addressed in this research.

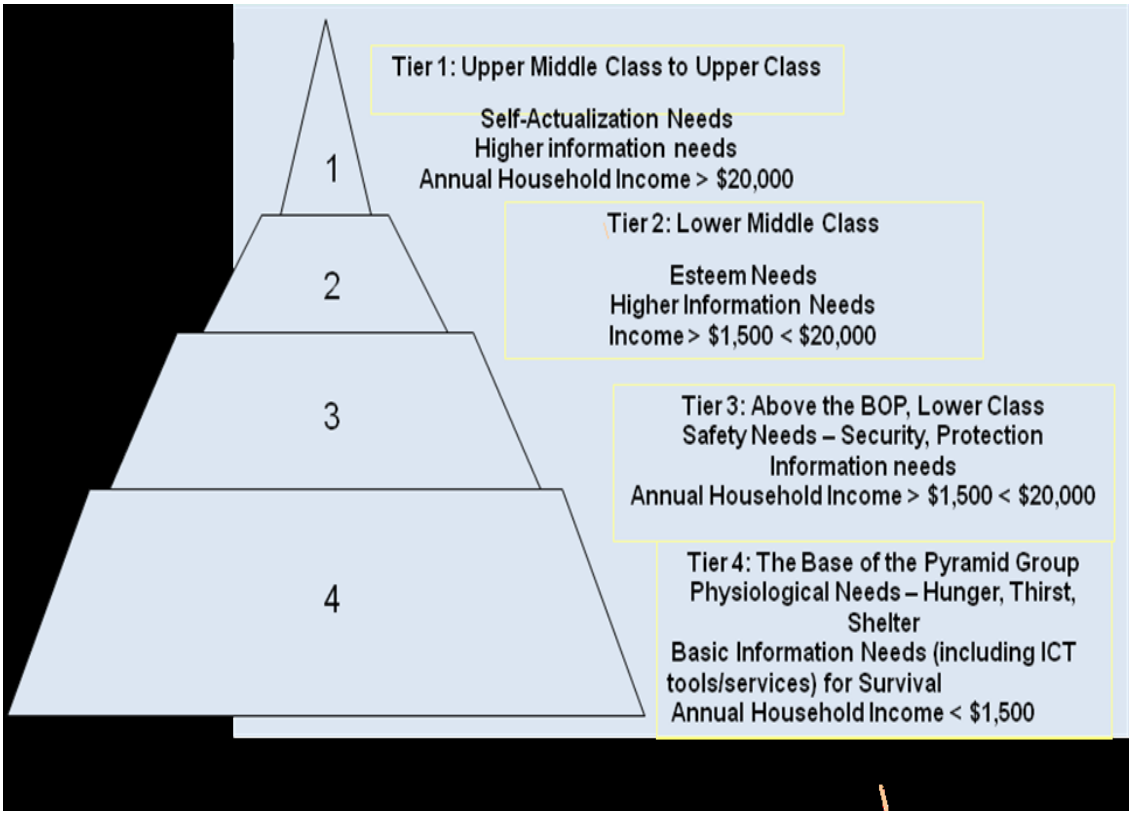
My Framework - A Pyramid of the World's Human Needs

The theories of human needs so far discussed, including Reiss' recent study (1998), did not include information needs. This research extends this important framework on human needs to the information science discipline to include:

1. Information needs for the BOP population.
2. An important addendum to the human needs framework - that needs do not tier, rather, needs overlap.
3. An important addition to the human needs framework - socioeconomic groups and their economic power.

Figure 4 is a redesign of Maslow's pyramid to include these three important additions.

Figure 4: World's Pyramid - Illustrating Human Needs and Economic Power



Linking Information Poverty and Needs Frameworks to the BOP Experience

Both information poverty and the human needs framework apply to the BOP populations. The BOP regions are faced with the issue of information supply in a two worlds' phenomenon – *the world of the haves* and *those who are looking for a chance to have.* With reference to information needs, it can be described as the *outsider's world* and the in*sider's world*. The *haves* live in a cosmopolitan or outsider's world with amenities and information access. They live on more

than $5 a day and can easily access information through libraries, the Internet, telephones, videos, and other ICT tools or services. The locals or the *insider's world* describes *those who are looking for a chance to have;* they are the impoverished BOP persons living on less than $5 a day but looking for opportunities to raise their net worth. The BOP population is therefore highly constrained. They lack the financial resources to purchase ICT tools such as telephones or computers, or ICT services. Moreover, since the BOP regions are predominantly rural, they lack basic infrastructure like a stable electricity supply, making the location of amenities such as libraries or information center kiosks very difficult.

These factors make the BOP communities the underserved population of our global space. Figure 4, the *World's Pyramid* is my attempt to develop a framework that includes both human needs, information needs and the economic power of the different tier groups. The BOP population is located on Tier 4 of the Pyramid when compared to the other world tier groups. The World's Pyramid also shows the overlap between the tiers with regards to both their needs and their economic potential. The number of people at the base of each tier is larger than at the top of that tier. Tier 4 is of particular interest to this research because it is the BOP tier.

I have combined Maslow's Hierarchy of Needs with Prahalad and Hart's Economic Pyramid (1999) model to create the World's Pyramid that illustrates human needs, including their information needs and their lack of economic power. The framework places *information needs* in the BOP tier as part of human *basic survival needs.* The BOP regions are not only constrained with basic needs such as clean air, food, drinking water, and shelter as Maslow's model portrays, but they are also faced with *basic information needs,* which helps with survival. Higher information needs that are shown on tiers 2-4 can bring about better economic empowerment and self-expression. With this understanding, the needs on Maslow's framework can no longer tier because

people at different tiers share a common need for information that can help in paving the way to meeting their other needs.

Additionally, Maslow's Hierarchy of Needs theory is often grouped with theories of workplace motivation and personality. Similarly, there is a need for the global society to motivate the BOP communities to join the Information and Digital Age. As was already discussed, Easterly (2006) cited an important group in the BOP, the *Searchers* whom the world can motivate and support with necessary tools so that they can work with their local BOP populations more effectively to reduce both extreme and information poverty.

As an individual or even a community moves up in relation to higher order needs, information needs become essential at each tier though they might be differentiated. At the physiological need level for example, a need to gather food, find shelter or get medical help will be alleviated by information tools such as cell phones. The ability to use such tools or information resources to reach out to families or providers of the services to meet the needs becomes essential. Opportunities to use such information tools can also arise in emergencies such as when one is sick and needs to reach a doctor or hospital for immediate medical care. In remote villages, hospitals are inaccessible because they are located many miles away in the cities. People are carried on the back of bicycles and motorcycles on non-motorable roads to the hospitals. In critical and emergency situations, cell phones can become a tool to save lives because healthcare providers can be contacted quickly and a clinic on wheels can reach the individual much sooner. The need for safety might arise during a storm, hurricane or tornado. During such critical moments, information tools such as cell phones become also very critical tools that can help information dissemination to save lives.

Information access and sharing for learning, research, and business strategy/management become the *higher order information needs*. The ability to

own and to use modern information and communication technology such as smart phones, computers, smart cards, or to access the library, and Internet databases to search for and retrieve information for various e-learning needs fit into the higher order information needs.

In the analysis on extreme poverty, scholars, despite their differences of opinion, tend to agree that extreme poverty is a very big threat to the Bottom Billion, especially those in Sub-Sahara Africa. Collier (2007) argues that if nothing else is done, the Bottom Billion will gradually diverge from the world economy over the next two decades. In addition, the Millennium Project that was cited in the discussion of extreme poverty has expressed early signs of lack of measurable results and a stifling of progress with the Millennium Development Goals (MDGs) in Sub-Sahara Africa. The way to start working towards a solution is to look at the Sub-Sahara Africa region as part of the global economic system and focus on direct funding of ICT infrastructure including transfer of technology and skills to help the people. Such activities should also include ICT training to enable effective use, information sharing, job creation, and sustainable development.

In the next layer of the framework, I discuss some of the barriers that can work against adopting ICT. I begin with the diffusion of technology innovation.

Diffusion of ICT Innovation and Adoption

I have developed the framework so far using the poverty framework, information poverty and human needs theories. I now examine diffusion of ICT innovation and adoption in SSA by building upon the perspective of Everett Rogers' diffusion of innovation theory. I discuss only the diffusion of technology innovation and the possible barriers to adoption of ICT innovation in SSA.

Innovation is defined by Drucker (1985) as *the specific instrument of entrepreneurship... the act that endows resources with a new capacity to create wealth.* Rogers (2003), whose diffusion of innovation model will be examined in this research framework, defines innovation as "an idea, a practice, or object that is perceived as new by an individual or another unit of adoption," (p.36). Orlikowski and Iacono (2001) posit that for technology innovation, researchers study diffusion of the innovation in order to know how many people, organizations, or nations have adopted the technology as well as the depth of the penetration or diffusion of the technology. This is an important assessment for my investigation because it includes an attempt to understand how ICT diffuses into university communities in SSA.

According to Quibria et al (2002), modern ICT innovation is roughly grouped into three categories depending on the type of use: computing, communication and Internet-enabled. The computing category is dominated by computers of different types such as hand-held, laptops, desktops, and mainframes. In the developed societies, computers have become an integral part of people's lives at home, school and the workplace. Human skills are augmented by the high speed and processing capabilities of computers. Moreover, the cost of computing has declined over the years, making it possible for businesses, institutions, organizations, schools, and homes to have many computers that are arranged in small peer-to-peer or complex networks in computer laboratories. Many businesses utilize computers for information and records management, enterprise resource planning (ERP), and a host of other business activities. The manufacturing industry uses computer-aided design and computer-aided manufacturing (CAD/CAM) techniques to design products.

The most common forms of communication technologies are the one-way communication media through broadcasting on radio and television. Other types of communication media are the two-way communication types that include fixed telephones lines, cell phones, other wireless devices, and faxes.

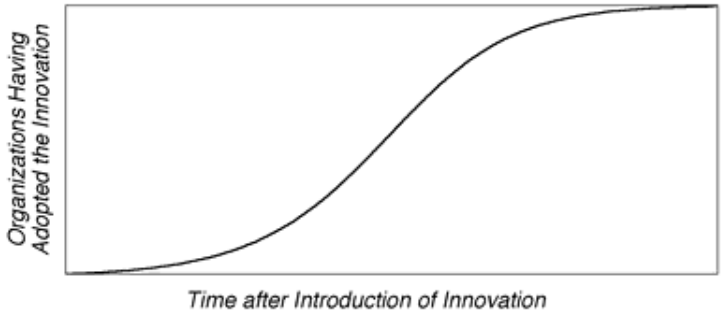
The sophistication in telecommunication tools and their software capabilities have revolutionized how we communicate. Communication and Internet-enabled ICT innovation have a bigger impact on our lives and society today. The Internet provides many-to-many, multi-faceted form of communication such as e-mail, Internet telephony, World Wide Web (WWW) connectivity, hypertext link management, Web page hosting, and searches. The Internet also provides chat rooms, newsgroups, instant messaging and other multimedia activities as well as social networking capabilities like Facebook, youtube, Twitter, LinkedIn, and a host of others.

Diffusion of Innovation Theory and Its Relevance to this Research

Before I focus on the challenges to the adoption of ICT innovation in the Sub-Sahara Africa BOP, I discuss Everett Rogers' diffusion of innovation theory and its relevance to my research.

Rogers' diffusion research started in 1957 with his dissertation work on the diffusion of agricultural innovations in a rural community of Collins, Iowa. In that agricultural research, he confirmed what was already known and applied in other fields such as marketing that most innovations took an S-shape rate of adoption over time (figure 5), that there were different channels involved at each stage of the innovation decision-process and that the early adopters tended to be the cosmopolitans who either have traveled extensively or have read widely. Rogers' additional work with rural farmers in Ohio further confirmed his earlier findings and led to the development of a general theory of innovation that was published in the first edition to his *Diffusion of innovation* in 1962. In this current (fifth) edition, Rogers discusses his model and employs case studies to support the universality of it.

Figure 5: An S-Shape Model of Innovation



In Rogers' definition of the term, *diffusion* as applied to the diffusion of an innovation, he has used four main elements to construct the definition; this is the foundation to his diffusion of innovation model.

Diffusion is (1) an *innovation* (2) that is *communicated* through certain *channels* (3) over *time* (4) among the members of a *social system* (Rogers, 2003:11).

The elements include innovation, communicated through certain channels, time, and social system. With respect to the ICT diffusion in the Bottom Billion of SSA, other elements are prominent. Usage is an important factor that affects adoption. Van Biljon and Kotze (2007) identify the ability to use mobile devices anywhere and anytime as one of the main factors that distinguishes them from stationary office-based ones. Mobile devices have incredible power for use in exchanging ideas at a distance and for managing daily lives (Donner, 2008). Wilson & Wong (2007) argue that government policy and regulation reform issues are particularly contentious and help to define winners and losers in the ICT sector of these African nations.

Other researchers suggest on affordability or cost as an important factor to ICT adoption in SSA (Rezaian, 2007; Business Week, September 2007; Elijah & Ogunlade, 2006; Butler, 2005; cellulular.co.za, 2004). These elements, *government policies*, *cost*, and the *usefulness* of the technology to enhance human lives can help to extend Rogers' elements and definition of diffusion of

technology innovation. If Rogers' definition is re-stated with these proposed elements, it would read: ICT diffusion is (1) an *innovation* (2) that has *government policy backing* (3) and is *communicated* through certain *channels* (4) over *time* (5) among the members of a *social system (6)* at *reduced cost (7)* and *easy to use*.

Rogers (2003) also developed an adoption/innovation model that divides adopters of an innovation into five categories. These categories are innovators, early adopters, early majority, late majority and laggards. Before I describe the five categories, it is important to understand that these categories are based on the rate of adoption of the innovation or the relative speed that an innovation is adopted. The attributes of an innovation, or how the members of a social system perceive an innovation, determines the rate of its adoption. Rogers identify five attributes: relative advantage, compatibility, complexity, trialability, and observability. I explain each attribute and relate it to mobile phone adoption.

Relative advantage is defined as the degree to which a particular innovation is believed to be better than the idea or product that it replaces. With mobile phone adoption, a relative advantage can be the convenience and choice of making a telephone call instead of trekking to hold a face-to-face conversation. Another relative advantage is accessing a remote resource via the mobile phone.

The compatibility attribute conceives the perception in the social system of the innovation's consistency with the value system and past experiences. With mobile adoption in SSA, this attribute might be lacking. Lagmia (2005) opines that some local chiefs resist mobile adoption because it goes against their beliefs and custom - an indication of an "insider" viewpoint that was discussed earlier.

Complexity measures the degree to which an innovation is perceived by the members of the social system as being difficult to use. Rogers (2003) argues that if a particular innovation is perceived as being difficult to use, its adoption

rate will show a downward trend over time. Beside the cost factor, the complexity attribute is one that has favored adoption of mobile phones (Butler, 2005; Elijah & Ogunlade, 2006; Srivastava, 2008).

The trialability attribute is the degree to which an innovation can be experimented upon on a limited basis. Mobile phone adoption offers trialability and this could be one additional attribute that has helped its diffusion. Individuals can contract for pay-as-you-go service phones and use those within a time period (Butler, 2005).

The observability attribute is the degree to which an innovation can be clearly seen as successfully adopted or not. With mobile phones, the evidence of successful adoption has been reported in many urban communities in SSA but is not so visible in most rural as well as economically challenged communities (Ssewanyana, 2007; Lagmia 2005; Elijah & Ogunlade, 2006).

The five categories of adopters identified above are now described. The innovators experiment with new technologies as soon as they appear. According to Rogers, innovativeness is the extent to which an individual, group is earlier in adopting new ideas than others within the social system. Van Biljon and Kotze (2007) have segmented the population based on the categories that Rogers provided. Innovators form a very small percentage of the population of adopters (2.5 percent).

The early adopters are those that are described as visionary and have an interest in technology for significant problems or tasks. The early adopters make up about 13.5 percent of the social system of the innovation.
Visionary individuals can consist of opinion leaders and change agents. Rogers (2003) describes "opinion leaders" as those who can influence others' overt behavior or attitude informally and in a successful way. This implies that opinion leaders can directly or indirectly influence technology diffusion by their

own adoption and use of the technology innovation. "Change agents," on the other hand, are those Rogers describes as capable of influencing clients' innovation decisions in a direction that is desirable by the change agency. Both opinion leaders and change agents invest great interest in ICT diffusion in SSA. Wilson and Wong (2007) outline some critical negotiation issues that change agents use in negotiating for the Internet in different African countries: policy reform issues, access issues, national ICT policy issues and technical issues. They also identify change agents as coming from the government, the private sector, the research and development community, non-governmental organizations (NGOs) and international organizations.

The early majority form 34 percent and they adopt not necessarily because they want to own another tool but because they are very pragmatic about what tasks they can accomplish with the tool to make work performance or day-to-day living easier.

Following the early majority are the late majority and the laggards. The late majority form about 34 percent of the adopters. They exhibit similar characteristics to the early majority but are less comfortable or interested with the innovation. The laggards comprise about 16 percent of the population and may never adopt the innovation.

Factors Inhibiting the Adoption of ICT to Meet Information Needs

The barriers for a person to adopt any form of ICT in order to use it for an information seeking event in a BOP population include an array of factors. Many BOP regions do not yet have an electric grid or telecommunication infrastructure like the cable system. Computing infrastructure is extremely expensive so that in some places, universities and libraries can only afford to equip computer laboratories and media centers through the purchase of old and used infrastructure that lacks connectivity to the Internet. The lack of schools or libraries in rural areas, extreme poverty, illiteracy, and training needs have led to the concept of a "Digital Divide" (Razaian, 2007; Conradie & Jacobs, 2003; Quibria, 2002). These factors pose critical barriers to a person who is seeking information in the BOP environment. My research attempts to investigate some of the barriers that affect the adoption of ICT.

Digital Divide

The issues of poverty that have been explored and discussed so far – extreme poverty, information poverty, economic hardship, minimal financial power, lack of ICT tools and services, health problems, and lack of access to the Internet for needed information expand into a broader concept of D*igital Divide*. The New Partnership for Africa's Development (NEPAD, 2002:8) states:

> The threat posed by the digital divide to the rapid development of African countries can on the whole be attributed to their inability to deploy, harness and exploit the development opportunities of ICTs to advance their socio-economic development. There is therefore an urgent need to put in place and implement ICT initiatives to bridge the digital divide at four levels namely (i) bridging the divide between the rural and urban areas within a country, (ii) bridging the gap between countries of a given

sub-region, (iii) bridging the inter-regional gap and (iv) bridging the gap between Africa and the rest of the world.

Taking the case of the divide within a country – between the rural and urban areas, it can be said that such a divide is both personal and communal. The BOP populations need basic information to sustain lives. There is a need to have information to help an individual as well as the community to have basic necessities such as food supply, drinking water, shelter, and health care. The report by the Washington University in St. Louis described in 2008 by C-SPAN TV, provides a remarkable example about Malawi, a BOP country.

Dr. Mark Manary, a Washington University School of Medicine pediatrician at St. Louis Children's Hospital, is using peanut butter foods (peanuts are widely grown in many regions of Africa) to treat malnutrition and this effort is saving the lives of children in rural Malawi. This revolutionary new method for feeding children in malnourished regions of the BOP could be adopted by other healthcare providers of rural malnourished children if the information were disseminated quickly to them. However, the parents of these malnourished children are isolated from any form of ICT; they cannot take action unless they hear about this trial feeding for survival program. ICT tools such as cell phones in the hands of the health care service providers and women in rural Malawi could become a powerful way to disseminate information about this and other trial efforts. Health care providers can use mobile telephones to communicate with the mothers of malnourished children. Figure 6 shows a picture of mothers at Montfort Health Centre in Nchalo, Malawi giving their malnourished children a trial feeding of peanut butter food as part of Dr. Manary's Project Peanut Butter.

Figure 6: Illustrating ICT Needs at the Rural BOP: Mothers at Montfort Health Center at Malawi Giving a Trial Feeding to their Malnourished Children

Story and image source: http://news-info.wustl.edu/news/page/normal/3602.html

One can raise a question about why some African children are malnourished if Africa is predominantly an agrarian economy. There are many reasons. An important one is linked to the lack an adequate infrastructure for food storage. There are no facilities to store extra foods during the season of harvest or plenty; therefore, the food supply is just enough to support the rural population during the season of harvest and about two months thereafter. The *hungry season* kicks in after the season of plenty. The *hungry season* is a BOP problem and Malawi is not exempt. Another reason is that in some years, dry weather conditions or drought produces a negative effect on the yields of food crops like corn, peanuts or millet. According to statistics from the World Food Program's Crop and Food Supply Assessment Mission in Malawi as reported by Washington University (2004), it is estimated that out of the 1.3 million people in Malawi, about 11 percent of the country's population suffer from food shortages during the *hungry season*, which usually lasts until the next harvest comes in.

Another divide that has lingered for so long and can be described in qualitative terms is the gap between Africa and the rest of the world. This is the gap that baffles many researchers and serves as a wakeup call for African countries. Targowski (2009) in a civilization index of world regions describes the integrated

infrastructure of Africa as *chaotic* while those in Europe are *good* and the Western-West/Japan are *very advanced*.

Intermittent Electricity Supply and Lack of Electricity Grid in Rural Areas

Electricity and other forms of energy supply that are used to power ICT tools like computers, mobile phones, radios, and television sets are in short supply in many BOP urban communities. Discussing the case of ICT in Nigeria, Ogunsola and Aboyade (2005) stress the ICT inhibitors, including the constant breakdown and low level of electricity supply in the universities, thereby making it difficult to run computer labs or university libraries and media centers effectively.

A major challenge that all SSA countries face is bringing ICT to rural areas (Conradie et al, 2003; Lagmia, 2005; and Ekanem, 2008). Many rural villages are yet to be connected to their nation's electricity grid (Conradie et al, 2003; Ekanem, 2008; Sachs, 2005). A typical SSA BOP village is inherently poor, illiterate and preoccupied with the basic needs of food, health and shelter. When the local government's rural electrification project has not extended the electricity grid to a rural village, people use paraffin lanterns for their household lighting (Ekanem, 2008). In an interview with Ekanem (2nd January, 2009), a retired United Nation Economic Commission for Africa (UN ECA) official, he described his observations of rural living and how people made daily trips to have their cell phones charged at the houses of a few other co-inhabitants of the village who can afford to power their homes with electric generators. For the rural poor, the issue of access to an electricity grid assumes great urgency.

Telecommunications Industry – Poor Infrastructure and Restricted Entry Policies

In addition to an inadequate electricity supply to power ICT tools, homes and small agrarian businesses, the BOP populations are challenged by the inadequate telecommunications infrastructure. In many BOP countries such as the ones in Sub-Sahara Africa, the government had full control of the telecommunications industry until the 1990s. Quibria et al (2002) argues that despite the increasing pressure for a competitive market in ICT, many BOP countries continue to maintain strong barriers against private sector entry because these governments have hiked up the costs of communication. Characterized by inefficiency, ineffectiveness and poor resource management, the government agencies that run the telecommunication services do not meet up to the people's expectations.

Some African governments have opted to privatize their telecommunication industries. Privatization has always been a recommended intervention strategy by aid providers, donor governments and lenders such as the International Monetary Fund (IMF) and the World Bank. The premise is to avoid large national debt and deficits, shift public expenditure patterns, and stimulate demand (Kozma, 2005). Despite privatization and lowering the barriers to entry for foreign companies in the telecommunication sector, these African governments still have a very important role to play in regulating the participants in the telecommunications industry in a transparent and effective manner.

In the case of Nigeria, the Center for Rural Development Cooperatives (2006) reported on an opinion poll for the Nigeria's National Communications Commission (NCC). The NCC is a government agency that was created by Government Decree Number 75 in 1992 to regulate the Nigerian telecommunications industry after its privatization in the same year. The 2006 Opinion Poll gathered opinion from stakeholders such as consumers, vendors,

and service providers. The 2066 respondents were drawn from all states in the country; the polling was done to obtain data about the NCC's effectiveness and transparency in regulating the telecommunications industry. Among the many findings, a large proportion of the participants in the survey (29.8% of individual consumers, 29.5% of corporate consumers, and 30.7% of service agents) considered NCC ineffective in performing its job. A significant number of participants (14.2% individual consumers, 9.9% of corporate consumers, and 19.8% service agents) did not indicate their opinion in the survey.

Even though the rural electricity grid has not reached many South African rural provinces, the country has made great strides in its telecommunication investments. South Africa has taken great steps to digitize its telecommunication and broadcasting industries. Langmia (2005) states:

> Digitizing the telecommunication and the broadcasting industries in South Africa was the only way for the country to go "global." This happened because the major roadblock that the country faced during the apartheid era was now something of the past. Thus, economic and technological development became a possibility.

South Africa is now a leader among its Sub-Sahara African neighbors in bringing Internet to its citizens. Classes in computer literacy for teachers of public schools were conducted in some of the provinces as early as 1999 to 2002. Potgieter (2004) concludes that such training allowed the national curriculum to be revised to include a compulsory technology course in three phases (grades 1-3, foundation; 4-6, intermediate; and 7-9, senior).

Uganda liberalized its telecommunication industry in 1996 and this action has attracted foreign investments. Ssewanyana (2007) reports on some of the ICT projects that have been initiated to address issues of poverty. The *Acacia* project, for example, extended the Internet to a few rural-based schools. The

MTN village-phone project sold mobile phones to women in many districts in Uganda. Despite these strides in Uganda, Ssewanyana argues that with eighty percent of the country's 28 million people living in the rural areas, modern ICT tends to benefit only the urban rich, while the poor have limited or no access.

According to International Business Machine Corporation (IBM, 2008) better ICT infrastructure means a great deal for African countries' development because they can participate in the knowledge economy in earnest by providing services that range from software development outsourcing to call centers for other world regions. This can only be possible if modern ICT infrastructure and training are extended to the Bottom Billion. According to Kevit Desai, the director of the Kenya Private Sector Alliance, a trade group in Nairobi, Kenya:

> The two pillars for Africa's transformation are energy and ICT. If you look at our history, you see that information has always been one way, coming to us through radio and television. It's never been interactive. But this interactivity of ICT could have a transformation effect on socioeconomic development (IBM, 2008: 20).

After the World Summit on the Information Society (WSIS) in 2005 at Tunis, the United Nation (UN) launched the Global Alliance for Information and Communication Technologies and Development (Global Alliance) in 2006 to provide a forum to address cross regional issues related to ICT in development. The Global Alliance forum was set up to address the importance of ICT in achieving the internationally agreed development goals, including the Millennium Development Goals (MDGs). The UN reported that the Global Alliance was a direct response to the need for ICT in development and that it is a people-centered and knowledge-based information society - supporting the achievement of a better life for all. The following objectives of the Global Alliance were outlined:

- Mainstreaming the global ICT agenda into the broader United Nations development agenda.

- Bringing together key organizations involved in ICT for development (ICT4D) to enhance their collaboration and effectiveness in the use of ICT for development and the achievement of the internationally agreed development goals.
- Raising awareness of policy makers on ICT4D policy issues.
- Facilitating identification of technological solutions for specific internationally agreed development goals and promoting pertinent partnerships.
- Creating an enabling environment and innovative business models for pro-poor investment and growth and for empowering people living in poverty.

The Alliance also acts as a "think-tank" on ICT4D-related issues and as an Advisory Group to the UN Secretary-General (UN, 2007).

Access to Computing Technologies and the Internet

More than one half of the 930 million to 1 billion inhabitants of the Sub-Sahara African region are less than 18 years of age (Collier, 2007; Razaian, 2007; IBM 2008). This large group of African youth needs to experience ICT education and Internet literacy because this group holds the key to Africa's economic, political, and technological future. The greatest resource for the development of Africa does not only lie in oil or energy as easily spoken by observers, but in developing the people, most especially the youth.

In a recent Internet café study in the South Eastern region of Nigeria, Etim (2009) reports that 90 percent of the Internet café users who were surveyed did not have access to computers at home or school. This dire need of computing technology has been barely supported by the privately owned and operated Internet cafés where people buy time to use computers for information access to meet different information needs. Langmia (2005), reports that in South Africa,

there were long queues to the Internet cafés that were established in some rural provinces. This implies that the demand for computing infrastructure and access far outweighs its supply. Internet literacy and accessibility is therefore a major setback to the people. The private sector can collaborate with institutions of higher learning to bring about a technological-based education and vocational skills transfer to the people of the SSA region.

Technology Acceptance, Literacy and Ease of Use

One of the theories that form the framework of this research is the diffusion of technology innovation. In the diffusion of an ICT innovation, the indigenous culture and beliefs are relevant to the acceptance or lack of it. Conradie et al (2003) argues that since most of the modern ICT tools originate from outside the traditional African culture, perceived benefits and acceptances including technology literacy are issues to address. In discussing the state of technology penetration in rural South Africa, Lagmia (2005) states: "One of the major setbacks for technology is consulting with local chiefs and councilors and making them see the need for Internet in their area" [p. 148].

Technology Adoption Model

The technology acceptance model (TAM) model developed by Fred Davis in the 1980s helps to explain some of the reasons people accept or reject computers. Among the many variables that might influence technology use, Davis (1989) suggests two: that people who are in a position to use an ICT such as computers are influenced by *perceived usefulness* and *ease of use.* Perceived usefulness is the degree to which a person believes that using a particular system or technology will enhance his or her job performance. Ease of use is the degree to which a person believes that using a particular system or technology will be free of effort [Davis, 1989]. One of the theoretical foundations of TAM is the

diffusion of technology innovations, which has already been raised and discussed in this framework. Adoption of innovations research suggests that ease of use takes prominence in the adoption of an innovation (Rogers and Shoemaker, 1971; Davis, 1989).

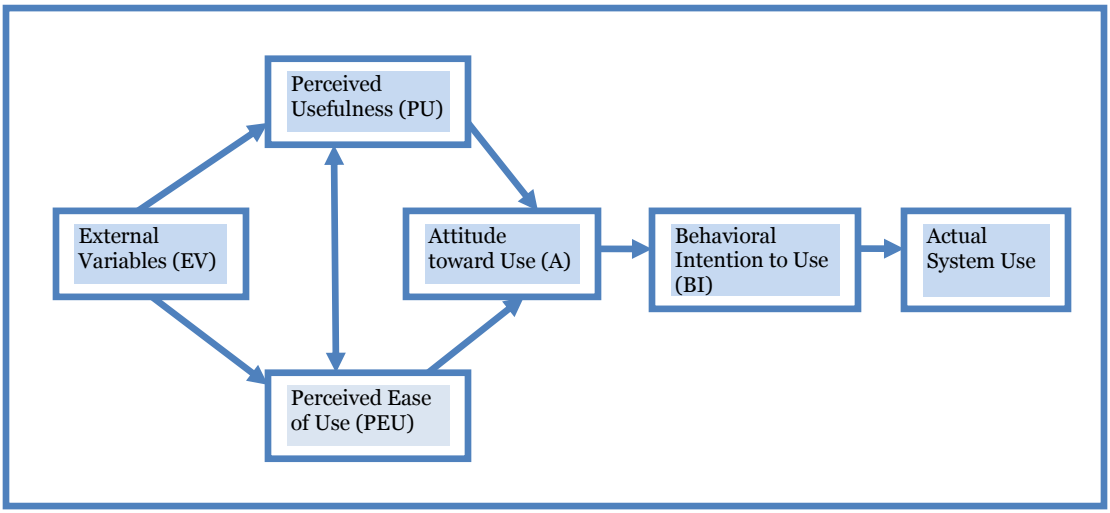
There are three main variations of technology adoption models in the literature. The first is the innovation diffusion model by the sociologist, Everett Rogers. This model has already been identified and discussed in this research framework.

The second model is TAM as developed by Fred Davis (1989). TAM is drawn from the theory of reasoned action, which has its base in the field of social psychology (Fishbein & Ajzen, 1975). This theory attempts to identify relationships between beliefs, attitudes, intentions and behavior. The focus here is only on technology adoption. There are six variables in TAM: external variables (EV), perceived usefulness (PU), perceived ease of use (PEU), attitude toward use (A), behavioral intention to use (BI) and the actual innovation (ICT) or system use. Figure 7 shows these six variables in TAM and their dependencies. The EV comprises demographic variables and prior experience; these influence both PU and PEU. Attitude toward use (A) is determined by PU and PEU variables. Behavioral intention (BI) to use is influenced by attitude (A) and PU. The actual use of the technology innovation is influenced by BI. These relationships can be expressed in simple algebraic terms.

$A = PU + PEU$

$BI = A + PU$ or $BI = 2(PU) + PEU$

Figure 7: Technology Adoption Model (TAM)



In a second variation, Van Biljon and Kotze (2007) opine that TAM assumes a "free" infrastructure or that the infrastructure is already there, but this will be such a risky assumption in SSA. In addition, TAM does not account for a user's prior usage experience in the measurement.

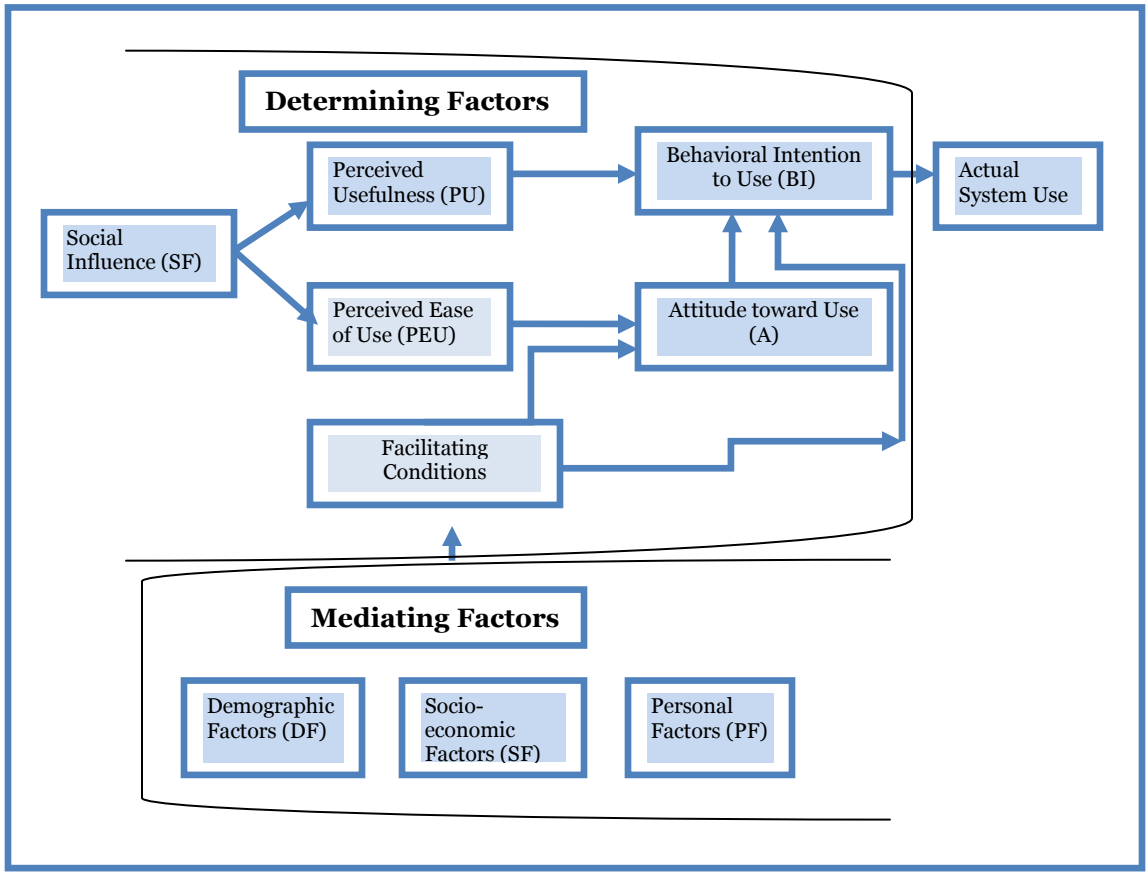
The third variation of the technology acceptance model is the Unified Theory of Acceptance and Use of Technology (UTAUT) model by Venkatesh et al (2003). The UTAUT model is drawn from several theories and models – the theory of reasoned action, TAM, the theory of planned behavior, diffusion of innovation, and motivational models such as Vroom's expectancy theory. The major addition from UTAUT model is the separation of mediation factors (expectancy, effort, social influence) from determining factors (age, gender, experience, and voluntariness of use).

Both TAM and UTAUT model have been applied to other technologies beside computers. Teo and Pok (2003) investigated the adoption of WAP (Wireless Application Protocol) enabled mobile phones among Internet users. They

reported that attitude was an important factor in the adoption of WAP-enabled mobile phones.

Van Biljon and Kotze (2007) extended TAM and UTAUT model in a study that surveyed 59 (39 male, 16 female, 4 did not indicate gender) undergraduate students from a South African university. Their model, Mobile Phone Technology Adoption Model (MOPTAM) is derived from TAM and UTAUT model. MOPTAM has both determining and mediating variables, which are grouped and linked in the model to show that both types influence the actual system use (Figure 8).

Figure 8: Mobile Phone Technology Adoption Model (MOPTAM)



The determining variables are the same as TAM, but external variables (EV) have been replaced with social influence (SI) and facilitating conditions (FC) have been added. SI is the set of cultural factors that influence PU and PEU. FC is the infrastructure, which includes the cost of the mobile phone, the cost of service, and the quality of service that the service providers set, based on their business models.

The mediating factors were not in the original TAM (figure 2-6a). The mediating factors include demographic factors (DF), personal factors (PF) and socio-

economic factors (SF). Demographic factors include age, gender, education, and prior technology experience or advancement. Personal factors consist of the user's perception of technology (technology orientation), derived from the five characteristics by Rogers – relative advantage, complexity, compatibility, trialability and observability. The socioeconomic factors are income and job-related status.

Van Biljon and Kotze used a multi-variant correlation (Pearson R) for their analysis. Significant positive correlations were found between technology advancement (one demographic factor) and the perceived ease of use (PEU) as well as with technology orientation (a personal factor). Socioeconomic factors (SF) were not tested because an assumption was made by the researchers that the study participants were from the same socioeconomic group. In addition, the researchers did not report the results of the other demographic factors (DF) such as age and gender on users' perceptions of mobile phone innovation. However, in a developed society study in Hawaii by Kwon and Chidambaram (2000), gender, age, income and occupation had no significant impact on users' perceptions about mobile phones (2000).

Some of the variables identified in Davis' TAM, Venkatesh et al's UTAUT model and Van Biljon & Kotze's MOPTAM will be tested in this research. I conclude this sub-section of technology acceptance, literacy and ease of use with a brief discussion about designing systems for users such as those in SSA.

The human-computer interaction (HCI) research community has emphasized ease of use in the design of technologies, such as the graphic user interface for users. Designers of information and communication systems have made great strides in designing systems and coding software that allow ease of use to be a reality in developed nations during the past two decades since Branscomb (1984), a former IBM vice president and scientist, advocated that it should no longer be necessary for a person to read a 300 page book before using a

computer. There is, however, a growing need for research on how to develop technologies that emphasize ease of use for the illiterate and those not familiar with technology like the new or prospective adopters in SSA. This research will attempt to extend ease of use research in SSA.

Aid and Funding Dilemma

Many donor organizations provide direct financial aid to the Sub-Sahara African countries to support development activities such as education, health, and public administration but not for ICT. Altafaj et al (2008), in reporting on how the European Union (EU) give aid to countries in ICT development explained that the majority of the recipient countries do not request direct aid for ICT as a sector because they see ICT as support the other sectors. The authors therefore recommend that recipient countries request and receive aid for ICT as a sector from donor governments. Altafaj et al also assert that this position resulted from the findings of the UN Task Force for Financial Mechanisms for ICT for Development that was commissioned during the 2003 World Summit on Information Society in Geneva. There is therefore an increased need for research that can support the critical role of ICT in the Bottom Billion Development.

Some economists like Easterly (2006) have criticized direct aid that Sachs (2005) supports based on a host of factors, including the fact that the recipient countries' leaders do not use the funds for the benefit of the poor and do not apply them to ICT. Collier (2007), on the other hand, has advocated that developed countries revisit the 1945 incident when the United State got serious about rebuilding Europe. The United States provided aid through the Marshall Plan, and created the General Agreement on Tariffs and Trade (GATT) that allowed Europe to be integrated into the U.S. economy.

Organizations providing aids and loans such as the United States Agency for International Development (USAID), the World Bank, International Monetary Fund (IMF), Organization for the Economic Co-operation and Development (OECD) can mandate what ICT investments the funds should be directed toward. Such an effort will help to extend ICT infrastructure and training services to the people and will directly engage the Bottom Billion populations.

Lack of Standards

Another big challenge is the development of standards that can allow an ICT service to be transferred to other Sub-Sahara African regions that have different telecommunication service providers (TELCOs). This is where the World Wide Web Consortium (W3C), International Telecommunication Union (ITU), and Organization for the Advancement of Structured Information Standards (OASIS) could step in to assist the BOP populations by creating new standards to govern the entire space of the mobile technologies. If at this time mobile banking is possible with SMS (text message), what should we expect as more BOP people get smart mobile phones for full Web access? In fact, The Economist (2008) argues that there could be "walled gardens" of specially adapted protocols for mobile devices.

Bank regulations

The central bank of each country oversees the well being of the financial sector, including regulating the banking system of each country. The regulations are different for each country. Moreover, some of the countries report that the TELCOs control the regulatory framework that affects mobile banking but not the central bank. This situation will need to be addressed before a mobile banking service functions properly. Kenya, the country in which the *M-PESA* (a mobile banking project in Kenya) was launched in 2007, is one of the few

countries that has been fortunate enough to have a central banking system that regulates the mobile banking business.

Internet Security Concerns

During the World Bank Conference that I attended on November 18, 2008 on the topic, "Enabling Mobile Transformation in Africa: Next Generation Mobile Services for Government, Health, and the Financial Sector," one of the main concerns raised by Kenya and concurred with by other African countries who are exploring mobile banking option was that of securing Internet and mobile banking transactions. Kenya, the owner of M-PESA, agreed that security was one of its biggest challenges. Tanzania participants shared that one of their biggest concerns about M-PESA was data security and how to handle the legal framework at the international level when services are conducted across borders. Although there was general agreement that data security was underdeveloped in all the Sub-Sahara African regions, not many solutions were offered to the countries during the conference. The World Bank took this as something that will receive future attention. The issue of data security is strongly tied to the creation of workable standards by different bodies.

Other common issues that limit the availability and use of ICT among the BOP groups include network readiness, large levels of unemployment, wage inequality, cost of purchasing and keeping an ICT tool/service, economic and financial poverty, sickness and disease, and civil conflicts.

The World Resources Institute (2007) asserts that the evidence of BOP penalties is seen in many different sectors. Mid-market households, those that Prahalad and Hart (2002) grouped as making between $1,500 and $20,000 a year, are seven times as likely as BOP households to have access to piped water or electricity, whereas many BOP households do not. BOP households have

significantly lower ICT spending especially those in the rural areas and are significantly less likely to own fixed telephone lines than rural mid-market households or even urban BOP households (Ssewanyana, 2007). This is consistent with the broad lack of access to ICT services in rural areas. The global wealth distribution therefore shows a wide gap between the rich and poor. Prahalad and Hart (2002) indicate that the growing gap between the rich and the poor in the world is reinforcing the known fact that the poor cannot participate in the global market economy even if they constitute 80 percent of the world population.

The Bottom Billion and the Internet Economy

The Bottom Billion countries are currently *outsiders* to the global Internet economy and there is a pressing need to include them in this Internet economy. During the Organization for Economic Cooperation and Development (OECD) ministerial conference on the Internet in Seoul, and as reported by U.S. Department of State (2008), the Coordinator for the International Communications and Information Policy, Ambassador David A. Gross remarked that the Internet has evolved from "an interesting technological phenomenon into a fundamentally important phenomenon known as the Internet Economy." Ambassador Gross, addressing the participants at the October 2008 International Telecommunication Union's Global Standardization Symposium in Johannesburg, South Africa, explained the dynamic aspects of the global Internet economy including the basic functions of the markets. Instantaneous communications fostered by the Internet has allowed entire industries to be linked together. In recognition of the fundamental importance of the Internet, the OECD economies agreed on a common goal of promoting the Internet economy and stimulating sustainable economic growth by means of policy and regulatory environments that support innovation, investment, and competition. The OECD countries also agreed to work together to promote ubiquitous access to ICT networks and services to enable widespread participation in the Internet Economy (U.S. Department of States, 2008).

If indeed the OECD member countries are working together to promote ubiquitous access to ICT networks and services, then the Bottom Billion countries cannot be ignored or left out indefinitely. The Bottom Billion countries can be brought in and viewed as partners in the development process instead of keeping them in their current position of *outsiders* to the global economic system. The OECD has broadened membership to non-European countries such as Japan, Korea, Mexico, and the United States. Admitting the Bottom Billion countries of SSA into membership is equally an admission into the *Internet Economy*. It is a direct way of enabling these countries to share and understand better the Internet economy so that they can become partners in an information age and the knowledge economy. It can also provide a way for developed countries to help the poor nations in ICT policy formulation and implementation of such policies. Currently, OECD has no member from the Sub-Sahara African region. South Africa is the only SSA country that is included under the list of "enhanced engagement country." For information about OECD member countries, see http://www.oecd.org/countrieslist/0,3351,en_33873108_33844430_1_1_1_1_1,00.html.

Sample Studies and Cases

A few studies that have been cited already have looked at ICT and socioeconomic development in developing countries. Some of those studies are Quibria et al, 2002; Elijah & Ogunlade, 2006 and Ssewanyana, 2007. Quibria et al conducted an analysis of ICT, education and income in selected Asian countries; the analysis showed a strong association between ICT adoption and socioeconomic characteristics. I have selected the two studies for the SSA region to discuss: Sswanyana and Elijah/Ogunlade studies.

In a Nigerian study by Elijah and Ogunlade (2006) on the uses of ICT for gender empowerment and sustainable poverty alleviation, both male and female participants in the study agreed that the leading causes of poverty were unemployment, income inequality between male and female, polygamy, business failure, sickness, and environmental degradation. Data were obtained from a survey of 50 men and 50 women in the Kwara State of Nigeria. Table 2 shows one of the tables in the published study that rank-ordered the responses from both male and female participants as to the causes of poverty. Women strongly agreed that unemployment, uneven distribution of wealth, business failure, and polygamy were the leading causes of poverty while their male counterpart strongly agreed to only unemployment as the leading cause of poverty. It is interesting to see that in this study, factors that some Western economists (Sachs, 2005; Collier, 2007; Easterly, 2007) argue as the main causes of poverty - over-population, financial mismanagement, bad leadership (governance), corruption, illiteracy, gender discrimination, and tribal differences - were ranked much lower by both male and female respondents.

Table 2: Study on People's Perception of the Causes of Poverty in Nigeria (2006)

Causes of poverty	S.A		A		U		D		SD		Mean score		Remark	
	M	W	M	W	M	W	M	W	M	W	M	W	M	W
Unemployment	39	43	8	6	3	1	-	-	-	-	4.72	4.84	S.A	S.A
Economic recession	7	11	11	14	18	5	9	13	5	7	3.12	3.18	U	U
Poor orientation	8	3	7	11	5	9	20	15	10	12	2.66	2.56	U	U
Sickness	17	27	19	8	-	2	8	9	6	4	3.66	3.90	A	A
Laziness	14	21	16	26	10	2	4	1	6	-	3.36	4.34	U	A
Uneven distribution of wealth	11	30	32	15	6	4	1	1	-	-	4.06	4.48	A	S.A
Financial mismanagement	13	7	16	9	7	14	12	11	2	9	3.52	2.88	A	U
Bad leaders	7	11	4	18	1	8	24	8	14	5	2.32	3.44	D	U
Business failure	11	33	27	16	10	1	2	-	-	-	3.94	4.64	A	S.A
Polygamy	21	37	17	8	3	5	8	-	1	-	3.98	4.64	A	S.A
Over-population	15	12	16	16	6	9	9	8	4	5	3.56	3.44	A	U
Illiteracy	10	11	15	12	7	2	16	14	2	11	3.30	2.96	U	U
Conservation	4	3	10	7	10	11	19	20	8	9	2.68	2.50	U	U
Corruption	16	18	19	17	5	8	8	6	2	1	3.98	3.90	U	A
Gender discrimination	5	12	11	25	6	6	21	7	7	-	2.72	3.84	U	A
Tribal differences	7	15	13	8	3	10	19	13	9	4	2.86	3.34	U	A
Environmental degradation	21	19	9	11	6	11	10	9	4	-	3.66	3.80	A	A

Where S A = Strongly Agreed (5); A = Agreed (4); U = undecided (3); D = Disagree (2); S.D = Strongly disagreed = 1; M= men's view; W= women's view. Total number (∑F) = 50 each for both men and women; mean score = ∑ rating point × observation / ∑F

Source: Nigerian study by Obayelu, E. and Ogunlade, I (2006). *International Journal of Education and Development using Information and Communication Technology (IJEDICT)*, 2006, 2(3), p. 49.

The authors conclude that access to low-cost ICT such as cell phones can help to provide reliable information to the poor, empower female and entrepreneurs from both sexes. They also add that using ICT to support poverty reduction would be possible if the Nigerian government would step up as the major employer of labor and encourage the proper use of ICT by the populace.

Ssewanyana (2007) conducted another ICT study in Uganda, a country in East Africa with an estimated population of 31 million people of whom about 80 percent live in rural areas. Data that was collected through a Uganda National Household Survey (NHS) of 2002/2003 were used to measure the impact of ICT on poverty reduction in the Central, Eastern, Northern and Western regions of Uganda. Before Ssewanyana reported on his measures, he reviewed the literature about applicability of ICT tools and services in different sectors in Uganda for information seeking. According to his report, ICT as a sector has provided employment directly and indirectly to many citizens of Uganda. Ssewanyana describes some of the ICT projects in Uganda that have helped to alleviate extreme poverty. Some of the projects include the *Acacia* project that extended the Internet to schools in rural areas; the MTN village phone project that sold cell phones to women in order to help them to earn income. As part of the MTN village phone project, the women sold communication time to people in their communities, used their cell phones to conduct small business activities, to communicate with family and friends, to participate in phone-in radio shows, to check prices of agricultural goods, and to transfer money through MTN built-in text messaging and financial software. This good review showed how ICT impacts such sectors like education, small business entrepreneurship, livelihoods, healthcare and government in Uganda.

After discussing how poverty is defined nominally by several authors, Ssewanyana provides an operational definition:

> A person is considered to be poor when the consumption expenditure is below the official absolute poverty line of one dollar per day [Ssewanyana, 2007, p.12].

The ICT tools used in the Uganda NHS survey were limited to radios, televisions, and telephones (both fixed and mobile). There were 48,553 participants in the survey from 9,709 households who were selected from a population of

25,272,369 people. Using percentage counts, Ssewanyana showed the ICT density per 100 people by region in 2002/2003 and concluded that the Northern region of the country had the highest proportion of people below the poverty line, followed by the Eastern region (Table3).

Table 3: Uganda - ICT Density Per 100 People by Region, 2002/2003

Region	Radios	TV Sets	% of Households with Radios	% of National Overall Poor	Number of Operational FM Radio Stations
Central	16.0	3.3	76.1	22	47
Eastern	11.8	1.4	56.5	46	17
Northern	8.6	0.3	37.7	63	17
Western	14.6	1.1	73.3	31	29

Source: Ssewanyana, J. K. (2007). ICT Access and Poverty in Uganda, *International Journal of Computing and ICT Research*, 1(2), 14.

Ssewanyana observed that a negative relationship occurred between ICT availability (ICT densities) and poverty levels; he reported a correlation coefficient value of -0.99 ($r = -0.99$).

I however found a few things that I felt could have been improved with the measurement section of the study. Ssewanyana used existing data (National Household Survey conducted by the Uganda Bureau of Statistics in 2002/2003); as such he did not test any hypothesis and that was understandable. But what could have been more helpful to a reader would have been the use of research questions to guide the study.

Ssewanyana establishes that a negative relationship exists between ICT availability (ICT densities) and poverty levels ($r = -0.99$) in the regions. This is a very high correlation coefficient. It was not reported what statistical software was used to analyze the data. Also, establishing some criteria such as how many ICT tools like radios or TV sets that a region should have to be removed from being a "poor region" in Uganda should have been set to serve as a baseline. It was hard to understand if the Western and the Central regions were

considered in the study as having enough ICT tools and services to be excluded from being among the "poor regions." It appeared to me that the Northern and Eastern regions that were grouped as the "poor regions" were placed in that grouping because they had the lowest incidence of ICT tools. This automatic placement without prior definition of what being an "ICT poor region" meant was a subjective measure.

In the Data section, Ssewanyana explains the source of the data and this was good. He also states that the unit of analysis was the household, but in the discussion of the results of his measures, conclusions and explanations were made only about the regions and not the households.

Although I have made a few remarks on the measurement section of the article, I praise Ssewanyana for doing the study using a large data set like the Uganda National Household Survey of 2002/2003.

I now discuss two cases of ICT projects in the SSA region that appear to hold promise – *EASSy* and *M-PESA*. I have raised these cases in this research framework in order to support the assessment of how having a form of ICT or the infrastructure can help in the development of other sectors of the economy to support sustainable development. Chapter three is fully devoted to ICT demand and adoption where the mobile technology penetration into the Sub-Sahara Africa is discussed.

East African Submarine Cable System

The East African Submarine Cable System (EASSy) is an example of the progress that is being made in the infrastructure area. During the last five years, East African countries such as Kenya, Uganda and Tanzania have broken new grounds in ICT infrastructure for development. The EASSy project is funded by the International Finance Corporation (IFC), the private sector arm of

the World Bank Group. The IFC (2008) reported that EASSy "is an initiative to construct and operate a submarine fiber optic cable along the east coast of Africa to connect eight coastal countries and island nations to each other and to the rest of the world. The EASSy project will be the first optical fiber connection for most of these countries to the global optical fiber network."

The EASSy project administration is located at the Telkom Secretariat in Nairobi, Kenya and supported by the New Partnership for African Development (NEPAD). The EASSy project cable network begins from South Africa's Mtunzini Landing Station to Port Sudan Landing station, a total distance of 8,500 kilometers (5282 miles).

EASSy Technology

The EASSy project plans to use the latest in undersea fiber optic cable technology for the network of the countries. Unlike its coaxial cable counterpart, fiber optic cable is better in transmitting information because the information is carried in the form of pulses of light. Another major advantage of the technology is that it carries a lot more information to independent destinations at a faster speed because of the optical amplification and wave length division multiplexing features.

The EASSy project has gained support and competition from the private sector. According to IBM (2008), if the project completes, the result will be four cables supplying Internet access to East and Southern Africa. The hope is that the IFC and the World Bank will extend the EASSy project or similar initiative to the Western Sub-Sahara African countries which appear to be left behind in the readiness for the networked world.

M-PESA Mobile Payment and E-Banking Service

The growth in mobile technology across many BOP regions is helping to meet the communication needs, increase access to information, including Internet-based information, and provide effective collaboration among people and groups in different physical locations.

I first heard about M-PESA during a World Bank conference on "Enabling Mobile Transformation in Africa: Next Generation Mobile Services for Government, Health, and the Financial Section" on November 18, 2008. This World Bank conference was one in a series that have been devoted to global dialogue with the Sub-Sahara African countries. In this particular conference, the World Bank conducted a live conference with participating African countries - Ghana, Kenya, Tanzania, and South Africa. I used the information gathered about M-PESA in the World Bank conference and the report by The Economist (2008) to compile the detail of the case for M-PESA.

According to The Economist (2008), M-PESA is a mobile payment service that was introduced by Safaricom, a mobile operator in Kenya in 2007. Safaricom provides a host of telecommunication services in the region including services for telephony, General Packet Radio Service (GPRS), Enhanced Data rates for GSM Evolution (EDGE), Data and Fax. Both GPRS and EDGE are services that are based on the 3G definition by the International Telecommunication Union (ITU, http://www.itu.int/osg/spu/ni/3G/). The 3G definition or standards are the third generation of telecommunication standards and technology for mobile networking. The 3G supersedes the 2G or the 2.5G standards under the International Mobile Telecommunications-2000 (IMT-2000).

M-PESA service uses the 3G standards to deliver a service that allows Safaricom subscribers to deposit and withdraw money using Safaricom's airtime sales agents. The subscribers are also able to send and receive money from each other using a short message service (SMS) or text message. The Economist

(2008) reported that about a quarter of Safaricom's 10 million customers have started using the service.

M-PESA and Mobile Banking

M-PESA is not just a send and receive money service; it is an introduction of mobile banking services to a region with over 80 percent of unbanked population (World Bank, 2008). In Kenya, the Central Bank of Kenya has partnered with Safaricom to create mobile banking services (e-banking) that are available to the citizens both in English and Swahili. During the World Bank conference, the following were also reported:

- Kenyan Central Bank stated that 81 percent of the population had no access to banking services; its goal was to connect Kenya's unbanked population through their mobile phones to basic e-banking services.
- The early adopters of the mobile banking services in Kenya and South Africa can now perform basic banking services, access e-statements, and change pin numbers.
- Kenya has projected to soon complete applications that will allow mobile phone users to make remote payments for consumed service (e-Government services), and to access micro-finance and insurance services.

In summary, I have used the poverty framework, human needs and diffusion of innovation theories to build the framework for this research. Figure 9 is a diagrammatic representation of my research model to show that ICT access and use will help to increase income, reduce both extreme and information poverty and empower the people to participate in e-services and innovation.

The three main propositions that I am putting forward in the research model are:

- ICT access and the ease of ICT use will increase income and reduce extreme/ information poverty.

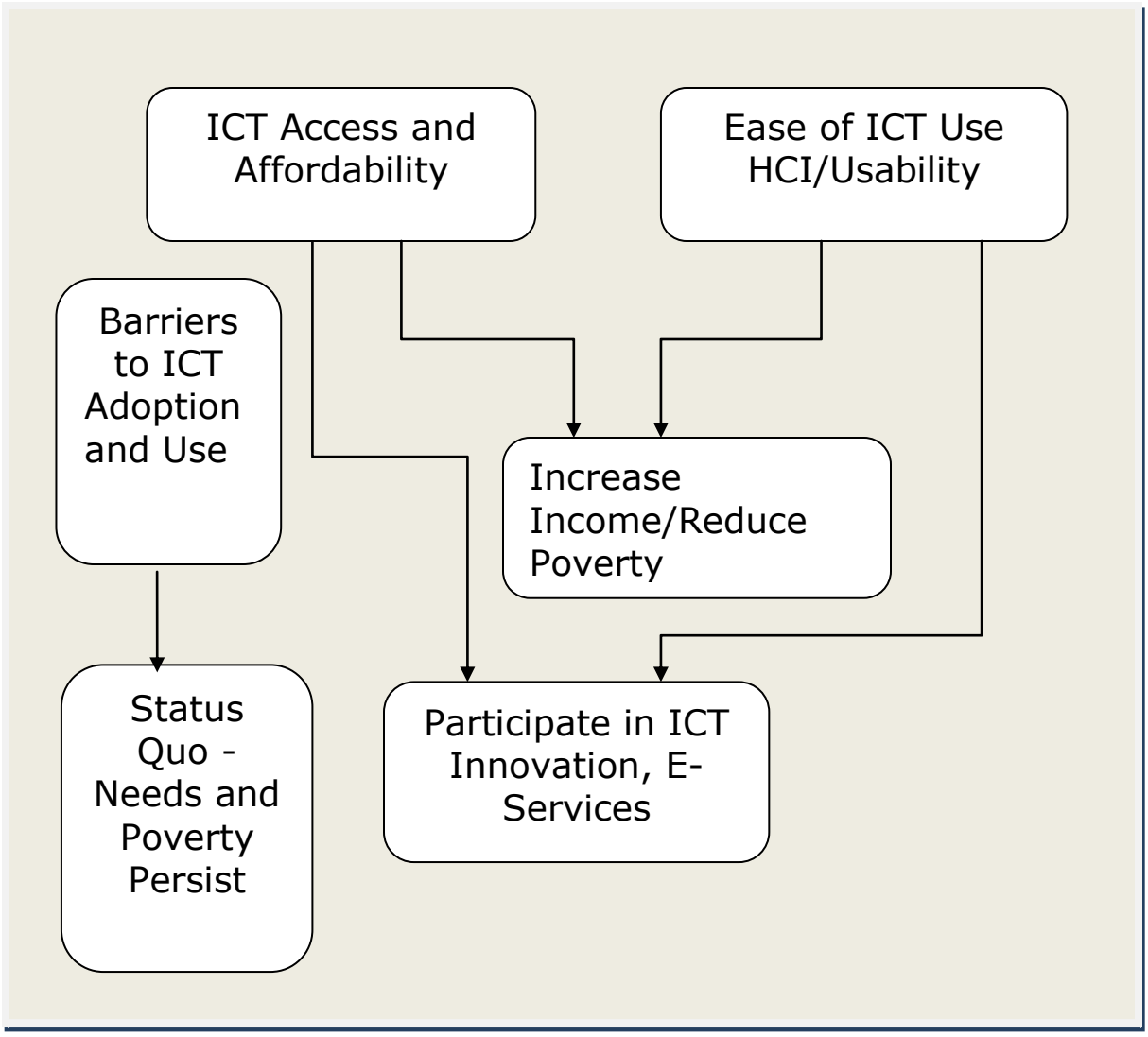
- ICT access and ease of use will also give rise to e-services such as e-learning, e-banking and microfinance, and e-health; empowering people in the SSA region to become part of a global ICT innovation.

- If barriers (as discussed earlier in this framework) to ICT access and use continue to persist, ICT adoption will be stifled and this will lead to the status quo, where people continue to live in extreme poverty and information poverty. Therefore, it is needful to understand the barriers as laid out in this research framework. Many of these barriers will not be investigated in this current research. The barriers that I plan to examine are those that relate to the following two areas:

    - Access to computing technologies, mobile technologies and the Internet
    - Technology acceptance, literacy and ease of use.

The Research Model

Figure 9: Research Model of ICT Access and Use in Sub-Saharan Africa to Alleviate Extreme and Information Poverty and to Encourage Innovation



Research Questions

This research uses the individual as the unit of analysis in formulating the research questions. The study will examine if mobile technology access and use have helped individuals to meet both their information needs and alleviated extreme/information poverty. The following research questions are raised for further investigation.

1. Do the participants in the study who own an ICT tool such as a cell phone or computer live on less than two U.S. ($2.00) dollars a day?
2. Is cost a factor for study participants' adopting and using different forms of ICT tools/services?
3. Is there a relationship between having access to an ICT tool or service and a study participant's ability to access the Internet and other information sources?
4. To what extent do participants in the study perceive mobile phone technology as an innovation that can help to sustain development (reduce poverty, enables income earning potential and broaden access to e-services)?
5. To what extent do study participants perceive mobile phones as being useful for different tasks they engage in?
6. To what extent do participants in the study perceive mobile phones as easy to use, satisfactory and dependable?

CHAPTER THREE

ADOPTION OF ICT AND MOBILE TECHNOLOGIES

Objective

The BOP regions are identified and discussed in chapter one. In chapter two, the theoretical framework for this research and the research model are developed. The first part of this chapter is used to discuss the literature on mobile technology adoption use in different regions of the world. The second part of the chapter is devoted to reviewing the literature on the adoption of mobile phones and telecommunication services by the Sub-Sahara African BOP populations. Some ICT and Internet studies in Sub-Sahara Africa are reviewed.

Evolution of Mobile Technologies (GSM) and the Worldwide Rapid Adoption

The economic and social structures of our society today are supported by information technology. Information and communication technology plays a vital role in the development of the world systems including the economic and educational systems (Hawkins, 2002). New information and communication technologies have brought significant changes to the global economy and the way people, businesses and countries interact (Kozma, 2005; Sachs, 2005; Soros, 2002). People depend on different forms of information technologies to communicate, perform their jobs, entertain themselves and socialize. The

worldwide adoption of technology as a whole has been influenced by mobile technologies.

Since the Global System for Mobile (GSM) Communication was first introduced at Finland in 1991 (GSM World), there has been a rapid growth in the adoption of the technology. Figure 10 shows a sample of newer generations of GSM phones by different manufacturers like Motorola, Nokia, iRiver, TWP and Samsung. GSM mobile phones operate using SIM (subscriber identity module) chip or card. A GSM mobile phone uses a smart and secure SIM card; data about a specific user is stored in the SIM card but not in the cell phone. In addition, data is transmitted in encrypted format. A subscriber who uses the smart SIM card in any GSM phone has his personal profile embedded in the SIM chip and he or she is authenticated to the network providing the service each time the SIM card is used.

Figure 10: Sample GSM Phones

Motorola GSM Phone

iRiver GSM Phone

TWP- 800 wearable GSM Phone

Samsung SCH-W619 GSM/CDMA Phone

GSM phone in wrist watch

Slider GSM Phone

Nokia 2626 GSM Phone

Images source: http://images.google.com/images?hl=en&q=GSM+phone+image&um=1&ie=UTF-8&ei=60jeSbKTCp2Ntge2komjAQ&sa=X&oi=image_result_group&resnum=1&ct=title

The evolution of mobile and wireless technologies has led to many generations of mobile telephony. In the last three decades (from the 1970s), mobile and wireless technologies have had four or five generations of technology evolution, namely from zero-generation to fourth-generation (0G to 4G). Some have actually called this a mobile technology revolution. Srivastava (2008) explains that second-generation (2G) mobile technologies still dominate most market regions. Modern GSM technology (third-generation or 3G and higher) has voice, data, fax and short message service (SMS or texting) capabilities. See Appendix A for the description of the different generations of mobile telephony and their respective protocols.

The GSM phones operate on 900 megahertz (MHz), 1800 MHz or 1900 MHz frequency levels. Dual-band phones operate at 900 MHz and 1800 MHz. The dual-band GSM phones are mostly used in Europe, Asia, Africa, Australia and South America. The tri-band GSM phones operate on 900 MHz, 1800 MHz and 1900 MHz frequency levels. They are used in Europe, Asia, Australia, Africa and North America. The quad-band GSM phones operate on 850 MHz, 900 MHz, 1800 MHz and 1900 MHz frequency levels. Their wider frequency band allows roaming in any region of the world. GSM is the *de facto* standard for the mobile telecommunication industry. Different telecommunication operators (TELCOs) allow access to the integrated service digital network (ISDN) services and Global Packet Radio Service (GPRS) via GSM phones for fast data transmission.

Today, there are more than 860 GSM mobile networks across 220 countries (GSM World, 2009). Srivastava (2008) opines that as of January 2006, there was already more than one mobile phone for every three inhabitants of our planet. The Asian BOP region has had the most growth in the adoption and usage of mobile telecommunication infrastructure and services in recent years. The India BOP region for example, beside China is the largest telecommunication market for the BOP regions.

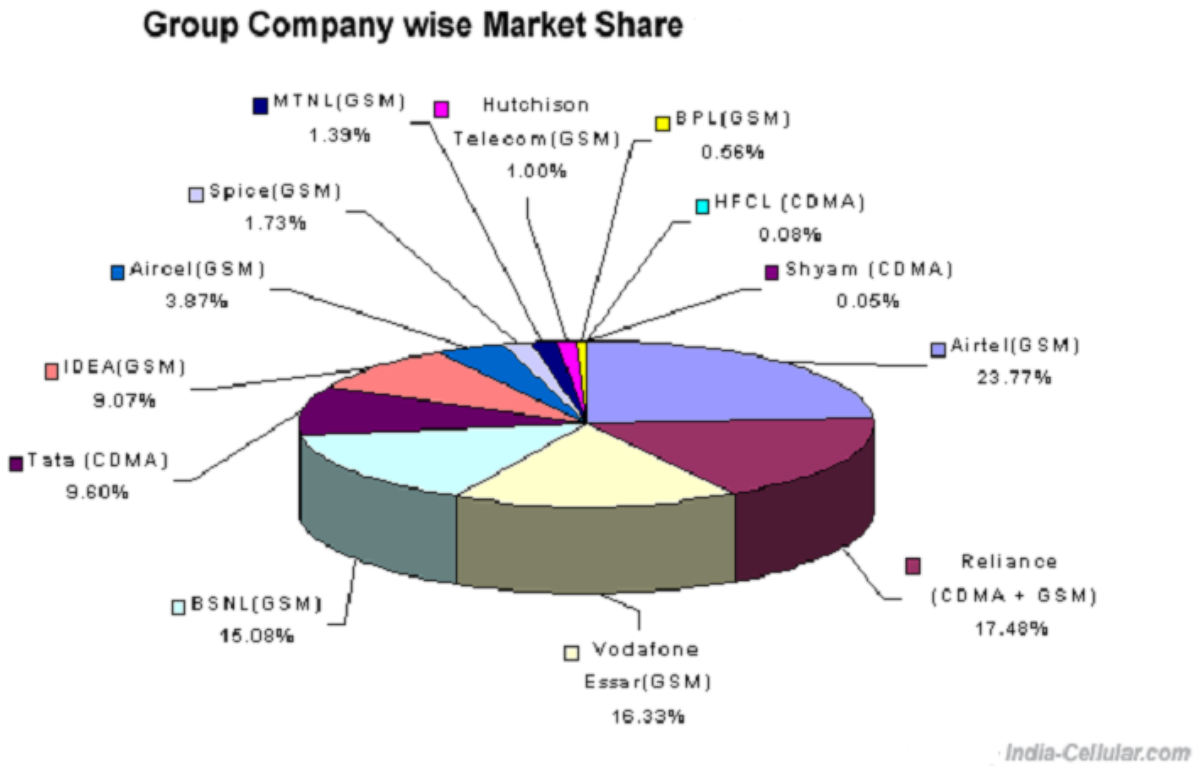
According to the Indian Telecommunications Department (2007), India has granted telecommunication licenses to many regional providers such as Airtel (GSM), Reliance, Vodafone, Tata Teleservices Ltd, and BSNL (GSM). Many leading foreign companies including US companies such as AT&T, Motorola, Nynex, US West, Hughes, Harris, Qualcomm, Sprint, Telstra, NTT, Singapore Telecom, Philippine Telecom, Bezeq, Siemens, Ericsson, Nokia, Fujitsu, Alcatel, and Bell Canada are also present. Table 4 shows the number of licenses the Indian Telecommunications granted in 2007. Figure 11 provides the market share of core providers of telecommunication service companies in India. In August 2007, the total number of Indian mobile subscribers was estimated at 196,943,207 with Airtel (GSM) holding the largest market share at 23.7 percent, followed by Reliance at 17.4 percent.

Table 4: Telecommunication Licenses in India for 2007

Summary of Licenses	
Basic Licensees	**2**
Cellular Mobile Telephone Services (CMTS) Licensees	**53**
Unified Access Services (UAS)	**103**
TOTAL LICENSEES	**158**

Source: http://www.dotindia.com/as/LIST%20OF%20LICENSEES%20JAN%2007%20-%20company%20wise%20for%20Website.xls

Figure 11: Indian Telecommunication Service Providers and their Market Share for 2007



Another important BOP country in Asia is Bangladesh. The Grameen Telecom, an arm of Grameen Family operations in Bangladesh is the leading telecommunications service provider in Bangladesh, with more than 10 million

subscribers as of November 2006 and about 15 million subscribers in October 2007 (http://www.grameenphone.com/index.php?id=64). Today, Grameen Telecom has partnered with Telenor (62 percent asset holdings), the largest telecommunications service provider in Norway with mobile phone operations in twelve other countries, and Grameen Telecom Corporation (38 percent asset holdings).

ICT Adoption in Sub-Sahara Africa BOP Region

ICT Policies

The African economic system is an integral part of the global economy.
In recent years, most of the African policy makers have heard about the payoff from ICT use in India, Singapore and other Asian countries. Leaders of African nations are beginning to understand the importance of using ICT for sustainable development and are immersed in the crafting, adoption, and implementation of national ICT policies (Adeyeye and Iweha, 2005; Ajayi, 2008; Best et al, 2007 & Rezaian, 2007).

The crafting of ICT policies for sustainable development is a big agenda item in Sub-Sahara African countries. However, the implementation process is slow in many of the countries. Researchers in socioeconomic policies offer suggestions as to how to craft and implement policies for growth and development. Sachs (2005) advises that countries craft their policies based on sound macroeconomic principles, taking into account their history, culture, geography, and development goals. Rezaian (2007) explains that the process of crafting ICT policy varies from country to country in the SSA region. This is because each country has its development objectives and priorities. Some of the items on these countries' priority lists include ICT-sector policy and regulation,

infrastructure, human capacity, and enabling an environment for active participation by the private sector.

Taking the ICT-sector policy and regulation, Rezaian (2007) adds that each country's ICT policy has sub-policies for many topics and provides a list of such sub-policies; a few of them include:

- Expand and modernize the telecommunications infrastructure
- Use new technologies in public administration and service delivery (e-Government)
- Initiate and strengthen the use of ICTs in academics, education and research institutions
- Create a conducive legal and regulatory environment for the growth of ICTs
- Create opportunities for private-sector development and growth of the ICT sector
- Develop human resources in the ICT sector
- Provide rural connectivity and universal access
- Facilitate applications of ICTs as enablers in agriculture, business, education, environment, health, trade and other sectors.

Organizations such as the New Partnership for Africa's Development (NEPAD) have adopted programs to accelerate the pace of information ICT policies and development in all countries of Africa (Parks, 2004; Rezaian, 2007).

It has taken more than a decade of effort, but as of 2006, all 54 African nations can finally boast of having connectivity to the Internet (Ololube, 2006). It is worth noting that many of these connections use less than 100 kilobytes per second (kbps). African nations can learn lessons from many Asian countries in their implementation of ICT policies. Kozma (2005), reporting on a study in Southeast Asia, stated that the policies that had the most positive effects on

growth and development were those that promoted education, facilitated the production and dissemination of knowledge and technologies, encouraged a high rate of savings, supported cooperation between government and business, and advanced industrial development.

While some of the African nations such as Ghana, Nigeria, and South Africa have developed their ICT policies and are slowly implementing them, others, such as Liberia are only beginning to craft theirs. Best et al (2007), discussing the case of Liberian government's plan to use ICT to develop this post-conflict country, states:

> Information and communication technologies (ICTs) have been identified by the Johnson-Sirleaf government as a critical tool toward the country's rebirth. They are being targeted toward strengthening areas such as government operations and transparency, economic activity and growth, post-conflict reconciliation, and security.

Best et al (2007) also reports the following excerpt of a speech by the Liberian President, Her Excellency, Ellen Johnson-Sirleaf, Africa's first female head of state, at the Georgia Institute of Technology on September 13, 2006:

> Our vision is for Liberia to become a globally competitive knowledge and information society where lasting improvement in social, economic, and cultural development is achieved through effective use of ICT. We want to create an enabling environment for the growth of an ICT industry in the country; to provide universal service and access to information and communication facilities in the country; and if realistic, to make Liberia a regional ICT hub so as to make the country's service sector globally competitive.

Liberia is in the process of developing a comprehensive ICT policy called *E-Liberia: Vision 2010* (Mangesi, 2007). Despite this vision, Ogundeji (2008)

reports that electricity supply and access are major hindrances to ICT adoption in Liberia. Temporary remedies are provided through a few fee-paying telecenters (kioks) that have sprung up around the country to help people to charge their mobile and computing devices. In general there is lack of improvement in Internet access in the country; a user pays an estimated 115 Liberian dollars (US$1.82) to browse the Internet for a few minutes in an Internet café in the central part of Monrovia.

ICT policies and government regulations are the major factors that affect the level of ICT use, including access to the Internet in each of the Sub-Sahara African countries. Some African countries have greater potential for growing their Internet usage because of their broad policies on technology, the Internet and telecommunications. It is not enough to formulate these policies; African nations can become proactive in the implementation of such policies.

Nigeria, the largest country in Africa with a population of 133.5 million and a gross domestic product (GDP) of 188.5 billion crafted its ICT policy in 2001. The goal was to have ICT policies in place to aid with national development. The sub-goals were to use ICT for education, creation of wealth, poverty reduction, job creation and global competitiveness (Nigerian National Policy for Information Technology, "USE IT", 2001). The National Policy on Information Technology envisioned making "Nigeria an IT capable country in Africa and a key player in the Information Society by the year 2005, using IT as an engine for sustainable development and global competitiveness." The Policy specified many broad objectives, including the following:

- To ensure that Information Technology resources are readily available to promote efficient national development
- To guarantee that each state benefits maximally, and contributes meaningfully by providing the global solutions to the challenges of the Information Age.

- To empower the youth with IT skills and prepare them for global competitiveness
- To integrate IT into the mainstream of education and training.

The IT Policy, USE IT, had broad goals but lacked specific guidelines or strategies for supporting policy implementation in different sectors including the educational sector. The strategy for implementing the Policy in the educational sector was discussed under human resources development. It is therefore not surprising to see that in the nine years after the formulation of USE IT Policy in Nigeria, universities in the country still lack computer laboratories or libraries that are equipped with media services or computers that can be used to access the Internet. According to Oyelekan (2008), "Perhaps, it would not be out of place to say that Nigeria has no national policy in the integration of ICT into her educational system" (p. 8). Five years after the target date of 2005, Nigeria is still a very late starter in terms of overall implementation of its ICT policies. There is an inadequate number of computers and skilled personnel in government offices, universities, and the private sector. This situation is compounded by the fact that the number of computers available for teacher training in computer education, a curriculum that includes ICT courses and use of computers in schools, is very low.

Etim (2006), reports that most Africa countries have inadequate access to the Internet. Many of these countries continue to struggle with underdevelopment. There is inadequate infrastructure such as electricity, computers, good roads, aviation, clean water, waste management, technology equipped classrooms, and telecommunication. Adibe (2005) makes a case that Nigeria, the largest country in Africa by population, which he terms a sleeping giant, must be roused:

> "… we take on Nigeria, one of the embodiments of Africa's paradoxes - and hope. A country of some 130 million people, Nigeria is the sixth largest oil producer in the world, and has some of the most resourceful

> people on the planet. Yet, it has remained a slumbering giant, unable to wake up and fight for its rightful place in the world and consequently poorly ranked in all the indices of human development. This has been a major source of concern, even irritation, disappointment and anger among many Africans who believe that Nigeria carries the hopes and aspirations of black people everywhere, and that unless the country quickly gets its act together and take its rightful place in the world, it will be difficult for black people everywhere to shake off the current stereotype that define them as underachievers, and people incapable of managing complex organizations and systems (p.1).

In an increasingly flattened world where the playing field is leveling, and with the Internet taking the center stage as the channel for information seeking, gathering, storage and dissemination, and for educational development, the following questions are critical:

- Can Africa emerge from a forgotten socioeconomic position to use ICT tools to become a key player in the global space?
- How can ICT tools be used to aid development, including educational development, information seeking and impacting change in Africa?

These questions are raised to engage the reader as we explore a few small-scale ICT researches that are being conducted in different African countries.

Collaborative ICT Studies

I have made an effort to uncover these studies through rigorous Internet searches. There are very few published scholarly journals that are emerging from the SSA region. A Harvard global study on countries' network readiness is reported. A recent ICT research effort that covers a network of African countries is being conducted and reported by researchICTafrica.net. This research body is

conducting integrated research on ICT policies, regulations, pricing, access, and usage in about 16 African countries.

Sub-Sahara Africa Readiness for the Networked World

In an extended study at Harvard University, Kirkman, Osorio and Sachs (2002) studied the ICT position of 75 countries and ranked them based on their readiness for a networked world. Only two Sub-Sahara African countries made the list (network readiness index, NRI) at the time of the study. Nigeria ranked the lowest in the 75th position, and South Africa ranked in the 40th. The three researchers used basic descriptive statistics to compute the countries' overall network readiness index. They ranked the countries based on their average scores on Network Use and ICT Enabling factors.

The networked readiness study has been conducted each year since 2002. In the 2007–2008 study that was conducted under the heading: *Fostering Innovation through Networked Readiness*, the top seven countries that were ranked as the most networked economies in the world were Denmark, Sweden, Switzerland, United States, Singapore, Finland, and the Netherlands (World Economic Forum and INSEAD, 2008).

The 2007-2008 study included a deep-dive into the following areas:

- Emerging ICT delivery to the developing countries
- Impact of ICT on innovation
- Network speed
- Unified communications
- Development of e-skills for the information age
- Regulations and emerging telecommunication markets
- Business network transformation and the implications for the global economy

- Innovation and collaboration on the participative Web

The 2008 NRI rankings showed that the Nordic countries (Denmark, Sweden, Finland, Iceland, and Norway) continued to rank at the very top of the index. The Asian countries featured in the top 20 were Singapore (5th), Hong Kong (11th), Taiwan (17th), and Japan (19th). India and China took 50th and 57th positions respectively. The Latin American and the Caribbean countries had mixed results. The countries that had impressive rankings and made it into the top fifty were Chile (34th), Barbados (38th), Puerto Rico (39th), and Jamaica (46th). Some of the larger countries in the region ranked lower – Mexico (58th), Brazil (59th), and Argentina (77th).

Despite the media attention that the Sub-Sahara African countries have received during the past two years on their adoption of mobile telephony, these countries, as in other years of the networked readiness study, ranked in the lowest categories of the 127 countries that participated in the 2007-2008 study. South Africa dropped from the 40th position in 2002 to the 51st position in the 2007-2008 study. Mauritius, a small island country in Southern Africa and located in the Indian Ocean east of Madagascar with a population of about 1.2 million people ranked in the 54th position. Nigeria, the largest country in the SSA region went from being the 75th in 2002 to a much lower ranking of 94th position, after Kenya (92nd) and Namibia (93rd). What is interesting to note is that Mauritius, Kenya and Namibia have made significant strides since they were not included in the 2002 NRI rankings.

The Sub-Sahara African countries' networked readiness is a work-in-progress. The new EASSy cabling technology (discussed as a case in the research framework) is likely to have some impact in the Southern and Eastern African countries. The regions with the greatest danger of being left even further behind in networked readiness are the Central and Western SSA regions. The NRI rankings for 2008 were published as part of the *Global Information*

Technology Report 2007-2008 by World Economic Forum and INSEAD. At the time of publication, many of the SSA countries like Liberia were focusing effort in developing their ICT policies and basic infrastructure for network readiness as explained in the report:

> The Global Information Technology Report 2007-2008 is released at a time in which the importance of high bandwidth connectivity for countries' competitiveness, sustained growth, and poverty reduction is widely recognized. Facilitating access and effective use of ICT has increasingly moved to the top of national agendas in most developed and developing economies, while more resources are invested in ICT infrastructure upgrading and development [p. ix].

ICT Access and Usage: An Evidence-Based Study

Some new ICT research efforts in Africa are funded by the International Development Research Centre (IDRC). Many African countries are involved in evidence-based ICT studies. The results of both demand and supply sides of ICT researches in Africa have been published by researchICTafrica.net. One of such studies is edited by Gillwald (2008), and the study is: *Towards evidence-based policy in Africa: ICT access and usage across 17 countries*. Twenty five thousand households were selected from the seventeen countries using previous census data. An hour long questionnaire was administered to each household that was selected for the study. Sample questions that were asked in the study centered on access to ICT tools and affordability of such tools. Some of the questions were used in the survey for the current study. These are listed in Chapter Five under the Research Design section.

Contributors from different African countries reported on the sub-set of the study for their respective countries. The full detail of this study can be found at the researchICTafrica.net site (http://www.researchictafrica.net/).

To shed light on how Africans are using ICT services, Gillwald (2008) reports on the second demand-side survey of ICT access and usage of about 23,000 individuals and households across 17 African countries during 2007 and 2008. This was a follow-up study on the 2004 survey of ten African countries. In both surveys, data was collected from rural, urban and metropolitan areas, providing the first disaggregated ICT data that was collected in the public African domain. In both studies, the disaggregated data included gender, age, education and limited household income.

In the study methodology, nationally representative surveys were conducted on households based on sample frames drawn from Census enumerator areas (EAs). The samples were split into three groups of metropolitan, urban and rural EAs. The EAs were mapped when there were no available maps, and the total number of households in an EA was divided by the target sample to determine the sampling interval. A random starting point was picked based on simple random sampling technique. The target sample was 24 households per EA. Data was collected from 23,000 households across 17 African countries.

Gillwald (2008) summarized the findings for 16 African countries. The following were the common denominators for the countries:

- African governments have recognized the important role of a pervasive communication infrastructure in building a modern economy.
- Some governments have begun making significant investments and capital allocation to backbone telecommunication infrastructure development.
- Some governments have entered into long-term contracts with suppliers to build or expand networks that could be operated efficiently, and in a competitive environment.
- With the digital divide receiving an increasing focus in many of these countries, greater efforts are being made to develop appropriate

indicators for measuring both the supply-side and the demand-side of ICT.

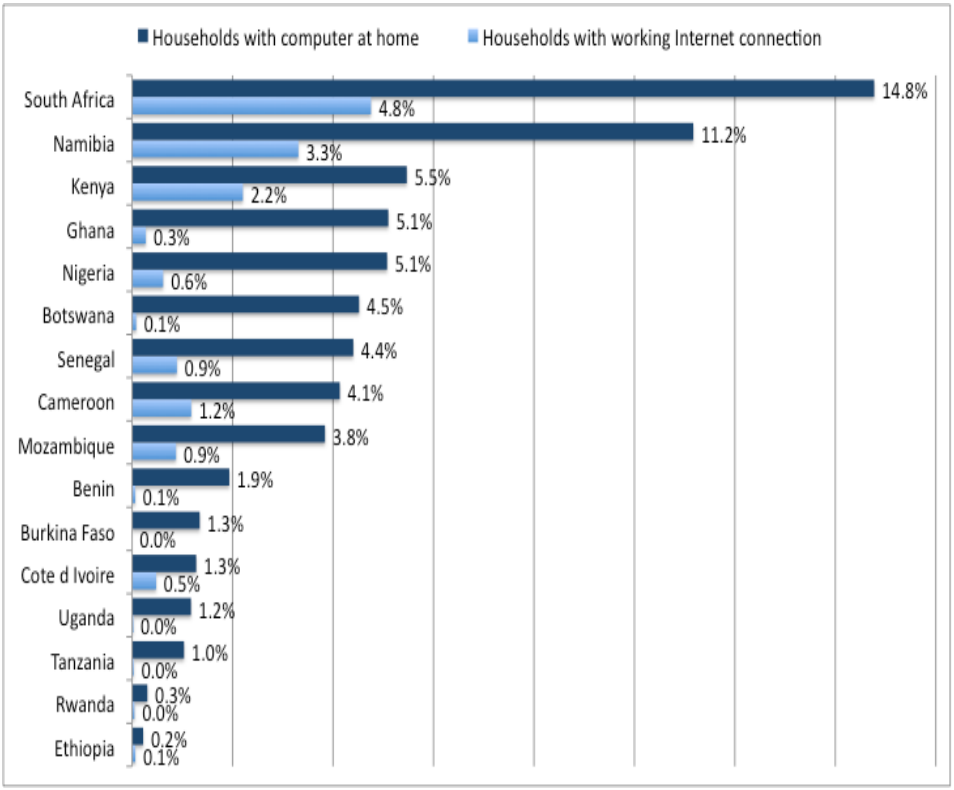
- Despite its relatively high cost, mobile telephony has received greater response in demands for voice telephony, especially following the introduction of flexible pre-paid services that has enabled a telephone for the first time for millions of Africans.
- Mobile telephony has addressed only an aspect of African communication problem – the access gap. The usage gap is still not being addressed fully. Mobile telephony has not addressed the divide between those who are able to access the Internet and other enhanced services when compared to those who cannot.

Gillward (2008) provided usage summary of the findings, and I quote:

> While large numbers of the people continue to be excluded from access to services, others are excluded from usage by the cost of services and, as services become more complex, by the absence of the necessary skills. Expanding mobile services have improved access to voice services. The surveys reveal a multiple communication strategy where individuals use different services, fixed and mobile, public and private, according to available resources to maintain their access. For example, people with mobile phones often make use of public pay phones, if they are available, because low denomination calls can be made rather than purchasing bulk airtime.
>
> The Internet was reported as being of limited use for a number of reasons: perceptions of its unreliability due to poor network quality; limited bandwidth and high costs; or the people communicated with were not using the Internet. This is because less than 5% of households surveyed had working Internet connections across the countries, with most countries below 1% (p.3).

Figure 12 shows computer ownership and Internet connection at the study participants' homes.

Figure 12: Computer Ownership and Internet Connection at Study Participants' Homes (researchictafrica study, 2008)



Source: Gillward (2008). Towards Evidence-based African Policy: ICT Access and Usage across 17 Countries. Retrieved October 1, 2008, from http://www.researchictafrica.net/.

As shown in figure 12, the SSA BOP African public is plagued with a major problem, lack of computers and Internet access. A major contributor to this problem is the lack of telecommunication infrastructure like a cabling system for dependable Internet access.

Kenya-Nigerian ICT Study

Oyelaran-Oyeyinka et al (2002) reported on a study conducted by The United Nations University, Institute of New Technologies (UNU/INTECH). The

participants in the study were university faculty from Kenyan and Nigerian universities - 171 respondents in Nigeria and 56 in Kenya. The study was conducted over a period of three months through the use of questionnaire and in-depth interviews. The goal was to understand what the Internet was used for and the constraints to use. The findings were:

- Many respondents (90 percent in Kenya) had access to the Internet, spending on average 1-2 hours per day.
- The cost and the convenience of access, however, were limited to institutionally provided facilities and not necessarily household computers.
- Those who did not use the Internet indicated lack or poor facilities and financial resources as the problems.
    - Slow dial-up connection to the Internet was raised as major issue.
- E-mail and academic research were the most popular reasons for Internet usage among both the Kenyan and Nigeria respondents. The Kenyan respondents scored higher for the Internet being the source of their teaching materials and current affairs.

Table 5 summarizes specific uses of the Internet by respondents in the study.

Table 5: UNU/INTECH 2002 Study – Specific uses of the Internet by Kenyan and Nigerian Universities

Usage Category	Nigeria (%)	Kenya (%)
E-mail	50.8	85.7
Academic Research	57.7	79.6
Teaching Materials	19.2	57.1
Current Affairs	14.6	51.0
Networking with peers	36.2	34.7
Publishing work in progress	18.5	12.2
Entertainment (sport)	13.8	8.2
E-commerce	6.2	4.1
Others	3.8	10.2

Etim (2006) reported that many African universities are connected through the inter-university network. Table 6 lists the inter-university networks.

Table 6: Inter-University Networks in Africa

Inter-university Network	African Country	Purpose and Network Description
Cameroon Inter University Network	Cameroon	• Provide universities in the region with modern infrastructure for communication and information sharing
Kenyan Educational Network (KENET)	Kenya	• Achieve high speed, reliable, and sustainable Internet Protocol (IP) network for connectivity among educational institutions
The Malawi Academic and Research Network (MAREN)	Malawi	• Provide bandwidth for inter communication with major academic sites
UCAD Information Technology Network	Senegal	• Connect schools and university faculties
National Research and Educational Networks – NUMIS, NUNet, PolyNet, TeachNet, elf Net, NULP, VLC	Nigeria	• Develop and use ICT to foster institutional collaboration among school administrators and the academic communities

Adapted from Etim, F. (2006), Retrieved August 23, 2007, from http://www.webpages.uidaho.edu/~mbolin/etim.htm

Telecommunication Services and Mobile Technologies

Before the emergence of the Internet, many African communities relied on face-to-face verbal communication as well as postal and telegraph services for information exchange. Other media were radios, newspapers, televisions, and where available, the local public library. In schools, students and teachers relied heavily on the chalk board and outdated text books. Few schools had libraries and audio-visual technology tools. Some cities had local libraries that were augmented by a university library. Telecommunication services for each country were managed by the government. In Nigeria, for example, telecommunication was managed by the Federal Government. It evolved from the very modest

beginnings of the VHF radio system of the 1950's to the Post and Telegraph era of the 1960s-1970s. In 1984, the Post and Telegraph Department and the Nigerian External Telecommunications Limited were merged to form the first for profit limited liability company, NITEL. Ogunsola and Aboyade (2005) report that NITEL embarked on a mission to facilitate telecommunication links between Nigeria and most parts of the world through a few digital projects; one of such projects was staged at the Federal Capital Territory, Abuja, in 1990.

The telecommunication industry in Africa is growing rapidly from the foundation work of the 1990s. In recent years, many telecommunication companies from around the world have rushed into Africa to service the information poverty regions with mobile telephony. Cellular.co.za (2004) states that mobile technology has permeated more widely than any other into new areas and we should examine how we can utilize the technology to move forward in order to narrow the digital divide.

Business Week (September 2007) reported:

> *Mobile phones are changing developing markets faster than anyone imagined. Today there are some 3 billion mobile subscriptions worldwide, and that will grow to 5 billion by 2015, when two-thirds of the people on earth will have phones, predicts Finnish handset maker Nokia Corp. Nowhere is the effect more dramatic than in Africa, where mobile technology often represents the first modern infrastructure of any kind. The 134 million citizens of Nigeria, Africa's most populous country, had just 500,000 telephone lines in 2001 when the government began encouraging competition in telecommunications. Now Nigeria has more than 30 million cellular subscribers … Yet billions of people around the world have still never used a telephone* (September 24, *Special Report*, http://www.businessweek.com/magazine/content/07_39/b4051054.htm)

Most of the unconnected masses live in rural areas that are much poorer and more remote than the cities. Citing the case of Muruguru (a village in Kenya) Business Week (September 2007) opined that cell-phone makers and service providers understood that they could make money by bringing cell-phone service within reach of people who live on two U.S. dollars ($2.00) a day or less. The people could buy new phones for as little as $20—and secondhand models for far less—as well as airtime in increments of about 75 cents equivalent in Kenya, enough for nearly 10 minutes of off-peak calling.

Mobile technology offers opportunity for the BOP poor to communicate through voice - a medium of communication that they are used to and quite comfortable with because many of them lack the skill to read and write information. Prahalad (2006) argues that manufacturers of these technologies can develop user friendly interfaces for products that the poor and the illiterate can understand and utilize. Surprisingly, illiteracy can lead to acceptance of state-of-the-art solutions. For example, an illiterate consumer can "see and hear," not read. He suggests video-enabled cell phones as being appropriate for many in the BOP markets.

There is hope that with mobile telephony, the BOP young and old in SSA will have access to the Internet, bypassing the need for owning and using expensive personal computers to connect to the World Wide Web. Srivastava (2008) is optimistic because mobile communication has already overtaken the fixed lines across geographies and socio-demographics such as gender, income, and age.

At the annual GSM 3G Africa expo at Cape Town's International Convention Centre, South Africa in 2006, many large telecommunication companies were there to announce their entry into the African markets and to showcase sample products they had made for the new target markets. Motorola and Nokia were present at the conference and both companies reported that they were launching new mobile telephones that they hoped will meet the style and

fashion-conscious African consumers. Nokia took the stage during the event to announce the launching of the new Nokia 8800 Sirocco Edition. Harrison (2006) reporting on the event also added that Sony Erricson, one of the largest providers of cell phones has released five new Walkman phones into several African markets.

Using the Nigerian telecommunications industry as a case in point, there is very rapid growth of service providers and the demand for telecommunication services. The Republic of Nigeria's Annual Report (2007) summarizes that the telecommunication industry in Nigeria is characterized by new service providers, increasing the number of consumers and regulators. Every type of telecoms operation is now available in the country in one form or another. Services available include fixed telephony, mobile telephony and the Internet. There is evidence of rapid growth in demand; this makes Nigeria the fastest growing telecommunication market on the African continent. The growth in telecommunication services and number of subscribers in Nigeria is shown in Table 7. The Nigerian Mobile (GSM) had about 872 thousand subscribers in 2003 and that figure has grown to over 43 million in 2007.

Table 7: Nigerian Telecommunication Subscribers (2003 – 2007)

Type of Telephone Service	2003	2004	2005	2006	2007
Fixed Wired Lines	872,473	1,027,519	1,223,258	1,697,567	2,235,257
Mobile (GSM)	3,149,472	9,174,209	18,587,000	32,322,202	43,593,310
Mobile (CDM)	N/A	N/A	N/A	N/A	399,606
Total	4,021,945	10,201,728	19,810,258	34,010,174	46,228,173

Adapted from: http://www.ncc.gov.ng/index1_e.htm

A closer look at the data provided in Table 7 shows a revolutionary growth or "exponential jump" in Mobile (GSM) phone subscription as opposed to the fixed (wired) lines. This leapfrogging pattern, for example can be seen in the 2004 data where Nigeria had only about 9 million GSM subscribers and that number grew to 43.5 million subscribers in 2007.

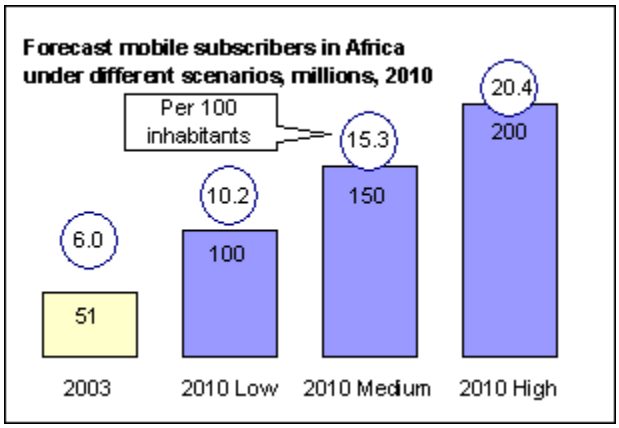
What are the implications for economic and educational development given this leapfrogging pattern of mobile adoption? Business Week (2007) explains that economists are making an effort to calculate the macroeconomic effect of this communications explosion, but no one really doubts its current impact. In the report by Business Week, Leonard Waverman, the chair of the economics faculty at the London Business School, postulated that a 10 percent increase in a developing country's mobile-phone penetration adds about 0.6 percentage points to the economic growth rate.

As new data become available and as further research is conducted in this area, it will be possible to better predict mobile phone innovation diffusion in Africa. An attempt at earlier predictions was made by International Telecommunication Union (ITU) in 2004 (see Figure 13). ITU predicted that there will be between 100 million to 200 million mobile subscribers in Africa by the year 2010. The current report for mobile technology subscribers for Nigeria and South Africa is over 80 million. Nigeria has more than 46 million cellular subscribers (Nigeria, 2007 at http://www.ncc.gov.ng/index1_e.htm, Table 6 in this chapter). South Africa had 42.4 million mobile subscribers in 2007 and that number is expected to grow to 48.5 million by 2010 (ResearchANDMarkets, 2008).

As mentioned in the research framework, relaxed regulations, favorable government policies, reduced ICT costs, and the usefulness of the technology to enhance lives are the most attributed factors that have helped the diffusion of mobile technology over the fixed (wired) lines or the personal computer (Butler, 2005; Business Week, September 2007; cellulular.co.za, 2004). Figure 13 shows a forecast made by the ITU in 2004 for the period, 2003 – 2010.

According to the ITU forecast, by 2010, mobile subscribers in Africa could grow to 200 million.

Figure 13: Mobile Technology is Widening Access and ICT Diffusion in Africa



(Source: http://www.cellular.co.za/news_2004/may/0501004-itu_says_africa_is_the_world.htm)

Cost is a key factor: According to ITU (2004), mobile technology diffusion in Africa is challenged by the issue of sustaining its growth in the face of constraints and affordability. Short-term growth will depend on potential users' ability to afford the services that are offered by ISPs.

Use Cases and Impact

Butler (2005) argues that the best tool for poverty alleviation on the Continent of Africa is the mobile phone. His argument stems from two cases, one in Bangladesh and the other in Uganda. In the early 1990s, the 2006 Nobel Peace Prize winner and social entrepreneurship, M. Yunus, opened Grameen Bank and funded micro enterprises in rural villages of Bangladesh using micro loans. Grameen Bank is a for-profit enterprise that is based in the capital city of Dhaka. In the late 1990s, it extended it services by setting up Grameen

Telecommunications, a non-profit organization that provided low-cost telephone services in rural areas. Village entrepreneurs were enabled through both micro loans, and telecommunication infrastructure from Grameen. Using micro-credits from Grameen Bank, rural village entrepreneurs (mostly women) purchased cell phones and used them to sell mobile telephone services to customers in both their villages and neighboring villages. Mobile telephone entrepreneurs profited while the villagers had instant communication. The net result was better living standards for the rural villagers in Bangladesh. Whether this case could be replicated in other BOP locations including Sub-Saharan African regions remains a subject of intense interest to this researcher and other researchers that are focusing on the BOP populations.

In the Uganda case, Butler discusses the *villagePhone* entrepreneurship effort and how poor rural individuals become "Village Phone Operators" through partnering with the country's microfinance institutions.

Cell phone diffusion is a leapfrogging ICT innovation in Africa. In a 2005 study by the *Centre for Economic Policy Research* and backed by Vodafone, Butler (2005) reports that cell phones have become the technology that help many different user groups share information.

Cell phones are the primary communication technology tool for individuals, small businesses, and many different user groups in the African BOP regions. Many cases are cited in the literature of dramatic changes and benefits; people have access to information that is helping them to live and work better than before the ICT era. Butler (2005) reports on a 2005 study by the Centre for Economic Policy Research in U.K. backed by Vodafone, a U.K. mobile phone giant, that there were higher rates of economic growth in developing countries with high mobile phone penetration. According to the study, a developing country that has an average of 10 mobile phones per 100 populations between 1996 and 2003 would have seen a surge in per capita GDP growth of 0.59 percent. This

figure is higher than what could be obtained without the growth in mobile technology. The study also found the following benefits or use cases:

- Young people and women entrepreneurs are being groomed; they make money by selling phone services and phone cards to villages on a pay per use basis.
- Users of phones gain business and employment opportunities.
- Mobile phones save people living in rural communities the financial costs and time involved with travel. As a result, 85 percent of people in Tanzania and 79 percent in South Africa said they had greater contact and improved relationships with families and friends as a result of mobile phones.
- About 62 percent of small businesses in South Africa and 59 percent in Egypt said they had increased their profits as a result of mobile phones.
- Over 85 percent of small businesses run by black individuals in South Africa rely solely on a mobile phone for telecommunications.

The results of this study suggest that growth in the African telecommunication market will continue to pay off for African economies.

Harrison (2006) reports how connectivity through cell phones is helping even the elderly population to obtain information that helps to meet their basic human needs. Citing the case of a 60 year old South African woman, Lucy Mhlapo who made her first phone call using a second-hand cell phone purchased by her daughter, Harrison quotes Mhlapo:
"I was so happy, I called my brother in Johannesburg and asked him to bring some mealie pap (referring to the staple starch food popular in Southern Africa)," she laughed.

Harrison reports also the case of Margaret Chinhete, a Zimbabwean woman who said that she spends about R100 ($15.00 equivalent) a month on her new phone from selling crafts since she can now contact customers by phone: "When I bought this (cell phone) I had never made a phone call. Now I use it to call

business contacts. It saves me from walking kilometers every day and I have doubled my monthly earnings."

South African firms have also created thousands of shared pay phones and experts say operators wanting to reach Africa's rural poor need to copy their example. "Community pay phones will remove the next barrier [to mobile phones] because they get rid of the upfront cost," said independent telecommunications analyst Paul Hamilton (Harrison, 2006).

Different ICT applications with mobile technology are now available for media reporters to work better. White African (2007) reports the case of the *Voices of Africa* project that is being piloted by reporters from Ghana, Kenya and South Africa. They are using Nokia E61i phones to send in their stories to the service stations. These are GPRS-enabled phones (Figure 3-5) with a special folding keyboard; anyone can send images, news articles and video to anyone else.

Figure 14: GPRS-enabled Phone for Fast Data Transfer and Ease of Information Reporting

The use cases point to areas of Information Science research that can be explored within the BOP regions. These are, among others, information needs, information seeking behavior, information retrieval, learning and use. The rapid adoption of cell phones over computers can point researchers in the direction of new questions to determine why this is the case. Sub-Sahara African is getting introduced to ICT tools and services that they have never had or used. Further

investigation is necessary to determine what their learning experience is in using the tools and in making sense of the array of information services. Kuhlthau (1991) explains that the individual actively gets involved in the information search process in order to find meaning which fits with what he or she already knows. What information resources they tap into and what access they have will depend on needs, availability of such information resources, and the experience they have with using the ICT tools to access those resources.

The Future of the Mobile Web in Sub-Sahara Africa

I want to conclude this chapter with a review of the mobile Web, and then look at the prospects for Sub-Saharan Africa.

Kroski (2008) defines the mobile Web as the World Wide Web accessed through a mobile device that ranges from a cellular phone to an iPod Touch. Such mobile devices and *handsets* (a familiar name in Sub-Sahara Africa for all kinds of cellular phones) have enabled Web capabilities that go beyond making calls, checking e-mail and downloading ring tones to retrieving traffic information, checking airlines schedules, accessing various banking systems to conduct secure transactions, and checking out e-books/journals from local libraries. These phones are smart enough to allow the convergence of a computer, cell phone, camera, media player into a single handheld device. The manufacturers of these smart devices are designing and adding new features to help humans to live better lives. They are constantly collecting data through surveys on the Internet to study and understand the behavior of the consumer. Kroski (2008) asserts that this evolution of handheld devices provides the most complete experience for the user because they are combined with the new high speed wireless data network access to the Internet.

Early adoption of the mobile Web in the U.S. is small when compared to the population of all those who own cell phones. Golvin (2007) reports that 73 percent of all U.S. residents own cell phones; for those between ages 18-27, it is 83 percent. Out of that number, only about 16 percent of American cell phone owners regularly browse the mobile Internet (Kroski, 2008). According to Khan (2008), 42 percent of those responding to a U.S. adult consumer survey said they use mobile devices to send or receive text messages, 24 percent to send or receive picture messages, 15 percent to send or receive email and 10 percent for instant messaging. Nine percent of these mobile device users who were surveyed searched for information using a form of browser or short message service (SMS or text message); eight percent for looking up directions or maps, and five percent for researching products information. The Economist (2008) argues that what appears to be a lack of growth in the demand for smart phones will soon show a major paradigm shift because of the two key players in the market place: Apple Inc. and Google.

Technology Considerations

Prior to the smart phone era introduced by the Apple iPhone, cell phones dominated all markets including the Sub-Sahara African markets. Similar to personal computers (PCs), the type of cell phones that dominate today's world markets have proprietary operating systems. A consumer will not only purchase the hardware (the physical cell phone), but will purchase add-on software or programs that the hardware needs to function with. Each manufacturer of cell phones – Nokia (the lead cell phone manufacturer), Samsung, Sony, Research in Motion (RIM), Symbian, and others – has developed proprietary operating systems to work with its cell phone devices.

This range of mobile devices and the underlying mobile wireless technologies require the development of services that are specific to each type of

infrastructure. There is a need for standardization and a unified platform for access and services. With respect to the hardware (the mobile devices and accessories), there are constraints with CPU power, displays, input devices such as the mobile keypad, voice input and restricted power units. Many wireless networks are constrained with bandwidth, latency and connectivity issues.

The Wireless Application Protocol (WAP) has become the *de-facto* standard for the mobile Web. It enables the use of smart mobile phones to present or deliver information and telephony services on mobile wireless devices. The WAP Forum has published a global wireless protocol specification that is based on other Internet standards such as XML and IP for all wireless networks. WAP is designed to work with other wireless network standards such as CDPD, CDMA, GSM, PDC, PHS, TDMA, FLEX, ReFLEX, iDEN, TETRA, DECT, DataTAC, Mobitex (MobileInfo.com). WAP will serve the future of the mobile Web similar to what the hypertext transfer protocol (HTTP) has done to the World Wide Web (WWW).

Recently, Apple has introduced its iPhone to change all of the barriers of purchasing add-on software for cell phones which is believed to be one of the reasons for the stunted growth in cell phones purchases in the developed countries (The Economist 2008). The Apple iPhone has an all-you-can-use free data plan. Apple has made available free software and tools at its online App Store for users to download to their iPhones. This is a very similar concept to the iTunes for Apple's online-music store.

Google has stepped up its game by providing the Google *Android*, an open source platform. Android is software that Google has made available to handset makers and operators/ISVs. T-Mobile is one of the first Internet Service Vendors (ISVs) to adopt Android for its G1 phone that was launched in September, 2008.

With such information about the U.S. mobile Web users and advances in the industry in the U.S., it is fair to conclude that consumer confidence is growing

for smart phones for the mobile Web. But can we say the same about the Sub-Sahara BOP populations? Asked differently, can they afford smart phones for mobile Web use? This is the question that researchers are asking but there is not a single study that I am aware of in the literature to show smart phone adoption or the use of the mobile Web in Sub-Sahara Africa.

CHAPTER FOUR

ASSESSMENT OF E-SERVICES

Chapter Objective

The preceding three chapters were used to introduce the research (Chapter One), develop the research framework (Chapter Two) and discuss the literature on ICT policies, ICT research and mobile technologies (Chapter Three). This chapter assesses e-Services. E-services (e-business and e-learning) in SSA are identified and discussed with specific examples and cases.

E-Services in Sub-Sahara Africa

In the research framework, several challenges or barriers to ICT adoption in SSA communities were identified and discussed. What is this region doing in its effort to overcome the barriers and to become part of the 21st century innovation? To answer this question, I first examine the historical perspectives with respect to information access and then discuss efforts towards e-learning, and e-business.

A Journey to E-Services

Despite the early telecommunications projects and the rapid diffusion of mobile technology in recent years, the literature shows that Sub-Sahara Africa is underserved in computers and Internet services. Many African societies today cannot boast of telecommunication hubs that provide enough affordable telephony and Internet access when compared to the developed societies.

Some of the rural dwellers are still living and using information as it was in the beginning of the 20th century. The communal lives of rural Africa at that time allowed people to depend greatly on their families, friends and organized groups such as the cooperative societies or churches for verbal information sharing. There were the local market squares where people met and communicated information that helped their personal as well as social information needs. Ayittey (1988) describes the period before European colonial rule when most of Africa had local free markets where there was information flow; goods were bought and sold for mutually agreed upon prices.

There was also the *village announcer* who walked through the village at the break of each new day to announce information that was pertinent to the survival of people in that community. The *village announcer* or *town crier* was an important informant, communicator, and an agent of change in the community. He was not necessarily in the lineage of the village chiefs or village dynasty, but served the dynasty and the people by gathering and disseminating information with a special *talking drum*. The *village announcer* was the gate keeper to information; his information dissemination skills brought people to the *Village Square* for meetings. Important deliberations and decisions were made on matters that affected the community. AfricaNews (2008) reports that the *talking drum* and *village announcer* are being revived to help rural Africans in Kenya stay informed even as they work towards a transition to what appears to be the dawning of a new era in information access and sharing through modern e-services.

As was discussed in chapter three, recent actions from the regions governments in formulation of ICT policies, relaxed regulations and encouragement of competition in the telecommunication industry have brought about changes that can support e-services in SSA. Four major e-services have sprung up in the region to aid sustainable development: e-agriculture (includes environment and green energy), e-business, e-health and e-learning. This research only examines two, e-business and e-learning. E-agriculture and e-health are very large entities that deserve separate research focus.

E-Business

E-business (electronic business) is the use of different forms of ICT tools and services to manage business processes. E-business activities can be performed via Web sites on the Internet or Intranets; electronic mail (e-mail); electronic meetings (e-meetings); electronic data interchange (EDI), faxes, and the like. Many e-business functions involve business to business (B2B), business to consumer (B2C or electronic commerce), government to consumer (G2C), and government to business (G2B).

Some multinational corporations (MNCs) have been doing business in the SSA region for some time now. Product development and market penetration by these MNCs are increasing in some of the SSA regions. Companies often start small and slowly expand. These companies, many of them are new comers to the region, are developing strategies and innovative ideas to enter and expand their influence. Nkanga (2007) reports the case of IBM's efforts to create e-business in Nigeria by extending the already established e-business in South Africa to this important country.

Enterprise for a Sustainable World counsels that any business activity that will have a sustainable impact must involve the people in the different BOP

regions. The participants in the BOP regions are to provide "native capability" to the innovation or e-business by:

1. Engaging in deep listening and mutual dialogue with income-poor communities.
2. Co-discovering and co-creating new business opportunities and business models embedded in the local cultural infrastructure.
3. Co-designing and launching BOP businesses that generate mutual value to all partners.

The SSA BOP populations are also advised to align with businesses that can help to improve their lives, their environment, support their local businesses to be more effective, save costs and increase growth. They are to explore new ways of working with the different players in their respective regions to improve communications and support a value chain that can improve both business performance and earnings. The BOP population needs to evaluate the opportunities created through collaboration continually as well as apply new innovations that will provide them sustainable growth and development.

The Case of Mali's Village Kiosk

One example of an e-business initiative is that of Mali's village kiosk. Mali is a country in the north western region of the Sub-Sahara Africa with a population of about 13 million people. Figure 15 shows the map of Mali and the neighboring West African countries.

Mali is an agrarian economy with such cash crops such as cotton, millet, rice, peanut, vegetables and livestock. The population that lives under one U.S. dollars ($1.00) a day is 72.8 percent (NationMaster, http://www.nationmaster.com/country/ml-mali/eco-economy). Mali is one of the countries that Collier (2007) describes as facing a landlocked trap (see chapter 2, the research framework). External trade routes have either become inaccessible or jeopardized by internal conflicts in the neighboring Cote d'Ivoire. Mali however is

not e-locked. With funding from the United States International Development (USAID) and the support of Geekscorp Mali, a new village kiosk, *Cybertigi* (Village Kiosk) has been formed in order to bring e-business to the rural Mali communities.

The International Center for Applied Studies in Information Technology (ICASIT, 1998) reported that as at 1998, there were about only 1,000 Internet accounts and four Internet Service Providers (ISPs) in Mali. Today, through new Internet cafés and kiosks, Mali has recorded more people accessing the Internet. The USAID in partnership with *Geekscorps Mali* has developed Internet kiosks in the rural areas.

Figure 15: Map of Mali and the Neighboring West African Countries

Image source, http://www.nationmaster.com/country/ml-mali

Casey (2006) reports the following processes that have been applied to create and operate the Mali Internet kiosks:
1. A cyber café which is called *CLIC* is setup in an urban area with facilities such as computers that are connected to the Internet along with other ICT tools that allow for emails, paper and photo prints, and the gathering of news.

2. The Village Kiosk (*Cybertigi*) is a local kiosk that is equipped with a few computers along with other basic ICT tools. The Kiosk clients are able to access services such as scanning, emailing, and news feeds.

3. There is a third intermediary called the *Mototigi* who physically transports data and documents between the *CLIC* and the *Cybertigi*/Village Kiosk.

4. The *Cybertigi/Village Kiosk* has a local manager who can also be the local photographer or the village known entrepreneur. If the local manager that is being trained to develop entrepreneurship skills has no photographic skills, he hires an assistant to handle photographic work. The local manager and the photographer help the village clients that come to use the *Cybertigi*/Village Kiosk.

5. Within each week, the *Mototigi* will make at least one trip between the Kiosk and the *CLIC*. Each time, the *Mototigi* gathers data from the Kiosk and he also delivers the data from the previous visit at the *CLIC*. Each *Cybertigi*/Kiosk has data gathered and delivered at least once a week.
Through this e-business innovation and collaboration, rural Mali communities are slowly being integrated into the information society.

As seen in the case of Mali, Internet kiosks (also known as Internet cafés or Cyber cafés), are viable ICT services that can support a community. Although still relatively new in many rural SSA communities, Internet cafés have helped millions of Africans who do not have personal computers at home, school or work to access the Internet. Table 8 shows the Internet usage statistics in some African countries.

Table 8: Internet Usage Statistics in Selected African Countries (2009)

INTERNET USAGE STATISTICS FOR SELECTED AFRICA (2000 and 2009)						
African Country	Population (2009 Est.)	Internet Users (Dec. 2000 Est.)	Internet Users (Sept. 2009 Est.)	Penetration (% Population)	User Growth (2000-2009)	% of Users in Africa
Angola	12,799,293	30,000	550,000	4.3 %	1,733.3 %	0.8 %
Benin	8,791,832	15,000	160,000	1.8 %	966.7 %	0.2 %
Botswana	1,990,876	15,000	120,000	6.0 %	700.0 %	0.2 %
Cameroon	18,879,301	20,000	725,000	3.8 %	3,525.0 %	1.1 %
Central African Rep.	4,511,488	1,500	19,000	0.4 %	1,166.7 %	0.0 %
Congo	4,012,809	500	155,000	3.9 %	30,900.0 %	0.2 %
Cote d'Ivoire	20,617,068	40,000	660,000	3.2 %	1,550.0 %	1.0 %
Egypt	78,866,635	450,000	12,568,900	15.9 %	2,693.1 %	18.7 %
Ethiopia	85,237,338	10,000	360,000	0.4 %	3,500.0 %	0.5 %
Gambia	1,778,081	4,000	114,200	6.4 %	2,755.0 %	0.2 %
Ghana	23,887,812	30,000	997,000	4.2 %	3,223.3 %	1.5 %
Guinea	10,057,975	8,000	90,000	0.9 %	1,025.0 %	0.1 %
Kenya	39,002,772	200,000	3,359,600	8.6 %	1,579.8 %	5.0 %
Lesotho	2,130,819	4,000	73,300	3.4 %	1,732.5 %	0.1 %
Liberia	3,441,790	500	20,000	0.6 %	3,900.0 %	0.0 %
Malawi	15,028,757	15,000	139,500	0.9 %	830.0 %	0.2 %
Mali	13,443,225	18,800	200,000	1.5 %	963.8 %	0.3 %
Mozambique	21,669,278	30,000	350,000	1.6 %	1,066.7 %	0.5 %
Namibia	2,108,665	30,000	113,500	5.4 %	278.3 %	0.2 %
Niger	15,306,252	5,000	80,000	0.5 %	1,500.0 %	0.1 %
Nigeria	149,229,090	200,000	11,000,000	7.4 %	5,400.0 %	16.3 %
Rwanda	10,746,311	5,000	300,000	2.8 %	5,900.0 %	0.4 %
Senegal	13,711,597	40,000	1,020,000	7.4 %	2,450.0 %	1.5 %
Sierra Leone	5,132,138	5,000	13,900	0.3 %	178.0 %	0.0 %
South Africa	49,052,489	2,400,000	4,590,000	9.4 %	91.3 %	6.8 %
Sudan	41,087,825	30,000	4,200,000	10.2 %	13,900.0 %	6.2 %
Swaziland	1,337,186	10,000	80,000	6.0 %	700.0 %	0.1 %
Tanzania	41,048,532	115,000	520,000	1.3 %	352.2 %	0.8 %
Togo	6,031,808	100,000	350,000	5.8 %	250.0 %	0.5 %
Uganda	32,369,558	40,000	2,500,000	7.7 %	6,150.0 %	3.7 %
Zambia	11,862,740	20,000	700,000	5.9 %	3,400.0 %	1.0 %
Zimbabwe	11,392,629	50,000	1,421,000	12.5 %	2,742.0 %	2.1 %
Data source: http://www.internetworldstats.com/stats1.htm#africa						

Internet cafés provide many services including e-business:

- E-mail and chats
- Internet telephony
- Internet search and query generation
- News
- Online courses
- Business and shopping
- Basic computer education

Internet café is one of the ICT services that have become available to BOP population for information seeking, access, retrieval and use. The Internet café usage can be traced to the 1990s when the private sector stepped in to help solve the information needs of the world poor. Very few people at the time in the BOP regions could afford to purchase computers, land lines, and mobile telephones to use for communication and Internet access. The people in the rural regions particularly, traveled long distances to make telephone calls to their family members who were working in cities or foreign locations mainly by using their nation's centrally-managed telephone centers that were sparsely distributed in the big cities. These calls were very expensive, forcing many to do without them or limit their talking time to only a few minutes. The Internet café solution then emerged, first in the larger BOP cities and it is now trickling down to smaller towns and villages.

Beside the mobile technology adoption that was discussed in chapter 3, services provided at the Internet cafés have helped to sustain e-business in many BOP regions. This innovative service uses computers to connect client to the Internet. It has helped to revolutionize BOP communication, information gathering, sharing and dissemination.

Internet cafés, unlike land telephone lines, are affordable. Etim (2009) studied two Internet cafés in the South Eastern region of Nigeria and reported that participants

in the study found the cost of renting computer time to be relatively low. She also found that Internet café services were highly needed by the participants in the study.

The Case of Ghana's E-Zwich

Another emerging case of an e-business innovation for the Sub-Sahara BOP populations is the smart card for electronic payments. In April 2008, President Kufour of Ghana, during a ceremony at Accra, the nation's capital, helped the Ghanaian government to launch a Universal Electronic Payment System called *E-Zwich (National Switch)*. It is a Radio Frequency ID (RFID) card with an electronic chip designed to work both online and offline because of its biometric and wireless features. The Ghana Broadcasting Corporation reports that the technology was becoming common among emerging and developing countries. It holds great prospects for Ghana as its citizenry steadily progresses into middle income status (Ghana Broadcasting Corporation, 2008).

E-Zwich is the brand name for the national smart card in Ghana developed under the umbrella of the new Universal Electronic Payments System (UEPS) which would ensure that all commercial banks, rural banks, along with savings and loans institutions in Ghana implement a common payment platform and biometric smart card system. To make sure that this technology is implemented Ajao (2008) reports in his blog that the Bank of Ghana (Ghana's central bank) has issued a directive that all banks link their automated teller machines (ATMs) and point of sale (POS) terminals to the National Switch, the E-Zwich, by the middle of 2008. Banks with existing switches are expected to upgrade them to make them compatible with the National Switch by July 1, 2008 while banks without switches (ATMs/POS terminals) are expected to integrate their payment terminals directly into the National Switch or through an E-Zwich compatible switch.

According to Ajao, the advantages of this new national payment platform are enormous. He states:

> A customer using a credit/debit/ATM card issued by a rural bank, can access cash from just about any ATM in any city or town in Ghana, and use it to effect payment for goods and services at stores equipped with POS terminals. A city dweller will also be able to access funds via ATMs in the deepest parts of Ghana (where ATMs exist). Hitherto, other payment platforms existed in Ghana, with VISA being the leading payment platform/ATM network.

E-Learning

E-learning (electronic learning) is the learning that is done via an ICT tool such as a computer. The ICT tool is oftentimes connected to a network such as the Internet or online databases making it possible for learning to occur anywhere and at anytime. According to WorldWideLearn, e-learning is interchangeable with these terms:

- online learning
- online education
- distance education
- distance learning
- technology-based training
- web-based training
- computer-based training (generally thought of as learning from a CD-ROM)

Yusuf (2005) explains that ICT can enhance teaching and learning through its dynamic, interactive, and engaging content. It also can accelerate, enrich, and deepen skills; motivate and engage the learner; help to relate school experiences to work practices; help to create economic viability for tomorrow's workers; contribute to radical changes in school; strengthen teaching, and provide opportunities for connecting between school and the world. ICT can make schools more efficient and

productive as well as provide a variety of tools that can enhance and facilitate teachers' professional activities.

E-learning offers lifelong participation in learning for different individuals and communities. It allows remote access to courses and resources on servers, Internet and remote databases; and a wider reach to students in different locations. Bassey et al (2007) assert that e-learning allows different modes of attendance, including part-time, distance, and work-based. They list several advantages of e-learning and some include:

- Students have access to a wide range of resources and materials which may not be available or accessible in a regular learning environment. Such might include audio, video, and virtual library resources.
- Students can participate and study at their own pace.
- Students choose when and where they study.
- Students have a technologically enabled, and an interactive environment that promotes a very active approach to learning.
- Students are motivated to explore interactive courseware, applications and online database resources.

I add that students can undertake self-based education and research using a variety of online tools and services. Where the Internet is accessible, students find information by constructing search queries and submitting them to search engines such as Google and Yahoo. They can read books online and e-Journals as well as have access to their virtual social networks.

For e-learning to take place, lessons must be made available via ICT tools such as computers and databases. Students accessed the courseware via computers, and very recently, mobile devices such as cell phones.
As was discussed in the research framework, computer resources are limited in the African BOP regions. A parallel problem is low rate of computer literacy among

students and faculty. These problems pose a major threat to the spread of e-learning in the SSA BOP regions.

Zehr (2004) reports that some pan-African initiatives like SchoolNet Africa are helping to provide computers in schools. However, the cost of Internet connectivity is much more expensive in Africa than in developed societies such as the United States. Because of such connectivity costs, Zehr (2004) states that schools in low-income communities in South Africa do not allow their students to use the Internet. The high connectivity cost can be linked for the most part to inadequate availability of information and communication infrastructure, computer literacy, poor administration and funding.

Computers are Core to E-Learning

Computers have become core ICT tools to aid e-learning in developed societies. Similarly computers can be used in the BOP regions for e-learning, information seeking and information retrieval. This ICT tool is expensive and many BOP people cannot afford it. Recently, innovation is helping to drive cost down. One such low cost innovative solution was introduced recently by Nicholas Negroponte's *One Laptop per Child* (OLPC) initiative. The OLPC is an innovation that can help the BOP children. The initiative which is driven by several non-profit groups, the goodwill of businesses and the public provide affordable laptop computers that can be used to tackle computer illiteracy.

These special laptops have unique features that can make them easy to use even in rural areas where there is limited electricity supply to power them. There is a built in solar panel for the screen, low energy usage that allows the built-in battery to run for several hours for low computational intense activities like reading and Web browsing. As shown in figure 16, there are two-top pointed antennas for signal boosting for that computer and other similar laptops in the surrounding areas.

Figure 16: One Laptop per Child for E-Learning

Image source: Amazon.com

There is no published data yet that shows if the OLPC innovation is helping to support e-learning effectively. What is known currently is that the cost per laptop has increased for poor countries from when the product was first introduced two years ago. This dramatic increase in cost has raised doubts about the laptop's affordability in the BOP regions (Beer, 2008).

It is estimated that about half of Africa's 930 million residents are below age 15 (IBM, 2008). This group must be reached with e-learning services because they hold the key to Africa's future economy and governance. At the moment, the educational infrastructure including those at the universities desperately needs overhauling. Kevit Dasai, director at the Kenya Private Sector Alliance, an industry trade group in Nairobi, Kenya warns that:

> The university system desperately needs to be reformed and overhauled. It is not aligned with the needs of the private sector. When you go into the labs or the electrical engineering departments, there is a smell of ancientness (IBM, 2008:8).

Digital Library Initiatives

A review of e-learning in the SSA cannot be complete without looking at digital library initiatives in the region. The goal for this sub-chapter is to raise awareness on the need for digital libraries in Sub-Sahara Africa and to discuss the case of Aluka Digital Library, one of the pioneering digital library initiatives in Africa.

Perspectives and Growth in Digital Libraries

The concept of a digital library (DL) has been defined in a variety of ways by librarians and DL researchers. Since this research has its base in the Information Science discipline, Arms (2000) definition of DL is used. He defines a DL as a managed collection of information, with associated services, where the information is stored in digital formats and accessible over a network.

Borgman (1999) reviewed the different perspectives in DL as belonging to mainly two schools of thought – researchers and librarians. Researchers focus on DL as content collected on behalf of user communities. Librarians, on the other hand, see DL as institutions or services. According to Borgman (1999), each perspective has its validity because DL projects draw from expertise and researches in multiple disciplines. She added that scholars from the field of computer science focus mostly on enabling technologies and networks, whereas those from library and information science concentrate on the content, organization, user behavior and publishing. Those researchers who are based in economics or sociology prefer the social context or the economic models. Scholars in the arts, education, geography, and health combined any of these areas in their research interests. The availability of funding from different sources such as the National Science Foundation (NSF) in the 1990s helped in the growth of the DL field in the United States. This also has helped to create collaborative researches in DL (Borgman, 2000).

In this information era where there is low cost equipment, cheap storage facilities, easier-to-use software, and open source technologies, electronic information publishing and distribution have taken root in both academic and business circles. These advances in information technology have enabled libraries to extend their services to include DLs. Some physical (traditional) libraries in academic settings such as colleges and universities have implemented digital libraries while the business communities have drifted away from shipping hard copy product manuals to their customers and now provide mostly digital information content to clients in centralized location (information centers) or via the Web. According to Marchionini (2000), digital libraries "marry the missions, techniques, and cultures of physical libraries with the capabilities and cultures of computing and telecommunications," (p.304).

Digital library research and implementation started in the early 1990s and has grown in significant proportions. According to Borgman (1999), the first DL initiatives in the United States (1994 – 1998) involved federal agencies. The second phase, the Digital Libraries Initiative (1998 - 2003) involved agencies. The National Science Foundation, for example, funded several DL programs/projects. In the United Kingdom, electronic libraries also sprung up in the same era. Domestic and international digital library conferences helped to pull together DL projects, enabling libraries to undertake projects in digital imaging, document indexing, management, and network services in addition to their traditional services of circulation, reference, and library management.

New online DL journals, DL software and sample digital libraries sprung up around the world in the late 1990s into the beginning of the Millennium. Marchionini (2000) reports on the Perseus Digital Library (PDL) that was guided by the main mission of providing and understanding the effects of broad access to digitized source materials in the humanities. Witten & Bainbridge (2003) report on the New Zealand Digital Library project which has helped to put a collection of New Zealand's newspapers on the Web. They also document the case of the Kataayi

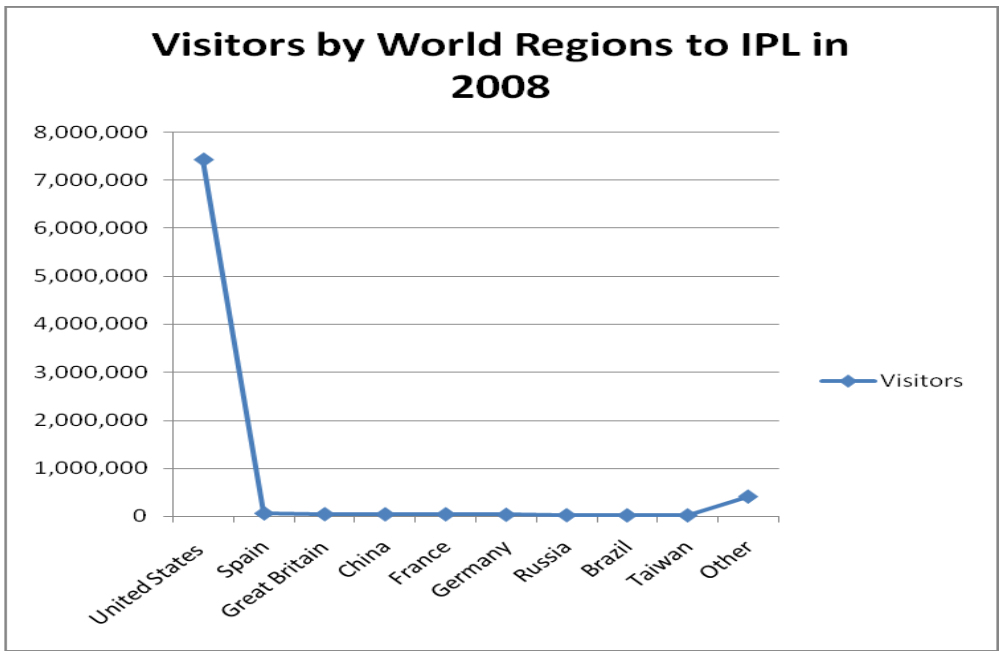
community DL project, an information and communication center with a major development impact in a rural community in Uganda.

How extensive are the knowledge and use of digital libraries in Sub-Sahara Africa? The answer is that the literature provides very little awareness and few development initiatives in digital libraries in SSA. Take the case of the Internet Public Library (IPL), an open-source and publicly available library on the Internet (http://www.ipl.org/). Data that were collected via Google Analytics during the course of 2008 on IPL usage was analyzed based on parameters such as monthly visits, visitors by world region, returning visitors, the browsers used by visitors, type of resources that were accessed the most, length of time spent on a page, etc. One of the statistics was on the visitors to IPL by world region. The United States showed dominance and other world regions were represented except for Africa. Figure 17 and Table 9 provide the statistics of visitors by world region to IPL between January and December, 2008.

Table 9: Visitors by World Region to IPL in 2008

World Region	Visitors
United States	7,425,973
Spain	68,053
Great Britain	51,223
China	48,898
France	44,163
Germany	39,522
Russia	30,346
Brazil	27,239
Taiwan	26,430
Other (English)	417,178

Figure 17: Visitors by World Regions to IPL between January and December 2008



The first step in the effort to bring DLs to Sub-Sahara African students and the public is to raise awareness about open-source and publicly available DLs such as IPL. The effort, however, can only happen if people are able to access resources on the Internet and other online systems. This issue was already raised and discussed in the framework with regard to lack of infrastructure, including telecommunication infrastructure in the region.

Very few cases of DL initiatives are available in the literature for SSA when compared to Europe and the United States. One case of a small DL in Uganda, East Africa, is the Kataayi DL project. According to Witten & Bainbridge (2003), the Kataayi community believes that an information and communication center would have a major development impact in the area's development. The Kataayi community built an information and communication center, gathered books that covered different subjects and built a digital library from these collections. This case is a model of a community organized social network that pulled resources together for the community's own digital library.

Witten & Bainbridge (2003) also confirm how developing countries are experiencing growth in mobile phone use, but digital library is a failure. They lament that developing countries are not participating in the information revolution, which includes digital libraries, because priorities are given to meeting basic needs such as drinking water, food, health, and sanitation. I discussed this situation extensively in my World Pyramid of human and information needs in the research framework (chapter two). According to them, digital libraries can help the developing world in the preservation of indigenous culture and dissemination of information/knowledge, including emergency information for disaster relief.

The Case of Aluka Digital Library

Another case in the literature is the Aluka DL that is available at http://www.aluka.org. Aluka is a digital library of scholarly resources from Africa. It is an international, collaborative initiative to build a collection of online digital

library and scholarly resources from and about Africa. The name "Aluka" is a Zulu word that means 'to weave', suiting its mission of connecting resources and scholars from around the world.

Aluka was founded by Ithaka, a not-for-profit organization that grew out of the Andrew Mellon Foundation in 2002. In the mid-1990s, The Andrew Mellon Foundation launched JSTOR, which is a not-for-profit organization that provides an online archive of back issues for leading scholarly journals. As JSTOR became available in the developing countries, it became clear that there was a great need not only to access scholarly resources in those countries, but also to develop local electronic content that could be made available online. At the end of 2002, with the support of the Mellon, Hewlett, and Niarchos Foundations, Ithaka, a new not-for-profit organization, was formed. Ithaka's mission is "to accelerate the adoption of productive and efficient uses of information technology for the benefit of the worldwide scholarly community" (see www.ithaka.org). As one of its first projects, Ithaka launched Aluka with the goal of creating an online archive of scholarly resources from the developing countries, beginning in Africa. Figure 18 shows the home page of Aluka with links to the digital collections from different African regions.

There are three main collections in the Aluka digital library. They are African Plants, Cultural Heritage, and Struggles for Freedom in Southern Africa. The collections in Aluka are made available to educational, research, and cultural institutions around the world.

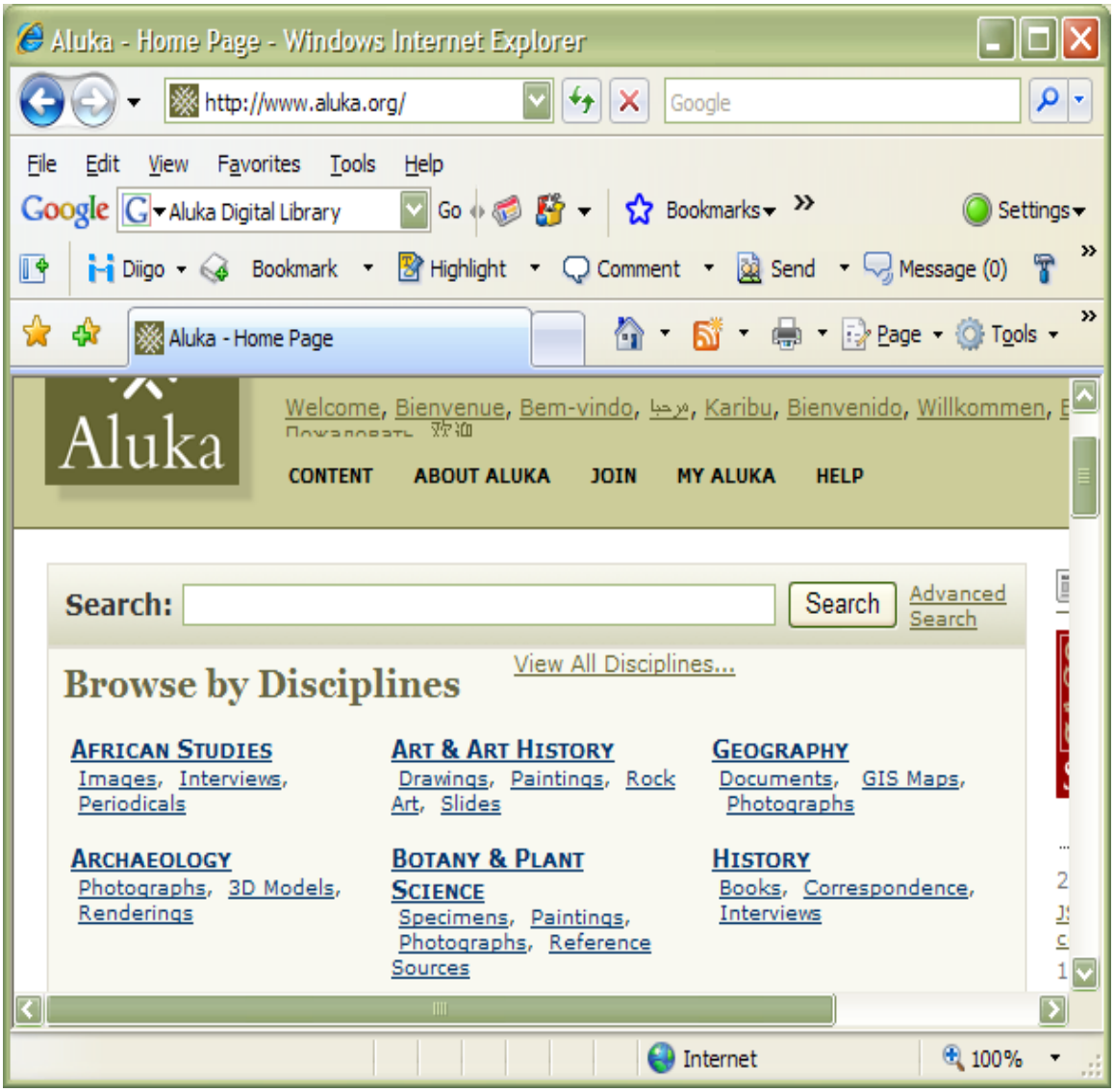
I begin with the Struggles for Freedom in Southern Africa. Although Aluka digital library became available online in February 2007, the collection initiative began as early as 2003. The initial collection focused on the Struggles for Freedom in Southern Africa. This effort was built upon an earlier work by the Digital Imaging South Africa (DISA) project that is based at the University of KwaZulu-Natal in Durban. With additional support from the Mellon Foundation, the work in South

Africa is expanded to four neighboring countries – Mozambique, Namibia, Botswana, and Zimbabwe.

The African Plants collection also began in 2003. The Andrew Mellon Foundation awarded an initial set of grants in December of that year to participating institutions. In July 2005, Aluka presented a working prototype of the African Plants database at the International Botanical Congress in Vienna. This was a major milestone for this digital library.

In mid-2004, a partnership between Aluka and the University of Cape Town was formed to use the latest techniques in laser scanning, and digital photography as a means of documenting African cultural heritage sites. This was the start of Aluka's third content area, African Cultural Heritage Sites and Landscapes. The collection and digitization work began in Tanzania in the fall of 2004, continuing on to Mali, Ghana, and Ethiopia in 2005. The same year, Aluka also partnered with the Trust for African Rock Art (Nairobi) and the Rock Art Research Institute to document these heritage sites. In the middle of 2008, the Aluka DL initiative successfully concluded its incubation stage within Ithaka. It is expected to be integrated into JSTOR in the near future.

Figure 18: Aluka's Home Page Showing Links to Digital Collections



Focus on Nigeria

Ololube (2006) attributes inadequate technological infrastructure, poor connectivity to the Internet, and teachers' lack of use of different information retrieval systems in teacher education programs as hindrances to the professional development of teachers in Nigeria.

Another challenge to e-learning has been funding. In a Nigerian study, Ololube (2007) looked at the relationship between funding, ICT, administration and planning. In the study, respondents were classified into two groups: academic *(N=62)* and non-academic *(N=92) s*taff of three institutions that offered teacher education programs (two universities and one college of education). He reports that the respondents were greatly dissatisfied with the insufficient funding and the slow pace of the integration of ICT into teacher education programs. They were also not satisfied with the administrative and planning processes. Computer education is still limited to federal unity secondary schools. Jegede and Owolabi (2003) made the following statement about the Nigerian system:

> It [computer education] is scarcely offered in any of the state secondary schools, which constitute more than 80% of Nigerian schools. Though some private schools have introduced computer instruction into their school systems, the number of schools that offer computer education is negligible compared to the general schools' population. From the questionnaires, the teaching of computer education in the federal government schools is limited to JSS (junior secondary school) levels only. However, very few private schools offered it at the SSS (senior secondary school) level. Almost 80% of the junior school students interviewed agreed that they could not operate computers. Therefore, the use of computers in education is rare in Nigerian schools. Also, the computer literate citizenry envisaged almost a decade ago is still a mirage (p. 3).

Bassey et al (2007) explains that the Nigerian government has funded some e-policy programs that were aimed at providing e-learning facilities in higher institutions in Nigeria. However, the effort has not been sustained due to several challenges. Ifinedo (2007) groups the challenges into three main categories:

- Infrastructural problems (poor Internet access due to low bandwidth, high costs of ICT services, lack of investments in ICT and inadequate power supply)
- Human capital problems (poverty, low illiteracy levels and poor IT skills)
- Institutional problems (organizational climate, resistance to change and lack of awareness).

Other writers have attributed the failure of e-learning in Nigeria as linked to the lack of a national policy on integrating ICT into the Nigerian educational system (Oyelekan, 2008; Yusuf, 2005b). The National ICT Policy, Use IT (2001) does not have a separate section for education, but groups a whole system of Nigerian education under human resources development, where it is mentioned that IT should be made mandatory at all levels of educational institutions. The policy was not backed by adequate implementation strategies that would have helped it to succeed. Nigeria remains a laggard in the use of ICT in education even when it is compared to other African countries. Botswana, for example, has Web-based e-learning services in several universities in the country. The flagship institution in Botswana, the University of Botswana, embarked on an e-learning program in 2001and is now well advanced with a WebCT eLearning platform that has well equipped smart classrooms, wireless LAN, digital projectors/scanners and videoconferencing centers (Tella, 2007).

Further development of e-learning technology has attracted little attention. E-learning is very minimal in the school curriculum; Internet connectivity in the universities and other institutions is poor, and students rely heavily on small and privately owned Internet cafés. The libraries are museums with old and out-dated

books, some of which were held since the colonial era. The libraries had no connection to digital libraries or online journals (Bassey, 2007).

In another study on the use of information and computer technology in Nigerian secondary schools, Aladajana (2006) reports that among teachers in the study, about 47% of the respondents were afraid to use a computer because of the [fear of] damaging it, 30% would rather avoid work that involved a computer, 32% would only use a computer when it was absolutely necessary and 34 % indicated that computers made them feel uncomfortable. In a related study, Iyamu and Ogiegbaen found that 92% of teachers never use any form of technology with their students.

Ogunsola and Aboyade (2005) report that some libraries in Nigeria face many problems in their effort to computerize library offerings and services:

> In the past decade, whatever has been done in terms of modern technological application or automation has not gone deep enough to make any appreciable impact. For instance, many Nigerian libraries face various problems in their attempt to computerize their library operations. These problems are not really of the library's making but is the usual problem confronting most of the computer installations all over the country today – shortage of manpower and lack of spare parts. Coupled with this, of course, is the problem of constant computer breakdown and low level of electricity supply. These problems have really slowed down the activities of Nigerian university libraries and other organizations in utilizing the computer-stored information for the services of its clientele (p. 11).

Other factors that impede e-learning and Internet usage include:

- Lack of skilled personnel to operate computers.
- High training costs.

- Lack of parts needed to maintain the computers because they are imported from other regions of the world (Zehr, 2004).

CHAPTER FIVE
THE RESEARCH DESIGN

Purpose of the Study

This study investigates the use of modern information and communication technology tools and services for alleviating the Sub-Saharan Africa (SSA) Base of the Pyramid (BOP) information poverty and extreme poverty. A research framework was used to discuss core concepts, the theories of poverty, human needs, information poverty, technology adoption and diffusion.

As discussed in the first two chapters, the main premise about poverty is that those in the BOP, particularly those in SSA form an economic group who live on less than two United States dollars ($2.00) per day (Prahalad and Hart, 1999; Prahalad and Hammond, 2002; Prahalad, 2006, World Bank, 2008). The SSA BOP is the poorest bottom billion (Sachs, 2005; Easterly 2006; Collier, 2007; World Bank, 2008). One researcher comments that they are heading towards a "black hole" (Collier, 2007). The studies and literature cited have produced substantial evidence to show that the economic disposition of the SSA has prevented it from taking part in the global information age. However, the BOP groups in the SSA region are adopting mobile technologies at a very rapid rate (Butler, 2005; The Economist 2008; Gillward, 2008; NCC, 2007; and Kroski, 2008). This study investigates the acceptance and adoption of such technologies, particularly as linked to alleviating extreme poverty and information poverty.

The study also investigates important barriers that have been identified in the literature in the use of ICT tools and services. One of the barriers that was identified and discussed in the literature section is infrastructure. Vachani and Smith (2008) identified poor roads, communications, and the lack of other basic infrastructures as adversely affecting the distribution of goods and services to the rural poor, therefore affecting both income and quality of life. Sachs (2005), in discussing his encounters with the rural poor of Africa, the group he called *the voiceless dying* states:

> I came to appreciate that isolation and lack of basic infrastructure are the prevailing conditions of most of rural Africa, and that rural Africa is where most Africans live. Perhaps these facts should have been obvious to me from the start. Relevant information on population densities, roads, motor vehicles, access to electricity and telecommunications, and the like was certainly available from published data. But without the benefit of visiting Africa's rural communities, I would not have known what to look for in the data, or what the data really meant (p. 193).

Butler (2005) asserts that for all the talk about alternatives to extreme poverty among the African BOP poor, "perhaps the best tool for poverty alleviation on the Continent [of Africa] is the mobile phone. Yes, that ubiquitous handheld device has done wonders for the poor around the world," (p.1). This study examines the impact of the mobile phones in the lives of a sub-section of the Sub-Sahara African population, the university students.

Location of the Study and Reasons for Selection

The SSA BOP region was selected as the region for the field research because it is the most affected by extreme poverty (World Resources Institute, 2007; Collier, 2007; Sachs, 2005; Easterly, 2006; United Nations, 2008). The population of the region is inching towards the one billion mark, and as such,

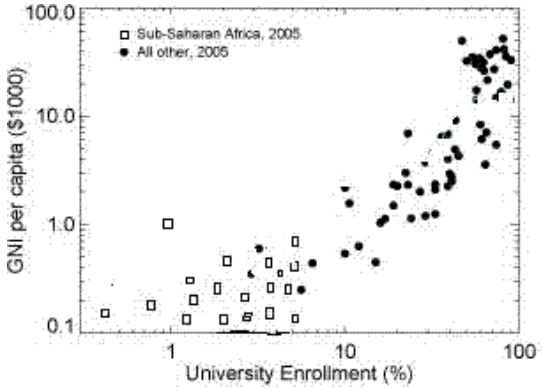
some scholars have already nicknamed it "The Bottom Billion" (United Nations, 2008; Collier 2007). The following is a summary of the relevant statistics for the 54 countries that make up the SSA region (UNESCO, 2004; Saint, 2005).

- Population: > 900 million < 1 billion
- Per capita income: > USD 100 < USD 2,800
- Life expectancy: About 46 years
- Annual population growth rate: 2.3%
- HIV/AIDS infection: 5 - 30%
- Primary education enrollment: 76%
- Secondary education enrollment: 26 – 30%
- Tertiary education annual enrollment: 4 - 9%

As one examines the above statistics, several issues stand out. Many have already been discussed in the framework of this research under the barriers to using ICT for development.

One core area that I want to revisit in this chapter is the statistics for education. There is strong evidence of a very low rate of higher education enrollment, illiteracy and digital divide in the SSA region. According to statistics from a research group in Harvard University, AfricaHigherEducation (2005) and Saint (2005), university enrollment rates in SSA are among the lowest in the world with an average annual enrollment rate of between 4 and 9 percent. The Harvard University research group indicates that there is a strong correlation between university enrollment and national income. Figure 19 shows how countries in the SSA compare with other countries in university enrollment and gross national income (GNI).

Figure 19: Education (University Enrollment) Plays a Critical Role in SSA Extreme Poverty, 2005



Source of data: http://www.arp.harvard.edu/AfricaHigherEducation/index.html

Description of Country and the University Setting for the Study

The study was staged at the University of Uyo in South Eastern Nigeria. A major reason for selecting University of Uyo was because it was the closest university to the location of the Internet cafés that I studied (see Etim, 2009). Another reason was that UniUyo has a large Campus with 18, 000 students. The Campus is very centrally located to serve all of Akwa Ibom State and the neighboring states like Cross River and Imo states. The aim of the study was to find out if students at University of Uyo had access to any form of ICT and if they have accepted/adopted mobile technologies. If they had accepted and adopted mobile technologies, for what purposes were they using the ICT tool,

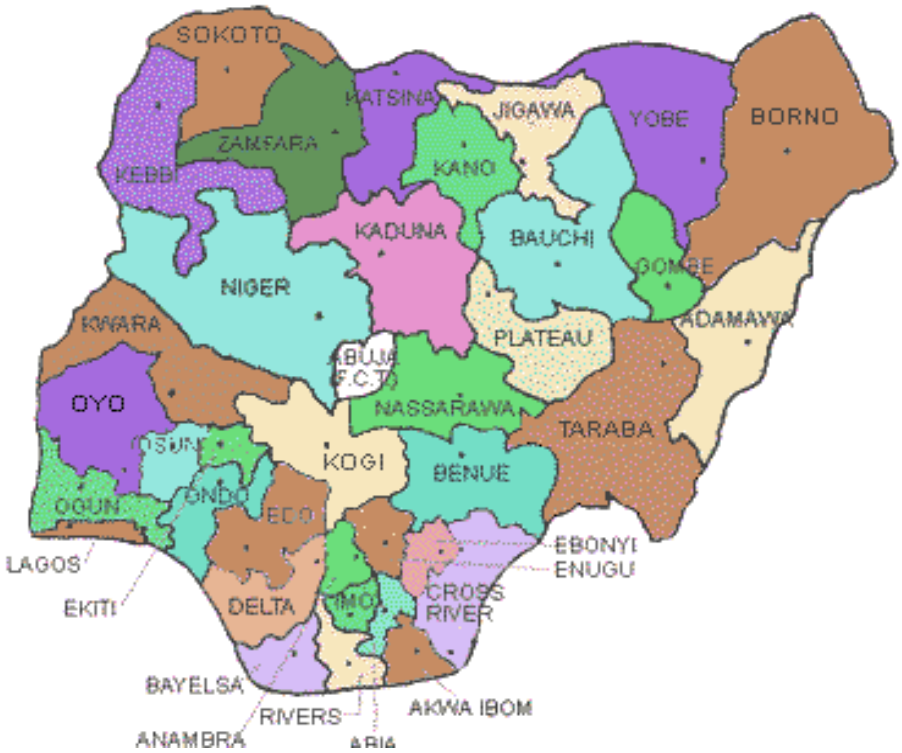
and how easy was it for them to use the technology. Particular emphasis was placed on less expensive ICT such as the cell phones. I now describe the country of Nigeria along with Akwa Ibom State, the city of Uyo and University of Uyo.

Nigeria is the largest country in the SSA region. It is bounded by Cameroon in the east, Benin Republic in the West, Niger Republic in the North, and the Gulf of Guinea in the south. Abuja is the Capital Territory while Lagos remains the commercial capital and major sea port. Figures 20 and 21 show the major cities and the states in the Federation. As the largest country in Africa with an estimated compact area of 923,768 square kilometers (356,376 square miles) and a population of about 133.5 billion people, Nigeria is a very multicultural and diverse country. The English language is the official language of communication; however, there are 250 ethnic groups that speak about 4,000 dialects. The main ethnic groups are Hausa, Yoruba, Igbo, Ibibio, Efik, Fulani, Igala, Kanuri, Tiv, Ijaw, Edo, Urhobo, Edoma, and Itsekiri (nigeriatoday.com). The illiteracy rate is very high in the country; only about 33 percent of girls and 32 percent of boys attend the last grade of elementary education (grade 6). The gross domestic product (GDP) is about 188.5 billion and the country is the sixth largest exporter of light crude oil (ncc.gov.ng).

Figure 20: The Map of Nigeria Showing Major Cities

Source: http://www.ncc.gov.ng/index1_e.htm

Figure 21: The Map of Nigeria Showing the States



Source: http://www.waado.org/nigerdelta/Maps/Nigeria_States.html

ICT Policy in Nigeria

Nigeria, like other SSA countries did not start early with modern ICT such as computers and cell phones. It was in the year 2000 that President Olusegun Obasanjo declared ICT a national priority during the National Information and Communication Infrastructure (NICI) Conference that was held in the country that year. He stated:
"Although we (Nigerians) are starting late, we are determined to develop our ICT infrastructure with a universal access capability in the shortest time. We shall connect our colleges, cities, schools, universities, research institutions and the entire public sector to the Internet" (Ajayi, 2007).

Nigeria started crafting its ICT policies in 2001 and relaxed telecommunication regulations during the same period to encourage foreign competing telecommunication companies (TELCOs) into the country. The main goal in the formation of ICT policies was to have policies in place to aid with national development. The mission statement has five broad policy areas on the use of information technology (IT) for Education, Creation of Wealth, Poverty Reduction, Job Creation, and Global Competitiveness (Nigerian National Policy for Information Technology, *USE IT*, 2001). The National Policy on Information Technology envisioned making "Nigeria to be an IT capable country in Africa and a key player in the Information Society by the year 2005, using IT as an engine for sustainable development and global competitiveness," (*USEIT*, 2001, p. iii).

The Policy specified many broad objectives, including the following (Nigerian National Policy for Information Technology, *USE IT*, 2001):

- To ensure that Information Technology resources are readily available to promote efficient national development
- To guarantee that the country benefits maximally, and contributes meaningfully by helping to provide global solutions to the challenges of the Information Age.

- To empower the youth with IT skills and prepare them for global competitiveness
- To integrate IT into the mainstream of education and training

The formulation of ICT policies brought about the establishment of the National Information Technology Development Agency (NITDA) in the Capital Territory, Abuja. During the 2007 UNESCO Conference, the Director-General of NITDA, Professor G. O. Ajayi, stated that NITDA was established to:

- Implement the 2001 ICT policy, *USE IT*
- *Co*ordinate the development of IT in Nigeria
- Regulate the country's IT Sector

The first task that confronted NITDA was to build the necessary infrastructure backbone and support for ICT. NITDA spawned the following infrastructure-building projects:

- National Information Infrastructure Backbone (NIIB).
- NITDA/State Governments Partnership for VSAT Internet
- Rural Internet Resource Centres (RIRC)
- Mobile Internet Units (MIU)

Ajayi also reported that the Public Service Information Network and other computerization projects have taken off and there was an organized private sector investment on ICT. The financial institutions have also made investments in the sector. The telecommunications industry in Nigeria is regulated by the Federal Government. Overall, the telecommunication industry in the country has seen positive growth. With the relaxing of telecommunication regulations, many Internet Service Providers (ISPs) have moved into the country to provide a variety of ICT tools and services.

The development of an ICT policy, the actions of NITDA as well as that of the Nigerian Communications Commission (NCC) helped to enable competition. The

cumulative effect is a faster growth in mobile telephony in the country when compared to other ICT tools such as computers, fixed telephony and the Internet combined. Table 10 provides data adapted from the Nigerian National Bureau of Statistics (2008: Table 353, p. 31). The data shows ICT equipment distribution by persons in the different states of Nigeria for 2007. The people in the southern states were adopting mobile phones at a faster rate than their counterparts in the northern states (see map of the states in figure 20b). The data also indicates that the use of traditional ICT tools such as radios were more common among the northerners than the southerners. Overall, mobile phone use is growing at a faster rate than all other forms of ICT. In 2000, there were about 266 thousand mobile subscribers, and that number grew to over 43 million by September of 2007 (see Table 7 in chapter 3).

Table 10: Percentage Distribution of Persons in Nigerian States by Type of ICT (2007)

State	Radio	Television	Mobile Telephone	Fixed Telephone	Personal Computer	Internet Service
Abia	36.2	21.9	40.8	0.2	0.6	0.4
Adamawa	55.5	14.5	29.1	0.3	0.7	0.0
Akwa Ibom	38.7	23.8	38.1	0.2	0.7	0.0
Anambra	33.6	20.6	45.0	0.1	0.4	0.3
Bauchi	76.4	6.4	16.7	0.5	0.0	0.0
Bayelsa	37.2	23.6	38.7	0.1	0.3	0.1
Benue	58.5	11.9	27.4	1.2	1.1	0.0
Borno	57.3	19.5	23.2	0.0	0.0	0.1
Cross River	43.0	19.8	36.9	0.2	0.1	0.0
Delta	35.8	24.2	39.4	0.0	0.4	0.2
Ebonyi	50.9	11.7	37.3	0.0	0.1	0.1
Edo	34.5	26.3	38.3	0.1	0.7	0.1
Ekiti	39.5	18.0	42.0	0.0	0.3	0.3
Enugu	36.7	18.6	42.3	0.6	1.5	0.3
Gombe	55.9	17.8	24.9	0.2	1.2	0.0
Imo	34.2	21.2	42.6	0.1	1.4	0.3
Jigawa	67.9	10.0	21.4	0.1	0.5	0.0
Kaduna	48.7	18.2	31.8	0.4	0.8	0.0
Kano	65.0	12.5	21.8	0.5	0.2	0.0
Katsina	77.3	11.8	10.4	0.0	0.3	0.2
Kebbi	60.4	18.3	18.8	1.3	0.6	0.6
Kogi	41.2	17.8	39.9	0.6	0.4	0.0
Lagos	22.6	22.6	50.5	2.0	1.8	0.5
Nassarawa	57.8	14.0	27.9	0.0	0.2	0.1
Niger	51.0	21.3	27.3	0.2	0.2	0.0
Ogun	34.2	22.2	42.0	0.1	1.3	0.2
Ondo	36.8	22.6	39.9	0.2	0.5	0.0
Osun	38.0	20.6	40.1	0.3	0.6	0.3
Oyo	34.5	19.2	43.0	1.1	1.7	0.6
Plateau	48.0	18.5	33.2	0.0	0.3	0.0
Rivers	33.0	23.1	43.0	0.1	0.9	0.0
Taraba	71.3	8.0	19.9	0.4	0.2	0.2
Yobe	82.7	5.5	10.7	0.2	0.6	0.2
Zamfara	69.3	10.9	18.8	0.8	0.2	0.1
FCT(Abuja)	33.1	18.9	45.5	0.5	1.7	0.4
Male	45.7	20.9	31.6	0.6	0.9	0.2
Female	34.5	14.4	50.0	0.3	0.6	0.2

Source: Adapted from Table 353, Nigerian National Bureau of Statistics (2008). Annual Abstracts of Statistics: Chapter 10, Transportation and Communication. Lagos, Nigeria: Nigerian National Bureau of Statistics, http://www.nigerianstat.gov.ng/nbsapps/annual_reports/CHAPTER%2010.pdf.

The Nigerian National Bureau of Statistics (2008: 1) states:

> The telecommunications industry in Nigeria is regulated by the Federal Government through the Ministry of Information and Communications, Nigerian Communications Commission and the National Frequency Management Council. The telecommunications environment is presently characterized by healthy competition, increasingly discerning consumers and vigilant regulators. Available services include Fixed Telephony, Mobile Telephony, Internet Services and other value added services. There is evidence of rapid growth in demand, usage, density and coverage, making Nigeria the fastest growing telecoms market on the African continent. The growth in telecom service delivery from 1999to 2003, for instance, is unprecedented.

Akwa Ibom State and the City of Uyo

The city of Uyo is located in the South-Eastern region of Nigeria (see figure 22). It is the capital of Akwa Ibom State, a state that was carved out of the mainland part of the Cross River State in 1986. Akwa Ibom State is the second largest oil producing state, after its distant neighbor, Rivers State. Uyo is a commercial city located away from the sea coast in the central part of the State. The city has grown rapidly in population since it became a capital city in 1986. The population of Uyo as of 2006 was over 700,000 people, (http://en.wikipedia.org/wiki/Uyo). New infrastructure such as roads have been built or widened to accommodate heavy traffic from the suburbs into and out of the city daily. The closest international airport is about 100 kilometers (62 miles) away. The neighboring towns are Abak, Etinan, Ibesikpo, Ikot Ekpene, Itu, and Oron. A national television studio has been opened to support the broadcasting of news and entertainment.

Since the city's population has been growing rapidly from 1986 that it became a capital city for Akwa Ibom State, both the federal and state governments have stepped in to help with the construction of housing estates to create affordable

housing for the populace. The ethnic groups that are the main dwellers of the city are the Ibibios and the Annangs. Groups of Igbos have migrated from the neighboring Imo and Anambra states to situate their commercial enterprises in Uyo.

The Ibibios are the oldest and largest occupants of the city of Uyo. When Akwa Ibom State was formed from Cross River State in 1987, the city of Uyo became the capital of Akwa Ibom State, a university town and commercial center for the region, allowing for a good representation of the other major ethnic groups - Annang, Eket, Oron, Ibeno and Mbo in the city. Oral history has it that Uyo and the neighboring towns such as Abak, Afaha, Eket, Etinan, Ikot Ekpene, Ibeno, Itu and Oron have been home for these ethnic groups even before the 1800s. The ethnic groups share a common ancestry. They have one language but different dialects and they often times understand each other. The culture is very similar, for example, they have common names such as Akpan (first son), Udoh (second son), Adiaha (first daughter), Nwa (second daughter), Eka (mother) and Ette (father). The similarities in the belief system, entertainment, foods, occupation, and the relative ease of inter-marrying among the ethnic groups also reveal their common ancestry. Figure 23 shows a common form of entertainment among the ethnic groups – dancers at a public event. The region has many rivers and the two important ones are Akwa Ibom and Cross River. The adequate annual rainfall (between 22 and 35 cm/8.7 and 13.7 inches) as well as the fertile land allows for Akwa Ibom State's agrarian economy. The State also has natural resources, such as crude oil, natural gas, limestone, and gold. Major cash crops are palm oil, palm kernel, cocoa, and timber. (http://www.akwaibomstategov.com/aboutakwaibom.html).

Figure 22: Map of Nigeria Showing the Location of Uyo

Figure 23: Group Dancers at a Public Event

Image source: http://www.akwaibomstategov.com/

Uyo is the home of the state's major university, the University of Uyo. The University operates from two campuses. The Town campus is located in the heart of Uyo city and houses the Central Administration, Faculties of Arts, Education, Social Sciences, Natural & Applied Sciences, Pharmacy, and Post Graduate School. The second campus is the Town Campus Annex and a permanent site that is to help transition the university to a larger land area; it is about 5 kilometers from the current main campus. The permanent site campus houses the faculties of Agriculture, Business Administration, Law, Engineering,

Environmental Studies and General Studies. The University inherited students, staff, academic programs and the Town campus facilities from the University of Cross River State in 1991. The library is located on the Town campus. It has an active collection of 46,745 volumes and handles about 409,977 lending/reference enquiries annually. There are about 271 journals and periodicals that represent different disciplinary interests. There is no statistics about electronic collections in the University of Uyo Library. Figure 24 is the view of the entrance to the main campus of the University of Uyo.

Figure 24: The University of Uyo (viewed from the main entrance area)

Image source: University of Uyo's Web site at http://www.uniuyo.edu.ng/

There are about 18,000 students, 800 academic faculty, 713 senior administration and technical staff, and 1086 junior staff. Most of the students are full-time and board on the dormitories on the campuses. The university is tuition free, in keeping with the Federal Government of Nigeria's policy on free tuition at the tertiary education level for all the federal government universities. Since the University of Uyo is one of the federal government institutions, it does not charge tuition to students. However, there are boarding and other fees that will bring a student's annual cost to about 80,000 to 100,000 naira (N100,000 is about $1000) in a year. The source of funds for these other fees is not

documented but there are speculations through word of mouth that students are supported mostly by their parents and other family members or by some merit scholarships. The admission process is highly competitive, and only about 20 percent of applicants get admitted. Admission is based on available slots for each program of study.

Although there are some out-of- state students, most of the students are in-state. About 80 percent of the 3.9 million residents of Akwa Ibom State live in the rural areas (http://www.akwaibomstategov.com/). Many of the students at the University of Uyo are first generation college attendees from these rural or BOP communities. My study will offer insight into the students' access/ownership of ICT tools/services and their adoption of mobile phones for different information seeking behavior and roles. I will now examine the model of the research and the research methods.

The Research Model

I have used the poverty framework, human needs and diffusion of innovation theories to build a framework for this research. Figure 25 is a diagrammatic representation of the research model which was first shown in the theoretical framework (chapter two). The model shows that ICT access and use helps to increase income, reduce both extreme and information poverty, and empower the people to participate in e-services and innovation.
The three main propositions that I am putting forward in the research model are:

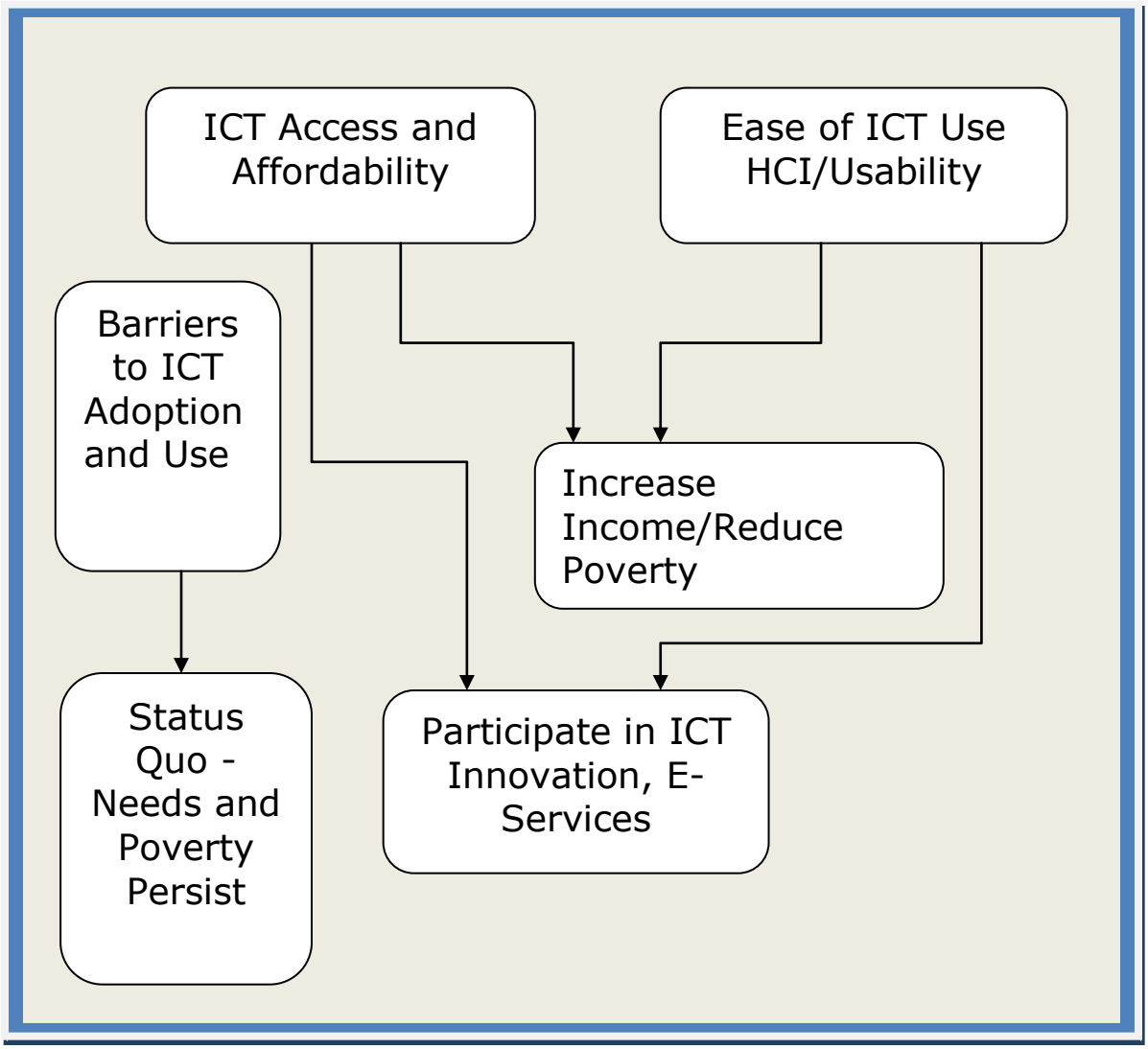
- ICT ownership, access and affordability will help to increase income and reduce extreme/ information poverty.

- ICT access and ease of use will also give rise to e-services such as e-learning, e-banking and microfinance, and e-health; which will empower people in the SSA region to become part of the global information society.

- If barriers (as discussed earlier in the research framework) to ICT access and use continue to persist, ICT adoption will be stifled and this will lead to a continuation of the status quo, where people continue to live in extreme and information poverty. Therefore, it is needful to understand the barriers as laid out in this research framework. Although many of these barriers are not investigated in this current research, identifying them here will help to raise awareness for future research. The barriers that I have incorporated into this research plan are the ones that help to inform the following two areas:

    - Ownership and access to computing technologies, mobile technologies and the Internet.
    - Technology acceptance, ease of use and innovation.

Figure 25: Research Model of Factors that Influence ICT Acceptance and Adoption in Sub-Saharan Africa



Research Questions

This research used the individual as the unit of analysis in formulating the research questions. As depicted in the research model (Figure 25), three variables were investigated and resulted in three blocks of questions. These were:

1. Access and affordability block
2. Ease of ICT use, human computer interaction block
3. Participation in ICT innovation and e-services block

Barriers to ICT adoption were considered within each of the three blocks of questions. The research questions were developed based on the model (Figure 25) and were used to test if mobile technology access and use had helped individuals to meet both their information needs and alleviated them from extreme/information poverty. The following research questions were raised for further investigation.

Access and affordability

1. Do the participants in the study who own an ICT tool such as a cell phone or computer live on less than two U.S. ($2.00) dollars a day?
2. Is cost a factor for study participants' adopting and using different forms of ICT tools/services?
3. Is there a relationship between having access to an ICT tool or service and a study participant's ability to access the Internet and other information sources?

Ease of ICT use, human computer interaction

4. To what extent do study participants perceive mobile phones as being useful for different tasks they engage in?
5. To what extent do participants in the study perceive mobile phones as easy to use, satisfactory and dependable?

Participation in ICT innovation and e-services

6. To what extent do participants in the study perceive mobile phone technology as an innovation that can help to sustain development (reduce poverty, enable income earning potential and broaden access to e-services)?

Research Methods

Survey Method

A survey method that utilized a questionnaire was selected for this research and it served as the primary method for data collection. Questionnaires, according Miller and Salkind (2002:301) "take a great deal of time and energy to develop, but when administered correctly, they provide a significant and accurate assessment". I followed guidelines provided by Bailey (1999) and Krosnick (short course developed for UNC Chapel Hill, Odum Institute, 2009) in the construction of the questions.

- I established the relationship of the method to the problem (research question) and the hypotheses.
- I avoided long questions and coded the options clearly.
- In forming each question, I kept the language simple and easy to understand; I avoided complex and ambiguous wording, and defined technical terms that might not be clear to the respondents.
- I made an effort to suggest all possible alternatives to the respondents. Where possible, I asked open-ended questions to allow respondents to write in the answers.
- I considered carefully whether a personal or impersonal question would obtain a better response.

It is needful to explain that studying the University of Uyo students' extreme and information poverty as well as their acceptance and use of ICT such as the mobile phones was one major step towards understanding the BOP group - the effects that extreme and information poverty had on the group and the value add of ICT to their lives. My study sample is a representation of the SSA BOP because the group is very closely interwoven together with similar culture, history, colonial rule and development challenges. The writers that were cited earlier in chapters one and two (Ayittey, Collier, Easterly, Hammond, Karnani, Prahalad, Sachs, the United Nations and the World Bank) address the BOP using cases or studies from individual countries within a BOP region. Prahalad and Hart for example, studied the Asian BOP using cases from India. Ayittey's economic models were tested in Ghana but the results were generalized for SSA region. In his *Africa unchained* (2005), Ayittey generalized a new leadership model (Cheetah generation) for Africa even though it is only being tested in Ghana. MOPTAM is also a model that was tested with 56 subjects in South Africa but it currently has a global imprint that it is an improvement to the original TAM that was developed in 1989 and the unified theory of acceptance and use of technology (UTAUT) of 2003.

The University of Uyo that my study sample was drawn from share very similar characteristics with all the other universities in the SSA BOP. One of such characteristics is that these newer universities grew out of the premier ones that were established during the colonial rule in the different African countries. The University of Uyo grew out of the premier Ibadan University College (now, the University of Ibadan). Examining a subset of the students in one university can help to explain or provide answers to issues in other universities and invariably, the BOP population. Early African universities that were established in the 1960s (the decade when many of the SSA countries' got their independence from colonial rule) had a key role in training government civil servants, lower-level managers for the colonial administrations, and had very little or no technological emphasis, except for the training of home economists (women)

and craftsmen (men). These universities were established by the colonial administration of England, Portugal and France. Some of the early African universities include:

- Fourah Bay College, Sierra Leone, 1826
- Liberia College, 1862
- Fort Hare College, South Africa, 1916
- University of Ghana, 1948
- Ibadan University College, Nigeria, 1948 (now University of Ibadan)
- Makerere University College, Uganda, 1949 (now University of Makerere)
- University of Dakar, Senegal, 1957
- University of Tananarive, Madagascar, 1960

The university system has expanded significantly and each country now has many universities, colleges and polytechnics. However, the curriculum has not expanded. As a result of this, out of the four to nine percent annual enrollment in tertiary education, over 70 percent are enrollment in humanities and social sciences. The core science and technology areas continue to suffer in enrollment, shortage of staff and sub-standard/outdated curriculum; and the contribution of these universities collectively to global knowledge is estimated at only 0.3 percent (Ogunsola & Aboyade, 2005; Saint, 2005).

With the limited enrollment in science and technology education, outdated curriculum, and poor infrastructure in these universities, skilled personnel in information science, computer science and information systems are difficult to obtain. Telecommunication and broadband access is very costly, making people, including the university populations starved for information that could easily be obtained using various forms of ICT tools, the Internet and online databases. This research therefore has a lot to offer to the SSA BOP region and the world. It would add to the world knowledge base in understanding the socioeconomic

disposition, ICT acceptance, adoption and use in the region. Some of the findings in this study would help to guide the crafting of new ICT policies, implementation of those policies and the overall understanding of what ICT tools and services were best fit for the SSA BOP people.

The Design of the Survey

The study design and the questionnaire items were developed to help support the BOP and Bottom Billion hypothesis that was discussed in chapter one as well as the issues of ICT acceptance and adoption theories/models that were laid out in Chapter Two. The development of the questionnaire items was guided by the theoretical framework, earlier studies (reviewed in the literature section), the research questions and the research model (Figure 25). Some of the earlier studies that were reviewed provided survey questions that helped with the design of the questionnaire items for each of the three blocks in this study.

Access and affordability block

The survey questions that were raised in Gillwald (2008) about ICT access and affordability guided my design of the questionnaire items for the access and affordability block. Some of the survey items in that study included:

Fixed Line access and affordability

- Do you have a working fixed-line telephone at your home? Yes or No
- Could you tell me how much you spent on your fixed-line telephone last month (charges and line rental) US$? (Open-ended question)
- Is the current cost of the monthly line rental of your fixed-line telephone - a) very low (b) low (c) ok (d) high (e) very high?
- Is the current cost of local calls to a fixed-line phone during peak time - (a) very low (b) low (c) ok (d) high (e) very high?

Mobile phone access and affordability

- Do you own a mobile phone or active SIM card? Yes or No
- Is the current cost of calls to mobile phones during peak time - (a) very low (b) low (c) ok (d) high (e) very high?

Public phones access and affordability

- Have you used any public phone during the past three months?
- What is your average public phone expenditure per month?

Computer/Internet access and affordability

- Does this household have a computer?
- Does this household have a working Internet connection?
- I know what the Internet is!
- I use the Internet
- Where do you use the Internet? Check options that are applicable: (a) cyber cafe' (b) at work (c) at an educational institution like school, university, etc. (d) at another person's home (e) use a mobile phone
- How often on average have you used the Internet in the past six months? (a) Every day or almost every day (b) At least once a week (c) At least once a month (e) Less than once a month

Ease of ICT use, human computer interaction block

The measurement scales provided by Davis (1989) have guided several studies in the areas of technology acceptance and adoption for different systems. Venkatesh et al (2003) and Van Biljon and Kotze (2007) used a similar scale in their study design for the technologies that they tested. This study used a related scale to develop the questionnaire items for the ease of use block for

mobile phones. In Davis' study, the system that was examined was called

Chart-Master. Sample items that were part of his study included the following:

Perceived Usefulness
Using CHART-MASTER in my job would enable me to accomplish tasks more quickly.
likely extremely|quite||neither||quite|extremely unlikely

Using CHART-MASTER would improve my job pertormance.
likely extremely|quite||neither||quite|extremely unlikely

Using CHART-MASTER in my job would increase my productivity.
likely extremely|quite||neither||quite|extremely unlikely

Using CHART-MASTER would enhance my effectiveness on the job.
likely extremely|quite||neither||quite|extremely unlikely

Using CHART-MASTER would make it easier to do my job.
likely extremely|quite||neither||quite|extremely unlikely

I would find CHART-MASTER useful in my job.
likely extremely|quite||neither||quite|extremely unlikely

Perceived Ease of Use
Learning to operate CHART-MASTER would be easy for me.
likely extremely|quite||neither||quite|extremely unlikely

I would find it easy to get CHART-MASTER to do what I want it to do.
likely extremely|quite||neither||quite|extremely unlikely

My interaction with CHART-MASTER would be clear and understandable.
likely extremely|quite||neither||quite|extremely unlikely

I would find CHART-MASTER to be flexible to interact with.
likely extremely|quite||neither||quite|extremely unlikely

It would be easy for me to become skillful at using CHART-MASTER.
likely extremely|quite||neither||quite|extremely unlikely

Participation in ICT innovation and e-services block

The design of items for this third block and barriers to ICT adoption was guided by several readings (ADB, 2003; Butler, 2005; Cellular.co.za, 2004; Collier,

2007; Conradie & Jacobs, 2003; Donner, 2008; Grameen Telecom Corporation; IBM, 2008; INSEAD & World Economic Forum, 2008; Lagmia 2005; Negroponte, 1998; NEPAD, 2002; NCC, 2007; Prahalad, 2006; Rogers, 2003; Srivastava, 2008 and Ssewanyana, 2007). Another source of guidance came from the interview that I had with Dr. Ita Ekanem, a retired United Nations Economic Community for Africa (ECA) in January 2009. When I consulted with Dr. Ekanem, he suggested that I include intervening variables such as lack of electricity supply to enable charging batteries for ICT tools.

The complete survey questionnaire may be reviewed in Appendix C.

Assistance at University of Uyo

Before I arrived at the University of Uyo, Dr. Stephen Bassey, an Associate Professor at the University, volunteered to publicize the study. I knew Dr. Bassey from an earlier book project, *Educational reforms in Africa: Essays on curriculum, libraries, counseling and grade levels* (New York: Edwin Mellen Press, 2009). He and I, along with other scholars contributed chapters to the book. I made phone calls to Dr. Bassey and also exchanged e-mail messages about the plan of my study. About ten days before my trip, I sent the invitation flyer (Appendix B) as an e-mail attachment to Dr. Bassey. I followed up with a telephone call to request that 600 copies of the flyers be printed out and distributed to students in different disciplines. We discussed the importance of obtaining a representative sample for the study and the need to ensure that the circulation of flyers reflected this. I requested that Dr. Bassey use the flyer information to make large posters that he strategically placed in different buildings at the two campuses. Information sharing by word of mouth was also deployed in order to recruit students for the study before I arrived in Nigeria and the University of Uyo.

The Journey to Uyo, Nigeria for Data Collection

I started my trip on July 27th, 2009 from Raleigh/Durham (RDU) International Airport and arrived at Murtala Muhammed International Airport, Lagos, Nigeria on July 29th. It was a very long flight with changing of plane and stops at Minneapolis, MN as well as Amsterdam, Netherlands. I arrived late in the evening at Lagos and spent a night there. I continued on my journey to Uyo the very next morning. The airport at Uyo is under construction and as such, there are no direct flights from Lagos to Uyo. To avoid a road trip from Lagos to Uyo (a 14-hour journey), I flew into Margaret Ekpo's International Airport at Calabar, Cross River State with a local airline, *Aero* and then traveled by road in a private bus transport service to Uyo. It was the last strip of the journey, the road trip to Uyo that confirmed immediately the issues that were raised and discussed in my research framework and literature about the lack of or a breakdown of the infrastructure in SSA region.

When all the passengers were seated and luggage was loaded properly into the bus, the driver of the bus announced to all passengers about how bad the Calabar-Uyo road was. He took out his mobile phone and called another driver who was already dispatched that morning to Uyo and had not yet returned. That driver told him that the road was at its worst state and that he should plan for detours through the bushes. It took five hours instead of two hours to arrive at Uyo because the road was flooded very badly with several weeks of heavy rainfall (it was the rainy season in the region). It was a journey that I would live to remember. Indeed, it provided an opportunity for me to hear several issues that were at stake with regards to the infrastructure and poverty in the region. Several of the passengers expressed anger and frustration at the lack of action to fix the Calabar-Uyo road, which was one of the federal government roads. Their anger was directly linked to the fact that Akwa Ibom State was one of the largest oil producers for Nigeria. Several of the passengers lamented about the deplorable state of several roads and public school buildings in Akwa Ibom State and other Southern States. I listened. One of the interesting discussions

centered on the dilapidated state of public schools' infrastructure, which included buildings, grounds, chairs, libraries, and the like. The four men who sat behind me discussed how they had all removed their children from public to private schools despite the heavy costs of private education.

I also took interest in observing the man who sat to my immediate right in the bus. He was busy most of the time on his notebook computer and an Apple iPhone. While several conversations were going on in the bus due to the road condition, this passenger was either working on his notebook computer or his iPhone. Curious about an iPhone user in the region, I struck up an interesting conversation with him about information and communication technology (ICT). He was very nice and answered my questions that ranged from the different types of mobile technologies that were being used in the region to prices of many ICT tools/services. Several other passengers had basic phones which they used at different points to alert family members, friends or business partners about the state of the road that would cause them to arrive late in the evening at Uyo. The trip to my final destination, Uyo, despite the deplorable road conditions, turned out to be an information-rich experience.

My observations during the trip helped to support some information grounds' studies by Karen Fisher (2005) about the diversity and richness of informal information grounds like hair salons, barber shop, and hospital waiting rooms. In my experience, it was the bus.

Another interesting observation while at Uyo was about my interactions to understand who dominates the mobile phone market in Nigeria. From the moment I arrived at Lagos, I observed the different types of mobile technologies that people were using for their information seeking and information sharing. During my stay at Uyo, I mingled with students at the University of Uyo grounds and learned about the different mobile technologies and the associated services. The Finnish company, Nokia, dominates the Nigerian mobile phone market. The

distributors that I talked to at Uyo displayed mostly Nokia brands; these ranged from basic phones of about 3,500 naira (about $20) in Lagos but sold for about 5,500 naira (about $35) in Uyo to flip phones as well as touch screen phones with price tags of well over 15,000 naira ($100 or more). The good news is that Nokia and a few other manufacturers have adapted the mobile technology to a wide range of consumers at prices so that many of them could afford to purchase a new or used phone. However, the bad news was that the service is very expensive and of poor quality. I bought a Nokia N79 mobile phone for 5,000 naira (about $34) and it had most of the features of a typical mobile phone in the U.S. In addition, it had a slot for a SIM card beneath the battery. One of the interesting or customized features for mobile phones in that market is a touch light that glows beautifully in the dark. I depended a lot on the touch light feature to move around or finish whatever I was doing when the National Electric Power Authority (NEPA) interrupted power supply every evening at about 8:00 PM the local time because the electricity is rationed to ensure that each area of Uyo had a few hours of power supply daily. The electricity supply problem was discussed above in chapter two as one of the barriers (interfering factor) to ICT adoption. I posted the information about the journey and my observations to my blog page, http://etimict.blogspot.com/.

The Sample

The sample was drawn from the University of Uyo students' population. Any student in the University was qualified to participate in the survey. The recruitment tools that were used were flyers (Appendix B), posters and word of mouth. Before I arrived at Uyo, Dr. Stephen Bassey, an Associate Professor at the University of Uyo, volunteered to publicize the study and worked with some of his students to distribute flyers in different dormitories and buildings on both Campuses. The posters were strategically located in the different buildings at

the two Campuses in order to attract a representative sample. Information sharing by word of mouth was also helpful in recruiting students for the study. The researcher, with the help of Dr. Bassey (volunteer) and another research assistant (hired at Uyo), administered the questionnaire to groups of students on August 4th and 5th, 2009.

The surveys were administered to students that showed up at the specified days, time and location that were provided on the flyers and posters. There were three administrations for each day and a total of six administrations during the two days. Initially, I had planned for four administrations, two for each day, but I was able to fit in a third administration in each of the two days later in the afternoon in order to accommodate the students that either arrived late or came because they had interacted with the ones that had participated in an earlier survey administration. The students arrived for the study in groups and were very eager to take the survey. Dr. Bassey, being a researcher also, was able to spot the groups and helped in selecting them in order to have a good representation of the different faculties and schools at the University of Uyo. The distribution of study participants by field of study (Table 15, Chapter 6) shows a good representation of the different faculties/schools at the University of Uyo.

Before each questionnaire administration, the researcher provided copies of the study fact sheet (approved by the University of North Carolina (UNC) IRB at Chapel Hill)) to the study participants. This information is provided in Appendix E. Enough time was given during each administration for participants to read the fact sheet as well as ask questions. It was a paper and pencil survey administration. A study participant spent between 50 minutes to one hour in answering the survey questions. Before giving the completed questionnaire back to the researcher, each study participant provided first name and contact phone number (approved by UNC IRB) for a possibility of being invited back to participate in the focus group interviews (focus group interviews will be

discussed later in this chapter). At the end of the questionnaire administration, a total of 320 questionnaires were collected, and 300 of them were usable.

Questionnaire

The first page of the questionnaire provided information to participants in the study. Appendix B contains the invitation flier and the information to participants. The questionnaire items are in Appendix C. There were 59 items and most of them were closed-ended. For every block on the research model, the variables (such as the dependent, independent and intervening) variables within a block were carefully mapped and used to develop the questionnaire items. The written questionnaire items were checked several times by the researcher, dissertation advisor and a statistician at the Odum Institute to ensure accuracy, completeness, and adaptability to the intended sample.
The items were grouped based on variables that were laid out on the research model (Figure 25). The categories of the questionnaire items included the following:

- General profile, ICT ownership, access and affordability
- Ease of ICT use, e-learning and training needs
- Infrastructure and ISP services
- Use of mobile phones to increase income, information access, alleviate extreme and information poverty
- Innovation, technology acceptance and ICT interaction.

Focus Groups

I used two focus groups to support the survey technique and to better inform two parts of my research. The two parts are:

A. The perceptions about the use of mobile phones to increase income or to alleviate extreme/information poverty.

B. The perceptions about mobile phones as a technology innovation that is diffusing successfully or unsuccessfully into the population.

Members of group one were selected based on their responses to the questionnaire items 45 to 56 on mobile phones. Group One consisted of eight participants in the study who indicated in the initial survey extreme likelihood that mobile phones were helping to alleviate extreme and information poverty. This group also included respondents who indicated that mobile phone innovation was a technology that was widely accepted and extremely easy to use. Group Two on the other hand consisted of five respondents (ten were invited and five showed up) who indicated in the initial survey that mobile phones were not helping in alleviating both information and extreme poverty and as such had a very low or non-acceptance within the population. Questions 46 to 56 in the questionnaire instrument were re-asked as open-ended questions during the focus group interview sessions in order to gain insight into the opinion of the groups and to solicit further responses or additional detail on those questions. The focus group interview sessions were audio taped (with UNC IRB permission). Some of the participants in both the survey and the focus groups were photographed with their consent (focus group participants signed consent forms; see Appendix F). I have used the next section to review the literature on focus groups in order to show applicability as a tool for my research.

Definition and Origin of Focus Groups

A focus group is an interview technique that is designed to determine responses of persons exposed to a situation previously analyzed by the researcher in order to discover (1) significant aspects of the total situation to which responses occurred; (2) discrepancies between anticipated and actual effects; (3) responses of deviant subgroups in the population; (4) processes involved in experimental induced effects (Merton & Kendall, 1946). According to Morgan (1996) a focus group is a research technique that collects data through group

interaction on a topic determined by the researcher. The researcher that conducts a focus group interview is called "investigator", "facilitator", or "moderator" (Merton & Kendall, 1946; Merton, 1987; Krueger, 1988; Morgan, 1996). A facilitator guides the discussion of issues and uses probing techniques to solicit views, ideas, and other information. A focus group has between 6 to 12 people and can last between 45 minutes to one and half hours.

The focus group, initially called "Focused Interview" by Merton originates from media communications (radio broadcasts) and World War II military training films. These two areas intersected based on the works by Paul F. Lazarsfeld, R. K. Merton, and Frank Stanton from Columbia University. As the head of Radio Research in Columbia University in the 1940s, Lazarsfeld received grant funding from the Office of Facts and Figures (predecessor to Voice of America) to test responses to several radio morale programs. The account of how the focus group technique was developed shortly after World War II (WW II) through an unplanned work session is reported in the literature (Hunt, 1961; Lazarsfeld, 1975; Merton, 1987). Focus groups have since spread to other fields steadily over the decades, eliciting interests in commercial, academic and non-profit sectors (Merton, 1987; Stewart et al, 2006).

Major Uses of Focus Groups

Merton (1987) explains that they (he, Lazarsfeld and Stanton) developed the focus group technique through the use of groups of participants in a "radio marathon." The groups, in a radio room setting pressed buttons to record their moment-by-moment reactions or responses to what they heard during the radio program. Participants were asked by the facilitator to press a red button if what they heard in the radio program evoked a negative response such as anger, irritation, disbelief or boredom. They were to press the green button when they had a positive response. For the rest, they were to do nothing. A polygraph (Lazarsfeld-Stanton program analyzer) was used to produce cumulative curves of likes and dislikes. Often after the radio programs, the groups were interviewed about their recorded likes or dislikes.

Focus groups have dominated marketing and advertising research since the 1970s (Stewart, 2006; Grays et al, 2008). In the United States alone, focus groups account for about 80 percent of the estimated $1.1 billion expenditure on qualitative marketing research (Wellner, 2003). Focus groups are increasingly being used in economic, library and social development research, mostly as a second technique that supports further probing into the sample that the researcher has already obtained data from by way of observations or surveys (Morgan, 1996; USAID, 1996; Merton, 1987; Naylor, et al, 2006; Grays, et al, 2008).

The United States of America's Office of International Development (USAID, 1996) discusses the use of focus interviews to launch pilot projects in developing countries. In the field of library and information science (LIS), focus group gained popularity in the 1990s (Walden, 2006; Grays et al, 2008). One area of application of focus groups has been to inform library planning and marketing (Becher & Flug, 2005). Wilson et al (2006) explore the use of focus groups to gather user feedback about library and its services. Focus groups have also been used to uncover Web page design flaws and the usability of design elements (Crowley, 2002; Leighton, 2003). In order to understand how a focus group could be used alongside with a survey, I reviewed a study by Naylor et al (2008) who used focus groups after an online survey was administered in an earlier research to investigate disappointing statistics on the use of a library chat reference service. The Milner Library at the Illinois State University in Normal had implemented a chat reference service a few years ago based on earlier reports of patron enthusiasm with chat reference services. However, it was observed that the use of the chat reference has been disappointing in many libraries including the Milner library. To probe why students have used Miler Library's chat reference service in a limited capacity, the authors, Sharon Naylor, Bruce stoffel and Sharon Van Der Laan from Illinois State University

embark on a study about students' research behaviors using focus groups (Naylor et al, 2008).

During the focus group interviews, the researchers asked such questions like the following to the focus group participants: How do our users conduct their research? What are their preferred ways of locating information? Does a chat reference appeal to them as an avenue of asking library-related questions? The researchers' intentions were to discover why students are not utilizing a particular library service and to find out the preferred way of how students seek information. Naylor et al (2008) discuss how the Milner library was faced with a decision about whether to discontinue the chat reference in the summer of 2005. Having had limited success with online surveys in an earlier study, the authors used focus groups for further investigation. They conducted seven focus groups with undergraduate students between August 8, 2005 and December 1, 2005. Students were recruited internally through instructors with whom the authors had worked with on information literacy classes.

Naylor et al (2008) report about their findings with the focus groups. About one half of the participants indicated that they would turn first to their instructors if they needed help with their research. About one half said that they would first seek help from the library. A few indicated that they would rely primarily on fellow students. Those who indicated that they would seek help from instructors did so because the instructors would clarify the assignment and might specify resources.

Another study by Grier & Bryant (2005) is on social marketing in public health. I reviewed this study because it is one that uses mixed methods with an underserved population that is similar to a BOP group. Since it is not directly discussed in this research proposal, I will briefly define the concept of social marketing before I discuss Grier and Bryant's study. The concept of social marketing is the use of marketing tools and techniques to design and implement

programs to promote socially beneficial behavior change. It has grown in popularity in recent years because of its application in many underserved communities in the United States and developing countries. The USAID, U.S. Department of Agriculture (USDA) and the Center for Disease Control (CDC) use focus groups in social marketing frequently with target populations. Grier & Bryant (2005) used focus groups to investigate a social issue - the Texas Women, Infants, and Children (WIC) Program. Focus group was used along with telephone interviews and surveys. The researchers' effort was to understand why families that were eligible for WIC would not participate in the program. Focus groups interviews revealed to the researchers that the families perceived WIC as a welfare program and being on welfare had a negative meaning with these families. The researchers were able to recommend that emphasis should be placed on nutrition education, health checkups, and immunizations instead of free food or stuff. Grier and Bryant (2005) study compares well with Naylor and Taylor (2008) because focus groups were used to understand behavior of the target populations.

A Plan for Data Analysis

In preparation for data analysis, the research questions were mapped to the questionnaire items and the variables in the research model (see Appendix D). The survey data that were collected through the questionnaire administration were collated and analyzed using SPSS statistical software tool. First level of analysis was basic descriptive statistics such as frequency counts, percentages, cross-tabulations and charts. Extensive data analyses were done using Pearson Product Correlation (R) and regression analysis. Table 11 provides an example of factors in MOPTAM (see chapter two) that would be analyzed using Pearson Product Correlation (Chapter Six).

Table 11: Factors that Influence Technology Adoption (Plan for Data Analysis)

Factor	**AG**	**G**	**Tech_A**	**PEU**	**PU**	**Tech_O**
AG						
G						
Tech_A						
PEU						
PU						
Tech_O						

AG = Age; G = Gender; Tech_A = Tecnology Advancement; PEU = Perceived Ease of Use; PU = Perceived Usefulness and Tech_O = Technology Orientation.

CHAPTER SIX

DATA ANALYSIS AND DISCUSSION

Approach to Data Analysis

As discussed in chapter five, the survey technique was the primary method of data collection for this ICT study. A total of 320 questionnaires were obtained from the survey administration and 300 of them were usable. The coding of the 59 items on each questionnaire was done very carefully and the entire coding effort took several weeks to complete. After the coding of the data, the researcher worked closely with the dissertation adviser and a statistician at the Odum Institute of the University on approaches to analyzing the data and the statistical software package to use for the data analysis. SPSS Statistical Package Version 18 (the new name is PASW Statistics Version 18) was used for the survey data analysis. In this chapter, the outcome of the data analysis is reported.

Two focus groups interviews were conducted following the survey in order to support and inform the survey data. The focus group interviews are also reported in this chapter based on the questions asked to the interview participants. The findings in both the survey data and the focus groups interviews are discussed in the last section of the chapter.

Survey Data Analysis

Firstly, the descriptive statistics for the data including frequency counts, percentages, and cross-tabulation of data items are provided. Following this, a detailed analysis is done on various segments of the data in effort to answer the research questions that were raised for this study using different statistical techniques including correlation and regression analysis.

Table 12 shows the age range of the study participants and Table 13 provides their levels of education. Many of the study participants (92 percent) were undergraduate students and 76 percent were 25 years old or less, but not less than 18 years of age.

Table 12: Age Range of Survey Participants

Age range					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 25 years	229	76.3	76.6	76.6
	25-30 years	44	14.7	14.7	91.3
	31-35 years	7	2.3	2.3	93.6
	36-40 years	11	3.7	3.7	97.3
	41 and above	8	2.7	2.7	100.0
	Total	299	99.7	100.0	
Missing		1	.3		
Total		300	100.0		

Table 13: Level of Education of Survey Participants

Level of education					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Undergraduate	271	90.3	92.2	92.2
	Post Graduate Diploma	2	.7	.7	92.9
	Masters Degree	14	4.7	4.8	97.6
	Post Masters	6	2.0	2.0	99.7
	Professional (DVM, LLB, MBBS)	1	.3	.3	100.0
	Total	294	98.0	100.0	
Missing		6	2.0		
Total		300	100.0		

Table 14 shows that out of the 300 survey participants, 144 were female (48.0 percent), 153 (51.0 percent) were male and three participants did not indicate their gender.

Table 14: Gender of Survey Participants

Gender					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	144	48.0	48.5	48.5
	Male	153	51.0	51.5	100.0
	Total	297	99.0	100.0	
Missing		3	1.0		
Total		300	100.0		

The categories for the participants' fields of study that were provided in the survey were not exhaustive. The five major ones that were included in the survey are distributed across five faculties or schools at the University of Uyo

and they are listed in Table 15 - Arts and Social Sciences (Arts & Theatre, Business, English & Linguistics, Music, Political Science, Psychology, Sociology/Criminal Justice & Anthropology); Education; Law; Math& Science (Biology & Microbiology, Chemistry & Biochemistry, Earth & Environmental Sciences, and Physics); and Medicine & Health-Related. There were other fields of study such as Architecture, Engineering and Food Sciences that were not given separate categories. Participants from these fields checked Math & Science and also wrote in their respective disciplines. Business students checked Arts & Social Sciences. Math & Science had the highest number of study participants with 30.2 percent; Medicine and Allied Health had 30.8 percent, Law had 14.7 percent while Art and Social Sciences had 14.3 percent. These statistics showed a good representation of the undergraduate students' population and their disciplines. The University of Uyo has four large faculties or schools - Math & Science, Law, Medicine and Art & Social Sciences.

Table 15: Fields of Study of Survey Participants

Field of study					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Math and Science	92	30.7	32.2	32.2
	Arts and Social Sciences	41	13.7	14.3	46.5
	Education	23	7.7	8.0	54.5
	Law	42	14.0	14.7	69.2
	Medicine and Health-Related	88	29.3	30.8	100.0
	Total	286	95.3	100.0	
Missing		14	4.7		
Total		300	100.0		

Sources of Income for Study Participants

Table 16 is used to list the sources of income for participants in the study. More than 84 percent of study participants indicated that their main source of income consisted of gifts from parents, family members and friends. About eight percent lived on wages from some form of employment (mostly part-time), four percent lived off their savings (these were often professional students who were laid off from work or persons who returned to school to complete a degree or pursue a graduate education). One percent indicated that they lived on borrowed funds but did not specify whether these were loans taken out in their own names or their parents'. Participants who indicated that they depended on government scholarship or bursary awards represented one and half percent of those surveyed, indicating that government support is not a major source of fund for students in this African university.

The statistics that were reported in the literature (World Resources Institute, 2007 & the World Bank, 2008) showed that 80 percent of Sub-Saharan Africa is part of the World's BOP population. The sources of income statistics support the literature that the students depended mostly on their BOP parents for a means of livelihood. How are the BOP parents able to generate funds large enough to support their children for the tertiary level of education? One explanation, though not tested in this study but suggested in the literature is based on the communal way of life of the people. Ayittey (1988) reports that the communal lives of rural Africans in the 20th century allows people to depend greatly on their families, friends and organized social groups for everything including the sharing of information and resources that are necessary for everyday living (Ayittey, 1988).

Etim (1988), in a study of bank financing of small businesses, found that banks refused to lend money to small borrowers like farmers and petty traders (mostly market women) because they considered them to be credit risks and they lacked

collateral like cars, homes, and bank savings. These small business owners and entrepreneurs formed their own cooperative societies and built pool of funds or *Etibe* (pronounced, *a-te-ba*) from small bi-monthly contributions. Each month, members took turns to draw from the pool of funds to meet specific business needs. Twenty years after Etim's study, it appears that this communal practice of *Etibe* or *Esusu* (pronounced A-soo-soo) in the Igbo environment has become stronger and is practiced widely by many social networks or groups in this region as a way of building equity income for different needs, including funding one's children's education, obtaining funds for entrepreneurship and the like. Some of the cooperative societies are now capable of providing micro credits at low interest rates. Individuals who are members can borrow funds to finance their relatives' education.

Table 16: Highest Source of Income for Survey Participants

Highest source of income per month					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Gifts from parents, family and friends	221	73.7	84.7	84.7
	Government scholarship, bursary and awards	4	1.3	1.5	86.2
	A full-time or part-time job	22	7.3	8.4	94.6
	My life savings	11	3.7	4.2	98.9
	A bank loan or other borrowed funds	3	1.0	1.1	100.0
	Total	261	87.0	100.0	
Missing		39	13.0		
Total		300	100.0		

Analysis to Help Answer the Research Questions

Research Question #1
Do participants in the study who own an ICT tool such as a mobile phone or computer live on less than two U.S. dollars a day?

Two U.S. dollars amounts to 300 naira (N300) and that amount is too little for a person to live on per day. Cross-tabulation analysis was done for owners of computers and mobile phones and their cost of living per day. Table 17 shows that out of the 58 participants in the survey who owned both computers and mobile phones, 1.7 percent of them lived on about N100, 6.9 percent lived on N100-N200 and 12.1 percent lived on N201-N300, bringing the percentage of

those who lived on two U.S. dollars or less per day but owned both computers and mobile phones to 20.7 percent.

Out of the 206 participants in the survey who owned only a mobile phone but not a computer, 7.3 percent of them lived on about N100, 7.3 percent lived on N100-N200 and 9.2 percent lived on N201-N300, bringing the percentage of those who lived on two U.S. dollars or less per day but owned only a mobile phone to 23.8 percent. One outlier was noticed in the data where one study participant lived on over N400 per day but did not own either a computer or a mobile phone.

Table 17: A Cross-Tabulation to Show Costs of Living Each Day and ICT Tool Ownership

Cross-tabulation for how much it does cost to live each day (food and other basic needs) * Have a mobile phone or SIM (Y or N) * Own a computer (Y or N)						
Own a computer (Y or N)				Have mobile Phone or SIM (Y or N)		Total
				Yes	No	
Yes	How much it does cost to live each day (food and other basic needs)	About N100	Count	1		1
			% within Have mobile Phone or SIM (Y or N)	1.7%		1.7%
		N101-N200	Count	4		4
			% within Have mobile Phone or SIM (Y or N)	6.9%		6.9%
		N201-N300	Count	7		7
			% within Have mobile Phone or SIM (Y or N)	12.1%		12.1%
		N301-N400	Count	11		11
			% within Have mobile Phone or SIM (Y or N)	19.0%		19.0%
		More than N400	Count	35		35
			% within Have mobile Phone or SIM (Y or N)	60.3%		60.3%
	Total		Count	58		58
			% within Have mobile Phone or SIM (Y or N)	100.0 %		100.0 %
No	How much it does cost to live each day (food and other basic needs)	About N100	Count	15	0	15
			% within Have mobile Phone or SIM (Y or N)	7.3%	.0%	7.2%
		N101-N200	Count	15	0	15
			% within Have mobile Phone or SIM (Y or N)	7.3%	.0%	7.2%
		N201-N300	Count	19	0	19
			% within Have mobile Phone or SIM (Y or N)	9.2%	.0%	9.2%
		N301-N400	Count	25	0	25
			% within Have mobile Phone or SIM (Y or N)	12.1%	.0%	12.1%
		More than N400	Count	132	1	133
			% within Have mobile Phone or SIM (Y or N)	64.1%	100 .0%	64.3%
	Total		Count	206	1	207
			% within Have mobile Phone or SIM (Y or N)	100.0 %	100 .0%	100.0 %

Research Question #2
Is cost a factor for study participants adopting and using different forms of ICT tools/services?

The first level of analysis was aimed at understanding access and ownership of different forms of ICT tools and services in order to evaluate how cost as a factor impacts access and ownership.

Table 18 shows that 21.2 percent of those surveyed owned computers and 78.8 lacked this important technology tool. A cross-tabulation analysis showed that 75.7 percent of those who lacked computers had access to a computer at an Internet café location (Table 19). This result tallies with the findings in a preliminary study that Internet cafés served important role of helping information seekers gain access to computers and the Internet (Etim, 2009). Other avenues for having access to computers were the University Library/computer lab (5.8 percent) and family/friend's computer (12.3 percent). Four percent reported no access at all to computers.

Table 18: Percentage of Survey Participants that Owned Computers

Own a computer (Y or N)					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	59	19.7	21.2	21.2
	No	219	73.0	78.8	100.0
	Total	278	92.7	100.0	
Missing		22	7.3		
Total		300	100.0		

Table 19: Access Locations for Non-Owners of Computers

Where non-owners of computers have access					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	My University Library or Computer Lab	14	4.7	5.8	5.8
	My family or a friend's computer	30	10.0	12.3	18.1
	A nearby fee paying Internet cafe'	184	61.3	75.7	93.8
	I don't have access at all to a computer	10	3.3	4.1	97.9
	Other	5	1.7	2.1	100.0
	Total	243	81.0	100.0	
	Owned computers (skipped this item)	57	19.0		
Total		300	100.0		

Compared to computer ownership, 99 percent of study participants owned mobile phones or SIM cards (Table 20). A cross-tabulation on computer and mobile phone ownership is presented in Table 21; 58 participants had both computers and mobile phones while 215 persons owned only mobile phones.

Table 20: Percentage of Survey Participants that Owned Mobile Phones

Have mobile Phone or SIM (Y or N)					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	293	97.7	99.0	99.0
	No	3	1.0	1.0	100.0
	Total	296	98.7	100.0	
Missing		4	1.3		
Total		300	100.0		

Table 21: A Cross-Tabulation to Show Computers and Mobile Phones Ownership

Own a computer (Y or N) * Have mobile phone or SIM (Y or N) Cross-tabulation				
Count				
		Have mobile Phone or SIM (Y or N)		Total
		Yes	No	
Own a computer (Y or N)	Yes	58	0	58
	No	215	1	216
Total		273	1	274

Figure 26 shows the distribution of telephone services that were used by study participants; 67.4 percent used prepaid SIM cards with their mobile phones. Study participants (28.94 percent) indicated that in addition to their use of mobile phones/ prepaid SIM cards, they also use public paid phones.

Both Figures 26 and 27 show that a fixed telephone line contract was the least used telephone service. Figure 26 shows that 67.4 percent had prepaid SIM card with their mobile phones while Figure 27 shows that less than 10 percent of all study participants owned a fixed telephone line at their homes.

Figure 26: Distribution of Telephone Services that are used by Study Participants

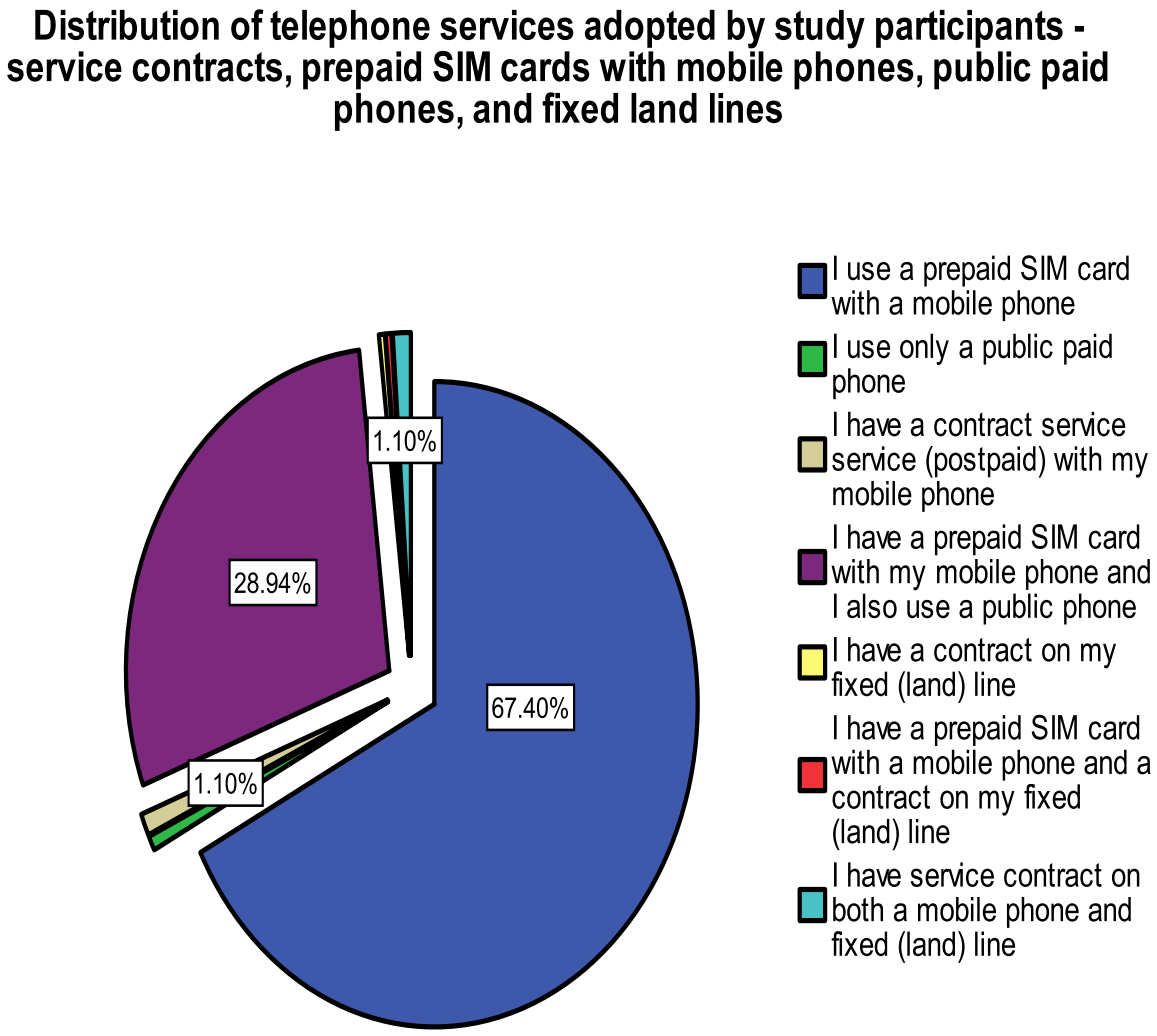
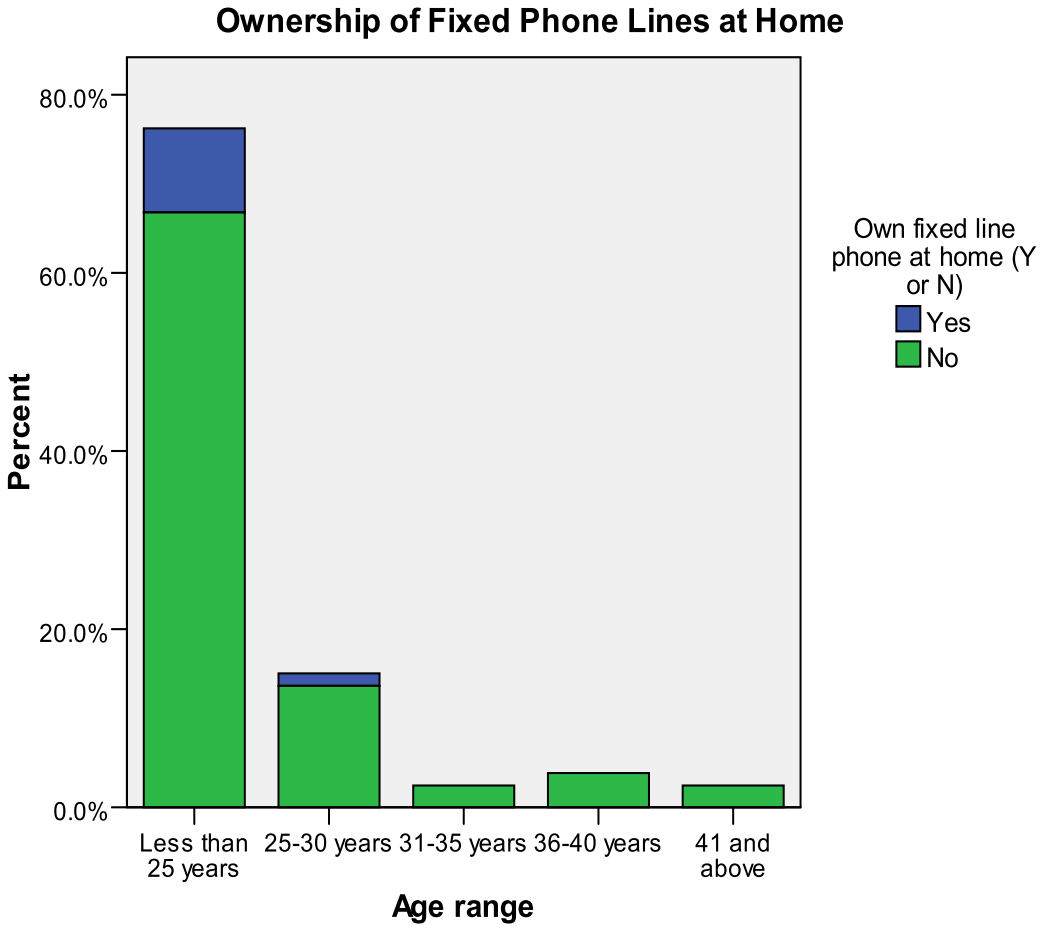


Figure 27: Ownership of Fixed Phone Lines at Home



These data show that except for mobile phone ownership, access or ownership of other forms of ICT tools like computers and fixed telephone or land lines and services is limited. Taking the case of computer ownership, further analysis was done to examine if cost is a predictor of the limited ownership and adoption of this important ICT tool.

Table 22 is a cross-tabulation of actual ownership of computers and the perception that it is expensive to own a computer. A large percentage of those who owned computers (34 percent) perceived that it was expensive to own this ICT tool while 60 percent of those who do not own computers also said that it was

expensive to own computers. The expected values (counts) are different from the actual counts, indicating that ownership of computers and the perception that computers are costly to own are related. Table 23 shows a Chi-square value of 22.998 at 0.00 level of significant.

Table 22: Cross-tabulation of Actual Computer Ownership and Perception about the Cost

Own a computer (Y or N) * Expensive to own a computer Cross-tabulation

			Expensive to own a computer (LS)					Total
			Extremely inexpensive	Quite inexpensive	Neither expensive or inexpensive	Quite expensive	Extremely expensive	
Own a computer (Y or N)	Yes	Count	11	6	7	11	18	53
		Expected Count	4.7	2.6	4.9	12.0	28.9	53.0
		% within Own a computer (Y or N)	20.8%	11.3%	13.2%	20.8%	34.0%	100.0%
		% of Total	4.4%	2.4%	2.8%	4.4%	7.3%	21.4%
	No	Count	11	6	16	45	117	195
		Expected Count	17.3	9.4	18.1	44.0	106.1	195.0
		% within Own a computer (Y or N)	5.6%	3.1%	8.2%	23.1%	60.0%	100.0%
		% of Total	4.4%	2.4%	6.5%	18.1%	47.2%	78.6%
Total		Count	22	12	23	56	135	248
		Expected Count	22.0	12.0	23.0	56.0	135.0	248.0
		% within Own a computer (Y or N)	8.9%	4.8%	9.3%	22.6%	54.4%	100.0%
		% of Total	8.9%	4.8%	9.3%	22.6%	54.4%	100.0%

Table 23: Chi-Square Statistics for Actual Computer Ownership and Perception of its Cost

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	22.998[a]	4	.000
Likelihood Ratio	20.431	4	.000
Linear-by-Linear Association	22.081	1	.000
N of Valid Cases	248		

a. 3 cells (30.0%) have expected count less than 5. The minimum expected count is 2.56.

A regression analysis (Table 24) indicates that as the highest source of income per month goes up one unit on the scale, ownership of computers is not increased; instead, ownership of computers goes down by 0.075 units on its own scale. The perception that computers are expensive to own is a predictor (by .084 units) of actual computer ownership.

Table 24: Predicting Computer Ownership Based on Sources of Monthly Income and Perception that it was Expensive to Own a Computer

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.542	.100		15.424	.000
	Highest source of income per month	-.075	.030	-.162	-2.506	.013
	Expensive to own a computer	.084	.021	.257	3.972	.000

a. Dependent Variable: Own a computer (Y or N)

Research Question #3
Is there a relationship between having access to an ICT tool or service and a study participant's ability to access the Internet and other information resources?

Research Question #4
To what extent do study participants perceive mobile phones as being useful for different tasks that they engage in?

Analyses that showed access to different ICT tools were done in the previous research question. The next level of analysis is to determine if there is a relationship between having access to an ICT tool or service and using it to access the Internet as well as for other tasks.

Table 25 provides a breakdown by gender in the use of mobile phones to access the Internet; 43.8 percent of female participants in the study and 40.4 percent of males indicated that they had never used their mobile phones to access the Internet.

Table 25: Mobile Phone Use to Access the Internet by Female and Male Study Participants

Sex * Use MP(mobile phone) to access Internet Cross-tabulation

			Use mobile phone to access Internet						Total
			Very frequently	Frequently	Occasionally	Rarely	Very Rarely	Never	
Sex	Female	Count	6	19	33	12	7	60	137
		Expected Count	9.9	20.2	30.6	11.3	7.4	57.7	137.0
		% within Sex	4.4%	13.9%	24.1%	8.8%	5.1%	43.8%	100.0%
		% of Total	2.2%	6.8%	11.9%	4.3%	2.5%	21.6%	49.3%
		Residual	-3.9	-1.2	2.4	.7	-.4	2.3	
	Male	Count	14	22	29	11	8	57	141
		Expected Count	10.1	20.8	31.4	11.7	7.6	59.3	141.0
		% within Sex	9.9%	15.6%	20.6%	7.8%	5.7%	40.4%	100.0%
		% of Total	5.0%	7.9%	10.4%	4.0%	2.9%	20.5%	50.7%
		Residual	3.9	1.2	-2.4	-.7	.4	-2.3	
Total		Count	20	41	62	23	15	117	278
		Expected Count	20.0	41.0	62.0	23.0	15.0	117.0	278.0
		% within Sex	7.2%	14.7%	22.3%	8.3%	5.4%	42.1%	100.0%
		% of Total	7.2%	14.7%	22.3%	8.3%	5.4%	42.1%	100.0%

Mobile phones were used by study participants mostly for communication task but very limited uses were indicated for other tasks. Table 26 provides counts on the

use of mobile phones for different tasks. Communication accounted for 265 counts (35 missing) while course work, e-mail, mobile banking, and job/profession had very few counts: 70, 31, 24 and 23 respectively. Missing data were substantial for these various task categories – 230 (course work), 269 (e-mail access), 276 (mobile banking) and 277 (job or profession). The findings probably indicate that the students were simply not using mobile phones for these other tasks or that usage of mobile phones for the tasks was at very rudimentary or early stages. The findings are supported with the focus group interviews. Two persons in both focus groups indicated having accessed Internet sites like Facebook or Yahoo messenger (see Focus Group Analysis, Group #1, Question #2). Several participants in focus group one indicated that they had used their mobile phones for a service that they called Google search message to find information for academic work (see Focus Group #1, Question#5 in the focus group analysis section).

Table 26: Mobile Phone Use for Different Tasks by Study Participants

Use of Mobile Phones for Different Tasks						
		Communicate	Course Work	Internet/Email Access	Mobile Banking	Job and Profession
N	Valid	265	70	31	24	23
	Missing	35	230	269	276	277

Computers were more frequently used to access the Internet than mobile phones. However, the use of computers to access the Internet was also found to be low. A few who used computers to access the Internet had a dial-up connection. Table 27 shows a breakdown of the frequency of access for various tasks; 44.5 percent of study participants indicated that they had never accessed the Internet, even with dial up connections.

Table 27: Access to the Internet via Dial-Up Computer Connection

Use dial-up connect to access the Internet					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very frequently	11	3.7	4.5	4.5
	Frequently	30	10.0	12.2	16.7
	Occasionally	42	14.0	17.1	33.9
	Rarely	34	11.3	13.9	47.8
	Very Rarely	19	6.3	7.8	55.5
	Never	109	36.3	44.5	100.0
	Total	245	81.7	100.0	
Missing		55	18.3		
Total		300	100.0		

Research Question #5: To what extent do participants in the study perceive mobile phones as easy to use, satisfactory and dependable?

The overall assessment of ease of use, satisfaction and dependability is measured with perceived ease of use, perceived usefulness, facilitating conditions (such as service quality) and personal factors that influence attitude towards use. The personal factors that were considered for this study were technology orientation and advanced knowledge in the use of technology tools. The frequency counts and percentages are presented followed by further detailed analysis. Pearson Product Correlation is used for further analysis to show significant relationships but not causality.

Perceived ease of use (PEU) was measured using items such as ease of use of mobile phones for different tasks including voice communication, accessing information for class assignment, and surfing the Web or accessing e-mail. Table

28 shows that 77.7 percent of study participants found mobile phones as extremely easy to use for voice communication.

Table 28: Mobile Phone is Easy to Use for Voice Communication

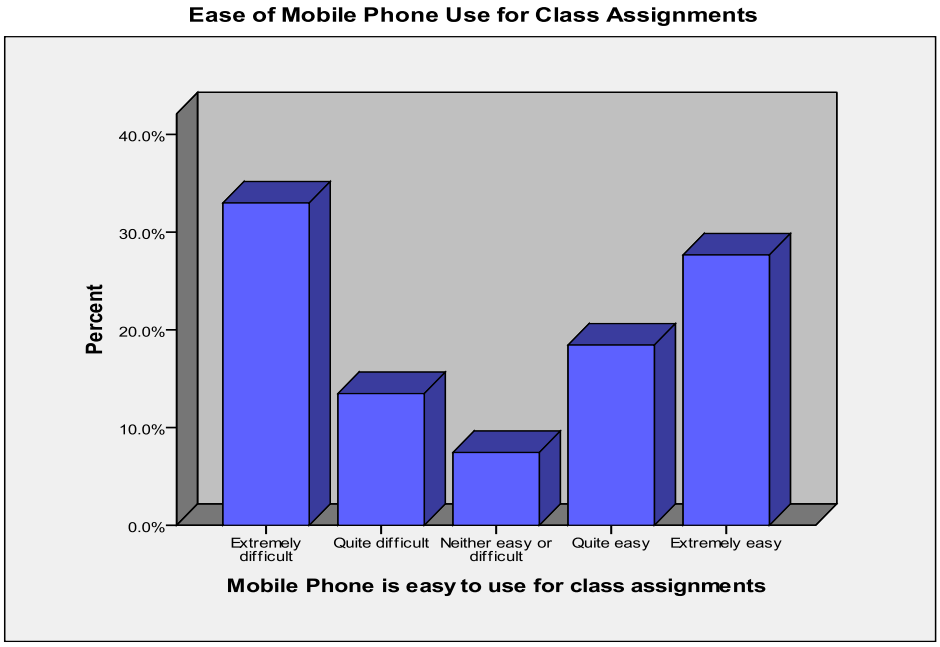
Mobile phone is easy to use for communication					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Extremely difficult	5	1.7	1.7	1.7
	Quite difficult	3	1.0	1.0	2.7
	Neither easy or difficult	6	2.0	2.1	4.8
	Quite easy	51	17.0	17.5	22.3
	Extremely easy	227	75.7	77.7	100.0
	Total	292	97.3	100.0	
Missing		8	2.7		
Total		300	100.0		

When participants were asked about their perceived ease of using mobile phone for other tasks, the results were different. Figure 28 and Table 29 shows the ease of use of a mobile phone for class assignments; 33 percent said it was extremely difficult, 13.5 percent indicated that it was quite difficult. The total percentage of those who indicated some level of difficulty in using mobile phone for class related work therefore stands at 46.5 percent. The percentage of those who indicated that it was extremely easy to use mobile phones for class assignments was 27.7 percent.

Table 29: Ease of Mobile Phone Use for Class Assignments

Mobile phone is easy to use for class assignments					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Extremely difficult	93	31.0	33.0	33.0
	Quite difficult	38	12.7	13.5	46.5
	Neither easy or difficult	21	7.0	7.4	53.9
	Quite easy	52	17.3	18.4	72.3
	Extremely easy	78	26.0	27.7	100.0
	Total	282	94.0	100.0	
Missing		18	6.0		
Total		300	100.0		

Figure 28: Ease of Mobile Phone Use for Class Assignments



Although a large proportion (27.7 percent) of the study participants perceived that mobile phones were extremely easy to use for class assignments, a larger segment (46 percent) perceived that it was either extremely or quite difficult to use mobile for class assignments.

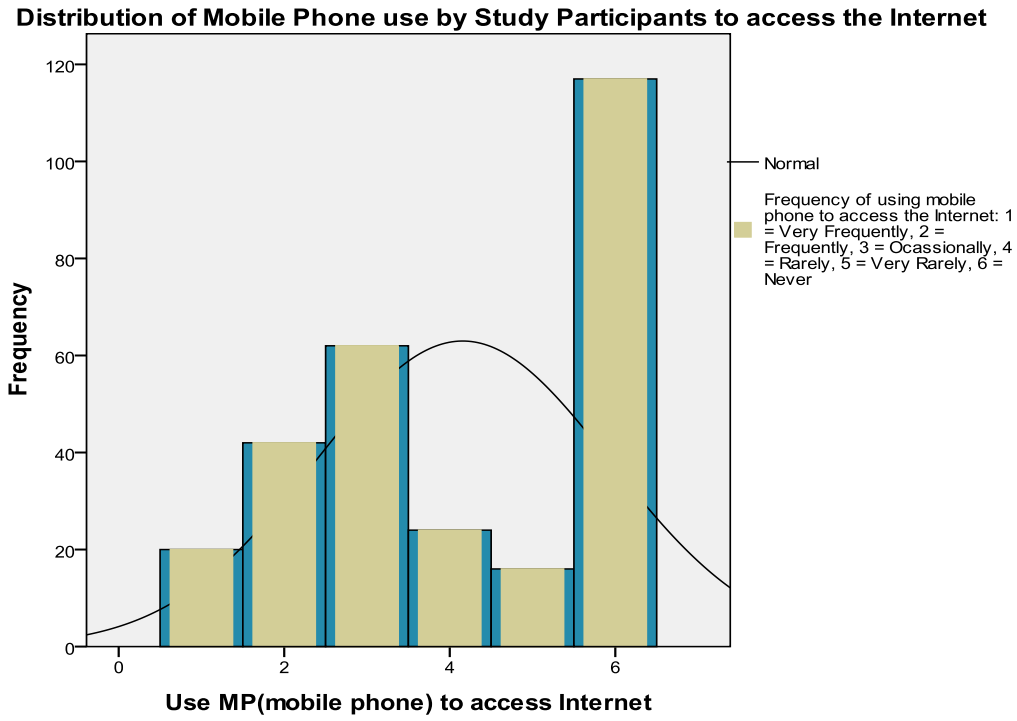
Another PEU factor was a measure of the ease of use of mobile phones to access the Internet and do e-mail. Table 30 shows that 34.1 percent perceived that it was extremely difficult to use mobile phones to surf the Web and 8.9 percent indicated that it was quite difficult to do so, bringing the total of those who indicated some level of difficulty of using mobile phone to surf the Web or access e-mail to 43 percent. The 10 percent who skipped this questionnaire item entirely were likely to be among the ones that had never used mobile phone to access the Internet.

One important area in technology acceptance that influences adoption involves personal factors (PF). Individuals are likely to accept a form of technology tool or service if they have prior or advanced knowledge of it. Being able to access the Internet with a mobile phone was considered in this study as technology advancement (Tech_A) factor. Figure 29 shows the frequency distribution for participants' Internet access with mobile phones; 116 or 43 percent of respondents indicated that they had never used their mobile phones to access the Internet.

Table 30: Ease of Mobile Phone Use to Surf the Web and Access E-mail

Mobile phone is easy to use to surf the Web and access email					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Extremely difficult	92	30.7	34.1	34.1
	Quite difficult	24	8.0	8.9	43.0
	Neither easy or difficult	34	11.3	12.6	55.6
	Quite easy	54	18.0	20.0	75.6
	Extremely easy	66	22.0	24.4	100.0
	Total	270	90.0	100.0	
Missing		30	10.0		
Total		300	100.0		

Figure 29: Frequency Distribution for Mobile Phone Use to Access the Internet

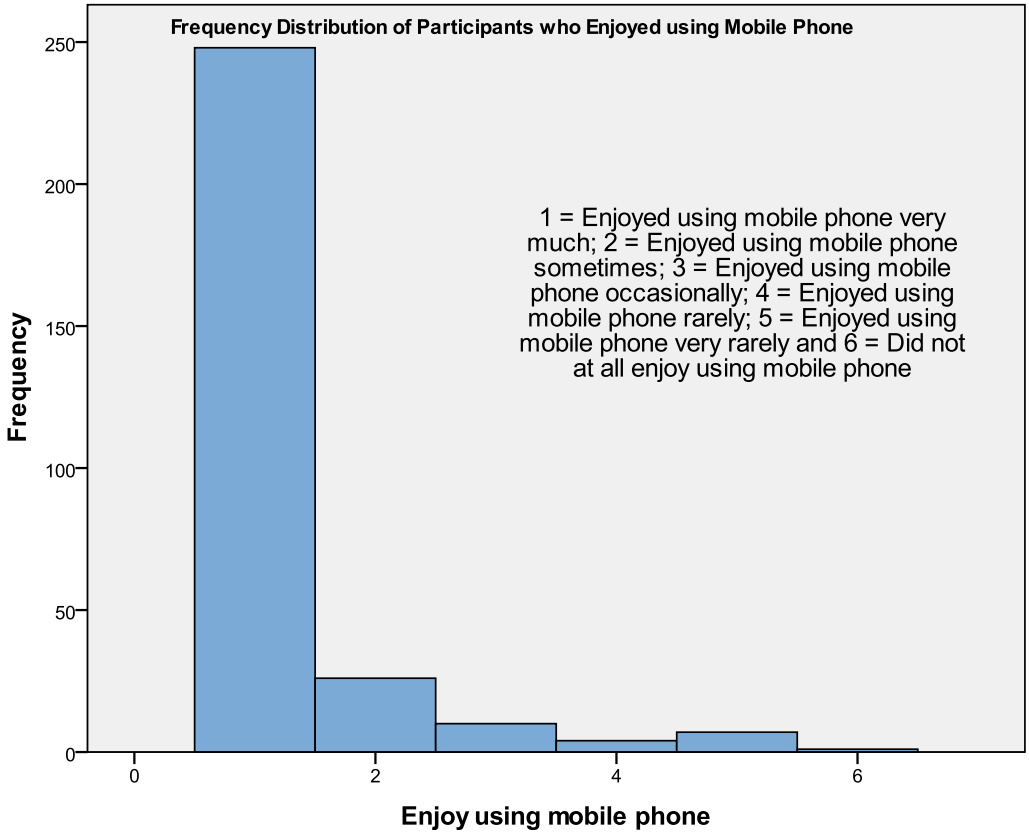


Another personal factor (PF) that was investigated was the personal interest of the user of technology. Table 31 and Figure 30 provide data on study participants' personal interest in mobile phone technology. The questionnaire item stated: "I enjoy using my mobile phone." This PF specifically measures technology orientation (Tech_O) and 248 study participants (83.8 percent) indicated that they enjoyed using mobile technology very much.

Table 31: Level of Enjoyment in Using Mobile Phones

Enjoy using mobile phone					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very much	248	82.7	83.8	83.8
	Sometimes	26	8.7	8.8	92.6
	Occasionally	10	3.3	3.4	95.9
	Rarely	4	1.3	1.4	97.3
	Very Rarely	7	2.3	2.4	99.7
	Not at all	1	.3	.3	100.0
	Total	296	98.7	100.0	
Missing		4	1.3		
Total		300	100.0		

Figure 30: Frequency Distribution of Participants who enjoyed using Mobile



Another PF, also measures technology orientation (Tech_O) was ease of becoming skillful in using mobile phones. The questionnaire item stated "It would be easy for me to become skillful at using mobile phone." Table 32 shows the responses; 69 percent indicated that it would be easy for them to become skillful in the use of mobile phones.

Table 32: Easy To Become Skillful In Using Mobile Phones

Easy to become skillful in using mobile phones					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Extremely difficult	9	3.0	3.1	3.1
	Quite difficult	6	2.0	2.1	5.2
	Neither easy or difficult	9	3.0	3.1	8.4
	Quite easy	65	21.7	22.6	31.0
	Extremely easy	198	66.0	69.0	100.0
	Total	287	95.7	100.0	
Missing		13	4.3		
Total		300	100.0		

A perceived usefulness (PU) factor that was measured was if the use of a mobile phone has helped to increase income. Common examples of using a mobile phone to increase income for this sample of students meant using it to contact parents for gifts, part-time work that was enabled via mobile phones and the like. It was rather difficult to measure the direct relationship of mobile phones to income since the students were not likely to be using their mobile phones for business activities because many of them were full-time students. The students depended on gifts from family and friends for their source of income (see Table 16). In the focus group interview, additional explanation was given to participants about what an increase in income meant for them and the responses from group one showed that mobile phones were being used to support income generation (see focus group section in this chapter, group 1, question 1).

Testing MOPTAM Factors using Correlation

The factors so far mentioned in the descriptive data analyses - PEU, PF, PU, Tech_O were discussed in the literature section. These factors along with others such as facilitating conditions (FC) influenced attitude towards actual mobile phone adoption and use. These factors were outlined in the MOPTAM model (Figure 8).

In testing MOPTAM using correlation, the following steps were followed:

1. The questionnaire items were first mapped to the factors in the MOPTAM model.
    a. A personal factor for technology orientation (Tech_O) was mapped. It was enjoyment in using mobile phones.
    b. Another personal factor for technology orientation (Tech_O) that was mapped was the ease in becoming skillful in using mobile phones.
    c. A third personal factor that was mapped was a technology advancement (Tech_A) factor about using mobile phones to connect to the Internet to find information for various needs.
    d. One perceived ease of use (PEU) factor that was mapped was ease in using mobile phones to surf the Web/access e-mail.
    e. One perceived usefulness factor (PU) that was mapped was the perception that mobile phones helped to increase income or earnings.
    f. One facilitating condition (FC) factor that was measured was that service quality by the mobile phone providers was dependable and reliable.
    g. A demographic factor of age (AG) was included in the list of factors.
2. Pearson Product Correlation (R) was used to analyze the relationships among the different factors. The results of the quantitative evaluation are provided in Tables 33 and 34 below. The significant values at 0.05

level are marked with a * symbol while those that were significant at 0.01 level are marked with a ** symbol.

Table 33: Correlations for Demographic, Perceived Ease of Use and Facilitating Conditions

		Age range (AG, DF)	Use Mobile Phone to access the Internet (Tech_A)	Mobile Phone is easy to use to surf the Web & do email (PEU)	Service quality for Mobile Phone is reliable/dependable (FC)
Age range (AG, DF)	R	1	.121*	-.149*	.007
	Sig. (2-tailed)		.044	.014	.905
	N	299	280	272	285
Use Mobile Phone to access the Internet (Tech_A)	R	.121*	1	-.270**	.137*
	Sig. (2-tailed)	.044		.000	.024
	N	280	281	258	270
Mobile Phone is easy to use to surf the Web & do email (PEU)	Sig. (2-tailed)	.014	.000		.562
	N	272	258	273	268
	R	-.099	-.332**	.372**	-.065
	Sig. (2-tailed)	.105	.000	.000	.292
	N	269	256	260	261
Service quality for Mobile Phone is reliable/dependable (FC)	R	.007	.137*	.036	1
	Sig. (2-tailed)	.905	.024	.562	
	N	285	270	268	286

In row one of Table 33, there is a significant relationship between age (a demographic factor) with Tech_A (those who used mobile phones to access the Internet) and PEU (perception that mobile phones were easy to use to surf the web and access e-mail). Despite the statistical significance of age with these two MOPTAM factors, the age ranges was a skewed distribution. This will be a limitation in generalizing these results because most of the students that participated in this ICT study (77 percent, Table 12) were undergraduate

students that were aged 18 to 25 years. The results, however, mean that younger students, mostly ages 18 to 25, were more likely to use mobile phones to access the Web than those in other age ranges. The ease of using mobile phones to surf the Web and access e-mail correlated inversely with age, meaning that the older a person gets, the more difficult it was for that individual to desire to use mobile phones to surf the Web or access e-mail.

The relationship between connecting to the Internet via mobile phones and the perceived ease of doing so was an inverse relationship. This confirmed the result in Figure 27 that many participants (66.2 percent) had rarely or never used their mobile phones to connect to the Internet. Service quality and reliability correlated positively with the use of mobile phones to access the Internet. This indicates that people are more eager to connect to the Internet via mobile phones when there is quality and dependable service.

Table 34: Correlations for Perceived Usefulness and Technology Orientation

		Use of Mobile Phone has helped to increase income (PU)	I enjoy using mobile phone (PF/Tech_O)	Easy to become skillful in using Mobile Phone (PF/Tech_O)
Use of Mobile Phone has helped to increase income (PU)	R	1	.037	-.029
	Sig. (2-tailed)		.537	.639
	N	283	279	271
I enjoy using mobile phone (PF/Tech_O)	R	.037	1	-.423**
	Sig. (2-tailed)	.537		.000
	N	279	296	287
Easy to become skillful in using Mobile Phone (PF/Tech_O)	R	-.029	-.423**	1
	Sig. (2-tailed)	.639	.000	
	N	271	287	287

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

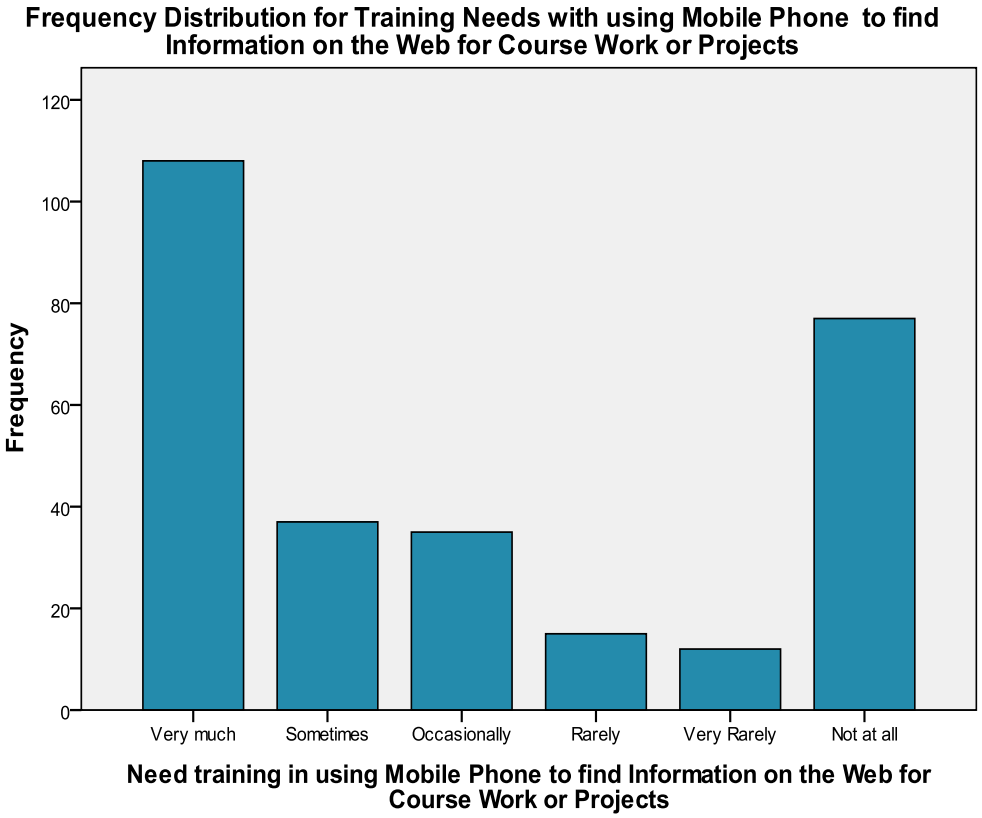
PF = Personal Factor; PU = Perceived Usefulness; Tech_O = Technology Orientation

In Table 34, enjoyment in using a mobile phone correlated inversely with ease in becoming skillful in using mobile phone. This is because participants in the study had limited or no experience in using mobile phones to access information on the Web. Table 35 and Figure 31 confirm this findings; 38 percent of respondents indicated that they very much need training in using mobile phones to access the Web in order to find information for course work or projects.

Table 35: Percentage of Study Participants that Needed Training in Using Mobile Phones to find Information on the Web for Course Work or Projects

Need training using MP to find info on the Web for course work/projects					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very much	108	36.0	38.0	38.0
	Sometimes	37	12.3	13.0	51.1
	Occasionally	35	11.7	12.3	63.4
	Rarely	15	5.0	5.3	68.7
	Very Rarely	12	4.0	4.2	72.9
	Not at all	77	25.7	27.1	100.0
	Total	284	94.7	100.0	
Missing	0	16	5.3		
Total		300	100.0		

Figure 31: Frequency Distribution of Participants who needed Training in using Mobile Phones to Access the Web for Information on Course Work and Projects



Research Question #6: To what extent do participants in the study perceive mobile phones as an innovation that can help to sustain development (reduce poverty, enable income earning potential and broaden access to e-services)?

Data in Tables 36, 37 and Figure 32 indicate that mobile phones were clearly seen as being very useful innovation for broadening social networks (52.7 percent) and increasing access to information for a better life (59.8 percent). The social networks referred to here were not online social networks as would be thought about in developed societies of today because many of the participants were yet to connect to the Internet using their mobile phones (see Figure 28), but mostly their circle of friends and program of study acquaintances in other

universities. These findings were also confirmed in the focus group interview with group one that mobile phones were helpful in broadening one's circle of friends and communicating within members of the same discipline (see focus group 1, question #2).

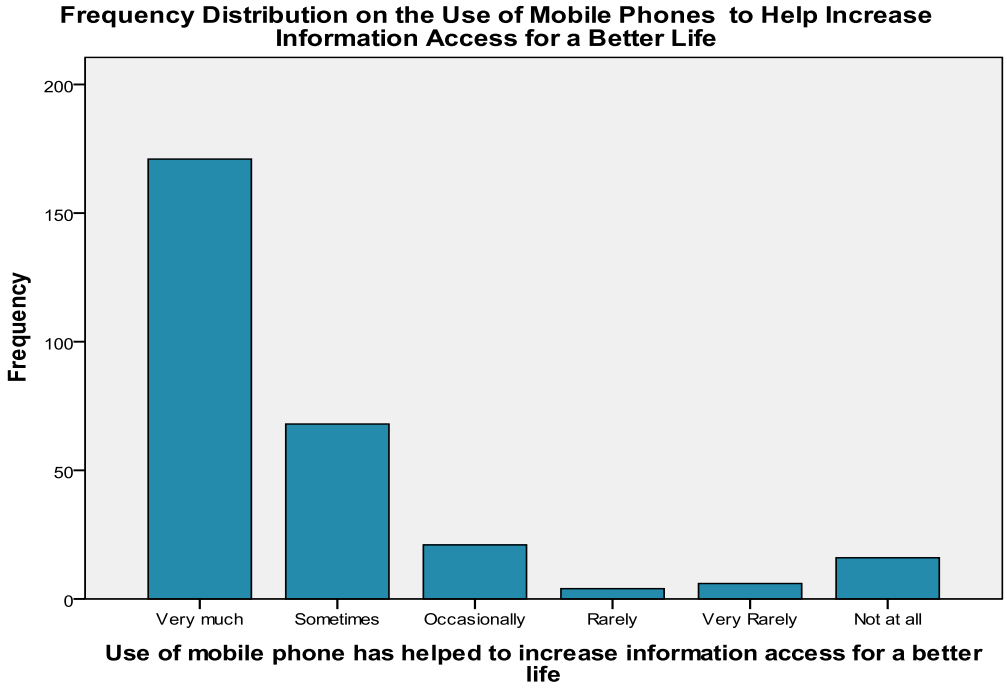
Table 36: Mobile Phones were Useful Innovation for Expanding Social Networks

Use of Mobile Phones has helped to expand social networks					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very much	149	49.7	52.7	52.7
	Sometimes	54	18.0	19.1	71.7
	Occasionally	24	8.0	8.5	80.2
	Rarely	13	4.3	4.6	84.8
	Very Rarely	6	2.0	2.1	86.9
	Not at all	37	12.3	13.1	100.0
	Total	283	94.3	100.0	
Missing		17	5.7		
Total		300	100.0		

Table 37: The Use of Mobile Phones Has Helped to Increase Information Access for a Better Life

Use of mobile phones has helped to increase information access for a better life					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very much	171	57.0	59.8	59.8
	Sometimes	68	22.7	23.8	83.6
	Occasionally	21	7.0	7.3	90.9
	Rarely	4	1.3	1.4	92.3
	Very Rarely	6	2.0	2.1	94.4
	Not at all	16	5.3	5.6	100.0
	Total	286	95.3	100.0	
Missing		14	4.7		
Total		300	100.0		

Figure 32: Frequency Distribution of Participants on the Use of Mobile Phones to Increase Information Access for a Better Life



As it was addressed above in the analysis for Research Question #5 with MOPTAM factors, income earning with mobile phones was not significant with this particular group of students. The students were not using mobile phones for business activities but rather to communicate with family and friends and to find information for various needs. However, during the focus group interviews, group one indicated that they used their mobile phones to solicit funds from family and friends as well as engaged in activities that led to getting some form of income (see focus group one, question #1).

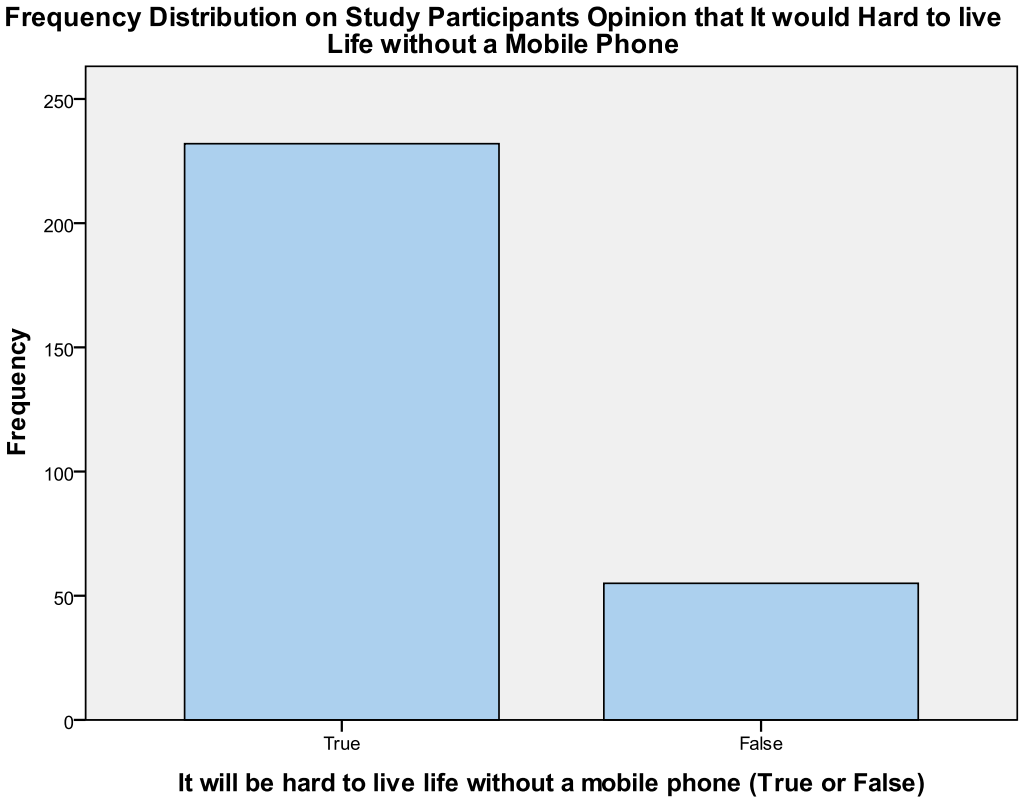
The final analysis done for this research question was to understand the impact of mobile technology in the lives of the study participants. It is such impact or value of the technology that will determine if the mobile technology is transient or a useful innovation that can help to sustain development in this African region. The questionnaire item asked: "It would be very hard for me to live my life now without a mobile phone." The analysis (Table 38 and Figure 33) shows that 80.8 percent of the respondents answered in the affirmative, that it would be very hard for them to live their lives without a mobile phone.

Table 38: It will be very Hard to Live Life without a Mobile Phone

It will be very hard to live my life without a mobile phone (True or False)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	True	232	77.3	80.8	80.8
	False	55	18.3	19.2	100.0
	Total	287	95.7	100.0	
Missing		13	4.3		
Total		300	100.0		

Figure 33: Frequency Distribution of Participants Opinion that It would be very Hard to Live Life without a Mobile Phone



Report on Focus Group Interviews

Two focus group interviews were used to amplify information received from the survey instrument and to better inform two parts of my research:

- Perceptions about the use of mobile phones to increase income or to alleviate extreme/information poverty.
- Perceptions about mobile phones as a technology innovation that is diffusing successfully or unsuccessfully into the population.

The two groups were selected from those who completed the survey and volunteered to be interviewed. They are designated as group one and group two. Group one participants responded that they expressed the extreme likelihood that mobile phones were helping to alleviate extreme and information poverty. This group also included respondents who indicated in the initial survey that mobile phone innovation was widely accepted and was easier to use than computers; therefore, they concluded that the mobile phone innovation was diffusing successfully into the BOP population of the study. Group two, on the other hand, consisted of respondents who indicated in the initial survey that mobile phones were not helping in alleviating either information poverty or extreme poverty and further, the technology had a low acceptance and was not diffusing successfully within the BOP population of the study.

The researcher moderated the focus group interviews in English and all participants communicated effectively using this language. Questions 46 to 56 in the questionnaire instrument (Appendix C) were re-asked as open-ended questions (Appendices G and H) during the focus group interviews. The open-ended question format was employed in order to gain insight into the reasons for the expressed opinions and to solicit further responses or additional detail. Participants in the focus groups were photographed with their permission and signed consent. Each participant signed a consent form and gave permission. Figure 34 shows the researcher briefing one of the groups and the participants signing the consent forms.

Figure 34: A Cross-Section of Participants in Focus Group One Interview Session

The questions were asked in the order that they were written. Participants in group one were very passionate about technology as a whole and the members discussed each question much longer and with more active energy than their counterparts in group two. Group two participants, on the other hand, showed less interest in the subject of technology and spent much less time than group one in discussing each item that they were asked. Group one spent an hour fifteen minutes and each question took between four and seven minutes while group two spent about thirty minutes, spoke less despite a lot of prompting and explanation of the items by the researcher. Overall, the discussions in both groups were serious and academic. Participants respected each other and raised hands to be noticed before they spoke. Figure 35 shows a cross-section of participants in focus group one. In the next several paragraphs, each question asked of each focus group is analyzed based on participants' responses.

Group One

Figure 35: A Cross-Section of Participants in Focus Group One Interview Session

Group one consisted of eight participants: three female and five male students. Ten qualified students were invited back for the focus group interview and all ten showed up with eight selected based on their extreme liking or acceptance of mobile technology. The group synergy developed very early during the interview session; members were very passionate about how useful technology was as a whole to modern society and to their particular environment. They emphasized the fact that the mobile phone was a technology that was widely accepted in the region of the study among all demographics. They shared examples of how even the youth and the elderly had found ways to save money to buy basic mobile phones I to be able to communicate with other family members that who were away from home and others in their communities. Group one participants agreed that, unlike computers, mobile phones were extremely easy to use, an attribute that has helped its widespread acceptance

and adoption in the region of the study. The response patterns to the nine open-ended items are analyzed next.

Group One/Question #1

In what ways have the use of mobile phones supported your income earning potential?

The responses to question one were centered on four themes about the use of mobile phones to support income earning effort by participants:

- Communicated with parents/family to obtain financial support rather than frequent home travels to visit and get financial help
- Verified direct bank deposits made by parents/family or employers
- Managed funds through mobile banking services
- Used mobile phones as clients to accessed server-based information/databases in organizational work contexts.

The first speaker, an undergraduate education major, said that she was able to call her parents to request that funds be deposited into her bank account. According to her, having a mobile phone has helped her to save money since she has cut down on travel costs. She was able to spend more time on her school work. She could call her family to check on their wellbeing as well as request that funds be direct deposited into her bank account. She could access the account via her mobile phone, check the balance and make payments wherever it was possible to use mobile banking services to do so.

Three other participants explained that they were able to use mobile phones to access their bank accounts as well and to check account balances or to verify deposits promised by parents and other relatives. A fourth contributor on the use of mobile phone for banking and earning income held part-time

employment; he shared with the group that his employer paid his monthly salary via direct bank deposits. He was able to access his bank account to verify the availability of funds. He added that access was dependent on the type of phone because not all phones have the capability for mobile banking services. When he was asked a follow-up question about whether the three major mobile phone service providers – Glo, MTN and Zain - provided mobile banking services, he answered in the affirmative and his school mates nodded their heads to affirm this. Figure 36 shows a participant making a point during the discussion and another participant listening intensely.

Figure 36: A Group One Participant Makes a Point during the Interview Session

A graduate engineering student spoke last. He introduced himself and said that his graduate engineering degree had a concentration in ICT. He believed that mobile technology was the best thing that has happened in recent years to the Continent of Africa. He talked very knowledgably about how an organization can develop a database for projects. He recounted briefly his experience on a previous job before he returned to school when he was able to use a mobile

phone as a client to connect to a database project server. He was able to monitor and control projects remotely using his smart mobile phone. He stated: "We may not be very enlightened in computer technology in this area but mobile phone is the best thing that has happened to us. For projects, all you need is to develop a database on a computer that will become the server. In my old job as an MIS (management information systems) person, I used a smart phone as a client to connect to a data bank to monitor projects. Also, you can develop a web site and use your phone to view the site. It helps to cut back on the risks that we workers face in excessive travel to and from project sites."

This engineering student's comments clearly reflect the technological changes that are taking place in the dominant oil producing states like Akwa Ibom State, which is one of the largest light sweet crude oil producers in Nigeria. The multinational oil corporations like Mobile and Shell Petroleum have drilled oil in the country for the last 30 or more years. These companies are introducing new technologies like smart mobile devices to support and exploit oil production/drilling. Systems in a control room can be accessed remotely with smart phones; oil wells are monitored remotely to check oil levels, data are collected from remote meters without the need to travel to oil drilling sites.

Group One/Question #2

Has the use of a mobile phone for daily communication helped to expand your social networks for information access and sharing?

An undergraduate computer science major kicked off the discussion by explaining that even before he came to the University of Uyo or had a mobile phone, he was able to connect using a computer at his school in Lagos to the Internet and he had access to Facebook. He explained: "When I was not even able to have a phone, I was able to connect using my school computer to the Internet and Facebook." He continued: "Facebook has enhanced my social life.

Academically, I am always able to obtain information about what I do not know very well when I chat with friends on Facebook. I now have many friends; a friend can refer me to his friends and they too become my friends." In part, this computer science major incorporated the folksonomy concept of FOAF (friend-of-a-friend) in his contribution. While he was speaking, there was complete silence and some blank facial expressions. I sensed that some of the study participants probably needed to know a bit about Facebook and so after he finished, I explained "Facebook is one of the social networks that one can access on the Internet. It has helped a lot of people like our last speaker to find like-minds on the Internet and engage in discussions, sharing and other activities that may relate to academic disciplines, economic, political or social issues. It has also allowed many people to build a network of friends."

A second contributor to the social network question was an undergraduate male architecture student. He explained: "I use my brother's phone to do e-mail and interact with my friends. I use Yahoo messenger a lot. Many of the people in my network are also students in the discipline of architecture, so we discuss a lot about my field and I have learned a lot from my network."

The region of my study is part of the Fourth World that was discussed in the literature chapter. The Fourth World or the BOP world is often by-passed by a whole era of information technology like telephone land lines or computer technology (Castells, 1996, 1997, 1998; Donner, 2008). This study, however, provides evidence that a small percentage of the Fourth World is participating in recent technologies like the Internet and Web 2.0 with the help of mobile phones. Although it was evident that the other six participants had not explored the Internet or the social networking world as yet, the two participants who contributed to this social network question provided evidence that a small percentage of the BOP population was able to connect to the Internet and were also familiar with social networks like Facebook.

Group One/Question #3

Has the use of a mobile phone helped to increase your information access to better your life?

In the literature review chapter, several writers (Bishop et al, 1999; ADB, 2003; Fisher, et al, 2004; Butler, 2005; Best, et al, 2006; Elijah & Ogunlade, 2006; Ssewanyana, 2007; Economist, 2008) were cited for providing cases or examples of the use of ICT tools and services to empower BOP communities. Butler (2005) and Ssewanyana (2007) shared examples of mobile phones' usage in East African communities to empower women and youth to become entrepreneurs, therefore giving them the potential to meet their physiological and information needs as well as reduce their extreme poverty. Unfortunately, the literature had very few use cases from Nigeria despite the fact that the Nigerian National Communications Commission (NCC) has statistics to show that Nigerians are the fastest adopters of mobile GSM phones in Sub-Saharan Africa - about 43.5 million residents of the country out of the estimated total population of 133.5 million (33 percent) have already adopted mobile GSM phones (see Table 7).

The intent in asking this question was to have the focus group participants speak on some specific cases of how mobile phone adoption or use has helped them as students or helped their families and friends to access information for a better life. Each of the eight participants spoke. All of them emphasized the convenience or ease of communicating with others, cost/time savings and travel risk aversion in calling people rather than traveling to meet people for face-to-face interactions. Cost savings and travel risk aversion were pointed out as major benefits because most of the students come from remote villages where travelling is a burden. The roads are often very bad and there are no taxi cabs to convey people back and forth from the villages to Uyo; but old bicycles and motor bicycles transports or "okada" are used.

Another area of consensus among the participants was the ease of networking with family and friends to obtain needed information to solve problems or address needs. Although most of the students were yet to be exposed to Internet social networks as confirmed in question two, they all agreed that their "circle of friends" and ease of sharing information among themselves has increased. One of them remarked "… we are always texting each other about class assignments and projects." When asked if they text during classes, they were amused and then one remarked "… one can't help if the class is boring." There was laughter. Google search message was mentioned by two participants as providing help in finding information for academic work. I will discuss Google search message with mobile phones in detail in question five. To conclude this question, I discuss three short cases that were also given as responses for this question.

Case #1

An undergraduate science (Zoology) major spoke about a job search situation that a close family member did. The family member saw a job posting in a national newspaper and decided to follow up. After reading about the posting and researching the company, the individual called the phone number in the job advertisement using his mobile phone. During the call he shared his expertise and interest in the position. He was able to secure an interview through the telephonic information exchange with the prospective employer. Using his mobile phone helped to save the cost and risk of traveling to inquire about the job. The only travel that was made was the travel for the interview and he did get the job.

Case #2

The graduate engineering student who spoke about using mobile phones for project work in question one explained how he often used his mobile phone to

record important social events like church events, funerals, marriages/weddings, naming ceremonies and the like. The recorded works would be downloaded to his laptop computer and with the help of a CD burner, he burn CDs and sell them to people. This was a part-time effort that helped him to generate income.

Case #3

The architecture student who spoke earlier about his use of his brother's mobile phone for e-mail and Yahoo messenger shared how a pay-as-you-go mobile phone helped his father's business to receive new capital investment. According to the student, his father was expecting a business partner/investor from abroad. The two men had never met because the arrangement was made by a third party who was working to help his father raise capital for his business. The venture capitalist/investor wanted to meet his father before he partnered with him. His father looked forward to the day of meeting. The investor's itinerary was sent by e-mail to his father several days ahead of time. When the day came, the father waited several hours at the Murtala Muhammed Airport in Lagos, Nigeria for the investor but he did not arrive. The father was not sure what the problem was and so he waited patiently but left for his home late in the night. The next day the student's father arrived in his office and decided to send an e-mail message to alert the third party about the non-arrival of the visitor. Apparently, the investor's flight was delayed and when he arrived the next day, he could not see his name waved among the crowd (the typical way to identify an unknown person in the airport in Nigeria). His mobile phone would not function in Nigeria. The investor decided nevertheless to pass through custom checks and when he got to Arrivals, he was able to buy a pay-as-you-go mobile phone from merchants who were hawking these tools. He was able to telephone the student's father. Both men met and everything went well for the student's father.

The cases shared showed positive effects of mobile phones on the people. A follow-up question was asked whether any of them had a negative experience

when using mobile phones, for example, social networking with others and had a possible security breach or violation. They all indicated that they had had no bad experience so far.

Group One/Question #4

Have you or someone you know used a mobile phone to increase access to information for e-business?

An undergraduate engineering student along with two other study participants spoke about mobile banking in their e-business experiences. The undergraduate engineering spoke about his use of a mobile phone for mobile banking services. He explained that his bank, from time to time, would "push" messages to him and other customers. Push messages are broadcast messages that service providers such as banks often send across the network to service participants. "Pull" messages on the other hand are ones that service recipients send to the service providers. Three students spoke about their mobile banking experiences as characterized by helpful pull and push messages. Some of the pull messages were checking daily account balances and verifying payments and deposits. Push messages were birthday greetings with customized features like customer nicknames and phone numbers.

The Zoology student concluded the discussion with the statement: "I am able to connect to my bank account using my mobile phone. I can flash my account at any time… I can see how much balance I have without moving a step from my room…I can recharge my phone using funds from my account very easily." Flashing with a mobile phone means a very quick call to a number to either alert the person on the other line to call you back or a quick view of status as in an account balance. Recharging a phone means adding minutes to talk on the phone. All of the participants indicated that they had pay-as-you-go mobile services and those who had mobile banking access signed up with service

providers like Zain, MTN or Glo to have their account automatically debited with a certain amount when their phone minutes were low. The debited amount went towards the purchase of additional talk or text minutes and the minutes were automatically credited to the phones. This is an example of early stages of collaborative service provision in the private sector between the mobile service providers and banks.

Group One/Question #5

Have you or someone you know used a mobile phone to increase access to information related to e-learning?

Two participants spoke about using Google search via their mobile phones to find information for their academic work. All the mobile service providers have Google search message service as an add-on service at a very nominal fee of five naira (N5.00) or thirty-three cents ($0.33) per message. The way that this works is that an individual connects through an "app" on the mobile phone to the Google search system. After connectivity is established, the person sends a text message or a query that attempts to express the information needed. A response is usually received within a few minutes. The response is the result for the query that was sent and could consist of several entries. A follow-up search or refinement could be done after the first set of messages have been browsed or read but that would be charged as a new request to the system. One of the students remarked that it was usually not an issue to do multiple searches because the service was very cheap, in fact it was the cheapest service that providers had for people but one that was the least used because many mobile users are not able to read/write and some prefer voice communication to texting.

A follow-up question was asked about the ease of using the viewing screen to read the messages and one of them remarked "… it is a matter of scrolling through everything." When asked if the viewing screen was too small, more

than half of them said it was not a problem. Their lack of experience with computer technology may help them to bypass the whole problem of adjusting from large computer screens to small screen devices.

When none of the interview participants volunteered information about whether they had a university-wide e-learning service, the researcher asked if the University of Uyo had one for teaching and learning. They all unanimously answered that there was none at the moment. This question confirmed the discussion in the e-learning section of the literature under the "Focus on Nigeria" that Nigerian universities are plagued with issues that hinder them from embarking on e-learning services. The Nigerian educational system is far behind their counterparts like Botswana and other African countries in the use of e-learning services. Botswana was discussed in the literature section (Tella, 2007).

The graduate engineering student and an undergraduate education major shared their participation in a national e-learning system that is called NOUN (National Open University of Nigeria; see http://www.nou.edu.ng/noun/index.htm). The University of Uyo allows students to transfer up to six credit hours from NOUN into their programs of study. The tuition for a three credit-hour course with NOUN was estimated at two thousand five hundred naira (N2,500 or $250) in 2008/2009 School Year.

Group One/Question #6

Who among you have used the Internet Public Library (IPL) for school work, research or professional work and what are your experiences?

Two students indicated that they had heard about IPL but have not used it. The other six students were hearing about IPL for the first time. They all copied down the URL and assured the researcher that they were going to explore the IPL site at http://www.ipl.org/.

Group One/Question #7

Has your use of a mobile phone increased your access to information for your everyday activities?

This question was a re-ask of question three. The architecture student pulled information daily from Google for his class assignments and projects. The graduate engineering student in preparation for a better job after graduation is using his mobile phone to call potential employers and has done a few telephonic interviews. The two education students and the computer science student each day connect to online databases to find information. The undergraduate engineering student is currently enrolled in a course with NOUN and he did some work each day via his mobile phone. Each person was using his or her mobile phone to increase their access to information for everyday activities.

Group One/Question #8

Do you think it will be very hard to live your lives now without a mobile phone? Please explain. What do you think this innovation means for the development of your university, the country and Sub-Saharan Africa?

All eight interview participants unanimously agreed that it would be very hard to live their lives now without a mobile phone. The undergraduate engineering major explained that the few times that he had forgotten his phone before he left for class, he would felt very miserable and often pay transportation back to his dormitory at the Town Campus to get his phone in between classes. Others nodded their heads that they felt the same and had done similarly. The mobile phone has become an important tool that helps to meet information needs. It is not only the physiological needs that were significant for these BOP students, but also information needs and meeting these needs was as critical as meeting their physiological needs. This supports my theoretical proposition that information need is an integral part of the pyramid of needs.

The students also agreed unanimously that mobile technologies, unlike expensive computers, were important innovations and powerful tools that would revolutionize the way the people of Sub-Sahara Africa lived and worked in the days to come.

Group One/Question #9

Do you think that the people who do not have mobile phones are missing out a lot on the ease of finding information for everyday living?

All eight interview participants said that the people who did not have mobile phones were missing out not only on the ease of finding information for everyday living, but were missing an important era of an "information revolution." The graduate engineering student concluded with the statement, "We have all been changed on how we communicate, collect and use information on an everyday basis. People who are not using mobile phones are missing a lot."

Group Two

Group two consisted of five participants. Ten members were invited back as in the case of group one but only five showed up for the focus group interview. Group two participants had indicated in the initial survey that mobile phones were not helping in alleviating either information or extreme poverty and as such, the technology had low or non-acceptance within the population. The participants were four male students and one female student. Their interests and participation in the questions asked was low when compared to participants in group one who were interviewed earlier in the day. Compared to group one participants, they were very brief in their responses and were not familiar with technology terms or uses. Their emphasis throughout the 45 minutes interview session was affordability of mobile phones and the maintenance costs that were associated with ownership of a mobile phone. The participants shared the opinion that mobile phone ownership was very expensive and that owners of such were only caught up in a "social fad" that they would not be able to maintain overtime. Their viewpoint tended to support Maslow's hierarchy of needs or the ERG theory that physiological or the existence needs are core but not information needs or needing tools that help information seeking. Figure 37 shows a section of participants in group two and Figure 38 shows the researcher explaining a question while the participants listened. The six questions (see Appendix H) that were asked to group two participants are reported.

Figure 37: A Cross-Section of the Focus Group Two Participants

Figure 38: A Cross-Section of Focus Group Two Participants with the Moderator Explaining a Question

Group Two/Question #1

Please share your opinion about mobile phones and other technologies as a whole. Do you see mobile phones or other forms of technology helping you to increase your income earning potential?

The first speaker was a male undergraduate English major who indicated that he did not have a mobile phone. He talked about how mobile phone ownership was a major expense item for students. He stated: "As far as I know, mobile phones do not help anybody to get income. Instead, you spend, spend and spend! You buy the phone, repair it from time to time and buy recharge cards almost every day." He added "I have seen students who are broke for using mobile phones; they can't control themselves but pretend they can afford to pay to recharge and make more calls. I can't afford that lifestyle 'cause I have to pay my school fees, buy food and transport myself."

A Food Science female undergraduate student spoke next. She indicated that she had a basic mobile phone to call home because she was from Cross River State. She indicated also that she made and received calls mostly from family members. She ended with "… I am very low key, very low end user; beside the need to call my family, I don't have a need to use a phone here." A male Linguistic major agreed with the first speaker and asserted that phones were very expensive purchases. He explained "As the first speaker had already said, I fully agree; the phones are expensive and you need to wait until you are working." The last speaker was a business/marketing major and he had a mobile phone. He stated, "You can make money if you use your mobile phone for business. I am only using mine to communicate with family and friends. I carry it with me always in case I have an emergency. To him, a mobile phone is useful in business, communicating with others and handling emergency situations. He was the first person in both focus groups to discuss the use of mobile phones in emergency situations; however, he mentioned no specific cases when he was probed to say more about it.

Group Two/Question #2

Would you say that a mobile phone has helped or not helped you to expand your social networks for information access and sharing?

None of the five participants were part of an Internet social network. They had no idea what an Internet networking group was, the researcher explained with examples like Facebook. They did not see a value for it since they could make friends and interact with people of like minds within their campus environment.

Group Two/Question #3

Who among you have used the Internet Public Library (IPL) for school work, research or professional work (keep count) and what are your experiences?

None of the participants in group two had ever heard about IPL. In fact, none of them had ever used the Internet, unlike group one where each participant had used the Internet either through a personal computer at home or school or one at the Internet café.

Group Two/Question #4

Do you think that if you had a mobile phone you could use it to increase your access to information for everyday activities?

The first speaker to question one stated again that there was no benefit to using mobile phones. The female student whose major was Food Sciences brought up the issue of experience. She explained with reluctance that she lacked experience. She was only able to use the phone to make and receive calls. She did not know how to send or receive a text message or use the basic apps that were part of her mobile phone except the flash light feature that was helpful at night or when electricity was interrupted. She explained: "I am not comfortable with using the handset. I just keep it in my bag and it is turned off until I want to telephone. I don't have the experience." One of them chipped in "… at least

you don't worry about the battery power or the recharge when you keep it turned off." There was laughter.

A follow-up question was then asked to her and another participant who indicated that they had mobile phones, if there was constant electricity to charge the batteries of their mobile phones. In response, one of them asked me if I was not familiar with how NEPA (Nigerian Electric Power Authority) operated in the area; before I could say anything, he went on to explain how bad the electricity supply was even at the University Campus; that in a given day, NEPA could give electricity for only two hours or less. It is called rationing of electricity power supply since demand has so much exceeded what was meant to be supplied with the old power grids. Before we exited the question, the female participant was asked if she would be willing to participate in a training session that would help her put her mobile phone to better use and she answered in the affirmative.

Group Two/Question #5

You indicated in the survey that it will not be very hard to live your lives without a mobile phone. Please explain. Follow-up: What do you think this innovation holds for your university, the country and Sub-Saharan Africa?

The participants confirmed that it was not hard for them to live their normal lives without mobile phones. However, the business/marketing major spoke about the future. He indicated that connecting with the developed world was necessary and important; however, lack of ICT resources that could have helped to make mobile phones affordable was hindering them from getting prepared for a better future. With time and resource availability, he hoped that the technology would become more affordable.

Group Two/Question #6

Do you think that your lack or non-use of a mobile phone will make you miss out a lot on the ease of finding information for everyday living?

Surprisingly, this last question raised the participants' energy level which had been flat most of the session and they all spoke taking turns to explain their viewpoints. The Language student who had no mobile phone and had insisted all the way that mobile phones had no benefits, said he was not missing anything, that he preferred to use the resources in the physical library and considered them more authentic than "something from anywhere that you can't see or touch." The business/marketing major spoke next and I quote: "I hear something about digital libraries. I think this will help us if access will not be very costly."

The three other participants took turns to reaffirm mostly the negative impacts. They spoke in depth about affordability and service quality and criticized the service providers but not the technology. It was interesting to see how the participants in group two showed great energy and spoke their minds towards the end of the interview session when questions about them missing out on mobile technology or the use of the technology for their everyday information seeking were raised. It was also interesting to watch their faces – yes, it was their faces that spoke much louder than their voices. As we completed the interviews, I pondered and reflected. As the moderator/researcher I asked, what turned them on towards the end? Did I provide more of a learning session about mobile technology that has helped to enlighten them? Did they suddenly grasp the value of mobile technology for this population based on the questions asked and my interaction with them? Some of these questions probably would only be answered in follow-up studies and interviews.

CHAPTER SEVEN

SUMMARY OF FINDINGS, CONCLUSION, RECOMMENDATIONS AND AREAS FOR FURTHER RESEARCH

Summary of Findings

The approach for this section is to discuss key findings based on survey research analyses and the focus group interviews that were reported in the previous chapter (Chapter Six, Data Analysis & Discussion).

Research Question #1
Do participants in the study who own an ICT tool such as mobile phone or computer live on less than two U.S. dollars a day?

Finding #1
Despite extreme economic poverty state, most study participants owned at least one form of an ICT tool – a mobile phone.

The study participants who owned both computers and mobile phones (58 out of the 300 study participants) lived on two U.S. dollars ($2.00) per day or less. Those who owned only mobile phones (216 out of 300 or 69 percent) and lived on

the same amount made up 23.8 percent. Both cases support a major finding that in addition to their extreme economic poverty, the students faced motivating information needs. They will save their limited income to buy an ICT device such as a basic mobile phone to help meet their information and communication needs. This finding validates the World's Pyramid that illustrated human needs and economic power (Figure 4); information needs were integral part of the students' existence or physiological needs. Any attempt to earn income to meet other existence needs and not meet the information needs of the person will lead to an information poverty state.

Research Question #2
Is cost a factor for study participants adopting and using different forms of ICT tools/services?

Finding #2
The cost of an ICT tool or service was a significant factor that influenced adoption of the ICT tool or service; mobile phones were the most attractive ICT tools for the students.

Finding #3
A large proportion (78.8 percent) of those surveyed who could not afford to own expensive computers accessed them in fee paid Internet cafés.

As reported in Chapter Six, only 21.2 percent of those surveyed owned computers while 78.8 percent lacked this important computational tool. The 60 percent of participants who did not own computers said that it was very expensive to own them while the 34 percent who did owned computers affirmed that computers were expensive to own. A Chi-Square analysis was significant (22.998, Table 23). A regression analysis (Table 24) was also significant and indicated that as the highest source of income per month (usually gift from families and friends) goes up one unit on its scale, ownership of computers

actually went down by 0.075 units on its own scale; indicating that the perception that computers were expensive to own was a valid predictor (by .084 units) of actual computer ownership. The probability of the students adopting expensive computers is very low even when income increases slightly.

It is reasonable therefore to infer that the affordability or cost variable was a major factor that determined why so many of the non-computer owners (75 percent, Table 19) decided to use computers at Internet cafés. It is also reasonable to infer that the lower costs of mobile phones encouraged 99 percent of those surveyed to adopt them.

The ICT affordability factor was discussed by some of the writers that were cited in the literature section (Donner, 2008a; Elijah & Ogunlade, 2006; Etim, 2009; Gillward, 2008). In the study of ICT access and usage at participants' homes across 16 African countries, Gillward (2008, *Research on ICT use in Africa study*; Figure 12) provides data to support the fact that it was the high cost of computers that restricted large segments of the population in each of the 16 African countries from owning computers or accessing the Internet. Table 10 provides data on the case of Nigeria - the percentage distribution of persons in Nigerian states by types of ICT that they owned. This table is important to re-examine because it includes very recent data from the Nigerian Bureau of Statistics on the distribution of types of ICT ownership. In many of the states of the nation, computer ownership and Internet access are less than one percent while mobile phone ownership is at 30 percent or above.

Participants in focus group two raised substantial concerns about the affordability of even mobile technology and the associated pay-as-you-go services during the interview. For example, when the last question was asked to group two participants, they listed the service providers by name – MTN, Glo, Zoom, VisaPhone, ATISALT and STARCOMMS – and criticized them for their unwillingness to make service affordable even when the quality of service was

poor. According to these students the providers entered this particular market at different times. Glo arrived first followed by MTN and Zain. Other providers were very recent arrivals in the region. Each provider would come in and would entice people with lower rates and the people would flock to it. After a few months and without any notice, the provider would hike rates sometimes as high as 50 to 100 percent of the original price. When a follow-up question was asked about changing to yet another new provider to use the discounts, they all interjected that it was difficult to keep changing providers since one would have to purchase a SIM (subscriber identification module) card each time; SIM cards linked a phone owner to a service provider. As they spoke, their facial expression showed a depth of frustration; one of them explained that people did not trust the companies although they could not help but continue to "give away their money to the providers 'cause they are hungry to talk on their phones." The fact that they could name the service providers that operate in their locale means that a mobile phone is a highly desirable item.

Research Question #3

Is there a relationship between having access to an ICT tool or service and a study participant's ability to access the Internet and other information resources?

Research Question #4

To what extent do study participants perceive mobile phones as being useful for different tasks that they engage in?

Finding #4

The students overwhelmingly adopted mobile phones (99 percent) for communication purposes but did not use them to access the Web or do other advanced tasks.

The details of the findings include:

a) They had limited knowledge about how to use of mobile phones for accessing the Web, e-learning (or m-learning), e-mail and mobile banking.
b) The mobile phones that many of the students could afford to buy were mostly Nokia basic phones for voice communication and texting (short message service or SMS for short). These basic mobile phones lacked advanced feature support as well as the smartness capability for accessing data, including Internet data.
c) Mobile phones could help people's non-Internet social networks or social status.

Although 99 percent of survey participants owned mobile phones, they did not use their mobile phones to access the Internet. Mobile phones were primarily used for voice communication with family and friends (agreed to by 265 study participants or 88.3 percent of those surveyed). The use of mobile phones to communicate or find information by making voice calls was also found to be the predominant use of the tool during the focus group interviews. Participants in focus group one also indicated that having a technology tool such as a mobile phone made a person well regarded within his or her social network; it was a form of status symbol or an object of inclusion.

Other than these two important findings about the uses of mobile phones, participants in the survey had very limited knowledge about the use of mobile phones for accessing the Internet or e-mail, doing advanced tasks such as e-learning via mobile phone (m-learning) or mobile banking (Table 26). Despite these overall findings, some focus group one members reported that they had ventured out to use mobile phones for m-learning, mobile banking and accessing the Internet.

The last questionnaire item (#59, an open-ended item) was to find out what features students would like to see added to their mobile phones to make them more useful to them. Ninety (90) percent of participants who responded to this open-ended item indicated that they would like to have access to the Internet. The real problem therefore was not that students did not want to access the Internet, but the ICT tools for accessing the Internet were either not available to them or affordable.

Research Question #5

To what extent do participants in the study perceive mobile phones as easy to use, satisfactory and dependable?

Finding #5

Perceived ease of using mobile phones for communication purposes was significant but was not significant with more advanced tasks.

The details of the findings include:

a) A few persons in the study who indicated that they used their mobile phones to access the Web were between ages 18 and 25 years.
b) The relationship between connecting to the Internet via mobile phones and the perceived ease of doing so is an inverse relationship (Table 33).
c) Students would require extensive training in order to use mobile phones for advanced tasks such as class assignments, surfing the Web, accessing e-mail, and mobile banking.

Many participants in the study (83.8 percent, Table 31 and Figure 30) perceived that it was extremely easy to use their mobile phones for communication. However for such tasks as using mobile phones for class assignments, participants (46.6 percent) were challenged, indicating a need for training students on how to use mobile phones for more advanced tasks like surfing the

Web or finding information for class assignments. The correlation analysis and discussion of the results for perceived ease of use of mobile phones for different tasks as well as perceived usefulness with other variables were provided in the "Testing of MOPTAM Factors" in Chapter Six (see Tables 33 and 34).

The results of the MOPTAM test were compared with that obtained by van Biljon & Kotze' (2007) in their MOPTAM model. In their study, Tech_A (technology advancement), a personal factor correlated positively with PEU (perceived ease of use) factors. The perceived usefulness (PU) of mobile phones was also a positive correlation with personal factors such as Tech_A and Tech_O (technology orientation). There was also a positive correlation between Tech_O (technology orientation) and Tech_A.

In this study, Tech_A correlated positively with PEU when mobile phones were used for voice communication. Negative correlation were established between Tech_A and PEU for higher level tasks such as students perception that mobile phones were difficult to use to access the Internet. The PU (mobile phone helped to increase income) was not significant with the personal factors (Tech_A or Tech_O). The Tech_A correlated positively with service quality, which was a facilitating condition (FC).

Research Question #6

To what extent do participants in the study perceive mobile phones as an innovation that can help to sustain development (reduce poverty, enable income earning potential and broaden access to e-services)?

Finding #6

Mobile phones are useful innovation for broadening access to information, e-services and non-online social networks (Tables 36, and Figure 32).

The details of the findings include:

a) Mobile phones could help to reduce poverty especially information poverty because they provide access to information for living better lives (Table 37).
b) Mobile phones could help in sustainable development because they are not transient things that had come into the lives of these students, but rather, mobile technology is more broadly accepted and shows promise of sustainability and use. More than 80 percent of study participants indicated that they could no longer live their lives without mobile phones (Figure 33 and Table 38).

Importance of the Study

The study offers insight into the adoption, diffusion and use of ICT among Nigerian students. The study can help the research community to:

- Have a better understanding of what ICT has diffused – in this case, the basic mobile phones
- Become aware of non-diffusion of computers, fixed phones and the Internet
    - Affordability issue restricts access, not the lack of acceptance of ICT
    - There is a high level desire by the people to access the Internet but they are limited by infrastructure, the capability of their mobile phones, inexperience with the technology and the high cost of service.
- Plan ICT investments and infrastructure development in Nigeria and the region of Sub-Saharan Africa
- Better understand that information needs are part of basic existence needs
- Better understand that investment in ICT can transform the region to become a part of global information society

- Supports Paul Collier's (2007) solution – need to investment in telecommunication infrastructure

The study affirms Donner (2008) on the position that mobile phones can change the Fourth World. The Fourth World concept by Manuel Castells - *The Information Age: Economy, Society and Culture: End of Millennium* (1998) was discussed in Chapter One. Part two of the book addresses the rise of the Fourth World and discusses "informational capital, poverty and social exclusion". Castells position is that in the network society, the accumulation of wealth is determined by technological capacities and the Fourth World lacks such technological capacities.

The study has also helped to inform the academic world and the global society that mobile phones are changing the landscape in Nigeria and SSA in many ways:

- Changes in how people now communicate/interact and work - Mobile communication has replaced a lot of face-to-face interactions and eliminated the risks and high costs of traveling on poor roads to exchange information for various needs
- Enables quick information access
- Enables social networking
- Signals that future possibilities appear almost infinite
- Shows that people want to use their mobile phones for more than voice communication (Internet, camera, music, scientific field work, etc.)
- Enables people in their respective roles, for example:
    - Student role (Google Search & early start in m-learning activities)
    - Entrepreneur role (see Figure 39)

- Demonstrates that technology married to possibilities can lead to economic development and reduction in extreme and information poverty
    - Examples abound in e-services:
    - E-business
    - E-learning (for example, a new state of the art library is being built in the city of Uyo that will encourage the use of books and other media such as computers and the Internet)
    - E-Government.

ICT is changing not only the communication landscape but it is enabling people in their different roles. Figure 39 shows a student entrepreneur at Uyo making use of different ICT tools to provide photographic services to the public in order to earn income that will help to support him at school. A careful look at the figure shows the entrepreneur with a digital camera in his left hand, a table that is sitting under an umbrella kiosk with a computer monitor and photographic processing equipment. There is a desktop computer sitting on the floor. This entrepreneur hopes to make enough money to buy a laptop computer, which could cost up to $1,000 in the region. His hope for a laptop computer is to reduce the burden of carrying the large desktop computer and monitor on his motor bike, which is parked a few feet away from his mobile kiosk (motor bike not shown in the Figure). Another main challenge is packing up or unpacking between the heavy tropical rainfalls that can sometimes come suddenly. He desires a permanent place for his business instead of the umbrella kiosk.

Figure 39: Entrepreneur Using ICT for Photography Services

Courtesy of the entrepreneur in the photo

Conclusion

Overall, ICT, especially mobile phones are not only accepted by the BOP students in the study but the students were excited and "hungry" for new forms of ICT to permeate their lives. Using the focus group interviews as evidence, the two focus groups did not criticize mobile phones or any form of ICT as being foreign to them. What the participants in focus group two complained about were issues of affordability of mobile phones and the confusion of services that were provided by different service providers. In the literature, several writers suggest that social and cultural factors such as beliefs, norms and values, among several others, are possible barriers to technology diffusion, including mobile phone adoption and diffusion in rural and economically challenged communities (Elijah & Ogunlade, 2006; Lagmia 2005; Rogers, 2003; Ssewanyana, 2007). My expectation therefore, particularly with focus group two before the interview, was that they would criticize mobile technology or any form of ICT as intruding into their lives, beliefs and indigenous culture. This was not the case, but rather, other factors were raised as the problem for their lack of use of mobile phones.

The survey findings confirm that participants accepted technology such as the mobile phones. The personal factors (for example, Tech_O or technology orientation) that were tested in the MOPTAM model showed that in general, the students enjoyed using mobile phones (83.8 percent, Table 31 and Figure 30). The use of mobile phones was particularly high for communication purposes (77.7 percent, Table 28).

Focus group one displayed distinct characteristics of early adopters and gate keepers (Rogers, 2003). The frustration observed among group two participants did not come from their dislike of technology or lack of acceptance, but was based on their inability to afford mobile phone services and the poor quality of the services that were provided. According to them, not only were usage

charges very high per call but services were not very dependable. The two persons who had mobile phones in group two described how "crossing over the network" service was particularly poor. In crossover calls, bad network experiences abound. Calls could be dropped or noise interference would be at very high level causing poor reception; overall the experience would be negative. One is said to cross over the network if a call originates from a phone with a different provider's SIM card to the one that is receiving the call. Each phone has an embedded SIM card. The SIM card holds information about the owner and links the owner with the service provider that issued the SIM card. That is the reason that mobile banking is possible because the identity of the owner is integrated into his or her SIM card. A family can share one mobile phone by having each member load or unload his or her SIM card at the time when the phone is used. As a researcher, I thought about the inconvenience and the burden placed on people who had to share phones because they could not afford to own personal phones.

I also concluded that group two participants were suddenly awakened about something and that thing was very valuable to them but they were not a part of it or able to enjoy it because there were so many obstacles to having it. Some of the obstacles included cost of infrastructure like the mobile phone or the SIM card, unreliable or lack of power supply to charge the batteries, cost of paying for the minutes, poor service quality, lack of understanding of the technology and lack of experience or needing training in using the technology. These users or potential users of mobile phones were confronted with many inhibiting factors to using the technology. These factors prevented them from exploring the technology, thereby making them continue life in the status quo - the information poverty state as illustrated in the research model (Figure 25).

As I analyzed the survey data and the focus groups' responses to my interview questions, it dawned on me that a participant's program of study or discipline could play a role in their technology awareness, literacy level or ignorance.

Group one interview participants were in disciplines such as architecture, computer science, education, engineering, information technology and zoology. They were all exposed to mobile technology and a few of them had accessed the Internet at an Internet café, home or school. Group two participants, on the hand, were English, linguistics, and food science majors. It could be assumed that group one participants were in disciplines that helped them to get exposure – hear, interact or read about different forms of technology. The group two participants were not exposed to technology and I could not help but explain things more for them than I did for group one. Group two participants appeared to be plagued by ignorance about what was happening in the technology fields as a whole; according to them, they all had no access to computers or the Internet. This confirms the findings in the survey that 44.5 percent had never accessed the Internet even with a dial up connection (Table 27).

Reflecting on Chatman's information poverty theory and the concepts of the insider and outsider (Chatman, 1996 & 1999) or the local and cosmopolitan (Merton 1972) viewpoints that served as part of the theoretical underpinning for this research, it is evident that group two participants were the insiders or the locals by reason of their lack of access to computers or lack of usage of mobile phones to communicate with the outside world. When one takes their responses to the question on social networks for example, it shows that they were preoccupied with their immediate environment on a university campus. By contrast, group one participants were similar to Merton's cosmopolitans or Chatman's outsiders, so called because they had an orientation and social behavior that was directed at keeping up with the interests and values of life outside of their environment, even when it was costly to do so. Group one members identified with strangers on the Internet via Facebook; they identified very quickly with me and built a rapport very early in the interview sessions. A few of them were using Google search message, Yahoo messenger and NOUN which are all technology tools/services that were offered outside their immediate University environment. The comparison here is made only on the basis of how

the two groups responded to the interview questions. There was no investigation into whether group two were the controllers of information networks within their immediate campus or local environment as Chatman (1996) would consider the insiders in, say, a prison. However, one thing was established. The members of group two as well as the large survey participants who had never used computers were so much centered on the everyday reality of their immediate campus environment that they could be bypassed by a whole era of the Internet and modern information and communication technology.

Limitations to the Study Findings

The following were limitations to this research:

1. The study sample consisted of mostly (77 percent) undergraduate university students who were between 18 and 25 years. The findings in this study should not be generalized for graduate students or people in a different age range.
2. The supply side of ICT in Nigeria deserves a separate study. This research does not lay claim to a thorough investigation of the service providers or the wide range of policies, politics and programs of the Federal Republic of Nigeria and its agencies such as the Nigerian National Communication Commission (NCC).
3. The study has been conducted in a rational manner and every effort was made to properly inform participants and collect data in a very objective manner. However, there is that small possibility that research biases may occur that affected responses.

Recommendations

The following recommendations are made based on the findings.

1. Policy actions and investments on the part of the government or the private sector that are geared to alleviating extreme economic poverty among university students and their families should include making ICT tools/services and the Internet accessible to them in order to alleviate their information poverty.
2. Computers are important ICT tools in developed societies. Universities in the U.S. and other developed information societies are repositories of knowledge via large databases and digital libraries. Computers are made available in university laboratories, public and university libraries. Since cost is a major factor for the students' adoption and use of computers, the Federal Government of Nigeria should partner with the universities to provide computers in public libraries and university libraries; the government should also build computer laboratories for students in their universities. The use of computer technology should be encouraged by providing training to students on both the hardware, Internet and the development of applications, including e-learning and digital libraries' applications. Universities that are not yet well connected to the Internet are greatly marginalizing their students' academic efforts.
3. Mobile phones have diffused successfully (99 percent of surveyed participants owned mobile phones) into the students' population but they have only been able to afford basic mobile phones for communication. The students should be encouraged to use mobile phones for advanced tasks such as accessing the Internet for information needs, e-mail, m-learning and mobile banking. Such encouragement can come from making smart phones more affordable to students. One way is that universities, through grant funding from the government and the private sector could subsidize smart phones' purchase by students.

4. The Nigerian National Communication Commission (NCC) should regulate as well as enforce ICT policies on the quality of service and pricing of mobile phone services throughout the country. The NCC should set up a governing board that creates quality of service and pricing standards in each state of the nation and mandates that such board oversee the activities of all service providers in each state. This will help to safeguard the interests of all mobile phone users and standardize service delivery. Service providers that will not comply with set standards on both quality of services and pricing should have their licenses revoked in effort to protect consumers.

Areas for Further Research

The future of ICT especially mobile phones and the Internet is extremely bright for Nigeria and SSA. As discussed in the literature (Chapter Two), the submarine cabling network, EASSy, is a major work in progress that will help Internet access in the South and Eastern African regions. Another major work in progress that was released recently by the Nigerian press (*Nigerian Curiosity*, February 2009) concerns the international submarine communication cable (Figure 40). The cable spans 9200km, from Portugal and passes through fifteen other countries to reach Lagos, Nigeria's commercial capital city. The project is financed in part by Globacom, a leading telecommunication service provider in Nigeria and the West African region.

Even before these major submarine cabling projects are finished, hopefully, and people can afford to purchase expensive computers or smart phones that will enable them to access the Internet, there is a great need for additional ICT research on several fronts. It is evident from my study that ICT tools and services adoption as well as use are at very early stages in the population of students that I studied. A follow-up study, if funding allows, could be a five to

ten-year longitudinal study that gathers data on a yearly basis from at least one university in each African region to be able to understand progressive adoption/diffusion as well as usage of different ICT tools (computers, Internet and mobile phones) and services (Instant Messaging, libraries, and video conferencing) by faculty and students.

Figure 40: A New Fiber Optic Cable at the Shores of Lagos, Nigeria (2009)

Image source: http://www.nigeriancuriosity.com/2009/02/nigerias-internet-future.html

Outside of the university environment or the students' population, other populations that could be studied in their adoption and use of mobile phones for different information seeking needs would be professionals and entrepreneurs, particularly very small scale businesses and market women. These groups would be suitable populations to investigate by means of focus group interviews, user studies or ethnographic studies. One part of the study should investigate whether the use of mobile phones can help to increase study participants' income earning potential or reduce extreme poverty.

The use of ICT tools for health is gaining popularity in the developed societies. A study that investigates the use of mobile phones by health professionals to service patients in very needy African communities is recommended. A subset area would be to investigate how health professionals use mobile phones to support health care delivery/services to patients.

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Appendix A
Generations of Mobile Technologies and Protocols

Generation and Protocol	Description
0G	Refers to pre-cellular mobile telephony technology in 1970s. These mobile telephones were usually mounted in cars or trucks, though briefcase models were also made.
PTT	Push to talk
MTS	Mobile Telephone System
IMTS	Improved Mobile Telephone Service
AMTS	Advanced Mobile Telephone System
0.5G	0.5G is a group of technologies with improved feature than the basic 0G technologies.
Autotel/PALM	Autotel, or PALM (Public Automated Land Mobile)
ARP	Autoradiopuhelin, Car Radio Phone
HCMTS	High Capacity Mobile Telephone System
1G	1G (or 1-G) is the first-generation wireless telephone technology, cell phones. These are the analog cell phone standards that were introduced in the 1980s.
NMT	Nordic Mobile Telephone
AMPS	Advanced Mobile Phone System
TAGS	Total Access Communication System (TACS) is the European version of AMPS.
JTAGS	Japan Total Access Communication System
2G	2G (or 2-G) is the second-generation wireless telephone, which is based on digital technologies. 2G networks is basically for voice communications only, except SMS messaging is also available as a form of data transmission for some standards.
GSM	Global System for Mobile Communications
iDEN	Integrated Digital Enhanced Network
D-AMPS	Digital Advanced Mobile Phone System based on TDMA
cdmaOne	Code Division Multiple Access technology defined by IS-95
PDC	Personal Digital Cellular
TDMA	Time Division Multiple Access
2.5G	2.5G is a group of bridging technologies between 2G and 3G wireless communication. It is a digital communication allowing e-mail and simple Web browsing, in addition to voice.
GPRS	General Packet Radio Service

WiDEN	Wideband Integrated Dispatch Enhanced Network
2.75G	2.75G refer to the technologies which don't meet the 3G requirements but are marketed as if they do.
CDMA2000 1xRTT	CDMA-2000 is a TIA standard (IS-2000) that is an evolutionary outgrowth of cdmaOne. CDMA2000 with 1xRTT is slight weaker than 3G requirements.
EDGE	Enhanced Data rates for GSM Evolution
3G	3G stand for the third generation of wireless communication technologies, which support broadband voice, data and multi-media communications over wireless networks.
W-CDMA	Wideband Code Division Multiple Access
UMTS	Universal Mobile Telecommunications System
FOMA	Freedom of Mobile Multimedia Access
CDMA2000 1xEV	More advanced CDMA2000 with 1xEV technology satisfy 3G requirements.
TD-SCDMA	Time Division Synchronous Code Division Multiple Access
3.5G	The 3.5G generally refer to the technologies beyond the well defined 3G wireless/mobile technologies.
HSDPA	High-Speed Downlink Packet Access
3.75G	The 3.75G refer to the technologies beyond the well defined 3G wireless/mobile technologies.
HSUPA	High-Speed Uplink Packet Access
4G	4G is the name of technologies for high-speed mobile wireless communications designed for new data services and interactive TV through mobile network.

Related mobile technology generations/protocols: 2G, 2.5G, 3G, 4G, CDMA, GPRS, UMTS, HSDPA, and HSUPA.

Helpful resources: http://networkdictionary.com/protocols and http://networkdictionary.com/wireless

Appendix B
Invitation to Students/Information to Participants in the Study

You Are Invited!

You are invited to participate in an Information and Communication Technology (ICT) study. The goals of the study are to investigate:

- Access to ICT Tools/Services and Affordability
- Adoption and Use of ICT Tools (computers and mobile phones) and associated services
- ICT as a solution for sustainable development

Date/Time:

Venue:

Contact:

Great Giveaways and Wonderful Prizes to Win!!!

Information to Participants in the Study

You have been selected to participate in an Information and Communication Technology (ICT) study in Nigeria. The goal of the study is to investigate the following areas:

- Access to ICT Tools/Services and Affordability
- Adoption and usage of ICT Tools (computers and cell phones) and associated services
- Poverty, Education and Training Needs and how ICT Impacts those Needs
- Infrastructural Issues that hinder ICT Use
- Innovation, Human/ICT Interaction
- Acceptance of ICT as a solution for sustainable development

For the purpose of this study ICT tools/services encompass mobile phones, computers, the Internet and the electronic services that are provided by telecommunication companies, Internet Service Providers (ISPs), banks, businesses, libraries, and your university computer laboratories.

The benefit of the study is that having understanding about current uses of ICT such as computers, the internet and mobile phones among students may facilitate among other things the creation of technology tools and software which they can use for their academic tasks as well as everyday information seeking behavior. It is often stated that information is power. Access to an information tool such as a mobile phone for a student can mean a world of difference on how he/she communicates, share information and support the student role.

Thank you for your participation in the study.

Appendix C
Questionnaire

General Profile, ICT Ownership, Access and Affordability

Instructions: Please circle the most appropriate response for each item.

Item	Question
1.	Your age range A. Less than 25 years B. 25 - 30 years C. 31 – 35 years D. 36 – 40 years E. 41 and above
2.	Female or Male A. Female B. Male
3.	Level of education (check highest level completed) A. Undergraduate B. Post Graduate Diploma C. Masters Degree D. Post Masters E. Professional (DVM, LLB, MBBS)
4.	Your field of study or major A. Math and Science B. Arts and Social Sciences C. Education D. Law E. Medicine and Health-Related
5.	Your source and estimated amount of income per month (check the biggest source of income and fill in estimated amount in Naira) A. Gifts from parents, family and friends (_____) B. Government scholarship, bursary and awards (_____) C. A full-time or part-time job (_____) D. My life savings (_____) E. A bank loan or other borrowed funds (_____)
6.	Do you own a computer? Yes No
7.	If "No" to item 6, where do you access a computer from? A. My University Library or Computer Lab B. My family or a friend's computer C. A nearby fee paying Internet café D. I don't have access at all to a computer E. Other (Specify _____)
8.	Does the computer you have access to connect to the Internet? (Skip item if you do not have a computer) A. Yes B. No
9.	If you answered "Yes" to item 8, how do you connect? A. Dial-up access , up to 56 Kbps B. Integrated services digital network(ISDN: 64 – 128 Kbps)

	C. Cable or Broadband Internet Connection (high speed) D. Wireless Internet Connection E. I don't know
10.	Do you have a mobile phone or an active SIM card (SIM = subscriber identification module)? A. Yes B. No
11.	Do you use your mobile phone to access the Internet or online databases (skip this item if you do not have a mobile phone)? A. Very Frequently B. Frequently C. Occasionally D. Rarely E. Very Rarely F. Never
12.	Check all that apply (skip item if you have no phone): A. I use a prepaid SIM card with a mobile phone B. I use only a public paid phone C. I have a contract service (postpaid) with my mobile phone D. I have prepaid SIM card with a mobile phone and I also use a public paid phone E. I have a contract on my fixed (land) line F. I have a prepaid SIM card with a mobile phone and a contract on my fixed (land) line G. I have service contract on both a mobile phone and fixed (land) line
13.	I have used a public paid phone during the last three months at my University or community A. Very Frequently B. Frequently C. Occasionally D. Rarely E. Very Rarely F. Never
14.	The current cost of calls to and from my mobile phone during peak time is Expensive -> extremely|quite||neither||quite|extremely <- Inexpensive
15.	The money that I used to buy my mobile phone came from A. Gifts from parents, family or friends C. Funds from scholarship, bursary or awards C. Salary from a full-time or part-time job D. My life savings E. A bank loan or other borrowed funds F. Other _____
16.	I have a fixed (land) telephone line at my home A. Yes B. No
17.	My subscription to a fixed line is paid through A. Gifts from parents, family or friends B. Funds from scholarship, bursary and awards C. Salary from a full-time or part-time job D. My life savings E. A bank loan or other borrowed funds F. Other _____
18.	It is expensive for me to own a computer Expensive -> extremely|quite||neither||quite|extremely <- Inexpensive

19.	It is expensive for me to own a fixed phone Expensive -> extremely|quite||neither||quite|extremely <- Inexpensive
20.	It is expensive for me to own a mobile phone Expensive -> extremely|quite||neither||quite|extremely <- Inexpensive
21.	It costs about ___ kobo (K) on a local call with my mobile or paid phone call during peak hours A. 10K - 50K B. 60K – N1.00 C. N1.01 – N1.50 D. N1.51 – N2.00 E. More than N2.50
22.	It costs about ___ kobo (K) on a local call using my mobile phone during non peak hours or weekends B. 10K - 50K B. 60K – N1.00 C. N1.01 – N1.50 D. N1.51 – N2.00 E. More than N2.50
23.	It costs about ___ kobo (K) to make a 1-5 minutes international call using my mobile phone or SIM card A. N1 – N20 B. N21 – N50.00 C. N51 – N100 D. N101 – N200.00 E. Other _____
24.	The estimated cost for my mobile phone in Naira (N) a month is about A. Less than N100 B. N100 - N150 C. N151 – N200 D. D. N201 – N250 E. Other _____
25.	I use _____ (N) to live each day (food, shelter and other basic needs) A. About N100 B. N101 – N200 C. N201 – N300 D. D. N301 – N400 E. More than N400

Ease of ICT Use, E-Learning and Training Needs

Instructions: Please circle the most appropriate response for each item.

Item	Question
26.	I can use my mobile phone for the following tasks (check all that apply) A. Communicate with family and friends B. Find information for class assignments/projects on the Internet C. Access and manage my electronic mail (e-mail) D. Connect to my bank for mobile banking services E. Find information for my daily job performance F. Find information for my professional activities G. Find information for my small business
27.	I find mobile phones easy to use for communicating with my family and friends Easy -> extremely|quite||neither||quite|extremely <- Difficult
28.	Mobile phones are easy to use to find information for my class assignment and projects on the Internet Easy -> extremely|quite||neither||quite|extremely <- Difficult
29.	I find mobile phones easy to use to surf the World Wide Web and to manage my e-mail Easy -> extremely|quite||neither||quite|extremely <- Difficult
30.	I find mobile phones easy to use to connect to my bank for mobile banking services Easy -> extremely|quite||neither||quite|extremely <- Difficult
31.	Mobile phones are easy to use to find information for my daily job performance or business activities Easy -> extremely|quite||neither||quite|extremely <- Difficult
32.	I need training in using a mobile phone to find information for course assignments and projects via the Internet A. Very Much B. Sometimes C. Occasionally D. Rarely E. Very Rarely F. Not at all
33.	I find it easy to use a mobile phone for short message communication (texting) Easy -> extremely|quite||neither||quite|extremely <- Difficult
34.	I enjoy using a mobile phone A. Very Much B. Sometimes C. Occasionally

	D. Rarely E. Very Rarely F. Not at all
35.	It would be easy for me to become skillful at using my mobile phone Easy -> extremely|quite||neither||quite|extremely <- Difficult

Infrastructure and ISP Services

Instructions: Please circle the most appropriate response for each item.

Item	Question
36.	I am able to connect via the computer or mobile phone to the Internet to find information for various needs Easy -> extremely|quite||neither||quite|extremely <- Difficult
37.	There is constant supply of electricity for me to charge or power my ICT tool (e.g. mobile phones and computers) A. Always B. Sometimes C. Occasionally D. Rarely E. Very Rarely F. Never
38.	In my community, we have __ Internet service providers (ISPs) A. Zero (0) B. 1 C. 2 - 3 D. 4 - 5 and above E. 5 and above
39.	My subscription to a fixed line is postpaid (service contract) A. Yes B. No
40.	I use pay-as-you-go (prepaid or SIM card) with my mobile phone A. Yes B. No
41.	I have a contract service with my cell mobile A. Yes B. No
42.	I use dial up connection (56K modem, transfers 56 kilobits of data a second) to access the Internet A. Very Frequently B. Frequently C. Occasionally D. Rarely E. Very Rarely F. Never
43.	I use my wireless mobile phone to access the Internet or online databases A. Very Frequently B. Frequently C. Occasionally D. Rarely E. Very Rarely F. Never
44.	The service quality that I receive for my mobile phone is reliable

	and dependable A. Always B. Sometimes C. Occasionally D. Rarely E. Very Rarely F. Never
45.	The service quality that I receive for my computer/Internet is reliable and dependable A. Always B. Sometimes C. Occasionally D. Rarely E. Very Rarely F. Never

Use of Mobile Phones to Increase Income, Information Access, Alleviate Extreme and Information Poverty

Instructions: Please circle the most appropriate response for each item.

Item	Question
46.	My use of a mobile phone has increased my income earning potential A. Very Much B. Sometimes C. Occasionally D. Rarely E. Very Rarely F. Not at all
47.	My use of a mobile phone has helped to expand my social networks for information access and sharing (A social network has persons or groups that you share some common interests with) A. Very Much B. Sometimes C. Occasionally D. Rarely E. Very Rarely F. Not at all
48.	My use of a mobile phone has increased my information access to better my life A. Very Much B. Sometimes C. Occasionally D. Rarely E. Very Rarely F. Not at all
49.	My use of a mobile phone increases my access to information for e-business (e-business is using ICT to support business activities; e.g. online banking or online shopping) A. Very Much B. Sometimes C. Occasionally D. Rarely E. Very Rarely F. Not at all
50.	My use of a mobile phone increases my access to information related to e-learning (e-learning involves the use of ICT for learning; e.g. online courses, digital libraries, etc.) A. Very Much B. Sometimes C. Occasionally D. Rarely E. Very Rarely F. Not at all
51.	I use the Internet Public Library (IPL) for my school work, research or professional work A. Very Frequently B. Frequently C. Occasionally D. Rarely E. Very Rarely F. Never

52.	My use of a mobile phone has increased my access to information for my everyday activities A. Very Much B. Sometimes C. Occasionally D. Rarely E. Very Rarely F. Not at all
53.	My use of a mobile phone has increased my access to social networks and Internet public media like Facebook, YouTube, MySpace, and LinkedIn A. Very Much B. Sometimes C. Occasionally D. Rarely E. Very Rarely F. Not at all
54.	It will be very hard for me to live my life now without a mobile phone A. True B. False
55.	The people who do not have mobile phones are missing out a lot on the ease of finding information for everyday living A. True B. False

Innovation, Technology Acceptance and ICT Interaction

Instructions: Please circle the most appropriate response for each item. The last item is open-ended and requires that you write in the answers. Thank you.

Item	Question
56.	In my opinion, mobile phones are useful innovation for development (A useful innovation is an instrument that endows resources with a new capacity to create wealth – Peter Drucker, 1985) A. True B. False
57.	In my opinion, I believe mobile phones are easy to use Easy -> extremely|quite||neither||quite|extremely <- Difficult
58.	Rank in order of importance why you chose to buy the mobile phone that you are currently using [1 is the highest and 9 is the lowest A. Low price _____ B. Brand name (also specify the brand _____) C. Camera feature _____ D. Music feature _____ E. Ease of Texting _____ F. It was recommended by the seller _____ G. It was recommended by a friend or family member _____ H. The leader of my social group has same phone type _____ H. Other (specify and rank _____)

59.	List the features that you would like to see added or made better for your brand of mobile phone to facilitate ease of use 1. 2. 3. 4. 5.

Appendix D
Mapping Research Questions to Questionnaire Items

Research Question Mapped to Questionnaire Items	Blocks on the Research Model
Do the participants in the study who own an ICT tool such as a cell phone or computer live on less than two U.S. ($2.00) dollars a day? Items: 6, 7, 10, 25	Barriers to Adoption and Use of ICT
Is cost a factor for study participants' adopting and using different forms of ICT tools/services? Items: 14, 18, 19, 20, 21, 22, 23, 24, 25	ICT Access and Affordability; Barriers to ICT Adoption and Use
Is there a relationship between having access to an ICT tool or service and a study participant's ability to access the Internet and other information resources? Items: 8, 9, 11, 12, 36, 37, 38, 42, 43, 44, 45, 47, 51, 52, 53	ICT Access and Affordability; Barriers to ICT Adoption and Use
To what extent do study participants perceive mobile phones as being useful for different tasks they engage in? Items: 26, 27, 28, 29, 30, 31, 33	Ease of ICT Use, Usability, and HCI
To what extent do participants in the study perceive mobile phones as easy to use, satisfactory and dependable? Items: 32, 33, 34, 35, 54, 57, 58, 59	Ease of ICT Use, Usability, and HCI
To what extent do participants in the study perceive mobile phone technology as an innovation that can help to sustain development (reduce poverty, enables income earning potential and broaden access to e-services)? Items: 46, 47, 48, 49, 50, 51, 52, 53, 55, 56,	Increase Income/Reduce Poverty; Participation in ICT Innovation/E-Services

Appendix E

Fact Sheet for the Survey

UNC-Chapel Hill Department: School Information and Library Science

Title of Study: Using ICT to Develop the Base of the Pyramid Populations: An Analysis of Sub-Saharan Africa

Purpose of Study: The purpose of this study is to learn about adoption and use of modern information and communication technology (ICT) tools such as mobile phones by the base of the pyramid (BOP) population of university students in Sub-Saharan Africa (SSA) for their information needs.

The Base of the Pyramid group in SSA has about 80 percent of the population that live on less than two U.S. dollars ($2.00) per day and are challenged by both extreme poverty as well as lack of critical information to redress the poverty condition. While the rest of the BOP world like Asia is developing, the BOP of SSA is classified as the Bottom Billion by several writers. The Bottom Billion has been specially marked as being the bottom on all indices of development including education, economic, health, technology and government. Despite extreme poverty, this population is adopting different forms of ICT including mobile technologies to support information seeking behavior.

My research goal is to gather data from the BOP university students at a local university in Nigeria, the University of Uyo, in order to understand if their ICT adoption and use can enable them to become part of modern information society.

Contact Information for Principal Investigator:

Name: Alice Etim
Email Address: etim@email.unc.edu
Telephone Number: XXX-XXX-XXXX

Contact Information for Faculty Advisor:

Name: Dr. Evelyn Daniel
Email Address: daniel@ils.unc.edu
Telephone Number: XXX-XXX-XXXX

By completing this survey, you agree to be a participant in this study. Participation is entirely voluntary. You can skip any question for any reason, and withdraw at any time, without penalty.

All research on human volunteers is reviewed by a committee that works to protect your rights and welfare. If you have questions or concerns about your rights as a research subject, or if you would like to obtain information or offer input, you may contact the Institutional Review Board at 011-919-966-3113 or by email to IRB_subjects@unc.edu. Should you wish to contact the IRB, please reference study #09-1274.

Appendix F
Consent to Participate in a Focus Group Study

University of North Carolina-Chapel Hill
Consent to Participate in a Focus Group Study
Adult Participants
Social Behavioral Form

IRB Study #__09-1274_____
Consent Form Version Date: 7-22-09

Title of Study: Using ICT to Develop the Base of the Pyramid Populations: An Analysis of Sub-Saharan Africa
UNC-Chapel Hill Department: School Information and Library Science
UNC-Chapel Hill Phone number: 1-919-962-8062

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Telephone Number:	XXX-XXX-XXXX

Contact Information for Faculty Advisor:

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What are some general things you should know about this focus group study?

You are being asked to take part in a focus group study. Joining the focus group study is voluntary. You may refuse to join, or you may withdraw your consent to be in the focus group, for any reason, without penalty.

Research studies are designed to obtain new knowledge. This new information may help people in the future. You may not receive any direct benefit from being in the research study. There also may be risks to being in research studies.

Details about this focus group study are discussed below. It is important that you understand this information so that you can make an informed choice about being in this focus group study.
You will be given a copy of this consent form. You should ask the researcher named above any questions you have about this study at any time.

What is the purpose of this focus group study?
The purpose of the focus group study is to learn about adoption and use of mobile phones by students. You are being asked to be in the focus group study because you can contribute to the opinions that will help to inform the adoption and use of mobile phones in this world region.

Are there any reasons you should not be in this study?
You should not be in this focus group study if you are less than 18 years of age or are decisionally impaired.

How many people will take part in this study?
If you decide to be in this focus group research, you will be one of approximately 12 to 16 participants. The participants will be grouped into two focus groups using responses that you provided in a previous survey. If you decide to participate, you will part of one of two groups, each of which will have 6 to 8 members.

How long will your part in this study last?
You will spend one hour with five to seven other participants in an interactive interview session.

What will happen if you take part in the study?

About 12 to 16 students who participated in the previous survey will get a chance to participate in one of a pair of focus group interview sessions. If you are selected for a focus group, the following activities will take place:

1. For each focus group, the researcher will interview the 6 to 8 students who agreed to be called back for the focus group study after participation in an earlier survey and based on their responses to survey questions 46 to 56 in the survey. You will be seated in a classroom or conference room environment within the University of Uyo and will participate in the focus group discussion.
2. The researcher will greet you with a welcome message and request that you read this consent form. The researcher will also review the ground rules for the focus group discussion.
3. You will be prompted to introduce yourself using only your first name and program of study at the University of Uyo.
4. The researcher will facilitate each focus group discussion by re-asking some questions from the earlier survey (questions 46 to 56) in an open-ended format. You must agree to be recorded as a condition to participating in the focus group. The researcher will start an audio or audio-video recorder to capture the key discussion points that will serve as research data from the focus groups' discussions.

5. As a participant in one of the focus groups you will be allowed up to an hour to respond to the researcher's questions, share your ideas and experiences and to interact with other participants about mobile phone adoption and use.
6. The researcher will end each focus group with sincere thanks for your participation. Each focus group participant will be given a small gift that is equivalent to about two U.S. dollars ($2) as a token of thanks for your participation. In addition you will be invited to participate in a drawing for one of three two-gigabyte zip drives that cost about US$10 each after the interviews.

What are the possible benefits from being in this focus group study?

Research is designed to benefit society by gaining new knowledge. You may not benefit personally from being in this focus group study but the information you contribute can help in understanding issues about information and communication technology access, affordability, adoption and use in your region of the country. It will become easier to explain the different ways that students use mobile phones and how that can influence the provision of services such as electronic learning (e-learning). The information that you share will also help to inform us about students' mobile phone acceptance, adoption and use.
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What are the possible risks or discomforts involved from being in this study?

The researcher cannot guarantee confidentiality since information exchange will take place in a group environment. However, all participants will be encouraged to divulge only their first names and no other personal identifying information.

How will your privacy be protected?

Participants will not be identified individually in any report or publication about this study. The first name and phone number information that will be collected in order to recruit focus group participants will be destroyed after the focus group interviews are completed.

Subjects must agree to be recorded as a condition of participation in this focus group study.

What will happen if you are injured by this research?

The researcher requests that participants respect the privacy of the other focus group members and not repeat what is said outside the room. There is no risk of injury.

What if you want to stop before your part in the study is complete?

You can withdraw from this study at any time, without penalty. The researcher also has the right to stop your participation at any time. This could be because you have failed to follow instructions, or because the entire focus group study has been stopped.

Will you receive anything for being in this study?
You and other participants in the focus group will be given a small gift that is equivalent to about two U.S. dollar ($2.00) after successful completion of the focus group interview. You and the other focus group participants will also have a chance to participate in a drawing for one of three two-gigabyte zip drives that cost about $10 each after the focus group interviews.

Will it cost you anything to be in this study?
There are no costs to you for being in the study

What if you have questions about this study?
You have the right to ask, and have answered, any questions you may have about this study. If you have questions, complaints, concerns, or if a research-related injury occurs, you should contact the researcher listed on the first page of this form and also below.

What if you have questions about your rights as a research participant?
All research on human volunteers is reviewed by a committee that works to protect your rights and welfare. If you have questions or concerns about your rights as a research subject, or if you would like to obtain information or offer input, you may contact the Institutional Review Board at 011-919-966-3113 or by email to IRB_subjects@unc.edu. Should you wish to contact the IRB, please reference study #09-1274.

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Title of Study: Using ICT to Develop the Base of the Pyramid Populations: An Analysis of Sub-Saharan Africa

Principal Investigator: Alice Etim

Participant's Agreement:

I have read the information provided above. I have asked all the questions I have at this time. I voluntarily agree to participate in this research study.

_____ _____
Signature of Research Participant Date

_____
Printed Name of Research Participant

_____ _____

Signature of Research Team Member Obtaining Consent Date

_____

Printed Name of Research Team Member Obtaining Consent

Appendix G
Questions for Focus Group #1

Item	Question
1.	In what ways have the use of mobile phones supported your income earning potential? [Probe forr examples]
2.	Has the use of a mobile phone for daily communication help to expand your social networks for information access and sharing (A social network has persons or groups that you share some common interests)? Please tell me more about your social networks before you had a mobile phone and after you had a mobile phone. [Guide them: Examples - "I had five friends before I bought a mobile phone but now I have more than 10 friends." "Having a mobile phone has helped me to connect with people on various internet sites such as Facebook."]
3.	Has the use of a mobile phone helped to increase your information access to better your life? [Prompt group to provide use cases.]
4.	Have you or someone you know use a mobile phone to increase access to information for e-business (e-business is using ICT to support business activities; e.g. online banking or online shopping)? [Prompt group to provide use cases.]
5.	Have you or someone you know use a mobile phone to increase access to information related to e-learning (e-learning involves the use of ICT for learning; e.g. online courses, digital libraries, etc.)? [Prompt group to provide use cases.]
6.	Who among you have used the Internet Public Library (IPL) for school work, research or professional work (keep count) and what are your experiences? [If participants do not know IPL, give them the URL, http://www.ipl.org/ and encourage them to check it out after the interview]
7.	Has your use of a mobile phone increased your access to information for my everyday activities [Probe for specific examples]?
8.	Do you think it will be very hard to live your lives now without a mobile phone. Please explain. Follow-up: What do you think this innovation means for the development of your university, the country and Sub-Saharan Africa?
9.	Do you think that the people who do not have mobile phones are missing out a lot on the ease of finding information for everyday living? [If participants say that non-users are being left behind, probe for specific examples of how people are being left behind in the information society]

Appendix H
Questions for Focus Group #2

Item	Question
1.	Please share your opinion about mobile phones and other technologies as a whole. Do you see mobile phones or other forms of technology helping you to increase your income earning potential? [Prompt group for specific cases they might know or witnessed misuse of mobile phones]
2.	Would you say that a mobile phone has helped or not helped you to expand your social networks for information access and sharing?
3.	Who among you have used the Internet Public Library (IPL) for school work, research or professional work (keep count) and what are your experiences? [If participants do not know IPL, give them the URL, http://www.ipl.org/ and encourage them to check it out after the interview]
4.	Do you think that if you had a mobile phone you could use it to increase your access to information for everyday activities? [Allow time for everyone in the group to respond about how mobile phones could help in specific instances and different aspects of their lives]
5.	You indicated in the survey that it will not be very hard to live your lives without a mobile phone. Please explain. Follow-up: What do you think this innovation holds for your university, the country and Sub-Saharan Africa? [Capture the negative viewpoints and probe for detail]
6.	Do you think that your lack or non-use of a mobile phone will make you miss out a lot on the ease of finding information for everyday living? [If participants say that non-users will not leave them behind, prompt them for opinion about what it means for them in not participating in today's internet revolution]