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INFORMATION COMMUNICATION TECHNOLOGY DEVELOPMENT IN THIRD WORLD COUNTRIES: THE CASE OF GHANA

DISSEPTION

Presented in Partial Fulfillment of the Requirements for
the Degree of Doctor of Philosophy in the Graduate
School of The Ohio State University

By

Alexander Yaw Adusei, Jr., B.A. (Hons), M.A., M.P.A.

* * * * *

The Ohio State University

2000

Dissertation Committee:

Dr. Steven L. Miller, Adviser
Dr. Suzanne K. Damarin
Dr. Isaac J. Mowoe

Approved by

Advisor
School of Teaching & Learning
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2000
ABSTRACT

The purpose of this study was to determine the level of telematics usage in Ghana with particular reference to the level of computer literacy and computerization in institutions and organizations in terms of information production and consumption; information sharing networks; and the nature of telecommunications services and facilities provided to networks. Furthermore, this study will establish baseline knowledge for further longitudinal inquiries in Ghana and for comparisons with other African nations which could help influence the policies of African governments concerning education and investment in information communication technologies.

Eighty-four research questions grouped into five major sections were analyzed using the results from hand delivered questionnaires from purposively selected individuals in Ghana. The responses gathered were analyzed using various descriptive statistics such as frequency distribution, contingency tables, graphs and measures of association with the assistance of the SPSS software at The Ohio State University.

Major findings included: (1) there is an appearance of extended dissemination of information communication technology in Ghana although we cannot sufficiently support that this wide network has been all embracing to the rural poor; (2) the data also presents us with the opportunity to look closely at the positive attitudes of middle level and lower level personnel towards ICTs, a trend which is not only encouraging, but a support for
cautious ICT application in the Ghanaian economy; (3) there is need for a clear partnership between the government and all stakeholders in the planning, implementation and formulation of ICT infrastructure and regulatory policies; (4) and that facilities used in ICT applications are dependent on the sophistication of services provided, an indication that Ghana can continue on this path if and only if clear economic agendas are set to improve on the existing technology in the country while at the same time monitoring its impact on society.
Dedicated to my son (Kuma)

(in loving memory)
ACKNOWLEDGMENT

I wish to thank Dr. Steven L. Miller, my advisor, for his direction, guidance, and encouragement throughout this research project and throughout my entire doctoral program at The Ohio State University. Through all my ups and downs, Dr. Miller believed in me and urged me to have faith in achieving this goal.

Special appreciation is expressed to other members of my advisory committee, Drs. Suzanne K. Damarin and Isaac J. Mowoe, for their constructive comments and suggestions throughout the research. I also express my gratitude to the panel of experts who so kindly gave helpful, timely inputs so that the instrument could be valid.

Many other persons were involved in bringing my academic quest to fruition. I am very grateful to Georgina Akua Adusei-Hawkins for bringing me to this country, and to Kojo Ampadu, for making difficult situations become so easy for me. I am very grateful to Patricia Jeppo and Judith Ntim for all their support and assistance through this course of study, and to Cathy Rosen for her assistance in editing my work.

Finally, I would like to thank my family for their love and support. My heartfelt gratitude goes to Sheila Stewart for supporting me and being there for me, no matter what the road entailed. Although my beloved son (Alexander Y. Adusei, III – aka - Kuma) did not live to see the completion of this project, I know he will forever be remembered for all the sacrifices that he had to make for me to finish this project. I also want to
acknowledge Nana, Justyn, Mavis, Zuriel and Albert for all the sacrifices they made during my frequent absences.

I am forever indebted to my parents, Alexander Yaw Adusei, Snr. and Nana Akua Afriyie Siakwan I (Antoahemaa), for their daily prayers, encouragement and unfaltering support. “Papa ne Nana meda mo ase.”
VITA

April 4, 1967 .............................................. Born – Kumasi, Ghana

1991 ................................................................. B.A. (Hons)
University of Ghana, Legon, Ghana

1992-1994 ............................................................ Teaching Assistant, Black Studies Department
The Ohio State University, Columbus, Ohio

1993 ................................................................. M. A. – African Studies
The Ohio State University, Columbus, Ohio

1994-1996 ............................................................ Administrative Associate, OMA
The Ohio State University, Columbus, Ohio

1994-1996 ............................................................ Policy Analyst, Economics Department
Ohio EPA, Columbus, Ohio

1996-Present ........................................................... Distance Learning Supervisor, OCSS
Ohio Central School System, Columbus, Ohio

1996-Present ........................................................... Administrative Associate, School of Teaching and Learning
The Ohio State University, Columbus, Ohio

1997-1999 ............................................................ Instructor, Center for African Studies
The Ohio State University, Columbus, Ohio
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CHAPTER 1

INTRODUCTION

The technological revolution, led by advances in information and communications technology (ICT), is changing the global economy by increasing the importance of knowledge as a factor of production. It is also changing the nature of markets, competition, and sources of comparative advantage. In particular, it has provided some solutions to the consequences of rapid population growth and resource depletion, and has offered hope for the sustainability of increased economic activity.

Three technological waves are currently driving the global economy forward: telematics (the intersection of informatics and telecommunications), biotechnology, and new materials (Sampson, 1996). Central in this new revolutionary\(^1\) wave is telematics because of the convergence of telecommunications, computers, satellites, and fiber optic

---

\(^1\) Edmund L. Andrews in his article, "Changing the Wiring Takes Time," *New York Times* [October 30, 1994] opined that the word *revolution* along with the phrase *superhighway* are among the most overused terms in telecommunications. He insisted that the information revolution is oversold and dismissed the word *revolution* as a marketing buzzword. In contrast, he argued that long-term changes occur slowly and unpredictably. A favorable support of this assertion comes from Massachusetts Congressman Edward Markey, who said, "The good news from Washington is that every single person in Congress supports the concept of an information superhighway. The bad news is that no one has an idea what that means."

technologies, which undergird the knowledge-based economy of the future (Drucker, 1994).

In his assessment of what is in store for the poor in the future economic order, Reich (1992) argues that it is the responsibility of the rich (symbolic analysts) to construct a "positive economic nationalism in which each nation's citizens take primary responsibility for enhancing the capacities of their countrymen for full and productive lives, but also work with other nations to ensure that these improvements do not come at others' expense."

Although we witnessed the numerous "white-elephants" that sprawled across Africa immediately after independence from colonial rule and, therefore, are conscious of the fine line between the essence of technology in our governments and businesses and its ultimate influence in our economic growth or decline, communication is an essential component that allows a society to engage itself, provide trade, and transfer goods, services and information. As real participants of this global economy, it is important for us to emphasize the importance of communication infrastructure [in addition to transportation, energy utilities, and money] as the true channel for trade and discourse which binds together a community, society or nation (Horwitz, 1989).

However, within the information and communication technologies (ICTs) scholarship, there have emerged two camps: those who believe in the unprecedented impact of ICT in economic development\(^2\) and those who believe in proceeding with

\(^2\) Thabo Mbeki, Deputy President, Republic of South Africa opined in a World Bank luncheon (1995) that, "it's clear that bringing developing countries onto the information highway constitutes a colossal challenge if we are to promote economic growth....the reality is that there are more telephone lines in Manhattan, New York, than in sub-Saharan Africa."
caution. Whatever the differences in ideology, these two camps agree that information technology has some potential to which individuals, institutions, and societies need to pay attention. Therefore, it was not surprising when Robert Reich (1990, 1991, 1992) opined:

We are living through a transformation that will rearrange the politics and economics of the coming century. There will be no national products or technologies, no national corporations, no national industries. There will no longer be national economies, at least as we have come to understand the concept. All that will remain rooted within national borders are people who comprise a nation. Each nation's primary asset will be its citizens' skills and insights.

Despite the economic potential of this technology, the concern that emerges from this discussion when addressed in the third world arena is education. Education is critical for economic growth and poverty reduction. Changing technology and economic reforms are creating dramatic shifts in the structure of economies, industries, and labor markets throughout the world. The rapid increase in knowledge and the pace of changing technology raise the possibility of sustained economic growth with more frequent job changes during individuals' lives. This was recognized as early as 1945 by Werner Jaeger who reiterated that:

Education keeps pace with the life and growth of the community, and is altered both by changes imposed on it from without and by transformations in its internal structure and intellectual development. And, since the basis of education is a general consciousness of the values which govern human life, its history is affected by changes in the values current within the community.

\[^3\] Schiller (1985) describes these technologies as being conceived, designed, built, and installed for the purpose of maintaining the status quo. He argues that there is no dualism, good or bad technology use, but only developing and using telecommunications for holding on to economic benefits resulting from a world system of power. According to Pilotta and Widman (1986), telecommunications can bring people together but also can separate them. They maintain that the transfer of technology from a developed nation to a developing one should respect the cultural uniqueness and allow for recipient autonomy.
These developments have created two key priorities for education: it must meet economies' growing demands for adaptable workers who can readily acquire new skills, and it must support the continued expansion of knowledge. The transformative capabilities of these new technologies can create new patterns of access to information, and this in turn can lead to restructured social situations (Meyrowitz, 1985). Therefore, each nation's primary assets will be its citizens' skills and knowledge.

Within this discussion arises the question of the existing infrastructure in third world nations and its potential in supporting this emerging society. By all standards, Africa has not been left out of the race for economic freedom and parity. However, there is abundant evidence to suggest that for us to be able to achieve the necessary level of advancement, be it technological or human, there is more to be done in our societies than just suggesting their (technology or human) existence.

In light of this, a sizable amount of money has been made available by financial institutions, governments and non-governmental organizations, and various developed countries to ensure that countries that are financially constrained can participate in technology development. By these overtures, governments of third world countries are also being encouraged to invest substantial amounts of their countries' budgets in technology. Some of the recommendations and suggestions stem from scholarly works that have also suggested that our educational institutions will be obsolete if by the turn of the millenium they are not equipped to produce critical minds that are ready to work in a technological environment (Brown, 1995; Bodomo, 1998).

With all this enthusiasm, the apparent question that has not yet been addressed is whether the investments being made by these governments have efficiently fulfilled their
goals and objectives? Or whether the enormous investments in ICT's are worth forgoing investments in general public services (schools, health centers, etc.) and/or support for the development of the economic sector? Block (1985) and Sussman (1987) contend that telecommunications investments only enhance the profitability of multilateral companies.

Similarly, Samarajiva and Shields (1990) argue that concentrating on the investments in the economic sector, health care facilities, school systems, social welfare and community services benefits a sizable portion of the population with less negative externalities than telecommunications investments, which come with their own cultural influences. By Agunga's (1998) assessment, irrespective of the argument over the impact of telecommunications in third world countries, success cannot be achieved unless substantial efforts are made to address the human aspect of communication. Therefore, to be able to forge the sustainability of African countries in the global economic system, our attention has to be drawn to the tool needed to foster this progress: information communication technologies.

Problem Statement

The buttressing of communication systems with computer technology has led to the development of a wide variety of tele-facilities, which contribute immensely to the development efforts of nations. These facilities have made it possible for professionals in all manner of occupations (for example, medicine, education, commerce, finance and banking) to exchange information and ideas through networking.

The developing countries see the communications revolution as an opportunity to correct historic imbalances and catch up with the industrialized countries. In planning
technological development compatible with natural resources, employment needs, and values, developing countries must decide whether to use the sophisticated technology of the Western World or to initiate development more in accord with indigenous characteristics. In this planning process, it is equally important that they pay more attention to the returns on their investment due to the cost of the technology and the constraints of scarce financial resources. However, the essence of returns cannot be well established if the needs and extent of usage of information producers and consumers in the country have not been addressed. Though the need and impact of the technology has been established in developed nations, we are always advised to be cautious when drawing such parallels (Tomlinson, 1990; Forester and Morrison, 1994; Stoll, 1995).

Researchers have investigated the relationship between telecommunications investment and economic development for almost 30 years. It has been established that highly developed national economies are correlated with highly developed telecommunications infrastructures (Cronin et. al, 1991; 1993a; 1993b; Dholakia and Harlam, 1994). The information communication technology revolution has reinforced economic and social changes that are transforming business, education and society. Inherent in this revolution is the emergence of the "information economy" (Reich, 1992) which is the critical resource and basis for competition.

Assessing the level of ICT usage and network interconnectedness in a nation is important because if telecommunications technologies can significantly contribute to development, investments in these technologies should 1) advance economic development and 2) support development in other sectors while 3) initiating entry into the
ensuing information age, an accomplishment Hardy (1980) suggests is necessary for future economic viability.

Therefore, the problem to be investigated in this study is the level of telematics usage in Ghana with particular reference to the level of computer literacy and computerization in institutions and organizations in terms of information production and consumption; information sharing networks; and the nature of telecommunications services and facilities provided to networks.

**Purpose of this Study**

Technology has become the means used to provide the objects necessary for human substance and comfort (Kassim-Momodu, 1988; Masuda, 1990; Huber, 1994). Currently, the distribution of this resource is disproportionately inadequate, and third world countries need to control a larger share of the world's major resource (Famoriyo, 1985; Stoll, 1995). It will be impossible for third world nations to narrow the gap between them and the industrialized world unless they appropriately acquire or assimilate the technology quickly and completely (Hoffman, 1985; Stoll, 1995; Penzias, 1995). For such decisions to be made appropriately, it is important for policy makers and planners to understand that the investments made in ICT encompass three major elements: (1) the accumulation of scientific knowledge (Famoriyo, 1985; Rheingold, 1993); (2) its transformation to fit the idiosyncrasies of [human] environments (Famoriyo, 1985; Gilder, 1990); and (3) its application to meet the manufacturing, education, health, and other practical needs of individuals and groups (Makanjoula, 1978; Ikoku, 1981; Famoriyo, 1985; Masuda, 1990).
The main objective of the study is to assess the level of telematics usage in Ghana. Specifically, the study aims at:

1. assessing the level of computer literacy in Ghanaian institutions and organizations;
2. determining the level of information production and consumption among institutions and organizations;
3. determining the nature of information sharing networks and the media through which information is shared;
4. assessing the nature of telecommunications services and facilities provided to information sharing networks; and
5. appraising the regulatory framework for telematics usage.

Our knowledge here will help facilitate the decisions of policy makers with regard to ICT in Ghana and also provide a baseline for future ICT studies in Ghana. It is incumbent on policy makers to make informed decisions based on the need for, and the level of usage of ICTs in Ghana. In addition, it helps to make the comparable case for Ghana as a leader in the information technology revolution in West Africa and a viable place for foreign investments dependent on ICTs.

Research Questions

In Africa, there has always been a caution (from experience) about the theory of "build it and they will come." In that light, the researcher's expectations are tempered with the realization that dependent institutions, businesses, organizations, and so on will converge at telematics accessibility areas. Therefore, the research questions this study attempts to answer are:
1. How diverse/widespread is telematics dissemination?

2. What are the attitudes, literacy level and level of ICT usage in survey participants?

3. What is the level of production, dissemination and consumption of information?

4. What is the level of information sharing networks, and how extensive is its dissemination?

5. What is the relationship between telecommunication services and available network facilities.

6. What are the major constraints to telematics development and usage?

**Assumptions**

For the purpose of conducting this study, the researcher made the following assumptions:

1. All things being equal, the assertions by Cronin et al. (1991; 1993a; 1993b), Hardy (1980), and Dholakia and Harlam (1994) are true and substantiated in developed countries.

2. The questionnaire developed for this study will provide a sufficiently valid and reliable measure of the constructs it is supposed to measure.

3. The participants selected for this study truly possess the necessary information about the subject and the population in question.
Limitations of Scope

To keep this study to a manageable size, the following limitations have been adopted:

1. The study is limited to personnel in institutions and organizations in the Accra/Tema, Cape Coast and Kumasi metropolis.

2. A sizeable population in the telematics industry is not included ("Mum and Pap").

3. The results are limited to the reliability and validity of the questionnaire.

4. The results are limited to the time the study took place.

5. The results are limited to the perceptions and honesty of the participants.

6. The researcher's judgement may be in error in estimating the representativeness of the sample or their expertise regarding the information needed.

Acronyms and Definitions of Terms

<table>
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<tr>
<th>Acronym</th>
<th>Definition</th>
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<tr>
<td>E-Mail</td>
<td>Electronic Mail - The use of telecommunications and computers for sending textual messages.</td>
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<tr>
<td>FTP</td>
<td>File Transfer Protocol - An Internet tool/site that permits transfer of files.</td>
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<tr>
<td>GARNet</td>
<td>Ghana Academic and Research Network</td>
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<tr>
<td>GNCIC</td>
<td>Ghana National Committee on Internet Connectivity</td>
</tr>
<tr>
<td>ICT / Telematics</td>
<td>Information and Communication Technology - technology that merges computing with high speed communication links carrying data, sound, and video.</td>
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<td>ISP</td>
<td>Internet Service Provider</td>
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<td>IT</td>
<td>Information Technology</td>
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<td>Term</td>
<td>Description</td>
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<tr>
<td>Kbps</td>
<td>Kilobits (thousands of bits) per second</td>
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<tr>
<td>Mbps</td>
<td>Megabits (millions of bits) per second.</td>
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<tr>
<td>LAN</td>
<td>Local Area Network; network linking computers at a single location.</td>
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<tr>
<td>MAN</td>
<td>Metropolitan Area Network; a network linking computers within a limited geographical area.</td>
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<tr>
<td>NCA</td>
<td>National Communication Authority</td>
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<tr>
<td>NCS</td>
<td>Network Computer Systems</td>
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<tr>
<td>TCP/IP</td>
<td>Transmission Control Protocol/Internet Protocol; two of the standard protocols for data transmission used on the Internet.</td>
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<td>UUCP</td>
<td>Unix to Unix Copy</td>
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<tr>
<td>WAN</td>
<td>Wide Area Network; a network spanning a large geographic area.</td>
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<tr>
<td>WWW</td>
<td>World Wide Web</td>
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<tr>
<td>Computer Literacy</td>
<td>The ability to recognize an application in which the use of a computer is appropriate and the ability to use the computer for that application</td>
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<td>Information Production</td>
<td>The collection, collating, preparation, maintenance and dissemination of data or information ready for consumption.</td>
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<td>Information Consumption</td>
<td>The usage of any part of published soft or hard information to make organizational or institutional decision.</td>
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<tr>
<td>Tele-facilities</td>
<td>Sites equipped with computer and telecommunications facilities that are used by community residents.</td>
</tr>
<tr>
<td>FidoNet</td>
<td>A set of data exchange procedures that permit connection of computer bulletin board systems over phone lines.</td>
</tr>
<tr>
<td>Telecommunications</td>
<td>Telecommunications is a general term for the electronic transmission of all forms of information, including digital data, voice, fax, sound and video, from one location to another over some form of communications link, e.g., fiber optics, satellites, telephone wire, or mobile phones, etc.</td>
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Structure of Dissertation

Chapter 2 provides a review of the relevant literature on the role of telecommunications in economic development, the circular relationship between education, economic development, and telecommunications investment and development, and, more importantly, the needs, usage, and literacy of Information Communication Technologies. The chapter also presents general African telecommunications network development and that of Ghana in a comparative perspective.

Chapter 3 discusses the research design and the methodology used in this study. Chapter 4 summarizes the analysis of the data and its findings and specifically addresses the research questions. Finally, Chapter 5 concludes the study with a review of what was accomplished, the study's contribution to knowledge, a discussion of the problems encountered, and some suggestions for future research.

4 However, due to the interest in the information revolution, publications have spewed from different quarters of academia, making the development of a comprehensive literature review almost impossible and probably beyond the scope of this study. Therefore, the chapter provides information relevant to and having direct bearing on this dissertation.
CHAPTER 2

REVIEW OF THE LITERATURE

Introduction

The process of development, the fate of people going through it, is a global drama. It, is the story often tragic, of billions of individual lives, their hopes and frustration, their efforts and their failures, their suffering and their conflicts. It is perhaps the central story of our time.

The promise of telecommunication systems for development has attracted a lot of funding and scholarly work over the past three decades. But as large-scale projects have developed, inevitably, questions have been raised concerning efficiency and cost-effectiveness in the age of scarce resources. However, the interest in the information revolution has spewed publications in different quarters of academia making the development of a comprehensive literature review almost impossible and probably beyond the scope of this study.

Nevertheless, the pioneering work of Hudson, Goldschmidt, Parker, and Hardy (1979) encouraged the work of Middleton and Jussawalla (1981), which was followed by the comprehensive bibliography developed by Heather Hudson (1988). While no one has equaled their tremendous contribution to the scholarship, research emanating from the
various disciplines (like economics, communications, education, political science, engineering, and sociology, to mention a few) has contributed to the understanding of causal or predictable relationships among telecommunications, education, and economic development.

Using these three major publications as a starting point, scholarship after their publication has been searched using the same categorization and organization and paying close attention to ICT needs, usage and extent or method of dissemination. Due to the wide variety of sources, this search was limited to those articles and books which have some direct relevance to the purpose of this dissertation. As a result, the review here has been categorized into three general topical areas: Telecommunications and Economic Development, Education and Economic Development, and the Needs, Usage, and Literacy of Information Communication Technologies.

Telecommunications and Economic Development

The massive literature and theories of development have been well grounded and dissected by scholars. To rehash these theories again here, while valuable, may not be necessary for the purpose of this dissertation. In fact, the linkage of the impact of telecommunications to economic development has become part of the development literature for the millenium and has in itself also grown beyond the confines of this research. While this dissertation adds to the knowledge, thinking, and planning of

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6 Agunga (1998) among others has spent a whole chapter of his book, Developing the third world: a communication approach on development theories.
developmental practices, it has become imperative that we not only continue with the emerging theories and literature in the field but also review recent thinking on telecommunications and economic development.⁷

Researchers have investigated the relationship between telecommunications investment and economic development for almost 30 years. It has been established that highly developed national economies are correlated with highly developed telecommunications infrastructure (Cronin et al., 1991). The information communication technology revolution has reinforced economic and social changes that are transforming business, education and society. Inherent in this revolution is the emergence of the "information economy," which is the critical resource and basis for competition. According to Bangemann (1994), throughout the world, information and communication technologies are generating a new industrial revolution already as significant and far-reaching as those of the past. It is a revolution based on information, itself the expression of human knowledge. Technological progress now enables us to process, store, retrieve and communicate information in whatever form it may take, unconstrained by distance, time and volume. This revolution adds huge new capacities to human intelligence and constitutes a resource which changes the way we work together and the way we live together.

In the second edition of their book *Telecommunications and Economic Development*, Saunders, Warford, and Wellenius (1994) dedicated the first part of the book to addressing 'the role of telecommunications in economic development.' While acknowledging the disparity in telecommunication infrastructure development in developing countries, they pointed to the symbiotic relationship between telecommunication infrastructure development and economic development. They opined that:

> as economic development takes place, some form of telecommunications gradually becomes the most cost-effective means of communicating for increasing proportions of the population. Having reliable telephone service removes some of the physical constraints on organizational communication in various sectors of the economy, permitting increased productivity through better management in both the public and private sectors. Markets become more effective as communication improves, more rapid responses to market signals become possible, and access to market information is extended at village, town, city, regional, national, and global levels.\(^8\)

At a level significantly higher than could be expected by chance, Hardy (1980), using data from 45 countries for the period 1960-1973, studied the relationship between GDP and the number of telephones per capita with time-lagged offsets of one year. He found that the relationship between these variables ran in both directions. Similarly, Cronin, Parker, Colleran, and Gold in their time series analyses of 31 years of U.S. data (1958-88, inclusive) found that not only does increase in output or GNP lead to increases in investment in telecommunications, but that the converse is true: increases in telecommunications investment stimulate overall economic growth.

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As a follow up to Cronin, Parker, Colleran, and Gold's work, Cronin, Colleran, Herbert, and Lewitzky (1993) reviewed trends in U.S. productivity to establish the relationship between productivity and the standard of living, the relative investment and growth of the telecommunication sectors and the resulting response by end users. Though previous research had supported the relationship between telecommunications infrastructure investment and economic development, a direct causal linkage between telecommunications investment and measures of productivity had not been established. They concluded that for "aggregate productivity measures for the manufacturing, private non-farm and total private business sectors of the economy, telecommunications investment is related to changes in productivity growth." In other words, their conclusion was in line with the *NTIA Infrastructure Report* (1991), which unequivocally stated that:

productivity growth . . . is the single most important determinant of a nation's standard of living, the consistent improvement of which is a fundamental concern of sound economic and social policy.

Therefore, for any country to ignore the potential of the revolutionary technology and its impact on economic growth or, more importantly, productivity growth is to avoid the "tidal wave of progress," which will advance our standard of living and humanize our lives (Dent, 1995).

Marsh (1976) reviewed the techniques for formulating correlations between national telecommunications systems and economic development in the context of investment requirements in several Latin American countries. He concluded that a cause and effect relationship between telecommunications and development is difficult to establish because of the complex interdependencies among the variables related to
telephone demand, such as population, income, price, and economic infrastructure. He was not alone in his thinking; Jussawalla (1979), in his presentation at the Pacific Telecommunications Conference, acknowledged that: "It is hard to state whether telecommunications causes change or facilitates it; it is evident, however, that economic scarcity is linked with communication scarcity."

Zhao and Junjia (1994) opined:

> Information is an important social resource. Along with materials and energy, it is one of the three mainstays of social resources. Information is a positive and active factor in harnessing the social productive forces. Only when information is free to flow in large quantities and at high speed can it effectively promote the development of production.

This assertion emanated from their attempt to demonstrate the awareness of Chinese planners in the post and telecommunications sector of the relationship between general economic development and the development of infrastructure for telecommunications and information. Though they acknowledge the hindrance of expected growth from by governmental control of the post and telecommunications sector, they could not ignore the benefit ratio of 1:14, an implicit internal rate of return of 45 per cent. From their perspective, however, the market economy will and should become the primary mechanism for optimal allocation of resources.

There are indeed many proven and potential benefits of the information communication technology. Offsetting these benefits are four major problems that scholars have pointed to in the literature. In their more debated works, Coates (1995), Rifkin (1995), Aronowitz and DiFazio (1994), Mowshowitz (1994), and Bridges (1994) argue that this advancement in technology will lead to extensive unemployment.
Supporting this assertion and providing some justification, some of their colleagues believe the employment shortage is possible due to the need for highly skilled employees in a process of continuous learning in complex organizations (Howard, 1995; Adler, 1992; NRC, 1994).

The discussion is advanced that, because of lower wages, developing countries will gain skilled jobs by export from industrial countries through telecommunications. But this advantage will be short-lived because wages for skilled service jobs in developing countries will rise with demand, and since developing countries may not be able to keep up with the ever changing technology (due to cost), the advantage might shift to other countries that are more effective in building knowledge and skills. Based upon a thorough review of production and employment statistics, Jones (1995) concluded:

Just as agriculture declined as a major employer in the nineteenth century to enable expansion in manufacturing to occur, as manufacturing declined as a major employer in the twentieth century to enable expansion in services to occur, it now seems inevitable that market-based service employment will decline rapidly - in exactly the same way, and for exactly the same reasons - due to the introduction of miniaturised, sophisticated, low-cost technology. We seem likely to pass through a post-service revolution into a post-service society which could be a golden age of leisure and personal development based on the co-operative use of resources. . . . But if we do not choose this option, and if things are allowed to drift, economic power will become even more unequally divided than it is now, resources will be the subject of a bitter struggle between the strong and the weak, and the prolonged, massive unemployment will traumatis society.

The fear that urban cities will be developed while villages and the rural population are ignored has prompted extensive research into the overall impact of
telecommunications on productivity. In third world nations, where 50%-90% of the country's wealth may depend on its minerals and agriculture, only a few firms are demonstrably better off and many will show negative productivity (Morton, 1991). Therefore, it is important for third world countries to pay close attention to over-ambitious claims (Weizer, 1991; NRC, 1994) and appropriately adopt the parts of the technology that will enhance the overall agenda of the country to enable it to grow and participate fully in the global market. Unnecessary expenditure by nations just because telecommunications investment is expected to spur growth is erroneous and will fail.

With this in mind, research has been done extensively to confirm or deny the impact of telecommunications investment in rural economies or development (Fraser & Estrada, 1998; Mowlana & Wilson, 1990; Moemeka, 1994; Casmir, 1991; Parker & Hudson, 1992). In *Rural America in the Information Age*, Parker and others (1989) summarized prior research into the complex relationship between telecommunications and economic development. Taken together, the research, which entailed macroeconomic statistical studies and a variety of case studies, showed that the availability of telephones contributed to economic development, particularly in rural areas. Apart from the significant positive externalities accrued by both the telecommunications providers and customers, the prior research visited by Parker and Hudson had gaps that needed to be bridged.

First, there was little evidence to support the assertion that investments and improvements in [telecommunications] impacted rural economic development beyond the

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9 Productivity in this instance is being used synonymously with economic growth and economic development. The assumption is that the more you produce the better the chance to export, earn hard currency and develop other sectors of the economy.
provision of basic voice communication. The absence of reliable quantitative data comparing rural and urban locations also created a significant gap in the literature.\textsuperscript{10} To bring the literature into better standing, two recent quantitative studies have helped filled these two gaps in the telecommunications research literature.

Parker and Hudson (1992) in their study of the relationship between telecommunications and economic development for rural areas in the states of Oregon and Washington confirmed the relationship between telecommunications infrastructure and rural economic performance. Though they could not support the existence of causality due to the lack of data, their findings held strongly after statistically controlling for the effects of population density and ruling out the possibility of a mere relationship existing between each variable and population density. They concluded that, in a modern economy, improved telecommunications could reduce the economic penalties of being rural.

In a separate study, DRI/McGraw-Hill (1990) and Cronin et al. (1991) asserted that national time series data could shed light on the relationship between telecommunications investment in one time period and economic growth in a later time period for the total economy (both rural and urban). Cronin et al. (1991) in their study examining 31 years of U.S. time series data concluded that there is a "cyclical, positive feedback process" which confirms that telecommunications investment stimulates

\textsuperscript{10} It is important for us to note here that while international organizations, foreign governments and financial institutions are looking to bridge the gap between the urban rich and the rural poor in third world countries, these findings would have been different if their study had been applied to a third world country. Rural areas in America can be poor and impoverished, but they cannot equally be compared to the magnitude of impoverishment in Africa or any other third world nation. It is therefore important for us to point out the lack of comparison and of research to confirm or deny the success of the technology to bridge the gap or extend economic growth to the rural areas.
economic growth, and economic growth in turn stimulates further demand for telecommunications investment. Though the causal connection identified in these studies was not a necessary condition for economic growth, it was sufficient to generate economic growth through production efficiency.

For third world nations and Africa in particular, the full effective use of information communication technology is far from realized (Bikson and Law, 1993). Therefore, spending without proper planning and an appropriate economic agenda will only result in the creation of "white elephants." "It can be no accident that there is today no wealthy developed country that is information-poor, and no information-rich country that is poor and underdeveloped" (quoted in Schware, 1995).

The multiplicity of criminal tools which became available with the advent of the information revolution makes even the reasonable decision-maker think twice before investing in the infrastructure. Without a doubt, the criminal dimension is difficult to measure and definitely underreported (Lewis, 1995). Cybercrime may already be contributing significantly to the chaos and anxiety of our times, and the potential for disruption of work, productivity, and employment itself is high. Evidence of cellular theft and phone fraud (Stephens, 1995), computer extortion and credit card fraud (Moore, 1994, 1995), moles in financial institutions providing access codes to criminals (Moore, 1994), and global organized crime threatening the world financial infrastructure (Raine and Cilluffo, 1994), to mention a few, are some of the crimes third world nations cannot afford to add to their already overflowing problems. Until security is improved on this global network, the question still left unanswered is, should Africans invest in a technology that seems to have more problems than benefits?
Undoubtedly, these changes go far beyond economics and technology to affect society in broader ways. Pitroda (1993) confirms that:

[a]s a great social leveler, information technology ranks second only to death. It can raze cultural barriers, overwhelm economic inequalities, and even compensate for intellectual disparities. High technology can put unequal human beings on an equal footing, and that makes it the most potent democratizing tool ever devised.

Research (Hudson, 1997) has shown that the ability to communicate instantaneously has contributed to the development process in three major ways:

- By improving efficiency, or the ratio of output to cost;
- By improving effectiveness, or the quality of products and services;
- By improving equity, or the distribution of development benefits throughout the society.

While it has been acknowledged that traditional communication systems are used for development, less developed countries are not homogeneous masses, and gaps in telecommunication technology or its suitability cannot be generally applied to all of them. However, the major problem is whether they can afford to be part of the group of information societies? By scholarly consensus, modern telecommunication technology is suitable and appropriate for improving the standards of living in remote rural areas (Porat, 1982; Pitroda, 1993). Hence, to further the discussion on telecommunication technology and economic development, an appropriate taxonomic agenda has been urged by experts to show that: communication supports market exchange (Masuda, 1990; Koelsch, 1995); information helps to coordinate national economic development and supports resource mobilization (Pelton, 1989; Penzias, 1995; Negroponte, 1995);
communication changes the perceptions and attitudes of society to support development (Rheingold, 1993; Huber, 1994).

In fact, the link between telecommunications and economic development may be considered in at least two ways, both of which depend upon one's view of economic development. One way is to consider the attempt by countries to retain or attract businesses or promote the formation of businesses within. The second way is to look at economic development through those activities which might promote economic growth that is, efforts to enhance the productive capacity of the economy. Through this second perspective, telecommunications may be considered most appropriately as a factor of production in the economy (Saunders et al, 1983).

In fact, researchers have now confirmed a causal feedback relationship, in which telecommunications investment enhances economic activity and growth, while economic activity and growth stimulate demands for telecommunications infrastructure investment (Cronin et al, 1993; Zhao & Junjia, 1994; Dholakia & Harlam, 1994). In his assessment, Gillings (1975) opined that without technological advances in a country's telecommunication system, a country risks falling further behind in the global market. In a supporting observation, the MacBride Commission (1983) stated in Many Voices One World that:

Communication has become a vital need for collective entities and communities. Societies as a whole cannot survive today if they are not properly informed. Self-reliance, cultural identity, freedom, independence, respect for human dignity, mutual aid, participation in the reshaping of the environment - these are some of the non-material aspirations which will seek through communication. But higher productivity, better crops, enhanced efficiency and competition, improved health, appropriate marketing conditions, proper use of irrigation facilities are also objectives - among many others - which cannot be achieved without adequate communication and provision of needed data.
To reaffirm the findings of the MacBride Commission, the Maitland Commission (1984) stated:

It is our considered view that henceforward no development programme (sic) of any country should be regarded as balanced, properly integrated, or likely to be effective unless it includes a full and appropriate role for telecommunications.

If there was any substance to the pronouncements of both the MacBride and Maitland Commissions at all, then Dickerson (1977) was right when he said: "If trade is the lifeblood of an economy, then telecommunications can truly be regarded as the nervous system of both the economy and society." According to Allaire (1994), the information revolution requires that all countries make major adjustments to achieve macroeconomic and political balance in an environment of uncontrolled information flow and global competition, trade, and investment. Therefore, those countries that establish their information infrastructure and develop a broad range of applications first will have a tremendous competitive advantage over those that lag behind. This advantage will accrue not only to the telecommunications industry, but also to such industries as manufacturing, banking and entertainment and to such activities as education and health.

**Education and Economic Development**

Four decades of scholarship within and between different disciplines has reached a general level of consensus based upon premised theories of societal change that understand 'knowledge' and/or 'information' as the 'most basic economic resource' (Bell, 1973; Drucker, 1993; Jones, 1995; Machlup, 1962, 1980). The means of production, as conceived by conventional economics - land, labor and capital - are very important, but it
is knowledge that transforms them into technologies and, thus, knowledge which is fundamental (Drucker, 1993). Therefore, the expansion in the skills, knowledge, and capacities of individuals - increasing human capital - is a key element in economic progress and raising living standards. This philosophy goes back to the speeches of Thomas Jefferson, who said:

I know of no safe depository of the ultimate powers of society but the people themselves; if we think of them as not enlightened enough to exercise their control with wholesome discretion the limit is not to take it from them but to inform their discretion of education.

As poignantly pointed out by Reich (1992), improving education or the future working force should be the primary objective of investing time and money in information technologies. Programs should be designed therefore to ensure that the future working force achieve the desired learning outcomes for content, and learn new ways of processing information. According to the National Research Council Board (1990), sharing information is unimportant to Africans if they cannot contribute to finding solutions to their own development problems. The Council opined that:

Economic development in Africa will depend heavily on the development of the information sector. Countries will need the ability to communicate efficiently with local and overseas markets to determine where they may have comparative advantages for supplying their products to consumers or to purchase essential imports, based on current prices and services. Many of the economic development problems facing African countries have scientific and technological components that will require solutions to be developed in Africa by African scientists....Lack of information is a critical constraint.

According to Peter Drucker (1993), successful firms are those which emphasize research and development and the training of their workers. Such firms, he contends, employ "knowledge workers" who "possess a substantial amount of formal knowledge, formal education, and the capacity for continuous learning." The same can be said about countries that vigorously invest in human capital development (Becker, 1993). It is the human resources of a nation, not its capital or its material resources that ultimately determine the character and pace of its economic and social development. "Labor market changes will be increasingly dynamic and education can no longer be static," personal development will become very important, and "education must be a whole-of-life experience" (Drucker, 1993).

It is quite clear that all countries that have managed persistent growth in income have also had large increases in technology education and training of their labor forces. To buttress this point, Edward Denison (1985), in his study of the United States found that the increase in schooling of the average worker between 1929 and 1982 explains about one-fourth of the rise in per capita income during this period. Although he does not give all the answers to the relationship between education, telecommunications, and economic growth, he has given us a starting point in the effort to establish the difference between causation and correlation of education to economic growth. However, the outstanding economic records of Japan, Taiwan, and other Asian economies in recent decades dramatically illustrate the importance of human capital to growth. Lacking natural resources, these so-called Asian tigers grew rapidly by relying on a well-trained, educated, hard-working, and conscientious labor force to compete in the global market.
Compelling evidence of the link between human capital and technology comes from agriculture. Education is of little use in traditional agriculture because farming methods and knowledge have been passed down through oral tradition. Therefore, farmers in countries with traditional economies are among the least educated members of the labor force. In contrast, modern farmers must deal with hybrids, breeding methods, fertilizers and complicated equipment. Education is of great value to these farmers because it helps them adapt quickly to new hybrids and changing technologies (Welch, 1970; Bindlish and Evenson, 1993; Bindlish et al., 1993).

In their recent study of the United States and Japan, Mincer and Higuchi (1988) opined that education and training is also helpful in coping with changing technologies and advancing productivity in the manufacturing and service sectors. Recent studies on technological change, education, and human capital formation in the United States (Gill, 1989) have confirmed the findings of Mincer and Higuchi (1988) that more rapidly progressing industries do attract better-educated workers and provide more on the job training.

In fact, the Maitland Report (1985) concluded not only that ICTs are critical to economic development, but also that they unleash forces that transform education, enrich national cultures and reinforce social cohesion. Therefore, it was not surprising when Robert Reich (1990, 1991, 1992) opined:

We are living through a transformation that will rearrange the politics and economics of the coming century. There will be no national products or technologies, no national corporations, no national industries. There will no longer be national economies, at least as we have come to understand the concept. All that will remain rooted within national borders are people who comprise a nation. Each nation's primary asset will be its citizens' skills and insights.
Implicit in all these findings is the fact that skilled manpower is essential for any development process and that education or training plays a crucial role. Education in general should emphasize national development and the preventive functions of welfare backed by sound policies geared towards reorientation and redeployment of resources, programs and institutions (Hollister & Jones, 1981; Becker, 1993).

Analyzing economic and educational data for the time period 1959 to 1974 for his doctoral dissertation, Gebre-Mariam (1982) concluded that:

primary, secondary, and higher education enrollment, whether viewed in raw score form or as proportions of the age group population, were highly correlated with measures of economic growth. Primary school enrollment was most predictive of GNP when lagged 6 or 8 years; secondary enrollment was most predictive of GNP when lagged 4, 6, or 8 years; and higher educational enrollment was most predictive of GNP when lagged 4 years. The correspondence between the optimum lag periods and the typical length of schooling at each educational level suggests that investment in the education of students entering a given level of schooling today will result in maximum returns in economic growth when those students leave school to enter and participate in the labor force.

In other words, irrespective of the level of educational expenditure, the return of the investment with respect to economic development and productivity growth is unmeasurable. In his study, however, Cunningham (1980) concluded that education and technology are both necessary though not sufficient conditions for economic development, and that education-technology-economic development may represent a causal sequence. He opined that education is truly a major variable for economic development and therefore refuted all studies which have assigned little or no credence to the relationship between education and economic development.

Not alone in his thinking, Edward Denison (1985), in his excellent study of the United States, found that one-fourth of the rise in per capita income during the period 1929
to 1982 could be explained by the increase in schooling of the average worker during this period.\textsuperscript{12}

Irele (1989) laments the inability of third world countries to refrain from using education solely as a tool for increasing the overall literacy level. He argues that producing people who can only read and write is not enough for the emerging global society, for the modern world is one of science and technology. Therefore, education must be viewed as the acquisition of the mental abilities to operate in the modern technological environment. Thus, to associate science and technology to the western world and viewed ambivalently in Africa is to place the African experience in a static motion.

Soedjatmoko (1989) reiterates the need for education to go beyond the mere seeking of knowledge. He postulates that if education is not made a key part of development planning, the country and its society cannot successfully compete in the global market. In fact, he argues that intellectual sectors of the nation should be free from creative restrictions and should be able to interact, grow and participate in the international community. However, for such exchange of ideas in the international arena to be possible, ICTs should be readily available and unrestricted.

It is apparent that education should be geared towards the development of goals and the training of personnel with broad and sound knowledge in working with other professionals, and dedicated to an inter-disciplinary approach to, and knowledge for

\textsuperscript{12} It is an important to caveat to note that this research failed to explain much of the remaining growth probably due to the difficulty in measuring the effects on earnings of improvements over time in health, on-the-job training, and other kinds of human capital. Nonetheless, he paved the way for researchers to understand the clear differences between correlation and causation in income growth and human capital growth.
development. Education must therefore equip students with the knowledge and ability to play the roles of:

- Promoting (social) policy and planning in development;
- Ensuring social justice with particular reference to more equitable distribution of the national wealth;
- Encouraging participation by the people in policy formulation, planning, and implementation; and
- Improving the social and cultural infrastructure by institution building (Hollister & Jones, 1981).

These concerns for participation, social justice, policy and planning, and institution building place education in the political and economic areas as well, especially given the fact that societal problems such as poverty, inequality, slum conditions and deviance have multi-dimensional aspects which are influenced or affected by social conditions along with economic capabilities and political commitment. Thus, students in educational institutions must acquire and pursue knowledge about the political process, the functioning and performance of the national economy, and the nature and role of social relations. In addition, they should understand the roles of government, voluntary organizations, communities and individuals and their relationships in the development process (Hollister & Jones, 1981; Agunga, 1998).

Basically, development requires that education focus on human needs, through attention to policy and planning, social administration, evaluation and research, political and economic action, and community organization. A useful curriculum must include all these to be responsive to the requirements of development. Based on the assessed needs, social policy will then be formulated. Jones and Hollister (1981) maintain that just and feasible social goals must be sought in the light of the needs identified. So also are
alternative policy proposals formulated. They contend that the curriculum should provide:

- A value system in keeping with the common good, which involves a humanistic approach toward social development;
- An understanding of the substantive areas of social policy;
- An ability to analyze, compare, and formulate alternative policy proposals; and
- An understanding of and preference for the development of comprehensive and systematic social policies versus ad hoc, remedial, and 'patch up' policies.

In addition to these, the socio-political and economic feasibility of policy and program, which implies an examination of political structures, social values and the process of economic development, must be addressed. This should lead to empowering students to understand social organizations and institutions, familiarizing them with theories and techniques of planning, organization and management, with emphasis on administrative structures and models, and providing them with skills in research design, techniques, and evaluation (Hollister & Jones, 1981; Freire, 1970 & 1987; Fanon, 1963).

Having said this, it is equally important for us to draw the attention of our students to the need to start looking critically at the policies protecting domestic producers and promoting exports and central planning by developing countries. There is enough data and scholarship to suggest that, despite the sometimes controversial and stiflingly conservative policies of international financial institutions (Chambers, 1980; Raikes, 1988; Green 1994), the major impediments to growth and development in developing countries are largely due to rampant government interference in internal prices, unstable monetary and fiscal policies, and biased trade policies.¹³

According to Amir (1990) and Sorman (1993), our development efforts have failed because our leaders have embraced unchallenged Western values; failed to ensure political stability; allowed corruption; and have continuously blamed their incompetence on the West. While we cannot deny the fact that most of the African experience has remained static because of the continuous interference of the West, it is important now to apportion the blame appropriately to force our leadership to take their fair share of the responsibility for economic underdevelopment (World Bank, 1991).

Touted as the tool to improve the inefficiencies of education has also been popular with educational reformists since the 1920s (Cuban, 1986). Seymour Papert (1993) points to the centrality of the computer in the truly modern school, and to personal media capable of supporting a wide range of intellectual styles. Perelman, on the other hand, believes that hyperlearning technology will enable virtually anyone to learn anything, anywhere, anytime. He opines that, the new technology will totally replace conventional schools. The virtual classroom (Tiffin & Rajasingham, 1995; Hiltz, 1994) is seen as the new primary locus of learning. Courses and whole institutions emerging online seem to be fulfilling the apocalyptic end of schooling as we know it.

Nevertheless, the Office of Technology Assessment (1995) warns that in our classrooms we should not be overzealous in our application of technology. The Office reports that a substantial number of teachers are still making little or no use of the technology because they lack the basic skills and training. In fact, Rosenberg (1991) reports that computer-literacy education often teaches only shallow recognition of jargon and components, and only a few applications. Some scholars believe that this purported revolution has in fact been a recurrent theme over the past 50-70 years (Birdsall, 1994;
Tyack and Cuban, 1995) and that we should not over-commit our institutions and students.

In Africa, improving educational standards and access is our biggest challenge. Education is critical for economic growth and poverty reduction. Telecommunications investment in education, therefore, contributes to the accumulation of technological skills necessary for the next millennium and competitiveness necessary for people to participate fully in their national economies and society.

While workers and organizations adapt and change in response to new technology, companies continue to be plagued by a widening mismatch between the skills their employees need and what colleges and universities are teaching (Marino, 1995). It is on this premise that Dwyer (1996) argues that educators must develop effective partnerships with companies, businesses, and industry to address the gap between what is taught and what is needed. He points to the mounting evidence that shows that technology improves the students' mastery of basic skills, test scores, writing, and engagement in schools. This is preparation that Morton (1996) considers to be necessary for a 21st century employee.

In the end, education more than anything else will determine a country's prospects for human development and competitiveness. A nation's endowment of skilled informatics professionals will strongly affect its ability to meet basic societal needs, to build competitive industries, and to exploit new development opportunities. This endowment depends on public and private education systems in tune with market demands. Education and the dissemination of information (with the aid of ICT) also helps
strengthen civil institutions and build national capacity and good governance, all of which are high priorities in Africa. To respond to the educational needs of business and the ever-changing global economy, the educational curriculum would have to reflect and develop partnerships with companies to build bonds that incorporate training and development in computer related skills.

Needs, Usage, and Literacy of Information Communication Technologies

Demand for telecommunications services is the key statistic used by telecommunications planners to project requirements for facilities and expected revenues. Yet there are compelling reasons to look beyond traffic demands or revenue per message when planning telecommunications systems for third world countries. In communications development, the requirement for needs assessment is particularly strong. Communications needs are not only often indirect but also cut across many different developmental sectors and involve a broad range of technologies and techniques. One of the primary purposes of a needs assessment is to help societies identify, plan for, and be responsive to those needs of its citizens that cannot be adequately expressed or addressed through the marketplace.

From the standpoint of social and cultural policy, a convincing argument could be developed for treating ICT development in a comprehensive and integrated manner. Failure to bring balances in both domestic and international information flows could

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14 This phenomenon is the core of this work as we determine the need for the technology, the extent of usage, and the justification for investments for economic sustainability.

15 This assertion was supported by U.S. Vice-President Albert Gore, Jr., when he addressed the International Telecommunication Union (ITU) Plenipotentiary Conference in Kyoto, Japan in 1994.
contribute to development inequities, regional imbalances, and migration to urban areas. Furthermore, the failure to link major sectors of the society – buyer and seller, administrator and worker, service provider and client, government official and citizen – can not only limit the effectiveness and potential benefits of development efforts, but also actually thwart and distort the development process. Hence the fundamental criteria in assessing and measuring a country’s communication and information needs should be considered. Inherent in these criteria is the technology-independent perspective that defines need as independent of any particular technology requirement. However, once the needs have been identified and policy goals set, then subsequent needs assessments should be undertaken that specify needs in terms of local resources and specific technical capabilities.

Clippinger (1980) identifies two generic criteria that guide any communications needs assessment. The distributional criterion, which has a geographic and demographic dimension, essentially requires that all countries should have their citizens and major geographical regions interconnected to the extent required for all members of the society to undertake their cultural, political economic, and personal activities. In other words, communications channels for initiating, sending and receiving messages, whether they be broadcasting, telecommunications, or traditional, should be accessible to all members of the society.

The second criterion which goes beyond the ideal goal of the universal availability of communications channels, argues for the resources, expertise, and ability to use these channels to produce and consume information. Again, there is no assumption of the types of technologies which should be used, but rather the insistence that the
technology should be selected and deployed in terms of how well it serves human needs rather than how efficiently it performs a specific technical function. Hence, the intention is to use human criteria as the basis for technological design and program selection (Clippinger, 1980).

Embedded in the concept of need is ICT usage. Usage has been conceptualized and quantified in different ways. In this instance, it is being considered as the application of ICT to the daily activities of individuals, institutions, organizations, and government functionaries. To be able to promote an effective transition in an information or automation society, communication planners argue for ICTs and policies that encourage the participation of intended beneficiaries in the planning and implementation of communications development projects (Hefzallah, 1999). By involving the intended users and beneficiaries, the system or project can be made more responsive and accountable to actual user need. Workers clearly differ in their need for communication technologies on the job. In fact, it has been substantiated through research that communications technologies allow many information workers to bring work home rather than transport themselves to their jobs (Williams, 1982). Even Rogers' (1983) concept of "technology clusters" suggests that adoption of one device triggers adoption of other related innovations. Even knowing how automatic bank teller machines operate predicts more positive attitudes toward new media technology (Carey, 1981). In the same token, other related studies have found that experience with personal computers is associated with positive attitudes toward other new media (Ledingham, 1983; Stover-Tillinghast and Visvanathan, 1983).
With widespread use of computers, people are likely to be confronted with new techniques and new equipment for which they may be quite unprepared. Thus, to maximize the benefit to be gained from the use of computers (and ICTs in general), there is a need to reexamine the question of formal education, training and continuing education. As in the conventional education system, where reading and writing are prerequisite, with the inevitable Information Age ahead of us, computer literacy will bring yet a new classification of people – computer literates and computer illiterates or information-haves and information have-nots. Training and retraining should, therefore, play an important role in shaping and reshaping the mind. In the world of informatics in particular, continuing education is inseparable from the normal training as this field is perpetually changing with the new techniques. Herein lies the source of literacy levels of ICT users and of course, the promotion of ICT applications in the various sectors of the economy, which in turn will put pressure on the demand side of the technology – a vicious cycle. However, to function well in the information age, one needs to understand the importance of being literate in ICTs. Hirch (1987) posits that

the complex undertakings of modern life depend on the cooperation of many people with different specialties in different places. Where communications fail, so do the undertakings. … The function of national literacy is to foster effective nationwide communications.

What some have called a “literacy crisis” has developed as new technologies emerge and conventional technologies are applied in new ways. Although some still hold that literacy is limited to “decoding and reproducing written and printed materials,” (Graff, 1981) many now suggest that telecommunications technologies necessitate a broader focus (Ong, 1982). Those advocating “not one but a variety of literacies” (Graff,
1981) point to such diverse concerns as computer literacy, media literacy, visual literacy, and technology literacy. As Hays (1984) points out,

what now seems necessary is a more “process oriented” and dialogic approach to literacy,….one that places an emphasis squarely on changing vocabularies and techniques (or technologies) for producing and reproducing meaning.

Within this literacy categorization has emerged the “new literacies” (Hefzallah, 1999). This new conceptualization is a combination of the new media, telecommunication, and computer technology literacies that have emerged with the ICT revolution. Not only should any educated person in this modern communication technology age possess basic information [knowledge] about these technologies but, most importantly, one has to have an open mind regarding the potential applications of these technologies, and acquire basic skills that empower the individual to use these technologies to enrich his or her information [and knowledge]. By knowing how to find, analyze, and use information today, the Libraries and the Learning Society (1984) reports, children “certify their readiness to become reasoning, thoughtful adults tomorrow as citizens of the information age.”

Various approaches to solving the third world ICT development problems and needs have been found to be wanting in one way or another. While there is no single all-embracing solution to this problem, there is an underlying theme that unites all the

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problems noted: a market mechanism whereby user preferences and needs can be expressed. Consequently, all major categories of communication and information exchange should be considered in performing an overall assessment of communications development needs, an assessment that takes into consideration the user needs, skills, and resources.

Furthermore, greater attention needs to be given to an understanding of the character and performance both of the current information infrastructure and of the intended infrastructure before development decisions are made. It is equally important that user groups are given the opportunity to be involved in the decision making process and the actual implementation process.

Whenever possible, government agencies should have clear objectives to which they can be held accountable through an auditing of their actual performance. Taken together, these measures may help divert attention from the technologies to the users and their needs, thereby reducing the developing nation’s vulnerability to technology misfits. In fact, a failure to coordinate information communication technologies’ planning and implementation can be exceedingly wasteful and injurious to the overall goals of balanced development.

**African Telecommunications Network Development**

Since the 1970s, considerable resources have been spent on persuading third world policymakers and planners that telecommunication is crucial for development. Bilateral and multilateral agencies such as the International Telecommunication Union (ITU), the World Bank, the International Monetary Fund (IMF), United Nations
Educational Scientific and Cultural Organization (UNESCO), United States Agency for International Development (USAID) and the Development Center of the Organization for Economic Cooperation and Development (OECD) have funded myriad research projects to generate empirical data and stockpile illustrations supporting the assertion that telecommunications can significantly contribute to economic growth, the delivery of social services, and a more equitable distribution of economic benefits.\(^{17}\)

Crucial in the drive to encourage ICT development in the Third World or developing countries is the January 1985 Maitland Commission report.\(^{18}\) The report states that

\[
\text{[i]n the industrialized world telecommunications is taken for granted as a key factor in economic, commercial and social activity and as a prime source of cultural enrichment. Moreover, in these countries telecommunications have come to be regarded as an engine of growth and a major source of employment and prosperity. The pace of technological innovation is such that inhabitants of the industrialized world look forward to enjoying the full benefits of the so-called 'information society' by the end of the century....The situation in the developing world is in stark contrast. In a majority of developing countries the telecommunications system is inadequate to sustain essential services. In large tracts of territory there is no system at all. Neither in the name of common humanity nor on grounds of common interest is such a disparity acceptable.}
\]

While the commission urged that countries and international agencies with development assistance programs give higher priority to telecommunications, it also recommended that:

\[\text{....developing countries review their development plans to ensure that sufficient priority is given to investment in telecommunications....We further recommend that developing countries make appropriate provision for telecommunications in all projects for economic or social advance and include in their submissions a}\]

\(^{17}\) See Hudson et al. 1979; Pierce and Jequier 1983; Saunders, Warford and Wellenius 1983.  
\(^{18}\) The official name of this report is The Independent Commission for World-Wide Telecommunications Development. This report's recommendations were officially endorsed in 1985 with the issuance of the Arusha Declaration which officially created the Center for Telecommunications Development.
checklist showing that such provision is being made. . . . . In setting targets and priorities, developing countries may want to distinguish between urban, rural and more remote areas. While the important economic advantage of satisfying demand in urban areas should not be ignored, extending the network into the rural and remote areas is essential if the aims of development are to be achieved. . . .

Bringing into fruition the reasoning behind the contribution of the world system to enable developing countries to informate, James Wolfensohn, the president of the World Bank, cited his own travels in developing countries to villages with no roads and schools with no electricity, no glass in their windows and without proper sanitation:

I have been touched by the drama of the gap that exists between the industrialized and the developing world, but I have also been touched by the opportunities to address the gap. I have met people in Morocco who are doing desktop publishing for firms in Paris. Ghanaian traders are using cellular phones to get their cocoa quotes; and in Brazil, Amazon chiefs are using video cameras and satellites to communicate with each other. . . . The challenge is to jump to the next level and to get the technology to large numbers of people. It is not enough to have a fireworks display to show the capabilities of technology. We need systemic solutions; we need to set targets; and we need to monitor progress and measure the impact on the poor. We need to innovate and take risks. We should not be afraid to make mistakes. . . . If Africa fails to transform itself fundamentally from here on, it will not be for lack of goodwill and external support. . . .

19 But these developing nations cannot ‘informate’ without first ‘automating’ which will require a substantial amount of resources and human-power. See Shoshanna Zuboff’s (1988), In the age of the smart machine: The future of work and power. In this book she cites two strategies for linking human components with electronic technology: an "automating" strategy and an "informating" strategy. Automating extends Taylorist technocratic assumptions of the industrial era to high-tech conditions. It assumes that technical experts are best qualified to harness the power of technology to get work done. The informating strategy challenges the bureaucratic control model on the grounds that it is not flexible enough to meet the challenges of the computer/communications revolution. It fails because its fixation on control prevents it from tapping higher human capacities for communicating, collaborating, creating novel solutions, and making value judgements.

20 Media reports of his comments in the Knowledge for development in the information age: Global Knowledge 97 conference held in Toronto. The English version of this article was published June 25, 1997 in a special joint venture supplement in the Financial Post.
Adding to the pronouncements of James Wolfensohn, Kofi Annan, the United Nations Secretary-General, in his speech at the opening of the Global Knowledge '97 conference, opined that:

The extreme inequalities in the world are morally untenable, economically irrational and politically indefensible.... We have learned too often that democratization -- like reform, I might add -- is a process, not an event.... For democracy to take root, it needs institutions, respect for the law, integrity of the armed forces and free and regular elections. The United Nations has been working to implement lasting democracy, and we have been doing so by spreading information and encouraging knowledge. Why? Because an educated electorate is a powerful electorate. Because an informed citizenry is the greatest defender of freedom. Because an enlightened government is a democratizing government.... Knowledge is power. Information is liberating. Education is the premise of progress, in every society, in every family.... Development, peace and democracy are no longer the exclusive responsibility of governments, global organizations or inter-governmental bodies. 21

Such powerful pronouncements would send any hedging government to join the global bandwagon. But such an optimistic and idyllic characterization of the ICT comes with ominous warnings that the technologies can, unless properly and carefully planned, produce new forms of dependence and exacerbate inequities in the distribution of goods and services (O'Brien, 1984; Clippinger, 1976; Becker et al., 1986; Halloran 1986; Smith 1980; Rodney, 1992). According to Michael Traber (1986) and Herbert Schiller (1985), the new ICTs were developed in, by and for the highly advanced capitalist economies of the developed countries. It is to be expected therefore that these technologies are being employed single-mindedly to serve market objectives. Traber (1986) notes that the information revolution has had no significantly emancipatory effect on humans by way of improving the quality of human life because it was a manifestation of "an information

implosion rather than explosion," whose benefits were spread in closed corporate structures of financial, Trans National Corporations (TNC) and military establishments.

This exclusivity could foster the geo-political environment for a new system of global domination and/or dependency. Created by the new ICTs, the system has another strategy for institutionalizing itself. This involves cajoling poor nations and their leaders into a new technologies race with glowing promises that electronic instrumentation offers the means of moving speedily out of backwardness into the 21st century - an exercise Schiller (1985) describes as a remodeling of the entire information system by some few market economies of the West. This relationship between information and economic power reflects an assumption that overtly respectable international development projects, business ventures, marketing, trade and technology transfer have usually resulted in the domination of the weaker peripheral nations.

According to Hamid Mowlana (1984), modernization of less developed countries has made them amenable to control by western power centers - a process he calls "westoxification." By converting to western standards, he maintains, these nations fall into domination and/or dependency relationship because of the "schizophrenic paralysis of creative power."

However, for "developing" countries to fall into line with these high cost, capital intensive, labor-saving devices based on satellites and computers, they will need to invest heavily in an infrastructure which could create technologically dependent nations - spare parts and technical skills would have to be imported from "developed" countries. Nevertheless, within a decade or two, African countries have joined the race to bridge the
information gap\textsuperscript{22} and make their economies viable to compete efficiently in the emerging global market.

The question that repeatedly comes back to be answered is, can these countries afford this rush for modernity at the expense of other equally important [schools, hospitals, etc.] public investments? Can they refuse to join the exodus of informing without imposing economic and social hardships on their population? If they should opt to join the global economy, what proportion of their scarce budget should be allocated to this development to make them competitive? These questions, while important, are not the bedrock of this dissertation or the foundation of questions being addressed.\textsuperscript{23} The returns cannot be well established if the needs and extent of usage of information producers and consumers in the country have not been addressed. It is to enable us to be able to make informed policy decisions that this dissertation contributes to the already existing body of knowledge.

\textsuperscript{22} The "information gap" between industrialized and developing countries is reflected in their access to telecommunications resources. While there are now almost 50 lines per 100 people in high-income industrialized countries, there is still an average of only one line per 100 in the poorest countries. There are almost three times as many telephone lines per 100 in the largest city of lower-middle-income countries as in their rural areas, and more than seven times as many lines per 100 in the largest city of low-income countries as in their rural areas. These gaps are even more significant given the fact that more than 50 percent of the population, and as much as 80 percent in the poorest countries, lives in rural areas (ITU: WTDR, 1995).

\textsuperscript{23} In fact it is preposterous on the part of policy makers to jump onto the bandwagon to invest in the technology and its infrastructure, or allow themselves to be forced into investment just because research has confirmed its causal relationship with economic growth without ascertaining the needs of the end users and the extent of usage in the economy. Once this has been established, policy makers may then be in a position to answer all the questions on "returns on investments."
Ghana in a Comparative Perspective

The republic of Ghana is a West African nation on the Gulf of Guinea sandwiched between Togo, Cote d'Ivoire and Burkina Faso, with a land area of 238,537 sq. km (92,100 sq. miles) and a population of over 16 million (1995). The country is divided into ten regions with the national capital at Accra. Broadly speaking, the country can be divided into two climatic regions - north and south - with some variations in each region. The vegetation is accordingly determined by the climatic conditions in each region - forest and savannah grassland (Kuada and Chachah, 1994).

Today five major ethnic communities live in Ghana, in addition to many smaller ones interspersed among them. They are the Akan, Ga-Adangbe, Ewe, Gonja and the Mole-Dagbani, each composed of many distinct ethnic groups (about 100 ethnic groups were listed in the 1960 census). All of these groups speak languages of the Niger-Congo language family and share cultural characteristics with other West African communities.

Today, English is the official language, and it is widely used in the country.

Politics

Ghana's political history has known many new beginnings that have ultimately disappointed their initial expectations. Ghanaians of all political persuasions justly look back with pride to the late 1950s when Ghana, led by Kwame Nkrumah, became the first sub-Saharan African country to throw off the yoke of imperialism. At independence, Ghana chose to be a multi-party state, a parliamentary democracy based on constitutional rule, with a Prime Minister as head of government. In 1960, under Nkrumah, Ghana
became a republic, and shortly after that the country became a one-party state (Oquaye, 1982).

Against the backdrops of the 1952 Nasser coup in Egypt, 1958 Abboud coup in Sudan, 1960 Mobutu coup in Leopoldville (now Congo), the 1963 assassination of Olympio in Togo, the takeover of Dahomey (now Benin) by Soglo, and the bloodless overthrow of one of the most towering political personalities in Africa at the time, Ben Bella of Algeria, the stage was set for the overthrow of Nkrumah by the National Liberation Council (NLC) in 1966. The NLC ruled till 1969, despite an unsuccessful counter coup in 1967, whence Ghana returned to constitutional rule with the late Dr. Kwame Abrefa Busia as Prime Minister (Oquaye, 1980; Agyeman-Badu and Osei-Hwedie, 1982).

However, in January 1972, Busia's Progress Party government was overthrown by the National Redemption Council (NRC) headed by the late General I. K. Acheampong. Kutu Acheampong ruled Ghana as President from 1972 until 1978, later changing his government's name to the Supreme Military Council (SMC). Nevertheless, in 1978, the late General F. W. D. Akuffo, Chief of the Defense Staff in the SMC government, overthrew Kutu Acheampong (Oquaye, 1980; Shillington, 1992).

A year later, Flt. Lt. Jerry John Rawlings staged another coup, which established his Armed Forces Revolutionary Council (AFRC) government. Not intending to stay on but to honor the scheduled civilian elections, the AFRC handed over governance to a democratically elected government on September 24, 1979. The government of the People's National Party (PNP), headed by Dr. Hilla Limann, succeeded the AFRC, and for the third time in 24 years, Ghana returned to a civilian administration and
constitutional rule. However, on December 31, 1981, the armed forces led by Jerry Rawlings struck again, overthrowing the Limann's government and declaring a 'Holy War' against the 'enemies of the people.' In November 1992, an election was held to elect a president and the next elected parliamentary government. In January 1993, following parliamentary elections, Ghana returned to civilian rule headed by Flt. Lt. J. J. Rawlings (Rtd.) and has been so since (Shillington, 1992).

Figure 1. Map of Ghana
Adapted from Official Government WebPage.
Economy

Many scholars agree that there is a close relationship between the economy and the political system. Owusu (1970) opines that the essence of (African) politics is the economic or material rewards it brings to the people. In the words of Harris (1975):

We are....concerned with the interrelationship between 'the political' and 'the economic' ...., and wish to emphasize the inter-connectedness of what are conventionally considered as social reality. Indeed, we are prepared to argue that the conventional separation of 'politics' from economics is misleading and invalid upon careful empirical analysis. Thus, we speak of the political economy...., meaning the interrelated structure of its political and economic life.

Rothchild and Gyimah-Boadi (1981) have argued that the explanation for Ghana's instability can be found in the country's restricted economic base, which is incapable of satisfying public demands and expectations. While many Ghanaian scholars will be quick to blame the Nkrumahist economic policies the country embarked on after independence, Giovanni Arrighi (1970) contends that Ghana's socio-economic problems, like those of most other African countries, have resulted from the failure to sustain an effective strategy of development which is rooted in the nature of the political economy of the continent.

In fact, the structure of underdevelopment in Africa as a whole stems from the continent's incorporation into the capitalist system, under colonialism, from which the present political economy was developed. The colonial relationship led to the destruction of the indigenous patterns of economic relationships and production. To some extent, it made the internal economies of Africa not only highly dependent on a few commodities, but also dependent on external economic interests. In 1952, a Report on the Financial
and Physical Problems of Development in the Gold Coast (Ghana), stated (as quoted in Kay, 1972):

If we are forced to sum up the Gold Coast economy in one word, the word we would choose would be "fragile." The second main economic weakness is, of course, that earnings of foreign exchange depend mainly on one commodity - cocoa.

The country's economy, based on cocoa, was export oriented. To this point, Ghana's main export products are cocoa, gold, and timber with tapered exports of diamond, bauxite, and manganese. The fluctuation of world market prices and the absence of processing industries for these products have historically affected Ghana's revenues.

To bring the country back into economic standing, the Ghanaian government in 1983 adopted various economic stabilization measures (economic recovery program), including cuts in the government budget, deregulation of price mechanisms, and devaluation of currency, as a result of its agreement with the IMF and the World Bank. Despite some current economic difficulties, Ghana is still considered an ideological showcase for structural adjustment. In 1987, Ghana's per capita GNP was $390. The World Bank's estimate of Ghana's GNP in 1991 was about $440 per capita. The average annual growth of GNP per capita in 1997 was 0.4 per cent. The World Bank's estimated average GNP per capita growth from 1998-02 is 3.1 per cent. Likewise, in 1988, Ghana's exports, which amounted to $1.014 billion, exceeded imports ($907 million) by over $4 million (WB, 1998).

While the crust of the nation's economic woes could be attributed to the inherited colonial structure, it is equally important for us to note that part of the blame could be attributed to the accelerated development by the Ghanaian government after
independence. The country's foreign exchange reserves stood at about $476 million at independence. But as a result of rapid industrialization and uncontrolled expenditure on prestigious and other projects (white elephants), by September of 1965, the reserve had dwindled to $14 million and became exhausted by March 1966 (The Gallatin Annual of International Business, 1966). Hence Omaboe's (1966) postulation that:

The pace of economic and social development that has been set for the country by the government in the last few years has been more than the export capacity of the country is able to bear.... This extraordinary expansion in government expenditure has had repercussions on the general level of activity of the domestic economy and together they have contributed to the external imbalance.

In essence, the economy had no checks on an inflationary wave of spending. Direct taxation hardly touched most people while indirect taxes were relatively light. Price controls were ineffective, and poor communication restricted the flows of goods and services (Kay, 1972). Since the political economy of Ghana is intertwined, until politicians and policy makers are able to satisfy the needs and demands of the masses and demonstrate that they are capable of reforming and managing the state machinery and the economy for the benefit of all Ghanaians (in relation to the global economic structure), they will not succeed in the social mobilization essential for economic development, institutional restructuring and the survival of a democratically elected government (Boakye-Sarpong and Osei-Hwedie, 1990). It was, however, not at all surprising that in its efforts to revamp the country's financial and economic standing in the world, the
government instituted the value-added tax (VAT)\textsuperscript{24} to get every citizen to pay his or her share of the tax burden.

**Education**

The educational system that prevailed in the post-colonial period followed the prototype of the colonial model, and contributed immensely to the distortion of the labor market. It simply produced theoretically bright people, who are walking libraries of fragmented and disjointed facts. It reinforced the economy's tendency to shape the dominant orientation of the labor force towards white-collar occupations. It is quite evident that the policies of the post-colonial governments showed no significant changes from the inherited model (Ninsin, 1991).

Emphases on practical and creative application of our educational skills have been almost non existent in the educational structure. Although through Nkrumah's educational policy, free universal primary education was established, functional illiteracy was a major problem in the educational system. Being able to read and write should not be enough for an individual to functionally participate in the Ghanaian society. To produce qualified people with hands on practical experience and technical know-how to support the emerging economy, the government revisited Prime Minister Busia's educational agenda, which had been on the shelves for some time (Avotri, 1993).

\textsuperscript{24}The implications of VAT is not the issue in this research, but there is enough debate on that in the country and its impact on the population such that it warrants future studies to determine how appropriate this tax burden is to generating or stimulating the economy. Should we be certain that each citizen is paying his or her fair share of the taxes? Or it is just a shame to keep the gap between the rich and the poor widening?
This new system emphasized an inquiry approach to teaching and learning. It also emphasized the attainment of affective objectives, and the development of vocational and creative skills, as well as the attainment of cognitive objectives. Subjects such as social studies, cultural studies, life skills and vocational skills were introduced. It was anticipated that social studies, for example, would facilitate the development of more positive attitudes towards society and the environment among students (Ghana Education Service, 1987).

With advice and a $232 million loan from the World Bank, the government launched a major educational reform in September 1986. The aim was to expand access to quality education at all levels, cut public costs, and increase the ranks of the vital manpower by giving priority to vocational and technical schools. In addition, the Government reduced pre-university education from 17 to 12 years (nine years of basic education, plus three years of secondary); reallocated government funds to basic education; instituted curriculum reform; established a firm basis for secondary and tertiary study; and involved the family and community in funding and access issues.

Currently, there are numerous grammar, secondary, basic, commercial, technical and vocational educational institutions throughout Ghana. There are four universities: the University of Ghana at Legon and Accra, the University of Cape Coast, the Kwame Nkrumah University of Science and Technology at Kumasi, and the University of Development Studies at Tamale, as well as one University College of Education at Winneba. In addition, there are numerous specialized tertiary institutions in the country. A functional literacy program has recently been initiated in Ghana, targeting illiterate adults.
In partnership with private enterprises, NGO's and other international institutions, the government has welcomed numerous projects that inculcate the use of technology in the classroom. Science and technology education has been accepted as the engine that could drive the move towards development especially in African countries and in countries that are also trying to scale the great divide between the poor and the rich nations (Anamuah-Mensah, 1998). It was recognized that the development game tends to favor those who can master and control science and technology information. A nation's prosperity is measured by its level of science and technology development. Therefore, science has been made compulsory at all levels of pre-university education. Some training colleges have been designated as science colleges to train science teachers for the basic level of education in order to boost the teaching of science at this level. Policies have also been put in place to enable universities in the country to give sixty percent of their admission quota to science candidates (Anamuah-Mensah, 1998).

In a proposal dated March 1996 by the Ministry of Education to the academy for Educational Development in Washington DC, section 3.3 reads as follows:

The percentage share of total education budget (recurrent + capital) out of national budget (recurrent + capital) rose from 21.95 percent in 1990 to 36.41 percent in 1992. In 1992, out of every c3 spent, c1 was spent on education. Total budget to the Education Sector rose from c58 billion in 1990 to c135 billion in 1992 and c311 billion in 1995. Between 1990 and 1991 alone, the total education budget doubled. During the same period, the Government of Ghana (GOG) expenditure rose by 33.21 percent. In 1991 and 1992, total education budget grew faster than GOG expenditure.

All these figures sound two good to be true until one compares them to the recent released results of the nation's educational report. According to a West African Examinations Council (WAEC) statement, out of a total number of 84,176 candidates
who took part in last December’s Senior Secondary Certificate Examination, only 9,863 (11.72 percent) candidates passed in all the nine subjects they were presented. The statement said 6,457 candidates (7.67 percent) passed in eight subjects while 5,306 (6.3 percent) passed in seven subjects. It said 14,369 candidates (17.07 percent) failed, 1,000 candidates (1.19 percent) were absent, and the results of 366 candidates were cancelled. Meanwhile, the results of 402 candidates have been withheld pending the findings of an investigation by WAEC (GRI, 1998).

However, the quality of education - as measured by final results for all learners - is determined by many variables. It is apparent that the amount of money and resources spent on developing and improving an educational system does not automatically guarantee its effectiveness or success (Bloom, 1976). Putting aside all other factors that could have contributed to such an abysmal performance, the results do not support all the investments that have been made quite recently. If Ghana is to be competitive in the global economy, its educational curricula and the manpower produced should reflect the demands of the working environment - *symbolic analysts* (Reich, 1992).

**Ghana's Telecommunication Initiatives**

Once considered a mundane and somewhat transparent "utility" framework for basic voice communication, the telecommunications infrastructure has moved to the forefront as the crucial physical transport for the dawning of borderless global electronic commerce. Certainly, the rapid emergence of the global internet is indicative of what sort of monumental social and economic changes are possible with the creative application of available telecommunications infrastructure, computing and information technologies.
However, in Ghana, this development has taken almost a century to emerge from the drawing board.

Colonial Era

In line with colonial policies, Ghana's telecommunications infrastructure was laid down and expanded by the colonial administration mainly to facilitate the economic, social, and political administration of the colony. In 1881, Ghana (formerly Gold Coast) installed its first telegraph line between the mansions (castles) of then governors of Cape Coast and Elmina. When the Christianborg Castle near Accra became the seat of colonial administration, the line was extended further to Aburi, on the outskirts of Accra. However, there were no communication linkages between the Christianborg Castle and Accra until 1882, when a telegraph line stretching 2.5 miles was installed (Salia, 1995; GTS, 1992).

Between 1887 and 1889, the telegraph lines were extended to cover all colonial castles or fort towns as well as commercial ports and fishing centers. By 1886, telegraph lines had reached the interior of Ghana all the way to the territories of the Ashanti Kingdom. Using their new communications technology, the British were able to penetrate the country to its hinterlands and the source of the gold trade; and by 1901 they had managed to conquer the Ashantis. With the effective use of the indirect rule and all its perks, the British were able to solicit the help of local chiefs to secure and protect the telegraph lines against vandalism. By 1904, a second manual telephone exchange

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25 These included Accra, Prampram, Winneba, Saltpond, Sekondi, Ankobra, Dixcove, and Shama.
consisting of 13 lines had been installed in Cape Coast in addition to the one erected in Accra in 1892 (Salia, 1995; GTS, 1992).

By the end of 1912, Ghana had forty-eight telegraph offices spread throughout the country. Between 1914 and 1930, Ghana's telephone exchange lines had grown to 1,560, linking the coastal region with the central and northern parts of the country (GTS, 1992). The trend of telecommunications development came to a standstill before, during, and immediately after World War II. However, in 1953, the first automatic exchange line, with 200 lines, was erected in Accra to augment the line installed in 1892. Three years later, the trunk lines installed in 1920 connecting Accra, Kumasi, Takoradi, and Tamale were upgraded with a Very High Frequency (VHF) network (Salia, 1995; GTS, 1992).

Post-Independence Period

Independence in Ghana brought a new spirit of urgency to the country's telecommunications development. With a sizeable government chest after independence in 1957, a seven-year development plan was launched to hasten the completion of a second new automatic exchange in Accra. By the end of 1963, over 16,000 telephone subscribers and 32,000 rotary type telephones were in use in Ghana (Salia, 1995; GTS, 1992). By clear indications of need, new telecommunication installations were commissioned at the periphery of the country to meet the rapid growth in commercial activities in mining, timber, cocoa, shear butter, and other cash crops. Since telecommunications development and improvement was considered a public good, it is important to point out that all investments were made by the government with little or no private initiative.
In 1974, under military rule, Ghana's telecommunications system was officially declared a public corporation with National Redemption Council (NRC) Decree number 311 under the Ministry of Transport and Communications. Despite the attempt by Ghana's Post and Telecommunications (GP&T) Department to initiate policy formulation and control of the country's telecommunications sector, it has been plagued with a low quality of service. Among existing problems are inadequate manpower service, unsatisfactory state of the external plant network, poor maintenance of service, insufficient power supply, the rampant breakdown of a large portion of power and air conditioning equipment, and delays in projects which invalidate future service projections, to mention a few. Despite her problems, the government is determined to improve on the country's abysmal telephone penetration record of 0.32 per one hundred inhabitants Ghana (Salia, 1995; GTS, 1992).

Present Conditions and Future Projections

With financial commitments totaling $76 million from the governments of Ghana, Japan, Canada, the World Bank, and the African Development Bank, the GP&T began a number of developmental projects to modernize and expand both national and international telecommunications services, which were expected to last from 1975 to 1979. Despite delays which pushed completion of the First Telecommunication Project (FTP) to 1985, a Second Telecommunications Project (STP) with an eight-year plan was executed in 1987. Through 1992, about $50 million of the project cost had been disbursed, but the cost of the project increased from $140.7 million to $173 million due to Ghana's economic growth (World Bank, 1995).
The impact of the completed portion of the STP on telecommunication services in Ghana was modest but appreciable (Table 1). However, the STP telephone density achievements as of 1994 (0.31 per one hundred inhabitants) was still among the lowest in Africa (WB, 1995). In comparison to some developing and developed nations, the task ahead of GT&P is enormous and almost unaccomplishable. Yet, the efforts of the government and private entrepreneurs provide evidence of tenacity and a willingness to bridge the gap between the core and the periphery. Not to put it mildly, these efforts to improve Ghana's telephone penetration would be accomplished if all stakeholders embarked on massive investments in accelerated telecommunications programs.

Acknowledging that telecommunications development cannot be the sole responsibility of the government; the Ghanaian government in 1987 relaxed regulations, issued private companies licenses, and allocated frequencies enabling them to produce, install, and maintain any compatible telecommunications equipment.26 With this in mind, the 1996 Accelerated Development Plan (ADP) was to achieve rapid expansion and improved quality of telecommunications services through increased private sector participation, the promotion of competition, liberalization and privatization27 of facilities and services, and the establishment of a regulatory body to oversee the sector.28

26 The government’s commitment to the telecommunications restructuring program is clearly evidenced in the promulgation of the National Communications Authority Act, 1996 (Act 524). The National Communications Authority (NCA) is expected to be an independent regulator to ensure that national objectives are realized. A highly commendable feature of the Act 524 is its clear separation of operational management and regulatory and policy making functions in the telecommunications sector. This is a key to efficient and rapid development of telecommunications in Ghana.


By 1992, about forty telephone companies were in operation, including a local cellular company and a paging company. Unfortunately, many Ghanaians are unable to afford cellular phones or pagers due to salaries barely sufficient for their basic survival needs. Therefore, they cannot afford to be paying over $300 to own a telephone, be it mobile or a wire-line facility.

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<td>Direct Exchange Lines Connected</td>
<td>38,046</td>
<td>44,834</td>
<td>130,000</td>
</tr>
<tr>
<td>Direct Exchange Lines Working</td>
<td>25.61%</td>
<td>40.89%</td>
<td>97.4%</td>
</tr>
<tr>
<td>Telex Lines Connected</td>
<td>316</td>
<td>881</td>
<td>1150</td>
</tr>
<tr>
<td>Telex Lines Working</td>
<td>40.13%</td>
<td>62.72%</td>
<td>93.2%</td>
</tr>
<tr>
<td>International Telephone Circuits</td>
<td>41</td>
<td>254</td>
<td>3000</td>
</tr>
</tbody>
</table>

Table 1. Telecommunications Service Data in Ghana
Source: GP&T Publications, Accra.

Hence, the expectation from the government is to improve upon its efforts at drawing more operators into the sector so as to force down prices for more people, who will be able to choose from a wide range of less expensive communications services and equipment.\(^\text{29}\) It was therefore not surprising when the government with the help of

\(^{29}\) At the same time, Ghana Telecom (GT), was separated as a commercial entity from the Ministry of Posts and Telecommunications, with a 30% stake sold to a Malaysian consortium for $38 million, and the availability of a second national operator's license was announced. The license was subsequently awarded to a consortium proposing a $10 million investment headed by the Ghana National Petroleum Corporation (GNPC), with the African Communications Group and Western Wireless (Cambridge Mass, US). GNPC is working with an Israeli company, Gilat (Eric Tenkorang 106554.3123@compuserve.com) to deploy a VSAT-based telephone network around the country. Both GT and GNPC each have 20-year exclusivity
parliament enacted a new Investment Code (GIPC, 1994), Act 478, which stipulates "the unconditional transferability of dividends, loan service payments, fees and remittance; and a commitment that no enterprise shall be nationalized or expropriated by the government."

Currently, the much anticipated partnership between the government, academic institutions, and private enterprises has begun with the partnership between the Ghana National Information and Communications Committee (GNICC) and the Ghana Academic and Research Network (GARNET). These two organizations have been charged with designing the specifications of a national networking backbone. However, the Ghana Distance Education Network (GHADEN), which will be comprised of 110 District Vocational Institutes, 20 Regional Polytechnics, and 6 National Universities, is close to securing a financial package. Arrangements are been made to beam courses offered by units of the University System of Georgia to the six universities in Ghana. Additionally, courses will be beamed from Accra Polytechnic to all of the 20 Regional Polytechnics (Simpson, 1999).

Despite the lead by academic institutions in the country to incorporate ICTs in the country's institutions of higher learning, the Ministry of Health has also submitted a proposal to the InfoDev Fund with the Global Health Network (Ghnet) to link five hospitals, the University of Ghana and the Ministry of Health in Accra (WB, 1998). The Ghana Distance Education Network also plans to implement Telemedicine and Telepharmacy in conjunction with the Medical College of Georgia. The Ghana Distance Education Network will also deploy Wireless Local Loop (WLL) technology to provide licenses. http://www.gnpc.com.gh / gnpc@ncs.com.gh
telephony service in hospitals, schools and rural areas. This telephony service will provide the platform for the implementation of President Clinton's Initiative to have Ghanaian schools connected to the Internet (Simpson, 1999).

This kind of cooperation is the bedrock of developed nation's ICTs development. With the country's eyes on the prize and all investments geared towards "leap-frogging" the technology, Ghana offers a stable economic and political environment, with an impressive growth record and excellent future growth prospects. It also has a transparent legal framework, which guarantees the protection of investments and the ability to operate in accordance with normal business practices. The investor oriented investment climate has led to a significant increase in the flouting of direct foreign investment to Ghana.

Conclusion

Throughout the literature review, opinions in support of or against the investment in telecommunications have been expressed. Though the accrual of benefits still seems a few years away for third world countries, the preponderance of evidence in the literature supports the positive impact of investments on economic growth and development if in fact user groups are given the opportunity to be involved in the decision making process and the actual implementation process.

However, for third world nations (specifically Ghana) to be in a comfortable position to participate in the millenium economy, they need to optimistically approach their investments in telecommunications optimistically and be assured that the ability to communicate instantaneously can facilitate the development process by improving the
efficiency (or the ratio of output to cost); effectiveness (or the quality of products and services); and equity (or the distribution of development benefits throughout the society), while at the same time paying close attention to the needs, skills, and resources of end users. Failure to coordinate information communication technologies planning and implementation can be exceedingly wasteful and injurious to the overall goals of balanced development.

It is in the spirit of making such decisions that this dissertation turns its attention to helping policy makers make informed decisions on the importance of telecommunications investments and the accrued benefits to their developmental goals.

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30 See Heather Hudson, Global Connections, p. 189.
CHAPTER 3

METHODOLOGY

Introduction

Information and Communication Technologies (ICT) are not only a significant factor in the performance and growth of economies - the importance of which is continuously growing - but they also represent a novel and effective tool to help advance sustainable human development. Research and studies reviewed, as well as knowledge in the field of telecommunications and development, support the existence of a relationship - either as a vital catalyst or a causal relationship.

However, Dholakia and Harlam (1994) are of the opinion that investments in telecommunications alone will not generate any meaningful economic growth since development takes place simultaneously over a number of sectors. They opine that since public policy makers have to allocate their scarce investment dollars to several competing inputs, telecommunications being only one of them, it would be more meaningful to the formulation of public policy if the positive relationship between telecommunications and economic development or between physical roads and economic development could be put in a comparative perspective.

Thus, the purpose of this study was to determine the level of telematics usage in Ghana with particular reference to the level of computer literacy and computerization in
institutions and organizations in terms of information production and consumption; information sharing networks; and the nature of telecommunications services and facilities provided to networks. This, according to scholars, is a contributing input to economic and human development. This study, however, departs from other studies, which have examined investments in a single developmental input - physical or telecommunications infrastructure - in isolation from other resources required for development.

While this dissertation does not purport to investigate the direct relationship of ICTs to economic development, if we accept the assumptions of Cronin et al. (1991; 1993a; 1993b), Hardy (1980), and Dholakia and Harlam (1994), there is an indirect relationship that suggests that the level of usage and dissemination ultimately contributes to the determination of economic growth.

This chapter explains the design and the methodology of the specific research that was accomplished and is divided into the following sections:

1. Population / Sample
2. Research Instrument
3. Data Collection Procedure
4. Data Analysis Procedures
5. Assumptions
6. Limitations of Scope
Population and Sample

The population of this study consisted of academic/research institutions, government agencies, commercial ventures, non-governmental organizations, and financial institutions in Ghana. The academic/research institution consisted of any accredited educational institution that has more than 50 students' population or any research institution whose main aim is to contribute to the educational or socio-economic well being of the country. Government agencies included in this study were agencies required by law or decree to make their records public, with citizens depending on these records for their livelihood or survival.

Commercial ventures consisted of businesses, organizations, or institutions that depended on profits for their existence. Those commercial ventures finally used had to have more than two salaried full-time employees. Non-governmental organizations included all local and international private non-profit organizations that do not derive more than 50% of their operational budget from the Ghanaian government or a single constituent government. Financial institutions included local and multinational financial institutions operating in Ghana.

A list of the survey population was obtained from the *Ghanaian Media Overview, Practitioners and Institutions 1998*. This directory contained every media practitioner or institution's name, size, location, product or service rendered, and ownership (public or private). A comprehensive list of financial institutions, non-profit organizations, and commercial organizations in the country was also obtained from the Ministry of Finance and Economic Planning. For academic/research institutions, the Ministry of Education gave the researcher a list of licensed and accredited institutions.
The population from which the study sample was selected was the 420 people in these directories identified as directly in charge of their organization’s ICTs, with access to their organization’s technology or directly involved in the purchase of information communication equipments or policy decision making in their organization. However, to draw boundaries to this study, a sizeable portion of the population was eliminated. In this instance, the study does not include "mum and pap" organizations. These are organizations or commercial ventures run on an individual or family basis, where not more than two people are paid outside the family or have not more than two full-time salaried employees.

From this population, the researcher purposively selected (Krathwohl, 1998; Fraenkel & Wallen, 1996) a group of 200 participants (Krejcie and Morgan, 1970).31 The researcher personally went through the provided directories and coordinated the listing of these participants in each of the three metropolitan areas under study. The participants were not selected in any statistical sense, rather they were chosen because they are supposedly knowledgeable about the issues being researched and willing to communicate about them (Kumar, Stern et al., 1993). Selection error was controlled by double checking the list to avoid duplication. However, since the results of this study are an aggregation of the opinions of survey participants, the researcher did not find their

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31 The choice of the participants with these characteristics has important implications for interpreting the results. The participants are not intended to be representative of the 10 regions of the country. This selection was intended to provide data from a range of metropolis in terms of location, population base, levels of ICT dissemination, usage and literacy, and resources. The assumption was that this range of participants would yield maximum insight on the research questions while keeping the number of participants relatively small for practical purposes. It follows that the results reflect diversity more than central tendency even though common themes are readily apparent. They allow us to extend the results reported here beyond the three-selected metropolis even though the detailed experiences are inevitably region specific. The data, while selective in breadth of coverage, are complementary in providing depth of insight about the factors influencing ICT dissemination, usage and literacy in Ghana.
responses to be duplicating even if some of the participants worked for the same parent organization or institution.

<table>
<thead>
<tr>
<th>Types of Organization</th>
<th>N</th>
<th>n</th>
<th>% of N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic/Research</td>
<td>80</td>
<td>30</td>
<td>38</td>
</tr>
<tr>
<td>Government</td>
<td>60</td>
<td>40</td>
<td>67</td>
</tr>
<tr>
<td>Non-Profit Organizations</td>
<td>40</td>
<td>25</td>
<td>63</td>
</tr>
<tr>
<td>Commercial</td>
<td>140</td>
<td>60</td>
<td>43</td>
</tr>
<tr>
<td>Financial(^{32})</td>
<td>70</td>
<td>40</td>
<td>57</td>
</tr>
<tr>
<td>Media Practitioners</td>
<td>30</td>
<td>5</td>
<td>17</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>420</td>
<td>200</td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Sample size for all the survey participants\(^{33}\)

Research Instrument

The instrument for this study was developed by the researcher with the help of Dr. Kwadwo Asenso-Okyere (Director) and Drs. Wayo Seini and S. Abdulai (staff) of the Institute of Statistical, Social and Economic Research in Ghana, Barbara Wharton and Marla Mamrick, both of The Ohio State University (Appendix B). The instrument was designed to collect data on: the level of telematics usage in Ghana with particular reference to the level of computer literacy and computerization in institutions and organizations in terms

\(^{32}\) This population includes multinational institutions operating in Ghana.

\(^{33}\) Where N=population and n=sample.
of information production and consumption; information sharing networks; and the nature of telecommunications services and facilities provided to networks.

Content validity of the instruments was established by a panel of experts consisting of graduate students and faculty in and outside The Ohio State University (Appendix C). These experts critically examined the instrument to determine if the questions did indeed represent adequately the content domain. Feedback from the panel was used to improve the content of the instrument.

The instrument was pilot tested to establish statistical reliability. Ten Ghanaians in the United States who have sufficient knowledge of the state of ICT development in Ghana and did not participate in the study were used for the pilot test. Cronbach's alpha was used to determine internal consistency for the summated variables.

The questionnaire covers five areas: general or organisational information; infostructure; communication infrastructure; constraints and barriers; and donor assistance. The general or organisational section identifies the organisation and determines the position of the respondent and the levels of competence and computer usage of various groups of people in the organisation. The infostructure section is intended to determine who produces information and who consumes it. It searches for how the information is produced; how the information gets to the consumers; and whether information produced by other organisations helps another organisation achieve its objectives.

The communication infrastructure section is geared toward determining whether users participate in an information-sharing network, the purpose of the network if they do, and the hardware and services they have access to. While there are many constraints
to the spread of networks in developing nations, generally, the major obstacle to overcome is the lack of a large, widely distributed, demanding and well-trained user community (Hudson, 1997). The final section seeks information about donor assistance, since there have been several externally funded initiatives to get developing countries connected to the global network - the Internet.

The researcher chose survey questionnaires for their efficiency in relation to the amount of time involved to complete the study and their ability to gather data from respondents (Gay, 1987). This data can also be guaranteed to be held confidential, thus perhaps allowing honest, direct answers. In addition, this method is less expensive to administer than other methods. The researcher included a token of appreciation, a Paper Mate flexgrip ultra pencil, with every single questionnaire. This gift was used as an incentive to encourage responses. However, the majority of the questionnaires were returned with pen marks all over them making survey scanning very difficult.

Data Collection Procedure

The process of data collection began with the design of the instrument, which was done by the researcher. As already explained, a questionnaire was developed and critically examined by a panel of experts. A final version of the instrument was revised for the study.

A two-step data collection process was used. The first step of the process was the delivery of the survey questionnaire and the second, within a few weeks, served as a follow up or retrieval of the completed questionnaire. A cover letter was attached to each questionnaire to explain the purpose of the study, and specific instructions were given to
guide participants in correctly entering their responses on the survey (see Appendix A). Due to the mailing system in Ghana, mailing surveys was avoided at all cost and where responses were not received on time, they were counted as non-responsive. In fact, survey questionnaires were delivered personally by the researcher and both paid and unpaid volunteers.

This process became possible with the help of the Student and Youth Travel Organization (SYTO), a non-profit organization with a large student base. With the help of Ms. Marian Thompson (Managing Director) and the direct assistance of Ms. Doris Afriyie (Program Manager), the researcher was able to solicit the help of university students for the administration of the survey. All the research assistants had a day’s training and were given specific people to contact from their locality. In all, 50 students from the three major tertiary institutions in Ghana were represented, with each responsible for one survey participant.

As a paid volunteer, a staff member from Network Computer Systems (NCS) covered participants who were on the list but were difficult to reach because of limited time and scheduling. This volunteer was reimbursed to cover 100 participants for a fee of $1 per survey instrument administered and $500 for his assistance. The staff member who was selected for this project spent a day with the researcher while questionnaires were being administered. The researcher then administered the rest of the surveys based on participants identified as very important but difficult to access by both the paid and unpaid volunteers.

Common knowledge among researchers in Ghana is the fear of people giving information to strangers. Moreover, with the limited time required to complete the
questionnaire, apathy and unwillingness to cooperate by survey participants was a concern. In spite of these concerns, the response rate was about 61%, far exceeding expectations. Although some questions were presumably left unanswered by respondents for fear of divulging too much information to the competition, the surveys received had meaningful responses to be used in the data analysis. The effectiveness of this technique by and large was to increase the response rate for the study while at the same time covering all the participants who had been chosen for the study.

Out of the 200 survey questionnaires administered, the researcher received 121 completed questionnaires. As of the time of the preparation of this manuscript, the rest of the questionnaires that had not arrived in time were considered non-responsive. From our numbered surveys, we could tell who had not returned their questionnaires but no attempt was made to follow up because the general consensus in Ghana was that if the person did not respond to it the first time, s/he would not be interested the second time around. The researcher was not bothered much by this phenomenon because the non-responsive participants came from all the sectors that were under study, so it did not significantly skew the data.34

Data Analysis Procedure

The data collected from the questionnaire was analyzed using various descriptive statistics such as frequency distribution, contingency tables, graphs and measures of association with the assistance of the SPSS software at The Ohio State University.

34 On a research note, the final step for data collection had been taken initially, thereby making extra steps almost impossible. If the survey instrument had been mailed, then it would have made sense to follow up with non-respondents even with physical contact if could be afforded.
All these analyses were done with the major purpose of finding the level of telematics usage in Ghana with particular reference to the levels of computer literacy and computerization in institutions and organizations in terms of information production and consumption; information sharing networks; and the nature of telecommunications services and facilities provided to networks. This knowledge has the potential to add more dimensions and understanding to policy planning and has implications for telecommunications investment, infrastructure planning and economic development or growth in Ghana. The baseline data generated here would serve as a starting point for further future ICT research in Ghana and a comparable case study for other African countries.

Assumptions

For the purpose of conducting this study, the researcher is making the following assumptions:

1. All things being equal, the assertions by Cronin et al. (1991; 1993a; 1993b), Hardy (1980), and Dholakia and Harlam (1994) are true and substantiated in developed countries.

2. The questionnaire developed for this study will provide a sufficiently valid and reliable measure of the constructs it is supposed to measure.

3. The participants selected for this study truly possesses the necessary information about the subject and the population in question.
Limitations of Scope

To keep this study to a manageable size, the following limitations have been adopted:

1. The study is limited to personnel in institutions and organizations in the Accra/Tema, Cape Coast and Kumasi metropolitan areas.

2. A sizeable population in the telematics industry is not included ("Mum and Pap").

3. The results are limited to the reliability and validity of the questionnaire.

4. The results are limited to the time the study took place.

5. The results are limited to the perceptions and honesty of the participants.

6. The researcher's judgment may be in error in estimating the representativeness of the sample or the participants' expertise regarding the information needed.
CHAPTER 4

ANALYSIS OF DATA

Introduction

Information and Communication Technologies (ICT) are not only a significant factor in the performance and growth of economies - the importance of which is continuously growing, but they also represent a novel and effective tool to help advance sustainable human development. Research and studies reviewed, as well as knowledge in the field of telecommunications and development, support the relationship that exists - either as a vital catalyst or a causal relationship.

The purpose of this study was to investigate the level of telematics usage in Ghana, with particular reference to the level of computer literacy and computerization in institutions and organizations in terms of information production and consumption; information sharing networks; and the nature of telecommunications services and facilities provided to networks. This inquiry will provide a knowledge base to help facilitate the decisions of policy makers, create a baseline criterion for future studies, and also, by comparison, make a case study for Ghana as a leader in the information technology revolution in West Africa and a viable place for foreign investments dependent on ICTs.
In this study, several questions were presented in Chapter I to further our investigations. As with most research study, there are no definitive answers to these questions. However, given the limitation that the results of the statistical analysis are only representative of the population from which the sample was chosen and representative only to the extent that the selection truly captures people with real knowledge of the subject matter, responses to the questions posed can provide insights beyond the three selected metropolitan areas even though the detailed experiences are inevitably region specific. The data, while selective in breadth of coverage, are complementary in providing depth of insight about the factors influencing ICT dissemination, usage, and literacy in Ghana.

This chapter presents the findings of the data analysis. The data interpretation is confined strictly to a reconstruction of what the survey participants presented as their observations and opinions. An attempt is made to reflect the participants' perspectives throughout the analysis even if this is not explicitly stated. The data is reported as the number of times the value occurs (the frequency, or count) and the [valid] percentage of the total sample size for each count.\textsuperscript{35} The chapter is organized into six sections:

1. Description of Organizations / Institutions
2. Production, Dissemination and Consumption of Information
3. Information Sharing Network
4. Telecommunication Services and Facilities
5. Regulatory Framework and Constraints to Telematics Usage
6. Research Questions

\textsuperscript{35} It is important to use valid percent values instead of the percentage of the total sample size for each count in cases where there is missing data or values. For the percentage calculations, SPSS uses the number of values present instead of the total number of cases in the sample.
Description of Organizations / Institutions

The general and organizational information on the survey questionnaire describes the background of the survey participants. As shown in Table 3, the majority of the respondents were males, 70.2%, with only 26.4% of the respondents being female. Yet, despite their under-representation within the ICT sector in Ghana, almost two-thirds of the females who responded to the survey were in a top or middle level management position (75%) – almost proportional to the male percentage (87.7%).

As indicated by Table 4, 28.0% of the respondents were in the academic/research community, 15.0% in government organizations, 10.7% in NGOs, 35.7% in commercial ventures, 3.5% in financial institutions, 2.8% in multinational organizations, and 4.3% in other stated communities.

It is obvious that with solid teamwork from the academic/research community and the commercial community, a solid relationship could be forged to boost the nation’s ICT efforts. More than half (67.8%) of the respondents indicated that their organization is both an information producer and consumer as against 19.0% consumers and 9.9% producers.

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36 There might be a good reason for this disparity, but this goes back to the core argument of the disproportionate number of women in the sciences in Ghana. In fact, it has been argued that, unless all the citizenry are given equal opportunity to be educated and support the economic growth of the society, third world countries do not stand a chance in competing in the emerging global order.
<table>
<thead>
<tr>
<th>Position</th>
<th>Missing Data</th>
<th>Count</th>
<th>% within Q2</th>
<th>% of Total</th>
<th>Count</th>
<th>% within Q2</th>
<th>% of Total</th>
<th>Count</th>
<th>% within Q2</th>
<th>% of Total</th>
<th>Count</th>
<th>% within Q2</th>
<th>% of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top Level</td>
<td>Count</td>
<td>1</td>
<td>25.0%</td>
<td>.8%</td>
<td>32</td>
<td>37.6%</td>
<td>26.4%</td>
<td>1</td>
<td>3.1%</td>
<td>.8%</td>
<td>34</td>
<td>28.1%</td>
<td>28.1%</td>
</tr>
<tr>
<td>Middle Level</td>
<td>Count</td>
<td>3</td>
<td>75.0%</td>
<td>2.5%</td>
<td>40</td>
<td>47.1%</td>
<td>33.1%</td>
<td>23</td>
<td>71.9%</td>
<td>19.0%</td>
<td>66</td>
<td>55.5%</td>
<td>55.5%</td>
</tr>
<tr>
<td>Low Level</td>
<td>Count</td>
<td>10</td>
<td>11.8%</td>
<td>8.3%</td>
<td>3</td>
<td>9.4%</td>
<td>2.5%</td>
<td>13</td>
<td>10.7%</td>
<td>10.7%</td>
<td>13</td>
<td>10.7%</td>
<td>10.7%</td>
</tr>
<tr>
<td>Other</td>
<td>Count</td>
<td>2</td>
<td>2.4%</td>
<td>1.7%</td>
<td>1</td>
<td>3.1%</td>
<td>.8%</td>
<td>3</td>
<td>2.5%</td>
<td>2.5%</td>
<td>3</td>
<td>2.5%</td>
<td>2.5%</td>
</tr>
<tr>
<td>Total</td>
<td>Count</td>
<td>4</td>
<td>100.0%</td>
<td>3.3%</td>
<td>85</td>
<td>100.0%</td>
<td>70.2%</td>
<td>32</td>
<td>100.0%</td>
<td>26.4%</td>
<td>121</td>
<td>100.0%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

Table 3: Crosstabulation of Sex and Position

Table 5 shows the self-described computer literacy levels of various groups of people in organizations/institutions that responded to the survey. As indicated in the table, the level of literacy is top down with top-level management being the most computer literate among the three groups.

Depending on the context (Table 7), attitude towards innovation or change could be interpreted differently. In a decreasingly supportive attitude to change, top level management strongly (47.1%) supports innovation as compared to 38.5% for middle level management and 14.3% for low level management.

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3.3% of the respondents did not report their sex.
<table>
<thead>
<tr>
<th>Type of Organization</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic/Research</td>
<td>39</td>
<td>28.0</td>
</tr>
<tr>
<td>Government</td>
<td>21</td>
<td>15.0</td>
</tr>
<tr>
<td>NGO</td>
<td>15</td>
<td>10.7</td>
</tr>
<tr>
<td>Commercial</td>
<td>50</td>
<td>35.7</td>
</tr>
<tr>
<td>Financial</td>
<td>5</td>
<td>3.5</td>
</tr>
<tr>
<td>Multinational</td>
<td>4</td>
<td>2.8</td>
</tr>
<tr>
<td>Other</td>
<td>6</td>
<td>4.3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>140</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

Table 4: Categories of Organizations / Institutions

<table>
<thead>
<tr>
<th>Personnel</th>
<th>High Literacy (%)</th>
<th>Average Literacy (%)</th>
<th>Low Literacy (%)</th>
<th>Non Use (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top Level</td>
<td>52.3</td>
<td>26.7</td>
<td>31.5</td>
<td>4.0</td>
</tr>
<tr>
<td>Middle Level</td>
<td>32.7</td>
<td>40.7</td>
<td>26.0</td>
<td>4.0</td>
</tr>
<tr>
<td>Low Level</td>
<td>15.0</td>
<td>32.6</td>
<td>42.5</td>
<td>92.0</td>
</tr>
<tr>
<td><strong>Total (%)</strong></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Table 5: Level of Computer Literacy

38 The total of this table exceeds 121 returned questionnaires because of the double counting of organizations that identified themselves as both Academic/Research and government (9) and Academic/Research and Commercial (10).

39 It is important to interpret these responses in relation to the sample size and the number of returned questionnaire (see Table 2).
Though low level personnel do not care if this innovation happens or not (76.5%), they would rather welcome it. In fact, when asked about the attitude of the three groups towards change (Table 7), respondents indicated that 40.5% of low level personnel would welcome innovation as compared to 25.2% of top level management. The enthusiasm being shown by top-level management is tempered with caution by the lower level management, who see the benefit of the technology but would not be overzealous in its application.

<table>
<thead>
<tr>
<th>Personnel</th>
<th>High Users (%)</th>
<th>Average Users (%)</th>
<th>Low Users (%)</th>
<th>Non User (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top Level</td>
<td>29.8</td>
<td>47.3</td>
<td>32.8</td>
<td>13.0</td>
</tr>
<tr>
<td>Middle Level</td>
<td>56.7</td>
<td>4.3</td>
<td>24.1</td>
<td>3.2</td>
</tr>
<tr>
<td>Low Level</td>
<td>13.5</td>
<td>48.4</td>
<td>43.1</td>
<td>83.8</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 6: Level of Computer Usage

<table>
<thead>
<tr>
<th>Personnel</th>
<th>Very Supportive (%)</th>
<th>Welcoming (%)</th>
<th>Indifferent (%)</th>
<th>Discouraging (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top Level</td>
<td>47.1</td>
<td>25.2</td>
<td>23.5</td>
<td>15.3</td>
</tr>
<tr>
<td>Middle Level</td>
<td>38.5</td>
<td>34.3</td>
<td>0</td>
<td>54.0</td>
</tr>
<tr>
<td>Low Level</td>
<td>14.3</td>
<td>40.5</td>
<td>76.5</td>
<td>30.7</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 7: Attitudes of Groups Towards Change
Production, dissemination and consumption of information

Despite the indication from almost 70% of the respondents that their organizations are both information producers and consumers, the types of information produced and consumed also reflects the nature and functions of the institutions surveyed. As shown in Table 8, over 27% of the organizations that responded produced information that furthered the cause of academic/research agendas. Of the valid respondents, 7.1% indicated that their organization/institution produces both academic/research and economic information whereas 5.1% indicated that their organization/institution produced both academic/research and financial information.

Health/medical and social information are also produced by some institutions but in both cases the institutions involved form less than 15% of the sample (7.1% and 9.1%, respectively). At least 4% of the respondents indicated that they produce economic and social information. While it might look as if some of the respondents did not produce any information, these were participants who had previously indicated they were information consumers only. A few respondents, however, indicated a combination of other types of information. Though significant, all the institutions involved form less than 15% of the sample, with the most important being academic/research and economic (5.8%), followed closely by academic/research and finance (4.1%) and economic and social information types (3.3%)

Other information types that were not specified in the questionnaire accounted for 13.1% of the surveys returned. As specified by respondents, these included statistical data, policy information, and technical and media information, to mention a few.
<table>
<thead>
<tr>
<th>Type of Information</th>
<th># of Organizations</th>
<th>Sample Percent</th>
<th>Valid Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic/Research</td>
<td>27</td>
<td>22.3</td>
<td>27.3</td>
</tr>
<tr>
<td>Economic</td>
<td>13</td>
<td>10.7</td>
<td>13.1</td>
</tr>
<tr>
<td>Social</td>
<td>9</td>
<td>7.4</td>
<td>9.1</td>
</tr>
<tr>
<td>Health/Medical</td>
<td>7</td>
<td>5.8</td>
<td>7.1</td>
</tr>
<tr>
<td>Financial</td>
<td>14</td>
<td>11.6</td>
<td>14.1</td>
</tr>
<tr>
<td>Other</td>
<td>13</td>
<td>10.7</td>
<td>13.1</td>
</tr>
<tr>
<td>Acad./Res. &amp; Econ.</td>
<td>7</td>
<td>5.8</td>
<td>7.1</td>
</tr>
<tr>
<td>Acad./Res. &amp; Fin.</td>
<td>5</td>
<td>4.1</td>
<td>5.1</td>
</tr>
<tr>
<td>Econ. &amp; Social</td>
<td>4</td>
<td>3.3</td>
<td>4.0</td>
</tr>
<tr>
<td>Missing</td>
<td>22</td>
<td>18.2</td>
<td>0.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>121</strong></td>
<td><strong>100.0</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

Table 8: Type of Information Produced

Respondents (28.3%) identified the business community as the largest perceived consumer of the information generated. If one considers the type of information important to the business community (economic and financial information), one would understand the significance of this data. Yet 23% of the respondents indicated that they perceive the academic/research community to be major consumers of information produced, followed closely by the combination of academic/research community and the business community (20.2%).
Over 10% of the respondents perceived policy/decision makers as consumers of the information they produce. Following closely were International Bodies (6.1%), Related Organizations (3%), and NGOs (1%), which formed less than 10% of the responding survey participants. Other types of consumers, who accounted for 8% of the returned surveys, were specified by respondents to include media personnel, government, general public, and individual clients, to mention a few.

<table>
<thead>
<tr>
<th>Consumers</th>
<th># of Organizations</th>
<th>Sample Percent</th>
<th>Valid Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic/Research</td>
<td>23</td>
<td>19.0</td>
<td>23.2</td>
</tr>
<tr>
<td>Business Community</td>
<td>28</td>
<td>23.1</td>
<td>28.3</td>
</tr>
<tr>
<td>Policy/Decision Makers</td>
<td>10</td>
<td>8.3</td>
<td>10.1</td>
</tr>
<tr>
<td>NGOs</td>
<td>1</td>
<td>0.8</td>
<td>1.0</td>
</tr>
<tr>
<td>International Bodies</td>
<td>6</td>
<td>5.0</td>
<td>6.1</td>
</tr>
<tr>
<td>Related Organizations</td>
<td>3</td>
<td>2.5</td>
<td>3.0</td>
</tr>
<tr>
<td>Other</td>
<td>8</td>
<td>6.6</td>
<td>8.0</td>
</tr>
<tr>
<td>Acad./Res. &amp; Business Community</td>
<td>20</td>
<td>16.5</td>
<td>20.2</td>
</tr>
<tr>
<td>Missing</td>
<td>22</td>
<td>18.2</td>
<td>0.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>121</strong></td>
<td><strong>100.0</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

Table 9: Perceived Consumers of Information

How information was distributed also contributed to the perceived consumers. Information could be physically disseminated through print, microfiche, and/or
diskettes/tapes. If electronically disseminated, consumers could receive it either through fax/telephone, email, radio and/or other specified source. In the survey, some of the organizations (12.4%) indicated they disseminate information physically through diskettes/tapes. Surprisingly, the use of microfiche (8.2%) to disseminate information edged the old method of print media (5.2%) to third place. A combination of Print and Diskettes/Tapes accounted for 3.1% of the information disseminated physically (not wired).

<table>
<thead>
<tr>
<th>Mode</th>
<th># of Organizations</th>
<th>Sample Percent</th>
<th>Valid Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wired$^{40}$</td>
<td>47</td>
<td>38.9</td>
<td>48.4</td>
</tr>
<tr>
<td>Less Wired$^{41}$</td>
<td>12</td>
<td>10.0</td>
<td>12.4</td>
</tr>
<tr>
<td>Not Wired$^{42}$</td>
<td>28</td>
<td>23.0</td>
<td>28.9</td>
</tr>
<tr>
<td>Other</td>
<td>10</td>
<td>8.3</td>
<td>10.3</td>
</tr>
<tr>
<td>Missing</td>
<td>24</td>
<td>19.8</td>
<td>0.0</td>
</tr>
<tr>
<td>Total</td>
<td>121</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 10: Mode of Information Dissemination

Electronically, disseminating information with the help of email (18.5%) was identified as the most important means of transmission. Though a combination of email

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$^{40}$ Combining respondents who identified their mode of information dissemination to be email only, fax/telephone only, radio only, fax/telephone and email, and fax/telephone and radio created this category.  
$^{41}$ This category is a combination of Diskettes/Tapes and Email, and Fax/Telephone and Print responses.  
$^{42}$ Respondents who identified their mode of information dissemination as Print only, Microfiche only, Diskettes/Tapes only and Print and Diskettes/Tapes were placed in this category.
and fax/telephone (11.3%) followed closely in electronic transmission, one could not ignore the prominence of email and diskettes/tapes (10.3%). Fax/telephones (7.2%) also fared well in electronic information transmission, yet we could not overlook the good showing of radio (6.2%) as part of electronic information transmission. In all, it is evident that the combination of all the electronic means of information transmission (wired and less wired) accounted for almost 61% of the overall information transmission.

On the information profile of organizations surveyed, we identified the importance of academic/research and economic information. While academic/research and economic information alone accounted for 24.7% and 30.6%, respectively of the returned sample, in combination, they accounted for 11.6% of the returned sample. Which means, should we put all these figures together, respondents who identified their organization's information profile to be either academic/research, economic or both accounted for almost 67% of the returned sample.

Over 8% of the respondents identified their organization's information profile as social. In fact, in combination, 8% of the respondents identified their organization's information profile to be economic and social. Other types of information profile which represented over 10% of the responding sample were identified to include financial, business, statistical, commercial and technical information.

The sources of information are important in policy formulation, particularly in shaping the regulatory framework for telematics usage. Local sources call for policies that will promote domestic growth in information production and consumption, while external sources call for policies that will ensure free flow of good quality information in a less stringent regulatory environment.
<table>
<thead>
<tr>
<th>Type of Information</th>
<th># of Organizations</th>
<th>Sample Percent</th>
<th>Valid Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic/Research</td>
<td>30</td>
<td>24.7</td>
<td>26.5</td>
</tr>
<tr>
<td>Economic</td>
<td>37</td>
<td>30.6</td>
<td>32.7</td>
</tr>
<tr>
<td>Social</td>
<td>10</td>
<td>8.3</td>
<td>8.8</td>
</tr>
<tr>
<td>Political</td>
<td>1</td>
<td>0.8</td>
<td>0.9</td>
</tr>
<tr>
<td>Other</td>
<td>12</td>
<td>10.0</td>
<td>10.6</td>
</tr>
<tr>
<td>Acad./Res. &amp; Economic</td>
<td>14</td>
<td>11.6</td>
<td>12.4</td>
</tr>
<tr>
<td>Economic &amp; Social</td>
<td>9</td>
<td>7.4</td>
<td>8.0</td>
</tr>
<tr>
<td>Missing</td>
<td>8</td>
<td>6.6</td>
<td>0.0</td>
</tr>
<tr>
<td>Total</td>
<td>121</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 11: Classification of Information Profile

In Table 12, both in country and external sources are significant for information consumers. The fact that 70 organizations identified their information consumption source to be all of the above suggested the appearance of a vigorous interaction between Ghana and the outside world in information trade. Only 35 organizations indicated that their information sources were entirely from either in country (21.4%) or external (7.4%). On the other hand, 30% of the organizations not interacting with the outside world is significant enough for caution. Unless the nature of their work does not require them to interact with the outside world, despite the 70% interaction, these organizations should be encouraged to interact in both markets for their information. This suggestion is in the right direction because 90.1% of the respondents indicated that information produced by
other organizations or institutions helps their organization to achieve its objectives while 78.5% acknowledged the importance of such information in their organizations decision making.

<table>
<thead>
<tr>
<th>Source</th>
<th># of Organizations</th>
<th>Sample Percentage</th>
<th>Valid Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Locally</td>
<td>6</td>
<td>4.9</td>
<td>5.7</td>
</tr>
<tr>
<td>Within Ghana</td>
<td>20</td>
<td>16.5</td>
<td>19.0</td>
</tr>
<tr>
<td>Regionally</td>
<td>4</td>
<td>3.3</td>
<td>3.8</td>
</tr>
<tr>
<td>Worldwide</td>
<td>5</td>
<td>4.1</td>
<td>4.8</td>
</tr>
<tr>
<td>All of the Above</td>
<td>70</td>
<td>57.9</td>
<td>66.7</td>
</tr>
<tr>
<td>Missing</td>
<td>16</td>
<td>13.2</td>
<td>0.0</td>
</tr>
<tr>
<td>Total</td>
<td>121</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 12: Source of Information Consumed by Organizations

To make this suggestion more compelling, with the exception of NGO's that operated only locally and within Ghana more than worldwide, the majority of the respondents acknowledged that their organizations operated in the local, regional, and worldwide markets. This information is important and indicates that there is a vigorous interaction between Ghana and the outside world in information trade.

43 Since respondents were asked to answer “Yes” or “No” for each item pertaining to their organizations source of information consumption, each source was analyzed as a unit of its own with only “Yes” responses reported here.
<table>
<thead>
<tr>
<th>Organization/Source of Information</th>
<th>Local</th>
<th>Regional</th>
<th>World-Wide</th>
<th>All of the Above</th>
<th>Missing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic/Research</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Government</td>
<td>2</td>
<td></td>
<td></td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>NGO</td>
<td>7</td>
<td>1</td>
<td>2</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Commercial</td>
<td>7</td>
<td></td>
<td></td>
<td>25</td>
<td>8</td>
</tr>
<tr>
<td>Financial</td>
<td>1</td>
<td></td>
<td></td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Multinational</td>
<td></td>
<td></td>
<td></td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Acad./Research &amp; Government</td>
<td>1</td>
<td>2</td>
<td></td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Academic/Research &amp; Commercial</td>
<td>4</td>
<td>1</td>
<td></td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Other</td>
<td>1</td>
<td>1</td>
<td></td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

Table 13: Relationship between Organizations and Source of Information Consumed

Information Sharing Network

The emerging current global dynamics has necessitated the need for countries and societies to be part of the emerging global ICT network. Involvement in this network is an attempt by these societies or establishments to stay competitive and involved in the emerging market structure.

Networking in telematics is a means of linking workers, firms, institutions, regions or countries together through computers. Thus, computers, apart from their traditional function of storing and processing data and information, can also be used to

---

44 In this analysis respondents who identified their information consumption as local or within Ghana were combined.
link distant users to exchange information through the use of telephone, radio, and satellite.

We have three forms of networks: the local area network (LAN), the wide area network (WAN), and the Internet. Through these networks, the exchange of information and dissemination of knowledge has been effected without large expense of time, labor and cost. The minimization of time, labor and cost, however, has been successful due to the elimination of the cost of long trips and the cumbersome nature of arranging face-to-face meetings among busy people.

Therefore, to stay comparatively competitive and efficient in the global market and make decisions in line with the needs of the society but relevant to the global structure, organizations and institutions need to participate in information sharing networks. As shown in Figure 2, over 74% of the organizations and institutions surveyed participate in networks.

Though the purpose for this participation may vary depending on the nature of the work, it is obvious that participation is mostly generated by sister organizations (33.9%) which spread across regions. Though this participation is still within Ghana, there is an indication of a healthy network of ICTs in Ghana. In fact, branch offices of organizations and institutions (for example, the banks, government agencies, and NGOs, to mention a few) have also helped in the dissemination of the technology and a strong networking

---

45 A LAN is a group of interconnected microcomputers having access to programs and data on file server and host minicomputers. A WAN is the linkage of local PC networks over long distance and multiple locations. An Internet - often referred to as the "Net" - is composed of a massive number of computers linked together through a worldwide, high-speed, telecommunications network.
system in Ghana. To buttress recognition of the healthy nature of the network system in Ghana, Table 14 presents the spread of network participants.

The choices “same city,” “same metropolis,” “same region” and/or “across regions” reflect the diverse network partnerships and the extent of information dissemination in Ghana. In fact, of the organizations that participate in networks, almost half (48%) indicated that other participants of the network are located across regions.

Figure 2: Network Participation

Not only is it significant for us to acknowledge the efforts being placed on achieving the spread of the technology in Ghana, efforts to bridge the gap between the “north” and the “south” also need to be recognized. As identified in Table 14, almost a
quarter of the organization (24.8%) maintains network partnerships abroad. These efforts could not be achieved without the sophistication of the information communication technologies and the full utilization of the appropriate network useful for the kinds of functions being performed. It is therefore not surprising that we find snippets of within same city (7.4%), within same metropolis (5.8%), and within region (9.1%). The success of all these could also be attributed to the appropriate use of telephone, microwave radio, and satellite.

<table>
<thead>
<tr>
<th>Location</th>
<th># of Organizations</th>
<th>Sample Percentage</th>
<th>Valid Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Same City</td>
<td>9</td>
<td>7.4</td>
<td>7.8</td>
</tr>
<tr>
<td>Same Metropolis</td>
<td>7</td>
<td>5.8</td>
<td>6.1</td>
</tr>
<tr>
<td>Same Region</td>
<td>11</td>
<td>9.1</td>
<td>9.6</td>
</tr>
<tr>
<td>Across Regions</td>
<td>58</td>
<td>48.0</td>
<td>50.4</td>
</tr>
<tr>
<td>Abroad</td>
<td>30</td>
<td>24.8</td>
<td>26.1</td>
</tr>
<tr>
<td>Missing</td>
<td>6</td>
<td>4.9</td>
<td>0.0</td>
</tr>
<tr>
<td>Total</td>
<td>121</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 14: Location of Network Participants

As with the purported confidentiality and privacy ensured with signing on to the Internet, most organizations (51.2%) involved in networking indicated that they entered
into formal agreement for their information sharing networks. Due to the understanding of a legal agreement and the honesty of confidentiality and privacy, participants, despite the uneasy feelings about information sharing in Ghana, willingly shared information (73.6%).

Although a few organizations and institutions have expressed their uneasiness about the ICT and information sharing (7.4%), their willingness to share was supported by the overall positive organizational attitude towards change and information sharing. From Table 14, more than two-thirds of the respondents (80.1%) acknowledged the very good or welcoming attitude of their organizations towards information sharing. It could be inferred that such grounded confidence establishes a well-grounded foundation for the advancement of telematics usage and investment in Ghana.

However, when attitude towards information sharing was compared to the type of information being shared, responses varied. In this instance, more than half of the respondents (64.1%) who acknowledged the very good attitude of their organization towards information sharing were talking about predominantly academic/research information only (43.6%) or sometimes in combination with economic information (12.8%) or financial information (7.7%).

Irrespective of how this positive attitude towards information sharing and type of information in Table 15 might look, there is a concern if one looks closely at the table. About 46.1% of the respondents who dealt with economic information were either indifferent or felt discouraged about the current existing information network. Without

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46 This category includes respondents who only checked “across regions” as the location of other participants in their network and also those who picked from “a to d” (including across regions) as the location of their network participants.
counting the missing items, more than half (54%) of the respondents who identified their information type to be financial had no confidence in the current information-sharing network. These isolated instances require a closer look because of the type of information in question. Organizations or institutions that depend on this type of information cannot afford to be left behind the global information sharing networks.  

<table>
<thead>
<tr>
<th>Attitude</th>
<th># of Organizations</th>
<th>Sample Percentage</th>
<th>Valid Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Good</td>
<td>39</td>
<td>32.2</td>
<td>34.2</td>
</tr>
<tr>
<td>Welcoming</td>
<td>58</td>
<td>47.9</td>
<td>50.9</td>
</tr>
<tr>
<td>Indifferent</td>
<td>8</td>
<td>6.6</td>
<td>7.0</td>
</tr>
<tr>
<td>Discouraging</td>
<td>9</td>
<td>7.4</td>
<td>7.9</td>
</tr>
<tr>
<td>Missing</td>
<td>7</td>
<td>5.8</td>
<td>0.0</td>
</tr>
<tr>
<td>Total</td>
<td>121</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 15: Attitudes Towards Information Sharing

There are qualitatively different impacts and opportunities for distinct modes of information exchange mechanisms between organizations, institutions, activities and patterns of work organizations. Distinct information exchange mechanisms in this context refers to traditional means of communication and new means of communication – that is,  

47 The strength of this analysis is dependent on the fact that of the 27 respondents who identified the type of information they produce as economic or financial, (with the exception one of the missing respondent) 13 were either indifferent or discouraged.
electronics based means. There are at least two distinct trends in networking activities. The first portrays electronic networks simply as substituting for traditional means of information exchange. The second view is more dynamic and probably more accurate. It suggests that ICT-based networking is growing in importance, and that it supports growth in social and other means of information exchange rather than simply improving on traditional processes, while new functions are developing in a complementary manner. With a broader proliferation of ICT then, there is both a deepening and widening\textsuperscript{48} of information usage, altering traditional forms of organizations (OECD, 1992).

In this instance, network participants also receive information either electronically or physically. Of the organizations and institutions that participated in networks, 11.6\% of them transmit information to participants of the network electronically, 3.3\% transmit information to participants of the network physically, but a resounding 67.8\% of the participants responded that their organization transmits information to participants of the network using both modes.

While the mode of transmission is equally important to this research, the medium being used is significant to the understanding of the impact of ICTs in Ghana. As shown in Table 17, out of the electronic mode of transmission, including the use of fax/telephone, radio, email, and other internet services, which were specified by respondents to include the WWW and file transfer, 8.3\% of the organizations identified the use of fax/telephones as their medium of transmission of information to network

\textsuperscript{48} Deepening refers to the intensification of information flows within the production processes or any other business activities. Widening emphasizes the extension of network links beyond the single operation or organization. This shift, bringing the integration of production and consumption processes to the center stage of innovation may create new growth potential.
participants. 4.9% of the respondents indicated their organizations use radio as the medium of transmission while 10% specified other means of information transmission which included WWW, file transfer and so on. However, over 17% of the respondents identified email as their organization's or institution's electronic medium of information sharing on their network.

<table>
<thead>
<tr>
<th>Type of Information / Attitude</th>
<th>Very Good (%)</th>
<th>Welcoming (%)</th>
<th>Indifferent (%)</th>
<th>Discouraging (%)</th>
<th>Missing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic/Research</td>
<td>43.5 (17)</td>
<td>9</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Economic</td>
<td>2</td>
<td>5</td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Social</td>
<td>3</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health/Medical</td>
<td>5</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Financial</td>
<td>1</td>
<td>5</td>
<td>15.4 (2)</td>
<td>38.5 (5)</td>
<td>1</td>
</tr>
<tr>
<td>Other</td>
<td>2</td>
<td>10</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acad./Res. &amp; Economic</td>
<td>12.8 (5)</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Academic/Research &amp; Financial</td>
<td>7.7 (3)</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Economic/Social</td>
<td>1</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Missing</td>
<td>14</td>
<td>1</td>
<td>1</td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>

Table 16: Relationship Between Attitudes Towards Information Sharing and Type of Information Produced

Overwhelmingly (40.8%), the combination of fax/telephone and email was identified as the common medium of transmitting information electronically to network
participants. While the combination of fax/telephone and radio accounted for only 9.2% of the electronic transmission of information to the network, it is important to acknowledge that organizations and institutions have seriously looked at all the appropriate and efficient means of sharing information replacing the old of face-to-face method, which involved cost, time and physical space.

<table>
<thead>
<tr>
<th>Medium</th>
<th># of Organizations</th>
<th>Sample Percentage</th>
<th>Valid Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fax/Telephone</td>
<td>10</td>
<td>8.3</td>
<td>10.2</td>
</tr>
<tr>
<td>Radio</td>
<td>6</td>
<td>4.9</td>
<td>6.1</td>
</tr>
<tr>
<td>Email</td>
<td>21</td>
<td>17.3</td>
<td>21.4</td>
</tr>
<tr>
<td>Other Internet Services</td>
<td>12</td>
<td>10.0</td>
<td>12.2</td>
</tr>
<tr>
<td>Fax/Telephone &amp; Email</td>
<td>40</td>
<td>33.1</td>
<td>40.8</td>
</tr>
<tr>
<td>Fax/Telephone &amp; Radio</td>
<td>9</td>
<td>7.4</td>
<td>9.2</td>
</tr>
<tr>
<td>None</td>
<td>23</td>
<td>19.0</td>
<td>0.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>121</strong></td>
<td><strong>100.0</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

Table 17: Means of Electronic Transmission of Information

On the contrary, where information was transmitted to network participants physically, 46% of the respondents said their organization or institution used the print medium. Occasionally (18.4%), printed materials also accompanied information on diskettes/tapes being transmitted to network participants. Yet, a sizable number of
organizations (34.5%) physically prefer to transmit information to network participants on diskettes/tapes to reduce the added cost, weight and burden of printed materials.

<table>
<thead>
<tr>
<th>Medium</th>
<th># of Organizations</th>
<th>Sample Percentage</th>
<th>Valid Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Print</td>
<td>40</td>
<td>33.1</td>
<td>46.0</td>
</tr>
<tr>
<td>Microfiche</td>
<td>1</td>
<td>0.8</td>
<td>1.1</td>
</tr>
<tr>
<td>Diskettes/Tapes</td>
<td>30</td>
<td>24.8</td>
<td>34.5</td>
</tr>
<tr>
<td>Print &amp; Diskettes/Tapes</td>
<td>16</td>
<td>13.2</td>
<td>18.4</td>
</tr>
<tr>
<td>None</td>
<td>34</td>
<td>28.1</td>
<td>0.0</td>
</tr>
<tr>
<td>Total</td>
<td>121</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 18: Means of Physical Transmission of Information

In Table 14, a significant number of organizations (24.8%) identified their other network participants as located abroad. For a developing country like Ghana, access to information abroad is very important for development of the country's ICT usage. Therefore, any obstacle to the free flow of information for networked organizations or institutions would be considered a hindrance to the development of an efficient and effective ICT. With this in mind, it was important for us to identify which organizations and institutions were networked and are able to exchange information internationally. From Figure 3, 93 respondents indicated that their organization and/or institution accesses or sends information abroad compared to 13 who indicated that their organizations/ institutions intend to access or send information abroad. With the little
technological innovation available, users have noticed that the only way to stay competitive is to be networked, not only locally but also internationally.

Figure 3: Have Access Abroad

But these decisions cannot be made in a vacuum. The method of sending information and the speed of information transmission need to be considered to see whether that process will be cost efficient. Due to the cost of having a dedicated line or lease line and the cost associated with peak and off peak hours, organizations and institutions which exchange information abroad use two different methods: 1) batched and sent (asynchronous) or 2) real time (synchronous).

From Figure 5, one can see that regardless of cost association, 55% of institutions and organizations that exchange information abroad uses the real time (instant) method to dispatch information. About 33.1% of institutions and organizations use the
asynchronous method, which is a more economical but slower method of sending information.

Figure 4: Intend to Have Access

The rationale for networking is not only to have easy access to information but also, in fact, networking in its broader sense goes beyond increasing "market intelligence" for business activities. It includes the intelligent and integrated use of internal and external information through computer integrated, global just-in-time systems to support and/or replace traditional production, distribution and research systems (Bugliarello, 1988; OECD, 1991). On this front, the compatibility and speed of the system being used becomes a central issue for successful networking.

These are valid percentages of the responses.
Interestingly, almost a third of the organizations and institutions (30.6%) did not know the speed at which information is transmitted to network participants. Of those who knew, 28.1% indicated that they transmit information at speeds between 19.2 and 64 Kbps, 14.9% indicated that they transmit information at speeds between 128 and 256 Kbps, and 7.4% indicated that they transmit information at speeds between 512 Kbps and 2 Mbps.

Figure 5: Method of Information Transmittal

Users of ICT in Ghana understand the relevance of speed and information retrieval and transmission, and the cost associated with such functions. Cumulatively, almost half of the valid respondents (48.2%) identified their organization’s or institution’s speed of information transmission as between 19.2 Kbps and 256 Kbps --
speeds sufficient to perform a lot of automation functions. While the majority of the respondents (45.5%) considered their current organizational speed of transmission to be adequate, those who felt the need for improvement in the speed of their organization or institution (36.4%) preferred speeds between 128 Kbps and 2Mbps.

<table>
<thead>
<tr>
<th>Speed</th>
<th># of Organizations</th>
<th>Sample Percentage</th>
<th>Valid Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.60 – 14.4 Kbps</td>
<td>3</td>
<td>2.5</td>
<td>2.7</td>
</tr>
<tr>
<td>19.2 – 64 Kbps</td>
<td>34</td>
<td>28.1</td>
<td>31.5</td>
</tr>
<tr>
<td>128 – 256 Kbps</td>
<td>18</td>
<td>14.9</td>
<td>16.7</td>
</tr>
<tr>
<td>512 Kbps – 2 Mbps</td>
<td>9</td>
<td>7.4</td>
<td>8.3</td>
</tr>
<tr>
<td>Don’t Know</td>
<td>37</td>
<td>30.6</td>
<td>34.3</td>
</tr>
<tr>
<td>Other</td>
<td>7</td>
<td>5.8</td>
<td>6.5</td>
</tr>
<tr>
<td>Missing</td>
<td>13</td>
<td>10.7</td>
<td>0.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>121</strong></td>
<td><strong>100.0</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

Table 19: Speed of Information Transmission

Investment in the technology by these organizations with clear understanding of what it adds to their competitiveness in the global market is manifested in Table 20. For effective ICT usage, the response time for desired information should be reasonable.

As indicated in Table 20, 25.6% of the respondents opined that their organizations or institutions receive responses to requested information instantly, 22.3% said information responses are received within an hour, while the majority (30.6%) of the
respondents said their response to requested information usually arrives within a day. Cumulatively, 80% of the valid organizations and institutions responded that they could secure a response to their information request at least within a day.

<table>
<thead>
<tr>
<th>Type of Response</th>
<th># of Organizations</th>
<th>Sample Percentage</th>
<th>Valid Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instantly</td>
<td>31</td>
<td>25.6</td>
<td>26.1</td>
</tr>
<tr>
<td>Within an Hour</td>
<td>27</td>
<td>22.3</td>
<td>22.7</td>
</tr>
<tr>
<td>Within a Day</td>
<td>37</td>
<td>30.6</td>
<td>31.1</td>
</tr>
<tr>
<td>2 Days</td>
<td>4</td>
<td>3.3</td>
<td>3.4</td>
</tr>
<tr>
<td>Within a Week</td>
<td>9</td>
<td>7.4</td>
<td>7.5</td>
</tr>
<tr>
<td>More Than a Week</td>
<td>5</td>
<td>4.1</td>
<td>4.2</td>
</tr>
<tr>
<td>Other</td>
<td>6</td>
<td>5.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Missing</td>
<td>2</td>
<td>1.7</td>
<td>0.0</td>
</tr>
<tr>
<td>Total</td>
<td>121</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 20: Response (turn-around) Time for Information

More than half (62.0%) of the respondents felt the response to information requests was good enough. For those who had some reservation about their response time, responses between instantly (51.8%) and within an hour (22.2%) were considered pretty reasonable. However, depending on functions, the rest of the respondents (26%) did not mind receiving responses to their information requests within a day or more than a week.
For effective telematics usage, the response time for desired information should be adequate. However when response time for information requested was compared with the type of information, a different picture emerged. Despite the quite impressive response rate (less than or equal to an hour) for information requested, it does not look that impressive considering that users of economic and financial information have to wait within a week on most occasions to receive responses to their information requests is taken into consideration. In fact, for users of health and medical information to wait for almost a week and sometimes beyond to receive responses of information requested creates an appearance of impropriety. It begs no question therefore to ensure that policies are aimed at pushing the response time for information within hours if not minutes.

Valid respondents who identified their organizations as part of a network opined that their organizations and institutions fail to further process all the information they receive. About 67% of the respondents indicated that participants do not further process information received. As evident in third world nations generally, and Ghana is no different, securing new infrastructure has never been a problem but supporting its continuous existence and maintaining it has always been a bone of contention in budgetary allocations. However, in this instance, payment for the usage and maintenance of ICT networks in Ghana has largely been effected by participants (43.8%) while government payments follow a distant third (15.7%) with other specified usage payments (21.5%), clearly sidestepping the normally relied upon benefactor, donor organizations. This picture does not say anything more than just that, Ghanaian organizations or institutions are willing to join and pay for a network once they know its benefits without relying on an outside support.
<table>
<thead>
<tr>
<th>Type of Information / Response Time</th>
<th>≤ One Hour (%)</th>
<th>1 - 2 Days (%)</th>
<th>3 - 7 Days (%)</th>
<th>&gt; a Week (%)</th>
<th>Other</th>
<th>Missing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic/Research</td>
<td>10</td>
<td>8</td>
<td>3</td>
<td>1</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Economic</td>
<td>6</td>
<td>4</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social</td>
<td>3</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health/Medical</td>
<td></td>
<td></td>
<td>2</td>
<td>3</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Financial</td>
<td>4</td>
<td>8</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>6</td>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Academic/Research &amp; Economic</td>
<td>4</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Academic/Research &amp; Financial</td>
<td>2</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Economic/Social</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Missing</td>
<td>21</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

Table 21: Relationship between Response Time for Information and Type of Information

Information on the level of payment for communications facilities, services and technical support was very scanty from the questionnaires that were received. However, as evident in Table 22, the majority of the institutions that answered the questions on payment for the various services seem to be at the lower end of the payment scale. For communications, about 92% (representing 31 organizations) paid as low as 250,000 cedis and as high as 3 million cedis annually. The other 3 organizations paid 5.1 million cedis and above.

Similarly, the majority of the 34 organizations (88.2%) that answered for the annual payment for network services indicated that they pay between 250,000 cedis and 3
million cedis. Just like communications, this phenomenon also applied to the 22 organizations that answered for technical support. Almost 96% of the organizations indicated they pay between the same range for communications and services.

<table>
<thead>
<tr>
<th>Value ('000 cedis)</th>
<th>Communication No.</th>
<th>Communication %</th>
<th>Service No.</th>
<th>Service %</th>
<th>Technical support No.</th>
<th>Technical support %</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 250</td>
<td>8</td>
<td>23.5</td>
<td>10</td>
<td>29.4</td>
<td>6</td>
<td>27.3</td>
</tr>
<tr>
<td>260 – 600</td>
<td>5</td>
<td>14.7</td>
<td>10</td>
<td>29.4</td>
<td>8</td>
<td>36.4</td>
</tr>
<tr>
<td>610 – 1000</td>
<td>7</td>
<td>20.6</td>
<td>0</td>
<td>0.0</td>
<td>4</td>
<td>18.2</td>
</tr>
<tr>
<td>1100 – 3000</td>
<td>11</td>
<td>32.4</td>
<td>10</td>
<td>29.4</td>
<td>3</td>
<td>13.6</td>
</tr>
<tr>
<td>3100 – 5000</td>
<td>0</td>
<td>0.0</td>
<td>2</td>
<td>5.9</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>5100 – 7000</td>
<td>1</td>
<td>2.9</td>
<td>1</td>
<td>2.9</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>7100 and above</td>
<td>2</td>
<td>5.9</td>
<td>1</td>
<td>2.9</td>
<td>1</td>
<td>4.5</td>
</tr>
<tr>
<td>Total</td>
<td>34</td>
<td>100.0</td>
<td>34</td>
<td>100.0</td>
<td>22</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 22: Annual Payment for Network Operations

Telecommunication Services and Facilities

Telecommunications involves use of an electronic conduit to transfer voice or data from point to point, or in mass diffusion from one to many points, such as broadcasting. It is often referred to as a core service since it facilitates the delivery of

50 Please note that some of the values presented here were converted to cedis using the daily exchange rate of 2,700 cedis to $1 as at 10/21/99. The Ghanaian exchange rate changes daily and on an average of three months vacillated between 2,500 and 3,200 cedis to a $1.
services produced by other sectors and also generates its own unique processing, transaction and delivery services. It also constitutes a mode of delivery or distribution channel for capital and information, and it is vital to services marketed by other sectors such as advertising, insurance, banking, data processing and retrieval, and legal and other professional services.

The telecommunications infrastructure is composed of facilities consisting of transmission systems - that is, copper, coaxial or fibre-optic cables, satellites and multiplexers, switching systems and other interconnected equipment - owned and operated by telecom organisations. The most common terminal equipment is a telephone handset, but attachments for computer connections such as modems and other equipment operated on customer premises are included. All types of services can be provided over telecommunications facilities by utilising the necessary accessories. Information, however, is the content of messages transmitted via telecommunications apart from the carriage function performed by network operators.

An efficient network system depends on successful and well-maintained telecommunications facilities. Among the organizations and institutions surveyed, dial-up service is the most used telecommunications facility. As identified on Table 23, dial-up service account for 31.3% of the valid responses, followed by a combination of dedicated radio and dial-up facilities (13.5%) and dedicated cable and VSAT (13.5%) facilities. Of the organizations involved in networking, 10.4% used dedicated radio and 9.4% used VSAT (satellite dish), respectively. In combination, it is obvious that Ghanaian institutions and organizations have found the advantage of having a dedicated line in addition to computer technology to send, edit, retrieve, and store information.
The emerging trend in ICT usage in organizations and institutions has also engineered the growth of the telecommunications service providers industry. Before the 1990's, the only telecom service provider in Ghana was the Ghana Postal and Telecommunications Corporation (now Ghana Telecom after Ghana’s privatization of government corporations). Currently, Ghana has ten major service providers with a few up-and-coming companies in their shadows.

Despite the appearance of government privatization, Ghana Telecom still controls the wheeling of information using telecommunications facilities. As shown on Table 21, Ghana Telecom dominates the provision of communication services to organizations and institutions either single-handedly (18.2%) or in combination with other network providers (33.1%). NCS, also a giant among Internet providers, follows with 12.4% of the market share with AfricaOnline coming next with 8.3% of the market. Though significant, the remaining service providers each serve less than 10% of the organizations and institutions responding to the survey.

Some of these service providers also provide a gateway to the outside world. At the core of these services are NCS, AfricaOnline, and Internet Ghana, which provide over 91% of international access and transmission of information. Although the Balme Library’s (University of Ghana) Internet service (formerly FIDONET) did not show prominently here (3.8%), it had provided the gateway to the outside world prior to the proliferation of all these service providers. Its abysmal representation here could be attributed to the lack of funds to support its expansion and capabilities.
<table>
<thead>
<tr>
<th>Type of Facility</th>
<th># of Organizations</th>
<th>Sample Percentage</th>
<th>Valid Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dedicated Cable</td>
<td>8</td>
<td>6.6</td>
<td>8.3</td>
</tr>
<tr>
<td>Dedicated Radio</td>
<td>10</td>
<td>8.3</td>
<td>10.4</td>
</tr>
<tr>
<td>VSAT (Satellite Dish)</td>
<td>9</td>
<td>7.4</td>
<td>9.4</td>
</tr>
<tr>
<td>Dial-Up</td>
<td>30</td>
<td>24.8</td>
<td>31.3</td>
</tr>
<tr>
<td>Other</td>
<td>4</td>
<td>3.3</td>
<td>4.2</td>
</tr>
<tr>
<td>Don't Know</td>
<td>9</td>
<td>7.4</td>
<td>9.4</td>
</tr>
<tr>
<td>Dedicated Radio &amp; Dial-Up</td>
<td>13</td>
<td>10.7</td>
<td>13.5</td>
</tr>
<tr>
<td>Dedicated Cable &amp; VSAT (Satellite Dish)</td>
<td>13</td>
<td>10.7</td>
<td>13.5</td>
</tr>
<tr>
<td>Missing</td>
<td>25</td>
<td>20.7</td>
<td>0.0</td>
</tr>
<tr>
<td>Total</td>
<td>121</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 23: Telecommunications Facilities

Control of a major share in the market is determined by the number of services provided and the spectrum of operational platforms a service provider can support. On the number of services provided by service providers, 26.4% of the respondents indicated that their organization or institution receives full Internet services in addition to 9.1% that receive a combination of full Internet and fax to fax services and 6.6% that receive full Internet or other specified services. Fax to fax, email to fax, Internet phone and email followed in order of importance accounting for only 13.2%, 11.5%, 10.0 and 8.2%, respectively, of the organizations that responded to the questionnaire.
<table>
<thead>
<tr>
<th>Service Provider</th>
<th># of Organizations</th>
<th>Sample Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ghana Telecom</td>
<td>22</td>
<td>18.2</td>
</tr>
<tr>
<td>Mobitel</td>
<td>9</td>
<td>7.4</td>
</tr>
<tr>
<td>Celltel</td>
<td>3</td>
<td>2.5</td>
</tr>
<tr>
<td>Capital Telecom</td>
<td>2</td>
<td>1.6</td>
</tr>
<tr>
<td>ScanCom</td>
<td>5</td>
<td>4.1</td>
</tr>
<tr>
<td>NCS</td>
<td>15</td>
<td>12.4</td>
</tr>
<tr>
<td>InternetGhana</td>
<td>7</td>
<td>5.8</td>
</tr>
<tr>
<td>AfricaOnline</td>
<td>10</td>
<td>8.3</td>
</tr>
<tr>
<td>Other</td>
<td>8</td>
<td>6.6</td>
</tr>
<tr>
<td>Ghana Telecom &amp; NCS</td>
<td>25</td>
<td>20.7</td>
</tr>
<tr>
<td>Ghana Telecom &amp; AfricaOnline</td>
<td>15</td>
<td>12.4</td>
</tr>
<tr>
<td>Total</td>
<td>121</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 24: Telecommunications Service Providers
<table>
<thead>
<tr>
<th>Service Provider</th>
<th># of Organizations</th>
<th>Sample Percentage</th>
<th>Valid Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Balme/CSIR's Internet Service</td>
<td>4</td>
<td>3.3</td>
<td>3.8</td>
</tr>
<tr>
<td>NCS</td>
<td>66</td>
<td>54.5</td>
<td>63.4</td>
</tr>
<tr>
<td>HealthNet</td>
<td>1</td>
<td>0.8</td>
<td>1.0</td>
</tr>
<tr>
<td>AfricaOnline</td>
<td>17</td>
<td>14.0</td>
<td>16.3</td>
</tr>
<tr>
<td>Internet Ghana</td>
<td>12</td>
<td>9.9</td>
<td>11.5</td>
</tr>
<tr>
<td>GARNet</td>
<td>2</td>
<td>1.7</td>
<td>2.0</td>
</tr>
<tr>
<td>Datatel</td>
<td>1</td>
<td>0.8</td>
<td>1.0</td>
</tr>
<tr>
<td>Other</td>
<td>1</td>
<td>0.8</td>
<td>1.0</td>
</tr>
<tr>
<td>Missing</td>
<td>17</td>
<td>14.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Total</td>
<td>121</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 25: Service Providers with Access Abroad

While the presence of NCS on this table seems to be impressive, it is equally impressive that the Ghanaian telecommunications industry seems to have taken off without any meaningful western penetration (especially by the United States). This situation calls for a meaningful policy to guide this virgin industry through appropriate competition, penetration, and infusion of capital from the outside world. From the African experience, it is virtually impossible for the industry to blossom solely on the backs of Ghanaian organizations and institutions.
<table>
<thead>
<tr>
<th>Services Provided</th>
<th># of Organizations</th>
<th>Sample Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Email Only</td>
<td>10</td>
<td>8.2</td>
</tr>
<tr>
<td>Email to Fax</td>
<td>14</td>
<td>11.5</td>
</tr>
<tr>
<td>Fax to Fax</td>
<td>16</td>
<td>13.2</td>
</tr>
<tr>
<td>Internet Phone</td>
<td>12</td>
<td>10.0</td>
</tr>
<tr>
<td>Full Internet</td>
<td>32</td>
<td>26.4</td>
</tr>
<tr>
<td>Other</td>
<td>6</td>
<td>5.0</td>
</tr>
<tr>
<td>Email &amp; Fax to Fax</td>
<td>12</td>
<td>10.0</td>
</tr>
<tr>
<td>Full Internet &amp; Fax</td>
<td>11</td>
<td>9.1</td>
</tr>
<tr>
<td>Full Internet &amp; Other</td>
<td>8</td>
<td>6.6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>121</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

Table 26: Services Offered by Service Providers

Within the spectrum of operational platforms a service provider can support, ICT users operate from a variety of platforms – DEC/VMS, UNIX, DOS, Windows, the Mac System, and other specified platforms. As shown in Table 27, the windows platform (41.2%) seems to be the major platform the majority of data communication service providers operate or support. A variety of other specified platforms account for 13.2% of the sample. This showing could be attributed to the various collaborative ventures in Ghana and the kinds of communication requirements needed to fulfill those collaborative ventures. The UNIX and DOS platforms also follow in order of importance, accounting
for 8.3% and 5.7% of the sample, respectively. In combination, the UNIX, DOS, and Windows platforms account for more than two-thirds of the sample percentage (81%).

<table>
<thead>
<tr>
<th>Platform</th>
<th># of Organizations</th>
<th>Sample Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEC/VMS</td>
<td>3</td>
<td>2.5</td>
</tr>
<tr>
<td>UNIX</td>
<td>10</td>
<td>8.3</td>
</tr>
<tr>
<td>DOS</td>
<td>7</td>
<td>5.7</td>
</tr>
<tr>
<td>Windows</td>
<td>50</td>
<td>41.3</td>
</tr>
<tr>
<td>Mac System</td>
<td>4</td>
<td>3.3</td>
</tr>
<tr>
<td>Other</td>
<td>16</td>
<td>13.2</td>
</tr>
<tr>
<td>UNIX &amp; Windows</td>
<td>19</td>
<td>15.7</td>
</tr>
<tr>
<td>DOS &amp; Windows</td>
<td>12</td>
<td>10.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>121</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

Table 27: Operational Platform

To be able to initiate and maintain a call, organizations and institutions should also know what communication protocol their service provider supports. In fact, this requirement would even help network participants decide on the kind of communication facility needed to link up to participants. The communication protocol embodies the rules and/or procedures that are required to successfully initiate and maintain communication. The protocol includes X.25/X.400, TCP/IP and FidoNet.
<table>
<thead>
<tr>
<th>Protocol Type</th>
<th># of Organizations</th>
<th>Sample Percentage</th>
<th>Valid Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>TCP/IP</td>
<td>80</td>
<td>66.1</td>
<td>66.6</td>
</tr>
<tr>
<td>FidoNet</td>
<td>2</td>
<td>1.7</td>
<td>1.7</td>
</tr>
<tr>
<td>Don’t Know</td>
<td>38</td>
<td>31.4</td>
<td>31.7</td>
</tr>
<tr>
<td>Missing</td>
<td>1</td>
<td>0.8</td>
<td>0.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>121</strong></td>
<td><strong>100.0</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

Table 28: Communications Protocol

Of the three main protocols, it appears that only TCP/IP (66.1%) is used significantly by the respondents. About a third of the organizations did not know what communication protocol the data communication service providers use (31.7%). A minuscule 1.7% of the sample indicated that they still fiddle with FidoNet communications protocol.

Regulatory Framework and Constraints to Telematics Usage

The facilities that make international exchange of information possible include telephone/fax, telex, store-and-forward e-mail, Internet e-mail and full Internet. The most used facility for international information exchange is the full Internet, which is used by about 42.1% of the organisations responding to the survey as shown in Table 29. Next in importance is Internet email and telephone/fax, which are used by 34.7% and 16.5% of the sample, respectively. Store and forward e-mail accounts for 3.3% of the sample.
<table>
<thead>
<tr>
<th>Facility</th>
<th># of Organizations</th>
<th>Sample Percentage</th>
<th>Valid Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tel/Fax</td>
<td>20</td>
<td>16.5</td>
<td>16.8</td>
</tr>
<tr>
<td>Telex</td>
<td>2</td>
<td>1.7</td>
<td>1.7</td>
</tr>
<tr>
<td>Store and Forward Email</td>
<td>4</td>
<td>3.3</td>
<td>3.4</td>
</tr>
<tr>
<td>Internet Email</td>
<td>42</td>
<td>34.7</td>
<td>35.3</td>
</tr>
<tr>
<td>Full Internet</td>
<td>51</td>
<td>42.1</td>
<td>42.8</td>
</tr>
<tr>
<td>Missing</td>
<td>2</td>
<td>1.7</td>
<td>0.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>121</strong></td>
<td><strong>100.0</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

Table 29: Facilities Used in Transmitting Information Abroad

The establishment and use of these facilities have not gone without their setbacks. Over 70% of organizations that are networking indicated that they encounter problems when using ICT facilities at their disposal. As indicated on Table 30, systems hang-up (37.2%) is the major problem encountered by network organizations. About 28.1% of the organizations and institutions sometimes encounter drop in speed when using the ICT facility at their disposal. In combination, 16.5% of the organizations responding indicated that they encounter system hang-up and drop in speed when using the ICT facility at their disposal. The 9.1% showing of data errors is significant enough to warrant serious consideration.

However, over 54% of the organizations and institutions surveyed attribute this problem to the lack of funds for capital investment. Of the 31.4% who saw this problem as a lack of resource personnel issue, the majority opined that the problem could be
resolved if they had a sufficient number of networking specialists and systems administrators available. For those who did not see the current information sharing network as one that adequately meets their needs (46.3%), the lack of these resources has been exacerbated by financial, technological and organizational constraints that have made the establishment of an information-sharing network almost impossible.

<table>
<thead>
<tr>
<th>Type of Problem</th>
<th># of Organizations</th>
<th>Sample Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drop in Speed</td>
<td>34</td>
<td>28.1</td>
</tr>
<tr>
<td>Data Loss</td>
<td>9</td>
<td>7.4</td>
</tr>
<tr>
<td>Systems Hang-up</td>
<td>45</td>
<td>37.2</td>
</tr>
<tr>
<td>Data Errors</td>
<td>11</td>
<td>9.1</td>
</tr>
<tr>
<td>Other</td>
<td>2</td>
<td>1.7</td>
</tr>
<tr>
<td>Drop in Speed &amp;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Systems Hung-up</td>
<td>20</td>
<td>16.5</td>
</tr>
<tr>
<td>Total</td>
<td>121</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 30: Facility Problems Encountered by Organizations

About 63% of the valid respondents identified the lack of financial assistance to be the most serious constraint to establishing an information-sharing network. While organizational constraints were seen as a minor problem (1.8%), over a third of the respondents opined that technological constraints (35.7%) were hindering their organization's or institution's efforts to establish an information sharing network that adequately meets their needs.
<table>
<thead>
<tr>
<th>Type of Constraint</th>
<th># of Organizations</th>
<th>Sample Percentage</th>
<th>Valid Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financial</td>
<td>35</td>
<td>29.0</td>
<td>62.5</td>
</tr>
<tr>
<td>Technology</td>
<td>20</td>
<td>16.5</td>
<td>35.7</td>
</tr>
<tr>
<td>Organizational</td>
<td>1</td>
<td>0.8</td>
<td>1.8</td>
</tr>
<tr>
<td>Missing</td>
<td>65</td>
<td>53.7</td>
<td>0.0</td>
</tr>
<tr>
<td>Total</td>
<td>121</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 31: Constraints to Establishing Information Sharing Networks

These financial constraints have hindered the ability of some of these institutions to provide the well-needed technical support. Support could be in-house (within organization), through a service provider, through a consulting firm, or it could be through a resource pool of the participants themselves. Interestingly, only a few of the network partners had confidence in their pooled participant resources (4.1%). The majority of the network participants relied on service provider support (54.5%) or they used their own in-house support staff (24.8%). It is also significant to note that 12.4% of the respondents indicated they use consulting firms. Ironically, the majority of the network participants (91.7%) would have preferred to have their own in-house support if they could afford it.

All these constraints exist in the midst of an unclear and confusing regulatory framework for ICT usage. Until recently, telecommunication services in Ghana had been essentially a public service, performed by the P&T. As a public utility owned wholly by government and operating under the then Ministry of Transport and Communication, it
assumed the dual role of regulator and service provider. This dual role worked well under a monopoly.

The effects of technological advances and changes in institutional structures have necessitated an almost continuous process of changing and adaptation of regulations. This has been the case in the communication sector of Ghana. The past couple of years have seen the introduction into the communication sector of a number of significant technological innovations. First was the introduction of cellular phones, then the Internet, and, finally, FM radio stations and cable television. These new dimensions to telecommunication services have evoked a number of institutional and regulatory restructuring activities in Ghana, namely:

1. The separation of Posts and Telecommunication (P&T) into different corporations;
2. Separation of regulatory responsibilities from operational functions; and
3. Diversification of sources of telecommunication services.

The rationale for the separation of P&T was to give telecom officials full control over their operations and end the subsidization of postal services by telecom service. This was also an attempt to level the playing field to allow competition in the sector (Mobitel, CellTel, ScanCom, Spacefon, Capital Telecom, SNO, Western Wireless). Therefore, in 1995, in recognition of this requirement, the Government of Ghana (GOG) finalized a policy reform bill, which was signed into law on December 30, 1996. The law provided for the approval of the Second Network Operator (SNO) to compete directly with the Ghana Telecom in all fields of telecommunications activity. The law also established a National Communication Authority (NCA) to oversee all aspects of implementation of
the legislation and adjudication of all instances of unfair competition. In addition, the
NCA was to supervise compliance with regulatory requirements by the various service
providers and liaise with relevant international bodies. In line with these responsibilities,
the NCA requires all service providers in the sector to apply for a license (authorization
for service) and frequency (authorization for frequency).

The appearance of competition is very obvious in the above legislation and the
creation of NCA, yet all competition still has to bridge information transmission and
retrieval through Ghana Telecom. In fact, WESTEL has dragged Ghana Telecom to court
for its refusal to allow them to use their backbone to wheel transmission and retrieval of
information, something the 1996 law promised.

Such muddled legislation and restructuring has created enough hindrances for
network operators and subsequently its users. In fact, within Ghana alone, 37% of the
valid respondents indicated that they encounter regulatory obstacles regarding the
production and dissemination of information compared with 18.3% and 17.1% for
regional and world-wide obstacles, respectively. Even in the local arena where
networking does not include partners outside Ghana, 30.5% of the valid respondents
indicated that they encounter regulatory obstacles regarding the production and
dissemination of information. With the exception of a few respondents who questioned
the handling of the spectrum allocation by NCA and the meddling in the ICT industry by
the Ministry of Transportation and Communication, the majority of the respondents
stayed silent on this issue for the fear of retribution (despite the researchers assurances of
confidentiality).
Research Questions

Six research questions were presented in Chapter I. The summary portion of this chapter presents the findings of the study relative to each of these questions.

RESEARCH QUESTION #1: How diverse/widespread is telematics dissemination?

For us to adequately answer this question, it is necessary to first define theoretically and anecdotally what is to be meant by “diverse/widespread” and how this is to be measured. It should also be emphasized that the “diverse/widespread” as reported is only in the context of the organizations and institutions surveyed.

For this study, “diverse/widespread” is defined as the levels of penetration attained by particular ICT products and the pace of diffusion of new ICTs in the face of the obstacles in Ghana. Ironically, the challenge that stands before developing countries is how to ensure that all segments of society\(^\text{52}\) get appropriate access to the "benefits" that ICTs offer.

Within this context, the response to this question could be ascertained from the sophisticated networks created, type of participants in these networks, and the mode and medium of information dissemination by participants of these networks. Over 74% of the organizations and institutions responding to the survey participated in networks, with a

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\(^{52}\)Hindering this discussion is the need for clarity on what "all segments of society" means. There are many potential end-users of ICTs within any developing country context including individuals, universities and educational institutions, NGOs and community organizations, businesses, government, public institutions and donors. Each of these users has different sets of needs in terms of content, technology applications, equipment and data speed transfer, levels of connectivity and interactivity, etc. They represent different age groups and cultural perceptions, with different affinities for and familiarity with ICTs. They also have different infrastructure constraints, e.g. related to urban, semi-urban, rural and remote environments, as well as limited budgets for purchasing equipment and software.
strong showing of locations of network participants. Table 14 reflects the diverse network partnerships and the extent of information dissemination in Ghana. In fact, of the organizations that participate in networks, over 70% indicated that other participants of the network are located in the country.\textsuperscript{53} To have information sharing in a country divided into ten regions covering a land area of 238,537 sq. km (92,100 sq. miles) is an achievement worth recommending.

Beyond this observation, the information produced and consumed by these networked partners which transcended local boundaries included academic/research, economic and/or financial, social, political, and health/medical. The mode of information dissemination (either electronic or physical) inculcated the best [but] appropriate technology that was available to the respondents. In fact, on the mode of information dissemination of the organizations surveyed, respondents identified almost 61% of their information transmission as electronic (wired and less wired).

However, depending on how one looks at the data available, the results can be interpreted differently. If networks and information being produced or consumed cut across regions, this gives an indication that the ICT is well grounded in the country, but it does not address the issue of whether all segments of society have appropriate access to the "benefits" that ICTs offer. In fact, we do not know at all whether rural Ghana is part of these networks being described. All we know is that sister organizations or related organizations are networked across regions in Ghana; whether they are in the metropolis or rural Ghana, we do not know. Nevertheless, we do know that the relationship between

\textsuperscript{53} This percentage includes respondents who checked "same city", "same metropolis", "same region" and/or "across regions" in Ghana with across regions accounting for more than half of the percentage.
organizations and sources of information indicates an appearance of vigorous interaction between Ghana and the outside world in information trade (refer to Table 13).

**RESEARCH QUESTION #2: What are the attitudes, literacy level and level of ICT usage in survey participants?**

As already shown, Table 5 reflects the self described computer literacy levels of the various groups of people in organizations/institutions that responded to the survey. As indicated in the table, the level of literacy is top down, with top-level management being the most computer literate among the three groups. On an average, however, top level management falls to an unsurprisingly third place.

Depending on the context (Table 7), attitude towards innovation or change could be interpreted differently. With a decreasing supportive attitude to change as expected, top level management overwhelmingly (47.1%) supports innovation as compared to 38.5% for middle level management and 14.3% for low level management.

Though low level personnel do not care if this innovation happens or not (76.5%), they would rather welcome it. In fact, when asked about the attitudes of the three groups towards change, respondents indicated that 40.5% of low level personnel would welcome innovation as compared to 25.2% of top level management. The enthusiasm being shown by top-level management is tempered with caution by the lower level management, who see the benefit of the technology but would not be overzealous in its application.

It is noteworthy that attitudes towards ICT innovation within the organizations and institutions surveyed emerged generally positive, or at least with frequency of positive judgements outweighing the number of negative ones. Although these opinions
may not necessarily include those of the blue-collar workers, the positive attitude towards working with ICTs encouraged sometimes positive sentiments toward retraining where necessary.

Despite the slight inclination to fear of the use of computer data banks as an infringement upon personal privacy, it appears that attitude measures at least help to predict national rates of innovation in the sense that positive attitudes lead to more innovation.\textsuperscript{54} In this case, the data displays high levels of reported experience with ICT and high positive responses (see Table 32).

<table>
<thead>
<tr>
<th>Question</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Worsen Unemployment</td>
<td>9</td>
<td>9</td>
<td>14</td>
<td>36</td>
<td>52</td>
</tr>
<tr>
<td>Help Create Jobs</td>
<td>38</td>
<td>50</td>
<td>27</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Reduce Tedious Tasks</td>
<td>52</td>
<td>48</td>
<td>16</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Help Solve Problems</td>
<td>42</td>
<td>59</td>
<td>12</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Threaten Privacy</td>
<td>8</td>
<td>27</td>
<td>33</td>
<td>31</td>
<td>22</td>
</tr>
</tbody>
</table>

Table 32: Attitudes to Telematics

\textsuperscript{54} This is an assertion Yuchtman-Yaar (1989) may take an exception to because the findings of his study indicate that despite the appearance of innovation in Japan, the manifestation of malaise in the Japanese public stems from culturally-rooted Japanese resistance to the Westernisation of Japan.
RESEARCH QUESTION #3: What is the level of production, dissemination and consumption of information?

Production and consumption of information is an essential aspect of ICT usage. In any case, the industry would not exist without the production of information. In this instance, the types of information produced and consumed also reflected the nature and functions of the institutions surveyed.

As shown in Table 8, over 27% of the organizations that responded produced information that furthered the cause of academic/research agendas. Of the valid respondents, 7.1% indicated that their organization/institution produced both academic/research and economic information whereas 5.1% indicated that their organization/institution produced both academic/research and financial information.

Health/medical and social information are also produced by some institutions, but in both cases the institutions involved form less than 15% of the sample (7.1% and 9.1%, respectively). At least 4% of the respondents indicated that they produced economic and social information. While it might look as if some of the respondents did not produce any information, these were participants who had previously indicated they were information consumers only. A few respondents, however, indicated a combination of other types of information. Though significant, all the institutions involved form less than 15% of the sample with the most important being academic/research and economic (5.8%), followed closely by academic/research and finance (4.1%), and economic and social information types (3.3%).

Other information types produced that were not specified in the questionnaire accounted for 13.1% of the survey returned. As specified by respondents, these included
Respondents (28.3%) identified the business community as the largest perceived consumer of the information generated. If one considers the type of information important to the business community (economic and financial information), one would understand the significance of this data. Yet 23% of the respondents indicated they perceive the academic/research community to be major consumers of information produced followed closely by the combination of academic/research community and the business community (20.2%).

Over 10% of the respondents perceived policy/decision makers as consumers of the information they produce. Following closely were international bodies (6.1%), related organizations (3%), and NGOs (1%) which formed less than 10% of the responding survey participants. Other types of consumers, who accounted for 8% of the returned surveys, were specified by respondents to include media personnel, government, general public, and individual clients, to mention a few.

As previously indicated, how information was distributed also contributed to the perceived consumers. In this case, distribution/dissemination of information was predominantly electronic, with consumers spreading out all over Ghana and beyond. In context, the appearance of a free flow of information [alone] in Ghana is a good step to future economic development.

To make this suggestion more compelling (see Table 13), with the exception of NGO's that operate only locally and within Ghana more than worldwide, the majority of the respondents acknowledged that their organizations operated in the local, regional, and
worldwide markets. This information strengthens the indication that there is a vigorous interaction between Ghana and the outside world in information trade if not viable economic or commercial ventures.

**RESEARCH QUESTION #4: What is the level of information sharing networks and how extensive is its dissemination?**

A number of studies reviewed have noted sectoral differences in networking patterns, as well as obstacles to network development (such as lack of awareness, skills shortages, and difficulty in achieving interconnectivity across services). We have some evidence on the application of networking, indicating that it is much more commonly used to integrate operations within large organizations than just to link firms to their suppliers and clients. Before the ICT revolution, with a few exceptions (e.g., the airline and travel industry), voice telephony and fax were much more heavily used to achieve inter-organizational linkages. Now, with the advent of the Electronic Data Interchange (EDI), X400 and X500 systems for email, and other related innovations, there has been a rapid shift towards the use of sophisticated networking systems such as electronic mail.

As reflected by this study, over 74% of the organizations and institutions responding to the survey participated in networks. Though the purpose of this participation may vary depending on the nature of the work, it is obvious that participation is mostly generated by sister organizations (33.9%) which spread across regions. Though this participation is still within Ghana, this suggests a healthy network of ICT in Ghana. In fact, branch offices of organizations and institutions (for example the
banks, government agencies, and NGOs, to mention a few) have helped in the dissemination of the technology and a strong networking system in Ghana.

The reasonably well-developed level of information sharing networks goes beyond the boundaries of Ghana. Of the 121 organizations/institutions responding, 48% indicated that other participants of their network are located across regions in Ghana. Yet, it is equally important to acknowledge the efforts being put forth to integrate Ghana into the global information system. As earlier identified in Table 14, almost a quarter of the organizations (24.8%) maintain network partnerships abroad. These efforts could not be achieved without the sophistication of the information communication technologies and the full utilization of the appropriate network useful for the kinds of functions being performed.

An overwhelming majority (77%) of the respondents indicated that their organization and/or institution access or send information abroad in addition to the not negligible number (66%) who indicated that their organizations/institutions intend to access or send information abroad. With the limited technological innovation available, users have noticed that the only way to stay competitive is to be networked not only locally but also internationally.

Despite the obvious loopholes in system as to whether information received by Ghanaian institutions and organizations is further analyzed or not, there is a clear and convincing attitude regarding the type of information being shared (see Table 16). With the exception of the financial institutions, which seem to have problems with others having easy access to their information, the majority of the respondents had a very good or welcoming attitude towards information sharing.

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RESEARCH QUESTION #5: What is the relationship between telecommunication services and available network facilities?

The standard genre of ICT service provision follows the availability and capability of network facilities. It is also noteworthy that organizations/institutions and/or businesses congregate around areas where networked facilities are available and there is opportunity for exchanging data between different complementary or related organizations (Greenhut, 1970; Isard, 1969). With the management literature providing much discussion of vanguard users of ICT, who are applying it as part of new production organizations and competitive strategies, there is some tendency to overstate the level of qualitative change.

Nevertheless, important developments are underway, even if the take-off is uncertain. For instance, more than 90% of the respondents were optimistic that usage of their services will increase despite their expectation of an upsurge of complementary or related organizations around their location.

The number of services provided determines the major share in the market controlled by a service provider. On the number of ICT services provided by service providers, 26.4% of the sample indicated that their organization or institution receives full Internet services in addition to 9.1% that receive a combination of full Internet and fax to fax services or 6.6% that receive full Internet or other specified services. Fax to fax, email to fax, Internet phone and email only followed in order of importance, accounting for 13.2%, 11.5%, 10.0 and 8.2%, respectively, of the organizations in the responding sample.
By the same token, the facilities that make international exchange of information possible include telephone/fax, telex, store-and-forward e-mail, Internet e-mail and full Internet. The most used facility for international information exchange is the full Internet, which is used by about 42.1% of the organisations in the sample (as shown in Table 29). Next in importance is Internet email and telephone/fax, which are used by 34.7% and 16.5% of the responding sample respectively. Store and forward e-mail accounts for 3.3% of the responding sample.

Tables 27 and 29 do not conveniently tell us the relationship between the sophistication of telecommunications services and the facilities used by responding survey participants. We wish to know whether the services being provided might serve as a useful predictor of telecommunication facilities identified by responding participants as important to their organisational functions.

In fact, several other variables could have been considered as predictors of facilities being used by respondents, including financial strength, resource personnel, and location. However, here we seek only a partial understanding of why some respondents use certain network facilities.

We now have available the conditional distribution of the two variables, and we can examine the distribution of the categories of one variable under the differing conditions or categories of the other. The data in Table 30 indicates that telecommunications services being provided relate to the available network facility.

From the table, one can acknowledge the movement from the older forms of communications (telephone, fax and telex) to the more expensive but efficient modern technology of Internet. Even though asynchronous communications at this time seems to
be the better choice for Ghanaian organisations and institutions, the respondents have overwhelmingly identified their use of synchronous communications due to the availability of the service.

The findings are hardly surprising as they relate to the investment requirements of each facility and the demand for its use. Obviously, with the prices of computers going down dramatically in the global market, added to the speed, capabilities and other packaged software and accessories (such as included modems), it is not strange that Ghanaian ICT users will cling to instant messaging rather than busy signals on phones or faxes. However, the connections being shown here are more of expediency, efficiency, and effectiveness in information transmission and/or retrieving rather than of cost.

<table>
<thead>
<tr>
<th>Services/Facilities</th>
<th>Missing Data</th>
<th>Tel/Fax</th>
<th>Telex</th>
<th>Store and Forward</th>
<th>Internet Email</th>
<th>Full Internet</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Email Only</td>
<td>1</td>
<td>3</td>
<td></td>
<td></td>
<td>12 (.29)</td>
<td>3</td>
<td>18</td>
</tr>
<tr>
<td>Email to Fax</td>
<td></td>
<td>2</td>
<td>2</td>
<td></td>
<td>6 (.14)</td>
<td>4</td>
<td>14</td>
</tr>
<tr>
<td>Fax to Fax</td>
<td>9 (.45)</td>
<td></td>
<td></td>
<td></td>
<td>8 (.19)</td>
<td>3</td>
<td>20</td>
</tr>
<tr>
<td>Internet Phone</td>
<td>3</td>
<td>3 (.75)</td>
<td>3</td>
<td></td>
<td>6 (.14)</td>
<td></td>
<td>12</td>
</tr>
<tr>
<td>Full Internet</td>
<td>3</td>
<td></td>
<td>1</td>
<td></td>
<td>10 (.24)</td>
<td>33 (.65)</td>
<td>47</td>
</tr>
<tr>
<td>Other</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>9 (.17)</td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
<td>2</td>
<td>20</td>
<td>2</td>
<td>4</td>
<td>42</td>
<td>51</td>
<td>121</td>
</tr>
</tbody>
</table>

Table 33: Relationship Between Telecommunication Services and Available Network Facilities

\*Two of the respondents did not report the facilities they use in transmitting information.
Although an absolute increase in use of advanced facilities may appear as a relative decline in the proportion of all ICT users with these facilities (if swamped by the sort of increase in the numbers of less sophisticated users which appears to be taking place), these findings show some important relationships between telecommunication services and available network facilities. Even so, the relationship established here is not only that of the better of the network facilities available, the sophistication of the services provided. Rather, the better the network facilities, the better and more sophisticated the services provided, which in turn encourages ICT usage and investments – a catalyst for economic spur.

RESEARCH QUESTION #6: What are the major constraints to telematics development and usage?

There are broad issues of setbacks that constrain developing countries in their efforts to develop and use modern ICTs to address their socio-economic needs. In the context of this study, six major constraining factors emerge (i.e., technological constraints, financial constraints, content and interface limitations, political and organizational/institutional constraints, human resource constraints, and socio-cultural constraints).

The high cost of ICTs constitutes the major obstacle for developing countries. Costs are typically discussed in four areas: infrastructure, hardware, telecommunication tariffs, and content. Infrastructure costs are very high for Ghana. In fact, it was anticipated that developing countries would spend 200 billion dollars from 1995-1999 in order to build over 300 million main lines and to upgrade their present telephone networks (de Cuellar, 1995).
Exacerbating this issue is the problem of financial priorities. The question of how much of a budget should be spent on this technology as a central feature of overall economic development or growth, while forgoing other 'equally' relevant and important projects such as roads and health services, to mention a few, still lingers.

Inefficient and bureaucratic policies and practices add to the problems of Ghana in meeting its financing needs. For example, it is estimated that 28 billion dollars will be needed to install a telephone line for every 100 people in sub-Saharan Africa, but if installation costs could be aligned with industry norms, the same goal could be realized for 8 billion dollars (d'Orville 1996). Compounding these inefficiencies are the high levels of import duties on information technology and communication equipments. These tariffs may have been established in many cases to protect local industries, but they may also be making needed hardware inaccessible to key sectors of the society. It has been demonstrated that governments in these countries prefer to use the

\[\text{With the 12 hour power curtailment exercise being undertaken by the Electricity Company of Ghana (ECG), many businesses have resorted to the use of light capacity generators to survive. Therefore, they were shocked on Wednesday, 25 March 1998, when the government announced the imposition of a five-percent import duty on power generating sets below 375 KVA. Industrial power generating sets do not attract any duty....Sales tax of 15 percent has also been imposed on personal computers. These changes were effected on Wednesday, 18th March under Act 545 of the Constitution and read in the 1998 budget statement. Importers who went to the Accra International Airport to clear their electrical goods expressed shock at the new rates and complained about the rather short notice given to them. Many industrial companies in the country have expressed deep concerns about the new tax rates on light capacity generators, which were hitherto tax free, in the face of the current energy crisis. They have therefore appealed to the government to consider waiving the import duty altogether (Ghana Review International: GRI.Broadcasts@port.ac.uk.). In any case, the importance of computers for the educational advancement of a developing country like Ghana, the progress of its business activities and other factors, would suggest that taxes on them should be as low as possible to encourage their acquisition and use. Governments have to make choices on what to tax; in economics, this is called "guns or butter." The choices they make usually provide an unfailing index to their enlightenment or otherwise. Paving Kotoka International Airport runway with gold while your university graduates do not know what a database is would be equivalent to cutting one's nose to spite one's face. Fortunately, there appear to be a number of people who are aware of the dangers inherent in such shortsighted policies.}\]
telecommunications sector as a "cash cow" to pay for other parts of the economy and projects unrelated to telecommunications (ITU 1994).

Such sentiments were shared in our survey. About 63% of the valid respondents identified a lack of financial assistance to be a constraint to establishing an information-sharing network that adequately meets their needs. These financial constraints, they opined, have hindered the ability of some of these institutions to provide the much-needed technical support. The support which could be in-house (within the organization), through a service provider, through a consulting firm, or through a resource pool of the participants themselves, has been hindered because organizations cannot afford to pay personnel with expertise, and neither can they afford to train their own existing staff. However, an overwhelming majority (91.7%) of the respondents stated that with the necessary incentives, they would provide in-house support.

The question of access to content also involves deeper issues than simply costs. There are strong concerns over the narrow range of diversity and relevance of content, particularly at local levels, as well as the low quality of production in developing countries. Most content is produced either in industrialized countries or the capitals of developing countries. It often fails to reflect the physical conditions, the culture, the experiences and the development priorities of many current and potential users. In addition, there is a growing phenomenon in which access to the Internet is constrained by too much information and too little bandwidth, particularly in developing countries. Criticisms are emerging, for example, against the World Wide Web as a large depository for "cyber-junk" (Noll, 1996). Since our study eliminated a sizeable and significant part of the ICT industry, there is the possibility that these concerns could hold true. However,
our respondents were confident that the information they are sending and/or receiving helps them achieve their objectives or at least helps in their decision making.

Nevertheless, the stifling of development with muddled legislation and restructuring has created an uncannily difficult situation for network operators and subsequently for their customers in Ghana. In fact, within Ghana alone, 37% of the valid respondents indicated that they encounter regulatory obstacles regarding the production and dissemination of information, compared with 18.3% and 17.1% for regional and world-wide obstacles, respectively. Even in the local arena, where networking does not include partners outside Ghana, 30.5% of the valid respondents indicated that they encounter regulatory obstacles regarding the production and dissemination of information.

The political dimensions these obstacles sometimes present create some fear in network operators and ICT users alike. For instance, despite the researcher's assurances to survey participants, with the exception of a few respondents who questioned the handling of the spectrum allocation by NCA and the meddling in the ICT industry by the Ministry of Transportation and Communication in Ghana, the majority of the respondents stayed silent on this issue for fear of retribution.

Finally, very real and debilitating socio-cultural constraints exist in developing countries which may prevent certain groups of users from going access to different ICTs. Various forms of discrimination extend into the ICTs. Women, for example, generally tend to have more limited access than men to information, the media, and communication.
facilities. This assertion, while well documented in the literature, was also supported by this study. Out of the 121 surveys that were returned, 70.2% were men with only 26.4% being women.

Current literature points to a gender gap in attitudes toward mathematics, science, and computers as an explanation for the disproportionate number of males in certain careers compared to females. This gender gap is seen as predominantly constructed through socialization and not as a biologically based phenomenon. According to Bandura (1986, 1989a), social learning theory provides an explanatory framework for understanding the complex process of socialization, and how stereotypical gender-role messages and modeling relate to predispositions and attitudes towards computers and computer-based technology. Social learning theory is mainly concerned with how children and adults operate cognitively based on their social experiences and with how these learning operations then come to influence their behavior and development (Grusec, 1992). The interaction between cognitive, behavioral, and environmental determinants are historical and cumulative as past actions, experiences, and influences are processed and then retained in some form as cognitive aids which in turn act upon future experiences and learning. The internalization of social rules, wisdom and irrationalities become self-concepts. Therefore, instead of a biological explanation as the basis for gender differences, social learning theory emphasizes the socialization of gender differences (Bandura, 1986). Hence, the development of individual interests, competencies, career paths, and self-concepts are prescribed by cultural sex typing (Bandura, 1989a).
CHAPTER 5

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Introduction

A voluminous literature addresses the question of why economic activity or specific forms of economic activity locate where they do. The literature recognizes that an inevitable consequence of economic development is increasingly complex interdependency among individuals and organizations. In general, the various models formulated by economists and regional scientists assume that businesses, workers, and consumers tend to locate in places that minimize the net costs of production and consumption. Various factors affect these costs, such as population skills and density, topography and natural resources, climate, availability of modern technology, existing infrastructures, pricing policies, government controls and regulations, and political boundaries. The availability of rapid and reliable communication is, of course, another important consideration in the decision governing location, that is, a reliable ICT system has significant space-bridging qualities.

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58 For summaries of the substance of this literature, see Greenhut (1963 and 1970); Richardson (1969); and Isard (1969).
59 For a discussion of factors affecting the population density of cities in the context of the transportation sector, see Linn (1983), pp. 90-105. The concept of the space-bridging qualities of telephones is examined in Kilgour (1982).
Summary

The purpose of this study was to investigate the level of telematics usage in Ghana, provide a knowledge base to help facilitate the decisions of policy makers, create a baseline criterion for future studies and also, by comparison, make a case for Ghana as a leader in the information technology revolution in West Africa and a viable place for foreign investments dependent on ICTs. To achieve appropriate knowledge in this inquiry, a purposively selected group of 200 participants were surveyed (see Chapter III). The participants were not selected in any statistical sense; rather they were chosen because they were supposedly knowledgeable about the issues being researched and willing to communicate about them. Responses to the questions leading our investigations were presented in Chapter IV. However, the research turned up a number of interesting findings and results that reflect issues in the available literature, leading to a number of general conclusions (ceteris paribus).

Findings and Conclusions

First, there is every indication that ICTs have taken root in the Ghanaian economy through networks, applications and extended usage. That is to say, the major step needed to stay competitive in the global economy has been made, and initial collaborative investments needed to ensure that the economy of Ghana will continue to grow are being assured through the efforts of all the organizations/institutions, businesses, NGOs and government functionaries that have found the contribution of ICTs to Ghana’s socio-economic development to be significant. In fact, in a modern economy, improved telecommunications can reduce the economic penalties of being rural and that in turn
could contribute to economic development (Parker and Hudson, 1992; Fraser and Estrada, 1998).

Secondly, there is a conscious effort to regulate and promote the extended use of ICT in Ghana. Moreover, the appearance of widespread and diverse use of ICT facilities alone presents an opportunity for all [the] bugs in the system to be corrected. ICT dissemination had to start from somewhere; though its spread to the rest of the country might be slow, the attempt to bring the rest of the country into the information world presents us with a good perspective of the enormous task ahead for both private and public investors and strengthens their understanding of future benefits to themselves and the Ghanaian economy as a whole.

The data also presents us with the opportunity to look closely at the positive attitudes of middle level and lower level personnel towards ICTs. This trend is obvious because the administrative culture inherited from the colonial days (even in academic/research circles) predefines top level administrators as delegating to their subordinates the performance of tasks involving typing and typing equipment. This phenomenon, while observable even in developed nations, is dissipating because of the dissemination of computers and their use by all levels of administration.

To confirm the administrative culture, though middle level personnel had only average knowledge of the technology, they more than doubled their technology usage above that of top-level management, who have high literacy levels. If there is any indication here at all, an argument could be advanced that the most frequent users turn
out to be the most competent.\textsuperscript{60} Therefore it is important for the community within ICT to pay close attention to its middle level management, who have taken keen interest in the usage of the technology in the performance of their duties.

Given the wide-ranging claims that are made concerning the potential of networking technologies to allow institutions to reorganize their activities across geographical space, and to enter into new patterns of relationships with their economic environments, this study brings knowledge to bear on ICT-based information networks' role in providing new means for collecting, assembling and arranging information, and thus driving the process of innovation, levels and degrees of division of labor, and economic development itself.

However, the dilemma of unstable political situations in third world countries (with Ghana being no exception until recently) has made collaborative investments between the private and public sector a murky prospect. In fact, while respondents in this study confirmed their willingness to pay for their use (as long as the benefits exceed costs) of the network facilities, they were not so enthusiastic when asked whether they would like to initiate improvements to existing systems. This confusion has been created due to unclear definition of roles between the government and the private sector. Yet, the solution to a successful and efficient ICT system in any country is not an either/or issue; rather, it is a combination of the efforts of all the stakeholders (government, private sector, NGOs, media, educational institutions, etc.), who strive to make “universal

\textsuperscript{60} Competence in this instance is vaguely being measured as literacy level and continuous usage to perform various duties.
within the trenches of ICT development have also emerge two important problems that policy makers and private investors have to deal with (the build it and they will come or wait till the economy grows to invest in ICT phenomenon). While they are well aware of the impact of ICT on competitiveness in the information age and its subsequent relationship with economic growth in Ghana, the timing for investment was difficult to sell to the society as a whole.

With every attempt being made to avoid the previous unpardonable mistakes by African leaders to grow their economies with no concern for future fiscal backing for their programs, it has become a dilemma for subsequent governments to buy into the “build it and they will come” philosophy. For these private and public investors in Ghana, the unquestionable fear is what if they do not come? Then, they would have misplaced valuable resources that could have been applied towards other development spending. But the irony of this fear is that, if the necessary preparations are not made, then when the economic boom occurs, Ghana will not be ready to compete in the global economy. This dilemma seems to be the holding block between the bold and sound technology investments needed in Ghana and the sparing investments found now in the country.

Irrespective of the responses received concerning the sources and current usage of information, the prospect is good for the advancement of the technology in Ghana. Such indicators are good for policy formulation in ICT and the regulatory institution governing it. If sources of information and the technology are used only locally or within Ghana,

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then it is about time both the public and private sector invest some capital into technology and information sharing to bridge the gap between the outside world and the country. On the other hand, if the sources and consumption of information are based regionally or worldwide, then investments should be geared towards not only bridging the gap but also ensuring the free flow of quality information in a less stringent environment while at the same time promoting domestic growth of information production and consumption.

Overall, these findings tend to support the conclusion that ICTs act more in a supportive role to the economic growth of the country. Moreover, the benefits appear to require higher levels of collaboration and investments from all sectors of the economy. These observations have been suggested several times in earlier research. Therefore, development spending in ICT is not only necessary but (at this point in time) a sufficient condition for creating an economic spur.

Limitations of Study

User surveys are often more useful when it comes to studying newer ICT applications, those used by only large and/or advanced users. These surveys are studies based on ICT-using establishments only. Typically, they will be based upon major ICT establishments, with samples drawn from lists provided by directories of computer users, participants in government programs, subscribers to ICT trade papers, etc. Such surveys clearly cannot be used directly to give a picture of average levels of ICT use (although their use often appears to be the case to estimate such circumstances, for example, by combining the information they yield with other data on firms in various sectors, etc.). User surveys can be used to give insights into the activities of advanced users in cases
where it would be cost-ineffective and even counterproductive to address questions to a more random sample of organizations. A key issue in establishing the comparability of such surveys is knowledge on how the ICT-using population has been established.

In this study, the population was established based on various directories in Ghana made available to the researcher. However, the elimination of a major chunk of the ICT industry ("Mum and Pap") from the population in some degree biased the true representativeness of the population, which could tell us very little by themselves about the extent of ICT usage across the economy. Nevertheless, the responses could be used to provide insight into activities and trends among leading ICT users to an extent impossible from the more general surveys. For instance, there is evidence of a trend to networking among ICT users in Ghana; this might well be swamped in a more general survey, where the larger increase would have been registered in the growing numbers of relatively unsophisticated ICT users.

In future, a broad compilation of such studies might prove a valuable way of identifying common trends and divergences among ICT users in Ghana and across African countries, and, not least in value, suggest types of questions and issues for analysis that might profitably be pursued in new (and perhaps more systematic) studies. In fact, future studies should pay more attention to cooperation among stakeholders, incorporation of technology into education, and, finally, research and on-going training of the working class.

\[62\] The extent of this problem as a limitation is open to question because it is obvious that the larger organizations are more likely to have a voice and be major players in ICT policy formulation or investment in Ghana. This means that, this might not be a limitation at all, but rather a positive step that gets to the core of this inquiry.
General Discussions and Areas for Further Study and Policy Development

The exploitation of ICTs, particularly through the Internet, has grown spectacularly in recent years, outdistancing efforts to plan and control their growth. Economic and commercial interests have been the main driving forces for the spread of ICTs. One result of the spread of ICTs has been an increase in inequities between certain strata of society, even in industrialized countries. These inequities result in large part from differences in ability to pay for ICT access, but have more serious consequences.

In Ghana, those excluded from access to electronic information resources are excluded by the new global culture that is empowered by the use of these resources. It is therefore necessary to identify those critical areas within Ghana that are not profit-generating activities, and to make sure that the government or non-profit sector provides for required ICT applications in these areas and ensures that they are available to all citizens in need of them. It is within this context that we present a discussion of some areas that we think require further study and policy development in Ghana.

Cooperation

An effort to support cooperation among individuals, communities and countries is critical to promote access to ICTs in developing countries. The Ghanaian government should seek to establish a framework and mechanism that ensures the participation of all sectors in implementing the national information and communication infrastructure and coordinating and harmonizing the multiple efforts of the different players (including the government ministries, private sector, NGOs, telecommunication administrations and operators. researchers, teachers, and the media). This may call for the formation of joint
boards (with representatives of government, industry, labor and consumer associations) far beyond the pseudo-autonomous NCA.

Increased cooperation would help achieve some cost efficiencies and economies of scale through standardizing "bulk purchasing" arrangements by "closed user groups." User organizations, having contributed to the aggregate demand, will gain access to networks or facilities at lower costs than they could have independently. In addition, users, through their aggregate demands, may negotiate cheaper rates for higher capacity networks and more sophisticated facilities. Public agencies should consider aggregating their demands for telecommunication networks and services regionally and presenting these to national and regional providers. A broker or common service agency acting on behalf of the joint interests of member countries or entities of public concern within a region might purchase, share and manage networks and services (ITU & UNESCO, 1995).

Finally, cooperation will be critical in resolving conflicts between legislation and international law regarding sovereignty in cyberspace, including questions of intellectual property rights to electronic works and their dissemination (de Cuellar, 1995).

Educational Technology

The technological revolution requires workers who are technologically literate and receptive to innovation—and who have a broad understanding of the modern world. The education system must therefore give students practice in understanding systems, manipulating them, talking about them to one another, and envisioning their function.
from many viewpoints. The use of tools for managing information complexity needs to become part of schooling for an ever-increasing portion of the population (Reich, 1992).

With the rapid growth of information and changes in the structure of production, the set of knowledge learned in school or in early years on the job frequently is not sufficient. Workers need an educational and training system that enables them to stretch their knowledge to deal with emergent situations and that provides opportunities for permanent learning. Preparing them to use technology requires a combination of skill-development, practice with complexity, and the development of adaptive problem-solving capabilities (Reich, 1992).

A combination of coached apprenticeship and guided self-assessment has proved most successful in training workers to deal with changing situations. Training in organizational management has also been shown to help firms manage their knowledge assets more effectively (Zuboff, 1988).

Fortunately, technology is creating new and better ways to educate workers, such as interactive radio instruction, instruction transmitted by satellite, and computer-simulated work environments. Technology can thus be used to increase the access to higher quality education in Ghana, while reducing costs. Therefore, it is important that future research on ICT in Ghana address the issues of how a holistic program of ICT development and its application in education could be implemented.

Training and Research

Training will be required at many different levels by many different users to avoid their becoming passive recipients. Training programs should be developed to make
decision-makers in Ghana aware of the opportunities that ICTs offer and of their potential pitfalls. They should explore how existing and emerging technologies can be applied to development goals. For example, ministries of education must be made aware of different technologies in order to consider how these can be applied in their education systems. Moreover, decision-makers should also be knowledgeably equipped to decline certain technologies which might not be compatible with the standards being used worldwide. In some developing countries, literally thousands of technology salespeople are trying to sell their products to the government with high-pressure pitches and promises. The decision-makers unfortunately are often not well equipped to make decisions concerning these confusing options. The general public also needs to upgrade its level of computer and media literacy to be aware of the importance of information availability and usage. Courses should be developed in this context for both schools and adult populations (ITU & UNESCO, 1995).

Ghana should also ensure the education and training of specialists needed to develop networks and ICT based applications. Both university-level education and practical continuing education are required; such education should cover both technical and management concerns and take full account of both the latest international developments and the national socio-economic and cultural contexts. Various modalities of public sector and or private sector cooperation should be considered to ensure the establishment and full development of needed education and training facilities. Regional cooperation may be an effective way to build facilities which are outside the reach of Ghana, at least in the immediate future (UNESCO, 1994).

As a complementary component of ICT education, Ghana should support research
on innovations and their use by different populations. Additional research and development to promote equal access to cyberspace and use of new cost-effective approaches could overcome various barriers to access. Universities and other centers of learning should be seen as key resources in these efforts, and should in turn envisage various strategies for collaboration with telecommunication operators and private enterprise, who can bring the results of research to the market and underwrite government research and network access. An interesting model for international cooperation is the UNESCO Chairs in Communication (ORBICOM) network established to promote higher education and research in communication through collaboration among academics and industrial associates (ORBICOM, 1996).

Reflection

The knowledge revolution comes at a time when traditional concepts of international development are being seriously questioned. The developing world has fragmented into a kaleidoscope of countries and blocs. Old donor-recipient relationships have become archaic. Global problems, too big for national governments and international agencies, call for new partnerships, coalitions and networks capable of responding at appropriate scale, and speed. What is important is not so much the tools themselves as those who are using them, and for what purpose, for whose benefit. And even beyond major national and institutional challenges, the big issues will be global and individual -- in keeping with the current paradox of a world moving simultaneously toward globalization and decentralization.

So far, the revolution is largely in the hands of entrepreneurs (enabling them to
push through the boundaries of the possible) and corporations (helping them maximize efficiency, speed innovation, and boost profits), though some NGOs and citizens' groups are making good use of the new channels. As in the early Victorian era, technology and dynamic economic forces have run far ahead of public policy and the ability of society to cope with problems and distribute benefits.

We have yet to find ways to ensure realization of the revolution's potential contributions in other areas of life: to revitalize cultures, create a sense of community, make democracy work, and nourish global citizenship. The technology, with its worldwide span and interactive links, has created something quite new -- combining the functions of pipeline, network, and global village square -- that could become a sophisticated, sensitive planetary nervous system.

Whether the knowledge revolution breaks the bonds of geography, time and hierarchy for most of the world's people or only for a minority depends on choices to be made -- about structure, access, regulation and ownership. No one knows if the new space for interaction and participation will generate global democracy, or will be closed off prematurely. Vision and leadership are urgently needed because decisions being made now will affect everyone. As Robert Reich (1992) stated:

[w]e are presented with a rare historical moment in which... transformations of economies and technology are blurring the lines between nations.... There is an opportunity for us, as for every society, to redefine who we are.... The choice is ours to make. We are no more slaves to present trends than to vestiges of the past.

New technology creates new tools -- distance education, telemedicine, telegeography -- that allow us to do things that used to be impossible. It extends the reach of knowledge, expands access, and enables refinements in its application to the
development process. Awesome new computational capacity makes research feasible that would have been too costly before computers. We see the promise of new, more cost-effective ways to put in place the building blocks of human development: health care, education and other social services. The new tools can support the decentralization of power, authority and knowledge; increase the accountability of government and participation by citizens; and facilitate the democratization of politics, planning, and development. This can be done while treading lightly on the land, using only minimal amounts of our limited stock of non-renewables.

If the earth is to sustain all of its people, now six billion, and increasing by almost 100 million each year, and improve the lot of the three to four billion living at varying levels of deprivation, we urgently need to find patterns of development that are not self-destructive. The same is true for those who are currently said to enjoy the highest quality of life, the richest fifth of the world's population, who consume an estimated 84 percent of its wealth.

This isn't the first knowledge revolution, but it is different from those of the past: faster-paced; global in scope; happening in a world where humans for the first time have not only the power to destroy all life, but (as Arnold Toynbee remarked almost four decades ago) the technical and practical ability to meet the reasonable needs of a decent life for everyone. This is all happening at a time when human activity is affecting ecosystems, the global climate, the biological evolution of our own species, and the prospects of future generations - while giving us the capacity to understand and change our impact. So the stakes are high.

Many of the findings from this study are quite exciting in their relevance to ICT
investments. Several factors relating to the exploratory nature of this study dictate that the findings cannot be assumed to be representative of Ghana nor can they be assumed to be representative of developing economies in general. However, many of the insights generated can be considered valid indications of important relationships. This study might have perhaps more fully helped us if the scope of our investigations had been broader. Then again, if the scope was so broad, our response rate might not have been significant, therefore giving us a different overview of the current situation in Ghana. Research in this area is in no sense likely to be “definitive” but, in combination with other data sources, could provide insights far more generalizable and conclusive.

In conclusion, it should be emphasised that, regardless of the numerous overheads involved, the hard reality is that, given the growing importance of information and communication technologies (ICTs) in the global market, the developing world and indeed Ghana has no choice but to reset its priorities in favour of setting up the appropriately necessary ICT infrastructure and building an efficient human resource base to join the information highway if it is to avoid global exclusion. Maybe with adequate education and appropriate investments in ICT infrastructure, Ghana will be in line with what Reich calls an “information society.”

There is no doubt that there is a potential upsurge in the usage of ICT in Ghana and that ICTs can play an important role in the development of Ghana. However, in order that the ICT may play this role effectively, certain structural changes need to be realized to complement the legislative and regulatory changes being put in place to generate competition for the Ghanaian consumer.
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[Dear]

I am conducting a study to determine the level of telematics usage in Ghana with particular reference to the level of computer literacy and computerization in institutions and organizations in terms of information production and consumption; information sharing networks; and the nature of telecommunications services and facilities provided to networks.

You have been selected to participate in this study because of your unique knowledge of the current Information Communication Technology development and applications in Ghana. We hope this research effort will provide the necessary baseline data to support planning, implementation and ICT policy formulation in Ghana.

I appreciate your assistance. The enclosed questionnaire asks about your organizational or institutional need and level of ICT usage. In fact, we are much more interested in your personal knowledge and observations of ICT development in your organization or institution. Please take time to complete the questionnaire. Your individual responses are very important to the success of this research effort. All information will be kept confidential.

My colleague will be picking the completed survey on a mutually agreed upon time. Please make sure all questions are completely filled to the best of your knowledge.
Enclosed is a Paper Mate flexgrip pencil, which you may keep as a token of my appreciation.

Thank you for your time, knowledge, and cooperation in making this study a reality.

Sincerely

Alexander Yaw Adusei, Jr.
Ph.D. Candidate
The Ohio State University
APPENDIX B

QUESTIONNAIRE
The purpose of this questionnaire is to seek your assistance in providing information that will be useful in determining telematics usage in Ghana and to plan for the development and optimal utilization of the telematics system. Read and complete the questionnaire provided. Please answer each question truthfully based on your knowledge and opinions. Unless otherwise stated, please fill in only one answer where applicable. Please use a no. 2 pencil.

1. Name of organization/institution

2. Sex of respondent?
   - A. Male
   - B. Female

3. Position of respondent?
   - A. Top Level Management
   - B. Middle Level Management
   - C. Low Level Management
   - D. Other

4. Is your organization an information producer and/or consumer?
   - A. Producer
   - B. Consumer
   - C. Both

5. In which of the following categories does your organization/institution belong (fill in all that apply)?
   - A. Academic/Research
   - B. Government
   - C. NGO
   - D. Commercial
   - E. Financial
   - F. Multi-National
   - G. Foreign Mission
   - H. Donor Agency
   - I. Other (specify)

6. How would you classify the computer literacy level of the following groups of people in your organization (on the average)?

<table>
<thead>
<tr>
<th>Low Level Management</th>
<th>Middle Level Management</th>
<th>Top Level Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Literacy</td>
<td>Average Literacy</td>
<td>Low Literacy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Non-users</td>
</tr>
</tbody>
</table>

7. How will you classify the level of computer usage among the following groups of people in your organization?

<table>
<thead>
<tr>
<th>Low Level Management</th>
<th>Middle Level Management</th>
<th>Top Level Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Users</td>
<td>Average Users</td>
<td>Low Users</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Non-users</td>
</tr>
</tbody>
</table>

8. What is the attitude of the following groups of people to change?

<table>
<thead>
<tr>
<th>Low Level Management</th>
<th>Middle Level Management</th>
<th>Top Level Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Supportive</td>
<td>Welcoming</td>
<td>Indifferent</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Discouraging</td>
</tr>
</tbody>
</table>

9. How will you classify your organization's information profile? (fill in all that apply)

   | A. Academic/Research
   | B. Economic
   | C. Social
   | D. Political
   | E. Other

10. How will you get the information to the consumers (fill in all that apply)?

    A. Physically
       - 1. Print
       - 2. Microfiche
       - 3. Disks/Other Tape
    B. Electronically
       - 1. Fax/Telephone
       - 2. Email
       - 3. Radio
       - 4. Other (specify)
    C. Other (specify)

11. Whom does your organization perceive to be the consumers of the information it produces? (fill in all that apply)

    A. Academic/Research
    B. Business Community
    C. Policy/Decision Makers
    D. NGOs
    E. International Bodies
    F. Related Organizations
    G. Other (specify)
<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. <strong>Does your organization participate in an information-sharing network?</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>A. Yes</td>
<td>B. No</td>
</tr>
<tr>
<td>2. <strong>Who are the other participants in the network?</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>A. Branch offices</td>
<td>B. Sister Organizations</td>
</tr>
<tr>
<td>3. <strong>Where are the other participants located?</strong> (fill in all that apply)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>A. Within the same city</td>
<td>B. Within the same Metropolis</td>
</tr>
<tr>
<td>4. <strong>How is information transmitted to participants of the network?</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>A. Electronically</td>
<td>B. Physically</td>
</tr>
<tr>
<td>5. <strong>If electronically transmitted, what is the medium?</strong> (fill in all that apply)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>A. Fax/Telephone</td>
<td>B. Radio</td>
</tr>
<tr>
<td>6. <strong>If physically transmitted, by what means?</strong> (fill in all that apply)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>A. Print</td>
<td>B. Microfiche</td>
</tr>
<tr>
<td>7. <strong>Do participants in the network further process the information they access from the network before use?</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>A. Yes</td>
<td>B. No</td>
</tr>
<tr>
<td>8. <strong>If Yes, how?</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. <strong>How will you describe the information-sharing network?</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>A. Formal</td>
<td>B. Informal</td>
</tr>
<tr>
<td>10. <strong>How are the various participants of the network linked up?</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>A. LAN (Local Area Network)</td>
<td>B. WAN (Wide Area Network)</td>
</tr>
<tr>
<td>11. <strong>What sorts of communication facilities are used to link up the participants?</strong> (fill in all that apply)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>A. Dedicated Line</td>
<td>1. Cable</td>
</tr>
<tr>
<td>12. <strong>What is the organizational attitude towards information sharing?</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>A. Very Good</td>
<td>B. Welcoming</td>
</tr>
<tr>
<td>13. <strong>Do users/participants share information willingly?</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>A. Yes</td>
<td>B. No</td>
</tr>
<tr>
<td>14. <strong>What kind of services do the data communication service provider(s) provide?</strong> (fill in all that apply)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>A. Email Only</td>
<td>B. Email to Fax</td>
</tr>
<tr>
<td>15. <strong>Who are will be the data communication service provider(s) for your organization?</strong> (fill in all that apply)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>A. Ghana Telecom</td>
<td>B. Datatel</td>
</tr>
<tr>
<td>16. <strong>On what kind of platform do the data communication service provider(s) operate?</strong> (fill in all that apply)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>A. DEC/VAX</td>
<td>B. UNIX</td>
</tr>
<tr>
<td>17. <strong>What communication protocol does the data communication service provider(s) use?</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>A. X.25/250, 400</td>
<td>B. TCP/IP</td>
</tr>
<tr>
<td>18. <strong>How is the network supported (technically)?</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>A. In-house support (organizational)</td>
<td>B. Service-Provider Support</td>
</tr>
<tr>
<td>19. <strong>Who pays for using the network?</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>A. Participants</td>
<td>B. Government</td>
</tr>
<tr>
<td>20. <strong>How much is paid annually on average by each participant for:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>A. Communication</td>
<td>B. Service</td>
</tr>
<tr>
<td>21. <strong>Does your organization access or send information abroad?</strong> (if yes, go to question 23)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>A. Yes</td>
<td>B. No</td>
</tr>
<tr>
<td>22. <strong>If No, do you intend to access or send information abroad?</strong> (If No, skip questions 23-32)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>A. Yes</td>
<td>B. No</td>
</tr>
<tr>
<td>23. <strong>How is the information transmitted?</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>A. Batched and sent</td>
<td>B. Real Time (Instantly)</td>
</tr>
</tbody>
</table>
24. What facility do you use?  
A. Telex  
B. Telex  
C. Store and forward Email  
D. Internet Email  
E. Full Internet  
F. Others (specify) ________  

25. What is the speed of transmission?  
A. 9.60 - 14.4 Kbps  
B. 19.2 - 56 Kbps  
C. 128 - 256 Kbps  
D. 512 Kbps - 2 Mbps  
E. Don't Know  
F. Other (specify) ________  

26. Is the speed good enough?  
A. Yes  
B. No  

27. If No, what is the desirable speed?  
A. 9.60 - 14.4 Kbps  
B. 19.2 - 56 Kbps  
C. 128 - 256 Kbps  
D. 512 Kbps - 2 Mbps  
E. Other (specify) ________  

28. How soon do you usually get a response when you request for information (turn-around time)?  
A. Instantly  
B. Within an hour  
C. Within a day  
D. 2 days  
E. Within a week  
F. More than a week  
G. Other (specify) ________  

29. Is the response time good enough?  
A. Yes  
B. No  

30. If the response time is not good enough, what is the desirable response time?  
A. Instantly  
B. Within an hour  
C. Within a day  
D. 2 days  
E. Within a week  
F. More than a week  
G. Other (specify) ________  

31. If Yes to question 22, how do you intend to access or send information abroad?  
A. Telex  
B. Telex  
C. Store and forward Email  
D. Internet Email  
E. Full Internet  
F. Others (specify) ________  

32. Through which Service Provider do you access or intend to access these services?  
A. Beim/CSIR's FidoNet  
B. NCS Gateway  
C. Internet  
D. HealthNet  
E. AfricaOnline  
F. InternetGhana  
G. GARNet  
H. DelNet  
I. Others (specify) ________  

33. Do you make or intend to make some of your corporate/organisation information available on the internet for access by the general public?  
A. Yes  
B. No  

34. If Yes, what interest will you be serving?  
A. Academic/Research  
B. Economic  
C. Social  
D. Business  
E. Other (specify) ________  

1. What are the major constraint(s) of your organization (fill in all that apply)?  
A. Lack of resource personnel  
B. Lack of funds for capital investment  
C. Major technological shifts  
D. Other (specify) ________  

2. If lack of resource personnel is a constraint what sort of resource personnel do you lack (fill in all that apply)?  
A. Networking Specialists  
B. Database Administrators  
C. System Administrators  
D. Application/Content Developers  
E. Others (specify) ________  

3. Will any of your existing personnel require further training to use the telematics facilities you subscribe to or intend to subscribe within the next 12 months? (If No, skip questions 4-5)  
A. Yes  
B. No  

4. If Yes, do you have any local (in-house) training scheme?  
A. Yes  
B. No  

5. If No, are there any plans for any such personnel to undergo training elsewhere?  
A. Yes  
B. No  

6. How much do you estimate to be the cost of training?  

7. Is the training tax deductible?  
A. Yes  
B. No  

8. If No, would you like to have a tax break?  
A. Yes  
B. No  

9. Would you offer more training if financial assistance were available?  
A. Yes  
B. No  

10. Do your organization intend to hire any qualified personnel soon?  
A. Yes  
B. No  

11. If Yes, how much are you willing to pay for their expertise?  
A. < 100,000 mo  
B. 100,000 mo - 199,000 mo  
C. 200,000 mo - 299,000 mo  
D. 300,000 mo - 399,000 mo  
E. 400,000+mo  

12. Do you consider the current information sharing network to be one that adequately meets your needs?  
A. Yes  
B. No  

13. If No, what are the constraints to establishing an information sharing network that adequately meets your needs (fill in all that apply)?  
A. Financial  
B. Technology  
C. Organizational  
D. Other (specify) ________  

14. What are the costs for dial-up connection on average for a month?  
A. Communication Cost  
B. Service Cost  

15. What are the costs for a leased line (dedicated) connection on average for a month?  
A. Communication Cost  
B. Service Cost  

16. Does your organization encounter any regulatory obstacles regarding the production and dissemination of information (fill in all that apply)?  
A. Local  
B. Within Ghana  
C. Regional  
D. Worldwide  

17. If the answer is Yes to any part of question 16:  
A. What is the regulation?  
B. From which sector is the regulation?
18. Do you encounter any communication problems when using any of the telematics facilities at your disposal?
○ A. Yes
○ B. No

19. If Yes, indicate the type of problem (fill in all that apply)?
○ A. Drop in speed
○ B. Data loss
○ C. System hang-up
○ D. Data errors
○ E. Others (specify)

20. What sort of improvements do you want to be made to your existing systems (fill in all that apply)?
○ A. Increase Network Capacity
○ B. Increase Speed of system
○ C. Instant user-consumer feedback loop
○ D. Interlinkage of functions
○ E. Other (specify)

20a. Who do you think should initiate these improvements?
○ A. Government
○ B. Private Entrepreneurs
○ C. NGOs
○ D. International institutions
○ E. Other (specify)
○ F. All of the above

20b. Do you know of any on-going project or proposed developments to improve the existing situation?
○ A. Yes
○ B. No

21. If Yes, what are they?

22. Who are the potential users of improved information sharing network in your sector?

1. Do you get or expect any donor assistance in the implementation of your information-sharing network (if No, skip questions 2-3)?
○ A. Yes
○ B. No.

2. If Yes, which agencies / donors offered you the assistance or you expect to get assistance from?

3. What sort of assistance do the donor(s) give you (fill in all that apply)?
○ A. Financial
○ B. Educational
○ C. Technological
○ D. Other (specify)

4. What comments do you have on the state of telematics/information technology in Ghana vis-a-vis what pertains in other parts of the world?

5. Does telematics (please indicate which opinion comes closer to your views by checking the column appropriately):
   - Strongly Disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly Agree
   - Worsen Unemployment
   - Help create jobs
   - Reduce Tedious Tasks
   - Help solve Problems
   - Threaten Privacy

6. Approximately how many businesses / organizations use your services in your area after your inception?
○ A. 1-2
○ B. 3-5
○ C. 6-10
○ D. 11-15
○ E. 16-20
○ F. Over 20

7. Do you expect an increase of usage of your services by these businesses/organizations?
○ A. Yes
○ B. No.

8. How many related/complementary businesses/organizations do you have in your area or location?
○ A. 1-2
○ B. 3-5
○ C. 6-10
○ D. 11-15
○ E. 16-20
○ F. Over 20

9. Do you expect an increase in these complementary related businesses/organizations?
○ A. Yes
○ B. No.
APPENDIX C

PANEL OF EXPERTS
Ayitey A. O. Bulley
Deputy Director, Software
Network Computer Systems, Ltd.
Accra, Ghana.

Dr. Kwadwo Asenso-Okyere, Director
Institute of Statistical, Social & Economic Research
University of Ghana, Legon

Dr. A. Wayo Seini
Institute of Statistical, Social & Economic Research
University of Ghana, Legon

Frank Mantey
Media/Communications Specialist
Network Computer Systems, Ltd.
Accra, Ghana.

Godfred K. Frempong
Science and Technology Policy Research Institute
Council for Scientific and Industrial Research
Accra, Ghana.

Joel Sam
Senior Assistant Librarian
Institute for Scientific and Technological Information
Accra, Ghana

Timothy K. Asiedu
Information Security Coordinator
DHL Ghana Limited
Accra, Ghana

Dr. Janet Henderson
Department of Human and Community Resource Development
The Ohio State University
Columbus, Ohio

Barbara Wharton
Program Coordinator, University Registrar
The Ohio State University
Columbus, Ohio

Anku Golloh
Doctoral Candidate
The Ohio State University
Columbus, Ohio

Dr. Susan Henderson
The Ohio State University
Dept. of Agric. Education
Columbus, Ohio

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