TECHNOLOGY, TRAINING, AND DEVELOPMENT: AN EXPLORATORY STUDY OF INTERNATIONAL INFORMATION COMMUNICATION TECHNOLOGY (ICT) DEVELOPMENT PROGRAMS

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ABSTRACT

This exploratory study examines issues relating to human capital growth, Information Communications Technology (ICT's) development, and training methods. This research uses quantitative methods to examine the relationship between ICT usage and human capital growth. The context for examination was gathered from the perspective of multilateral funding agencies. The theoretical framework is two fold, the first is a mixture of Participatory Instructional Design Methods and the second is International ICT (Information Communications Technology). With little research in existence that has combined the two above mentioned frameworks in a way that has been proven to be practical and useful in its implementation, this research will address the need to create engaging learning environments in ICT training programs. It may have valuable implications for not only those Program Officers working on the development of international ICT training programs, but also for those participants and trainers who are or have been involved with these programs.

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CHAPTER I

HUMAN CAPITAL GROWTH AND LINKAGES TO ICT TECHNOLOGY

I first became interested in the transfer of technology when I served as a Peace Corps Volunteer in the Gambia from 1998-2000. I accepted a posting as a 9th Grade Science teacher in a school known as Pakalinding Junior Secondary School. My school was located mid-way up the country, in the Region IV capital known as Mansakonko, directly behind the Regional Health Center in Mansakonko (Appendix 1). Within my first month at the school, the school bursar, Alagie Bah, approached me and asked me to assist him with fixing a computer that the school had donated to them in the early 1990's. I was surprised to find that there were actually computers in such a rural school. The village in which I lived had no electricity and no running water, but the school was able to gather current (otherwise known as electricity) for several hours during the day using an electricity generator it received from the commissioner.

When I had a chance to look over the computer, I noticed a large bar code on the side labeled with 'USAID' (US Agency for International Development). I would later discover that this computer was from a defunct USAID infrastructure development initiative in the early 90's. I was able start up the computer, and at the DOS prompt typed in the appropriate commands for starting the Windows 5.1. My counterpart was surprised. Apparently no one at the school knew how to get passed the DOS prompt to begin the Windows operating system commands that were

common in the early 1990's to computer users. Simple computer commands such as this had not been effectively taught to the recipients of this round of USAID donations.

It was this lack of sustainability of the knowledge transfer in this 1990's USAID project that sparked my interest in how technology transfer programs can use training more effectively. In 1998-1999, I spent a year in collaboration with my counterpart, Alagie Bah, soliciting from within country for donations and constructing computers from spare parts. I received no outside funding for the development of this computer lab, and to my knowledge, as of Fall 2003, the computer lab is still functioning.

Once we were able to put together the infrastructure for a computer lab, I focused my energy on developing training methods that would not only promote the sustainability of the computer lab I had assisted with developing, but that would also increase the human resource capacity of the region in which I lived. For my last year in country I focused on developing training programs based on the needs of the participants. The need was so great for computer training, I spent my entire last year in country, working with various Ministries developing appropriate workshops and action plans that spanned more than 5 years.[1]

Although this experience was unique in that it was a project that was successfully done at a grassroots level without outside funding, I feel that by using similar methods of collaboration and training techniques, foreign assistance projects could increase their impact. This experience is the driving force behind the research presented in this paper.

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[1] For more information on the action plans set forth during this time period and the workshops that were developed, please see http://www.zubernation.org/training

Purpose of Study

Initially, within this study, I intended to conduct a preliminary examination of the extent of the effectiveness of "participatory training techniques" within a number of ICT training programs. I set out to compile a preliminary list of the current ICT projects, the countries in which they are being implemented, as well as the development sector within which they're being implemented. This study was to be built on previous research that proposes indicators of participation and using these indicators as a measurement of the practice of the participatory training techniques. The information gathered by this preliminary study was also to be used to analyze any trends that became apparent between participatory learning methods and other variables in international ICT training programs such as sector, gender distribution, and length of programs.

However, during the process of this examination, I was forced to slightly alter the purpose of my research. Due to the lack of response rate in my evaluation tool (a problem I will discuss more in depth in my chapter on data analysis), I was unable to gather a clear and unbiased picture of the training methods used in the ICT projects currently being implemented.

Even with my response rate close to zero, I was still determined to find a way to show that more effective training on technology leads to sustainable outcomes. Building on the literature review I conducted for the initial research, within this exploratory study, I have chosen to explore a possible relationship between usage levels of ICT technology and human capital growth. As I will further explore, human capital can be described as the capabilities or capacities, both innate and derived or accumulated, embodied in the working age population that allow it to work

productively with other forms of capital to sustain economic production (OECD, 2003).

Within this study, I make the assumption that human capital growth can partially be measured by the amount a country spends on education at the primary, senior, and tertiary levels. By increasing the usage of ICT technologies, countries have been able to increase access not only to equipment, but also a more informed, educated work force. The ICT revolution has been solely about spotting opportunities and inviting everyone to learn and make good use of them (UNESCO, AED, 2002). ICT has rapidly become an integral part of the social environment as jobs are being transformed rapidly into tapping on keyboards and looking at screens.

It is this connection of increased usage of ICT's with human capital growth that inspired me to make an argument for increasing the quality and effectiveness of ICT training programs. By looking at the relationship between indicators of human capital growth with ICT usage levels, the intermediate step includes the transfer of knowledge of the technologies at hand.

Primary Research Question

The primary question I will explore in this research is to what extent has human capital growth contributed to the usage of ICT technology in a developing setting? As I ask this question, there is an underlying assumption that an increase in human capital growth is representational of more effective training programs being implemented.

In an effort to address this question, below are the implementation questions of this research, in the order in which I will address them.

Implementing Questions

- What are the necessary contributions that need to occur for ICT usage to increase in a developing country? How do ICT technologies develop and to what extent are conditions appropriate for ICT development? What is the origin of the term ICT and how are development agencies currently approaching the implementation of these projects? Factors such as access, cost, relevance and quality will be discussed.

- What is meant by human capital growth, and how can the relationship between human capital growth and ICT technology be examined? What indicators could be used to measure ICT growth in a developing country?

- What are the implications of the findings of this research regarding training, technology transfer programs and ICT usage in developing countries?

- What training methods are the most effective at promoting the sustainability of ICT literacy in transfer programs? What inputs in ICT transfer programs would lead to human capital growth, and subsequently, to the development of a country?

The answers to these questions may have valuable implications for not only the Program Officers working on the development of international ICT training programs, but also for participants and trainers who are or have been involved with ICT programs, either domestically or internationally.

Methodology

As I have briefly mentioned, with the advent of a lack of responses to my survey under the original methodology, I was forced to re-think my stated research question and hence re-design my approach to the research. In this research, I have chosen to use quantitative methods to show that there is a relationship between, what the UN considers an indicator of human capital growth and ICT technology usage.

I will accomplish this by searching for a linear relationship between the indicators provided by the UN. I was able to use publicly available quantitative

information that the UN provides for both technology usage and rates of illiteracy. I was able to find the most valid information on ICT's relating to infrastructure and usage indicators. Even though it may be extremely difficult in the developing context to measure usage of technology such as a village well or a rice husking machine, the usage for technologies such as access to the Internet and cell phone usage are relatively easy to track somewhat reliably. Although there may be some flaws in usage based on the fact that multiple users can use the same ISP (Internet Service Provider) connection, and that multiple parties may use a single cell phone, for the purposes of this study, these indicators provide enough accuracy. I used the statistical package known as SPSS to conduct a bi-linear regression on human capital growth.

Independent Variables Used

In choosing the independent variables for this study, I attempted to find variables that would indicate usage while also covering a spectrum of Information Communication Technology tools. The first variable I chose was the number of Personal Computers. This indicator was compiled by the UN and consisted of the number of Personal Computers that were accounted for in the country.

The second indicator I chose was also compiled by UNESCO and consisted of the number of Cellular and PCS subscribers. This number was segmented into subscribers with packet service (typically, this coincides with third generation system deployment, or the upgrade of current digital systems next generation systems) to capture the mobile population with Internet or data services (UNESCO, 2003). These numbers do include what are known as" Packet Only" access infers subscribers with specialized devices, such as the Palm VII or email readers that do not incorporate voice services. As technology continues to advance, devices such as packet only ones

are becoming increasingly popular and are likely to overlap with ownership of a standard mobile phone (UNESCO, 2003).

The third indicator I chose involved the number of Fixed Telephone Line subscribers. This indicator was also compiled by UNESCO and was arrived at using existing collection information from local telephone service provider (UNESCO, 2003).

With the advent of this new methodology, and using these new indicators, I was able to provide some in depth analysis that will hopefully be beneficial to those in the field of ICT development.

Throughout the course of this research, the reader may find several re-occurring terms that are important for defining the context of either the problem or the findings. Below, the reader will find a brief introduction to what I mean when I refer to the terms, human capital growth, the digital divide, participatory methods, and appropriate technologies.

Human Capital Growth

As previously mentioned, human capital growth can be described as the capabilities or capacities, both innate and derived or accumulated, embodied in the working age population that allow it to work productively with other forms of capital to sustain economic production (OECD, 2003). The term human capital has traditionally applied to education broadly defined and includes the knowledge and skills that the working age population (or more narrowly the labour force) accumulated through formal educational attainment, training, and experience (OECD, 2003).

According to the UN, in the field of training and education, it is suggested that the average educational attainment of the working age population may be adopted as

an indicator of the sustainability of human capital in the education area (UNESCO, 2003) Additional years of education normally produce more knowledgeable and skilled workers; a situation where average educational attainment is declining is not consistent with the sustainability of human capital (OECD, 2003). However the problems associated with adopting an input indicator such as educational attainment as a proxy for sustainable human capital are much less severe than would be the case if a true input indicator such as educational expenditures was adopted (Stuart, 1997). Based on this discussion, for the purpose of this paper, I will be using the illiteracy rate as an indicator of the level of human capital development. This indicator is defined as the number of illiterate individuals over the age of 25 in a country as a percentage of the total population.

Definitions

Digital Divide

In the report of the 1999 IDC/World Times Information Society Index, the information gap between rich and poor countries continues to widen. This Index showed that there were only 55 countries that account for 97% of the global GDP and out of those 55 countries, they account for 99% of the IT (Information Technology) expenditure. The remaining 150 or so countries not included in this index only accounted for 3% of the global GDP and less then 1/2 % of all IT expenditures (AISI 5). This "gap" in IT expenditures between developed and lesser developed countries is what is commonly known today as the digital divide.

Development and multilateral agencies have been attempting to address this digital divide phenomenon, through the promotion of technology transfer programs, particularly involving information communications technology programs, better

known as ICT's. The focus of these transfer programs has primarily been on capacity building.

> A digital divide threatens to exacerbate already-wide gaps between rich and poor, within and among countries. Timely access to news and information can promote trade, education, employment, health and wealth. One of the hallmarks of the information society -- openness -- is a crucial ingredient of democracy and good governance. Information and knowledge are also at the heart of efforts to strengthen tolerance, mutual understanding and respect for diversity (Kofi Annan, 2002).

The swift emergence of a global information society is changing the way people live, learn, work and relate. An explosion in the free flow of information and ideas has brought knowledge and its myriad applications to many millions of people, creating new choices and opportunities in some of the most vital realms of human endeavor. Yet too many of the world's people remain untouched by this revolution.

Advancements in Information Communication Technology's (ICTs) have revolutionized the world economy. Information can now be collected, analyzed, and communicated with increased speed through dramatic innovations in information technology, rapid international communication and transportation capacity, and massive technological connection across national boundaries (UNESCO, AED, 2002). The speed with which the revolution in ICT has taken place is phenomenal. The ICT revolution has brought change that is not limited to only one single sector of society.

The information and communication technology (ICT) sector in general is a key sector for economic performance and overall development (KPMG, 2000). Advances in ICT increase competition by making supply respond to demand more effectively, putting pressure on prices. They can enable access to new markets and improve productivity through potential supply chain integration and restructuring of production processes. Advances in ICT can increase transparency, enable more

effective utilization of information and improve the quality of existing information (by allowing information to flow faster and in a more targeted manner).

Participatory Methods

Over the past decade there has been a general movement towards more culturally sensitive participatory methods of training in developing countries. In the implementation of Information Communication Technology (ICT) training programs internationally, this has also been true. Organizations use terms such as, "participatory education" and "participatory evaluation," to describe ICT training projects in proposals as well as in their project reports. As development programs continue to embrace participatory methods, particularly involving ICT training programs, it then becomes important to determine what aspects of these methods are effective.

As previously discussed, there has been quite a bit of research done in both the field of international ICT development and the application of the field of participatory methodology, however, there is very little research that has been done on the combination of these two fields of study. Seeing that ICT development projects typically entail not only equipment distribution, but also knowledge transfer programs, or trainings, and seeing that participatory learning methods have been proven to be an extremely effective method of knowledge transfer, a combination of these two frameworks may be useful.

Appropriate Technology

Experts in the field such as Matthew Betz define appropriate technology as: "Providing technical solutions that are appropriate in the economic structure of those

influence to their ability to finance the activity, to their ability to operate and maintain the facility, to the environmental conditions involved, and to the management capabilities of the population" (Le Goc, 2002). Others such as William Riedjik refer to appropriate technology as "that which maintains the sum of a country's knowledge, skills, resources, and other qualities of its people" (Le Goc, 2002). While other experts such as Kelvin Willoughby, noting some discrepancies in the initial definition, have re-defined and broadened appropriate technology to be "a technology tailored to fit the psychosocial and biophysical context prevailing in that particular location and period" (Le Goc, 2002). This final definition begins to take into consideration the effects that this current age of globalization has on technology, particularly computer information systems distribution.

Until January 2002, US funded ICT development programs could be thought of on two levels, the first being infrastructure building, and the second involving knowledge transfer through training. However, upon evaluating the efficiency and effectiveness of implementing ICT programs, the US government spearheaded a new strategic approach to attacking the problem of the digital divide. This strategic approach consisted of a three tiered approach to implementing ICT programs. The first is through ICT infrastructure development, the second is focused on setting up ICT's in educational systems, and the third is establishing the policies that govern these technologies. Training is now an integrated complement of all three of these approaches, and can be view as essential in the implementation of them all. It is by looking at capacity building programs such as those focused on transferring information technology knowledge though training, that a connection between information communication technology, training, and human capital development, can first be seen.

Framing the question

The theoretical framework will involve a combination of several seemingly un-related frameworks including, ICT (Information Communications Technology) development theory, human capital growth theory and participatory training methodology. Seeing as there is little research in existence that combines these frameworks in a way that has been proven to be practical and useful in its implementation, this research may lay the foundation for such a combination.

In this study, it was important to the discussion to gain incite into how the development world currently views technology transfer. By laying out the current framework in which ICT development projects are being developed and implemented, we may then begin to gain an understanding of the context of international ICT projects as a whole. However, as mentioned early, to answer the questions proposed in this research project, solely utilizing the framework in which ICT development projects are working within will not be adequate. The frameworks involving human capital development and the theory of participatory methodologies must be viewed as well.

Outline of Research

First, it is necessary to provide a detailed overview of the current literature in the field of ICT technology, participatory training, and indicators of definitions of human capacity development. In this literature review, I provide a general introduction of the problem of the digital divide from an international development perspective. Within the description of the problem, I also provide a historical overview of the evolution of Information Communications Technology (ICT). I then contextualize the research problem

by taking a brief look at the tech readiness of developing countries by looking closely at the status of the continent of Africa. Next, I provide the reader with a brief introduction to the Information Revolution. I begin by defining this revolution in terms of the major actors within it and go onto show the impact of these players, including ICT development programs.

The next two parts focus on training methods. The first part discusses the traditional Participatory Action Research methodology and focuses on the aspects that apply to technology development. The final part focuses on instructional design techniques. Finally, I focus in on the training methodology that has been utilized in implementing these programs. I provide a brief overview of the evolution of the methodology over the past decade within these foreign assistance ICT programs.

In the next chapter of the research, I discuss the methodology used in employing this research. This section is broken up into two parts: the first part being the methodology I initially planned to use and the second will be a discussion of the amended methods. Within this section, I provide the reader with a brief overview of some of the problems encountered in the implementation of the original methodology and my reasoning for choosing the amended methods.

In the next chapter of the research, I provide an analysis of the data that I was able to collect. In this chapter, the reader is walked through a quantitative discussion of the analysis of a relationship between increasing the use of technology and the Human Capital Growth. I then discuss how increasing the effectiveness of ICT training programs can lead to an increase in Human Capital Growth.

The final chapter provides the reader with a proposed model that may be used in a more effective implementation of these programs. I discuss conclusions that I've

made about the research problem. I also discuss the limitations of the research and the implications I've identified for future research.

Limitations of Research

Limitations to this research include limitations in responses and resources that were not seen prior to beginning the study. Due to these limitations, it is impossible for me to conclusively prove that implementing more appropriate training techniques within ICT development projects will lead to an increase in human capital development, although a look at the a quantitative description of this relationship will be given.

This chapter has laid the foundations for this paper. It introduced the research problem, as well as the research questions and hypotheses. The research was justified, definitions were presented, the methodology was briefly described and justified, the report was outlined, and the limitations were given. On these foundations, the report can proceed with a detailed description of the research.

CHAPTER II

ICT'S: THE SETTING, THE STRUGGLES, THE SOLUTIONS

This chapter is broken up into four parts. The first part provides the reader with a general introduction of the problem of the digital divide from an international development perspective. Within the description of the problem, I also provide a historical overview of the evolution of Information Communications Technology (ICT).

The second part provides the reader with a brief look at the tech readiness of developing countries by looking closely at the status of the continent of Africa. The third part provides the reader with a brief introduction to the Information Revolution. I begin by defining this revolution in terms of the major actors within it and go onto show the impact of these players, including ICT development programs.

The last two parts focus on training methods. The first part discusses the traditional Participatory Action Research methodology and focuses in on the aspects that apply to technology development. The final part focuses on instructional design techniques.

Finally, I focus on the training methodology that has been utilized in implementing these programs. I provide a brief overview of the evolution of the methodology over the past decade within these foreign assistance ICT programs.

Digital Divide

> "In which directions do communications flow? Are the benefits distributed equally or proportionally among participants? Who processes' global issues—that is, who wields influence, control or authority?...Who commands the capabilities—financial, technical and intellectual—to set up or alter the networks of transactions? Whose values are effectively promoted in the endeavor?" (Cogburn and Adeya, 1999)

In some countries the introduction of the Internet marks the beginning of a process of de-industrialization and the transition from industrial to the information society (Thapisa, 2000). The assumption is that information can be used to improve things such as, the quality of life, economic productivity, and the management of the environment. .

Over the past decade in particular, the transition of society from a material one to an information society has become a prevalent movement. With most of the world currently "on-line", or rushing to get there, there is a tremendous need for a definition of the social processes involved in this. This transition from a material to an information society is commonly termed as an "Information Revolution" (L. Brock, 2002).

Although this may be a term loaded with different interpretations, there have been attempts to deconstruct this term. One interpretation of this term is defined by L. Brock. He breaks apart the transition into three dimensions:

1. The upgrading of processing information rather than materials as objects of economic activity.
2. The involvement of global communication networks, which is the pointer to socio-cultural dimensions.
3. The change in the nature of work, which has profound socio-economic dimensions (Brock, 1996).

In order to begin investigating the role of ICT's in the developing world, it is important to first look at what is considered technical and social concurrently. Our knowledge of technology is essentially social; it is a construction rather than a reflection of the machine's capabilities. This can be seen clearly in the differing ways in which computer technology has been utilized. The technology of the computer is utilized for anything from ensuring national security to developing the cars we drive to assisting children with learning elementary arithmetic. Of course, not any construction is possible because the construction of technological capacity is not itself unconstrained (Grint and Woolgar, 1997).

So, how did this disparity in access and usage of technology arise? In order to explore this question, it is important to first look at the history behind the evolution of Information Communications Technologies.

According to a report by OECD in 1998, OECD member countries defined the ICT (Information Communication Technology) sector as a combination of manufacturing and services industries that capture, transmit and display data and information electronically. This definition is based on an international standard classification of activities (OECD, 2002), and was considered to be a first step towards obtaining some initial measurements of ICT sector core indicators. (OECD, 2002)

Some scholars have said that IT (Informational Technology) includes all those technologies utilized to create, store, process or communicate information, but usually means the electronic forms. IT is the technical means by which the processes within society gains desired goods and services and maintains security are carried out with some degree of efficiency (McMahon, 2002)

In 2002, the dot-Com Alliance, a USAID ICT development sponsored project, referred to ICTs as the collection of technologies and applications available from the convergence of "information technology" and "telecommunications." The project goes on to describe how ICT's are "used in establishing telecenters, creating e-governance and e-commerce systems, enabling distance education, building human capacity and improving institutional efficiency." (dot-Com, 2003)

These varied definitions, provide some understanding of the complexity of technology in development today. To gain a deeper understanding, and gather more information of the foundation of the status of the work today, it is important to first look at the evolution of ICT's in international development.

The development of ICT's

Prior to the Second World War, development of technology largely focused on expanding US military research in aerospace and in communications. (McMahon, 2002) It was not until the invention of the transistor, that ICT technology was able to begin to break away from its sole use as a government tool to one that civilians could utilize as well. The transistor was invented for the purpose of improving switches in the Bell telephone systems. It was invented at Bell Laboratories by civilian researchers funded by the private corporation, AT&T.(McMahon, 2002). In 1951, Western Electric, the manufacturing arm of AT&T , began manufacturing transistors, and in 1952, as a result of an anti-trust settlement with the US government, Bell released essential information on transistor technology as part of the anti-trust settlement. (McMahon, 2002). Once the transistor market opened up to private industry, the companies that were manufacturing transistors grew in scope. In 1958, Jack Kilby at Texas Instruments (TI) and Rober Noyce at Fairchild, dramatically

increased the utility of semiconductors with the development of the integrated circuit (IC) (McMahon, 2002). This was the birth of modern telecommunications.

Simultaneous with the development of the technology surrounding telecommunications was the evolution of computer technology. Once again, this field was primarily dominated by the government, especially the military. In the late 1940s', there were several computer projects of importance beginning with John Von Neumann, who helped establish the theoretical bases of computing, and with a number of other luminaries in 1946, was working on the first parallel processing machine, the IAS computer. Building on Von Neumann's research, at MIT, Jay Forrester was working on a real time computer called Whirlwind. Whirlwind was completed in 1953 and it was the first time a computer was capable of extremely fast processing time. With the research and design in the works in 1952, the US Air Force, who funded the project, authorized MIT to enter into discussions with private companies to construct a computer system. By 1953, IBM announces the IBM 650 computer (McMahon, 2002).

Despite the telecommunication origin of the invention of the transistor and IC, micro-electronic components became most useful due to their subsequent utilization in electronic computers. In 1958, Sperry Rand, a business machines firm replaced the vacuum tubes in the CPU's of the IBM 650 with transistor technology. This resulted in a drastic increase in the production of computers. In 1951 there were only 10 computers in the US, primarily being utilized as a reserve for the military; By 1970, there were around 75,000 being utilized in not only the government sector, but also within universities and business; By 1992, there were about 70 million being used by personal consumers within the US (McMahon, 2002).

The development of the computer came in three stages, one of the first generations (1951 to 1958) was the big, valve computer; next came transistorized computer (1958-1964); followed by computers using integrated circuits (1964-1971); and the next generation (1971-1980) utilized large-scale integrated circuits (LSIC's) and the latest generation (1980-onwards) has utilized very large-scale integrated circuits (VLSIC's) intended to have much greater human interface capacity. (McMahon, 2002). As computer technology and telecommunications became increasingly commercial, it became cheaper and more accessible on a wider scale. The converging origins of the development of computing and telecommunications technology makes the pairing of these two seemingly unrelated technologies one that is natural (McMahon, 2002).

In the 1980's, the growth of wireless personal communication technologies has allowed regions without satisfactory infrastructures to leap into the telecommunications age without enormous investment in wired networks. Given that this growth in telecommunications and computing has been happening concurrently, it is only natural that development programs should move towards focusing on both of the topics. During the early 1990's, this is realization that the development field had, and hence, the term Information Communications Technology (ICT) was born.

Despite the combination of telecommunications and computer technology, the overshadowing problem of the digital divide is still growing. In an effort to address this problem, formative, participatory evaluations of each developing context plays a key role. Although every country context is slightly different, for the purpose of this paper, and in an effort to provide some kind of contextually example of the problem at hand, I will provide an example of an extreme case of the digital divide.

Tech Readiness of Developing Countries: an African perspective

The developing world is comprised of a variety of different countries varying as much in their level of technological development as they do culturally. Therefore, in order to gain some sort of understanding of the issues this paper discusses, I will use one of the more extreme examples. The following takes a look at the current ICT infrastructure on the continent of Africa to provide the reader with some idea of the level of access to technologies that are in Africa.

The use of ICTs in general has grown rapidly in most urban areas in Africa. As an indication, only four years ago a handful of countries had local Internet access, now the Internet is available in every capital city (World Bank, 2000). There are now as many mobile cell phones on the continent as there are fixed lines, hundreds of new local and community radio stations have been licensed, and satellite TV is now also widely available.

Clearly a number of countries such as those in North Africa and Southern Africa have more highly developed economies and better infrastructures that would naturally result in larger populations of Internet users. Most of these countries were also among the first on the continent to obtain Internet access and so have had the most time to develop the market. There are now local Internet Society chapters in all of the African regions and in most of the countries with large Internet user populations

According to a report conducted in 2002 by Michael Jenson, of the 770 million people in Africa:

TABLE 1

Status of Technology in Africa

Number of People / Type of Technology
1 in 13 have a TV
1 in 40 have a fixed line
1 in 40 have a GSM line
1 in 130 have a PC
1 in 150 use the Internet
1 in 400 have pay-TV (World Bank, 2000)

These numbers, although rather misleading because they include South Africa, which is far more technologically advanced then any other African country, are still helpful in providing an overview of the current situation in Africa. Nevertheless, the Internet continues to grow rapidly in Africa, and local Internet access is available in all 54 countries and territories (Africa Internet Connectivity, 2002). The number of dialup Internet subscribers now stands at over 1.3 million, up from about 1 million at the end of 2000. The total international incoming Internet bandwidth is now well over 1 gigabyte per second, while outgoing traffic is estimated at about 800Mbps (Africa Internet Connectivity, 2002).

Although encouraging trends have emerged in the last few years, the differences between the development levels of Africa and the rest of the world are even wider in the area of ICTs than they are using more traditional measures of development. Issues such as, irregular or non-existent electricity supplies are a common feature and a major barrier to use of ICT's, especially outside the major towns. Many countries have extremely limited power distribution networks that do not penetrate significantly into rural areas, and power sharing (resulting in regular power outages for many hours) is a common occurrence, even in some capital cities such as Accra, Dar es Salaam and Banjul. Furthermore, most governments still treat

ICTs as luxury items, and place large taxes on the importing of materials and equipment. Since little production of technological equipment occurs in Africa, almost exclusively imported commodities are extremely expensive, and thus unobtainable by the majority.

Academic institutions and NGOs in Africa, especially those in Francophone countries, have been addressing these problems for many years by attempting to reduce the cost of equipment through extensive use of free and open-source application software and operating systems such as Star Office and Linux (Jensen, 1999). There is currently more worldwide growth in popularity of Linux and Open Source Software worldwide, the use of low-cost software more widely in Africa may be an option (Jensen, 1999).

This is just one example of the effects of the digital divide on a continent. It became apparent that in Africa, the lack of money for purchasing the expensive equipment and software needed for growth of ICTs has hindered ICT infrastructure development and hence, access of the African people to ICT's. However, despite the lack of sufficient funds to develop and ICT infrastructure on a wide scale basis, it is obvious that there are some individuals trapped in this digital divide who desire access to ICT's. This phenomenon was extremely apparent to me in my Peace Corps experience, but it has also been written about and termed the "Information Revolution."

"Information Revolution"

According to the UNDP, the challenges that need to be addressed for Africa to thrive on the integration of technology:

1. The development of information and communication infrastructure.
2. Human resource development and employment creation
3. The current African position in the world economy
4. Insufficient legal and regulatory frameworks and government strategy.

In their report put out in 1999, Cogburn and Adeya generated the following prescription:

> "National and regional strategies are already in place to address this issue. However, they need to take care to develop strategies to minimize the impact of the components of the population whose educational level and technical skills do not fit (and may never fit) the requirements of the new techno-economic paradigm of the information economy." (Cogburn and Adeya, 1999)

Development organizations, such as the UNDP, see the transition of the global economy, to one based on knowledge and information as presenting numerous opportunities for developing countries that are willing to address them strategically. They claim that Africa and other developing countries can move to strategically develop competitive advantages within this new economy, based on their own specific histories and material conditions (Cogburn and Adeya, 1999). This promotion of development organizations, such as the UNDP, in coordination with the national and regional governments of areas such as Africa, of upgrading the methods of processing information, rather than materials as means for economic growth in the developing world, displays the first attribute of Brock's "Information Revolution".

Development agencies are not the only ones involved in the propagation of this revolution, but private industry such as ISP's, and Web-based service organizations have also played a role in generating Africa's involvement in this Revolution. They have acted in response to the high cost of Internet services and the slow speed of the web, and also because of the overriding importance of electronic

mail, lower-cost email-only services have been launched by many ISPs and are continuing to attract subscribers.

There is also a rapidly growing interest on the part of the people of Africa, in kiosks, cyber cafés and other forms of public ICT programs, such as adding PCs to community phone-shops, schools, police stations and clinics that can share the cost of equipment and access amongst a larger number of users. Many existing 'phone shops' are now adding Internet access to their services, even in remote towns where it is a long-distance call to the nearest dialup access point. In addition, a growing number of hotels and business centers provide a PC with Internet access. Regional ISP, AfricaOnline, has rolled out hundreds of public access kiosks as part of its e-Touch franchise program in which local stores are provided with a PC to provide email and Internet access (ISC, 2002).

Over the past few years, there has been a tremendous attempt to gather quantifiable information regarding the distribution of the infrastructure in Africa. One study has been done by Network Wizards. They are a multinational non-profit Internet software consortium which surveys yearly the number of "domains" or hosts to the Internet. Since this survey's conception in 1987, the main goal was to compile quantitative information regarding the Internet (ISC, 2002). In 1999, in the Network Wizards survey, the total number of computers permanently connected to the Internet in Africa (excluding South Africa) broke the 10,000 mark. However, these figures have become increasingly meaningless in Africa with the widespread use of .com and .net domains, and the frequent re-use of IP address space behind firewalls due to the difficulties of obtaining pubic IP space. As a result, many of the African countries in the Network Wizards surveys show zero or only a handful of hosts, when in actual fact there might be hundreds, if not thousands of machines connected to the Internet

there (ISC, 2002). The lack of available quantifiable information regarding Internet usage in Africa is one obstacle in being able to measure its impact on inequality within the social context of Africa itself.

Each computer with an Internet or email connection usually supports a range of three to five users. This puts current estimates of the number of African Internet users at somewhere around 4 million in total, with about 1.5 million outside of South Africa. This works out to be about one Internet user for every 200 people, compared to a world average of about one user for every 15 people, and a North American and European average of about one in every 2 people (Jensen, 1999). The UNDP World Development Report figures for other developing regions in 2000 were: 1 in 30 for Latin America and the Caribbean, 1 in 250 for South Asia, 1 in 43 for East Asia, 1 in 166 for the Arab States (Jensen, 1999). Little quantifiable information is available regarding the number of rural vs. urban users in Africa, but it is safe to say that users in the cities and towns vastly outnumber rural users (Jensen, 1999).

However difficult it may be to accurately measure the distribution of infrastructure within Africa itself, it is not difficult to compare Africa's existing infrastructure with the rest of the world. Part of the differentiation comes from the cost of the infrastructure. Currently, the average total cost of using a local dialup Internet account for 20 hours a month in Africa is about $68 per month (World Bank, 2000). ISP subscription charges vary greatly - between $10 and $100 a month, largely reflecting the different levels of maturity of the markets, the varying tariff policies of the telecom operators, the different regulations on private wireless data services and on access to international telecommunications bandwidth.

According to the Organization for Economic Cooperation and Development, in 1997, 20 hours of Internet access in the U.S. cost $29, including telephone charges.

Although European costs were higher ($74 in Germany, $52 in France, $65 in Britain, and $53 in Italy) costs have likely dropped since 1997 and all of these countries have per capita incomes that are at least 10 times greater than the African average (Jensen, 1999). Real gross domestic product (GDP) growth in Sub Saharan Africa fell from 3.7% in 1995 to 2.0% in 1999, whereas gross national income (GNI) per capita declined to $490 in 1999 from $520 in 1995 (Jensen, 1999).

With the growing worldwide consensus over the importance of ICTs in addressing development issues, there are currently tremendous resources being directed toward supporting access to the Internet in Africa by both the international community and national governments. The impact of much of these efforts will depend largely on the extent of expanding the understanding of the social impact of technology on developing societies.

Technology choice and design options are becoming more readily apparent as technologies mature, but perhaps more importantly, a re-assessment may be needed of the traditionally held view that implementing technology in a setting with limited resources is not feasible. However, before we enter in to addressing this issue, it is important to gain an understanding of the next step in ICT development, the ideal methods used to transfer technology.

Instructional Design

> "How technological capabilities are utilized is more critical than the capabilities themselves. Simply put, more is not necessarily better: Designers must be aware of the cognitive demands their systems place on learners and thoughtfully apply techniques that support, not interfere with, learner effort...It is far easier to create something with great cosmetic appeal than an integrated learning system that is consistent with available research and theory" (Hannafin, Hannafin, Hooper, Rieber, and Kini, 1996).

Evidence has shown that there is a dramatic shift away from instructor-led, classroom training to a more learner-centered, technology-mediated training. This shift is evident when we look at data provided by the American Society of Training and Development that Bassi and Van Buren (1999) used to predict that companies will have reduced classroom training nearly 20% between 1997 and 2000 by delivering training programs using CD-ROM's, intranets, or the Internet (Brown, Ford, 2002). All of these solutions are using computers in a variety of forms and therefore can be referred to as "computer-based training."

Although it is has been shown that computer-based training can reduce long-term training costs for learners (Hall, 1997), there is still a question of how to implement these types of trainings effectively within organizations. Most of the current literature has focused on the technology (interface, navigation and screen design) without discussing the learning processes and outcomes (Brown, Ford 2002). This lack of discussion on these processes is an obvious gap in the research into computer technologies and training today. As most researchers will agree, a poorly designed training will not stimulate and "support learning no matter how appealing or expensive the technology used" (Brown, Ford 2002).

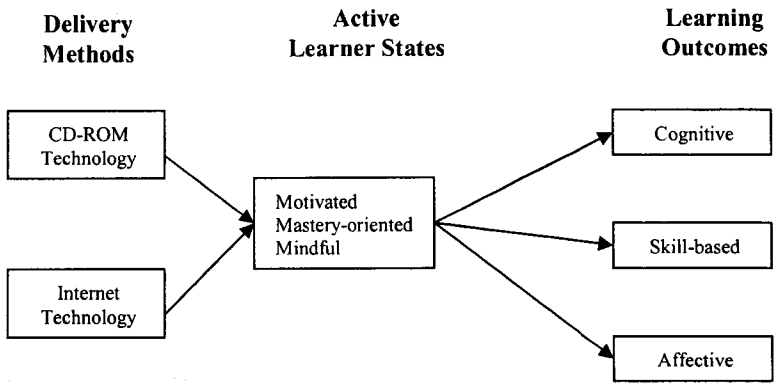
In an attempt to address this issue, Brown and Ford discuss the need for creating an engaging learning environment for the user so that they will become "active participants in their own learning experience." (Brown and Ford, 2002). Obviously this is a challenge, particularly when computer based technology is used that needs to be established ahead of time.

There are many models of learning that exist out there. Malcolm Knowles discusses what is called the "Whole-Part-Whole Learning Model" (Knowles, 1980). Another one that is commonly used in instructional design mentioned is an "Input-

Process-Output model of Learning" (Brown and Ford, 2002) (Figure 2). Rather than enter into the debate of what aspects of these learning models for the purpose of this discussion, I will use the "Input-Process-Output" model as a basis for comparison.

The "Input-Process-Output" consists of three various components including Delivery Methods (eg: CD-Rom technology, Internet, Intranet technology), Active Learning States (eg: Motivated, Mastery-oriented, and Mindful), and Learning Outcomes (eg: Cognitive, Skill-based, Affective).

Figure 1: Input-Output Process Model



Brown, Kenneth and Ford, Kevin. "Using Computer Technology in Training: Building and Infrastructure for Active Learning." *Creating, Implementing, and Managing Effective Training and Development: State of the Art Lessons for Practice.* San Francisco: Jossey-Bass, Inc., 2002: p. 196.

This model, which is a commonly accepted design principles of today, is focused around traditional classroom delivery where a "structured and sequenced learning environment" assists learners in mastering the training content" (Brown and Ford, 2002). However, as we go further in depth with the research done on effective

learning strategies, this reliance on the traditional "input-output" method has tremendous flaws in its practical application.

Yet, this is a model that is commonly used today in the design and delivery of computer-based training. This model does deviate slightly from the traditional classroom instruction in that a) classroom instruction is inherently group-focused and normative; the class is usually targeted to average learners and there is a projected distribution of participants and b) computer-based instruction puts control of the training in the hands of the learner; learners structure and guide their own learning (Brown and Ford, 2002). Therefore, while the design of such programs is still based on the traditional input-output model, computer based training "offers the potential to individualize learning experiences based on the desire, abilities, experience and ongoing activities of the learners" (Brown and Ford, 2002). A tremendous importance then is placed on learner characteristics, or the actual needs of the learner.

At this point, a discrepancy arises in the literature. There is a tremendous amount of information regarding the transfer of ICT's in developing context, particularly as it relates to the digital divide movement and information revolution. However, there is limited information on the methods behind training of ICT's in a developing context. The simple part of this paper is to show a correlation between the usage of technology and economic growth. The more difficult explanation comes from the creation of a training methodology that will increase usage of technology. This paper will attempt to generate an ideal model of this methodology by combining the training methods developed by instructional designers in the U.S. context with nonformal participatory learning methods that have proven to be effective in community development efforts in developing contexts. The following is a brief overview of what is meant by Participatory Learning Methodology.

Participatory Action Research

One of the most well known participatory methods in today's development spectrum is Participatory Rural Appraisal (PRA). PRA allows the communities to take control over their own learning. (Chambers, 1997) Traditional PRA involved much visualization, the physical expression of sharing knowledge through maps, models, lists, matrices, and diagrams. PRA begins with the assumption that poor communities have a wealth of local technical and social knowledge.

Seeing that the concept of PRA was created based from prior experience and not from prior principle, a concretized definition of the ideals employed is extremely difficult to determine. However, the three general pillars upon which can be used to discuss the concept are:

1. The behavior and attitude of others
2. The methods, which shift the normal balance from closed to open, from individual to group, from verbal to visual, and from measuring to comparing.
3. Partnership and sharing information, experience, training, between insiders and outsiders, and between organizations.

PRA was originally designed as a reaction to the modernization approach to pre-packaged technological solutions to development that can be imposed by external professionals. (Archer and Cottingham, 1996) Robert Chambers is seen as one of the experts behind PRA. He refers to the pre-existence of this idea within other educational methodology frameworks:

> "Participatory Rural Appraisal belongs to, draws on, and overlaps with other member of a family of approaches that have been or are participatory in various ways. These include the community development of the 1950's and 1960's, the dialogics and concscientization of Paulo Freire, participatory action research, and the work of activist NGOs." (Archer and Cottingham, 1996)

Although PRA is a technique most commonly discussed in development work, it is this broader concept of Participatory Action Research (PAR) upon which PRA is based, that has begun to appear in ICT programs over the past decade. Generally, the concept of PAR focuses on the idea that the poor and exploited people can and should be able to analyze their own reality. It was originally developed as an institute of social change, so it has enough rigidity within it to work with computer technology, yet it possesses enough flexibility to enable participants' inclusion in the process.

From the beginnings of PAR, this methodology has been commonly associated with giving "credence to the development of the powers of reflective thought, discussion, decision, and action by ordinary people participating in collective research on 'private troubles' which they have in common." (McTaggart, 1997) It grew out of the belief that people would take more effective action by collecting and analyzing data together. (Watkins and Brooks,1997) Kurt Lewin is a western social psychologist who is typically credited with unknowingly translating Freire's participatory ideology into the Westernized world for use in the development sphere in the 40's. The tradition he began, commonly known as action science, emphasizes the continuities between the "activities of science and the activities of learning in the action context...and the benefits of combining science with social practice." (McTaggart, 1997)

From Lewin's work there were four types of action research that developed:

1. Diagnostic Action Research—designed to produce a needed plan of action.
2. Participant Action Research—where it is assumed that the residence of the affected community who were to help
3. Empirical Action Research—Primarily a matter of record keeping and accumulating experiences in day to day work, ideally with the succession of similar groups.
4. Experimental Action Research—Calls for a controlled study of the relative effectiveness of various techniques in nearly identical social situations. (McTaggart, 1997)

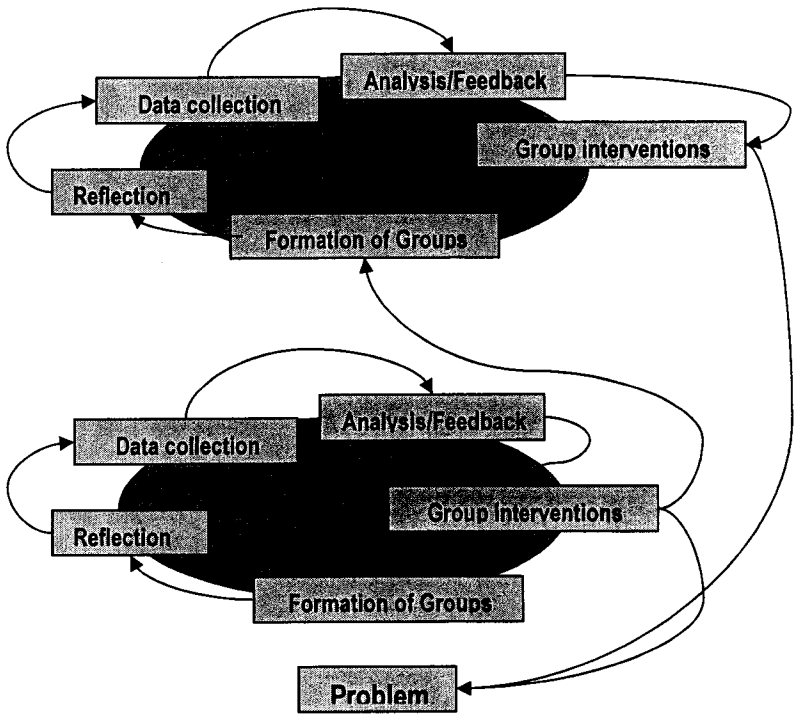
Although all of these research methods may be applied to development work in some aspect, as stated earlier, it is Participant Action Research that can be seen as effective in the variety of ICT programs employed. The breakdown of typical PAR procedures are:

1. Formation of groups from among those who have the problem.
2. Reflection on problems in groups
3. Collection of data around the problem.
4. Group analysis and group feedback.
5. Group-designed interventions to attempt to solve the problem. (Watkins and Brooks, 1997) (Figure 2)

As can be seen by the systems model of the PAR procedure (Figure 2), this is a closed system, yet has the opportunity to grow. It is a procedure that begins with a problem of some sort, yet uses traditional group problem solving to attempt to address this problem. The image I have constructed appears to be sort of the beginning of a spiral, an infinitely growing spiral that has a problem from which it is based.

Traditionally, PAR has been used in rural/grassroots development programs. However, I feel that there are some aspects of this methodology that translate extremely well to technology training. These aspects can be seen in the newly developed field of instructional design theory.

Figure 2: Diagram of Participatory Action Research System



Here is where a gap in not only the literature, but in the field can be seen. There are appropriate models of development involving community participation that have been deemed extremely effective. There are also appropriate models for learning new technologies in the US context that have been extremely effective, particularly involving blending learning using an input-output model in instructional design. However, there is currently no model that combines these two models in a practical way in an international context.

A second gap may also be seen in the literature discussion of ICT development and the motivating factors behind it. There are numerous discussion about how the introduction of technology effectively will lead to economic development. However, literature discussing the process by which this happens is sparse. It is this scarcity that led me to step back and look at ICT development as a process. This process of

technology transfer which begins with access, progresses to quality or training, moves on to increasing users, which increases human capital that eventually increases access so the cycle begins once again. Within the next chapter, I will discuss in detail the methodology that I have used within this research and the problems I've encountered.

CHAPTER III

QUALITATIVE COMPLICATIONS AND A QUANTITATIVE SOLUTION

The focus of this study was initially on attempting to discover the extent to which the identified ICT programs are using participatory techniques such as the Participatory Learning Approach (PLA), within their implementation. The initial action plan for this study was to critically analyze the survey results of the ICT Program Officers, in order to gather some sort of measurement of effectiveness and hence a preliminary consensus on the conditions that need to exist for effective implementation of ICT training in a developing context. However, due to an extraordinarily low response rate, this method was not usable, and an alternative method had to be adopted.

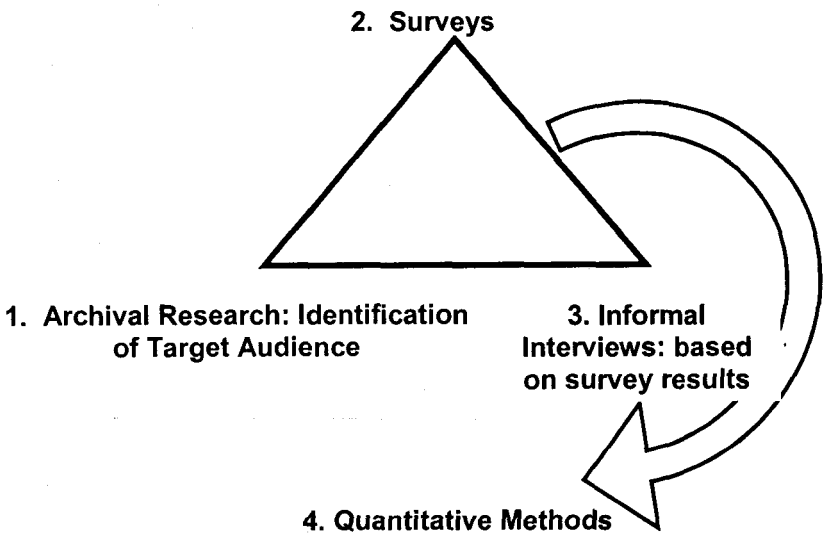
The purpose of this chapter is to operationalize the proposed hypothesis in the research. By operationalize, I mean to "specify the operations or activities used to measure a theoretical concept or variable" (Ferris 31). The operationalizing of the hypothesis involves two distinct tasks, the first is determining which variables will adequate represent the factors in the hypothesis, and the second is to determine how these variables work together as a new indictor to affect the hypothesis.

I will begin by describing my initial methodology. I will then go on to provide a detailed description of my data collection instruments, as well as justification for the methods ultimately used.

Methodology

When I initially embarked on this project, I mapped out a triangulation technique of data collection. Below you will find a detail of each piece of this triangulation:

Figure 3: Triangulation of Methods



If you'll notice from Figure 3, I began this research by conducting archival research to identify the program officers and possible ICT projects of interest. My intent was to compile a list of program officers and the types of projects that were currently active, so I could have a pool of projects and people in the field in which I could then use as the subjects of my research. I was able to acquire a list of 60 + program staff and their contact information. This list provided me with a pool of relevant individuals who would then have the relevant knowledge and

background to be able to provide me with the information I was looking for on my survey. I identified my primary target group for this survey and interview process through internet research and informal networking and discussion with people involved in the ICT development community. This identification was done using a top-down approach. I began by looking at the major funding agents of technical projects such as ICT programs (ie: USAID, World Bank, UN, etc..). Once the major funding agents were determined, I then looked at the organizations where these funds are distributed. It was within these organizations, primarily NGO's, that I was able to compile the list of program officers for my sample.

Survey

The second part to my methodology was the development of an on-line survey. In this survey, I asked questions that would not only provide me with a demographic breakdown of various project characteristics, but that would also provide some incite into the effectiveness of their specialized ICT training programs.

My initial goal for this review was to be able to identify whether or not the targeted ICT training programs were using a participatory approach. In order to accomplish this, I began by first looking at the origins of "participatory methodology" and from there extracting the indicators I would use to compare with the current methodology being employed in ICT training programs. Once these indicators became apparent, I integrated them within the development of the survey questions in hopes I could compare them with the survey responses I received.

My initial goals in conducting this survey were:

1. To generate a demographic breakdown of all of the current ICT projects occurring.

2. To attempt to identify what aspects of these training projects these program officers feel are the participatory learning aspects.

The goal of this survey was to be able to look at a variety of cross tabular data to see if there are any trends appear in the types of training that is being done, or even in the types of projects that are being implemented. This data will include information about the characteristics of participants, directly related indicators of participation in training, and even the location of projects.

The survey questions were developed in November 2002 and I chose to conduct the survey on-line. My logic in choosing to place the survey on-line was derived from my assumption that because each individual I was surveying worked in some capacity for a technology development program that they were technology savvy. A preliminary iteration of the survey was sent out to 3 technology savvy colleagues of mine who work for international development agencies. I chose these three colleagues, not only because of their familiarity with some of the international development terms used in the survey language, but also because of their familiarity with education terms and participatory techniques. I integrated the feedback they provided for me in the survey, and after 3 more iterations, had a survey that was ready to be distributed.

I sent out the first round of surveys in May 2003. I drafted a cover letter and sent an email out to all of the individuals I had identified through careful research of the field (Appendix 2). I received all of my responses in this first round. I followed up again in June 2003, but received no responses to my request. Prior to sending out

the first iteration of the survey, I was having informal discussions with several individuals in on the list. I was hoping that this survey will illicit a response rate of at least 30% based on the interest I have begun generating through discussions and networking within the ICT development community. However, I received 3 responses. Further discussion of the results from the survey may be found in Appendix 3.

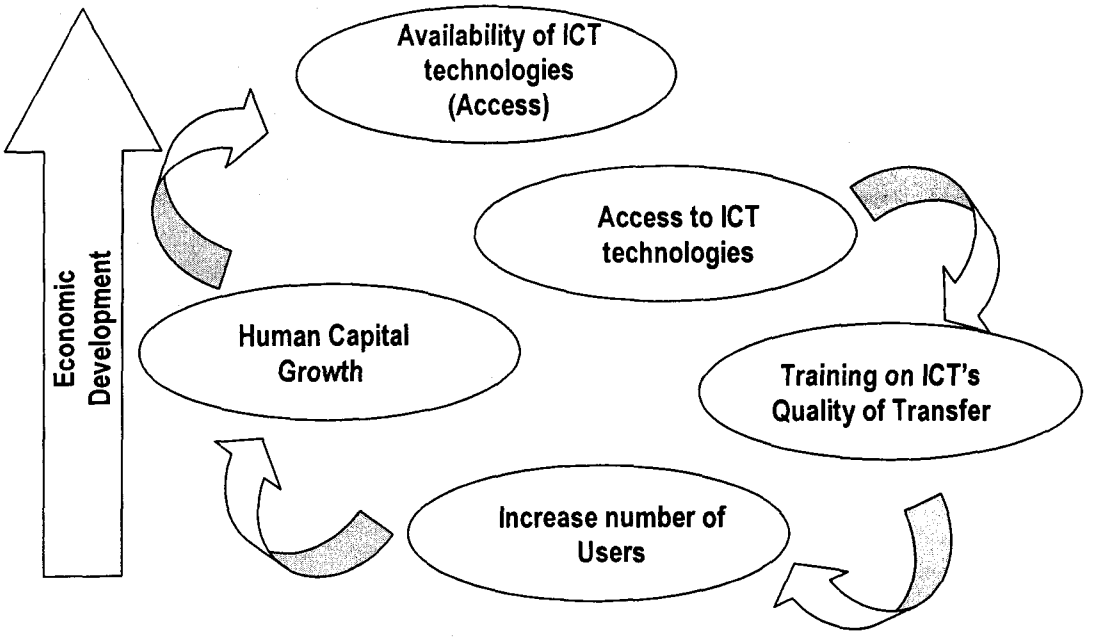
Interviews

The third and final component of the methodological triangulation was to choose at least 10 of these program officers and conduct face-to-face follow-up interviews. Within these interviews, I intended to gather some qualitative information, regarding the effectiveness of the participatory approach of their programs. This information would have been helpful in my interpretation of the survey results. I was hoping to be able to generate more in depth, clarification questions for the interviews, based on the results of the survey, regarding what types of participatory methods are being used in the specified programs. Unfortunately, in this case, it made little sense for me to interview the identified individuals, if there was no preliminarily information upon which to develop interview questions.

With the advent of a lack of responses in my survey, I was forced to re-think the methodology that would address my research question. It seemed impossible for me to further explore the types of methods used in ICT training programs, when I wasn't able to elicit a response from the program managers. Therefore, I began looking for a way or a method of exploring the connection between ICT development and more effective training.

With the lack of response rate and the gap in the literature on successful processes of technology transfer, I chose to look at the process as a whole. Below you will see a model of the process of ICT development as I have defined it:

Figure 4: Technology Transfer Process



Although this model is circular in nature, it should take the shape of an evolving spiral of sorts progressing upwards. If you'll notice from the model, although there is no direct connection between the quality of training and Human Capital Growth, they are only separated by the Increase in number of users. Seeing that there are statistics that are readily available that represent human capital growth and usage, in attempt to gain some sort of incite into the value of effective training, I chose to analyze usage level and human capital growth. I determined that the most reasonable way to achieve such a connection would be to use quantitative measurement tools.

I was able to find the most valid information on ICT's relating to infrastructural and usage indicators. Even though it may be extremely difficult in the developing context to measure usage of technology such as a village well or a rice husking machine, the usage of technologies such as access to the Internet and cell phone usage are relatively easy to track somewhat reliably. Although there may be some flaws in usage based on the fact that multiple users can use the same ISP (Internet Service Provider) connection, and that multiple parties may use a single cell phone, for the purposes of this study, these indicators provide enough accuracy.

I was able to use publicly available quantitative information that the World Bank provides. I then was able to conduct a quantitative analysis of World Bank data sets to determine whether or not a relationship between ICT usage and human capital growth does exist. In this case, I used a combination of indicators from the World Bank and the UNDP.

I used the statistical package known as SPSS to conduct a bi-linear regression on human capital growth. I was searching for some sort of a relationship between and increase in human capital growth and an increase in ICT usage. If I would be able to find such as relationship, then as Figure 5 indicates, then the relationship between ICT training and human resource capacity becomes apparent.

Defining and Measuring the Variables

Dependent Variable

Human Capital Growth

As previously mentioned, human capital growth can be described as the capabilities or capacities, both innate and derived or accumulated, embodied in the working age population that allow it to work productively with other forms of capital

to sustain economic production. The term human capital has traditionally applied to education broadly defined and includes the knowledge and skills that the working age population (or more narrowly the labour force) accumulated through formal educational attainment, training, and experience (OECD, 2002).

In the field of training and education, it is suggested that the average educational attainment of the working age population may be adopted as an indicator of the sustainability of human capital in the education area (OECD, 2002). Additional years of education normally produce more knowledgeable and skilled workers; a situation where average educational attainment is declining is not consistent with the sustainability of human capital. However, the problems associated with adopting an input indicator such as educational attainment as a proxy for sustainable human capital are much less severe than would be the case if a true input indicator such as educational expenditures was adopted (Stuart, 1997).

The first independent variable in this hypothesis is ICT usage indicators. As previously mentioned, I have chosen three indicators of ICT usage that cover the broad spectrum of ICT's. The three variables I have chosen are 1. Mobile Phone subscribers; 2. Personal Computer Usage; 3. Internet Analog Dialup Accounts (Figure 5).

Independent Variables

Figure 5: Independent Variables

Mobile Phone	Subscribers (000s)	Cellular and PCS subscribers. Future forecasts incorporate other technological platforms, including third generation systems. Forecasts are segmented into subscribers with packet service (typically, this coincides with third generation system deployment, or the upgrade of current digital systems next generation systems) to capture the mobile population with Internet or data services.
Personal Computer Usage	Survey Per (100)	The number of computers per household.
Internet Analog Dialup Accounts	Accounts (000s)	This data point captures the number of individuals subscribed to an Internet service (usually via an Internet Service Provider (ISP)). This number is not to be confused with the notion of Internet "users", which is the more common statistic used to measure the size of the Internet market. Each account, therefore, may have more than one user. Primary Source: Operators

Source : UNESCO Institute for Statistics (United Nations Educational, Scientific and Cultural Organization). 2003. Correspondence on education expenditure.

Timeframe

When looking at the effect that ICT usage has on a Human Capital Growth indicators there is a plethora of data available, particularly in the past five years, for a wide range of countries. Keeping in line with the global reach of the ICT projects that currently exist, I chose to keep and use the data that spanned the globe.

As I will discuss further in my analysis, I chose to use only those data points that were within 3 standard deviations from the mean. Therefore, although the data I viewed was global in nature, it was not all encompassing.

Over the past five years, more and more data is becoming available on usage levels of ICT's. As previously discussed, as globalization has become a driving force for development, ICT usage has begun increasing. International development

agencies have not been the driving force behind the technology, in fact, they've been struggling to keep up. Given this fact, measurement of ICT usage is relatively new to the field. Therefore, data is sparser the further back in time you get. I chose to view only the data from 2001. This year was the first year that had data for the majority of the countries on ICT usage.

Unit of Analysis

My unit of analysis is the end user. I have chosen this as my unit based on the assumption that human capital growth will eventually lead to economic development (Figure 4). By focusing on the relationship between the number of users of ICT technologies and the number of illiterate individuals in a country, I am able to show that these two seemingly unrelated topics have a meaningful comparable unit of analysis.

Tools used in analysis

I used the statistical package SPSS to study the relationship between illiteracy rates and ICT usage levels. Assuming my model of the ICT development process is true, a relationship between the quality of training and human capital growth may be inferred as well. With the advent of this new methodology, I am able to provide an in-depth analysis that will hopefully be beneficial to those in the field of ICT development.

CHAPTER IV

RELATIONSHIPS BETWEEN ICT USAGE AND HUMAN CAPITAL GROWTH

This part of the paper tests the hypothesis that there is a relationship between the usage of ICT technology and the Human Capital levels of a country. According to the UN's definition, human capital can be thought of as a labor analogue to the production of capital (Stuart, 1997). The concept of human capital can be described as the capabilities or capacities, both innate and derived or accumulated, embodied in the working age population that allow it to work productively with other forms of capital to sustain economic production (Stuart, 1997). Human Capital can be an extremely difficult characteristic to quantify. Multilateral institutions (as seen in the UN's development of the Human Development Indicators) have developed measures of sorts that attempt to quantify this characteristic. These measures are primarily made up of indicators of illiteracy within a particular country.

It was this aspect that led me to choose to use the illiteracy rate as a representation of human capital growth in my analysis. The illiteracy rate of a country can be a determinate of the level of human capital a country possesses. Within this analysis, I explore how an increase in the users of ICT technology has a relationship to the human capital growth.

To begin my analysis, I must first begin by stating the null hypothesis (H_0). The null hypothesis is a term that statisticians often use to indicate the statistical hypothesis tested. The purpose of most statistical tests is to determine if the obtained results provide a reason to reject the hypothesis that they are merely a product of chance factors. The null hypothesis in this case states: H_0 = that there is no

relationship between human capital indicator and the indicators for usage of ICT technology.

The following analysis is based on the alternative hypothesis (H_1) that there is some sort of relationship between human capital growth and ICT usage. It is based on the relationships developed in the model of ICT development seen in the previous chapter (see Figure 4: Technology Transfer Process).

THE MODEL

To study the relationship between human capital growth and ICT usage it is important to first define the model from which this relationship will be determined. The independent factors that I chose to test, based on what researchers have identified as an accurate indicator of Human Capital Growth, the illiteracy rate. The three dependant factors chosen are the number of Telephones (per 100 users), the use of personal computers, and the usage of cell phones (per 100). The data was gathered from sources provided by the World Bank, and the UNDP Human Development Index.

I began my analysis by first performing a bivariate analysis on each of the specified indicators of usage to verify that there was indeed a significant relationship that did exist between each of the variables chosen. The formulas used to determine each of these bivariate relationships are as follows:

$$\textbf{(1)}\quad Y = 48.884 - 7.252x_1$$

Where **Y** is equal to the rate of illiteracy in a given country and x_1 is equal to the adjusted number of Cell Phone users per 100 people in a specified country.

$$\textbf{(2)}\quad Y = 34.460 - 2.499x_2$$

Where **Y** is equal to the rate of illiteracy in a given country and x_2 is equal to the adjusted number of Personal Computer users per 100 people in a specified country.

$$(3)Y = 60.823 - 9.931x_3$$

Where **Y** is equal to the rate of illiteracy in a given country and x_3 is equal to the adjusted number of Telephone Lines per 100 people in a specified country.

Based on the factors that I am assuming are indicators that are representational of ICT usage, I have chosen to look at the following three variables, 1) Cell Phone users, 2) PC Users , and 3) Telephones (per 100 users) users[1]. I chose these factors because as the usage level of technology increases, this implies that more people are gathering new technical skills. When skills acquisition occurs, then the human capital of a country can increase. Therefore, as I discusses earlier, it becomes extremely important to look at sustainable ways to achieve an increase in the usage of technology.

[1] Data for Internet Usage, PC usage, and Cell Phones was obtained from the World Bank Development Indicators (2001).

THE DATA

TABLE 2

Definition of Variables

Variable	Definition
Y	The knowledge and skills that the working age population (or more narrowly the labour force) accumulated through formal educational attainment, training, and experience. In this case this is the illiteracy rate or the percentage of individuals in a country between the ages of 15-25 who can be categorized as having below average literacy skills.
x_1	Cellular and PCS subscribers. Future forecasts incorporate other technological platforms, including third generation systems. Forecasts are segmented into subscribers with packet service (typically, this coincides with third generation system deployment, or the upgrade of current digital systems next generation systems) to capture the mobile population with Internet or data services.
x_2	The number of personal computers per 100 households.
x_3	This data point captures the number of individuals subscribed to an Internet service (usually via an Internet Service Provider (ISP)). This number is not to be confused with the notion of Internet "users", which is the more common statistic used to measure the size of the Internet market. Each account, therefore, may have more than one user.

EMPIRICLE RESULTS

Bivariate Analyses

To begin my analysis, I conducted a bivariate analysis on each of the variables representing usage. Prior to running regressions on these variables, I eliminated all of those data points that were outside of 3 standard deviations from the mean. The great advantage of doing this was that it helped me eliminate those countries for which we have poor data and those countries that are extremely technologically advanced (ie: the US).

The first variable I looked at was the number of Cell Phone users. In an effort to generate a strong relationship, you will notice that I adjusted this number by taking the natural log of it. Figure 6 shows the scatterplot of the Illiteracy –vs- the Cell Phone users adjusted. Each point represents a country and the line drawn through the points represents the best fit line of the plot. A 95% confidence interval for the variance of the population represented in this graph is indicated by the two lines drawn on either side of the mean line.

Figure 6: Scatterplot of Illiteracy –vs- ln(Cell Phone Users)

(1) Y(x) = 48.884 -7.252x

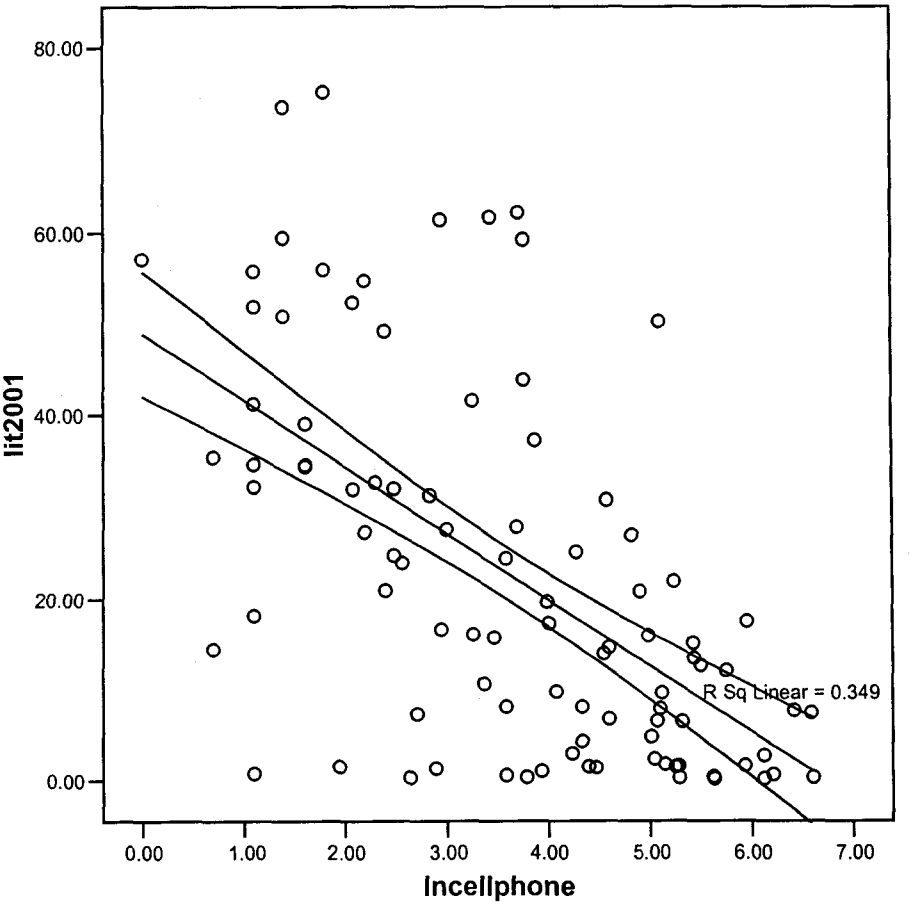


TABLE 3

Regression of Rate of Illiteracy and adjusted Cell Phone users (Equation 1)

R	R Squared	N	Beta	B (Constant)	B (variable)	T-Score	Significance
.774	.599	78	-.590	48.884	-7.252	-6.979	.000

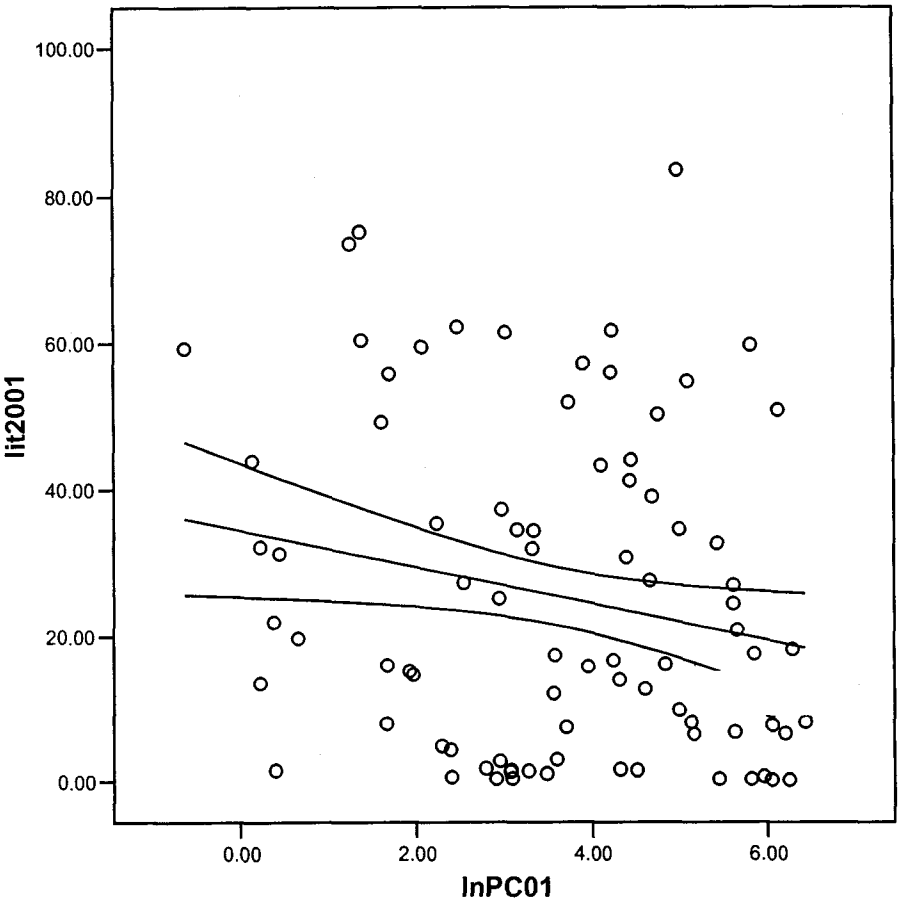
The results of the regression may be found in Table 3. The R Square adjusted for usage of cell phones expenditure is .559 which indicates that the relationship between ICT expenditure and GDP per capital is relatively significant. The slope for the equation is 48.884, and the x coefficient is negative, which makes the mathematics behind this model slightly complex. This model shows that the illiteracy rate is inversely proportional to the log of the usage of cell phones. To put into simple terms, this indicates that for every 1 person who uses cell phones, there is a decrease by the inverse exponential of 7.252 in the level of illiteracy in a given country. The t-score is -6.979, which means that we can be more than 95% certain that the slope of the line is not zero. Therefore, the null hypothesis can be rejected.

Usage of Personal Computers

The second variable I ran a bivariate analysis on was the Usage of Personal computers. Once again, prior to running the regression of these variables, I eliminated all of those data points that were outside of 3 standard deviations from the mean. Once again, I noticed a non-linear relationship between the raw data points. In an effort to generate a strong relationship, I adjusted the usage of personal computers number by taking the natural log of it. Figure 7 shows the scatterplot of the Illiteracy –vs- the Usage of Personal Computers adjusted.

Figure 7: Scatterplot of Illiteracy –vs- ln(PC Users)

(2) Y(x)= 34.460 – 2.499x



If you'll note in the graph above, Figure 8, although there is a slight grouping of the data points at the lower end of the residuals, there still does not appear to be a definitive pattern associated with them. However, upon running the regression on the variables, it became apparent that a relationship between these two variables was not very strong.

TABLE 4

Regression of Rate of Illiteracy and adjusted Personal Computers users

(Equation 2)

R	R Squared	N	Beta	B (Constant)	B (variable)	T-Score	Significance
.259	.067	78	-.200	34.460	-2.499	-1.851	.068

The R Square adjusted for the usage of Personal Computers is .067. I attempted to adjust it using a Log function and squaring it, however a correlation never became apparent. This shows that there is little to no correlation between the natural log of literacy indicators and the number of people using personal computers.

Telephone Lines

As with the number of telephone lines, I ran the number of telephone lines and was able to see a slight correlation between the number of lines and the natural log of the literacy indicator. The R squared value was .559, and although that does not indicate an extremely strong relationship, it does indicate that one exists.

Figure 8: Scatterplot of Illiteracy –vs- ln(Telephone Lines)

(3) Y(x) = 60.823 – 9.931x

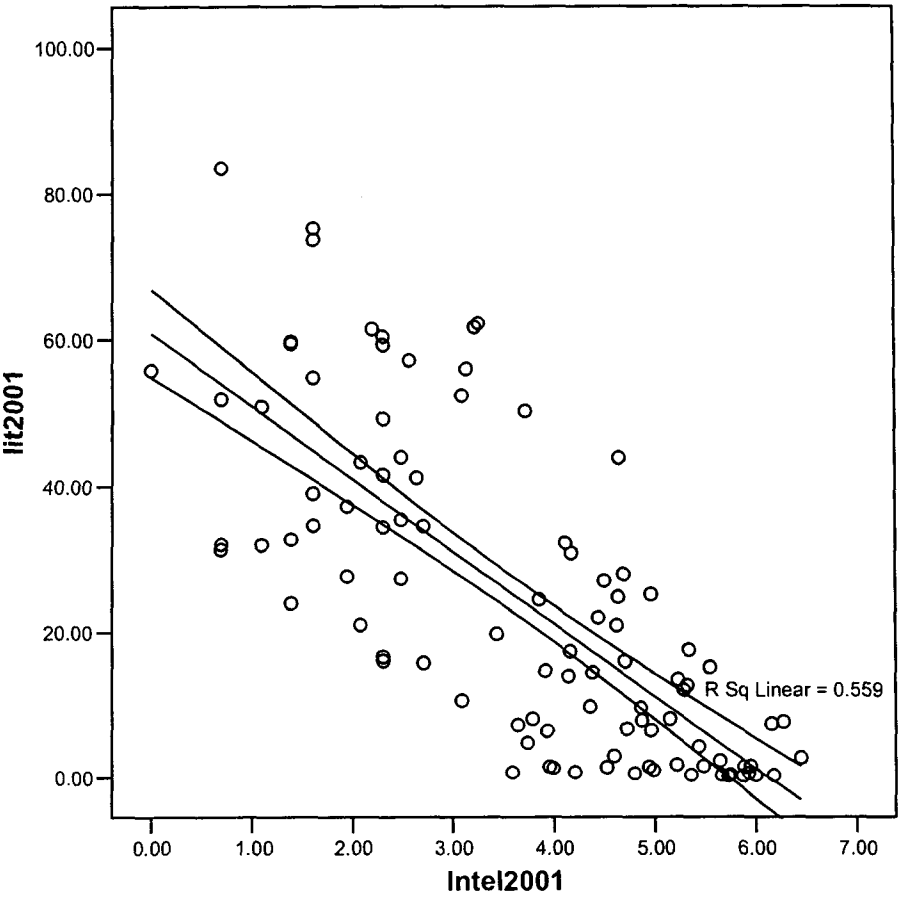


TABLE 5: Regression of Rate of Illiteracy and adjusted Telephone Lines

(Equation 3)

R	R Squared	N	Beta	B (Constant)	B (variable)	T-Score	Significance
.748	.559	78	-7.48	60.823	-9.931	-11.035	.000

The R Squared value of the telephone lines per capita is .559 which indicates that a significant relationship between the number of telephone users and the natural log of the literacy indicator. The slope for the equation is 60.823, which means for every telephone line there is an increase of 60.823 in the natural log of the literacy. The t-score is -11.035, which means that it is far more than 99% certain that the slope of the line is not zero. Therefore, with this confidence level, the null hypothesis can be rejected in this case.

By running, and manipulating a bit, the previous bivariate relationships for the3 variables I have chosen, I was able to verify a somewhat significant relationship for the number of telephones and the number of users of cell phones. However, these relationships do not provide the true influence that each of these factors has on illiteracy level of a country. Each of these bivariate relationships is extremely complex and are effected and influenced by a variety of other factors. Hence, it is necessary to conduct a multivariate analysis in order to get a bit closer to the true influence of each of these indicators.

Multivariate Analysis

Usage of Cell Phones, Telephone Usage, and PC Usage

(4) Y = 66.364 – 1.559x - 1.829x – 7.991x

Table 6 (a,b, c, d, e): Final Regression Model including Cell Phone users, PC users, and Telephone users (Equation 4).

Table 6a: Descriptive Statistics

	Mean	Std. Deviation	N
lit2001	23.3553	21.13858	78
lnPC01	3.5728	1.78320	78
lncellphone	3.7838	1.67399	78
Intel2001	3.8194	1.63389	78

Table 6b: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.774(a)	.599	.582	13.65966

a Predictors: (Constant), Intel2001, lnPC01, lncellphone
b Dependent Variable: lit2001

Table 6c: ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	20599.243	3	6866.414	36.800	.000(a)
	Residual	13807.393	74	186.586		
	Total	34406.636	77			

a Predictors: (Constant), Intel2001, lnPC01, lncellphone
b Dependent Variable: lit2001

Table 6d: Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	66.364	4.786		13.866	.000
	lnPC01	-1.559	.886	-.131	-1.759	.083
	lncellphone	-1.829	1.598	-.145	-1.144	.256
	Intel2001	-7.991	1.644	-.618	-4.861	.000

a Dependent Variable: lit2001

Table 6e: Residuals Statistics

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	-4.9377	61.6983	23.3553	16.35612	78
Residual	-23.65123	33.94142	.00000	13.39092	78
Std. Predicted Value	-1.730	2.344	.000	1.000	78
Std. Residual	-1.731	2.485	.000	.980	78

a Dependent Variable: lit2001

Looking at the adjusted R Squared overall value for the model, it seems to be extremely reliable fit. The adjusted R Squared value is .774 and it has an F (factor) of 38.600, therefore we can say that the statistical significance of the regression as a whole is rather high. When initially running this model, I used a multitude of combinations. I began by running the non transformed variables against a transformed illiteracy rate, where I received an R squared value of .515 and a F of 51.983. In the end, I ended up running the illiteracy rate against the above mentioned variables.

One should also note the absence of the usage of the Internet. This is a variable that is currently on the front line of discussions in ICT circles. I chose not to include this within any of my analysis. This variable is currently measured by many of the multilateral agencies', including the World Bank and the UNDP. However, due to the newness of the tools and methods used to measure this, this variable varies from agency to agency when comparing a single country across the board. In the initial planning of this analysis, I added Internet usage data to one of my models, only to discover that the numbers were so inconsistently reported that it was not a valid indicator of the usage of ICT technology.

CONCLUSIONS

This model including the Telephone Usage, Cell Phone Usage, and the number of PC's accounts for 77.4% of the movement seen in the illiteracy rate. This number shows that there is a slight relationship between two seemingly unrelated topics: usage of technology and illiteracy. Looking at the t-scores for each variable, the slope attributed to Telephone Usage is -7.991. The t-score is -4.861 with a significance of .000. This means that there is more than a 99% certainty that the slope attributed to Telephone Usage is not zero. The slope attributed to Cell Phone Usage is -1.829. The t-score is -1.144 with a significance of 2.56. This means that there is an extremely high chance that Type I error can be found in the relationship. Therefore, it is questionable whether or not we should accept the null hypothesis for this variable. Unfortunately, we cannot say with more than 95% certainty, because are sample consists of 81 and the t-score is not above the cut off of 1.664.

The slope attributed to PC Usage is -1.559. The t-score is -1.759 with a significance of .083. This means that there is approximately a 95% certainty that the slope attributed to PC Usage is not zero. Bivariate analyses revealed that personal computer usage has the weakest relation to the illiteracy level of a country. The number of people with cell phones had the next strongest relationship, followed by the number of telephone lines.

To summarize, a multivariate analysis revealed that indeed ICT usage does have a slight effect on the rate of illiteracy in a country, or in turn, on the indicator chosen to represent human capital growth. This analysis also revealed the extreme complexity of this model and the complexity of using working data that had been collected by a multilateral organization. However, even given the extreme complexity of this model, I was still able to conclude that there is indeed a positive correlation between the usage of ICT technologies and the Human Capital Development indicator chosen.

In conclusion, this model brings together two seemingly unrelated topics. Illiteracy is something that is not commonly brought into the discussion when speaking of technology. However, this model provides some initial incite into how when more people begin using technology, specifically telephones and cell phones, that the illiteracy level of the population as a whole decreases.

Recommendations that I would give someone who would like to further explore this quantitative study include slightly altering the quantitative approach. I would be interested to see what would happen if the data points were isolated for a particular region (i.e.: Africa, Latin America, etc...). It would also be interesting to look at a region or globally over an extended period of time. The data could then be

lagged possible over time. Unfortunately, currently, technology usage tools have not been around long enough to show any reliable results.

Over the past decade researchers have encountered a similar battle when trying to apply solely quantitative methods to figuring out a solution to the digital divide. Although the quantitative data seems so readily available there are still barriers. They claim that quantitative factors represent the supply side, the qualitative factors tell us more about the users, that is, the demand side (OECD, 2002). Simple economics tells us that supply and demand go hand in hand, so what the research is saying now is that in order to solve the digital divide problem, or to promote ICT development, both the infrastructure or supply aspects, as well as the qualitative information needs to be studied hand in hand. The Quantitative information misses issues such as language, the literacy rate, and the users' need for specific content as such have nothing to do with the telecom market, and it is also easier to miss these factors.

CHAPTER V

CONCLUSIONS

"Information technology has become a potent force in transforming social, economic, and political life globally" (Hafkin, 2001). However, there are still many obstacles that prevent the effective integration of information communications technologies to developing countries. For example in Sub Saharan Africa the tele-density is still less than 1 line per 200 inhabitants with a poor-quality network still in place (Karelse and Seya Sylla, 2000). Without adequate access to telephone lines, the possibility of the benefits of computer technology become inaccessible. The analysis section of this paper touched briefly, on a macrocosmic scale, how increasing usage levels of ICT's will contribute to an increase in aspects of human capital growth.

There are currently ongoing development projects that are attempting to address these issues through their IT development initiatives in the Third World. However, the majority of the aid projects focus on equipment development while "ensuring successful transfer of technology has received little or no attention within international donor organizations, and there are indications in some instances that this aid process is already faltering" (Odedra-Straub, 1995). Although the accessibility to equipment is an important aspect, it is "only one element in the process with a larger part being played by the organizational environment and by recipient skills"(Heeks, 1995).

As Heeks mentions, it seems that the current flaws in information communications technology development still fall on the inability to provide effective, sustainable training.

Summary of Findings

The primary question I have explored throughout this research has been to what extent has the usage of ICT technology contributed to human capital growth in a developing setting? As I asked this question, there is an underlying assumption that an increase in human capital growth is representational of more effective training programs being implemented. Through quantitative methods, I was able to show that 3 various forms of ICT usage have approximately a 48% effect on one indicator of human capital growth. Although, with my limited resources and limited access to information, I was not able to account for more of a relationship, I believe the important aspect to focus on is the inconclusively positive correlation that was shown. Those usages of the particular ICT technologies shown have a positive effect on an indicator of human capital growth.

As seen in this discussion, the attempt to implement linear training methods such as the input-output model, may not be the most effective in a developing context. However, as organizations such as the UN Commission on Science and Technological Development support this non-formal approach, by stating that Science and Technology literacy can be obtained through learning by decentralizing the development process, action at a local level and participation by communities are important in the creation of technological awareness (Fraser-Abder and Mehta, 1995). For although "Information technology obviously will not solve the world's problems

wisely deployed and developed, it has proven to be a powerful tool for promoting social causes" (Karelse and Seye Sylla, 2000).

Over the past few decades, ICT programs have been developed under this appropriate technology framework. By definition, the implementation of an appropriate technology program by means of an ICT program implies that not only is training a component of the program, but that the involvement of the community or population is also necessary.

One non-formal technique that is introduced by educational theorists Merriam and Caffarela, situation cognition (the acquisition of knowledge through situations or experiences) is seen to be easily adapted within the training of computer technology. An example of a computer-based cognition strategy, "anchored instruction," incorporates the theory of situation cognition into actual practice.

The Cognition and Technology Group at Vanderbilt developed the technique of anchored instruction. Its major focus is to break the content of education into complex realistic problems. The focus is on making the content more meaningful, to provide multiple ways to learn the content and maximize the existing knowledge and experience (Merriam & Caffarela, 1999). The problems posed serve as "anchors" or macro contexts for both guided and interactive explorations. They are no longer learning from their experiences, they are learning within the experience itself, as they respond in situations and as the situations respond to them. The situations should be complex, contain both relevant and irrelevant information, and require the learner to

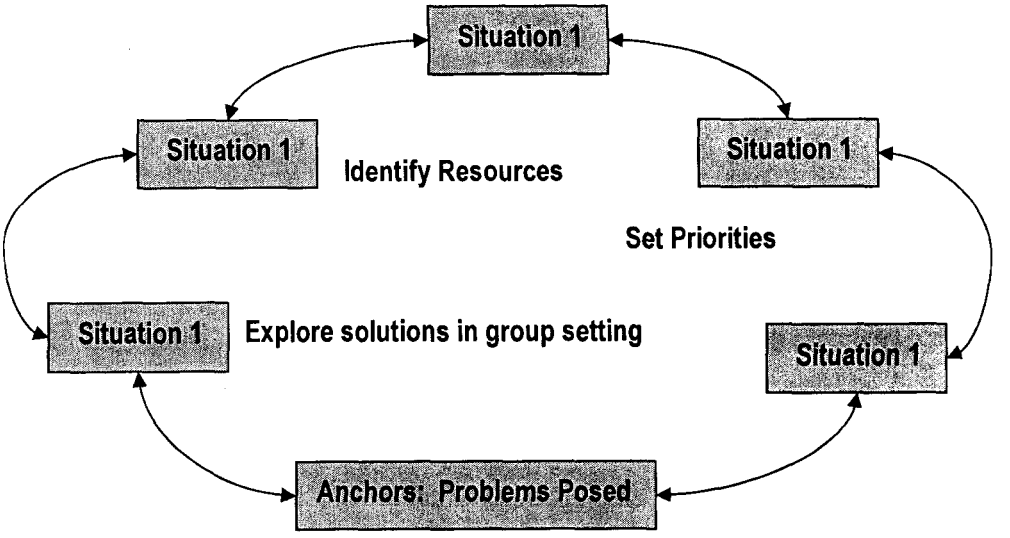
identify resources, to set priorities, and to explore alternative solutions in a collaborative setting (Merriam & Caffarela, 1999).

Freire proposes a parallel non-formal technique when he discusses problem-posing education where "The world—no longer something to be described with deceptive words—becomes the object of that transforming action by men and women (Freire, 2000)." This technique draw on the learners experiences and enables them to put into practice the conclusions they've drawn from these experiences.

In a recent issue of the *Educational Technology* journal, the application of non-formal techniques within Information and Communications technology-based learning was examined. Within the article, they give examples of Anchored instruction or Third-person experience based design. They propose activities such as Goal Based Learning and Case Study as being examples of the anchored instruction techniques (Ip and Naida, 2001).

Looking at Ip and Naidu's "Goal Based Learning" design, assumptions become clear, and parallels becomes apparent between the designs proposed and the techniques utilized in the training program itself. The Goal Based Learning places "learners in a contrived but authentic situation within which they have the opportunity to learn by doing and by making mistakes in a safe environment"(Ip and Naida, 2001). This design requires learners to assume the main role in the problem resolution hence, the goal of the participant in this context encompasses the completion of the task proposed. In order to achieve this goal, the participants must have acquired the necessary skills desired in order to complete the task (Ip and Naidu, 2001).

Figure 9: Anchored Instruction Model



As this model shows, the system, once again is a closed structure, however, the learner is able to visit and re-visit each of the various situations posed at their own discretion. They are encouraged to use techniques such as problem identification, setting priorities, and exploring solutions in a linear mode, much as was seen in the instructional design model, "input-output design" seen in Figure 1. However, in this model, the learners are encouraged to develop their solutions in a group setting. Even though there is an "anchored" problem posed, there are also a variety of different situations in which they can visit. These characteristics of this model closely emulate the Participatory Action Research model that was seen in Figure 2. Therefore, this

anchored instruction model proposed by Ip and Naidu seems to very well be a model that encompasses aspects of both the westernized instructional design model of learning technology with the participatory approach proposed.

Although I was not able to definitely discover that the training methods previously discussed are the most effective in international ICT programs, I was able to show that there is a connection between the number of people using ICT technology and the human capacity growth. With this in mind, and referring back to Figure 4, one can see the importance of building upon training methods that have proven to be effective to ensure a higher usage rate. Although I am not able to draw a general conclusion that indeed these two approaches, when combined will provide more effective training of ICT's in a developing context, the development of such a model in the US context does provide some hope that the model will be passed along to developing contexts'.

Future Directions of Research

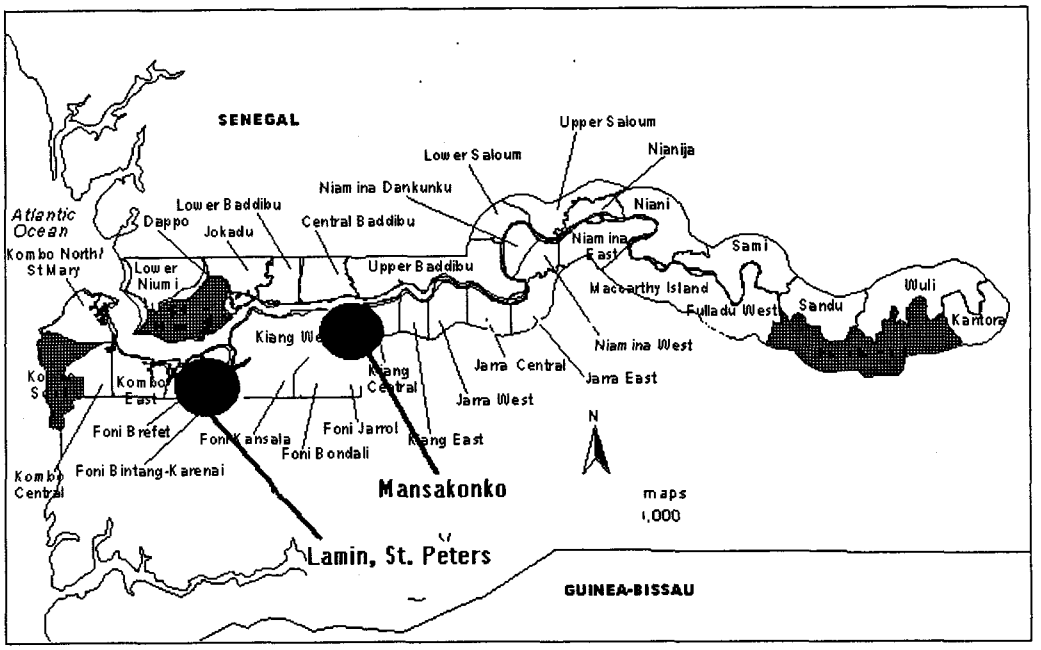
In the development community today, there are many discussions about how to promote more sustainable ICT projects involving education, policy, and infrastructure development. I feel that the quantitative information presented in this study might indeed provide these programs with an indication of where they should focus their attention to generate the most impact. The findings show the importance of focusing attention on the process behind increasing the usage of ICT's. Within the theory discussed in this research, I am suggesting that it will be through the integration of more of an anchored instruction type model of learning within ICT training programs that an increase in ICT usage will occur.

The areas that I would like to explore further, or that I recommend the ICT community explore further, can be broken up into two areas. The first would involve a more in-depth analysis of the positive relationship between human capital growth and ICT usage. The ultimate goal of international development projects is to promote sustainable economic growth for developing countries. However, due to the extremely long-time frame needed when looking for economic growth and the relatively short life span of technology, it is impossible to look for trends or to show achievement based on indicators such as GDP. It makes perfect sense then, for these programs to begin looking at indicators that will be able to provide them with information in the short term, including human capital growth.

The second area I think can be explored further is more practical in nature. It involves how to increase an indicator such as human capital growth. Since it was shown that ICT usage can increase human capital growth, the focus needs to be on increasing ICT usage. To increase the number of people using ICT technologies, more effective training programs that will promote sustainable usage levels will need to be implemented. I have recommended some methods that may be used in the more effective implementation of such training programs; however, I would really like to see more recommendations based upon the experiences in the field.

APPENDIX 1

MAP OF THE GAMBIA



Source: CIA: The World Factbook. Retrieved March 20, 2002 from the World Wide Web: http://www.cia.gov/cia/publications/factbook/geos/ga.html

APPENDIX 2

SURVEY LETTER

My name is Julianne Zuber and (Contact Person) passed along your information to me. I am currently working on a thesis for completion of my MA, and seeing that the topic in on ICT training programs, (Contact Person) thought you may be able to assist me.

I am attempting to look at various training programs employed in international ICT programs. I have created an on-line survey to see how instructional design techniques are being integrated within these training programs. I am currently in search of individuals who either have been or are involved with ICT programs and who are willing to take my survey. The survey is on-line and will only take around **10 minutes** to complete and return.

If you're willing to complete the survey, it can be found by going to:
http://training.american.edu/Thesis/

You can access the survey by entering in the word "cat"

Any information provided in this survey will be used for research purposes only and your name will not be used in any public disclosure of this information.

Also, I would really appreciate if you'd be willing to participate in a follow-up interview. If you're interested, please let me know.

I would greatly appreciate your contribution to this study.

Thank you,

Julianne Zuber

APPENDIX 3

Survey Results

Much of the literature on Internet survey methodology has focused on the common problem on non-responsiveness. Although Dillman (Dillman, 1991) points out that "a low response rate does not necessarily entail non- response error." Response rates in Internet surveys have been reported to be as high as 70% (Brenann & Hoek, 1992) as low as 0% (Pradham, 1999). The subject of the study and characteristics of the sample have significant effects on the response rates. Factors effecting non- responses in this survey may have included technical problems with the Web page link in the initial batches, timing of the follow-up waves, confidentiality concerns and mis-identification of the survey as spam.

In this initial trial, I received responses from 2 individuals out of the initial 60 I sent the survey. I sent the survey out in May of 2003. A month later I sent a follow up email (Appendix 4) asking those who had not responded to please respond. I received one more response. My total response rate for the survey was 3:60 or 5%. Because of the low rate of response I received, the information provided in the survey cannot really contribute substantively to this paper, and may only be used as a representation of portion of the population of program officers in ICT development programs.

Watt (Watt, 1998) recommends incentives such as donations to charity or sweepstakes may lead to a higher response rate. For this project no incentive was offered. Appeals were made in the cover letter that explain how statistics generated by the survey would be provided to the organizations that participated.

I would recommend having someone from within each organization send out the survey. As a graduate student/researcher, it was extremely difficult for me to gain

credibility within the international development community. The programs that I was attempting to survey were primarily being funded by the US government and, as I was to find out later in the research, are made up of a tight knit network of individuals.

I would also recommend that this type of research and even a more in depth evaluation be done by the government agencies themselves. As I mentioned, the majority of the money that is going into ICT training program is coming from the US government. It is therefore ultimately the responsibility of the government to make sure that these programs are using the most effective, efficient methodologies possible in order to reach their deliverables. Unfortunately, there seems to be little motivation on the part of the organizations to change their methodologies unless dictated by the government.

APPENDIX 4

EMAIL MESSAGE FOLLOW-UP

My name is Julianne Zuber and (Contact Person) passed along your information to me. I am currently working on a thesis for completion of my MA, and seeing that the topic in on ICT training programs, (Contact Person) thought you may be able to assist me.

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If you haven't done so already, please assist me by completing my survey. It can be found by going to: http://training.american.edu/Thesis/

You can access the survey by entering in the word "cat"

Any information provided in this survey will be used for research purposes only and your name will not be used in any public disclosure of this information.

Also, I would really appreciate if you'd be willing to participate in a follow-up interview. If you're interested, please let me know.

I would greatly appreciate your contribution to this study.

Thank you,

Julianne Zuber

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