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IMPLEMENTING A TECHNOLOGICAL INNOVATION IN SMALL BUSINESS CENTERS IN KENYA: BARRIERS AND USER CONCERNS

BY

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THESIS

Submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Education in the Graduate College of the University of Illinois at Urbana-Champaign, 1996

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JASON MUNYIRI GITHEKO

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IMPLEMENTING A TECHNOLOGICAL INNOVATION IN SMALL BUSINESS CENTERS IN KENYA: BARRIERS AND USER CONCERNS

BE ACCEPTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY

Director of Thesis Research

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† Required for doctor's degree but not for master's.
Problem. The performance African institutions has been negatively affected by the difficulty of communicating with other institutions. Despite several attempts to use low-cost computer networks to alleviate this problem, little is known about the factors that influence the success of implementation.

Purpose. This study aimed to examine the process of implementing a FidoNet Bulletin Board System (BBS) in Kenya with a focus on: (a) factors that should be considered; (b) barriers to implementation; (c) changes in the concerns of BBS users; and (d) change in BBS users’ perceptions regarding the utility of the BBS. The Concerns-Based Adoption Model developed by G. E. Hall and colleagues and E. M. Rogers’ diffusion of innovations model constituted the conceptual framework.

Method. A case study approach was adopted with the case consisting of four Small Business Centers (SBC) and a network services provider. Observations and interviews were conducted during site visits over a four-month period. Concurrently, modems and communication software were installed and SBC staff trained in their use. Two questionnaires were pre- and post-administered to participants to measure changes in user concerns and in their perception of the BBS’ utility.

Results and Conclusions. The categories of factors that need to be considered were: (a) effective promotion of networking; (b) the nature and reliability of telephone services; (c) computer systems maintenance; (d) security of equipment; (e) human resource concerns; (f) communication and coordination with project participants; (g) finance and budgetary
priorities; (h) cooperation among networking service providers; and (d) government procedures and regulations.

The categories of barriers identified were: (a) interpersonal and inter-organizational conflicts; (b) technical difficulties; (c) financial constraints; (d) regulatory problems; (e) skill and motivational problems; and (f) inadequate decision support systems. At the end of the study, users still displayed the profiles of new or non-users of the innovation (BBS) and their perception of utility of the BBS showed no change; consequently, it was concluded that substantial change in user concerns and perception of utility may take much more than four months. A number of recommendations are made and several areas of further study suggested.
DEDICATION

To my wife Nduta and children, Mithamo and Wamuyu also; to my dear parents who have passed on.

But his delight is in the law of the Lord; and in the law doth meditate day and night. And he shall be like a tree planted by the rivers of water that bringeth forth fruit in due season; his leaf also shall not wither; and whatsoever he doeth shall prosper. Psalms 1:2-3
I would like to express a special thanks to my dissertation committee Dr. Scott D. Johnson; Dr. Mildred Griggs; Dr. Robert Nelson; and Dr. Michael Waugh for their valuable critiques and recommendations. As my academic advisor and thesis director, Dr. Johnson was instrumental in steering me towards my present focus. He found new ways of doing things when I thought I had run out of viable options. Dr. Johnson's own achievements as a teacher, researcher, and writer will continue motivate and inspire me.

To Dr. Mildred Griggs who provided me an opportunity to be directly involved in research and to acquire some of the skills that I needed for my own work, I have the deepest gratitude. Her research project also provided me financial support for the two of the three years I spent as a full time student at the University of Illinois. I will be forever grateful for her concern and support especially at those crucial moments of crisis.

Dr. Robert Nelson was instrumental in initiating the entrepreneurship and small enterprise movement in Kenya and in my enrollment at the University of Illinois. He has continued to be a visionary always seeking new frontiers in entrepreneurship development and always encouraging those in this field to aim for bigger goals.

I acknowledge the financial support provided by the UNDP/ILO Entrepreneurship Education Project in Kenya and by the Center for Africa Studies at the University of Illinois.

I owe an irredeemable debt to my wife Nduta my children Mithamo and Wamuyu who provided a refuge and fulfillment beyond the world of academic pursuits. I thank many other people for friendship, prayers, and encouragement. They include my extended family in Kenya and members of Champaign Alliance Church.

Finally, I must acknowledge the ultimate source of strength and be thankful for the privilege of a personal knowledge of He who has made abundant provisions in the last four years. He has faithfully provided as He promised: "Delight thyself also in the Lord; and he shall give thee the desires of thine heart" (Psalms 37:4).
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<tr>
<td>ASCII</td>
<td>American Standard Code for Information Interchange</td>
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<td>BBS</td>
<td>Bulletin Board System</td>
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<td>DOS</td>
<td>Disc Operating System</td>
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<td>Entrepreneurship Promotion Project</td>
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<td>PBX</td>
<td>Private Branch Exchange</td>
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<td>PCMCIA</td>
<td>Personal Computer Memory Card International Association</td>
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<td>SBC</td>
<td>Small Business Center</td>
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<td>UPS</td>
<td>Uninterruptable Power Supply</td>
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CHAPTER 1

INTRODUCTION

Technology is considered a primary factor in development (Scherer & Perlman, 1992) and hence offers possible solutions for some development problems in Africa and other developing countries. In particular, by facilitating access to information, information technology creates opportunities for stimulating positive change (Mody & Dahlman, 1992). Information is regarded here as a force capable of effecting change in society (Braman, 1989). Greater knowledge about the implementation process would be expected to result in more successful adoption of technology.

The performances of many research and educational institutions in Africa have been negatively affected by the difficulty of accessing and exchanging information with others (Abidi, 1991; Board on Science and Technology for International Development, 1989). Informational difficulties also hinder government planning (Njiru, 1990). In recent years, attempts have been made to apply low-cost computer networks to help alleviate this problem (African Academy of Science and American Association for the Advancement of Science, 1992). Despite these efforts, little is known about the factors that affect the successful implementation and acceptance of new technologies.

The bulletin board system, a relatively simple interconnection of computers using telephone lines or packet radio, provides many potential applications. In the U.S., for example, bulletin board systems (BBS) are used by corporations, government, and educational institutions in addition to hobbyists and the general public (Hedtke, 1990; Mayo, 1989). A number of schools and colleges operate bulletin boards that link students, teachers, and parents. One correspondence school uses a bulletin board as a convenient communication medium to link students and tutors. Many computer software and hardware companies use bulletin boards to provide customer support services.

The BBS used in this study consists of Fido-compatible communication software that runs on a microcomputer and is accessible from other computers via a telephone line and
modem. The Fido BBS has facilities to exchange electronic mail, electronic files, and
discussions with other similar BBSs. It can be interfaced with the Internet to allow for the
exchange of e-mail with Internet users (Bush, 1990). Files can be exchanged between
FidoNet and the Internet by using suitable encoding methods to convert these files into a
form suitable for transportation through various networks and gateways (Appendix G).
The interconnected system of Fido BBSs is referred to as FidoNet.

A close examination of the complex processes involved in introducing technological
innovations such as a BBS is needed to ascertain if these processes match the
implementation models developed in the West. Of particular interest in this study are the
Concern-Based Adoption Model (Hall & Hord. 1987) and the diffusion of innovations
models (Rogers, 1995).

Purpose of the Study

The purpose of this study was to examine the processes associated with the
establishment of a BBS in Kenya. The specific process to be examined was the
implementation phase, which is the final component of the innovation process model
(Rogers, 1995). Emphasis was placed on the process of linking Small Business Centers
(SBC), located in technical training institutions, to a FidoNet service provider and hence
allow the SBCs to become members of FidoNet.

The study was intended to identify factors that need to be considered during the
implementation of the innovation and barriers to implementation, indicate changes in user
concerns during implementation, and describe changes in the users' perceptions of the
utility of the system. Emphasis was placed on documenting the day-to-day occurrences
and events surrounding the implementation process, hence demonstrating how the
processes unfold and how events and people interrelate and affect each other. The
participants of the study are leaders in entrepreneurship education in Kenya who pioneered
the implementation of the entrepreneurship education curriculum and the establishment of the Small Business Centers within technical training institutions.

Research Questions

The following research questions guided this study:

1. What factors (e.g., government policy, quality of infrastructure, availability of expertise, and institutional readiness) should be considered in implementing a bulletin board system in Kenya?

2. What barriers hinder the implementation of a bulletin board system in Kenya?

3. How do user concerns change during implementation of the innovation?

4. How do the bulletin board users' perceptions regarding the utility of the bulletin board system change over time?

Significance of the Study

The results of this study are expected to contribute to knowledge about implementation of computer networks in Kenyan technical training institutions, including an identification of the problems that occur throughout the process. This study is expected to assist information technology policy makers in Kenya by providing knowledge about related issues such as the status of computer expertise within educational institutions.

Bulletin board systems and other kinds of computer networks have wide applications and this study can facilitate their wider adoption in Kenya by helping illuminate the intricacies of the implementation process. In addition, the results will add to existing knowledge concerning the adoption and use of information technology in developing countries.
Assumptions

It is assumed that information has value in national development and that the bulletin board technology is a mature technology which can be used without further development. In addition, it is assumed that the theoretical models used in this study, including the instruments derived from these models such as the Stages of Concern Questionnaire, can be validly applied in Kenya. Rural sites were expected to experience greater difficulty in communications and have less likelihood of possessing staff who were experienced microcomputer users. This assumption influenced the structuring of the site selection.

Limitations of the Study

1. The results of this study cannot be generalized to other technologies.

2. This study is based on two specific models of the innovation process and hence its results may not be validly used to test other models of this process.

3. Limited research funding only allowed observations over four months even though a longer duration would have been preferred.

Definitions

**Bulletin Board System (BBS).** A BBS is a service that allows users to dial in from their own computers to a remote computer, usually through a telephone line, and exchange electronic mail, documents, or other files with other users who subscribe to the service. In this study e-mail and BBS are terms used interchangeably because e-mail was the most widely used service offered by the BBS operators in Kenya. In many cases, interactive facilities on the BBS were disabled leaving only e-mail and file transfer facilities because such interactive services encouraged users to stay on-line for long periods and tie up the telephone lines. This prevented other users from exchanging mail with the system.

**Change Agent.** According to Rogers (1995), a change agent is "an individual who influences a client's innovation decisions in a direction deemed desirable by a change
agency" (p. 27). The change agency is any individual, group, or organization that seeks to institute change. In this study change agents are those individuals inside or outside the technical training institutions who encourage the adoption of computer networks by these institutions.

Change Facilitator. According to Hall and Hord (1987), change facilitators are persons who "for brief or extended periods, assist various individuals and groups in developing competence and confidence needed to use a particular innovation" (p. 11). In this study a change facilitator is a person who helps the participants develop the competence and confidence needed to use the bulletin board system. Change facilitators may be participants in the study.

Computer Hardware. This term refers to all physical parts of a computer system. In practice this will refer to the enclosure containing the main computer components, the keyboard, the mouse, printer, and the monitor (screen or visual display unit).

Computer Network. A computer network can be defined as two or more computers connected to each other via electronic means for the purpose of exchanging information or sharing common equipment such as an expensive laser printer or plotter (O'Dell, 1989). In this study, a computer network is synonymous with the BBS used by the Small Business Centers and other interlinked computers that may be accessible from this system.

Computer Software. Computer software are computer programs used either to operate the hardware or perform a task such as computation, sending a file through a modem, or creating a text document. The software of particular interest in this study includes (a) communication software that allows a computer user to exchange files with a remote computer using a modem, and (b) the BBS software that allows users to gain access to a number of services on the board such as electronic mail, file transfer, and electronic conferences.

Implementation. According to Tornatzky and Fleischer (1990), the technological innovation process includes the creation, dissemination, adoption, and implementation of
the concerned technology. They regard implementation as the events following the
decision or set of decisions to adopt a technology. In this study implementation includes all
the activities involved between the decision to utilize a bulletin board system in an
institution and the regular use of bulletin boards in that institution.

Innovation. Hall and Hord (1987) define an innovation as the program or process
being implemented. For the purposes of this study the innovation is the bulletin board
system (BBS).

Modem. A modem is a device that links a computer to the telephone network. It
converts digital data from the computer into a form suitable for carriage through an analog
telecommunication system such as a telephone system or packet radio system. It also
converts received analog signals back into digital form. These two processes are called
modulation and demodulation respectively and hence the term modem. The device may be
contained within the enclosure of a microcomputer (internal modem) or may be connected
externally (external modem).

Opinion Leadership. Rogers (1995) defines this as "the degree to which an
individual is able to influence other individuals' attitudes or overt behavior informally in a
desired way with relative frequency" (p. 27). In this study opinion leaders are those
individuals who have some influence (other than by use of administrative authority) over
the attitudes and behaviors of participants towards the innovation. This may include
administrators, teachers, or other persons with whom participants regularly interact.

Packet Radio. Packet radio is an interactive radio system that transmits groups of
codes formatted in specific standardized ways (called packets or frames). Unlike ordinary
radio systems, several packet radio stations in one locality can share one operating
frequency and transmit data to specific receivers using coded addresses that are included in
a packet (Mayo, 1989). They can be used for linking users to a bulletin board host system
to which a packet radio transmitter-receiver (transceiver) is attached.
Stages of Concern. The stages of concern are points along a continuum representing how individuals perceive an innovation and how they feel about it (Hall & Hord, 1987). In this study, the stages of concern represent how Small Business Center staff perceive or feel about the introduction of the bulletin board service, how they feel about their capability to use it, their new role in its use, the incentives for its use, the day to day management of its use, and the impact of its use. A detailed description of the seven stages of concern is presented in Chapter 2.

Summary

This chapter provided a rationale and purpose for conducting this study and defined the overall communications and informational problem that provided a background for the study. The four questions that guided the investigation were stated following which a brief discussion of its significance and associated assumptions was presented. Finally, some key terms were defined. The next chapter is a survey of the literature pertinent to this research project.
CHAPTER 2
REVIEW OF THE LITERATURE

This chapter is a review of the literature related to the implementation of an information technology innovation in the context of a national development program. A brief background outline of Kenya's development strategy is included. The chapter then provides a synthesis of viewpoints on information, innovation, and technology. The innovation diffusion model developed by Rogers (1995) and the adoption model developed by Hall and others (Hall & Hord, 1987; Hall, Wallace, & Dossert, 1973) are subsequently reviewed. These models serve as a framework for the design of this study. A discussion of the structure, functioning, and use of electronic bulletin boards then follows.

Since the industrial revolution, technology has acquired importance as a stimulus for change in society. This is one of the themes of the so-called Schumpeterian tradition in economic analysis (Scherer & Perlman, 1992). In many developing countries including Kenya, development or ameliorative change, is a major concern in government planning. This change spans political, economic, technological, cultural, and even spiritual domains. While it is possible for developing countries to adopt technologies from other parts of the world in order to solve problems or stimulate change, the adoption process can be complex. The adoption of technological innovations is associated with positive change but there has been increasing unease about some negative consequences of technology-driven industrialism and the assumptions underlying its practice (Schoenhoff, 1993; Ullrich, 1992). This study was motivated by a need to better understand the implementation phase of the technological innovation process in a developing country environment.

National Development in Kenya

The pursuit of economic development is a major preoccupation of governments in developing countries. According to Gibb (1988), the broad goals of economic policy include: (a) growth measured in income per head; (b) full employment and avoidance of
under-employment; (c) price stability; (d) balance of payments stability; (e) and an acceptable level of social equality and opportunity. Developing countries such as Kenya face problems in all five areas. The Sessional Paper No. 1 of 1986 (Republic of Kenya, 1986) in particular brought attention to the great number of jobs that needed to be created in Kenya between 1986 and the year 2000. It was estimated that 6,000,000 jobs would be needed in that time period. This estimate was based on population growth projections which indicated that there would be a labor force of 14 million by the year 2000 compared with 8 million in 1986. Non-farm jobs were expected to contribute about 40% of this requirement. These projections motivated a search for ways to stimulate job creation.

Small Enterprise Development

Based on the known potential for small scale enterprises to create jobs (Nelson, 1986). Kenya initiated efforts to encourage the development of small enterprises. These culminated in a national strategy for small enterprise development (Republic of Kenya, 1989) although parts of this strategy did not become official government policy until 1992 (Republic of Kenya, 1992) implementation began in earnest in 1990. The four areas addressed by this strategy included: (a) the creation of an enabling environment that aimed to streamline laws and regulations affecting small enterprises in order to orient them towards encouraging rather than inhibiting small scale enterprise growth and development: (b) improving access to credit for small enterprises; (c) identifying and alleviating gender specific barriers to small enterprise growth and development; and (d) encouraging better small enterprise non-financial promotional programs. One of these promotional programs was aimed at encouraging the young technically skilled graduates of Kenyan technical training institutions to initiate their own enterprises.
Entrepreneurship Development

The central role of business entrepreneurs is the creation of business enterprises. Their contribution to promoting regional and national economic growth was recognized by economists earlier in this century (Schumpeter, 1942) and gained renewed attention in the 1980s (Gibb, 1988; Nelson, 1986). Gibb (1988) presents the rationale for stimulating economic growth by increasing the number of entrepreneurs in a region. He argues that entrepreneurs initiate small business enterprises which create employment and do so at lower capital costs than large businesses, serve as a training ground for developing skilled workers, provide opportunities to adopt and adapt technologies appropriate to the local environment, and contribute to a more even distribution of incomes between rural and urban areas by improving the productive capacity of rural areas.

Entrepreneurship Education

One of the first entrepreneurship development strategies adopted in Kenya involved introducing entrepreneurship education in all technical training institutions in the country. These institutions were encouraged to develop Small Business Centers (SBC) whose mission as described by the Ministry of Research, Technical Training and Technology (Republic of Kenya, 1993) was to “facilitate the development of small and ‘Jua Kali’ enterprises [small artisan-run manufacturing and service enterprises] and promote an entrepreneurial culture within the institution and the local community” (p. 1).

Small Business Centers also coordinate the teaching of entrepreneurship education and provide internal entrepreneurship education consultants to other departments in their home institutions. The Centers' mission extends beyond their home institutions to the local communities. They are expected to promote entrepreneurship and small enterprise creation and growth in these communities through such activities as training programs and consultancy services.
Communication and Development

Krippendorff (1987) outlined four paradigms of communication and development based on his belief that communication can not be separated from development. His approach serves as a way to view the role of communication, and hence of information, in development. These paradigms relate to social, political, and economic development.

The first is the control paradigm in which a controller aims to effect change and institutes actions to serve his or her interests. The network-convergence paradigm involves a more balanced communication. It is democratic and participatory. It involves the reaching of consensus or mutual understanding, formation of collective action, and the genesis of social structure and organization. Such convergence is possible if individuals are linked by a network of communication channels.

Krippendorff's third paradigm is information-seeking. This assigns communicational initiative to the receiver. The sender responds to the receiver's requests. The success of this process requires that the receiver be aware that he or she has informational needs. It also requires that the receiver know where information may be obtained, how to get information, and how to use the information to effect the desired improvement.

The fourth paradigm, autopoiesis, is based on the concept of biological self-production or self-renewal by which, for example, the chemical constituents of living cells are replaced many times in a cell's lifetime yet leave the structure and functioning of the cell relatively unchanged. The cell, when viewed as a system, is self-organizing and self-constructing: its organization does not appear to be controlled or determined by an external organizer. Autopoietic systems are organizationally self-referenced and autonomous. This concept, developed by Maturana and others (Maturana, 1980; Maturana & Varela, 1972, 1975), implies a continuous, cyclic, self-renewing process whose outputs serve as inputs to the same process. Whether this concept can validly be applied to social systems is the subject of vigorous debate (Mingers, 1995).
Krippendorff argues that social systems are self-referential or self-organizing and that communication is a primary constituent of self-production. In his view, a trend towards autopoietic organization implies an increase in the autonomy of the social system. An example that seems to fit this paradigm is the Old Order Amish (Ericksen, E. P., Ericksen, & Hosteller, 1980) who have systematically avoided changing their way of life for about 200 years.

Each of these paradigms serves to highlight different views of development ranging from extrinsic control to enhanced autonomy and organizational closure. They facilitate inquiry by highlighting the importance of the pattern of communications, and hence of information exchange, between a client system and the change agent or change facilitator. The client system could be a developing country, region, community, or perhaps an organization while the facilitator may be an individual, organization, or government who is actively involved in encouraging and assisting the change process in the client system.

Information

Information is enigmatic. Braman (1989) presents a scheme that consolidates the various viewpoints on the meaning of information and suggests ways to avoid conflict between these viewpoints. Braman's definition of information consists of a four-level hierarchical framework. Position in this hierarchy is based on the breadth of phenomena each definition covers and the social complexity allowed by that definition. She suggests that at the deepest level of analysis, information is a constitutive force in society. At another level, it is seen as a perception of pattern. A third way is to view information as a commodity and finally, as a resource. This hierarchical form of defining information allows us to select the most useful definition or to use multiple definitions without forcing a choice between them.

According to Braman (1989), although it is relatively easy to grasp the concept of information as a resource, such a view gives rise to some difficulties. Braunstein for
example, argued that information, unlike matter and energy, is not subject to physical laws and hence can not be treated as a resource in economic terms (Braunstein, 1979). This definition (information as a resource) emphasizes the uses to which people make of information rather than the effects it has upon people and society, therefore, its scope and complexity is limited.

A view of information as a commodity suggests that a production process exists. Models for such information production chains have been suggested by a number of writers (Boulding, 1966; Machlup, 1980; Owen & van Halm, 1989). Owen and van Halm distinguish four functions in a broadly conceived information chain: production, distribution, acquisition, and use. Production is perceived as a process of generating information rather than of physical production of documents. Braman, adapting Boulding's and Machlup's models, outlines the following phases in the production chain: information creation, processing, storage, transportation, distribution, seeking and destruction (Braman, 1989).

The problems that arise from the non-materiality of information are multiplied when information is treated as a commodity. However, the scope of this view is greater and provides for greater descriptive complexity than that of information as a resource because it involves an interaction of producers and users of information.

It is more difficult to conceptualize information as the perception of pattern. Viewing information as a perception of pattern implies the inclusion of the context of that information. This in turn allows for information to possess a future and a past, to be affected by factors such as motive, and to have effects (Braman, 1989). An example of this approach is the one adopted by Rogers (1995). He regards information as "a difference in matter-energy that affects uncertainty in a situation where a choice exists among a set of alternatives" (Rogers & Kincaid, 1981, p. 64). The term 'matter-energy' implies the totality of the material universe. He equates uncertainty with the ability to perceive alternatives in the occurrence of an event and to be aware of the relative
probabilities of these alternatives. This view of information is relevant to this study because Rogers has used it to develop the concept of an innovation. The innovation is viewed as a new alternative. The uncertainty about the probability that the new alternative is superior then leads to a search for information in order to reduce this uncertainty. Hence, information and innovation are inseparable concepts.

The final level in Braman’s (1989) hierarchy is a view of information as a constitutive force in society. This takes into account the role of information in shaping the context. According to Braman, "information is not just affected by the environment but is itself an actor affecting other elements in the environment" (p. 239). This definition credits information with the creation of social structure rather than merely a constituent of that structure. According to Krippendorff (1984), one of the consequences of such a view of information is that it can not "be built into a system of analysis that is essentially flat and provides no opportunity for self-reference" (p. 16). This view of information is in harmony with constructivist views of learning where each individual is assumed to construct their view of the world based on their own perception. Thus it is implied that information creation and flows directly affect the structuring of society. The main problem arising from such an approach is the difficulty of isolating cause and effect relationships. This last definition grants us the broadest coverage of phenomena and allows for any degree of social complexity.

Thus it is recognized that information has power to structure society and hence there is a need to consider the broader implications of any information policy and the implementation of any information technology. These definitions also provide a means to identify more clearly the role of information in the process of innovation and change in society.
Innovation

Innovation can be viewed as a process or a product. Rogers (1995) adopts the product view defining an innovation as "an idea, practice, or object that is perceived as new by an individual or another unit of adoption" (p. xvii). Owen and van Halm (1989) develop the concept of innovation further and suggests that an additional requirement for innovation is that the new idea, object, or practice cause a structural change in society or a segment of society. They argue that, though innovation is viewed as the adoption of something new (process), it is the adoption rather than the newness that is the essence of innovation. Though this does not coincide with Rogers' definition of innovations (as entities that can be diffused or disseminated), his additional discussion of the role of change agents and of the consequences (changes) arising from the adoption or rejection of a new idea, practice, or object indicates that he recognizes the structural effects of the innovation process.

Diffusion research, according to Rogers (1995), has largely ignored these structural consequences. The three reasons suggested for this state of affairs are: (a) pro-innovation bias among researchers; (b) use of one-shot survey methods that are incapable of describing the complex time-varying processes involved; and (c) consequences that are difficult to measure as well as adopters of an innovation who may be unaware of some consequences of the adoption. The importance of the observer's value system and research methodology is particularly emphasized. Rogers' framework includes the notion of cultural relativism which is the assertion that no culture is best and each should be judged "in the light of its own specific circumstances and needs" (p. 411). In Rogers' view, every judgment regarding consequences is to some degree value ridden. This presents special difficulties for a researcher working in a foreign culture.

Tornatzky and Fleischer (1980) point out that discussions of innovation indicate that it can be regarded either as (a) a new tool (or idea, practice etc.) or (b) as the process of introducing new tools into a new social environment. Seen in this light, Rogers'
The diffusion of innovations is a description of the innovation process. Although there is consensus that the innovation means adopting something new, the concept is treated at varying depth and levels of complexity by different writers. For example, Rogers (1995) presents a six-stage innovation development process including the presence of needs or problems, research, development, commercialization, diffusion, and adoption, and consequences. Owen and van Halm's (1989) definition emphasizes the adoption and the resulting structural change by the adopting segment of society. The extent of this change is used by Nord and Tucker (1987) to develop a dichotomy that regards innovation as either radical or routine. According to them, radical innovation involves the development of completely new routines and may accompany attitudinal changes in the members of the concerned social unit.

Thus, for the most part, the innovation process involves the development and adoption of something new and results in substantial change in the adopting segment of society. This process, which can be broadly characterized by Scarbrough and Corbett's (1992) three stage cycle (invention, exchange, and use), can extend over several decades or longer (Martin, 1984; Owen & van Halm, 1989; Tornatzky & Fleischer, 1990). Technological innovation presents examples of this process.

Technology

Definitions of technology range from those that view it as machinery and hardware (Batstone, Gourlay, Levie, & Moore, 1987) to a view of technology as a cyclic process that includes the three stages of invention, interactive exchange with the product and labor markets, and use (Scarbrough & Corbett, 1992). In this latter view, flows of knowledge are at the core of exchanges between the three stages. Scarbrough and Corbett also view the organization as a process. They argue that organizational structures can be viewed as the "relatively fluid outcome of interactions between processes of invention, production and exchange" (p. 12). Rogers (1995) views technology as "instrumental-action that reduces
the uncertainty in the cause-effect relationships involved in achieving a desired outcome" (p. 12) and considers technology to possess both a hardware aspect and a knowledge base ("software"). Others such as Schoenhoff (1993) imply a dichotomy between tangible (hardware) and intangible (knowledge based) technologies. Some of these intangible aspects are hinted at by Graubard (1980) who states that technology should be thought of as a system of which its social, cultural, intellectual, managerial and political aspects are an integral part. Rogers (1983) too, points out that it is often wrongly assumed that the desired effect of Western technology can be acquired while avoiding the "social values and institutions in which the technological innovations are embedded in Western nations" (p. 383). Technology thus seen is embedded in a social environment and can not be analyzed as an isolated phenomenon.

The key features emerging from these views of technology are (a) that it is usually developed in response to a problem or need, (b) that each technology has a knowledge base imbedded in it, (c) technology has power to transform part of our environment, (d) technology emerges out of specific social and cultural contexts and hence may be considered integral to that context, and (e) technologies are part of a dynamic process of change in society. These features serve to provide a description of technology for the purposes of this study and a foundation for examining the process of technological innovation.

Technological Innovation

Consolidating innovation and technological processes gives us technological innovation. Technological innovation may be regarded as a "complex interaction of people, scientific concepts, aspirations, and consequences" (Tornatzky & Fleischer, 1990, p. 50). Consequently, in studying the process, one may elect to focus on various social units. Possible categories are the individual, the social group, organizations, aggregates of organizations, or societies. Classifying and categorizing the processes involved may
facilitate the study of technological innovation. For example, Havelock (1971) described three viewpoints on change. These include (a) the social interaction models; (b) the research, development, and diffusion models; and (c) the problem solver models.

**Social Interaction Models**

These are viewpoints that regard innovations as finished objects that can be disseminated through a social unit. Examples are the "classical" innovation diffusion model (Fliegel, 1993; Rogers, 1995). Because the primary process is dissemination, the main interest in these models is on the adoption process and the associated series of decisions that individuals make. In other words, the focus is on the social interactions involved in the adoption process. These models largely ignore the process of developing the innovation.

**Research, Development, and Diffusion Model**

This model focuses on knowledge creation and utilization and views the process as orderly, planned and sequential. The sequence begins by identifying a problem and ends with the diffusion of the innovation. The main weakness of this model is the neglect of the end user. Little attention is paid to the need to assist the user implement the innovation.

**Problem-Solver Model**

This perspective, exemplified by the organizational development tradition, focuses on helping the end user develop problem-solving skills. The outside consultant becomes a facilitator in the process and not an advocate for any specific innovations. Thus the outsider is non-directive. The primary consideration are the needs of the user. It is assumed that user commitment will be strongest for self-initiated innovations. This approach is adopted in the Concerns-Based Adoption Model (Hall, Wallace, & Dossert. 1973; Hall & Hord, 1987) described later in this chapter. Havelock's (1971) models help
highlight the different possible perspectives of the technological innovation process. In these models, the two main perspectives are those of the innovation developers and the innovation users.

**Stage Models**

Technological innovation is usually characterized as a process that proceeds in stages. Several such stage models exist and each could be placed in one or more of Havelock's three categories presented above. Bright (1969) for example, focused on hardware technologies and developed an eight-phase process to describe what is considered a complex socio-economic and technical process. The main stages include the initiation of a product idea, its design, trial, adoption, and proliferation. Bright's eight stages or phases are not distinct and may overlap. Although this may imply a linear process, he indicates that there are feedback and feedforward effects.

Abernathy and Utterback use an evolution analogy to describe the development of high-technology industries (Abernathy & Utterback, 1978; Utterback & Abernathy, 1975). This has three stages beginning with a fluid stage where there is a lot of trial and error both in testing the market and in developing stable production processes. The second stage is called the dominant design and transition stage where a dominant design emerges. Finally, a stage is reached at which the industry takes on a rigid structure and enjoys the returns from a mature product. This is accompanied by internal resistance to innovation. Abernath and Utterback call this the specific or mature stage.

The two models above view the process from the developer's perspective. Rogers (1995) presents a more comprehensive model whose perspective is closer to that of an external observer and provides details of the adoption process. His model involves six stages namely: (a) realization of a need or problem; (b) research; (c) development; (d) commercialization; (e) diffusion and adoption; and (f) consequences of adoption. Rogers' innovation-development process model is used in this study as applied to the
implementation of an innovation. His suggested models for the diffusion and adoption process serve well for this study.

Some authors point out that an innovation may be introduced too early, citing the case of the Great Eastern steam boat and the electrical heaters, hearths and motors (Haustein, Maie, & Uhlmann, 1981). These failed because certain support systems (a large harbor in the first instance and electrical generation in the second) were not yet in place indicating the need for what may be called 'technological readiness' before an innovation takes root.

Though the stage models are relatively simple to understand and apply, Tomatzky and Fleischer (1990) caution that they can be misleading. They point out that in reality the innovation process is highly interactive, indicating that it is better to think of the different stages as rooms connected by a finite number of doors rather than steps on a staircase. These rooms represent core behaviors. In Tomatzky and Fleischer's view, a participant in the process of technological innovation will eventually wander through all the rooms. Additionally, they note that these participants are generally unaware of these stages. Hence, it is suggested that perception of stages is subjective. According to Tomatzky and Fleischer (1990), these models can be viewed as centered either on the user's perspective or the innovation developer's perspective.

Scope of Change

Because innovation is regarded as the adoption of something new with a resulting structural change in the adopting unit, the extent of change required before such an adoption can be regarded as an innovation is at issue. Tomatzky and Fleischer (1990) adopt Nord and Tucker's (1987) radical-routine dichotomy regarding it as a radical-incremental change continuum but point out that differences in the scope of change during the technological innovation process may be multidimensional and discontinuous. Such change may defy analysis using a linear model. For example, the scope of change in the adopting social unit may be with reference to the cost implications of an innovation or to its
complexity. In addition, cumulative minor changes may result in a major change. Ultimately, Tornatzky and Fleischer conclude that innovation is a change in scope that "is significant at least to the person or organization doing the innovating" (p. 19).

A related aspect of technological innovation is the magnitude of difference between an innovation and existing technology (Martin, 1984). Martin, using Kuhn's (1962) concepts of normal and revolutionary science, proposes an analogous idea of normal and revolutionary innovations which represent the two extremes of a continuum. A normal innovation involves alterations within an established technology while a revolutionary innovation, a much rarer occurrence, emerges when a technology is first developed or an new technology replaces an old one. Examples of revolutionary innovations abound in this century including the development of the transistor, the jet engine, and antibiotics.

The following features of technological innovation emerge from this review:

1. There are different perspectives in the study of technological innovation and different approaches are likely to emphasize some areas while ignoring or de-emphasizing others. One such difference in perspective arises from differing definitions of technology and innovation. Some of these differences have been presented in this review.

2. Technological innovation seems to progress in phases. Different researchers have selected different metaphors to describe these phases. Some, like Abernathy and Utterback (1975) and Utterback and Abernathy (1978), use an evolutionary analogy while others implicitly or explicitly use biological development analogies characterized by stages such as those developed by Bright (1969) and by Rogers (1995). These phases are popularly thought of as cyclic progressions rather than linear changes and generally involve: an initiation (or discovery, conception, invention, fluid) phase, a development (or exchange, dominant design, etc.) phase, and use (or implementation, commercialization, etc.) phase. More recently, it has been pointed out that the process is non-linear and does not possess a fixed sequence of stages.
3. Investigators agree that the phenomena involved are complex and it is difficult to assign cause-effect relationships between various factors.

4. Change resulting from the innovation process as viewed by the innovator, may range from the relatively minor or incremental to major or radical change.

5. Common viewpoints of technological innovation focus either on the technology user’s or the technology developer’s perspective and rarely do they examine both perspectives.

Implementation Models

As indicated earlier, technological innovation proceeds non-linearly, emanating from an urge to change an existing technology or to introduce a new technology. An innovation cycle ends when the new or improved technology is adopted for routine use to an extent sufficient to cause substantial structural change in the adopting social unit. This could be an organization, an individual, or an industry. Of particular interest in this study are the events surrounding the adoption of an innovation, that is, its implementation. The following section outlines two adoption and implementation models that form the design foundation for this study.

Diffusion of Innovations Models

Studies of the diffusion of innovations and have revealed patterns in the process of adopting innovations. An innovation is regarded here as a product rather than a process. Rogers (1995) concludes that adopters of innovations fall into five categories ranked by the speed at which they adopt innovations. He classifies the 2.5% of the population who are first to adopt as innovators. Early adopters are the next 13.5%. The early majority constitute the following 34% of the population while the late majority make up the next 34%. The last 16.5% of the population to adopt are called the laggards. These categories
represent ideal types designed to facilitate empirical studies. Each of these types is thought to possess distinctive characteristics and values.

Rogers offers a detailed description of the characteristics of these categories of individuals. The innovator's chief characteristic is venturesomeness, that is, a great eagerness to try new ideas. The early adopter, while less rash and daring, has greater social acceptance, therefore, greater potential to influence the opinions of his or her peers regarding a new idea. Each category of adopters have different kinds of social networks with innovators being described as "cosmopolite" while laggards are "localite." This indicates that the innovator has social networks spanning relatively wide geographical areas and are more likely to travel while laggards are almost socially isolated. Rogers suggests that innovators are forward looking while laggards are backward looking preferring to base their decisions on how things were done in the past. Several other variables are used to characterize adopters including: (a) socio-economic factors such as years of education, social status, and degree of upward social mobility; (b) personality variables; (c) and communication behavior. It should be noted that the tendency to treat innovativeness as a trait is not supported by research (Fliegel, 1980).

Rogers (1995) identifies five steps in this process of adoption (which he calls the innovation-decision process):

1. **Knowledge**: The individual obtains knowledge about the innovation.
2. **Persuasion**: He or she evaluates the innovation and forms attitudes towards it.
3. **Decision**: A decision is made to adopt or reject the innovation.
4. **Implementation**: The innovation is implemented.
5. **Confirmation**: The adoption decision is confirmed based on further information about the innovation.

Such further information may result in a reversal of the adoption decision leading to rejection. As indicated earlier, the innovation-decision process is not easily packaged in a linear stage model as suggested by Rogers. In supporting the use of stages he states that
research strongly supports the presence of knowledge and decision stages but less strongly supports the presence of a persuasion stage. The process may be centered around an individual or other decision-making unit.

Of particular interest in this study is the diffusion of innovations in situations where the adopting unit is an organization rather than an individual. There are shortcomings in the attempt to apply the methods used to study innovative individuals to the study of innovation in organizations. To facilitate the study of innovation in organizations, Rogers (1995) presents a model that regards innovation in organizations, including implementation, as a process. This process view is contrasted with the view of adoption as an event which was characteristic of earlier "classical" diffusion research. Rogers' model divides the process into two broad phases called initiation and implementation. The decision to adopt acts as the boundary between the two phases. The first has two stages (agenda-setting and matching) while the latter has three stages (redefining/restructuring, clarifying, and routinizing).

Agenda-setting—This corresponds to the identification of an important problem in the organization and a search for its solution. One or more individuals in the organization may be involved.

Matching—Rogers describes this as "a kind of reality testing in which the organization attempts to test the feasibility of the innovation in solving the organization's problem" (p. 394). The decision to adopt is based on the results of this reality testing.

Redefining/Restructuring—An innovation brought in from the outside may have to be modified to fit the organization (redefining) or the organization may adjust its structure to accommodate the innovation (restructuring). During these processes, the innovation loses its foreign character.

Clarifying—This stage involves the gradual clarification of the meaning and applications of the new idea. This is accompanied by an increasing level of adoption within
the organization. According to Rogers, excessively rapid implementation can result in misunderstandings and unwanted side effects.

**Routinization**—This is the final stage of the process. At this stage the innovation becomes part of the regular activities of the organization. However, the innovation may fail to gain a following and ultimately be discontinued.

The successful adoption (or failure) of computer networking may be viewed from this perspective of innovation diffusion especially because it provides a broad framework with which to analyze the temporal characteristics of the process and identify individuals who represent each of the five adopter categories within the technical training institutions in Kenya. Rogers’ (1995) model is useful in helping determine critical factors in the adoption of an innovation. One of the problems presented by the model is the difference in approach between the introduction of innovations to individuals and to organizations. The model is based on research in diffusion of simple innovations such as the use of hybrid corn by farmers whose adoption was a result of the decision of a single individual. The description of adoption within organizations contains few details regarding the innovation process within the organization. Roles or opinion leaders and change agents are less clear-cut for innovation within organizations.

Comparing Rogers’ (1995) descriptions of innovation diffusion in organizations and that of diffusion with regard to individuals reveals differences in the underlying approaches. The individual seems more prone to external influences and control than the organization which is depicted as having the ability to identify its problems and seek solutions. Individuals seem to possess less autonomy and are therefore less capable of self-referencing than are organizations. Rogers’ innovation-decision process model seems to correspond to Krippendorff’s control paradigm while that for innovation in organizations seems to correspond more closely to the information-seeking paradigm.
Concerns-Based Adoption Model

Hall and Hord (1987) emphasize the importance of the implementation process and argue that it may take several years to complete. Their analysis centers on the adopter and indicates that adopters' innovation-related concerns change as their competency in using the innovation changes. According to Hall and Hord, during the initial stages of using an innovation, these concerns are centered on the capabilities of the adopter to use the innovation and on the role he or she will play with respect to the innovation. In addition, adopters are concerned about the rewards of using the innovation. As their knowledge of the innovation increases, the adopters become more concerned about how to use the innovation. Finally, after they have developed some confidence from routine use of the innovation, their concerns shift to focus more on the impact of the innovation and on ways to improve or replace the innovation. Hall et al. (1973) and Hall and Hord (1987) present these ideas in the context of their Concerns-Based Adoption Model (CBAM).

The model, which was developed as a conceptual framework for guiding the process of adoption of innovations principally in educational settings, is centered around the role of a change facilitator who acts as a link between a resource system and the user system. This model views adoption as a process rather than an event. The change facilitator's role in this process is to "assist others in ways relevant to their concerns so that they become more effective and skilled in using new programs and procedures" (Hall & Hord, 1987. p. 11). The change facilitator intervenes to help clients who constitute the user system (which includes both the users and non-users of the innovation). He or she has access to a resource system that may include experts, libraries, administrators, and colleagues in other institutions. Ultimately, it is intended that users will develop the ability to make use of the resource system without the intervention of the facilitator. In order to assist the change facilitator understand the users and hence decide how to apply the resources available, Hall and colleagues developed three independent diagnostic tools that are based on the concepts of stages of concern, levels of use, and innovation configurations.
Stages of Concern

Hall and Hord (1987) consider implementation of an innovation to be as important as the development of the innovation. According to them, an individual who is in the process of adopting an innovation such as a new curriculum, has concerns initially about himself or herself with regard to how capable they are to use the innovation, what organizational role they will play in adopting the innovation, and what rewards will accrue from adopting the innovation. For example, in using a computer for assisting instruction, a teacher may be concerned about their own computer skills or about the career advancement opportunities such use may provide. When an individual acquires sufficient confidence about their own relationship with the innovation, then they focus their concerns on how to use the innovation, that is, on the task. Finally, the teacher begins to consider the consequences of the innovation. In the example given, he or she may begin to ask questions about the effectiveness of computer assisted instruction as compared to other kinds of instruction.

The CBAM includes six stages of concern. An additional stage labeled awareness represents a potential user who is unaware or unconcerned about the innovation. The stages are as follows:

Stage 0  **Awareness**: Little concern or involvement with innovation.
Stage 1  **Informational**: Awareness of innovation, interest in learning more.
Stage 2  **Personal**: Uncertainties about demands of the innovation, one's adequacy to meet those demands, and one's role in the innovation.
Stage 3  **Management**: Concerns about tasks and processes of using the innovation. such as time demands, efficiency, organizing, managing, and scheduling.
Stage 4  **Consequence**: Concerns about impact of innovation on students regarding relevance, performance, competencies, and changes needed to increase outcomes.
Stage 5  **Collaboration**: Concerns about coordination and cooperation with others in using innovation.
Stage 6  **Refocusing:** Concerns about more universal benefits of innovation and possibility of improving or replacing the innovation.

**Levels of Use**

From observations in the late 1960s and early 1970s, Hall and colleagues noted differences in how innovations were used. They subsequently identified eight **levels of use** including three "nonuse" and five "use" descriptions. These are observable behaviors unlike stages of concern which are inferred from information supplied by the subject. Though no direct correspondence between stages of concern and levels of use is claimed, they are thought to be related. These levels of use are as follows:

- **Level 0 Nonuse:** User has no knowledge of the innovation and makes no efforts to gain knowledge about innovation.
- **Level 1 Orientation:** User has recently acquired information about the innovation and (or) is exploring its value and its demands upon user and user system.
- **Level 2 Preparation:** User preparing for first time use of innovation.
- **Level 3 Mechanical use:** User mainly involved in attempts to master use of innovation often resulting in disorganized or shallow use.
- **Level 4a Routine:** Use patterns stabilize and user begins to give consideration to improvement of innovations and consequences of its use.
- **Level 4b Refinement:** User varies use of innovation to increase impact on clients that are within immediate sphere of influence. Variation is based on knowledge of consequences of the innovation's use.
- **Level 5 Integration:** User combines own efforts with those of colleagues to seek collective impact of innovation on clients within immediate sphere of influence.
- **Level 6 Renewal:** User re-evaluates quality of use of innovation and explores major changes in its use or seeks alternatives to the innovation. User also
explores new developments in the field and seeks new goals for self and the system.

In this description of levels of use, the user, the clients, and the user system corresponds to the teacher, the students, and the school. Applications of the CBAM may be possible in other kinds of situations and would need the model's user to identify who or what corresponds to the user, the client and the user system in the particular situation the model is applied.

Innovation Configurations

In addition to levels of use and stages of concern, Hall and Hord (1987) developed a way to describe an innovation using the concept of innovation configurations. After many studies involving the use of curriculum innovations, they noted that though several people may be using the same instructional module, the operational form of these modules differed between faculty and campuses. This led to the development of innovation configurations as a means to define and describe innovations in use. According to Hord, Rutherford, Huling-Austin, and Hall (1987), "Innovation Configurations (IC) represents the patterns of innovation use that result when different teachers put innovations into operation in their classrooms" (p. 13). This approach uses innovation component checklists that are developed by consulting innovation developers and facilitators in addition to observing and interviewing users of the innovation.

Bailey and Palsha (1992) examined the psychometric properties of the Stages of Concern Questionnaire (SoCQ), the primary instrument for measuring stages of concern. They conducted a factor and reliability analysis and looked at the correlations between the seven subscales of the questionnaire.

Their results support a conclusion that the basic assumptions behind the CBAM are sound. However, analysis did not support the subscale structure of the SoCQ. A shortened version of the questionnaire enhanced its reliability. The baseline data that would
be required to test Bailey and Palsha’s shortened questionnaire is unavailable hence, the original 35-item SoCQ was used in this study.

These three, stages of concern, levels of use, and innovation configurations, are regarded by Hall and colleagues as tools that the change facilitator uses to increase his or her understanding of users and hence improve the effectiveness of facilitative interventions. Three facilitator styles (responder, manager, and initiator) are identified in the Concerns-Based Adoption Model and discussions of factors such as school climate are included. Based on the research experiences, Hall and Hord (1987) and Hall (1992) attach a great deal of importance to the influence of the principal in an educational institution. They regard the principal’s support as crucial to the success of an innovation but point out that there may be other change facilitators in the institution.

This study made use of the CBAM framework for studying the process of adopting the use of an electronic bulletin board system by individual teachers especially those who are members of Small Business Centers within Kenya’s technical training institutions. It is inherently positive in approach with each innovator regarded as an individual with unique needs. Rogers’ (1995) model is a communication-based approach and would be useful in guiding the study of the dissemination of information about an innovation to various people involved in the implementation of the innovation such as institutional principals or Small Business Center staff. Rogers’ innovation process models would serve to identify critical points in the stagewise diffusion of an innovation. It would also be useful in explaining adoption phenomena such as differences in adoption speed between similar institutions. Ultimately, the results of this study are expected to enrich both models by confirming their postulates or revealing weaknesses or gaps in theory as well as demonstrating practical difficulties of relating the theory to realities in the field.

Rogers’ (1995) current model incorporates greater detail regarding innovation in organizations and like the CBAM, seems to correspond to the information-seeking paradigm which makes the two models philosophically compatible. They both
acknowledge the structural effects of knowledge, even though their more explicit statements regarding information or knowledge seem to favor a view of information as a resource. However, as described earlier, this simultaneous use of multiple views of information are accommodated by Braman's (1989) four-tier hierarchy.

Bulletin Board Systems

History

In 1974 Intel corporation introduced the 8080 microprocessor chip, the first microprocessor capable of making microcomputers a reality (Augarten, 1984). Some of the early applications for microcomputers were terminal emulators (Dewey, 1987). This involved the use of software that allowed a microcomputer to act like a terminal when connected to another computer (called the host) over telecommunication links. Early hosts were mainframe computers but soon computer professionals and hobbyists felt the need to design software that allowed microcomputers to act as hosts. Additionally, there was a need to find a way to detect and correct for errors arising from transmission over noisy telephone lines. A number of computer programs such as the xmodem, ymodem, zmodem, and kermit were designed to solve these problems (Wolfe, 1994).

During 1978 in the Chicago area, Christensen wrote a program called the Computer Bulletin Board System (CBBS) that allowed communication between microcomputers (Christensen & Seuss, 1978). This was the first electronic bulletin board system. CBBS was released as public domain software. The name "bulletin board" was derived from the first applications of this software which was first used to present bulletins to users. Although the users could select what bulletins they wanted to see, initially there were no file transfer capabilities. Other capabilities were added later such as the ability of a remote user to use the host's operating system to run programs on the host machine. This facility is now often referred to as "doors."
The next milestone was the development of echonets beginning with Jenning's FIDO BBS software written in 1983. These consist of bulletin boards that were linked by telephone or packet radio which allow messages originating at one board to be 'echoed' to nearby bulletin board systems. The arrangement allows bulletin boards to operate as conferencing systems and carry electronic mail to remote corners of the planet through telephone lines and low orbit satellites (African Academy of Sciences and American Association for the Advancement of Science, 1992; Mayo, 1989; Wolfe, 1994). FidoNet carries worldwide electronic mail through the network of computers (nodes) all running Fido software utilities and operated by volunteer hobbyists. The costs involved are borne by the node operators. Individual users (whose computers are referred to as Fido points) may access their mail by calling a node on which they are registered. In addition to e-mail, BBSs are commonly used as a depository of various materials in electronic form such as software, text documents, and images. Telephone charges are the major cost of using a BBS. Security is maintained by use of passwords or by operator assigned levels of access that limit what BBS facilities a caller can use. More sophisticated boards may apply additional security features such as call-back modems.

Modern bulletin board software can operate from a network of microcomputers, each with connections to the telephone system which allows such a board to support several simultaneous callers (Hedtke, 1990; Wolfe, 1994). Leading bulletin board software now support Remote Imaging Graphics (RIP), a facility that allows the caller on a remote computer to use a pointing device such as a mouse while interacting with the BBS. Older software was restricted to text mode operation where the caller issued commands by pressing keys on their keyboard.

Utility

Writing on computer-mediated communication, Rapaport (1991) emphasized that one of the primary roles of computer based communication, which seeks to support group processes, is as a facilitator of "the conversational aspects of human interaction" (p. xix).
Consequently, electronic mail (allowing individuals to exchange messages) and conferencing (allowing groups to share communications) are core facilities in a computer mediated communication system. The bulletin board system was developed for these very purposes. These messages can be shared with the board's members using netmail or with other boards using echonets such as Fido. These features give the board networking capability. Boards with multiple telephone lines allow users who are logged on to "chat," that is, exchange messages in real time.

In addition to e-mail and conferences, bulletin boards allow for an exchange of files including software and documents. Using single or multiple compact disc drives (CD-ROM), thousands of such files can be accessed (Bosak & Sloman, 1993).

The third major application is the "door" facility that allows users to run programs on the host microcomputers. The most frequently used doors are for computer games but this facility can be used to carry out remote on-line searching of a database.

According to Hedmke (1990), bulletin boards are used by government (e.g., National Aero-Space Administration, Naval Observatory, Small Business Administration, and Department of Commerce), businesses and corporations (e.g., customer support by software and hardware manufacturers, information exchange by stockbrokers and message systems for wholesalers and direct sales organizations), schools and colleges, and by the general public. This shows that the computer, when viewed as a flexible tool, offers many possible applications of bulletin boards by groups of individuals and by organizations.

Mayo (1989) provides examples of the use of packet radio bulletin boards for disaster management. These are popular with amateur radio operators. Indeed many bulletin boards are operated by hobbyists who continue a tradition that started at their inception.
Implementation Considerations

Hardware Components

Wolfe (1994) and Hedtke (1990) describe the basic technical requirements for the operation of a bulletin board. These include a computer, a modem, suitable bulletin board software, and access to a telephone line. BBS users require all these except bulletin board software. Instead, they need communication software.

Human Factors

Recounting experiences in Africa, Muteshi and Rigby (1992) indicate that use of the FidoNet system requires three levels of training. These include: (a) end users who need to learn how to send and receive messages and files; (b) end-user installer/trainers who need to know how to install the communication software and connect their computer to the telephone line hence requires some knowledge of communication theory and of microcomputer operating system software; and (c) node operators. Node operators are the people who operate the actual bulletin board host computers. They need to take care of all aspects of the board’s operation including recruiting new members, collecting fees, and performing all other duties to ensure the board’s continued operation and financial survival.

Applying the innovation models outlined in this chapter, we may categorize the people involved with innovation as: (a) members of the user system: (b) facilitators or change agents; or (c) members of a resource system. The implementation process for an innovation may be influenced by any factors that affect the user system, the resource system, or the change facilitators. For example, the anxiety associated with using computers may limit the user’s ability to acquire the skills necessary to "routinize" the innovation (Anderson, 1983; Jay, 1981). Technical factors such as difficulty in linking a modem to an institutional switchboard may hinder the process (Banks, 1992; Dewey, 1987; Wolfe, 1994). A number of authors have presented problems and issues associated with implementing information technology-related projects in Africa (Board for Science and
Technology for International Development, 1989; Dooley, 1995; Mody & Dahlman, 1992). These offer a deeper insight into the implementation process for contexts similar to the one encountered in this study.

Summary

This review has presented the policy context within which the innovation was introduced and studied. This includes the presence of Small Business Centers within educational institutions with a mission that extends beyond the institutional boundaries and whose information and communication needs may be met in part by using a bulletin board system. Staff at four of these Centers were involved in this study.

Development was presented as a major government preoccupation in developing countries and Krippendorff's (1987) communication and development paradigms were included as a way to link development activities to communication. This link is important because the innovation that is the focus of this study is a communication tool. Because the innovation implemented is an aspect of information technology, the concepts of information, innovation and technology were presented in some detail.

Two models that focus on the adoption of innovations were then presented. One is based on communication theory (Rogers, 1995). The other adopts an approach based on organizational development (Hall et al., 1973; Hall & Hord, 1987).

A short history of the electronic bulletin board and a description of the facilities offered by contemporary boards were provided. Finally, a discussion of factors associated with the implementation of a bulletin board were presented. Because bulletin boards involve the use of computers and telecommunication links, it would be expected that factors affecting the use of these technologies would also affect the use of electronic bulletin board systems.
CHAPTER 3
METHODOLOGY

A case study method was used in this project. By using this method, the rich data required to understand a complex, time-varying phenomenon such as the implementation of a new technology, are more effectively captured.

There have been concerns regarding the methods used to study complex processes such as innovation. Rogers (1995) argues that the research methodology used to study the complex processes associated with the diffusion of innovations needs to be capable of capturing this complexity. For this reason he discourages the use of one-shot surveys. This is especially important with time-varying phenomena that require extended observation. The communication and development paradigms presented by Krippendorff (1987) and Myrdal's (1956) argument that tradition influences both the questions people ask and the way they ask them, suggest a need for caution and an explicit acknowledgment of a researcher's standpoint and background. These concerns are important because the researcher's background may influence his or her interpretation of qualitative data.

It is not easy to generalize from case studies. Hamel, Dufor, and Fortin (1993) suggest a way to link the local (single case) and the global. They argue that, by applying Thom's (1975) catastrophe theory and the concept of a singularity, the reconstruction of the global from the local is possible. According to them, such reconstruction requires that cases be representative of the selected society and that the case and any analysis resulting from the case, be conducted with rigor. Hamel et al. (1993) use the phrase sociological representativeness in reference to representativeness that meets these criteria.

Yin (1989) outlines some features of the case study method. Of particular interest is the concept of analytic generalization (as opposed to statistical generalization) by which an investigator tries to "generalize a particular set of results to some broader theory" (p. 21). Such generalization requires that theory be tested through replications in
a second or third study. This theory testing requirement presents some difficulty when comparing case studies done by different researchers because such comparison needs a common theory as a frame of reference. Indeed there have been complaints about case studies of information technology innovations in developing countries that lack a conceptual framework (Heeks, 1994). Heeks suggests the use of case studies that build on previous studies but does not indicate the need for a common frame of reference.

In this study, four sites were studied simultaneously rather than consecutively as Yin's approach may imply. This avoids a situation where the results of one case may influence the interpretation of data in subsequent cases. There is the additional risk that, during the period between consecutive case studies, changes may occur that alter the phenomenon of interest or its context to a degree sufficient to invalidate comparison between cases.

Case studies serve well for theory testing and for situations where there are multiple sources and types of data (Yin, 1993). They also allow the context to be considered as an important part of the phenomena under investigation. In order for the case study to be useful in this generalization, it needs to be representative of the population to which generalization will apply. To improve this representativeness and provide replication and hence aid in theory testing, a case was developed that involved four institutions (see Figure 1).

The two models selected as a framework for the study were chosen because of the large amount of research that supports each of them. Hall and colleagues (Hall et al., 1973, Hall & Hord, 1987) started work on innovation adoption soon after Sputnik, the former USSR’s spacecraft, in the late 50s. Their model is based on a developmental approach. Rogers' (1995) model, based on communication theory, is the cumulative result of many studies in the diffusion of innovations beginning as early as 1903. The statistical models incorporated in Rogers theory are based on a large number of studies. For these reasons, these models are quite robust and well-tested.
To recapitulate, the research questions guiding this study were:

1. What factors (e.g., government policy, quality of infrastructure, availability of expertise, and institutional readiness) should be considered in implementing a bulletin board system in Kenya?
2. What barriers hinder the implementation of a bulletin board system in Kenya?
3. How do user concerns change during implementation of the innovation?
4. How do the bulletin board users' perceptions regarding the utility of the bulletin board system change over a time?

The Case

The case consisted of four technical training institutions linked to the Bulletin Board System through the telephone network as illustrated in Figure 1. The decision to include four institutions was made based on the resources available for the research which was exploratory in nature, and on the need for adequate representation of the technical training institutions in Kenya. In addition, consideration was given to Yin's (1989) recommendation that case studies be replicated to ascertain that results were consistent across the cases. Such replication would allow generalizations to be made with greater confidence than would be possible using a single case.

Each site was conceived as consisting of people playing certain roles. There were three roles central to the study: the BBS user, the administrator, and the technician. Users were those who used the technology, technicians were those who maintained and installed the hardware and software involved in this technology, and the administrator was one who administered institutional operations. The administrator would normally be the principal, deputy principal, or a department head. It would be possible for an individual to play more than one of these roles. The BBS operator represents a fourth key role. This role involves keeping the hardware and software running smoothly as well as supervising other staff and maintaining user records. In addition to these roles, the case
includes the complex interactions of the actors involved at each site and their relationships to each other. These complex interactions and relationships include the observable or expressed feelings, opinions, and beliefs of the people involved especially as these relate to the participants' involvement with the technology.

Figure 1. Constituents of the case.
Selection of the Four Sites

Four Small Business Centers at four different technical training institutions were selected for the study. Two urban-based and two rural-based institutions were selected in order to better represent the range of technical training institutions. The availability of a computer and access to telephones services were prerequisites for participation in the study because the BBS (or e-mail system) could not be set up without these basic requirements. It was assumed that rural SBCs would be more likely to face skill shortfalls and unreliable telephone services and hence it was thought important to have rural representation. In addition, about 11 of the 17 SBCs in existence at the time this study was initiated were rural based which would make it imperative that a rural SBC be included.

A preliminary questionnaire containing demographic items was sent to all 17 SBCs whose names and addresses were published in a brochure produced by the Entrepreneurship Promotion Project who coordinated the SBCs. The preliminary questionnaire contained items related to the availability of a microcomputer and telephone service, number and proficiency of computer users among staff members in the college, the size of the institution (number of students and staff), and its location. A letter of introduction explaining the purpose of the study accompanied this questionnaire. It had been intended that four SBCs would be selected based on the data collected using this preliminary questionnaire. Institutions that had a computer and telephone service available for the study were to be stratified into two groups: those in urban and those in rural areas. Two institutions were to be randomly drawn from each group. For this purpose, a town with at least 100,000 people, based on the 1989 population census, was considered an urban area.

However, these questionnaires were not returned and, in some instances, were not received by the SBCs to whom they had been sent by the researcher. Consequently, a call was made to each institution to explain the research project and ascertain the nature
of computing and telephone facilities. If these facilities matched the desired profile, they were asked to participate. Only five SBC met the requirements and were willing to participate.

A number of SBCs that had a computer could not be reached because of disrupted telephone services. In some instances, coordinators were not in their offices and despite messages left for them, did not respond to the calls. Of the 11 SBCs that had a computer, 5 were eliminated due to lack of interest or inadequate facilities while at 1 institution, the principal was away and consequently, no decision could be made regarding participation in this study. Three of the remaining five institutions were urban. Of these, two were selected to provide for the greatest geographical distribution. Two of the five eligible institutions were rural-based and consequently, were selected to participate in this study. The selection process did not involve any random sampling.

Selection of BBS Provider

During the planning of this study, information available from sources such as the American Association for the Advancement of Science indicated that there were two FidoNet BBS service providers in Kenya. One was part of an international non-governmental organization (NGO) and specialized in providing e-mail services to other NGOs. The Network Service Center (not its real name) was the second organization which was initially established as part of a major Kenyan university but later converted into an NGO. This second organization focused on providing e-mail services to educational and research institutions. Because this study principally involved educational institutions, the Network Service Center was selected as the BBS for this study. As a Kenyan organization that relied on locally recruited employees, it would be expected to provide better representation of a Kenyan BBS service provider than the first organization which relied more on expatriate management.
Site Profiles

Site 1

Site 1 was Govi Institute which was located in Govi town. The Institute’s SBC was situated at the center of Govi town while the rest of the institute was about 2 km (1.2 miles) away from the town. Govi town is a small rural community near the Indian Ocean coast. It is surrounded by dramatic hills that rise out of the plains stretching south towards the Kenya-Tanzania border. One of Kenya’s biggest National Parks borders Govi Institute and buffaloes have been known to stray into the institute’s campus. Communication to Govi is easy because it lies on the main road connecting the coast to the interior as far west as Zaire. Numerous buses provide daily services along this route. The SBC is located next to the main bus station in Govi town. The town is served by a modern digital exchange and the SBC had a direct telephone line, the only one among the four SBCs in this study to have such a line. The other SBCs accessed their telephone lines through manual switchboards.

The SBC’s one-room second-floor office contained a word processor, microcomputer and a photocopying machine. The location seemed dusty, possibly as a consequence of its proximity to the bus station which was unpaved. The rest of Govi Institute was housed in a former tourist hotel. No development appeared to have occurred since its establishment. Unlike many of the other similar institutions, it possessed only 40 acres of land. Increased economic hardships in this sisal-growing area had reportedly resulted in diminished community support. There was little government support except for teachers’ salaries, therefore, it was difficult for the institute to finance its operations.

The enrollment was about 300 students with 33 teaching staff. The principal lived on the campus. He was a very helpful and humble man determined to turn the Institute around after mismanagement had driven it into serious debt. He was exploring all ways to raise money for the Institute such as offering space and facilities for training seminars.
Although he joked that a miracle was required to turn the Institute around, he had already made progress towards achieving this turn-around by reducing the college's debt by about 75% since taking over as principal.

Because this study was concerned with the SBC, the researcher had very little interaction with the Institute staff due to the distance separating the SBC and the Institute. The SBC staff consisted of its coordinator and one staff member who acted as the clerk and secretary. The SBC coordinator expressed a lot of optimism regarding his future plans for the Center. He had used some of his own resources to establish the SBC because the Institute had severe financial constraints. This SBC was well known in the locality due mainly to the promotional efforts of the coordinator. Govi's only computer applications training was offered at this SBC and was conducted by the coordinator.

Site 2

Mago Institute is located on the western part of Kenya near the Kenya-Uganda border and at the foot of Kenya's second highest mountain, an extinct volcano. The Institute was about 8 km (5 miles) from Mago town. The town, not unlike Govi in size, is situated amidst a sugar-growing zone. Problems at the local sugar factory had reduced the factory's capacity to process cane which negatively affected the local economy.

Although there were regular bus services between Mago town and other major urban centers in Kenya, most of the road between the town and Mago Institute was unpaved and became slippery and rutted when it rained. Commuter services were irregular along this road and the local people relied on bicycles for transport. Although the telephone services were relatively good in terms of voice clarity and ease of making a connection, frequent breakdowns of services made the line unreliable. The Institute operated a manual branch exchange with extensions to the various offices most of which were located in other buildings away from the small administration block. The telephone extension in the SBC's three-room office was not working due to storm damage.
Mago Institute was a converted farm and retained a farm atmosphere. The campus was located in a wooded area with a strange rocky structure to the east that was the subject of local legend. Kenya’s second highest mountain (4,321 m; 14,176 ft) dominated the horizon to the north. Heavily laden tractor-trailers could be seen hauling sugarcane to the local factory along a dirt road to the east of the Institute. The Institute owned about 500 acres of land on which maize was grown and dairy cattle were kept. Although the facilities were well-kept, there appeared to have been little development since the Institute was established. Some of this stagnation was blamed on a community divided by its political leaders. According to the principal, the community seemed uninterested in the growth and development of the Institute. However, unlike Govi, Mago Institute appeared to be relatively healthy financially, possibly due to the added income from farming. Like Govi, government support was limited to teachers’ salaries with a token amount for support staff.

The enrollment was 300 students with 30 teaching staff. The principal had been at the Institute for about two years. He had taken over amidst great drama when the former principal refused to leave. He lived on the campus and jokingly explained that his previous city location had not prepared him well for his current job where he was expected to know all about farming. According to him however, he had learned quickly and was coping. He was actively involved in seeking linkages with agencies and institutions that would help develop the Institute. Already, there were some European graduate students attached to the Institute studying tropical agriculture. Mago Institute had developed a soil-testing lab, the only one in Western Kenya, and was involved in developing other agriculture support services.

Among the four sites in this study, this site had the greatest sense of community. Staff were transported each morning from Mago town by an institute vehicle and the staffroom was a place of congregation for the teachers. A tea club managed the 10:00 a.m. tea. Unlike other institutes where the researcher rarely interacted with staff.
members, at Mago there were several people who regularly visited the SBC, especially those who had an interest in the SBC’s computer. However, the SBC appeared to have no permanent staff except the coordinator.

Site 3

Ruku Institute was located in the Rift Valley in an area that had some of Kenya’s best farmland. The Institute was at the edge of Ruku town’s municipal boundaries, about 7 km (4.3 miles) from the town center. The town, with a population of about 150,000, is Kenya’s farming capital. This site was considered an urban area due to its proximity to Ruku town. Transport was easily available between Ruku and other major towns in Kenya and Ruku Institute could be reached easily by the public transport services that served the farming communities to the south of Ruku town. An all-weather (tarmac) road went by the Institute’s gate.

Ruku Institute was served by two telephone lines including the principal’s private line. In addition, there was a pay phone at the college that was used by students and for unofficial calls by staff. Despite the relatively good telephone facilities in Ruku town, this institute experienced frequent extended failures of their telephone lines. Ironically, a telecommunications training facility was situated next to the college. The Institute’s manual switchboard was operating beyond capacity with at least two departments including the SBC, sharing an extension.

There were good physical facilities at this institute with a relatively large administration block and sizable workshops. As a result of support from a European country, they had a well-equipped agriculture department which among other things, owned a combine harvester. Ruku Institute had about 500 acres of farmland which it used for wheat and dairy farming. However, a half-finished building intended to be a new administrative building, had been lying in that state for some years indicating that there were some financial difficulties at this college. The European country that had been
providing support was about to terminate this support and based on conversation with the principal, it appeared that Ruku Institute, like Mago, was actively seeking new partners and collaborators to help develop the institution.

The enrollment was 1,200 students with 130 teaching staff which made Ruku one of the biggest institutes of its kind in Kenya. According to the SBC coordinator, the principal preferred to give staff autonomy and let them get their work done without close supervision. Unlike the other principals, who had expressed concern regarding the possible cost of using the Fido BBS, the principal at Ruku seemed more concerned about whether the link would be successfully established.

Despite the SBC’s location on the campus just 200 yards from the administration building, there were few encounters with other staff members except the coordinator and the SBC clerk/secretary. Judging by comments made by the SBC coordinator, cooperation among staff was not as good at this institute as it was at Mago. However, the coordinator seemed on excellent terms with the principal.

Site 4

The Kenya Technical Institute was located on the outskirts of a major metropolitan area and easily accessible by road. Unlike the other three sites, this college specialized in training technical teachers many of whom joined the staff of Kenya’s technical training institutions. Although they had five telephone lines, only one was functional at any one time. Staff were prohibited from making external calls from the Institute’s telephone lines. In the past, telephone facilities had been misused resulting in very large telephone bills. Consequently, restrictions were placed on telephone usage. However, two pay phones were provided for use by staff and students. Many of the staff lived on campus and had private telephones. The principal had a private telephone line. Part of the problem of accessing this college by telephone was created by the need to try so many numbers because an outsider could not easily tell which of these five lines was
operational on any given day. In addition, these lines were switched through an exchange that seemed problematic which frequently forced the caller to dial several times before getting a connection.

Of the four institutes involved in this study, this college had the best facilities including a well built campus that had an administration block, classrooms, boarding facilities, workshops, a substantial library, and sporting and leisure facilities. The Institute had been constructed in the 1970s with help from a North American country. The college had several computers and had recently created a Department of Computer Science. The library maintained a computerized database of its holdings. However, external support from the government had been on the decline hence, like other similar institutions, they faced increasing financial pressures.

The enrollment was 700 students with 160 teaching staff. All the students at this institute had acquired training in their academic areas at other institutions and often had taught for a number of years before coming here for professional training. Professional qualifications allowed them to obtain promotion because, without these, they were regarded as untrained teachers. The current principal, who was relatively new at the Institute, appeared enthusiastic about the BBS concept. He had learned about computer networking initiatives in Kenya while chairing a computer studies curriculum development workshop late in 1994. The objective of the workshop had been to develop an informatics (computer studies) curriculum for secondary schools. At this workshop, several presentations were made including two on networking. However, he was concerned about the cost of using the BBS (referred to as e-mail in Kenya because this was the most frequently used service) especially after the research was completed when they would be required to pay a monthly subscription fee. According to him, any substantial expenditure would have to be justified to his Board of Governors.

The college had the air of a large institution where the principal appeared relatively unreachable and remote from the daily goings-on. This was unlike Mago where the
principal would be seen walking around the Institute talking to staff and checking on the farm. There was a much greater atmosphere of formality and procedure here than at other sites. However, staff members seemed less conscious of these official appearances. It was difficult to tell who was a staff member, visitor, or student because the students were mature adults.

When the researcher first entered the SBC coordinator's office, the latter was searching the drawers in his office. He explained that he had just taken over as the coordinator and was trying to find out where everything was. Thereafter, he appeared to be very busy. Though he indicated interest in this research project, he did not invest much time to try and learn how to use the e-mail system. He seemed more eager to learn how to operate a computer and use a word processor.

Towards the end of the study, some members of staff at this institute acquired great interest in some of the aspects of computer-based communication. However, this interest seemed to be based on personal missions rather than the desire to meet a specific institutional need. They were particularly fascinated by fax cards, a device they had not encountered before. The Entrepreneurship Promotion Project, which coordinated Small Business Centers, was housed at this institute. Its coordinator, on finding out about the e-mail system in an office near his, came in to have a look but declared that the technology was too complex for him raising his hands in symbolic surrender. He promptly returned to his office without waiting for a demonstration.

Network Services Center

The Network Services Center (NSC) operated the BBS used in this study. Founded in 1992, the NSC was originally housed at the Center for Nuclear Science Techniques, University of Naro. Dr. Musa, the NSC founder, at that time worked at the Institute for Computer Science at the same University. When he left the Institute, the Network
Service Center was converted into an NGO. Its mission includes the provision of high level computer science education, research, and the promotion of information technology.

At the beginning, the new NGO was housed in its director's house but later moved to a suite of offices in a Nairobi suburb. The process of installing four telephone lines for this new office was difficult and frustrating. A delay of several weeks occurred before the Center could be moved due to the difficulty of obtaining vital telephone lines. Even after telephone lines had been installed, some of the functions of the Center could not be moved due to inadequate security at the new site. An effective security system needed to be installed. Worst of all, telephone lines in Kenya did not automatically provide international dialing facilities and the new lines could not be used for international calls. Because the Center's mail server made daily calls to U.S.-based gateways used to exchange mail with the Internet, it could not be moved to the new site. Additionally, the 24-hour monitoring required for the mail system was difficult to achieve at the new location. Once the telephones were installed at the new offices, communications improved. A fax machine could now be used. Only two lines had been available at the previous site one of which was dedicated to the server. There was easy access to the new offices by road because they were on a major thoroughfare.

Although the Fido node operated by the Center had capability to interface with popular BBS software, the node operator had not implemented this aspect of the node. He explained that users tended to stay on-line for lengthy periods when accessing BBS services and hence tied up the single telephone line making access to the BBS difficult for other users. The Center was in the process of experimenting with a BBS setup now that they had an extra telephone line. Fido node software could operate without what is traditionally considered a "BBS" such as Wildcat!, Power BBS, RAP BBS, or other popular BBS software. More efficient use of the telephone line occurred when these BBS software packages were not activated.
During the period the study was conducted, the Network Service Center was undergoing extensive change. Among these changes was the move to a bigger and more accessible office, the initiation of e-mail and computer applications training, hiring of a full compliment of staff, and sector-based promotion of e-mail. The sectors targeted were organizations and individuals involved in small enterprise development, those involved in agricultural and related research, and the legal profession. Although the Network Service Center had been in existence for about two years, it had not yet taken shape as a stable organization. It depended very heavily on Dr. Musa possibly because most of its directors were dormant. The organization had gone through difficult times including attempts by some directors to start up similar organizations of their own. In addition, it had gone through the struggle to define itself and make decisions such as whether it could offer any free services. Other struggles included strains in its relationships with other organizations especially those involved in providing e-mail services in Kenya.

The Center was the first local initiative to offer e-mail services. It was also the only such organization whose mission includes research and high level training even though such training had not yet been implemented at the time of this study. Progress towards these goals was evident. For example, they implemented a children’s computer training program that included e-mail and had plans for a program for senior executives. In addition, there were plans for a collaboration between the Center and a new university with the intention of running joint programs that could be used as credit at this university.

One particularly pivotal role that the Center had played was the involvement of Dr. Musa, two years previously, in the drafting of a national Information Technology Policy. This document had not yet been debated and passed by the Kenya Parliament, a process that was required before it became official policy. However, one specific proposal arising from this draft has been adopted. This was a call for the lowering of import duty on computers and computer-related products such as software and spares. Import duty
was lowered from 40% to 10% resulting in a substantial drop in the cost of computers in Kenya.

The NSC initially had a staff of four (excluding the directors). One of these staff members was normally stationed at the old site to monitor the mail system and answer calls. In addition to these employees, the director was assembling a technical team consisting of persons with varied expertise who would be able to assist the center implement its projects. Towards the end of this research, some interviews were conducted to select additional employees who could take on the duties of administrator, and accountant or play both roles. The indeterminate organizational structure, high employee turnover (two employees were replaced during the time this study was conducted), and the director’s entrepreneurial management style, were features associated with a small firm during their start-up phase. The researcher was able to participate as a member of the Center’s technical team and to assist the director when he was away at conferences. However, this caused some problems that are discussed in the next chapter.

Other Organizations and Individuals

Although the research focus was on the institutions and individuals constituting the case as defined earlier in this chapter, a substantial amount of time was spent troubleshooting e-mail systems for organizations and individuals served by the Network Service Center. Most of these organizations were NGOs and research centers.

Data Organizing Elements

A review of the literature yielded four elements around which data collection could be organized. One was the factors considered in implementing a BBS. The second was the barriers to implementation or problems experienced during implementation. The third was the concerns of users during implementation while the fourth and final aspect was the users' perception of utility of the BBS. This being an exploratory case study, no clearly
defined variables could be specified aside from user concerns. Based on reports in the literature and the researcher’s experience, possible specific factors, barriers, concerns, and tasks for which the BBS had potential high utility were listed and used to construct the instruments described in the next section.

Four categories of factors were included in this list. These were:

1. Effects of government (or government-owned corporation) policy.
2. Institutional readiness for the innovation.
3. Availability of expertise.

Five categories of barriers were listed including:

1. Lack of administrative support.
2. Technical difficulties.
3. Financial constraints.
4. Regulatory problems.
5. Staff reluctance or inability.

A list of concerns was derived directly from the Concerns-Based Adoption Model developed by Hall et al. (1973). This model proposed the following seven stages of concern: (a) awareness; (b) informational; (c) personal; (d) management; (e) consequences; (f) collaboration; and (g) refocusing. Details of this model were provided in Chapter 2.

When considering users’ perception of utility, use was made of the researcher’s personal experience in the operations of Small Business Centers. A list of possible tasks that SBC staff were expected to perform regularly was drawn up. These are listed in Table 3, Chapter 4.
Instrumentation

The instruments used in this study include: (a) a standard Stages of Concern Questionnaire; (b) a BBS Utility questionnaire; (c) a document review, observation, and interview guide used during site visits; and (d) a BBS operator's interview guide. As explained below, some of the instruments that could be pre-piloted were reviewed by the researcher's peers especially for clarity of meaning and completeness. The instruments were also critically assessed by a committee of professors from the researcher's college.

Stages of Concern Questionnaire

The Stages of Concern (SoC) Questionnaire was used in its original form (Hall et al., 1979) with no structural change except references to "students" are changed to "staff" because the innovation was directed at staff rather than students. The developers of the SoC Questionnaire caution against changing the wording because such change is likely to invalidate the scoring scheme.

This instrument contains 35 eight-point Likert-like scale items which are categorized into seven groups of five. The items are randomly listed on the questionnaire but a scoring scheme identifies the five groups. Raw scores for each group were used to select a percentile from an accompanying table which was then plotted on a line graph. This resulted in a line profile that could be compared to illustrative examples supplied in the user's manual (Hall et al., 1979).

The questionnaire's developers point out that the interpretation of the profile thus obtained needs to be confirmed by personal interaction with respondents. The profile serves as an indicator of the respondent's needs with respect to the innovation and does not measure the cognitive or affective capabilities of the respondent. This instrument is intended as a diagnostic tool for change facilitators and is invalid for non-adult respondents.
The **SoC Questionnaire** has been found to have test-retest correlation (reliability coefficient) ranging from 0.65 to 0.96 on its seven factors and internal consistency coefficients ranging from 0.80 to 0.93 (Hall et al., 1979). This indicates acceptable item consistency but has a range of reliability that extends below the 0.80 normally used as the lower limit for research (Borg, Gall, & Gall, 1991). Although these reliability factors are assumed to apply for this study because nothing in the literature indicates that they are invalid, Bailey and Palsha (1993) found that a shortened version of the questionnaire enhanced its reliability. The baseline data that would be required to test Bailey and Palsha's shortened questionnaire is unavailable, therefore, the original 35-item SoC Questionnaire was used in this study. In addition, the user's manual does not discuss the effects of using the questionnaire in a culture that is different from the USA where development of the original SoC Questionnaire was carried out.

This questionnaire was pre-piloted by requesting three advanced doctoral candidates in the researcher's department to read it for clarity both of the instructions and of the individual items. Minor adjustments were made to remove ambiguity.

**BBS Utility Questionnaire**

This instrument was used to ascertain the change in the perceived utility of the BBS as seen by the participants at the four sites. It consisted of a list of tasks that SBC staff would be expected to perform regularly (Table 3). Each respondent was requested to explain how the BBS would help them perform each task. It was developed by the researcher and pre-piloted by requesting advanced doctoral students in the researchers department to review it. The list of tasks was not sorted using any deliberate scheme or criteria.

**Document Review, Observation, and Interview Guide**

The document review guide provided a tentative scheme for classifying factors and barriers. It was used to guide the review of documents and in addition, guide on-site
observations and informal interviews with SBC staff. The scheme was expanded in the field to accommodate factors and barriers that fell outside the original framework. The categories included on this instrument were obtained from reviewing the literature and from the researcher’s own experience of, and knowledge about conditions in Kenya.

This instrument guided the collection of qualitative data in the relatively informal context of a site visit. Its checklist structure allowed for flexible use and fast recording of observations of conversation. It served as an organizer of information. The instrument was pre-piloted in the same way as the BBS Utility Questionnaire and subsequent adjustments made to improve its clarity and completeness.

BBS Operator’s Interview Guide

In addition to items contained in the Document Review, Observation, and Interview Guide, the BBS Operator’s Interview Guide contained items concerning how the BBS was started and factors that need to be considered in setting up a BBS. This instrument was used to provide additional data for research questions 1 and 2. Although intended as an interview guide, it served as an observation and document review guide in the field because much of the information it was intended to help collect was obtained through the researcher’s observations while at the Network Service Center (the BBS service provider) and by reviewing documents at the NSC such as the original proposal for the establishment of the Center.

Data Collection

Data collection was carried out according to the schedule in Table 1. At least three visits were made to each site. Although visits were originally intended to last up to a week, technical problems with the equipment (modems and computers) and with telephone services as well as the disruption created in the schedules of SBC staff by the researcher’s visits, made such extended visits impractical. Consequently, visits lasted
one working day. Visits to two sites were delayed due to equipment damage as outlined in the next chapter. Towards the end of the study, it became very difficult to reach participants at the four sites because they had extended Christmas vacations lasting eight weeks. Staff were away from their institutions during this time.

All data were collected by the researcher. This data consisted of observation, interview, and document review notes. Where possible, interviews were audio taped. Originally, it had been intended that video taping would be performed during site visits while users accessed or tried to access the BBS. However, in addition to the prohibitive cost of video equipment in Kenya and the need to hire a technician, the difficulties experienced in connecting the sites to the BBS were not overcome early enough to allow for any meaningful use of the facility.

Table 1

Data Collection Schedule

<table>
<thead>
<tr>
<th>Task</th>
<th>Month</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Planning with EPP and NSC. meetings with Ministry of Technical Training</td>
<td>Aug.</td>
</tr>
<tr>
<td>- Installation of e-mail system, user training.</td>
<td>Sept.</td>
</tr>
<tr>
<td>- Initial administration of Stages of Concern and BBS Utility Questionnaires</td>
<td>Oct.</td>
</tr>
<tr>
<td>- First site visits.</td>
<td>Nov.</td>
</tr>
<tr>
<td>- Second site visits.</td>
<td>Dec.</td>
</tr>
<tr>
<td>- Third site visits.</td>
<td></td>
</tr>
<tr>
<td>- Final administration of Stages of Concern and BBS Utility Questionnaires</td>
<td></td>
</tr>
<tr>
<td>- Interviewing BBS operator, observations at the NSC.</td>
<td></td>
</tr>
</tbody>
</table>

Note. EPP=Entrepreneurship Promotion Project. NSC=Network Service Center.
Although users were not able to access the BBS throughout the four-month duration of the study, they had an opportunity to try out the communication software functions. As reported in the next chapter, even where the installation was successful, the SBC staff either did not try to use the system or were incapacitated by a variety of barriers.

Pre-test and post-test administration of the Stages of Concern and BBS Utility Questionnaires were carried out in order to ascertain the change in BBS-related user concerns and in their perceptions regarding the utility of the BBS. The two questionnaires were administered during the first visit to each site with the exception of Site 4 where there were some preliminary visits before the instruments were administered. Due to the difficulty of reaching the participants at the end of the study, the post-test administration was administered by mail. In each instance, the respondent was provided the questionnaires and asked to complete them after reading through the instructions. None of the participants requested help with interpreting any of the questionnaire items which was evidence that there was little difficulty in understanding the contents of these instruments.

It had been intended that, during each visit, the researcher would immerse himself into the daily operational activities of each institution, observing not only the users as they accessed the BBS, but also the way they related to other actors including those playing technician and administrative roles. Informal interviews were to be conducted with users, administrators, technicians, and other persons concerned with using the BBS. In the field, however, it was found that some sites were easier to enter and initiate interaction with staff members than at others. Where the SBC was a substantial distance from the rest of the institution such as at Govi Institute (Site 1), little interaction occurred with anyone except the SBC coordinator and to a very limited extent, the SBC clerk-secretary. The greatest interaction occurred where staff at the sites had computer-related needs of the kind that the researcher could provide assistance such as help with installing and using applications. This occurred at Site 1 and 2. Another determinant of
the extent of interaction was the SBC coordinator. The more people who regularly visited the SBC office (where installation of the communication software was done), the more people the researcher got to meet and interact with.

Using a diary format, notes were made during each site visit. Observations were guided by (but not limited to) the Document Review, Observation, and Interview Guide. An effort was made not to intrude into the daily routines at the Institutes visited. It was emphasized to users that they were to determine the utility of the technology on their own based on the neutral information provided and on their interaction with the system.

It was thought important that the SoC questionnaires be completed conscientiously in order for the resulting profiles to be a useful representation of user concerns. In this study, circumstances forced the post-test administration of the SoC Questionnaire by mail, a situation that the researcher considered undesirable because it diminished the ability to check that the questionnaires was completed without hurry and by the designated participant.

The Network Service Center

During the periods between site visits, the researcher participated in the daily operations of the NSC. It had been intended that the NSC director, who operated the Fido BBS (or node), be interviewed but it was found that most of the required information could be collected by attending NSC meetings, meeting NSC clients, troubleshooting and installing e-mail systems for the NSC, and reviewing documents at the NSC. Such participation allowed the researcher to gain first hand experience of the day-to-day operations of the Center. However, it also generated conflict between the role of a researcher and that of an NSC staff because the researcher eventually came to be regarded as part of the Center. As a result of researcher’s experiences at the NSC, comparisons could be made between the way the technology was received at the four
sites and its reception by other NSC clients, an outcome of the study that had not been planned beforehand.

Data Analysis

Analysis of data from the adopted instrument (Stages of Concern Questionnaire) was performed in accordance with the instrument developer's recommendations (Hall et al., 1979). The data from this questionnaire was used to show the change, if any, in user concerns over the course of the study. The raw data from Stages of Concern Questionnaire for two administrations of the instrument consisted of a list of questionnaire items and the scores for each item. For each respondent, item scores were summed up by category and the results were used to select a percentile score from a table generated during the development of the instrument. These percentiles were then plotted to create stages of concern profiles. An example of such a profile is shown in Figure 2. The profiles were prepared in the field where possible and interpreted according to the guidelines provided by the developers.

An abridged version of the field notes was prepared to provide a narrative account of the events and experiences in the field. The observation and interview data were content analyzed and presented as summary narratives organized around the key points that emerged from the data in relation to: (a) the factors considered in establishing a BBS and (b) to implementation barriers and problems.
The **BBS Utility Questionnaire** responses were scored according to a scoring scheme developed by the researcher and exhibited in Appendix G. The scheme is related to the level of detail provided in the responses and to the respondent’s apparent understanding of the basic function of a BBS which is a tool for communication. Three versions of this scheme were tested by three graduate students in the researcher’s department and adjustments made until a version was produced that yielded scores independent of the analyst. It was found necessary to emphasize to the analyst that the main function of a BBS is communication and information exchange rather than computing. Using the scheme, the questionnaires were analyzed and the pre-test scores compared with the post-test scores. In addition, based on informative interactions that
occurred with NSC clients who were not part of the original case definition. Brief discussions were prepared contrasting the differences between the way e-mail was received in these organizations with its reception at the four sites.

Summary

This chapter described the type of research design used and presented a rationale for using the case study method and for adopting the particular conceptual models on which the study is based. The case was defined and the procedures for selecting case participants outlined. Profiles of the four sites and of the Network Service Center, who operated that BBS used in this study, were presented. An outline of the elements that served to organize the data were presented followed by a description of the instruments used. The data collection procedures were then explained, and finally, the data analysis methods were described. Copies of the instruments are contained in the appendices.
CHAPTER 4
RESULTS

Data were collected through informal interviews, observations, and questionnaires. A preliminary questionnaire designed to gather the data on which to base site selection had been sent to each of the 17 Small Business Centers (SBC) in Kenyan technical training institutions in early August 1994. Because only one questionnaire was returned, a call was made to each SBC that had a computer. Selections were made based on the institution's willingness to participate in the study, the availability of a working telephone at the SBC, and the location of the institute.

Each of the four selected institutions was then visited at least three times. During the first visit, the SBC coordinators were asked to complete the Stages of Concern Questionnaire and the BBS Utility Questionnaire. Originally, it had been planned that the participating Small Business Center staff be asked to complete a second set of the same questionnaires during the final visit but this proved impossible because the staff could not be located during the semester break in December 1994 when the study ended. Instead, the questionnaires were mailed to the participants and returned by April, 1995. All the names of people, institutions (and their locations) directly involved in this study have been changed to maintain confidentiality.

Events and Experiences in the Field

The following is an abridged account of events between August, 1995 and December, 1994 in chronological order. Names have been changed where necessary to protect the identity of individuals, places, and organizations. A description of the results follows this narrative account.

Week 1 (August 24 - 27)

The Entrepreneurship Promotion Project (EPP) provided partial support for this study and also supplied the computers to some of the SBCs located at technical training
institutions. An initial meeting was held with the EPP staff to discuss the status of the Small Business Centers. At this meeting, it was mentioned that four of the computers that were donated to the Small Business Centers had developed problems and were awaiting repairs at the project office.

The EEP coordinator explained that they planned a workshop in Ruku in September to develop some guidelines that would assist those working in the field to establish entrepreneurship development programs such as Small Business Centers. The Small Business Center coordinator at Ruku Institute, one of the potential field sites situated in Ruku town, was to be present at this workshop. Plans were made to visit this Institute and talk with the principal while at Ruku. Later in the week, a visit was made to the Office of the President to collect application forms for authorization to conduct research.

Week 2

Tuesday, August 30

The EPP's address was used as the return address for the preliminary questionnaire sent out to all the Small Business Centers. Their office was visited to find out if any questionnaires had been returned. Only one questionnaire had been returned; it was from an institute that did not have the required facilities.

While at the EPP office, a meeting was held with the new Small Business Center coordinator at the Kenya Technical Institute where the EPP office was based. The study was explained and, because he indicated interest, the SBC coordinator was requested to complete the preliminary questionnaire. After reviewing the questionnaire, it was clear that the site fit the criteria for location and facilities. This college was named "Site 4." A second visit was scheduled for the following week to install the communication software and to start the initial training. The SBC coordinator at this site had expressed interest in learning how to use the computer (he had a microcomputer in his new office) and of the hope that his brother, who had recently graduated from college, would teach him word
processing. Later, the researcher learned that the coordinator's brother had been employed by a company in western Kenya and so could not help with the computer.

Site 4 was the most well-equipped of the four sites that were eventually selected. It was situated on the outskirts of a major metropolitan area. Developed in the late 1970's with the assistance of a North American country, it provided the only professional training facility for mid-level technical teachers most of whom joined Kenya's technical training institutions on graduation. The well-kept campus included workshops, sports facilities, a substantial library, staff offices, and outstanding computer facilities. It had an enrollment of about 700 students with 160 teaching staff in programs that included engineering, business studies, education, computer science, and entrepreneurship education. Unlike other participating institutions, this college enjoyed comparatively large government support. However, declining support had resulted in increased financial pressure.

Week 3

Monday, September 5

A meeting was planned to inform the Ministry of Technical Training officials about this study. This Ministry coordinated technical training institutions. Dr. Musa of the NSC accompanied the researcher to the Ministry of Technical Training. He had worked with the director of technical training in the Ministry on a policy paper and his former physics teacher worked as an assistant director of the applied technology directorate in the same Ministry. For these reasons, he was well known there and he thought he could help speed up the formalities.

At the Ministry, it was indicated that the deputy director of technical training would be the appropriate person to meet but because he was not in his office, a meeting was instead held with Mr. Bahati, Dr. Musa's former teacher. He indicated interest in the study, explaining that difficulty in getting information was a major problem at the Ministry. He mentioned a proposal that had been presented about two years before but explained that it
was rejected because the proposal writer seemed to have self-serving objectives. Mr. Bahati said they would be interested in new initiatives in this area.

Plans were made with Dr. Musa to collect modems that had been detained at the airport awaiting duty payment. Discussions with Dr. Musa revealed that his Center had been operating from his house but was to move to a recently leased office. He appeared to be the only person at the NSC who installed e-mail systems but it seemed unlikely that Dr. Musa would be available for travel to distant parts of Kenya to install Fido points. The research budget could not support the expense of such an arrangement. Consequently, it became necessary that the researcher do the installations himself. The researcher made the decision to prepare himself to install the systems. He would need to learn how the Fido software was installed and how it worked. He would also need to learn how to install and configure modems.

**Wednesday, September 7**

A meeting was held with Mr. Yala, the SBC Coordinator at Site 4, to discuss the e-mail service. Mr. Yala reported having explained this research project to his principal who requested that a written proposal that described the project and specified what the Institute would be expected to contribute. A three-page proposal was prepared and presented to the principal.

While at Site 4, an official of the EPP suggested the following institutions be contacted to participate in the study:

1. Mago Institute in Western Province.
2. Masa and Ruku Institutes, both in the Rift Valley.
3. Mosa and Govi Institutes, both in Coast Province.
4. Kambu Institute in Central Province.
Calls were made to Masa, Mago and Govi Institutes. The Masa principal said they would be unable to participate but the SBC coordinator at Govi indicated interest in participating in this study. Govi Institute became Site 1.

Mago Institute in Western Province is rural-based and had a computer and a telephone line available for the study. The principal was very positive, consequently, it was agreed that communication software and a modem be installed during the week of September 19, 1994. This Institute is referred to as Site 2.

Calls to other recommended sites failed either due to bad telephone lines or difficulty in reaching staff. In one institute, it was determined that the SBC office was some distance away from the administration building and that it would take several minutes to deliver a message and get a response. All such institutes were eliminated from the list of potential participants in the study because telephone services, which were essential for a Fidonet point, were inadequate.

Table 2
Relative Distances Between Sites

<table>
<thead>
<tr>
<th></th>
<th>NSC</th>
<th>Site 1 (Govi)</th>
<th>Site 2 (Mago)</th>
<th>Site 3 (Ruku)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site 1 (Govi)</td>
<td>400 (250)</td>
<td>560 (350)</td>
<td>240 (150)</td>
<td>640 (400)</td>
</tr>
<tr>
<td>Site 2 (Mago)</td>
<td>560 (350)</td>
<td>960 (600)</td>
<td>320 (200)</td>
<td>320 (200)</td>
</tr>
<tr>
<td>Site 3 (Ruku)</td>
<td>240 (150)</td>
<td>640 (400)</td>
<td>320 (200)</td>
<td>320 (200)</td>
</tr>
<tr>
<td>Site 4 (KTI)</td>
<td>16 (10)</td>
<td>400 (250)</td>
<td>560 (350)</td>
<td>240 (150)</td>
</tr>
</tbody>
</table>

Note. Distances are indicated in kilometers and (parentheses) miles. Site 4 and the NSC were situated in the same city.

Thursday, September 8

Having visited the Network Service Center, it appeared that certain information was
either unavailable or not easily accessible. This included details of people and
organizations who wanted a Fido point installed, a description of services offered by the
center, a Fido node administrator’s guide (software installation and maintenance, point
installation, accounting systems), and a directory of people registered on the node. Later, a
brochure was made available and it was discovered that a directory was available in
electronic form.

Friday, September 9

Visit to Site 4. A meeting was held with the principal at Site 4. He requested details
of the costs involved in installing and using the Fido communication system. In his
opinion, “technology was not the problem, the problem was financial sustainability.” He
was concerned that running the system would involve substantial costs resulting in
questions from his Board of Governors. The Board’s sanction was required in order to
commit the institution to the e-mail system and the associated costs. There were to be no
costs to the institution during the duration of the study except perhaps the installation of a
telephone extension at the Small Business Center. However, the principal was concerned
that the system would cost a substantial amount to maintain after the research study was
over, he did not seem concerned about the potential benefits or about possible ways to
cover the costs of using the system such as charging fees for its use by students and staff.

On inquiring about the Institute’s telephone number, a staff member explained that
there had been telephone problems at the institution. Consequently, four of the five
telephone lines were disconnected to cut costs. Permission was required before any staff
member could make outside calls. However, the principal had his own direct line, an
arrangement that was later found to be common at the larger institutes. He seemed
supportive of the idea of the e-mail system though still hesitant and unsure of its
implications. It became apparent that cost would be a major factor in deciding whether or
not to adopt the system. Consequently, by eliminating the initial costs of the e-mail system
the long procedures associated with obtaining the BoG’s approval were avoided.
Telephone regulations. Dr. Musa had indicated that through a new start-up company, the Network Service Center was authorized to install modems with the understanding that engineers from this company supervised the installation. The Kenya Telecommunications Corporation controlled all telecommunication services in Kenya and required that telecommunication equipment such as modems, fax machines and telephone head sets be type-approved. A substantial fee was required for this approval. Anyone connecting such equipment to the telephone system had to be licensed or needed to work under the supervision of a licensed engineer.

Other matters. A projection of the costs of maintaining the e-mail system was required by the principal at Site 4. A request for the necessary information was made to Dr. Musa but he did not have a brochure or other printed outline of these costs. Plans were made to install FrontDoor, the Fidonet communication software, in a 286 microcomputer over the weekend and use it to communicate with the research sites.

Week 4

Monday, Sept. 12

Attempt to install FrontDoor. The initial attempt to install FrontDoor on a 286 microcomputer failed with the FrontDoor setup program indicating an “unknown error.” Dr. Musa was consulted over the telephone but he was unable to help because he had never encountered this problem before. He suggested that the computer be brought to his house but this was not feasible at that time.

Research authorization. Later in the day, authorization to conduct research was requested from the Office of the President but it had not been signed. The official in charge had promised that the authorization would be ready by the afternoon of Friday September 9, 1994. Without this authorization, data collection could not legally proceed, therefore, it essential to obtain this authority before making official site visits.

Visit to Site 4. An attempt was made to install FrontDoor in the SBC’s computer. Unfortunately, it turned out that the floppy drive was a low density type and could not read
the high density software disks provided by the Network Service Center. Dr. Musa did not have the software on low density disks. These would have to be created. A decision regarding which telephone line to use for the modem at Site 4 had not yet been made.

**Tuesday, Sept. 13 - Saturday, Sept. 17**

This week was spent in Ruku at the Entrepreneurship Project Monitoring and Evaluation Guidelines workshop. A meeting was held with the Ruku Institute SBC coordinator who was at the workshop. This provided the opportunity to explain the research project. However, a planned visit to Ruku Institute did not occur due to the heavy workload at the workshop. The visit was postponed until the following week. The principal at Ruku Institute was positive about participating and the Institute was close enough to Ruku town (est. pop. 150,000) to be considered an urban setting. Ruku Institute was selected and named Site 3.

**Week 5**

**Monday, September 19**

The official authorization to conduct research was finally obtained from the Office of the President three weeks after the application was made.

**Visit to Site 2 (Mago Institute).** A call to Mago Institute was attempted earlier in the day but their telephone seemed to be out of order. The bus trip to Mago Institute was a long one. It went through the Rift Valley, over the western escarpment of the Rift, and on towards the Uganda-Kenya border. Upon arrival at Mago town on Tuesday morning, and after waiting for daybreak, a hotel was located.

Mago Institute was situated about 8 km (5 miles) from Mago town on a 500-acre farm. From a distance, the whitewashed buildings looked like a part of a farm. There was a joke about people trying to locate the Institute who, on arrival, looked around and asked directions to Mago Institute not realizing they were at the Institute.
The Institute derived its name from a legendary people who were said to have lived on a strangely shaped rocky hill to the east of the Institute. Mt. Elgon, a large extinct volcano, could be seen to the north on a clear day. The local economy depended on sugarcane though the local sugar factory had complex problems which had a negative impact on sugarcane farming. The principal took great interest in the farm, jokingly saying that when he moved from Nairobi to Mago, he had known nothing about cattle. He now functioned as the farm manager in addition to being the principal.

At the Institute, a long conversation was conducted with the principal regarding the research project and many other things. The plan was to begin work on the computer immediately after the meeting but that morning there was no electrical power in the SBC office. After about 15 minutes of searching, the Institute's electrician was located. He traced the problem to the building's fuse box and repaired it.

The researcher presented the research project to Mr. Wali, the SBC coordinator, explaining what e-mail was and how the facility could be used. However, the telephone extension to the SBC office was not working; apparently it had been out of order for some time due to storm damage. The Telecommunications Corporation technicians had visited twice without repairing the damage.

FrontDoor, the Fido software suite, was installed successfully but the modem was not as easy to deal with. The internal-type modem had no documentation yet it required jumpers to be set up to configure the communications port. After systematically testing every jumper combination, a combination that seemed to behave as COM 4 was selected.

To get around the non-functioning phone extension problem, a connection was made to the telephone terminal in the staff room which was next door using a 10 m (30 ft) cable. With this arrangement, it was possible to make a call using the SBC's headset. However, attempts to call using the modem were unsuccessful.

After several unsuccessful tries were made, it was decided that another attempt be made after lunch; however, when the computer was switched on at that time, it would not
initialize. Each time the boot process aborted just before executing the start-up batch files on the hard disk. The SBC had no DOS boot diskette or any kind of software, though there were some foreign language applications installed by a European student who was on attachment (interned) at the Institute. This student had DOS on a diskette which was used in an attempt to start the computer. The computer would not boot from the floppy drive either. The possibility that a computer virus was responsible for the problem was considered but seemed unlikely. In any case, anti-virus software was not available. Because no solution could be found at that point, a return visit was required to deal with the situation. There was the hope that the problem would disappear when the computer was left off overnight because the problem appeared to be spurious.

Friday, September 23

The researcher prepared to leave for Ruku but on calling Ruku Institute was told by the SBC coordinator that he had a funeral to attend. The coordinator requested that the meeting be postponed until the following week. On a previous occasion the coordinator had been overheard saying he was going to a funeral as a way to avoid a scheduled appointment.

Sunday, September 25

On this day, the researcher was invited to attend a meeting at the Network Service Center meeting. Dr. Musa, the director, seemed to regard the researcher as part of the NSC and wanted any help the researcher could provide. The meeting included a discussion of e-mail training for NSC clients. Apparently, the NSC had not held a formal training session for users and had been relying on informal site-based training. This on-site training had proved insufficient. Several requests for training had been received from clients. Some people felt that the manual that Dr. Musa had written as too long or too complex. Such people and preferred to be shown how to use certain features instead of reading about them.
Week 6

Monday, September 26

Trouble with computers. On a previous occasion, Mr. Tambu of the Entrepreneurship Promotion Project office had requested help in repairing some of the computers that had broken down. There were four computers in need of repair at the Project office. One of these belonged to the Small Business Center at the Govi Institute (Site 1) and would create a delay in getting the Institute on-line. The entire day was spent trying to repair the 386-type microcomputers but without success. It was recommended that a professional be contracted to check the computers but apparently, the EPP was short of funds because it was about to wind up. According to Mr. Tambu, they could not afford a professional firm.

In addition to the problems with the computer hardware, important pieces of software (a word processor, a spreadsheet, and a data base management package) had not been successfully installed in any of these microcomputers even though they had been “in use” for almost a year. Mr. Tambu requested help to install software in those machines that were out in the Institutes but it appeared that they had no funds to cover the expenses. The researcher helped those that he could. The software provided by the EPP officials included a disk toolkit and an antivirus program. Printed manuals were available that outlined the procedure for installing the spreadsheet and data base packages.

Tuesday, September 27

First visit to Site 3 (Ruku Institute). Ruku Institute is located outside the Ruku Municipality on about 500 acres of farmland. The Small Business Center at Ruku Institute was situated at a building that was part of the carpentry workshop. An administration building housed the offices of the principal and other administrative staff situated about 200 yards from the SBC office. The site, located in some of Kenya's prime farmland, offered an impressive view of the Great Rift Valley.
The coordinator explained that a European government had been aiding the Institute, especially the department of agriculture which now had several pieces of expensive machinery including a combine harvester. However, this assistance was about to come to an end. There were indications that the Institute had financial problems. For example, a half-finished building that was to be an administration building had been in that condition for years. According to the coordinator, the current principal was determined to complete this building.

**Meeting with the principal.** When the principal learned of the researcher's arrival, he requested a meeting. During a previous telephone conversation, he had been quite positive and willing to be involved in this project. By the time of the principal's request for a meeting, the modem had been installed and the software loaded. Though the telephone wiring could not be easily accessed to allow the modem to be connected, it was easier than Mago Institute because wiring was accessible inside the SBC office.

After the purpose of the research project was explained to the principal, he revealed that one of their computers had a modem with which they had tried unsuccessfully to call the US. It appeared that they had an interest in communicating with others including people outside Kenya. If this was true, then a need existed at this Institute for the kind of communication facilities that Fidonet could offer.

**Phone trouble.** When the researcher and the coordinator entered the principal's office, he was testing his telephone. He explained that when someone called, it would ring once then stop. Later, on the way out of the administration building, the telephone operator was informed that some calls would be made from the SBC telephone extension to test some equipment. In response, the operator explained that such calls could not be made because the SBC and the Mathematics department shared the same extension which overloaded the line. At first it appeared that the operator was unwilling to help. After some discussion, the coordinator went back to the principal to explain the problem. It was
decided to temporarily disconnect the Mathematics department extension until the testing was completed.

On arrival at the SBC office, the coordinator called the operator to request an outside line but the operator reported that both of the Institute’s telephone lines had stopped working. Apparently, in the few minutes since the meeting with the principal, something had gone wrong. In addition, the modem would not turn on. After some checking it was determined that the modem's power adapter had burned out. By this time it was 4:30 p.m. Nothing further could be done so the researcher left taking with him the modem and its adapter. It was decided that he would return after getting the adapter repaired.

Wednesday, September 28

Site 4 telephone problem solved. The next visit was to Site 4 where a modem was to be set up for their Small Business Center. Mr. Tambu of the Entrepreneurship Promotion Project offered to allow the software to be installed on the microcomputer in his office, which was very close to the Small Business Center. The SBC coordinator would be able to use it. This arrangement would avoid the expected delay that would have resulted if a telephone extension to the SBC office had to be installed. The SBC coordinator seemed unwilling to talk to the principal about this telephone extension and preferred that the researcher handle the matter. This did not seem appropriate because the researcher would then be acting as though he were the SBC coordinator, meeting the principal, requesting the line, and supervising the installation of the extension. This seemed to go well beyond his role as a researcher. In the circumstances, the arrangement with Mr. Tambu seemed to be a good solution.

Installing the modem proved quite troublesome. After several unsuccessful attempts to get the modem to work, Dr. Musa was called. He suggested changes to the modem configuration codes which seemed to work; the mailer program, *FrontDoor*, now
proceeded through the modem initialization process stopping as expected with the message “Waiting for event or call.”

Despite apparent success in initializing the modem, attempts to make a call were unsuccessful. It appeared that the problem lay in the wiring between the modem and the telephone line. On making some inquiries, it was discovered that there was a telephone technician at this Institute. He was located after a one-hour search. The problem was presented to him and, after carrying out some testing, he suggested a different way to connect the RJ11 wiring from the modem to the three-wire telephone cable in the office. The new connection worked. This discovery indicated that the connections made at Sites 2 and 3 may have been wrong and explained why it had been impossible to dial out with the modem from Site 2. This was proving to be a learning process. By this time, it was late in the afternoon and time for the secretary to close the office.

**Thursday, September 29**

The installation at Site 4 was continued from the point at which it had been terminated the previous day. There were still problems with the modem. It would connect to the Network Service Center server but hang up immediately. Dr. Musa was called again. He was able to spare some time and come to Site 4 where he tried several different settings. The modem finally connected successfully to the Network Service Center server.

**Friday, September 30**

Several messages were sent successfully from the microcomputer at Site 4. Mr. Yala was shown how to compose and send a message. His first message was directed at a Kenyan NGO requesting a response to an earlier letter to them. He repeatedly said he did not know “how to use this thing.” Clearly, he found the microcomputer intimidating although he expressed willingness to learn. At this time, it became clear that the EPP secretary was going to be a source of some trouble because she seemed reluctant to allow
Mr. Yala to call out from the Project phone line. Mr. Tambu, the EPP official in whose office the e-mail system was installed, was away at that time. On his return he was requested to clarify the arrangement so that the secretary did not unnecessarily restrict Mr. Yala when he attempted to use the system. The secretary acted in this way because of fear that the EPP coordinator would reprimand her for allowing Mr. Yala to use the Project telephone line.

Week 7

Wednesday, October 5

Plans were made to go to Ruku and then on to Mago but Dr. Musa thought the researcher's presence in a Network Service Center meeting on Thursday was crucial. Consequently, it was decided to go to Ruku in the morning, return the same day, then leave for Mago on Thursday evening.

Second visit to Site 3 (Ruku). At Ruku, time was spent getting everything to work properly. A modem was borrowed from the Network Services Center because Ruku's modem had not been repaired. However, modem settings were still troublesome. Worst of all, the telephone headset at the SBC office turned out to be defective and could not dial so it was impossible to call Dr. Musa for some guidance. The telephone operator compounded these problems by repeatedly disconnecting the SBC extension from the outside line. Finally, the attempt to set up the modem was abandoned and the software provided by the Entrepreneurship Promotion Project was installed. By the time this task was completed it was getting dark. It was decided that the SBC try to get a working telephone headset installed and, if possible, eliminate the shared extension.

The trip was frustrating for the researcher although the SBC was happy to get their computer functional for the first time since they received it. It was now clear that it would take a long time to get e-mail running smoothly at the sites. For example, the SBC coordinator at Ruku Institute had said on a previous visit that there was a telecommunications training college situated nearby where they would get some help
installing a new SBC telephone extension. However, during a later visit, the old defective extension was found to be still in place. There was a concern about the difficulty experienced setting up the modem and getting FrontDoor to work with the modem. The lack of installation manuals for the modem and communications software contributed substantially to these difficulties. The researcher had to learn the installation procedures either by observing Dr. Musa or by trial and error.

**Thursday, October 6**

The meeting at the Network Service Center (NSC) was intended to bring together NGOs in small enterprise development to discuss the potential for using e-mail in these organizations. Although the meeting was very informative, only one NGO representative attended. He explained that he was in charge of a resource center. In his opinion, there was great potential for the provision of network services (e-mail) to those NGOs who had a large branch network in Kenya.

The NSC had recently installed e-mail at the NGO whose representative attended this meeting. In an interesting contrast to the four research sites, it was reported that this NGO, which specialized in rural enterprise development, had taken great interest in the e-mail system with everyone clamoring to learn how to use it. A picture was presented of an intense workplace where everyone had their objectives and targets and worked, sometimes at unusual hours, to achieve these targets. Despite the high performance expectations at this NGO, it seemed that employees were self-directed and enthusiastic about their jobs. This representative commented that he was among the oldest employee at his organization indicating that most employees were in their mid 20s.

**Second visit to Mago (Site 2).** After the meeting, the researcher went to get a bus ticket for Mago only to find that Akamba, the bus service, was fully booked for the day. It was decided to go by whatever means that were available, eventually reaching Mago early on Friday morning, October 7.
Immediately after the regular Friday morning flag-raising ceremony, the computer at Mago was checked. An attempt to use a DOS boot disk to initialize the machine failed. The computer case was opened and the modem and multifunction Input/Output (I/O) card removed. The contacts of the multifunction card were cleaned and the card replaced. The machine now successfully started up, but there was still something wrong. In about two out of five tries, it gave an error message during booting indicating a bad COMMAND.COM (DOS command interpreter). It was decided to re-install DOS as well as the basic software applications that they required.

At mid-morning, work started on the mail package. Its menu system was illegible, a problem that was usually caused by incomplete or missing CONFIG.SYS file settings. FrontDoor was reinstalled and its settings configured for the Mago Institute Fido point after which a software utility used to determine the number and identity of communication ports on the machine, was launched. The anti-virus toolkit produced a warning beep indicating infection by the "caterpillar" virus.

The virus was cleaned up and the utility run a second time. This time, it reported that a COM3 port was connected as COM 4. This appeared strange but it worked. The modem tested for presence of non-volatile RAM by issuing an "AT&V" command. The modem returned an error indicating no RAM on the modem. Modem register S0 was set at 0 to disable the autoanswer facility and S7 set at 60 so that the modem would wait for up to 60 seconds for a response after dialing.

After lunch, a long cable was hooked up to the staffroom phone extension as before (the SBC telephone extension was not yet repaired) and the system tested by attempting to dial. After several minutes of unsuccessful attempts, new modem settings were tried out as shown below:

S7=30 did not work.
S7=15 did not work.
S0=1 did not work.
S0=2 worked to some extent. Some non-ASCII characters were received of the type expected from a noisy telephone line.

**FrontDoor** had three primary modes: text editor, terminal, and mailer. Modem configuration testing was performed in the terminal mode. On receipt of these first characters, a mode switch was quickly made from the terminal to mailer and a call made to the Network Service Center. The mailer started with the expected message “starting remote access procedure” but hang after this. Modem register S7 was set to 60 seconds, the standard setting used by the Network Service Center, and another call made. This time, the test message was successfully transmitted. Another message was composed and successfully transmitted. However, it was noticed there were still some line noise manifest in the form of initial non-ASCII characters. The modem took a long while to connect (approximately 40 seconds). Subsequent trials seemed to improve connection speed. The SBC coordinator sent messages to two NGOs who promote small enterprise development. Apart from the telephone extension problem and the rather slow modem, the system worked well.

Instructions were provided on ways to protect the modem and computer from lightning strikes such as unplugging the phone line from the modem except when making a call and unplugging the microcomputer from the electrical wall socket overnight and during weekends. The installation time at Mago would have been substantially shorter if the modem manual had been available and if the modem had non-volatile RAM to store settings. A Fido point installation guide would also have been of great assistance.

**Saturday, October 8**

**Installing telephone lines.** The Network Service Center had recently acquired a suite of offices but had not been able to get telephones installed. They were to be installed this Saturday. Some of the reasons for poor telephone service became apparent as the telephone technicians proceeded with the installation. The distance between the telephone
cable and the Network Service Center was about one kilometer (0.63 miles). Drop lines were used to cover this distance. They had to drag long drop lines along the side of the road and lay them out before they mounted the lines on existing poles. In the process, pairs of drop lines were dragged over each other causing the insulation to be rubbed off. If it rained on such wires, there was likelihood of short circuiting between the two strands of wires in the drop line. The researcher helped the NSC get the telephones installed because the director had to be away at a conference. The director did all the administrative and technical work making the NSC a one-man show as far as client services were concerned.

Week 8

Wednesday, October 12

A planned visit to Ruku Institute was postponed due to overwhelming administrative matters at the NSC which Dr. Musa had left in the hands of the researcher while abroad at a conference in West Africa. Mago Institute had not picked up their mail since the previous week. It appeared that they either did not have much interest in using the system or that they had experienced problems that prevented them from accessing their mail.

At Site 4 it was agreed between Mr. Tambu and Mr. Yala that the e-mail system would remain in Tambu's office where Yala would have free access to the system. This arrangement was still verbal and it appeared that it may be necessary to remove the modem from Mr. Tambu's office and re-locate to Mr. Yala's office. Yala had shown little initiative in trying to learn to use the system without help.

During a call made to Mr. Buka of the Govi Institute (Site 1) the previous week, he reported that he had managed to get another computer. Mr. Tambu of the Project office had not been up-to-date regarding the status of computer facilities at Govi because he did not know about Mr. Buka having acquired another computer. A visit would have been made to Govi much earlier and their e-mail system installed if this information had been obtained earlier. It was decided that a visit to Govi Institute be made that week. A call was made to
schedule a visit for Friday, October 14 but Mr. Buka, the Coordinator, was not in. A
message for him was left with the SBC clerk and it was resolved to proceed with the visit
with the assumption that the SBC coordinator would receive the messages left for him.

Friday October 14

First visit to Govi (Site 1). Due to his unfamiliarity with the town, on reaching Govi
the researcher mistakenly got off the bus at the main road to the coast not realizing that the
main town was about two kilometers from the main road. A call was made to the Govi
Institute SBC from a payphone but there was no answer. However, a second call made
after lunch hour was answered by the SBC clerk who explained that the coordinator was
not in but indicated that the principal had just come into the SBC by chance. The research
project was explained briefly to the principal on the telephone and subsequently, he helped
provide transport to the SBC which turned out to be situated at the center of the town on the
second floor of a building overlooking the main bus station. It consisted of a single rented
room in which a microcomputer, electronic typewriter, and a photocopying machine were
located. Perhaps due to its location near the bus station, some of the items in the office
were covered in a visible layer of dust.

Govi Institute was some distance from the town center. Both the railroad and the
highway linking the coast with inland centers passed by Govi. Govi town lay between two
hills and bordered a large national park famous for elephant and other big game. A series
of dramatic hills rose up from the plains (part of the Nyika plateau) that extended
southward towards the Kenya-Tanzania border in the south. Sisal growing seemed to be
the major economic activity in the area with plantations stretching in all directions.

Installation of the modem and communication software was started immediately on
arrival at the SBC. There was a problem setting up the telephone area code in FrontDoor's
control file. The modem did not appear to be dialing the correct number. It was discovered
that the C:\FD directory had not been included in the PATH statement of the
AUTOEXEC.BAT batch file as was required. Finally, everything seemed to be working smoothly and the principal was shown how to prepare and send a message. The installation took about 2 hours. It was made easy by the availability of a direct telephone line and the absence of extensions or a manual switchboard. By this time, the researcher had mastered the telephone line wiring configuration and knew the common sources of modem problems.

During the installation, the principal asked several questions regarding computers including such things as the difference between a "floppy" and a "hard" disk which he thought referred to 5.25 inch and 3.5 inch diskettes respectively. He was quite impressed by the speed at which a page of text could be sent via e-mail and explained that he had once worked as a telecommunications technician before joining the teaching profession. At that time, he worked for the Department of Civil Aviation's wireless communications center and with facilities to communicate with people all over the world.

At about 4:30 p.m. the principal said he wanted to walk back to the Institute where he lived. A copy of the e-mail manual and the Network Service Center brochure were left behind for Mr. Buka and a date was set for another visit (October 25). While walking to the Institute, the principal explained that they had serious financial problems with many creditors waiting to be paid. He commented that he felt as though he had been sent to the Institute to perform a miracle. The main creditor was the water supply organization who, when he took over the Institute earlier in the year, were owed a large amount of money. The Institute had now reduced this debt by about 75%. They were trying to raise funds by renting out Institute facilities for seminars and workshops. Unlike many of the other Institutes who had 200 to 500 acres of land, Govi had only 40 acres of land. Although the Institute which had a lot of funds when it started, these had been lost due to poor financial management. Enrollment was low and, like Mago Institute, very little money came from the central government except for teachers' salaries. Water was occasionally disconnected causing acute embarrassment to the Institute especially when seminars were in session.
The SBC, which seemed much more autonomous than others the researcher had visited, was running computer courses to raise funds but little information was available about these in the absence of the coordinator. The principal seemed quite unhappy about the coordinator’s absence and indicated that he thought the coordinator was not a very reliable person. It seemed that disagreements had occurred between the two.

**Week 9**

**Tuesday and Wednesday, October 18 and 19**

The researcher set up e-mail at two private homes both belonging to US Embassy officials. They both wanted to keep in touch with their relatives. One was relatively conversant with e-mail and had been using Fido though a different provider until he was convinced to switch to the Network Services Center. The second wanted the system because her son in the USA subscribed to DELPHI, an on-line service, and had urged her to get e-mail so that they could keep in touch. She was less conversant with microcomputers despite having owned one since 1987 and had several frustrating experiences with it. She got upset when it did not perform in the way she expected, though on many occasions her expectations were based on misconceptions regarding how the system operated.

During these installations, a search had to be made for a distribution of FrontDoor on 5.25" disks. The NSC director was away and so could not help. In addition, one of the Network Service Center employees kept interrupting the mail server to type a document which prevented any caller from picking their mail. It seemed surprising that Dr. Musa continued to maintain such employees.

For the first time, an e-mail message was received from one of the sites. Two messages came from Govi Institute’s SBC. They were intriguing because the SBC coordinator at Govi had not been present when their system was set up. It was assumed that the Govi Institute principal had shown the coordinator how to use the system. On a subsequent visit to Govi Institute, the coordinator explained that he had relied totally on the
The FrontDoor manual to learn how to compose and send an e-mail message. However, though the researcher replied to the e-mail messages, nothing further seemed forthcoming from Govi.

**Week 10**

**Monday, October 24**

The day was spent troubleshooting e-mail systems at locations in Naro that were served by the NSC. At one organization, an NGO specializing in population services, they reported that they could not print e-mail messages longer than two pages. On visiting their installation, a virus check found the "Noint.a" virus. This discovery caused an uproar in the office with two of the secretaries accusing each other of responsibility for the virus. The e-mail system was checked after the virus was removed; it seemed to have no printing problem.

At a second location, the problems were more complex. They claimed they could not send or receive mail. The telephone setup was difficult to deal with because they had a modem connected to a two-line telephone. Dialing out was quite complex. A successful call was eventually made after several attempts. However, an NSC technician installed a line for the modem while the researcher was testing the setup. The system successfully tested using this new line. However, this site had problems with very long e-mail addresses that could not fit in FrontDoor’s 63-character address field. This was left unsolved. The researcher later requested and obtained help from the an engineer in Boston who operated the Internet/Fido gateway through which the Network Services Center exchanged mail with the Internet. At that time Dr. Musa was out of the country and could not assist with this problem.

An American gentleman visiting the Network Services Center reported that he had been given the name of a firm who re-wined his burned out modem adapter for a few hundred shillings. It was hoped to have Ruku Institute's adapter repaired as soon as
possible. The firm was located and the modem adapter delivered to them. They promised
to have it ready by the end of the week.

Tuesday, October 25

Second visit to Site 1 (Govi). During the second visit to the Govi Institute SBC, it
was discovered that the reason the coordinator had not called or responded to the e-mail
messages was that his phone had been disconnected due to non-payment of bills.
Apparently, they had a large telephone bill half of which, according to Mr. Buka, had been
incurred by the principal.

Mr. Buka explained that he had borrowed a computer from the Govi Institute's
Department of Tourism after his original microcomputer from the Entrepreneurship
Promotion Program broke down. He soon had to return the borrowed microcomputer to
the Tourism program at Govi Institute and was a little desperate about getting his
microcomputer repaired because his current computer course would have to be terminated if
he failed to obtain a replacement computer. Without the telephone, little could be done with
the e-mail system. A number of software packages were installed on the SBC computer
including a database package that Mr. Buka had been unable to install and software
provided by the EPP.

Later in the evening, after a tour of Govi town and a meeting with a local merchant
who needed help installing his new computer, Mr. Buka provided a very detailed account
of his experiences at Govi and explained that he had used some of his own money to get
the Small Business Center established. His response to an inquiry regarding some of the
principal's complaints about him served to strengthen the impression that the relationship
between the principal and the SBC coordinator was not very good.
Wednesday, October 26

Visits were made to a few more locations in Naro to help solve e-mail problems. At one site they used a PCMCIA (Personal Computer Memory Card International Association) modem which, according to them, was not working. After investigation, it was found that a fax "Terminate and Stay Resident" (TSR) program was the source of the problem. This was solved by removing the statements in the AUTOEXEC.BAT and CONFIG.SYS files that called the TSR. This location also had problems due to a shared Internet address which could be changed only by Dr. Musa who maintained the server's directory of e-mail users (called the point list in Fidonet systems).

Thursday, October 27

A visit was planned for Ruku (Site 3) but urgent documents needed to be prepared and sent to the University of Illinois in order to be able to obtain a visa that would allow the researcher to re-enter the US after his field work. Eventually, the journey to Ruku was put off. Ruku's modem power adapter had been repaired but still overheated very rapidly. If left plugged in for long, it would probably burn out again.

Saturday, October 29

The Boston gateway operator sent mail explaining the reasons why some of the e-mail users had been experiencing problems. When Dr. Musa returned from his trip he explained that he knew what the causes of the problems were. However, because they were not described in any manual or list of "Frequently Asked Questions" (FAQ), these problems plagued practically all e-mail users with whom the researcher interacted except one or two advanced Fidonet users.
Week 11

Monday, October 31

The morning was spent responding to mail including requests for help received from NSC clients.

Tuesday, November 1

The researcher had slowly become deeply involved at the Network Service Center helping Dr. Musa. The NSC's two employees seemed unable to work without supervision and reluctant to move to the new office probably because at Dr. Musa's house, from where they previously operated the NSC, they had been served meals and had the company of other employees in the house.

That afternoon it was discovered that the phone lines to the NSC mail server were not working. The employee who normally sat next to the mail server should have noted the lack of activity on the server had they been sufficiently alert. The local telephone exchange was informed about the problem and asked to check the lines. Half an hour later, the telephone lines were repaired but soon after, the problem recurred. It was eventually repaired late in the afternoon. Dr. Musa, who had just returned from a trip abroad, thought the problem may have been caused by a lose cable between the modem and the telephone line.

Thursday, November 3

Third visit to Site 2 (Mago Institute). The Small Business Center coordinator was not present when the researcher arrived at Mago Institute on the third visit but there were other staff members who seemed very interested in the computer. During a call to the Institute earlier in the week, they had reported that the software installed on a previous visit were not working. A test indicated a minor problem in the AUTOEXEC.BAT file which was solved.
One of the Institute's staff members sat across the room from the computer stating that rays from the machine gave her a headache. She regarded the microcomputer as a threat to her health. During conversation, she explained that, though the coordinator was "the most reliable" person at the Institute, he was "soft" rather than aggressive. This was offered as an explanation for the difficulty the coordinator appeared to have controlling the utilization of the computer by staff members at the Institute.

When the coordinator arrived (at about midday), telephone connections were made as usual through the staffroom extension and an attempt made to send e-mail. The SBC extension was still not working and no one seemed overly concerned about it. It did not appear to be treated as an important issue. This made it seem that there was little interest in the e-mail system. It is possible that they felt powerless to get the Telecommunications Corporation to repair the extension because the Corporation's technicians had visited the Institute twice without solving the problem.

After lunch, guidance was provided on the process of writing and sending or receiving mail. The coordinator admitted that he had not looked at the software manual given him on a previous visit and could not locate it on that day. Though the SBC coordinator did not seem confident using the computer, a few messages were successfully sent.

Mr. Wama, another staff member, was more eager and confident. He was also the youngest among the group of staff who seemed most interested in using the computer. He showed signs of being more innovative and tried doing new things. For example, he reported trying to use a spreadsheet program to maintain student records and prepare transcripts. That afternoon, he displayed a wedding card that he was trying to design for a member of staff using a simple graphics program.

Mr. Karu who headed the Motor Vehicle department, was mainly interested in Computer Aided Design (CAD) and programming languages. He had no manuals to help him but got very exited when he discovered that BASIC was available on the machine.
Apparently no one at the college was aware that BASIC was bundled with the microcomputer operating system software. Some time was spent helping Mr. Wama and Mr. Karu get to know how to use the applications they were interested in. They lightheartedly said that they wished the researcher was there all the time to answer their questions and to troubleshoot. This was an interesting wish indicating a desire for an in-house consultant.

**Week 12**

**Monday, November 7**

One of the Network Service Center employees used Ruku Institute's modem then left it plugged into the power outlet causing it to overheat and burn out again. An attempt to purchase a replacement transformer and build another adapter was unsuccessful because the generic transformers available locally had lower current ratings than what was required for this modem.

**Tuesday - Friday, November 8 - 11**

During this week, the transformer for Ruku's damaged modem adapter was re-winded but the Institute. However, the Institute could not be reached because their telephones were out of order hence no visit could be scheduled. The week was spent at the Network Service Center helping with the preparation of some of the programs they were planning to start. Attending NSC meetings provided an insight regarding the changes taking place at the center and those planned for the future. In addition, they were an opportunity to learn more about the problems faced by the NSC.

Troubleshooting modems and FrontDoor served as a way to identify the common e-mail problems faced by NSC clients. At one location, their difficulties stemmed principally from misconceptions about how the e-mail system functioned and a failure to use the appropriate commands. For example, the researcher found that they used "Alt+S"
to send and pick up mail. This command was intended for sending mail. If their outbound mail folder was empty (no messages waiting to be sent out), the command elicited no response from the mailer and, consequently, they were unable to retrieve mail waiting to be picked up from the NSC's server. The correct command to pick mail was Alt+F (for Forced poll). They however, repeatedly resorted to Alt+S and continued to call the Network Service Center claiming they could not receive mail.

Site 4. Several visits were made to Site 4. The situation had not changed despite having talked at length with the principal while at the Informatics workshop at Machakos. It began to appear as if Mr. Yala, the SBC coordinator, had some misgivings about using Mr. Tambu's computer. He mentioned at one time that it would have been so convenient if the e-mail software was installed on his computer because he could more easily try it. However, he did not seem willing to get a phone extension installed possibly because he was not sufficiently familiar with the requirements for the e-mail system. Some time was spent in his office drawing diagrams to show how the connections would be made. Because Mr. Yala had been an engineering instructor, it was assumed that diagrams would help Mr. Yala understand the proposed system better but no progress was made.

Those at Site 4 made no attempt to use the system. Instead, on two occasions, configuration files had been inadvertently altered making FrontDoor non-operational. These had to be repaired. No one had noticed that FrontDoor was not functioning indicating that no one tried to run the program. Mr. Yala frequently explained that he was very busy in his new job and expressed regret that his brother would not be able to help him learn how to use the computer. His lack of basic computer skills placed him at a disadvantage because he was not confident enough to try using the computer on his own.

Utilization of the Fido system. The SBC coordinator at Site 2 had reported having tried to use the system only once but according to him, it "did not work." Often, this phrase was used when the person reporting was not able to offer a detailed account of what went wrong. Mr. Buka (Site 1), on the other hand, had successfully sent two mail
messages but was handicapped by a disconnected line. The researcher was not sure how long his phone would remain disconnected. When asked when his telephone would be repaired he said simply: "Uh! I will pay [the phone bill]."

**Planning the last visits.** The SBC Coordinator at Ruku (Site 3) was still unreachable. This delay was creating concern because, as vacation time at these Institutes neared, reaching staff members was likely to get more and more difficult. It was decided to make the last visits to each site in December. No visits had been made through most of November to give the sites an opportunity to try out the system. The only exception was Ruku where system testing had been delayed by the hardware problem. Towards the end of November calls were made to Mago (Site 2) and Govi (Site 1). At Mago, the SBC coordinator was reported to be on leave, a surprise because he had not indicated that he would be away. The secretary at Mago promised to inform the coordinator about plans for one last visit to the Institute. Similarly, a message was left for Mr. Buka (Site 1) who was not in his office.

**Telecommunications policy issues.** The Telecommunications Corporation required that all equipment intended to be directly connected to the telephone network be type-approved. Equipment vendors pay a yearly license fee that enables them to sell a specific brand of telecommunication equipment in the country. Individuals who imported their own equipment such as telephone head sets, fax machines, and modems were supposed to take it to the Corporation for testing and pay KSh. 3,000 (US $60) for the test; however, it seemed that many did not do so.

Similarly, any person connecting equipment to telephone lines or installing telephone wiring inside buildings was supposed to be licensed by the Telecommunications Corporation. The researcher managed to get around this by sheltering under the Network Service Center which sheltered under K-media because K-media was licensed to install equipment by the Corporation. However, the Corporation could still demand that each modem be tested and charge the type-approval fee. Modems of the type used in this study
had a market value of about US $10, hence it seemed unfair that individuals would pay about US $60 for type approval alone. The matter was unresolved by the time the researcher left Kenya.

There were other areas where the Telecommunications Corporation had no clear policy. For example, there was no apparent policy on e-mail. Dr. Musa explained that he avoided advertising in the media because of the fear of the potential consequences of publicly promoting an e-mail service. Despite this explanation, the NSC had organized several seminars many of which were attended by government Ministers. The patron of the NSC was himself a senior civil servant. To an outsider, this statement about advertising appeared to be unfounded. However, the director gave the example of a firm that widely advertised satellite dishes only for them to be declared illegal by a government Minister. A few months after the incident, other firms brought in and installed large numbers of these dishes without any comment from the government. Dr. Musa was worried that he, being a pioneer, would be singled out for similar treatment. At the time this research was conducted, none of the other e-mail service providers in Kenya advertised their services except by word of mouth and direct mail.

**Week 15**

**Wednesday, November 30**

A call was made to Mago Institute again to inform them of a planned visit. They explained that the SBC coordinator had left without the principal’s knowledge, and was involved in the marking (grading) of national examinations. No one at the Institute seemed to know the specific marking center to which the coordinator had gone. It was decided that the final interview would have to be conducted by phone if necessary and a copy of final questionnaires left with the principal to be given to the coordinator when he returned to the Institute. After discussing with the principal, a date for the last visit to Mago was agreed upon.
At Ruku (Site 3), no one answered the phone and it appeared that either the telephone was not working or there was no one to answer the call. Their modem was still at the NSC and, as the delay continued, it seemed that they would have to install it themselves. Because the software was already installed in their SBC's computer, the modem could be installed by anyone who could follow simple instructions explaining how to connect the three cables involved namely, the serial link between the modem and the computer, modem-to-telephone line cable, and the modem power cable. The Institute had an office in Naro and it was decided to send the modem through that office if the planned visit to Ruku Institute failed to take place.

Week 16

Wednesday, December 7

Final visit to Site 2 (Mago). The researcher got to Mago earlier than usual (at 4:30 a.m.). On this day, the Land Rover that picked up staff did not turn up. However, someone who recognized the researcher helped him get a ride on a vehicle that was headed for Mago.

When the principal got to his office, a meeting was held that included an informal interview. At the close of the interview, the principal explained that he was trying to seek opportunities for the Institute and look for sources of assistance or collaboration "out there." Although this search would have been greatly assisted by e-mail, the principal was more familiar with fax machines and expressed his wish for one such machine at Mago Institute. He recounted how while in the principal's office at Ruku, a faxed message had been received from the USA. That experience seems to have had a strong positive impact on the Mago Institute principal regarding the utility of a fax machine. The possibility of using a fax card in a microcomputer in place of a fax machine was explained but, in the absence of a concrete experience, the concept of a microcomputer-based fax system did not seem as alluring as the fax machine. After resolving to continue communicating when the
research study was complete, the meeting came to an end. There were no other staff members at the Institute during that visit because everyone was away on vacation.

Friday, December 9

Final visit to Site 1 (Govi). The final visit was made to Govi Institute with the hope that the principal and Mr. Buka, the SBC coordinator, would be available for one last meeting, however, the SBC office was locked. The researcher decided to walk to the Institute which was about 2 kilometers (1.2 miles) from the center of the town.

The SBC secretary, who was at the Institute, explained that Mr. Buka had gone on leave and that the principal was away. It looked like the final interviews would have to be conducted by telephone. It was decided to mail Mr. Buka the final questionnaires and ask him to return them by mail. While at Govi Institute the deputy principal arrived, but after a short discussion it became clear he was not interested in the SBC's affairs. In response to a query about the SBC's telephone he replied that it was unlikely to be reconnected in the near future. Because there was little else to do, the rest of the day was spent helping a local hardware merchant install his new computer and set up English language software in the computer which had recently arrived from Germany.

Week 17

Thursday, December 15

The researcher's relationship with the Network Service Center had been getting quite complex. It appeared that Dr. Musa regarded the researcher as a part of the NSC staff but did not seem aware that the research held priority for the researcher. In the final week of the stay in Kenya, during a discussion with Dr. Musa who had just returned from California, the director made some comments suggesting he was dissatisfied with the help provided by the researcher. Dr. Musa had expressed disappointment regarding the modems that had been given to the four Institutions involved in the study, implying that the
Institutes should have been charged some money for the modems. However, selling these modems could not easily be justified because they had been donated by well-wishers. Though Dr. Musa had paid the bigger portion of import duty and value added tax for the modems brought into the country by the researcher, all of those modems except five used by the researcher, were given to the NSC consequently cost recovery could not be used as a reason to charge the four Institutes for the modems. However, each of the four principals had been informed regarding the NSC’s fee structure which would apply if they decided to continue the e-mail service after the research came to an end.

Two people expressed complaints about Dr. Musa to the researcher indicating that there was an atmosphere of distrust and rivalry amongst the e-mail service providers especially the Fidonet node operators who targeted the non-commercial sector. Dr. Musa shrugged off these accusations explaining that he believed they were motivated by jealousy or a desire to discredit the competition.

Calls to Ruku Institute still did not get through. Their modem was eventually delivered to their Naro office with written instructions and diagrams explaining how to connect the modem. Information on how to contact the NSC was also provided.

**Week 18**

**Sunday, December 18**

The researcher left Kenya on December 18. Each of the four SBC coordinators were requested to return the last two questionnaires by mail. There was some difficulty getting the questionnaires from Site 3 and 4. At Site 3, the coordinator reported that he had lost the questionnaire. A replacement copy had to be mailed.

Early in 1995, the researcher talked to the principal at Site 3 intending to obtain his assistance in getting the questionnaires returned. During the conversation, he mentioned that an American professor was visiting the Institute. This professor had taken an interest in an earlier letter that was sent to the principal explaining how they could get help with the
e-mail system from the NSC. Eventually, with the professor's help, the SBC Coordinator was able to attend an e-mail training seminar held by the NSC early in 1995. Consequently, by the time the coordinator returned the questionnaires in April, the Ruku Institute SBC was operating their e-mail system and hence became the only one among the four sites that successfully implemented the e-mail system. However, information regarding who had taken the initiative and what roles all those involved played was not available to the researcher.

The next section contains results related to the perceived utility of the BBS by SBC coordinators. In addition, brief sketches of e-mail implementation among other NSC clients who were encountered while at the NSC are included to allow comparison.

Perceived Utility of the BBS

Using a questionnaire, participants were provided with a list of 16 categories of tasks that they were likely to be familiar with as part of their routine work. They were asked to specify how they thought the BBS, which offered e-mail and file transfer facilities at that time, would help in carrying out these tasks.

The tasks are listed in Table 3. The responses were classified into three categories:

Category 1: The respondent did not describe what the BBS could do in relation to the task, or respondent thought the BBS could not assist in carrying out the task.

Category 2: Responses where the respondent indicated that the BBS could help in carrying out the task but did not relate this to the primary function of a BBS, that is, to facilitate communication.

Category 3: Responses where the respondent said that the BBS could help in carrying out the task and indicated an understanding of the primary function of a BBS, that is, as a means to facilitate communication.

A flow chart (see Appendix G) was constructed to help score the responses. Its objectivity as a scoring tool was tested on three doctoral students in the author's department.
and found, in the author's judgment, to yield the same score (within about 10%) as long as it was emphasized that the primary function of a BBS is communication, not centralized computing services.

The responses to the perceived utility of the BBS obtained through the BBS Utility Questionnaire at the start of the study and at the end, were compared for each participant. The results are shown in Table 4. The four participants are listed across the top (1–4). These numbers correspond to the four sites involved in this study. The percentages of their responses that fell into each of three categories is indicated. For example, for participant 1, 37.5% of their responses at the beginning of the study fell into Category 1, 0% in Category 2, and 62.5% in Category 3.

Table 3
List of Job Tasks Likely to be Familiar to Participants

<table>
<thead>
<tr>
<th>No.</th>
<th>Task</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Drafting letters</td>
</tr>
<tr>
<td>2</td>
<td>Preparing project proposals and reports</td>
</tr>
<tr>
<td>3</td>
<td>Keeping personnel records</td>
</tr>
<tr>
<td>4</td>
<td>Preparing for and attending meetings</td>
</tr>
<tr>
<td>5</td>
<td>Giving presentations</td>
</tr>
<tr>
<td>6</td>
<td>Planning and executing research</td>
</tr>
<tr>
<td>7</td>
<td>Writing for publication</td>
</tr>
<tr>
<td>8</td>
<td>Creating and maintaining databases</td>
</tr>
<tr>
<td>9</td>
<td>Organizing seminars</td>
</tr>
<tr>
<td>10</td>
<td>Supervising and administering projects</td>
</tr>
<tr>
<td>11</td>
<td>Carrying out evaluations</td>
</tr>
<tr>
<td>12</td>
<td>Teaching and consulting</td>
</tr>
<tr>
<td>13</td>
<td>Preparing budgets</td>
</tr>
<tr>
<td>14</td>
<td>Maintaining accounts</td>
</tr>
<tr>
<td>15</td>
<td>Making requisitions</td>
</tr>
<tr>
<td>16</td>
<td>Others (specify)</td>
</tr>
</tbody>
</table>
Table 4

Comparative Percentage of Responses in Each of Three Categories for the Four Participants

<table>
<thead>
<tr>
<th>Response Categories</th>
<th>Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre</td>
</tr>
<tr>
<td>1</td>
<td>37.5</td>
</tr>
<tr>
<td>2</td>
<td>0.0</td>
</tr>
<tr>
<td>3</td>
<td>62.5</td>
</tr>
</tbody>
</table>

Due to the small number of people involved any further analysis of the responses would not be justified. Three of the four participants used the network to send e-mail only when the researcher was present during site visits. Participant 1 sent two e-mail messages on the system in the researcher's absence, but the disconnection of his telephone prevented further use. When asked if he intended to use the system after the end of the study, he explained that he would do so if it offered a way to reach people and agencies that were important with regard to his SBC's goals and objectives. Participant 2 reported trying to use the system once but was unsuccessful. He too had problems with the telephone system at his institution as described earlier in this chapter. By the time participant 3 completed the final questionnaire, he had attended an e-mail training seminar and reported using the e-mail system regularly; however, this happened after the researcher left Kenya. At Site 4, there was no attempt to use the system in the researcher's absence. Unlike other Small Business Center coordinators who reported having attended a two-week computer course, participant 4 had just taken over as coordinator at the start of this study and had not attended any computer courses. He stated several times that he "did not know how to use this thing" (the computer).
While at the NSC, interaction occurred with NSC clients that were not part of the original case definition. It is appropriate to briefly contrast the differences between the way e-mail was received in these organizations as compared to the reception at the four sites. There was noticeably greater interest in e-mail at these other places than at the four sites in the case. In a number of institutions, especially the research centers, it was apparent that e-mail was an essential tool. The most frantic calls for help were received from these institutions. The most enthusiastic reception of e-mail was at an NGO that specialized in small enterprise development and which had recently started efforts to develop a resource center on small enterprises including the development of computerized databases.

The following are thumbnail sketches of several organizations encountered while helping out at the Network Service Center. Not all had e-mail services but they all considered e-mail very important.

**BankTech.** This company operated from one of the newest buildings in Nairobi. They specialized in banking software and solved networking problems in client premises daily. For example, at one time, they wanted an icon representing the banking software package running on a UNIX computer, to appear on (and hence be accessible from) the "desktop" of the manager's microcomputer which used a popular graphic user interface. One of the problems for which they sought a solution for was a way to link their clients' local area networks (LAN) to other LANs in different locations and to BankTech. They wanted employees at these banks to have access to e-mail which would enable them to reach other employees in the same bank, to reach BankTech, and to have access to the Internet. The company was trying to use the latest technology including the development of in-house multimedia technologies.

The staff was young, some still in college and working part time. It was also a very fast-moving and intense workplace. The director was heard to comment that an e-mail address on their business cards would enhance their image. In contrast to the leisurely progress of events at technical training institutions, at BankTech decisions were often made
after a few minutes of intense brainstorming. One employee commented that his employers thought he was a miracle worker. Obviously, he had acquired a reputation for solving problems and management had great expectations in his abilities. This employee was asked to evaluate the Fidonet system for its suitability as an e-mail system. This assessment indicated that BankTech's requirements were beyond the capability of FrontDoor.

**Rural Development Program.** This was an NGO that focused on rural enterprise development. Recently, they had created a resource center and developed the first database on small enterprise development in Kenya both in print and in electronic form. They now had one of the best resource centers in the country for small enterprise development materials and were so confident of its quality that they had started charging a small hourly fee for access to materials in the resource center. The NGO had a research department whose work contributed to the resource center.

When e-mail was installed, the resource center manager reported that all the employees wanted to learn how to use it. He explained that the work culture at this organization emphasized a results-oriented approach and did not place great importance on keeping to official office hours. Employees were judged based on their productivity. He indicated that the atmosphere was intense but jovial with most employees being in their mid 20s. Indeed, he jokingly said that he was one of the older ones at this NGO. Like the financial technology company, this NGO was intensely goal driven. They made frequent use of e-mail and were the only ones to attend the first consultative meeting convened by the NSC to discuss potential applications for networking in the area of small enterprise development.

**Commerce Point Kenya.** The trade point was an office connected exclusively by electronic means to other similar trade points all over the globe that exchanged information on buyers, sellers, and business collaborations. For example, a German businessperson who needed a Kenyan collaborator to set up a production facility could send his request to the Commerce Point. Local business people could then scan such requests to identify those
they were interested in. Similarly, buyers and sellers could use the system to identify trading partners in other countries. The Commerce Point was established while this study was going on. The person in charge realizing its great potential, indicated that should the parent organization charged with running the Commerce Point lose interest, he was willing to operate the Commerce Point as a private agency. E-mail was a lifeline for the Commerce Point because information was delivered almost exclusively via e-mail.

Research labs. Several research labs were NSC clients. Most calls for assistance during the period this study was conducted came from these institutions. Usually, from staff who expressed frustration with their e-mail system. Sometimes the NSC failed to provide timely assistance. For example, at one research Institute situated in Western Kenya, they had completely abandoned the NSC system because they could not get it to work and had not been able to get technical support from the NSC. The Institute had acquired a new modem and terminal software which they intended to use to link up with a sponsoring agency in the USA. Like many of the organizations described here, e-mail was important because research data needed to be transmitted to distance locations. Their attempt to use terminal software to communicate with the USA would probably have failed due the difficulties in setting up a stable link that could handle the satellite delays. Although they had a young and competent network administrator at the Institute, his expertise was in LANs and he was unable to deal with modem problems at that time. Their NSC link was re-established with the researcher's help. This particular case did not reflect well on the NSC because they had failed to provide timely technical support.

Agricultural Research Center. This center specialized in semi-arid agriculture and were part of an international chain of agricultural research centers. Although they had access to a global e-mail facility, this system did not offer access to the Internet because their proprietary network had limited reach. They required an alternative means of communications so that they could access researchers through the Internet.
NGOs and research institutions required a means to send documents cheaply. This was especially the case where sponsors or research collaborators were based in other countries. Fax was considered too expensive and many sought a way to lower communications costs by using e-mail to send both messages and documents. This need also existed among small enterprises. One financial consultant who had many clients in the USA explained that e-mail offered a way to cut his fax costs because he could make use of e-mail-to-fax gateways and hence eliminate expensive international telephone calls.

Masters Electronics. This company was interesting, first because of the entrepreneurial approach of its director, and second because it was here that a substantial amount of time was spent trying to compare the costs of e-mail with that of fax. This company was a small contractor specializing in telecommunication services including supply and installation of radio communication equipment and of interior telephone wiring. They also sold telephone equipment and computers.

This was one of the few commercial organizations that the researcher interacted with. The director expressed great interest in e-mail but was insistent that a comparison be made between the cost of sending faxes direct to Europe and sending them through e-mail via a gateway in Boston. So interested was he that, by the time the researcher left Kenya, he had contacted Compuserve, the on-line services company, to inquire about the possibility of subscribing to their service or setting up a franchise.

When the director was told about e-mail, he immediately started exploring the possibility of starting an e-mail bureau service where people could come in to send or pick their e-mail. He was particularly interested in cost comparisons between fax and e-mail and it was while trying to obtain data for such comparisons that the researcher discovered how difficult it was to obtain this data. Rough calculations at that time indicated that if e-mail was used as an alternative to international fax, it was not cost efficient unless more than about ten faxes were sent every month. It seemed that where others saw costs, he saw business opportunities, an approach that could be aptly described as entrepreneurial.
These brief descriptions reveal that there is much greater interest in e-mail among NGOs, private companies and research institutions than was witnessed among technical training institutions. E-mail could be a solution to a pressing problem or it could be a life line allowing new kinds of services such as Commerce Points. For the research labs and NGOs, being able to easily communicate with sponsors and collaborators was an important goal. Sometimes e-mail offered the only way to send timely research data in electronic form. Among the private companies, e-mail offered an alternative to fax and the possibility of substantially lowering communications costs. In these institutions, the workplace was intensively goal directed. Many of them had predominantly youthful employees who seemed the most enthusiastic about new technologies.

The following two sections provide outlines of the factors to consider when implementing a BBS and barriers to implementation based on the data collected in the field.

Factors to Consider When Implementing a BBS

The factors likely to influence the success of the implementation process were noted from observations in the field and from analysis of relevant documents. These documents included African Academy of Sciences and American Association for the Advancement of Science (1992), Kenya’s Information Technology draft policy and minutes of meetings at the Network Service Center (NSC). The last two are non-public documents and are not quoted verbatim. The researcher participated in the NSC’s meetings and in a number of occasions took down the minutes of the meetings.

To aid data collection, an observation guide was constructed outlining a tentative scheme for classifying factors. This guide was based on reports in the literature, the researcher’s personal experiences with e-mail, and personal communications with people involved in the development of e-mail systems in African countries. Four broad categories of factors were identified originally:

1. Effects of government (and government corporations) policy or lack of policy.
2. Institutional readiness for the innovation.
3. Availability of expertise.
4. Telecommunications and related infrastructure.

Although many of the observed factors fit into these broad categories, alternative categories represented the situation in the field better than the original tentative categories. Based on field observations, the following categories were developed:

1. Promotion of networking.
2. Telephone services.
3. Computer system maintenance.
5. Human resource concerns.
6. Communication and coordination.
7. Finance and budgetary priorities.
8. Cooperation among networking service providers.

Promotion of Networking

There was a need to convince decision-makers and the potential end users of the usefulness of the technology and to deal with administrators’ fears that were related to the use of the technology. For example, some may have been concerned that e-mail would interfere with existing fax facilities especially if a telephone line was shared between the fax machine and the modem. Others may have been uneasy about the ease with which information could be transferred from one place to another by e-mail.

Some of the concerns expressed by those involved in promoting networking include:

1. The need for intensive promotion. This need was emphasized during a consultative meeting organized by the NSC intended to bring together those involved in small enterprise development. The NSC was interested in obtaining their views regarding the potential usefulness of e-mail for individuals and organizations who later came to be
referred to as the small enterprise development facilitators. Representatives from small enterprise development NGOs thought that there was a need for awareness-creation using such means as demonstrations and seminars. In their opinion, lack of awareness about the technology and its potential usefulness was a major hindrance to its adoption.

2. Demonstration of the cost-effectiveness of networking (commonly referred to simply as "e-mail"). Difficulty was experienced in demonstrating any cost advantage that e-mail may have had over other technologies such as fax. Dr. Musa, the director of the NSC expressed the same need. Although it was possible to calculate the cost of sending for example, a 20-page document between two locations, it was difficult to obtain data in most organizations regarding their typical expenditure on fax and telephone calls. Such data would allow comparison of costs of using different means of sending information.

3. The need to reassure administrators. According to the documents reviewed, some administrators may feel inadequately prepared to deal with computers and networking. An apt example was the SBC coordinator at Site 4 who stated several times that he was unfamiliar with computers. It seemed that administrators had little contact with computers in their organizations hence were unlikely to develop computer skills. Consequently, they were less likely to acquire insights regarding the potential for technologies such as e-mail.

4. Dealing with reluctance to share information. Government may be overly cautious about telecommunication technologies that it can not easily monitor. An illustration of this caution was the storm created when a businessman first brought satellite receiving dishes to the local market. Similar caution is reported at the organizational level by administrators who may have been concerned that e-mail would make it too easy to access documents in their organizations. Fidonet node operators can easily open and view messages sent through their node which has potential consequences for confidentiality. Users generally do not know this and it appeared that node operators tended not to tell users about it for fear that they would avoid using e-mail altogether. Although encryption
technology allows users to ensure a higher level of confidentiality its use is likely to arouse the attention of security agencies judging from stringent regulations in countries such as the USA where certain encryption software is classified as munitions.

**Telephone Services**

Reports from all over Africa indicate that those involved in implementing e-mail systems have to contend with issues revolving around the use of telephone services. Because Fidonet relies on dial-up connections where computers are interlinked by means of modems and telephone lines, the quality of telephone service is important. Fidonet software is designed to handle noisy telephone lines. However, the noisier the line, the slower data is transmitted. In addition, due to the unreliability of telephone services, there was greater likelihood that service may be interrupted without warning. This was frustrating to users and prevented the use of automated calling schedules. Factors associated with telephone services included:

1. **Time, cost, and procedures for getting a phone line.** At Site 2 the original request for a second telephone line had been made to the Telecommunications Corporation in 1990. It was not until 1994 that a line became available. In Naro, it cost KSh. 9,000 (about US $200) to install a telephone. It seemed that tips were commonly given prior to service provision. Such tips, which could exceed the official fees, were illegal.

2. **Type of exchange (digital or analog).** One user reported that they had serious difficulties with their Fidonet system during a time when they used a telephone line switched through a relay-type exchange. However, when they got a line from a digital exchange, these problems ceased. The digital exchanges allow tone dialing which seemed less prone to spurious dialing errors and "busy" tones.

3. **Regulations and procedures regarding modem installation.** The Telecommunications Corporation had regulations regarding modem installation that require every modem to be type-approved. It costs KSh 3,000 (US $ 60) to have this done. In
addition, only technicians and engineers licensed by the Corporation could connect modems and other telecommunications equipment to the telephone lines. In reality, people were found to ignore these regulations. However, a Corporation engineer stated that the Corporation confiscated such equipment when discovered. In Zimbabwe, their telecommunications service provider had similar regulations but, unlike Kenya, had instructed telephone users to ignore those regulations until they were updated.

4. **Seasonal variation in service quality.** A Nairobi-based international research center with stations in outlying areas, reported seasonal variations in the quality of telephone services. The worst service occurred during the rainy season. This may be related to the way telephone cables were installed. Problems associated with these cables are discussed in the next section of this chapter.

5. **Supervising installation to ensure standards are kept.** The principal at Site 2 thought that, repairs of the telephone system at his Institute had been delayed due to inadequate supervision of the Telecommunications Corporation technicians. The researcher witnessed the installation of drop cables at the NSC and noted some of the consequences of careless installation. Such practices could greatly increase the probability of the occurrence of faults in the telephone line.

6. **Cost of telephone service and differential quality of Africa-Africa versus Africa-Europe links.** A system administrator with the East and Southern Africa Network (ESANet) explained in a paper published in African Academy of Sciences and American Association for the Advancement of Science (1992) that ESANet centers in eastern and southern Africa were forced to communicate through GreenNet, London, because the telephone links between African countries and Europe were much better than between one African country and another. In Ghana for example, it was cheaper to call most European countries than to call many African countries.
Computer System Maintenance

A lot of time and effort could be saved by instituting effective system management practices. The researcher encountered instances of computer virus infection and computer users who had no backup copies of software. In other cases, users did not have adequate skills to deal with routine system maintenance in-house. The following needs were observed at one or more sites and at locations served by the Network Service Center:

1. The need for precautions and procedures to minimize down time. These include the use of up-to-date antivirus software, the use of uninterruptable power supplies (UPS) to guard against data loss due to power outages, and keeping equipment unplugged overnight or on weekends when not in use to guard against voltage spikes caused by lightning strikes. Among the locations visited, very few took precautions against computer virus. The use of power conditioning equipment and precautions against surges caused by lightning strikes, were more common. Three of the four sites had an UPS.

2. Keeping backups of data and copies of software. At two sites where problems occurred due to hardware or software faults, it was found that there were no backup copies of the operating system (DOS) or copies of installed software. Similar situations were found at other locations served by the Network Service Center. At one site, a virus was found on the computer system. No DOS boot diskette were available.

3. Computer maintenance policies. The organization cited in (2) above did not appear to have policies specifying who was responsible for maintaining the computers. Indeed there was a heated argument between two secretaries with each blaming the other for the existence of the virus. Each accused the other of having failed to take action regarding the virus. Because neither had the skills to deal with the problem, they explained that they would call the computer vendor to deal with the situation though they sounded doubtful that the vendor would respond quickly if at all. The argument had been about whose responsibility it was to call the vendor.
4. **Routine maintenance.** In three of the four sites involved in the study, computers were situated in relatively dusty environments. It was noted that routine cleaning of computer parts prone to damage from dust such as the keyboard and floppy drives was not practiced. Lack of such maintenance was likely to result in failed diskette drives. This was the researcher's experience at one institute where diskette drives had failed in several computers after they were used for a demonstration at a local International Show. The drives returned to normal after cleaning.

5. **User's guides.** None of the computers at the sites visited had user guides. This, combined with inadequate user training, made it unlikely that they would be able to deal with computer problems when they arose. This was more serious in places like Site 2 which was hundreds of kilometers from possible sources of technical support.

**Security**

In many parts of Kenya, especially in or near major urban centers, theft and violent robbery of computers seemed to have increased. The two incidents described below serve as indicators of this apparent trend. In one case robbery at a University had taken place at gun point in broad daylight. This made it imperative that computer owners take precautions to minimize potential loss from such theft and to make it more difficult for criminals to get hold of equipment. Measures that could reduce loss include insurance against equipment damage and theft, alarm systems, guards, and well trained employees.

An electronic alarm system was to be installed at the new NSC office with a facility to call in armed backup guards when necessary. A security agency was hired to provide a trained guard on the premises. In one meeting, the need for employees to be familiar with procedures in case of a daylight robbery attempt were discussed. It is interesting, however, that in some regions in Kenya, the fear of theft and robbery was minimal. At Govi for example, the researcher noticed that windows in a new supermarket did not have steel bars, a feature common in most Kenyan towns. On inquiring about this, he was
informed that there was very little incidence of theft and robbery at Govi. Despite the presence of relatively expensive equipment, the SBC office did not have steel doors, unlike at other institutions the researcher had visited.

During the period when this study was conducted, a daytime robbery occurred at Daystar University, where gun-wielding robbers took computers and a Private Automatic Branch Exchange (PABX). At one computer company which assembles microcomputers, burglars had broken in and stolen computers that carried critical company data. At Govi where Site I was situated, the researcher received a discreet indirect inquiry from a senior police officer who was trying to identify the owner of a Macintosh computer recovered from suspected criminals. These events seemed to indicate a trend towards increased computer theft.

Human Resource Concerns

The critical need for effective human resource development interventions was apparent everywhere the researcher went. If training and development is included among such interventions, then several of the needs in this section could be categorized under this heading. For example, lack of adequate computer systems maintenance practices could be related to a lack of skills or awareness of the need for such maintenance. The discussions in this section indicate the nature of these needs. The following factors were encountered in the field or in the documents reviewed:

1. How to lead and motivate staff. The principal at Site 2 reported difficulties when he tried to create greater enthusiasm about computer use. The principal expressed the following thoughts during an interview in his office:

   ... This office of ours the SBC. it has been a headache for me to motivate people to get there. I was so much interested in the computer myself. Now I don't have as much time to do this kind of thing. So I have tried [Mr.] Wali. I think I have sent him to four seminars trying to create some interest in him but Mr. Wali is a very conservative
person with due respect. He is a very conservative person. It is very difficult to motivate him to get out of himself and really take up challenges and he is slow to move. He is very precise; whenever he does something he does it very well. But sometimes I like people who can take those risks, make mistakes but you make a move. You can correct a decision you have made whether it is wrong or right. If it is wrong then you can correct it afterwards but you have made a decision.

... So you find that when you have a technology like this one when the problem really is more with the personnel, the manpower, other than the equipment, it is difficult to solve, it needs transformation. When I came here even when I was trying to get this facility [computer], I thought there would be a lot of excitement -- everybody would want to whatever. We preached every day 'please make use of this facility. This can produce report cards which have been staying here for years, terms [semesters], months.' But you preach until now at least I am getting some motivation from Wama who is picking up although that fellow from Business, Mr. Toye, is spending a bit of time there so the interest is picking up slowly.

... I have a lot of interest in the computer myself. When I was at [his previous station], I spent a lot of time at the computer. Anything I was writing, I did it on the computer... Most of my staff have not been exposed to computer technology. they are younger than me, they just left school the other day but for some strange reason they are not interested in computer technology. For some reason in this country, we do not want to spend time on academic pursuits; on things that do not directly benefit us. But we do not see that if we take interest in this kind of thing it can even help you. Even if you are looking for a job now people want you to be computer literate.

The main cause of frustration was difficulty in getting his staff members interested and enthusiastic and getting them to start trying to use the computer for some of the tasks for which it was suited. The principal specifically mentioned record keeping and preparation of reports and transcripts.
2. How to determine required skills. One article in African Academy of Sciences and American Association for the Advancement of Science (1992) indicated that some of those charged with training computer system users found it difficult to determine the skills required by users and system administrators. It would be expected that inadequate assessment of training needs would lead to inadequate training.

3. Managing training. A number of training-related needs were encountered including: (a) hiring trainers, (b) preparation of instructional materials, (c) meeting the costs of training, (d) selecting a mode of training, and (e) credibility of trainers.

In regard to trainers and promoters, Dr. Musa of the Network Services Center explained during one conversation with the researcher, that:

People really haven't understood the extent of utilizing the technology. The trouble is the harvest is enormous but the harvesters are very few. There are not many people who have the expertise to sell these ideas or the time to sell these ideas or the resources to sell the ideas or the desire to sell the ideas. The people who may have the expertise may not have the resources to share this with others. . . . there aren't many good trainers. I do know that getting good engineers is hard enough but getting good engineering teachers is even harder.

The implication was that good trainers were hard to get, indicating that organizations like the NSC may require training-of-trainers services. This may be especially true in those kinds of organizations where trainers were likely to be selected due to their familiarity with the technology rather than their training skills. Similarly, problems with the preparation of training materials and the selection of the type of training may be a consequence of emphasis on technical skills at the cost of training skills.

Muteshi and Rigby (1992) recounted their experience when they visited Uganda to install a Fido system. One of the local engineers who they described as well suited for the position of a node operator, had problems gaining acceptance as an e-mail expert until he went to Kenya on a training course. According to the writers, it was not the skills this
engineer gained in Kenya (he acted as a resource person at the training program due to his outstanding skills) that increased his acceptance rather, it was because he had "gone away" for training. It appeared that people at the university in Uganda believed, consciously or unconsciously, that one became an expert only after formal training, preferably abroad.

Although institutions seemed willing to have their staff trained, the costs of computer training may be high enough to discourage them from sending staff for training. The amount of money such institutions were willing to pay may be related to the extent to which they valued the skills to be offered at such programs.

In some cases, users could learn on their own if provided suitable manuals. For example, the coordinator at Site 1 managed to use the e-mail system to send the researcher two messages. He relied solely on the manual prepared by Dr. Musa and had no other assistance.

6. Contingencies to deal with staff depletion. If trained staff leave, institutions and service providers may be incapacitated. At the Network Service Center, the most serious problems arose when Dr. Musa, who set up the system, was away. Similarly, if only one staff member at an institution was trained, the institution would be unable to use the service in his or her absence.

The extent of training required could be gauged by the experience of the researcher after the preliminary questionnaires were sent out to all SBCs. These were intended to collect data on which the selection of the four sites to be involved in the study would be based. The completed questionnaires indicated that many of those who completed them were unfamiliar with the features of their computers. Figure 3 shows an example of an item in one such questionnaire.
6. If you have one or more computers, please supply as many of the following details of one as possible:

Manufacturer: SAMTRON
Model: SC-441V
Capacity of Hard Disk ____________
Number of serial ports: 9318412409
Types of diskette drives present: 360 kb  720 kb  1.2 Mb  1.44 Mb

Figure 3. An example of a completed item from one of the preliminary questionnaires.

The respondent was expected to indicate the size of the hard disk drive. No response was given. It is assumed that they were unable to determine the disk capacity. Instead of indicating the number of serial ports, the respondent indicated the serial number of the computer. No response was given when asked to indicate the size of the diskette drive.

**Communication and Coordination**

There were several instances where visits to the field sites failed due to inadequate communication and coordination with individuals concerned. The most frequent occurrence was the arrival at a distant site only to find that the key individual was absent. In every instance, this happened when a third party was relied on to relay a message about a planned visit instead of speaking directly to the persons concerned. Towards the end of the study, it was more difficult to reach people first, because many teachers did not visit their institutions during the vacations and second, because the telephone problems were somehow more intense.
Several times it was found that the information possessed about a site was inadequate or that, inadvertently, assumptions had been made about the facilities available. For example, SBC coordinators were initially asked if it was possible to make external telephone calls from their offices or wherever the SBC's computer was installed. If the answer was yes, it was assumed a call could be made using a modem. On visiting the first site, however, the manual switchboards used at many of the institutions were found to present a barrier. In those situations, it was necessary to make a request for a line from the institution's operator before one could dial from an extension. For a voice call, one would ask the operator to make the call. When the call went through, the operator would then switch it manually to the right extension. Such a procedure would not work when using a modem. After the first few site visits it became apparent that anyone involved in installing such e-mail systems would require a well thought out checklist to assess the client's facilities before embarking on a long journey. It was also necessary to gain familiarity with different telephone systems such as manual switchboards and multiline telephones. Without careful questioning, such site information was difficult to acquire. Based on this information, the installation technician could take along all the required accessories and tools.

One of the problems noted in using e-mail to send and receive documents was that few institutions and organizations could be reached by e-mail. In one project described in African Academy of Sciences and American Association for the Advancement of Science (1992), they found it necessary to provide fax links to those institutions involved in the project that did not yet have e-mail so that these institutions could be reached.

Alternative telecommunication technologies such as packet radio and satellite were encountered by the researcher in discussions with informed individuals and in reports such as the one cited above. However, there was no evidence of their use in the field. HealthNet-Kenya which was reported to be using low-orbit satellite technology seemed to have abandoned this approach in Kenya due to the low transmission speeds which were
found incapable of handling their international traffic. They were now using dial-up links to exchange mail with locations outside Kenya (Clemens, 1995). Nevertheless, organizations like the Volunteers in Technical Assistance (VITA) continue to pursue these alternatives.

**Finance and Budgetary Priorities**

Three of the four principals that were involved in this study emphasized the importance of cost considerations in deciding whether to adopt new ideas such as the Fidonet system. At Site 2 the principal expressed it as follows:

... Very useful yes. So there is no question of this technology being useful but it is only because of our financial constraints [that] we tend to think some things are not really important just because you want really to prioritize. Even now when you consider the [Institute's] farm and you have no money, if you had KSh. 650 [US $13] do you buy a bag of fertilizer for the maize [in the farm] or do you pay for this [e-mail] facility? So, really the two things are important but this [food] is life. I think anybody who would try to find out how this facility works would find that it is very important like we need a fax machine. Everywhere I go people ask me "Do you have a fax machine so we can send you some messages?" Fax is important but when you think of investing KSh. 50,000 [US $1,000] on fax, they [Board of Governors and institution's staff] don't think that kind of money should be spent on fax machines. But it's important.

The principal explained that, though the concerned government Ministry would blame the Board of Governors for bad financial decisions, the principal would not escape responsibility for misleading the Board because he was considered the Board's chief advisor. The priority that items such as e-mail received seemed to be related to the value attached to them. The principal at Site 2 did not consider the e-mail system high enough in priority to warrant any budgetary allocation.
Dr. Musa of the Network Services Center thought that e-mail should be seen as an investment but, as discussed earlier in the previous section, it was not easy to demonstrate the cost advantages of e-mail let alone convince potential users that it was an investment.

**Cooperation Between Network Service Providers**

There was distrust and hostility among e-mail service providers in Kenya. Indeed, sending e-mail to someone on another Fidonet node in Kenya usually required that the mail be routed through the Internet. Because the Internet was not available within Kenya, such routing would necessitate an international telephone call to transfer mail to a suitable gateway. At the time of this writing, there had been no successful attempt to form a collective body able to implement a telecommunication link that would eliminate the need for making international phone calls to exchange mail with the outside world.

The NSC had written a proposal in an attempt get some of the major potential and actual e-mail users to fund the establishment of a dedicated line to the Internet but that attempt did not succeed. When asked about it, NSC director did not explain the specific reasons why it failed but hinted that many organizations were not willing to share telecommunication links with others for fear of security breaches.

Since the fieldwork for this study was conducted, the e-mail situation in Kenya has changed with the Internet now directly accessible within Kenya. In addition, most e-mail service providers now do not send e-mail to clients on each other’s systems via the Internet but have agreed to gate such mail locally. However, not all providers are involved in this arrangement.

**Government**

At an informal meeting with a senior government officer in the Ministry concerned with technical training institutions, the officer explained that a proposal to set up an electronic network to link Small Business Centers had been presented to his Ministry.
However, the Ministry shelved it because they were unsure about the intentions of the proposal's developer. He explained that his Ministry was very interested in information systems but implied that they were wary of being misled or misdirected by individuals or organizations whose ultimate agenda were self-serving.

Other officers in the same Ministry confirmed these impressions and revealed that the Ministry was striving to keep up with the tasks of gathering information regarding implementation of various programs. They sought to be more effective with increasingly fewer resources. It was clear that they were willing to cooperate with anyone who would facilitate the attainment of their objectives. It was also clear that it was essential to build relationships of mutual trust with government officers and understand the realities of their work environment.

The following government-related factors were noted:

1. The need to keep relevant government officials informed of activities relevant to their Ministries.

2. Meeting government regulatory requirements. For example, research requires an authorization from the Office of the President.

5. Obtaining support from government by establishing mutual trust.

6. Involvement in related policy initiatives (e.g., the NSC was involved in drafting an IT policy for Kenya).

7. Realistic expectations regarding the time lines for procedures where government offices were concerned.

Barriers and Problems During Implementation

Factors that hindered or prevented successful implementation of the Fidonet system are regarded as barriers to implementation. These were identified from experiences in the field through observations, interviews, discussions, and by direct involvement in troubleshooting and installation of the system. An observation guide had been designed in
order to aid data collection. This guide was based on reports in the literature, the researcher's personal experiences with e-mail, and personal communications with people involved in the development of e-mail systems in African countries. This tentative outline had five broad categories of barriers namely:

1. Lack of administrative support.
2. Technical difficulties.
3. Financial constraints.
4. Regulatory problems.
5. Staff reluctance or inability.

Although "staff" in item 5 above initially referred to staff at SBCs, in the field it became apparent that the term would need to include staff at the Network Services Center, employees at organizations who were the NSC's clients, and others at the four sites who were participants in this study. In particular, telephone operators, clerks, and secretaries were participants in the interactions that occurred at these institutions and organizations. At a number of locations served by the NSC, secretaries were the chief users of e-mail rather than technicians or administrators and managers.

Although many of the observed barriers and problems fit into these broad categories, it was found that alternative categorization represented the situation in the field better than the original tentative categories though the difference between them was very small. The categories derived from field observation are as follows:

1. Interpersonal and inter-organizational conflicts.
2. Technical difficulties.
3. Financial constraints.
4. Regulatory problems.
5. Skill and motivational problems.
6. Inadequate decision support systems.
Interpersonal and Inter-Organizational Conflicts

Conflict generally interfered with the ability of organizations to run smoothly and hence with their effectiveness. Three points of conflict were observed among the various actors in this case:

1. Conflict within NSC. The researcher faced conflicts as a consequence of being deeply involved in the affairs of the NSC whose director treated the researcher as a permanent member of NSC. Towards the end of the study, this involvement created friction between the researcher and the director, Dr. Musa. About three weeks before the study ended, Dr. Musa went on a trip outside the country expecting the researcher to run the NSC while he was away. However, the researcher's primary mission in Kenya was to conduct research. This had been made clear during NSC meetings. Consequently, the NSC affairs took second priority. On his return, Dr. Musa remarked that the researcher seemed to have abandoned the NSC while the director was away.

2. Conflict between NSC and other providers. Relations between the NSC and other e-mail providers appeared strained. Though this study would have been strengthened by information provided by other e-mail service providers, it was thought unwise to approach them due to the real possibility that this would create suspicion between the NSC and the researcher.

3. Conflict between the SBC coordinator and the principal at Site 1. The Entrepreneurship Promotion Project officer in charge of SBCs had been called to arbitrate this conflict. He thought that the SBC coordinator’s problems developed because he was more educated than everyone else at the Institute. However, other factors may have been at play including the coordinators failure to communicate effectively with the principal and possibly, the principal’s concern that the SBC was too autonomous. Though the SBC was financially independent and able to generate enough pay for rent and supplies its telephone was disconnected due to nonpayment of bills.
Technical Difficulties

Many technical problems were encountered. Because the researcher had to learn how to install Fidonet points, some of the problems encountered with telephone wiring and modem settings during the initial site visits were due to his lack of experience. The most common problems were due to difficulties in installing and configuring modems and the FrontDoor communications package. Problems with telephones were also experienced. The following is a description of the technical difficulties encountered.

1. **Defective computer hardware.** Most of the computers supplied to the technical training institutes seemed defective. Four out of nine computers were non-operational while two had to be repaired in the field by the researcher. The machines were inadequate for modern software especially Microsoft Windows™ applications because they had only 2 megabytes of random access memory (RAM). The Entrepreneurship Promotion Project was unable to provide technical support to SBCs. According to the EPP official in charge of SBCs, there were no funds available to hire an experienced technician who could repair the computers.

2. **Telephone problems.** There were a number of telephone-related problems. The SBC telephone extension was not functioning during the first visit to Site 2. A tree had fallen during a storm hitting a steel telephone post which bent and stretched the telephone lines including lines that linked the manual switch board to the various telephone extensions in other buildings. The Telecommunications Corporation technicians had been to the Institute twice to check on this problem. During the last field visit to the Institute, the telephone extension had not been repaired. The Corporation had an obligation to repair the line because there was a maintenance contract concerning this. Their services in this respect were poor. Mago Institute had requested an additional phone line in 1990 but had been told that there were no lines available. The principal had now been informed that there were lines available. This was four years after the initial request had been made.
At Site 3, the telephones failed while the principal was testing his telephone. It turned out that such line failures were quite frequent at this site. Later at the NSC, while watching telephone lines being installed and talking to the Corporation technicians, it was discovered that many problems with telephones resulted from poorly installed lines especially the lack of proper cables and the overuse of drop lines. In addition, there appeared to be an ethics problem in the Corporation. It was hinted that technicians and engineers were tipped heavily before the NSC's urgent request for additional telephone lines could be granted.

The NSC's main line, used by clients transfer mail to and from the mail server, regularly broke down (about once every two weeks) making it necessary to call the exchange for help. It seemed that these problems lay at the exchange or between the exchange and the client's premises. These were usually solved shortly after calling the exchange. In one instance, the technician checked the line and solved the problem while the researcher waited on-line after calling the exchange. These experiences pointed at additional sources of problems in addition to poorly installed telephone cables and drop lines.

3. Difficulties in communicating with sites. Communication with sites sometimes proved difficult. Telephone services frequently broke down. In other cases, staff members were not at their institution, especially during vacations. At one institution, the telephone was disconnected due to bill non-payment. At another institution, four of the five telephone lines had been disconnected for the similar reasons. Staff were not permitted to make outside calls on the one line that remained. These communication problems tended to disrupt planned schedules and slow attainment of objectives. There seemed to be no urgent desire on the part of these institutions to get the telephone services corrected.

4. Difficulty in repairing equipment. Repairs of a power adapter for a modem caused a major delay at Site 3. It took a few weeks to find someone who could re-wind the adapter's transformer. In this instance, the modem had a power adapter that could not be replaced with the kinds available in the local market. Some of the modems encountered
used commonly available step-down transformers in their power adapters and hence could easily be replaced.

5. Overheating transformers. The modem power adapters that were encountered most frequently were simple step-down transformers intended to operate at a primary input of 110 volts and 60 Hz (cycles per second). When these were used in Kenya in conjunction with another step-down transformer to convert the local 220 volts to 110 volts, the modem adapters often overheated when left on for long periods. An investigation revealed that this phenomenon was caused by the difference in supply voltage frequency between Kenya and the USA. The modem power adapters were optimized for 60 Hz operation while Kenya’s electrical supply was 50 Hz.

6. Difficulties in software set-up. Setting up the communication software used was relatively complex. It required a person who was comfortable working with DOS batch files and familiar with modem configurations as well as microcomputer hardware. Any changes made to the DOS start-up batch file (AUTOEXEC.BAT) could cause the system to fail requiring a technical support person to physically attend to the problem.

7. Difficulties in configuring modems. Installing a modem required a lot of experience and usually needed several trials. Problems resulted mainly from S-register settings, carrier detect (CD) and data-terminal-ready (DTR) signaling, incompatible modem error correction protocols, and incompatible modem data compression schemes. This was aggravated by missing modem manuals (the modems were donated) which made the task of modem installation and troubleshooting doubly difficult.

9. Difficulties in e-mail addressing. E-mail addressing proved a constant source of problems for users. NSC node did not seem to insert proper (“From:”) headers causing problems for the recipients because many people used their reply key without much thought about whether it would direct the response to the correct address.
Hi. Finally, I can send some mail. We have just had a chat with John ...

Figure 4. An example of a misaddressed e-mail message.

Figure 4 is an example of the headers of an e-mail message received from the Network Service Center. It illustrates the problem concerning mail headers containing addresses in the wrong format. The correct return address ("From:" header) should be "Amos.Githeko@nscc.aact.kenya-net.org" rather than the Internet-format Fido address "Amos.Githeko@p3.f300.n731.z5.fidonet.org."

Using the reply key would address the reply to "Amos.Githeko@p3.f300.n731.z5.fidonet.org" which would send it to the official Internet/Fido gateway for Kenya situated in South Africa. It could also end up with GreenNet in London, UK. Because the Network Service Center did not call these zone gates, this mail would be lost.

10. Difficulties with the Fido/Internet gateway. The Internet/Fido gateway that the NSC used could not reliably handle uppercase domain names. In some cases, Internet mail systems used operating systems which automatically converted e-mail addresses into uppercase even if the user typed the address in lower case. One system known to operate in this manner was VAX. Special precautions could be taken to force such systems to use lowercase addressing and hence allow the Fido/Internet gateway to convert and transfer the
message. This problem caused frustration both on the Kenya side and to those on the Internet trying to reply to mail sent to them from Kenya.

Another problem was caused when mail received at the NSC from the Fido/Internet gateway did not have proper Fido addresses. Such mail had to be re-addressed manually, a time-consuming and intrusive process because it required that the message be opened. No satisfactory explanation was received regarding the source of this problem.

**Financial Constraints**

All the institutes involved in this study faced declining government grants and in two instances, declining support from Western agencies that had provided assistance in the past. One of the principals was explicit regarding the financial status of his institution indicating that it was in serious debt. Such pressures would be expected to lessen the likelihood that the institutes would spare any funds to develop e-mail facilities.

Mago Institute (Site 2) received government support only for the salaries of teaching staff. Priorities were established with this constraint in mind. The principal did not think the Board of Governors, who had overall power in the institution, would consider networking to be important at that time. The situation was similar at three of the four institutions visited. However, this principal emphasized several times that the ability to establish communication links, especially international or with other institutions and government offices, were crucial. He was in the process of writing proposals seeking linkages with institutions and organizations in other countries. Already there were European students on attachment (internship) at the Institute. Despite the importance of communication and information access, he did not consider these to be high enough in his priority list to warrant much financial support.
Regulatory Problems

The main regulatory barriers encountered involved the requirements set forth by the Telecommunications Corporation with regard to modem type-approval fees. The Corporation required that any modem be type-approved before it could be installed in Kenya. This approval was both expensive and slow. In addition, anyone connecting telecommunication equipment such as telephone head sets and fax units to the telephone network needed to be licensed by the Corporations or to work under a licensed supervisor. This Corporation, which was a government-owned, was the sole operator of telephone services in Kenya. There were indications, however, that trends towards a liberalized economy were taking effect in the telecommunication sector allowing competitors to offer some telecommunications-related services.

1. Regulations controlling connection of equipment to phone lines. Modem installation could be done only by a person licensed by the Telecommunications Corporation. There were very few such people available and, in order to be able to install modems, the NSC had to shelter under another company who had the Corporation’s approval. The Corporation lacked sufficient standardization to allow clients to purchase equipment that met its standards and install such equipment easily. Hardwired telephone connections were still used on the customer premises. Most international equipment used the RJ11 connectors. It was necessary to link RJ11 modem sockets with hardwired phone terminal boxes.

2. Absence of a national policy on computer networking. Dr. Musa felt that lack of supportive government and Telecommunication Corporation policies was the reason business people had been hesitant to adopt networking technology. The Corporation had not encouraged networking beyond promoting its packet switched (X.25) system and no one seemed to know the corporation’s position on technologies such as e-mail. However, there had been indication of a more positive outlook. While the researcher was carrying out this study, the Corporation published a notice allowing service bureaus to operate. These
offered telephone-related services such as fax. Government “liberalization” policies seem to be changing the situation somewhat with the increased privatization of what were previously restricted service areas monopolized by the Corporation.

3. **Modem type-approval fees.** Modems were required to be type approved by the Corporation at a cost of KSh. 3,000 (US $60) which was quite expensive considering that the modems used had been donated and hence cost little except for import duty at 20% (now reduced to 10%) and value added tax at 18% based on declared value. These costs could have been avoided too if there were letters from donors showing that the modems were donated to educational institutions. The Corporation served both as a regulatory body and a service provider.

**Skill and Motivational Problems**

1. **Low motivation of members of staff.** At Site 2, the principal reported that he found it difficult to get his staff interested in the computer they had received about a year earlier. It took a long time for staff members to take interest. In his view, the SBC coordinator still showed inadequate interest in the computer. This was despite having been sponsored to a number of training seminars. The principal was quite interested in utilizing the computer but said he no longer had time to spend on it. He thought attitudes took too long to change. He suggested that low staff motivation might be a result of the perception that there were no direct material benefits gained from trying to use the computer.

Such low motivation was not found at the other sites. Indeed, SBC Coordinators at two institutions actively expressed interest in participating in this study, but could not do so due to inadequate telephone services at their institutions. Motivation was an area difficult to observe. For example, one participating SBC coordinator said he was very interested in learning how to use the computer. However, he did not try to learn how to send e-mail messages or do anything else to suggest he was indeed interested. A possible indication of the reasons for this problem was a comment made by a member of staff at Site 2 who
remarked that they wished the researcher could be available all the time to answer queries. It seemed that there was a desire for easily accessible help while learning how to use various computer applications. The exception was Site 3 where the coordinator asked no questions about computer applications.

2. Lack of basic computer skills. The SBC head at Site 4 admitted he "did not know how to use this thing" [computer]. He was additionally preoccupied with the job he had very recently taken up as the head of the SBC and Entrepreneurship department. He may have been unhappy because the modem was installed in the adjoining Entrepreneurship Promotion Project office rather than on his office computer. His feelings were hinted at during conversations with him. Because there was no suitable telephone wiring in his office, the modem could not be installed in his office computer. He had been reluctant to follow up with the principal and get a telephone line installed in his office that could directly access outside numbers (the researcher had prepared a three-page proposal for the principal at Site 4 explaining the technology, the requirements for its use, and the related financial implications for the college). There was a prohibition on outside calls from institutional telephones making it impossible to use the SBC telephone extension for the e-mail system.

3. Inadequate performance by Network Service Center employees. The clerical staff at the Network Service Center performed inadequately. Their work habits were quite unacceptable. In one incident, it had taken a few weeks to find someone who could repair a damaged power adapter. About a week after the adapter was repaired, a NSC employee left the adapter on for too long causing it to burn out a second time. These employees were eventually replaced with better employees resulting in marked improvement in services. During the same period the NSC moved to a more spacious location. Previously, its office space had been limited to one room.

4. Inadequate systems management. Some of the computer users encountered did not keep a boot disk or have properly installed antivirus software. The researcher had to
clean out viruses on two occasions. Other precautions such as systematic data backups were not taken.

7. Lack of skilled trainers and promoters. According to Dr. Musa, people were lacking who had the expertise, resources, and desire to promote networking. In his opinion, there was a shortage of good trainers.

8. Lack of installation and maintenance technicians. At the Network Service Center, only Dr. Musa seemed experienced in installing modems and Fido software. This made it very difficult to get help and the researcher had to install the Fido points himself. Only on a few occasions was technical support provided over the telephone. The reasons for this included inability to reach Dr. Musa (when he was not in the office or when he was out of the country), defective telephone equipment at the site, or the expense of making a long distance telephone call. Because no funding was available to meet his expenses, Dr. Musa could not be expected to travel all over Kenya to install e-mail systems at the four sites. In addition, his many commitments, including travel to conferences abroad, left little time to spend with clients and train them well.

9. Inadequate user training. There were numerous calls to the Network Service Center from users requesting help with very basic procedures indicating the need for additional basic training on the use of the e-mail system. The researcher assisted in planning and implementing the NSC's first e-mail user training seminar. Previously, training had been restricted to on-site tutorials during system installation. A manual had been written by Dr. Musa because FrontDoor, being freeware, had no formal manual.

10. High level of skills required to install software. In all except one institution that participated in the study, users initially did not appear able to install software on their own. However, it was later found that people were available at these institutions or nearby who could install software if adequate instructions were provided. For example, at Site 2, there were a number of European students who had provided some foreign language versions of two software packages. At Site 3, the coordinator explained that there were people in the
nearby Ruku town who could install software. At Site 1, however, the SBC head had some software which he was unable to install. There were no people nearby who could help. The Entrepreneurship Promotion Project, which supplied the computers, had promised to install software, but ultimately, it was the researcher who installed software at four institutions on behalf of the Project. This included one institution in Nyeri which did not take part in the study.

The Fido communication software required more complex installation than ordinary applications packages and in none of these institutions was anyone found who could install it. Some of the reasons for this included the absence of a software installation manual and the need to understand computer hardware and modem configurations. This kind of skill was lacking. The researcher took a few weeks to learn how to deal with the problems that frequently occurred during the installation process. Dr. Musa explained that providing installation manuals would allow potential competitors to steal the NSC’s “trade secrets” and hence start up competing services. For this reason, he seemed reluctant to compile an installation manual.

Inadequate Decision Support Systems

According to Dr. Musa, cost-to-benefit analysis is difficult because few people have information concerning how much they spent on communication (post, fax, voice calls, driving) which would allow cost comparisons with e-mail alternatives. He felt that people would accept e-mail more easily if it was demonstrated that it could save them money.

Other Issues

The following two items were noted but are presented separately because they represent potential barriers rather than real events observed in the field. They were considered important and worthy of inclusion in this account.
1. **Institutions unable to share resources.** Dr. Musa observed that local institutions found it difficult to share facilities forcing a lot of duplication of efforts. No evidence of this was found among the technical training institutions. Willingness to share resources could be related to a desire for collaboration as opposed to competition, an issue that was mentioned in the previous section where it was noted that lack of cooperation among e-mail service providers led to convoluted routing of mail between clients served by different service providers.

2. **Lack of knowledge about the technology among policy makers.** It was reported that potential beneficiaries and policy makers were largely unaware of this technology. Karanja, Mwaniki, and Ochuodho (1992), remarked that most University staff were unaware of the existence of e-mail. This was true of people the researcher encountered in the technical training institutions but did not appear to be a barrier. However, discussions with the principals at Site 2 and at Site 4 and with a senior official at the Ministry of Technical Training headquarters revealed that a great deal of power in decision-making lay with the Boards of Governors and with the Ministry headquarters. It did not appear that there was much awareness among these powerful groups regarding the requirements for this technology and its possible utility for educational institutions.

The following section provides an analysis of user concerns with regard to the BBS and highlights the key features and trends in the Stages Of Concern Profiles obtained from an analysis of concerns data.

**Concerns of Users About the Innovation**

The data in this section was collected using an instrument developed by Hall and colleagues (Hall et al., 1979) called the Stages of Concern (SoC) Questionnaire. The instrument is designed to measure the concerns that users of an innovation have about the innovation. Hall and colleagues theorized that users' concerns are transformed through seven distinct stages as the user acquires greater and greater familiarity with the innovation.
These stages of concern are part of the Concerns-Based Adoption Model (CABM) described in some detail in Chapter 2. The SoC Questionnaire is used in the CABM as a diagnostic tool to help the change facilitator design an intervention strategy and to monitor the change brought about by the intervention.

Each participant completed a copy of the instrument at the beginning and at the end of the study. At each site, the first questionnaire was completed during the first visit to the site by the researcher. The final questionnaires were sent to the sites because it proved difficult to locate the participants after the Christmas vacations had started. These institutions normally had an eight-week Christmas vacation ostensibly to allow the them to offer short courses. In reality there was rarely any staff members present at those times.

The questionnaire had 35 Likert-like 8-point scale items consisting of seven groups of five items corresponding to the seven stages of concern in the Concerns-Based Adoption Model. The items were all listed in random order on the instrument. Analysis consisted of summing up the scores of items in each of seven groups and obtaining a percentile score for each group. According to Hall et al. (1979), this percentile score was based on:

the response of 646 individuals who completed the questionnaire in the spring of 1975. The individuals were a carefully selected stratified sample from elementary schools and higher education institutions with a range of experience with the innovation of teaming or modules (p. 26).

The percentile scores were then charted to produce the profiles that follow. The model predicts the profiles of users at different stages of familiarity with the innovation. Peaks in the profiles show the categories of concerns that were predominant for the participant. These were used to typify them. For example, a profile with one predominant peak at stage 5 (Collaboration) would be considered a Single High Collaboration Profile. Two predominant peaks at stage 4 and 5 would produce a High Collaboration and Consequence Profile.
Based on these peaks and some personal knowledge of each individual, one can interpret the profiles. According to Hall (1987), the seven stages of concern were an elaboration of three broad concerns: (a) the individual's concerns about their ability to cope with the innovation and about the benefits of using the innovation, (b) concerns about how to use the innovation, and (c) concerns about the impact of the innovation. Group scores may be obtained by calculating the mean group score for each of seven stages then determining the percentile scores and constructing profiles as explained earlier.

Figure 5 consists of profiles constructed from group results. Figures 6 to 9 are the profiles of individual participants. A discussion of these profiles is presented in the next section. However, they were characterized by high scores in the early stages and lower scores in the later stages with one exception: a distinct peak was found in each profile at stage 5 (collaboration). Hall's (1987) model could be used to predict the first feature but the second feature was unexpected.

Other noteworthy characteristics were the similarities in shape between the pre-test and the post-test profiles. For participant four, the shapes were almost identical. All that changed were the magnitudes of the scores. This was an unusual score. Participants 2 and 3 showed the greatest variation between the pre-test and the post-test profiles. It is suspected that the care with which each participant completed the questionnaire could influence results. The more conscientious participants would be expected to provide more consistency, however, there was no easy way to control this factor.
Figure 5. Combined stages of concern profiles for all participants.
Figure 6. Stages of concern profiles for participant one.

Figure 7. Stages of concern profiles for participant two.

Figure 8. Stages of concern profiles for participant three.

Figure 9. Stages of concern profiles for participant four.
Implications of the Concerns-Based Adoption Model

The Concerns-Based Adoption Model (CBAM) utilizes a number of diagnostic tools aimed at increasing the change facilitator's effectiveness. One set of tools deals with the concerns of the user. In the original CBAM research, the users were teacher trainees or practicing teachers who were involved in adopting new approaches or curricula. According to Hall and Hord (1987), the most reliable measure of concerns is the SoC Questionnaire. The SoC Questionnaire was used in this study to ascertain how user concerns about the BBS changed over the course of the study.

The SoC profiles in Figures 5 through 9 show multiple peaks. For this reason, it is impossible to offer a simple single-peak interpretation in which an individual's concerns are clearly focused on a single stage of concern. The combined profile shown in Figure 5 is typical of a nonuser. However, the peak at stage 5 was unexpected based on interpretation using the SoC user's manual (Hall et al., 1979). Some past studies (e.g., Ciccheli & Baecher, 1989), as well as current work (Kirby, 1996), were examined in addition to communications with G. E. Hall who, with others, developed the Concerns-Based Adoption Model (personal communication, August 6, 1995). This search for comparative data revealed that the peak at stage 5 was not unusual. It is interesting, however, that such peaks seem to be typical of the profiles of change facilitators or people with a coordinative role with respect to the innovation. The SBC coordinators played such a role. These differences in SoC profiles had been noted by the developers of the CBAM approach and which led to the development of a different stages of concern questionnaire for change facilitators (Hall & Rutherford, 1991). In addition to the nature of the coordinators’ work it is conjectured that the nature of the technology and cultural attributes may offer alternative explanations for the high stage 5 score. These are discussed later in this section.

Figure 10 shows the way that SoC profiles are hypothesized to progress as a user gains familiarity and confidence in the use of the innovation. Figure 11 groups the SoC Questionnaire items in relation to their associated stages of concern. It is apparent that the
pretest profile on Figure 5 corresponds closest to the nonuser profile in Figure 10 except for the differences noted above. The posttest profile in Figure 5 shows a large increase in management concerns, a smaller increase in collaboration-related concerns, and a decline in refocusing-related concerns. Concerns at the first three stages remained relatively unchanged. The posttest profiles seem to indicate that the users were still concerned about obtaining more information despite the interactions with the researcher over the course of the study. Similarly, their personal concerns did not decline. The increase in management-related concerns suggests that their concerns about how to use the innovation increased.

The decrease in refocusing concerns would seem to point at a better understanding of the innovation and possibly, a reconsideration of views held earlier about alternatives to this innovation. At the end of the study, the most intense concerns are those related to collaborating with others. Again, this is an indication that participants made progress towards becoming more familiar with this innovation despite the small number of instances in which they used the innovation. Hence, aside from the unusual peak at stage 5, the instrument used shows promise as a diagnostic tool to help identify user concerns during the implementation of an innovation such as a Bulletin Board System.

Participants had widely differing computer-related experiences, especially in relation to e-mail. For example, the innovation was successfully implemented at Site 3 (participant three) by the time the posttest was carried out. Participant one had successfully used the e-mail facility without help but this happened only on one occasion after which his telephone service was disconnected. He taught computer application packages to a group of students and had some confidence in computer use although his computer skills were not considerable. In contrast, participant four was a novice with respect to microcomputer use and interacted with the e-mail system only on a few occasions. The profiles do not seem to indicate these differences.
<table>
<thead>
<tr>
<th>Item Number</th>
<th>Stage 0: Awareness</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>I don't even know what the innovation is</td>
</tr>
<tr>
<td>12</td>
<td>I am not concerned about this innovation</td>
</tr>
<tr>
<td>21</td>
<td>I am completely occupied with other things</td>
</tr>
<tr>
<td>23</td>
<td>Although I don't know about this innovation, I am concerned about things in the area</td>
</tr>
<tr>
<td>30</td>
<td>At this time I am not interested in learning about the innovation</td>
</tr>
</tbody>
</table>

**Stage 1: Informational**

<table>
<thead>
<tr>
<th>Item Number</th>
<th>Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>I have very limited knowledge about this innovation</td>
</tr>
<tr>
<td>14</td>
<td>I would like to discuss the possibility of using the innovation</td>
</tr>
<tr>
<td>15</td>
<td>I would like to know what resources are available if we adopt this innovation</td>
</tr>
<tr>
<td>26</td>
<td>I would like to know what the use of the innovation will require in the immediate future</td>
</tr>
<tr>
<td>35</td>
<td>I would like to know how this innovation is better than what we use now</td>
</tr>
</tbody>
</table>

**Stage 2: Personal**

<table>
<thead>
<tr>
<th>Item Number</th>
<th>Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>I would like to know the effect of using the innovation on my professional status</td>
</tr>
<tr>
<td>13</td>
<td>I would like to know who will make decisions with regard to the use of the innovation</td>
</tr>
<tr>
<td>17</td>
<td>I would like to know how using the innovation will change my daily job tasks</td>
</tr>
<tr>
<td>26</td>
<td>I would like to have more information on time and energy commitments required by this innovation</td>
</tr>
<tr>
<td>33</td>
<td>I would like to know how my role in this college will change when I am using this innovation</td>
</tr>
</tbody>
</table>

**Stage 3: Management**

<table>
<thead>
<tr>
<th>Item Number</th>
<th>Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>I am concerned about not having enough time to organize myself each day</td>
</tr>
<tr>
<td>8</td>
<td>I am concerned about conflict between my interests and responsibilities</td>
</tr>
<tr>
<td>16</td>
<td>I am concerned about my inability to manage all the innovation requires</td>
</tr>
<tr>
<td>25</td>
<td>I am concerned about the time spent on non-academic problems related to the innovation</td>
</tr>
<tr>
<td>34</td>
<td>The coordination of tasks and people is taking too much of my time</td>
</tr>
</tbody>
</table>

**Stage 4: Consequences**

<table>
<thead>
<tr>
<th>Item Number</th>
<th>Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I am concerned about staff attitudes towards this innovation</td>
</tr>
<tr>
<td>11</td>
<td>I am concerned about how the innovation affects staff</td>
</tr>
<tr>
<td>19</td>
<td>I would like to evaluate the impact of the innovation on staff</td>
</tr>
<tr>
<td>24</td>
<td>I would like to excite staff about their part in using this innovation</td>
</tr>
<tr>
<td>32</td>
<td>I would like to use feedback from staff to change the use of the innovation</td>
</tr>
</tbody>
</table>

**Stage 5: Collaboration**

<table>
<thead>
<tr>
<th>Item Number</th>
<th>Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>I would like to help other staff learn how to use the innovation</td>
</tr>
<tr>
<td>10</td>
<td>I would like to develop working relationships with others using this innovation in this college and elsewhere</td>
</tr>
<tr>
<td>18</td>
<td>I would like to familiarize others with the progress in using this innovation</td>
</tr>
<tr>
<td>27</td>
<td>I would like to coordinate my efforts with others to maximize the benefits of using this innovation</td>
</tr>
<tr>
<td>29</td>
<td>I would like to know how other people use this innovation</td>
</tr>
</tbody>
</table>

**Stage 6: Refocusing**

<table>
<thead>
<tr>
<th>Item Number</th>
<th>Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>I know some other approaches that might work better</td>
</tr>
<tr>
<td>9</td>
<td>I would like to revise the use of the innovation</td>
</tr>
<tr>
<td>20</td>
<td>I would like to revise the approach to the innovation</td>
</tr>
<tr>
<td>22</td>
<td>I would like to modify the use of the innovation based on the experience of staff</td>
</tr>
<tr>
<td>31</td>
<td>I would like to determine how to supplement, enhance, or replace the innovation</td>
</tr>
</tbody>
</table>

Figure 11. Relation between the stages of concern and SoC Questionnaire items.
One of the difficulties of interpreting the SoC profiles is the lack of a consistent pattern of change. Each individual's profile changed in a different way. For example, for participant number four, all the concerns increased. Hall and Hord (1987) cautions that detailed interpretation of these profiles is difficult without special training and hence no such interpretation will be attempted here. However, some of the more easily identified changes reflect the collective trend shown in Figure 3. Participant three shows a general decline in those concerns that are associated with both the nonuser and the inexperienced user. This is expected because he attended a special e-mail training course and started to use the e-mail system (called the BBS elsewhere in this document) regularly before he completed the posttest administration of the SoC Questionnaire. It is interesting that there is very little decline in his collaboration-related concerns which suggests that these concerns are unrelated to familiarity with the e-mail system.

Participant number two, who was reported by his principal as being "very conservative" and difficult to change, showed some very large changes in profile. Informational and personal concerns declined while management, consequence, and collaboration-related concerns increased. In the posttest profile, he had a second peak for concerns about managing the innovation (stage 3) which included concerns about how to use the innovation. The general trend of these changes is predicted by Figure 10 which shows the hypothesized development of stages of concern. However, the lack of change in stage 0 (Awareness) concerns is unexpected.

Collaboration-Related Concerns (Stage 5)

For participant number one and two, the intense collaboration-related concerns especially in the posttest seems to be inconsistent with a relative lack of concern about consequences of the innovation. However, an examination of the questionnaire items shows that the consequences are specifically with regard to staff members while collaborations are with regard to "others." It is speculated that, because the technology is
designed as a communication medium, it encourages concerns about collaboration with others. It is also worth noting that all the SBCs were in one way or another involved in efforts to identify potential collaborators or other sources of assistance. This could have raised the SBC staff's sensitivity to opportunities for collaboration. The possibility of a cultural propensity for collaborative behavior has also been considered. Hence three explanations are considered: (a) that the role of a coordinator requires collaboration with others, (b) that the technology is aimed at linking people hence encourages collaboration, and (c) that cultural influences encourage greater collaborative behavior than the population used to construct the SoC percentile scale (described at the beginning of this section). Future studies will hopefully be able to shed more light on possible explanations for these high collaboration-related concerns.

Awareness-Related Concerns (Stage 0)

All the profiles have high stage 0 concerns both in the pretest and in the posttest. Because these concerns are typically high for the nonuser, high scores for awareness-related concerns seem inconsistent with the overall trend of the profiles. This is especially apparent for participants number three and two. Looked at differently, the high scores in stages 0-2 may indicate that there was little change in the concerns of participants over the course of the study. Because they interacted with the e-mail system only on a few occasions over the four months period, it would not be surprising that there would be little change in the participants' innovation-related concerns.

The profiles indicate an increase in management-related concerns which focus on the need to accommodate the innovation by allocating time for its use and its management as well as resolving conflicts of interest between the innovation and other prior commitments that participants may have had before the innovation was introduced. There is a less pronounced increase in consequence- and collaboration-related concerns. Refocusing-related concerns drop while awareness, informational, and personal concerns for the
group, remain relatively unchanged. An unequivocal interpretation of the profiles in isolation would be difficult. Some features of the SoC profiles such as the high posttest awareness-related concerns could not be explained adequately based on a simple interpretation of the profiles. However, the collective profiles seem to show individuals who are new to the innovation and who have begun to gain some familiarity with the innovation. The relatively unchanged stage 0-2 scores suggest that the participants were still concerned about the nature of the innovation and about their personal adequacy in relation to the use of the innovation.

Summary

This chapter began with a detailed account of the events over the four-month duration of fieldwork. These included site visits and experiences at the NSC and its clients. The results of analyzing the users' perception of utility based on responses to the BBS Utility Questionnaire, were presented. This was followed by a list of factors that need to be considered during implementation and of barriers to implementation. These were based on analysis of interviews, observations and reviews of related documents. Finally, Stages of Concern profiles for the four Small Business Center coordinators were provided accompanied with a discussion of the profiles' key features. The following chapter contains a discussion of these results as well conclusions, recommendations and suggested areas for further inquiry.
CHAPTER 5
DISCUSSION

This study set out to examine the process of establishing a computer bulletin board system (BBS) in Kenya. It is intended to contribute to knowledge about the factors that affect the successful implementation and acceptance of simple computer networks in Kenyan technical training institutions (TTI). This chapter contains a discussion of the findings and an outline of the conclusions. The chapter concludes with a list of recommendations and suggested areas for further study.

Factors to Consider When Implementing a BBS and Barriers to Implementation

Although the factors to be considered when implementing a BBS and the barriers to implementation were considered to be two separate areas of investigation, both are often treated in the same way in the literature and referred to as "issues." For this reason, they are discussed together.

Four categories of factors to be considered when implementing a BBS were identified based on the literature and previous experiences. The results, however, fit better when organized under nine categories of factors. For the barriers to implementation, four of the five categories identified in the literature were supported by the results and two additional categories were developed. The two categories of factors added were: (a) interpersonal and inter-organizational conflicts and (b) inadequate decision support systems.

Table 5 shows a comparison of the constraints to the implementation of information technology-related initiatives in Africa. The three reports cited in Table 5 based their conclusions on several projects. For example, Moussa and Schware (1992) did a desk review of 76 World Bank-funded computer-related projects in Africa. Although different authors use their own schemes to categorize constraints, this limited comparison demonstrates that there are some common constraints and factors. Hence, this study, despite the small number of participating institutions and individuals, does reveal constraints that are similar to those identified by a much broader analysis.
Three constraints are cited by all four reports: (a) financial constraints, (b) human resource constraints, and (c) technical problems. Although two of the reports use the term "environment," it is not used with reference to the same phenomenon. None of the reports offer a conceptual framework on which to base analysis.

Table 5
Comparison of Barriers to Implementation Reported by Different Sources

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<tbody>
<tr>
<td>Financial</td>
<td>Funding</td>
<td>Costs, marketing, and sustainability</td>
<td>Shortage of funds</td>
</tr>
<tr>
<td>constraints</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skill and</td>
<td>Human resources</td>
<td>Human resource development and training</td>
<td>Shortage of trained personnel</td>
</tr>
<tr>
<td>motivational</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>problems</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technical</td>
<td>Technology and</td>
<td>Hardware and software</td>
<td>Communication</td>
</tr>
<tr>
<td>difficulties</td>
<td>information changes</td>
<td></td>
<td>difficulties</td>
</tr>
<tr>
<td>Regulatory</td>
<td>Local environment</td>
<td>Leadership and participation</td>
<td>Absence of an enabling environment for growth of information systems</td>
</tr>
<tr>
<td>problems</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interpersonal</td>
<td>Institutional weaknesses</td>
<td></td>
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<tr>
<td>and inter-</td>
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<tr>
<td>organizational</td>
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<tr>
<td>conflicts</td>
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<td>Inadequate</td>
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<tr>
<td>decision</td>
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<tr>
<td>support systems</td>
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</table>

Note. aAAS/AAAS=African Academy of Science and American Association for the Advancement of Science. bBOSTID=Board for Science and Technology for International Development at the National Research Council.

The differences between what was expected based on a review of the literature and what was observed, serves to demonstrate that individual cases of the implementation of technology have characteristics that deviate somewhat from the general picture provided by a meta-analysis such as that done by Moussa and Schware (1992). This study differs from the literature because it deals with a specific technology implemented by a particular type of organization in one developing country. Although Dooley (1995) describes a similar case, the aim of that project was to apply a specific technology (video conferencing) as a training medium. He, therefore, considered issues such as the appropriateness of adopting an educational model from the U.S. and using it directly in Kenya. In contrast, the BBS (or
e-mail system) implemented in this study was not intended to deliver a specific service. It was conceived as a communication tool to be used by the participants as they wished. Possible uses were certainly constrained by the limitations of the system and by the user's knowledge and skills. The way in which a technology is used will alter the list of factors to be considered and probably introduce additional potential constraints to implementation.

**Mode of Intervention**

One noteworthy observation made by Dooley (1995) relates to the relationship between the institution where the program designers and instructors were situated, and the two sites in Africa where training was carried out. He observed that it was "not going to be a canned program 'sent' to Africa, but a collaborative, interactive discussion on items that were of interest to both parties" (p. 102). This indicates the importance of recognizing the various modes of intervention. Krippendorff's (1987) paradigms for communication and development, reviewed in Chapter 2, serve well to differentiate these modes. Krippendorff's approach is not unique in differentiating modes of intervention. Others such as Lippitt and Lippitt (1986) have expressed similar thoughts though they focused on the consulting process. Rogers' (1995) more recent emphasis on a "convergence model" as opposed to a "linear model" of communication reflects a shift from Krippendorff's control paradigm to a network-convergence paradigm. If there were similar trends in the communication models on which diffusion research is based, then we can conjecture an increasing emphasis on the information-seeking paradigm. It is relevant to ask how the change facilitator determines his or her mode of intervention. Such intervention could vary along a continuum with a directive approach on one extreme and a passive observer approach on the other extreme. The results of this study provided insight regarding how the change facilitator's style of intervention may be influenced by the client.
Nature of Conflicts

Conflicts served to discourage cooperation. For example, inter-organizational conflict between the NSC and other e-mail service providers seems to go beyond competitive rivalry. It took on a personal vendetta between the people heading these organizations. Such hostility precluded the possibility of cooperative leasing of a dedicated line that would allow full Internet services to be offered within Kenya at relatively low expense due to the shared cost.

At Govi where the principal and the SBC coordinator had some serious differences, the conflict seemed a long standing situation that existed before this study begun. Based on conversation with both parties, it appeared that differences arose because the coordinator desired greater autonomy for the SBC and may have had difficulty referring every matter to the principal. As a result, the principal may have felt that the coordinator was not forthright in all matters related to SBC operations and on occasion found it necessary to report his misgivings to the Entrepreneurship Promotion Project which oversaw the implementation of SBCs. This was in contrast to the Ruku and Mago Institutes where no such mutual suspicions were observed between the SBC coordinators and the principals.

These conflicts indicate the need to encourage a more professional administrative style where an effort is made to avoid what appears to be power struggles or struggles for control. Absence of conflict may not necessarily be a positive sign because such absence could indicate a lack of initiative to define and attain goals within institutional units and departments such as SBCs. The challenge is to harmonize departmental goals and institutional goals without either of them trying to take unconditional precedence over the other. Part of this harmonization could be achieved by creating what Senge (1990) called "shared visions" discussed later in this chapter.

There is a close relationship between the barriers to implementation (such as conflicts) and the factors to be considered during implementation. The former seems to be a subset of the latter. Innovation attributes such as complexity and trialability may be related to how
potential users perceive the innovations (Rogers, 1995), but no attempt was made here to study the effects that these attributes had on the adoption process. However, this provides an avenue for further research.

The overriding factor in these results is the part played by individuals and the effects of organizational practices and policies. In each of the six categories of barriers identified, there are human factors related to philosophical outlook, skill and motivation, planning systems, and priority setting. Organizational weaknesses are key to the problems related to telephone services because telecommunications was controlled by one corporation making it easy to assign blame for poor telephone services. It is not clear why this corporation was unable to improve services or why they continue to impose regulations that seemed to serve little purpose. The scope of this study does not allow deeper analysis of many of these issues but as indicated earlier, the results serve to identify areas that invite further inquiry.

**Perception of BBS Utility**

Perception of utility was included as a dimension of inquiry because adoption decisions depend on the benefits that the innovation provides the prospective user. It is difficult to justify the adoption of an innovation in educational institutions unless concrete benefits are gained from its use. This study examined changes in users' perceptions of utility of the BBS (or e-mail system) during the adoption process. It was expected that the participants would perceive greater utility as they learned more about the innovation. The results did not conform to these expectations. Instead, there was little change in the reported perceptions in relation to the job tasks listed in Table 3. A further comparison between the acceptance of the innovation at the technical training institutes and the way it was received by NSC clients in the private sector shows a distinct difference. The NSC clients were much more enthusiastic and learned to use the system very rapidly. Their interest and enthusiasm was partly because of the cost saving achieved by using e-mail rather than fax. In a number of instances, overseas collaborators and funding agencies strongly suggested e-mail as the communication system of choice. These private sector
organizations were already using voice calls or fax as means of communication. E-mail was presented to them as an advantageous alternative.

Why did the NSC clients respond more enthusiastically than the users at the four technical institutes? It appeared they had greater interest and a stronger drive toward the achievement of specific results in their organizations and had specific communication needs. Decision-making in these organizations seemed faster and the cost of the e-mail service was not a major barrier. These organizations and individuals regularly used computers and, in some cases, had a modem installed. Because the study did not examine organizational structure, operation, and culture, these results raise a number of questions that invite further inquiry.

Two of the technical institute principals were concerned about cost and the need to justify any substantial expenditures to their Board of Governors. The Mago Institute principal was convinced that e-mail, like fax, would be very useful but he indicated that these items were not high on their priority list due largely to the institute's financial constraints. Thus, while the institutes were worried about how much the technology would cost, the NSC clients were excited about how much they could save in telecommunication costs. The comments made by the SBC coordinator at Govi show that he assessed the benefits of the technology in terms of who he could contact through e-mail.

The Govi SBC coordinator's comments suggest that there exists what we might call "communication domains," which are those subsets of the community with which the user (the coordinator in this instance) wants to communicate. These communication domains provide links for professional involvement, job, family relationships, or business interests. Within each domain, users would have a homophilous relationship (Rogers, 1995) with domain members (i.e., a horizontal relationship with people of similar social stature, education, professional affiliation, and so on). There could also be vertical relationships (heterophilous) with those of higher or lower position in a hierarchy such as an organizational structure, age group structures common in African cultures, or expertise.
level in a novice-expert continuum. If the technology involved here does not facilitate communication within such communication domains, it seems unlikely that the potential user of the technology would see much benefit in adopting the technology.

As indicated earlier in this section, the users’ perception of the utility of the BBS showed little change over the course of the study. Due to the small number of individuals involved in this study, no statistical conclusions can be drawn though the results offer useful indicators. The lack of change could be explained in at least two ways. One is that the users (or potential users) acquired a "mental model" of the technology during the initial encounter at the beginning of the study. During this first encounter, they may have made conclusions regarding how useful the technology was with respect to the job tasks listed in the BBS Utility Questionnaire. Further experience with the technology may not have changed their mental models or added new insight or knowledge about the innovation that could substantially alter their perception of utility. The other possible explanation is that the instrument used was inadequate in ascertaining this change. Perception its utility may indeed be viewed as a component of the user’s (or potential user’s) mental model of the technology. Based on these results, it is now thought that a Likert-like scale in which respondents indicated a "utility score" for each job task, may be more effective in revealing change in perception. Additionally, recording changes in mental models may offer new insight regarding changes in user perception of the technology over time. Again, this offers opportunities for further inquiry.

**User Concerns About the Innovation**

The Stages of Concern profiles identified a slight change in the users’ concerns about the innovation. Collectively, the participants’ higher-level concerns seemed to increase (except for stage 6 concerns). These results suggest that substantial change in user concerns may take much longer than four months or require much greater interaction with the technology and with change facilitators. An unexpected peak in stage 5 (collaboration) could not be adequately explained. Studies cited earlier show that this feature is not
unusual but do not offer sufficient explanation regarding why it occurs. There are three possible influences that may contribute to unusually high collaboration-related concerns: (a) the nature of the participants' jobs (they were coordinators); (b) the nature of the technology (its purpose was to assist communication); and (c) a possible cultural propensity towards greater collaboration. Further study is required to explain this phenomenon.

**Participant Observer Effect**

The following discussion is a comparison between what was considered the normal, typical, or natural process of implementing e-mail by NSC clients and the procedure adopted in this study. Some ways in which the researcher's presence may have influenced the SBC and institutional staff's behavior towards the technology are outlined.

Table 6 illustrates the differences in the natural process of implementing e-mail among NSC clients and the procedure adopted in this study. Some of the differences were: (a) The SBCs were informed about e-mail by the researcher and the initiative to implement e-mail did not originate within the institutions unlike other NSC clients who had their own internal needs took the initiative to approach the NSC; (b) services were available free during the study including the provision of a modem; (c) the researcher acted a roving consultant during the duration of the field work and assisted with computer-related problems of all kinds without charge; and (d) no attempt was made to advocate the adoption of the technology by the SBCs in contrast to the strong advocacy position taken when dealing with other NSC clients.
Table 6

Comparison Between Natural Process of Implementing E-mail With the Procedure Adopted in This Study

<table>
<thead>
<tr>
<th>Natural Process of Implementing E-mail at the NSC</th>
<th>Implementation Procedure Adopted in this Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Potential clients got to know about e-mail or the Internet through experience at a University abroad, through the media, by attending promotional events, or by word of mouth.</td>
<td>The researcher contacted technical training institution principals and SBC coordinators to explain the research study and request them to participate.</td>
</tr>
<tr>
<td>2 Potential clients discovered that e-mail services were available in Kenya (e.g., from the NSC).</td>
<td>Follow-up calls were made to answer queries regarding the role they would play and any commitments they would be required to make such as providing access to a telephone and computer.</td>
</tr>
<tr>
<td>3 They contacted the NSC to inquire about services available, technical requirements, and cost.</td>
<td>Of five institutions that were interested and who met the technical requirements, four were selected to participate. Site visits were scheduled.</td>
</tr>
<tr>
<td>4 Potential clients decided to acquire the service. A visit to the client’s premises was scheduled. Sometimes the NSC technician make a prior visit to install a connecting point for the modem.</td>
<td>Site visits were conducted during which an attempt was made to install and test the modem and software. If the attempt was unsuccessful, another visit was scheduled.</td>
</tr>
<tr>
<td>5 During the site visit, the NSC installation engineer would install and test the modem and software (FrontDoor) then train the client on the basics of using the system. A user guide containing a FrontDoor tutorial was provided.</td>
<td>Where installation was successful. SBC staff were shown the basic functions and requested to test the system by sending e-mail.</td>
</tr>
<tr>
<td>6 The client was requested to test the system and request help if required. More advanced training was offered at the NSC’s e-mail seminars.</td>
<td>Further site visits were made to solve technical problems and make observations.</td>
</tr>
<tr>
<td>7 Client requests for help were responded to by telephone or a site visit if necessary.</td>
<td>The e-mail service was provided free for the duration of the study with the option to subscribe at the end of the research project.</td>
</tr>
<tr>
<td>8 The NSC billed the client for installation, monthly service fee, modem rental (if a modem was supplied on rental), and per-kilobyte internal mail traffic (local mail was free).</td>
<td>One institute sent their SBC staff to a NSC seminar after the end of the field work for this study. They successfully used e-mail on their own. This was considered a successful implementation.</td>
</tr>
<tr>
<td>9 Some clients attended the NSC’s e-mail seminars to improve on their skills.</td>
<td></td>
</tr>
</tbody>
</table>

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This brief analysis indicates that participants in this study had the opportunity to learn about e-mail and to try it out at no cost. However, this advantage did not appear to influence them to implement the technology, because only one out of the four institutions successfully implemented e-mail.

It would appear at first sight that the researcher had little effect on the attitude of SBC staff towards the technology beyond awareness creation. There was a range of levels of interest among participants. Some appeared relatively disinterested and made little attempt to try sending e-mail despite successful installation of the e-mail system. In contrast, Ruku institute eventually succeeded in implementing e-mail despite the serious technical difficulties experienced at that site (Site 3). A case may be made for the existence of an important variable which could be called internal motivation. This would account for the existence of a strong drive to implement e-mail as a way to solve some institutional problem or meet a felt need. Evidence of situation of this nature existed at Ruku where they reported having unsuccessfully attempted to communicate with modem.

In considering the possible influence of the researcher’s presence may have had on the participant’s behavior, it would be useful to outline the possible ways in which the researcher could affect participant’s behavior. According to Rogers (1995) 49% to 87% of the variance in the rate of adoption of an innovation is explained by five attributes: (a) relative advantage over competing ideas practices or products; (b) compatibility with existing systems and future desires of the adopter; (c) complexity; (d) trialability (opportunity for limited trials); and (e) observability (ease of observing results). Other variables include: (a) the type of innovation-decision (e.g., individual, collective/organizational); (b) the nature of the communication channels diffusing the innovation at various stages in the innovation-decision process (e.g., mass media or interpersonal); (c) the nature of the social system in which the innovation is diffusing (e.g., its norms, degree of network interconnectedness); and (d) the extent of the change agent’s promotional efforts in diffusing the innovation. It is pointed out that it is the perception of
attributes that has influence rather than attributes as classified by experts or change agents. This framework may be adopted in this study to consider ways in which the researcher may have influenced the outcomes of the study.

Did the researcher influence the perceived relative advantage, compatibility, complexity, trialability, and observability? Because the researcher was the exclusive source of information regarding the innovation there seems little doubt that he would influence the perceived complexity, relative advantage, and compatibility of the technology. For example at Mago, the principal indicated during an interview with the researcher that the institute was considering purchasing a fax machine due to the opportunities for communication that it offered. During this interview, the researcher explained to the principal that a fax/modem card in their microcomputer could offer them fax facilities at a much lower cost than purchasing a fax machine (KSh. 4,000 for a fax/modem card compared with about KSh. 50,000 for a fax machine). Despite this advantage, the principal did not appear interested in pursuing the cheaper option. It could be speculated that he viewed it a more complex and less compatible technology than the fax machine. It is likely that the way e-mail and fax-via-computer technology was presented made it appear complex and less compatible to the principle vision and value system. The researcher may not have had as great a social status in the principal’s eyes as other (more successful) principals and agencies who advocated the use of fax machines. Fax may have appeared less experimental because one could walk into a store and purchase fax machine while e-mail which required more complex hardware, software, and computer skills, was not similarly accessible. It is interesting that Ruku Institute where the Mago principal encountered the use of a fax machine, was the one site where e-mail was successfully implemented, indicating that they recognized the potential for the technology and hence probably faced fewer perceptual barriers. Further inquiry would be required to ascertain the nature of these variables on the adoption decision process for this technology.
Although this analysis is speculative, it may be concluded that the way a technology is presented to a potential adopter may be a determining influence on the decision to adopt that technology. The five attributes outlined could serve as variables to gauge the likely impact of interventions such as promotional events. Because it is the potential adopter's perception that counts, it would seem imperative to develop ways to ascertain such perceptions. Also indicated is the potential influence of the change agent's or change facilitator's status in the eyes of the adopters because the extent of his or her impact on adopter perceptions may hinge on agents perceived status.

**Innovation Champions and Facilitators**

The successful implementation of e-mail at Ruku institute is attributed to the interest the principals had in the technology and in the presence of an American professor at the institute. The professor appears to have taken on the role of an innovation champion by offering to contact the NSC and have them install the e-mail system. Rogers (1995) adopts the view of an innovation champion as a "charismatic individual" (Howell & Higgins, 1990) who is able to use their influence to overcome indifference or resistance to an innovation within an organization.

The researcher, by easing access to the technology and providing and opportunity to try it out, played a similar role despite the effort to avoid an advocacy position. However, the champion is more often seen as a powerful individual within the organization. It would appear that the facilitator's role may be as important. There is a difference in approach that Krippendorff's (1987) development paradigms, discussed in Chapter 2, serve to illustrate. The facilitator fits the network-convergence and information-seeking paradigms while the change agent role seems to match the control paradigm. The researcher deliberately took on a facilitative approach in which stress was placed on responding to the adopter's needs rather than advocating for a specific course of action. A facilitative approach would be more likely to have the same impact as that of an innovation champion where the adopter
had a clear vision of their goals and an insight in the ways in which the technology could assist in the attainment of these goals.

Obviously, a facilitator, by virtue of serving as the link between the client system (institution) and the resources (services, technology, knowledge base) plays a role and has influence on the course of the implementation (or adoption) process. Assuming the adopter had the desire to implement the innovation, removing the facilitator would delay the implementation because the adopter would need to locate a new facilitator. If the adopter had no clear vision of their goals with respect to the technology and no strong desire to adopt it, then it would seem that removing the facilitator would end the innovation adoption process. However, because such an adopter was already aware of the technology, they would be expected to be more receptive to further information than individuals with no prior encounter with the technology.

Role of Vision

How does internal motivation develop? The result of this study indicate that a strong need for external communications with people and organizations situated long distances away served as a motivation to try out the technology. The case of Ruku is an example of this situation. The technology becomes a means to an end or goal. This section examines the role of such goals and the vision that motivates the generation of such goals.

Senge (1990) presents a technology of learning organizations in which an ensemble of five disciplines is the core requirement to creating such an organization. One of these disciplines is the requirement for shared vision (as opposed to personal or enforced vision statements). He conceives of shared vision as shared “pictures of the future.” Such a vision becomes an important part of leadership in an organization and a source of goals, values, and missions which serve to “bind people together around a common identity and sense of destiny” (p. 9). Pursuit of these goals and mission would necessitate the mobilization of the resources required to attain the goals. Such a model elevates the
importance of vision and goals above the instruments used to attain such goals. Adopting this view would place barriers such as a lack of clear institutional goals and motivation above financial constraints and skills inadequacies.

Such a view would seem to be supported by the results of this study. The Govi Institute SBC for example, was among the most active of those observed yet the institute had the severest financial constraints. The SBC coordinator appeared to have a clear vision of the role of the SBC in the Govi area and was strongly motivated to investigate all manner of options to obtain the resources required to achieve his vision. Though the e-mail system at Govi fell into disuse because the telephone service was disconnected, the coordinator seemed capable of reviving it if it offered an opportunity to communicate with those he wanted to reach (development and funding agencies).

It can be argued that without a vision of the future, whatever resources were available would be haphazardly consumed while in the presence of clear goals, not only would resources be allocated in proportion to the importance of each goal but there would be greater motivation to seek additional resources. For the technical training institutes however, such a vision would be difficult to construct without an insight into the technology and its potential applications. For this reason, in the initial stages, information, explanations, and demonstrations of the technology would seem the most crucial requirement. This was the view of the small enterprise development agency executives who met at the NSC to share their views regarding the potential for information technology applications in small enterprise development. It is hardly surprising that both Rogers (1995) innovation-decision process and the Concerns-Based Adoption Model (Hall et al., 1973) place acquisition of knowledge and information at the first stages of the process of adoption. Appendix H contains a suggested strategy for facilitating the adoption of e-mail and other network applications in technical training institutions in Kenya.
Conclusions

Based on the results of this study the following conclusions are made:

1. User's perceptions of the utility of a technology appear to change very slowly, if at all, over the course of the implementation. Based on the results in this study, it is believed that the apparent lack of change resulted from: (a) few opportunities to use the technology, (a) a strong influence of the initial concepts or mental models formed at the first encounter with the technology which changed little over the course of the study, or (c) weaknesses of the instrument used to measure change in perception of utility.

2. Motivation and leadership seem to be important influences in the implementation process. It appears that the greater motivation and leadership in the private sector organizations and research labs helped them adopt the technology more easily than the technical training institutions. The differences between the two kinds of organizations may be attributed to differences in their organizational culture.

3. The barriers to implementation identified in this study are a subset of the group of factors that need to be considered during implementation. These barriers are dynamic and are likely to change over time and from one case to another. For example, at the time the fieldwork for this study was done, e-mail service providers did not cooperate with each other, but this situation improved some time after the study was completed.

4. Weak telephone services are a major hindrance in any attempt to implement this technology. The aspects of these services that impacted the implementation process included: the quality of phone connections (high noise levels), relatively low reliability of connections, the high cost and long wait time for new installations, questionable ethics of some Telecommunications Corporation employees, lack of standardization of equipment, regulations that hindered use of telephone services, and the slow or ineffective maintenance services, especially in rural areas. The majority of these problems could be related to management weaknesses at the Corporation.
5. Considering the technical problems encountered in this study, there is need for effective support services such as information provision, repair, training, and general maintenance in order for facilitate the application of information technology to solve or alleviate institutional problems. Hardware breakdown is a major problem and such hardware may lie idle for years due to the lack of suitable software, training, or support.

6. A broader conception of what constitutes the innovation or the technology is required. This would lead to more realistic cost estimates at various phases of implementation including equipment and software costs, installation of equipment and software, user training (seen here as a process rather than one-shot training event), computer stationery supplies, security, technical support, and site preparation.

7. The tools provided by the Concerns-Based Adoption Model were valuable. They enabled the preparation of Stages of Concern Profiles. These profiles indicate that the participants were non-users with respect to this technology seem to show that there was little change in user status over the course of the study. This conclusion is supported by the lack of change in perception of utility of the technology over the duration of the study. These results also indicate that it may take much longer than four months for people to progress from the non-user stage to become experienced or renewing users (see Figure 10). Although the Concerns-Based Adoption Model and its associated tools can be a useful analysis device for the facilitator, it is doubtful whether the Stage of Concern analysis is useful in isolation because it provides information only about general stages of concern but not about specific concerns and skill needs.

Recommendations

Based on the results presented in this study, the following recommendations are made:

1. **Promotion of networking.** There is a need for greater promotion of networking. Judging from the reactions of private sector organizations, there are substantial cost savings to be gained from using computer-based communication (e-mail, file transfer, e-mail-to-fax...
Many who could gain from the technology are unaware of its potential. This includes key decision makers in government and in educational institutions. Network service providers could take a lead in this effort with the assistance of government departments, interested NGOs, as well as multilateral and bilateral agencies.

2. **Staff motivation.** Unlike the private sector organizations cited in this study, staff at technical training institutions did not seem excited about the technology. For this reason, if such institutions decide to adopt the technology, they may have to find ways to motivate their staff. Some non-material incentives include greater power in decision-making, internal promotions, and freedom to find innovative uses of the technology. Some staff members may also require help in identifying the strategic value of new skills for the development of their careers.

3. **Telecommunication services.** The state of telecommunications need to improved by paying greater attention to client needs and possibly ending the monopoly in the provision of telephone services. Based on the results of this study, the following were areas that require attention: (a) high costs of a new telephone installation; (b) lengthy wait period for a telephone line sometimes lasting years; (c) frequent breakdown of services; (d) slow or ineffective maintenance services; (e) noisy lines unable to provide enhanced services such as data communication; (f) lack of a clear policy on e-mail and other networking services that use the telephone network as a data transport medium; and (g) low speed capability of the packet switched network.

4. **Cooperation between network service providers.** The Ministry of Research Technical Training and Technology is in a position to influence service providers and encourage them to cooperate in developing infrastructure and various networking systems for the country. Without such cooperation, each will expend resources to set up independent networks and eventually, a great deal of effort will be needed to harmonize these disparate systems in order to create an integrated national network. The Ministry
needs to encourage providers to work together, possibly by appointing a neutral third party to facilitate this cooperation.

5. **Technology assessment**: Few technical training institutions have the expertise to adequately determine their computing needs and specify their requirements. A technology assessment service is required to: (a) collect information on new technologies and provide a basis for assessing the technology; (b) provide end users the tools to make their own assessment; (c) help in estimating the cost of implementing new technologies including hardware, software, training, supplies, maintenance and technical support, and site preparation; (d) provide help in accessing low-cost software such as shareware possibly by maintaining an archive of such software; and (e) assist institutions in planning for productive use of computer facilities.

6. **Developing computing and communication facilities**: At the institutional level, help is required to ensure that supply contracts have explicit maintenance clauses, manuals are supplied for all hardware and software, and that adequate installation assistance or instructions are provided. There is a need for much greater care in introducing information technology applications including: (a) a realistic costing (maintenance, technical support, site preparation, & training); (b) need for the training of users and support staff; and (c) help in utilizing the technology by using it to assist in various aspects of institute operation such as administrative record-keeping (students & staff records), preparation of instructional materials, and the provision of computer-related services to internal and external customers.

7. **Training**: The results of this study indicate that most of the SBC coordinators did not have sufficient computer skills to adequately use their computer facilities. Because sufficient training is probably the most effective way to ensure that the technology is used productively, delivery of such training, both to technical training institution staff and to the network service providers' staff, is essential. Help is also required in planning and
managing training including conducting training needs assessment, designing instructional materials, financing training programs, training of trainers, and evaluating training.

8. **Facilitators.** This study is most relevant to the change facilitator. Change agents should plan thoroughly and visit project site so that they can: (a) work closely with people and ensure that they have a genuine interest in the innovation; (b) help assess their training needs; and (c) address their facility needs. Judging from the results of this study, the Stages of Concern Questionnaire can be used to help assess potential user training needs by providing information about their concerns with respect to the technology.

9. **Security.** Due to the growing security risks, measures need to be taken to reduce the possibility of theft. This may involve the use of alarm systems or the fastening equipment to furniture in such a way that makes it very difficult to remove. Staff should also be aware of the need to take routine measures that would make it more difficult to remove equipment. In this respect, it is better to use internal modems rather than external modems. In addition to being more difficult to remove, internal modems are cheaper and do not require external power supplies, which makes them more suitable for Kenyan conditions. In addition, adequate insurance would minimize losses arising from theft or damage of equipment while regular data backup would prevent potentially devastating loss of critical data.

Appendix H provides a suggested strategy to facilitate adoption of e-mail and other network technologies among small enterprises and small enterprise development agencies.

**Suggestions for Further Research**

The results of this study indicated that there are several areas that invite further inquiry. The following suggested areas for further research are stated in the form of research questions or problem statements:

1. Why do individuals with similar backgrounds (education, age, occupation) seem to respond in ways that vary widely with respect to innovations. Some respond faster and with greater interest. Some will acquire related skills (e.g. computer applications skills)
substantially faster than others in a similar environment. What factors are responsible for this? Do the same individuals respond similarly to different innovations or is the response a function of the innovation. Can "innovators" (Rogers, 1995) with respect to one innovation be "laggards" in relation to another technology or innovation?

2. How does organizational culture influence how different organizations respond to innovations (some slow and unmotivated, some fast-moving and enthusiastic)?

3. What preparation do Small Business Centers and Technical Training Institutions (SBC/TTI) staff need in order to take advantage of the information technology?

4. What are the informational needs of SBCs/TTIs?

5. How do mental models of computing and communication systems influence the acquisition of computer skills or other information technology-related skills?

6. What are SBCs' experiences in trying to use their microcomputers? What tangible benefits have accrued? What problems have been encountered? How have others in Kenya and elsewhere introduced computers into similar institutions for optimal benefits (shared experiences, lessons to be learned)?

7. How can SBCs use information technology to provide sustainable community services? How have others in Kenya and elsewhere implemented such services (shared experiences, lessons to be learned)?

8. What is the status of telecommunication services in Kenya? What are the key problems and their possible solutions? Some specific concerns include the variables of service quality such as telephone installation speed and quality, noisiness of lines, cost, and reliability in terms of percentage of the time a line is down. Other concerns are the organizational effectiveness of the telecommunications service provider and related government policy for instance, liberalization of telecommunication services.

9. What is the status of information, technology, and information technology policy development in Kenya?
10. What guiding principles should technology policy (especially information technology) be based on? How is technology related to development? What models are used as a basis for national or institutional technology policy development? What models are available to aid such policy formulation? What case studies exist to serve as a starting point to technology policy formulation? What lessons can be learned from nations that have implemented such policies?

11. Why is there so little change in the user’s perception of utility of network applications such as e-mail? How does instrument design affect how well this change is recorded? What influences users’ (and potential users’) perception of utility of network applications?

12. Why does the Stages of Concern Questionnaire show a peak at the Collaboration Stage (Stage 5) even for non-users? Is it due to questionnaire design, cultural influences, type of technology, or job responsibilities?

13. What are the approaches to planning within SBCs and TTIs? How can the planning be made to assist growth and development and to focus more on freeing institutions from dependency and paralyzing financial constraints? What are the experiences of others across the globe in the development, management, and expansion of similar institutions?

14. How do individuals’ communication patterns influence the nature and intensity of their interactions with others and consequently, of their adoption behavior with respect to information technology innovations?

Summary

This chapter presented a discussion of the results. An analysis of other studies and reports that deal with the same problem indicate that financial constraints, human resource constraints, and technical problems are common barriers across Africa. The facilitator’s or change agent’s mode of intervention which could vary along a continuum with a directive
approach on one extreme and a passive observer approach on the other extreme, is highlighted. The results of this study provided insight regarding how the change facilitator's style of intervention may be influenced by the client's needs.

Reflection on conflicts and their consequences leads to a conclusion that there is need to encourage a more professional administrative style where an effort is made to avoid what appears to be power struggles or struggles for control. However, the absence of conflict, rather than being a positive sign, may indicate a lack of initiatives to define and attain goals within institutional units and departments such as SBCs.

The overriding factor in these results is the part played by individuals and the effects of organizational practices and policies. In each of the six categories of barriers identified, there are human factors related to philosophical outlook, skill and motivation, planning systems, and priority setting. Organizational weaknesses are key to the problems related to telephone services because telecommunications was controlled by one corporation making it easy to assign blame for poor telephone services.

User concerns regarding the innovation changed very little over the course of the study. This could be explained in at least two ways. One is that, during the initial encounter with the technology, the users (or potential users) acquired a "mental model" of the technology and this model failed to change. Alternatively, the instrument used may have been inadequate in measuring this change. These results suggest that substantial change in user concerns may take much longer than four months or require much greater interaction with the technology and with change facilitators.

Summary of Conclusions

1. User's perceptions of the utility of a technology appears to change very slowly if at all over the course of the implementation.

2. Motivation and leadership seem to be important influences in the implementation process.
4. Weak telephone services are a major hindrance in any attempt to implement this technology.

5. There is need for effective support services such as information provision, repair, training, and general maintenance in order to facilitate the application of information technology.

7. The tools provided by the Concerns-Based Adoption Model were valuable in identifying the status of users in relation to the technology.

Summary of Recommendations

1. There's a need to promote the technology among potential beneficiaries.

2. Institutional staff need to be motivated in order to be able to overcome the challenges of adopting the technology.

3. There is need to improve the reliability and maintenance effectiveness of telephone services.

4. To develop a national integrated computer network, service providers would need to cooperate with each other and with relevant government and private sector agencies.

5. There is need for realistic costing of projects to avoid the situation where expensive installations fall into disuse because there are insufficient funds to maintain them or because staff are inadequately prepared to fully utilize the facilities.

6. Training is required to prepare people to take advantage of the technology.

7. Facilitators are needed to assist new users overcome the hurdles that inevitably face new adopters of such technologies.

8. Security measures will be required to avoid loss through theft of equipment and materials.

Several suggested areas for further inquiry are provided including: (a) how organizational culture, mental models, and individual attributes affect the implementation process; (b) informational and training needs of technical training institutions with respect to the technology; (c) the status of information and telecommunication services in Kenya.
and (d) principles and strategies that can lead to an effective information technology policy in Kenya.
REFERENCES


gopher://gopher.psg.com /Networking computers/FidoNet/FTS-0001 The Basic 
FidoNet Standard (v15).
*Byte*, 150.
Publishing Corporation.
between the U.S. and selected African countries. *International Journal of Educational 
Telecommunications, 1*(1), 93-104.
moral directive: Population growth, family ties, and the maintenance of community 
among the Old Order Amish. *Rural Sociology, 45*, 49-68.
the future*. Westport, CT: Greenwood Press.
in Kenya: Barriers and user concerns*. Ph.D. Thesis, University of Illinois at Urbana-
Champaign.
NY: State University of New York Press.
about the innovation: A manual for use of the SoC questionnaire*. Austin, TX: 
University of Texas.
conceptualization of the adoption process within educational institutions*. Austin, TX: 
Texas University, Research and Development Center for Teacher Education.


APPENDIX A

DOCUMENT REVIEW, INFORMAL INTERVIEWS, AND OBSERVATIONS GUIDE
DOCUMENT REVIEW, INFORMAL INTERVIEWS, AND OBSERVATIONS GUIDE

The document review was intended to help identify and describe factors that need to be considered in implementing a BBS and the barriers to implementation. The classification scheme below was drawn from a preliminary review of the literature. The scheme was used to guide the review as well as the on-site observations, and informal interviews of research participants.

TENTATIVE SCHEME FOR CLASSIFYING FACTORS AND BARRIERS

A Effects of government (and government corporation) policy or lack of policy

- import duty on computers and telecommunication equipment
- licensing of modems
- state security concerns
- lack of facilitative IT policy

B Institutional readiness for the innovation

- staff motivation and interest
- institutional leadership
- presence of innovative "champions" to lead innovation
- financial support
- staff's computer-related knowledge and skills
- availability of computer hardware, software, and related accessories
- access to a telephone line
- perception of need for the innovation
- time available for innovation implementation

C Availability of expertise (awareness about, accessibility, cost, effectiveness)

- availability of BBS operators
- availability of trainers for BBS use
- availability of technical support for BBS users
- availability of technical assistance with installation of user's equipment
- hardware and software assessment information (expert reviews)

D Telecommunication and related infrastructure

- access to telephone service
- type of telephone exchange
- data transmission speed
- speed of line installation
- cost of installation and use of telephone service
- telephone tariff structures

E Barriers and Problems during implementation

- lack of administrative support
- technical difficulties
- financial constraints
- regulatory problems
- staff reluctance or inability
BBS OPERATOR’S INTERVIEW GUIDE

BBS Name: ________________________________________________

Location: ______________________ Telephone number: ________

1. Please explain how the BBS started
   e.g., • who started it, their background
         • when was it started
         • why was it started
         • where did support come from
         • what facilities and equipment then and now
         • problems encountered

2. What factors need to be considered in setting up a BBS?
   e.g., • funding
         • expertise
         • clients
         • hardware/software
         • telecommunication
         • time
         • regulations or laws
         • security of data, software, and equipment
         • training

   Refer also to categories of factors derived from the literature.

3. What factors would you consider to determine whether a BBS was functioning
   successfully? What would you expect to see?
   e.g., • equipment installation
         • software installation
         • management and operation
         • financial viability
         • client support
         • nature of services
         • down time
         • user training
         • preparation for the future (expansion plans)
         • ease of use
         • frequency of use
APPENDIX C

STAGES OF CONCERN QUESTIONNAIRE

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STAGES OF CONCERN QUESTIONNAIRE

Your Name: __________________________________________________________

Name of College: ______________________________________________________

Your Department: ____________________________ Date: ________________

The purpose of this questionnaire is to determine what people who are using or
tinking of using computers for networking are concerned about at various times during the
novation adoption process. The items were developed from typical responses of school
and college teachers who ranged from no knowledge at all about various innovations to
many years experience in using them. Therefore a good part of the items on this
questionnaire may appear irrelevant to you at this time. For the completely irrelevant items,
please circle “0” on the scale of 0 to 7. Other items will represent those concerns you do
have, in varying degrees of intensity, and should be marked higher on the scale.

For example:

This statement is very true of me at this time. 0 1 2 3 4 5 6 (7)
This statement is somewhat true of me now. 0 1 2 3 (4) 5 6 7
This statement is not at all true of me at this time. 0 1 2 3 4 5 6 7
This statement seems irrelevant to me. 0 1 2 3 4 5 6 7

Please respond to the items in terms of your present concerns, or how you feel about
your involvement or potential involvement with COMPUTER NETWORKING
USING AN ELECTRONIC BULLETIN BOARD SERVICE (BBS).

I do not hold to any one definition of this innovation, so please think of it in terms of
your own perceptions of what it involves. Remember to respond to each item in terms of
your present concerns about your involvement or potential involvement with the above
tamed innovation.

Thank you very much for taking time to complete this task.
The following statements refer to the kinds of concerns you may have. Please circle one choice per statement.

<table>
<thead>
<tr>
<th></th>
<th>I am concerned about staff attitudes towards this innovation</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I know some other approaches that might work better</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>I don't even know what the innovation is</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>I am concerned about not having enough time to organize myself each day</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>4</td>
<td>I would like to help other staff learn how to use the innovation</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>5</td>
<td>I have very limited knowledge about this innovation</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>6</td>
<td>I would like to know the effect of using the innovation on my professional status</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>7</td>
<td>I am concerned about conflict between my interests and responsibilities</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>8</td>
<td>I would like to revise the use of the innovation</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>9</td>
<td>I would like to develop working relationships with others using this innovation in this college and elsewhere</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>10</td>
<td>I am concerned about how the innovation affects staff</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>11</td>
<td>I am not concerned about this innovation</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>12</td>
<td>I would like to know who will make decisions with regard to the use of the innovation</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>13</td>
<td>I would like to discuss the possibility of using the innovation</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>14</td>
<td>I would like to know what resources are available if we adopt this innovation</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>15</td>
<td>I am concerned about my inability to manage all the innovation requires</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>16</td>
<td>I would like to know how using the innovation will change my daily job tasks</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
</tbody>
</table>
18 I would like to familiarize others with the progress in using this innovation 0 1 2 3 4 5 6 7
19 I would like to evaluate the impact of the innovation on staff 0 1 2 3 4 5 6 7
20 I would like to revise the approach to the innovation 0 1 2 3 4 5 6 7
21 I am completely occupied with other things 0 1 2 3 4 5 6 7
22 I would like to modify the use of the innovation based on the experience of staff 0 1 2 3 4 5 6 7
23 Although I don’t know about this innovation, I am concerned about things in the area 0 1 2 3 4 5 6 7
24 I would like to excite staff about their part in using this innovation 0 1 2 3 4 5 6 7
25 I am concerned about the time spent on non-academic problems related to the innovation 0 1 2 3 4 5 6 7
26 I would like to know what the use of the innovation will require in the immediate future 0 1 2 3 4 5 6 7
27 I would like to coordinate my efforts with others to maximize the benefits of using this innovation 0 1 2 3 4 5 6 7
28 I would like to have more information on the time and energy commitments required by this innovation 0 1 2 3 4 5 6 7
29 I would like to know how other people use this innovation 0 1 2 3 4 5 6 7
30 At this time I am not interested in learning about the innovation 0 1 2 3 4 5 6 7
31 I would like to determine how to supplement, enhance, or replace the innovation 0 1 2 3 4 5 6 7
32 I would like to use feedback from staff to change the use of the innovation 0 1 2 3 4 5 6 7
33 I would like to know how my role in this college will change when I am using this innovation 0 1 2 3 4 5 6 7
34 The coordination of tasks and people is taking too much of my time 0 1 2 3 4 5 6 7
35 I would like to know how this innovation is better than what we use now 0 1 2 3 4 5 6 7

This Stages of Concern Questionnaire was developed at the University of Texas as described by Hall, George, & Rutherford (1979)

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Procedures for Adopting Educational Innovations/CABM Project
R&D Center for Teacher Education, University of Texas at Austin

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BBS UTILITY

Name: ____________________________ Date: __________

Position: ____________________________

Department or Institutions: ____________________________

What are the daily tasks involved in your job and, in your view, how can electronic bulletin board systems assist in executing these tasks?

<table>
<thead>
<tr>
<th>No.</th>
<th>Task</th>
<th>How bulletin board systems can assist</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Drafting letters</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Preparing project proposals and reports</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Keeping personnel records</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Preparing for and attending meetings</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Giving presentations</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Planning and executing research</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Writing for publication</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Creating and maintaining data bases</td>
<td></td>
</tr>
<tr>
<td>No.</td>
<td>Task</td>
<td>How bulletin board systems can assist</td>
</tr>
<tr>
<td>-----</td>
<td>--------------------------------------------------</td>
<td>--------------------------------------</td>
</tr>
<tr>
<td>9</td>
<td>Organizing seminars</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Supervising and administering projects</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Carrying out evaluations</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Teaching and consulting</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Preparing budgets</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Maintaining accounts</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Making requisitions</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Others (specify)</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX E

PRELIMINARY SURVEY
PRELIMINARY SURVEY

Please complete the following survey. Leave any items that may not apply to your institution. Mark one choice where choices are presented.

1. Name of SBC Coordinator: __________________________________________

2. No. of staff in the SBC including coordinator: __________

3. How many persons in your college are able to install computer software?
   None 1 to 2 3 - 4 More than 4

4. How many persons in your college are able to install computer equipment (hardware)?
   None 1 to 2 3 - 4 More than 4

5. How many persons in your college are able to maintain computer equipment?
   None 1 to 2 3 - 4 More than 4

6. If you have one or more computers, please supply as many of the following details of one as possible:
   Manufacturer: __________________________________________
   Model: __________________________________________
   Capacity of Hard Disk _____ Mb
   Number of serial ports: __________
   Types of diskette drives present: 360 kb 720 kb 1.2 Mb 1.44 Mb

7. Do you have a printer? Yes ____ No ____

8. What kind of protection do you have against power fluctuations? ________________

9. In your estimate, what is the chance of power failure in any month?
   Less than 10% 10% to 30% 31%-50% more than 50%

10. How long do power failures normally last?
    Less than 1 hr. 1 to 2 hr 2 to 6 hr. More than 6 hr

11. How many telephone lines are installed in your college? ________________

12. Do you have access to a telephone in your office? Yes ____ No ____
13. Is it possible to dial outside calls from your office?  Yes _____ No ______
14. Does your college have a telephone operator?  Yes _____ No ______
15. Is your local telephone exchange a manual or an automatic exchange? Man. ___ Auto. ___
16. How many students do you have in your college (estimate)? _______
17. What is the number of teaching staff? _______
18. What is the nearest major town? _______________________________________
19. How far is the town from your college? _______ Km
20. How would you rate transport facilities between Nairobi and your college?
   Excellent    Good    Satisfactory    Unsatisfactory

Thank you for your time.
APPENDIX F

HOW FIDONET IS LINKED TO THE INTERNET
HOW FIDONET IS LINKED TO THE INTERNET

Each Fido point and node normally consists of a microcomputer. Fido points and their associated Fido node are usually linked by telephone and modems but satellites have been used by such Fido systems as HealthNet and VITANet. The Fido system is highly structured with the addressing system based on geographic location and relationship to the node. A typical Fidonet address would be 1:324/118.9 which has four components.
starting on the left. The number “1” represents the geographic region of North America and is referred to as the zone. There are six such regions covering the whole earth. Africa is zone 5. The number 324 is referred to as the net. In Africa, the net identifies the country. Kenya is 731. The third number, 118, is a specific FidoNet node in a given net. The last number is the identifying number of a FidoNet point connected to node 118. Each point has a boss node from which it derives its address though it is possible for one point to call another point on a different node. Zone gates exchange mail between different zones.

To transmit a message from a Fido point to a destination say, on Compuserve, normally the point would transfer the message to its boss node which would call a zone gate. The zone gate would transfer the message to a Fido/Internet gateway that allows exchange of mail between the Internet and FidoNet systems. The message would then be transmitted to an Internet/Compuserve gateway and on to the Compuserve client. The Network Service Center in Nairobi did not make use of a zone gate but exchanged mail directly with a Fido/Internet gateway.

A message can be addressed to a FidoNet address from the Internet by transforming the Fido address into an Internet address. The general transformation is represented below:

“1:324/118.9” is transformed to: “Name@p9.f118.n324.z1.fidonet.org”

where “Name” is the name of the Fido point owner or other person with an official account on the Fido point for example Jason.Githeko@p63.f151.n109.z1.fidonet.org.
APPENDIX G
SCORING SCHEME FOR BBS UTILITY QUESTIONNAIRE
SCORING SCHEME FOR BBS UTILITY QUESTIONNAIRE

The question asked was: What are the daily tasks involved in your job and, in your view, how can electronic bulletin board systems assist in executing these tasks?

Scoring Procedure

1. Ask the question: Does the respondent describe what the BBS can do in relation to the task?
2. If answer is "No," Score 1
3. If "Yes," ask the following question: Is it clear from the respondent's answer how the BBS' communication facilities would help me in accomplishing the given task?
4. If "No," score 2. If "Yes," score 3

SCORING GUIDE FOR BBS UTILITY RESPONSES
APPENDIX H

STRATEGY FOR IMPLEMENTING A

SMALL BUSINESS CENTER NETWORK (BIZNET) IN KENYA
STRATEGY FOR IMPLEMENTING A
SMALL BUSINESS CENTER NETWORK (BIZNET) IN KENYA

But unlike other major technological triumphs with which it might be compared—the transformation of agriculture, the conquest of disease and trauma, the building of railroads and airlines, the electrification of everything—the information revolution has yet to produce vast and obvious economic benefits or bring widespread and major improvements in the quality of life.

-Landauer (1995)

Mission: To stimulate and support innovation and entrepreneurship through technology.

Since the fieldwork for this study was completed, a vast change has occurred in the state of wide area computer networking in Kenya. At the time fieldwork for this study was going on, there was no access to the Internet within Kenya except for a few United Nations offices. FidoNet was the most commonly available e-mail system. Service providers used gateways in Europe or the U.S.A. to transfer mail to and from the Internet. Few people in the Universities and perhaps even fewer in the private sector had heard of e-mail.

Less than 18 months later, there are now four Internet Service Providers (ISP) within Kenya including the state-owned telecommunications corporation. This corporation had been a monopoly in the provision of telecommunications and postal services since Kenya's independence. It is now about to be broken up into three independent organizations with provision for public involvement in the new telecommunications company through the issue of shares. One will be a regulatory agency similar to the Federal Communications Commission in the USA. A second organization will handle postal services while a telecommunications company will be created to provide telecommunications services. These three services had previously been provided by one monolithic organization. Hence, the corporation acted both as a regulatory body and a service provider which would make it more likely that regulations would favor the regulator. Over the past five years there has been signs of a reduction in monopoly.
Other areas such as broadcast media had similarly been monopolized by state corporations. There are signs that private radio and TV stations will be allowed to operate. Satellite communications too had been restricted. This has made it difficult for institutions or private organizations to operate any two way satellite communications systems. There are expectations that these restrictions will be lifted in the next 12 months which will allow private uplinks to operate. Finally, the telecommunications corporation was expected to implement 64 kilobit data circuits at the beginning of the second quarter in 1996. These will allow faster access to interactive Internet services such as the World Wide Web.

Existing links are limited to 14.4 kilobits per second which is inadequate for applications such as accessing the World Wide Web.

By the end of 1996, therefore, it is expected that:

1. Sixty four kilobit lines will be available for lease by service providers in at least two cities (Nairobi, and Mombasa);

2. Private communications via VSAT will be an available option (for communications within Kenya);

3. There will be at least six ISPs but more likely seven or eight;

4. Awareness about e-mail and other Internet services will be wide spread in the major towns and in postsecondary institutions especially Universities;

5. The cost of basic e-mail service is likely to be within reach of small enterprises; and

6. Those with influence over policy will have a greater insight regarding the potential applications of networking in the country such as linking up government institutions and departments; helping market Kenyan products to the global community; stimulate innovation and entrepreneurship through easier access to information (ideas, techniques, technology); promote human resource development through distance education and access to global resources such as on-line publications; and provide an infrastructure to support all kinds of research; evaluation and monitoring activities especially in agriculture, health, and tourism.
Such a situation implies that there will be few technical barriers to accessing the Internet for those living in the two cities cited above. Unless providers expand services to other towns, long distance telephone charges would be a major barrier to anyone attempting to use such services from other locations in the country. The use of VSAT for in-country links may offer a relatively inexpensive way to extend services outside the two cities.

Guiding Principles

The most crucial item in any attempt to develop a strategy to implement e-mail for Small Business Centers is a clear picture of what can be attained and the expected benefits of adopting the technology. Landauer's statement (quoted above) is a reminder that the computer revolution has not yielded any noteworthy productivity gains when compared to technologies such as electricity and the internal combustion engines. There is a common saying among computer professionals that computerizing bad organization results in automatic problems. This implies that work procedures may need to be changed before having computers takeover part of the work.

Therefore, areas in which computers and computer-based communication can be used with the greatest benefit need to be identified. Possible benefits for the SBC include:

1. Access to people and organizations that were previously difficult to access including potential partners and collaborators;

2. Speedier exchange of documents with other institutions, agencies, and government departments resulting in faster planning and more effective coordination;

3. Computerized records that reduce the amount of time required to access and maintain such records (e.g., student records, staff records, research data, business records, and publications);

4. Provision of services to the community (global communication via fax and e-mail, graphic design and publication, production of instructional materials, access to distance education programs) that improve the value of the SBC in the community;
6. Access to instructional resources that were previously inaccessible such as on-line journals and other materials that may be developed to suit the new medium;

7. Developing a foundation for electronic commerce such as linking the Kenya Trade Point with businesses outside Nairobi, linking sellers and buyers, or providing access to industrial and trade directories; and

8. Improving coordination between central government offices and individual institutions through faster and more convenient communications.

**Cost Strategies**

Rogers (1995) provides an example of what he calls interactive innovations (applications that provide communication links between people such as fax, e-mail, and teleconferencing). Two of the factors responsible for rapid growth of the Internet were **sequential interdependence** and **reciprocal interdependence**. Sequential interdependence occurs when each addition organization that joins a network increases the benefit of the network for potential adopters by reducing the cost of adoption. This happens when a new member shares in the cost of running the network. If e-mail services to BizNet were provided at a fixed cost by a service provider, then each additional SBC that joined the network would share the load and reduce the cost for existing and future members. Assuming a threshold level exists where cost will cease to be a barrier, reduction of the cost of adoption will eventually reach this level and, combined with the other diffusion of innovation effects, result in an increased rate of adoption. This threshold level is often referred to as the **critical mass** in the literature and is usually in reference to the numbers of adopters. Based on Rogers (1995) adopter categorization bell curve, it would be estimated that the critical mass would be reached after the innovators and early adopters had implemented the innovation. This suggests that the critical mass adoption level is about 16% though Rogers indicates that critical mass occurs earlier for interactive technologies as compared to non-interactive technologies.
Reciprocal interdependence is the situation when a new member increases the utility of the network for both existing members and future members of the network. This happens when the new member is regarded highly by existing and potential adopters. In planning an SBC network, it would be essential to have institutions and organizations perceived as important by SBCs join the network early to make it attractive for others to join. The Govi SBC coordinator recognized this aspect of e-mail and indicated that he would use e-mail if it offered access to those he considered important. It was suggested that such groups be regarded as communication domains. Such institutions include relevant government ministries, development agencies, universities, other SBCs, and funding agencies. Identifying important domains in relation to SBCs would allow promotional efforts to be targeted at those who are likely to increase the perceived value of the network for SBCs.

Technical problems could be overcome by the presence of a roving trainer/consultant who could if necessary, visit sites to solve technical difficulties. Such a person could operate as a member of staff in the Ministry of Technical Training or provide services for a fee (which would probably be less attractive to SBCs). More efficient use of the network would result if there was consensus on the file formats for documents, graphics, e-mail attachments, and compressed text or binaries. This would allow a common set of utilities to be used by all. Technical support for one utility would be much easier that having to support a large variety of software tools some of which may be obscure and undocumented.

In addition to recommendations listed in Chapter 5, a way would need to be developed to allow institutions to finance the purchase of equipment and meet training and operational costs. Equipment could be partly funded by grants or provided under a hire-purchase agreement. Institutions could then generate an income by offering services for a fee to enable them to meet their payments. In order to stimulate utilization of such services,
intense promotional activities would need to be mounted such as participation in shows and exhibitions, demonstrations during events such as an open house, and through the press.

Ultimately, the sustainability of an SBC network would depend on the support of local communities who would utilize the services provided by the network. For this reason it would be essential that these communities be involved in planning such services. In addition to creating a sense of ownership in the community, such involvement would allow the services to more closely match the needs in the local community. In keeping with the mission of SBCs, stimulating and supporting innovation and entrepreneurship would be the primary goal of an SBC network.

Implementation Issues

The success of BizNet would require a dedicated group of people to champion the innovation in technical training institutions and at the Ministry for Technical Training. The importance of champions is highlighted in the literature on innovation. This person would need to carry some weight in the organization he or she belongs to and hence be able to have a say in decision making and the allocation of resources. One of the tasks involved in promoting BizNet would be to identify potential champions and provide them with the information they need to make decisions and make a case for adoption of the technology at their institutions. Useful information would include: (i) detailed descriptions of potential applications both for the institutional community and for surrounding communities (especially small businesses); (ii) detailed descriptions of the resource requirements for adopting BizNet including computer hardware and software options, telecommunications, staff, training, security, space and furniture, supplies, and technical support; (iii) information on options for financing such a project and possible sources of assistance as well as suggested formats of funding proposals; (iv) information on the status of wide area computer networking in Kenya; (v) training packages and options; and (vi) maintenance and technical support options.
Careful thought would be required to develop a simplified and non-threatening way to communicate networking concepts. The five innovation attributes listed by Rogers (1995) (relative advantage, compatibility, complexity, triability, and observability) would form the framework for communicating these concepts so that resistance to the innovation arising out of adopter perception are avoided as much as possible. This would require the development of a set of metaphors to describe the operation of the Internet and its various services to people who would likely be unfamiliar with computers and communication hardware.

Finally, a system of evaluating the impact of BizNet would be essential to measure the benefits of the system. Such evaluation could include case studies describing how BizNet is used by individuals and enterprises, estimates of change in SBC's status as a result of adopting the system (e.g., number of people served, income, staff development activities, SBC's perceived value in the community, new projects and collaborations, linkages between local organizations and nation or international organizations through BizNet, and increased interest in the applications of computers in institutional management and business operations), or other econometric or sociological assessment of impact.

National Policy Issues

A draft Information Technology (IT) Policy document already exists. However, this document does not contain goals or strategies for attaining such goals. Instead, it contains a listing of areas of interest and suggested steps to stimulate the adoption of IT such as reducing import duty on computer and communications hardware. No attempt is made to link this draft policy with other related areas such as technology and information policies.

Crucial areas that are skirted or neglected is the need to reform telecommunications. The problem areas identified in this study include high telephone installation fees, slow maintenance services, poor telephone installation practices, difficulty in obtaining lines, over-regulation, lack of adoption of popular wiring standards such as RJ11 wall jacks,
expensive type-approval fees requirements even for equipment that meet widely accepted standards such as the US FCC standards, questionable ethics among telephone company employees, and lack of an Internet strategy. Sixty four kilobit leased lines have only recently become available and line quality makes it difficult to attain higher speeds such as 14,400 bps or 28,800 bps. Low speeds increase usage costs because files take longer to transfer over the telephone network.

In addition to these telecommunication bottlenecks, there is little evidence that a detailed analysis of the potential impact of adopting wide area networks in Kenya has been conducted. It is difficult to present a rationale for adopting the technology when there is little information on which to base arguments for its adoption. Analysis is required on several levels: (i) individuals, (ii) organizations and businesses, (iv) government and government-run agencies, (v) educational institutions, (vi) key sectors such as health services and agriculture, and (iv) overall national impact. This would form the basis for setting national objectives and hence for developing projects and programs.

The Ministry of Technical Training has no internal IT specialist. Because the ministry also has the technology and research portfolios, an internal IT specialist is essential to provide leadership in this key area of technology. Such a specialist would be able to provide guidance to the national Council of Science and Technology with regard to national IT policy development and implementation. He or she would commence the task of harmonizing the various IT-related efforts that may already be in progress and provide focus to ensure that resources were directed at attaining national goals and objectives.

Specific areas that such a specialist would need to address includes: (i) the role of telecommunications in the development of IT; (ii) promotion of an IT industry such as development of software and hardware for local, regional, or global markets; (iii) human resource development in IT at various levels; (iv) the design and development of an integrated national computer network; (v) resource mobilization for IT-related development; (vi) promotional and educative activities among national leaders such as legislators, judges.
and government and private administrators; (vii) strategies for promoting innovation and entrepreneurship through IT; (viii) helping develop integrated information technology, and IT policies including the rationalization of the electronic distribution of government publications and data; and (ix) studies of the impact of computers and networking on productivity, competitiveness, and quality of services and products both in the private and public sectors.

The BizNet could be used as a launching pad for activities in several of these areas such as the electronic dissemination of government publications including documents produced by research organizations or distance education targeted at staff in technical training institutions. A specific example of relevant publications are a set of marketing fact sheets developed by the Kenya Industrial Estates Informal Sector project. SBCs could download an electronic version and print individual fact sheets on demand for a small fee. Manuals and project profiles aimed at small enterprises could be distributed in a similar fashion.

Theoretical Outcomes

An important theoretical outcome of BizNet could be a method to measure the impact of computer networks in Kenya with possible application to other similar environments. In addition, further knowledge would be acquired regarding the implementation of this technology. It would provide an opportunity to test different intervention strategies such as those suggested by Krippendorf's (1987) four paradigms of development. Demand patterns for IT services could easily be established which would yield projections that would be useful to service providers.

Conclusion

This brief outline proposal provides a description of the changes that have taken place in telecommunications and computer networking in Kenya over the period since the
field work for this study was completed. A set of guiding principles is presented as a
starting point for a framework on which to base the development of a Small Business
Center network (BizNet). A list of national IT policy issues is suggested as well as the
potential theoretical outcomes of implementing BizNet.

By facilitating information access, IT offers opportunities for increasing the value and
impact of SBCs by providing them with a tool to access information and hence an
opportunity to provide information to small enterprises. The value of such information
may lie in its potential to catalyze innovation and entrepreneurship rather than in its value as
a commodity. Ultimately, such catalysis would positively affect the production of goods
and services and hence the national productivity levels as measured by economic
parameters such as GNP per capita.
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