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Last Mile Initiative

Innovations:

Research Findings from the
Georgia Institute of Technology

EDITED BY MICHAEL L. BEST



Last Mile Initiative

I n n o v a t i o n s

Research Findings from
the Georgia Institute of Technology

EDITED BY MICHAEL L. BEST



Academy for Educational Development





In the fall term of 2005 thirteen students from the Georgia Institute of Technology came together as USAID Last Mile Initiative (LMI) Innovation Fellows. Their job was to provide fresh and dynamic new perspectives into LMI programs in Africa, S.E. Europe, and Latin America. These student research fellows came from every major discipline represented at Tech including International Affairs, Computer Science, Industrial Engineering, Engineering Psychology, Mechanical Engineering, and Industrial Design. The results of these activities, contained in this volume, are a wide range of insightful, passionate, and often provocative research outputs, including:

- A new typology of cyber café's in Abuja, Nigeria.
- An assessment of the soft-power relationships within aid funding of LMI programs in Macedonia.
- An assessment of existing work flow networks, and the possibilities of new digital networks, for coffee co-operatives in Rwanda.
- An evaluation of ICT needs amongst rural health providers in Peru.
- An evaluation of the needs, and the independence, of telecommunications regulators within the West African region.
- A study of the prospects, and the impediments, to liberalization of the Internet market in Ethiopia.

The program's Principal Investigator was Michael Best of Georgia Tech. Michael Tetelman of the Academy for Educational Development was the project manager. The program was funded by USAID's Last Mile Initiative under the direction of Juan Belt and Bernie Mazer.



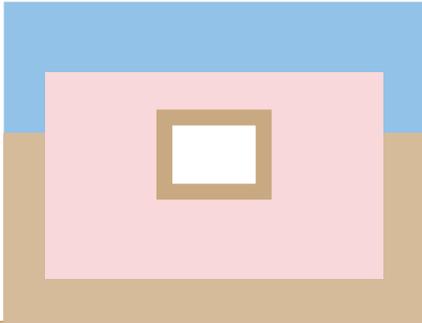
ACKNOWLEDGEMENTS

The idea to involve Georgia Tech researchers within LMI projects – the work of an “Innovation Committee” * originated with Jeffrey Cochrane working with Anthony Meyer. Initial program design was conducted by them in collaboration with Dennis Foote, Al Hammond, and Michael Best. The project, subsequently, was overseen at USAID by Juan Belt and Bernie Mazer. Direct project management and guidance was provided by Michael Tetelman of the Academy for Educational Development under the dot-ORG Program.

Each in-country activity was made possible by a long list of people all providing extraordinary help, insights, inputs, and often warm welcomes. From USAID this included Peter Lampesis, Jonathan Metzger, and Judith Payne. Since a majority of projects occurred in the African region, special thanks are due to Brian King. A number of USAID contractors also were instrumental in the success of these projects including Brian Mitchell, Timothy Schilling, and Glenn Strachan. Each student research fellow interacted with, and was facilitated by, many people; all of them get our heartfelt thanks.

The book was designed by Kaushik Ghosh and Mishta Roy.

Finally, this volume is a testament to the passion, intellect, and compassion of thirteen extraordinary students from the Georgia Institute of Technology. These students came from all of the major colleges of the Institute, came to Tech from all parts of the globe, and ranged in class seniority from a single undergraduate representative to a number of senior PhD students.



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INTRODUCTION

MICHAEL S. TETELMAN, PH.D.

The Last Mile Initiative (LMI) is a USAID-funded global program that expands access by rural citizens to information and communications technology (ICT) and related applications. LMI seeks to do this by building or extending critical telecommunications infrastructure. Former USAID Administrator Andrew Natsios launched this initiative to *“spur increases in productivity and transform the development prospects of farmers, small businesses, new startups and other organizations in rural areas presently underserved by the world’s major voice and data telecommunications networks.”* LMI is currently active in 25 countries, representing the four major regions where USAID works – Africa, Europe/Eurasia, Latin America/Caribbean, and Asia-Near East.

LMI programs seek to fulfill ambitious objectives such as driving the development of leading-edge technology solutions that extend connectivity from the edge of existing networks to the underserved; creating innovative business models that make the extensions of connectivity profitable; and developing innovative content and applications for users to turn their connectivity to strong advantage. Some of the LMI programs are also working directly to improve the telecom regulatory/policy environments in which they operate; other LMI programs are catalyzing positive regulatory change indirectly by virtue of creating competitive, private sector-based wireless broadband networks.

As befits a program of this scope and diversity, USAID created an LMI Innovation Committee in 2004 whose purpose is to provide cutting-edge research, analysis, and implementation support for the LMI programs. The LMI Innovation Committee’s lead partners are the Georgia Institute of Technology and the World Resources Institute, and the Academy for Educational Development (AED) provides overall management of the Innovation Committee through USAID’s dot-ORG Program.

Georgia Tech and AED are honored to present this edited volume of Georgia Tech’s work for the LMI Innovation Committee. This compilation of ten research papers represents the collective work of thirteen student research fellows, eleven of whom traveled to the LMI countries Ethiopia, Rwanda, Macedonia, Nigeria and Peru. Principal Research Investigator Dr. Michael Best ably led the students’ work.

The research papers utilize a wide range of disciplinary methodologies and many important topics that relate to LMI and the ICT-for-development community as a whole. For example, several papers provide practical strategies for improving the enabling environments in which the LMI programs operate. They do so through sharp analyses of national and regional telecom regulatory institutions (e.g. Ethiopia, or the West Africa Telecommunications Regulators Assembly - WATRA) and by exploring how one USAID Mission (Macedonia) created a vibrant and constructive environment for its ICT-for-development programs to flourish.

Other papers look at the essential intersections of ICT access and sector-specific development, here concerning LMI programs designed to strengthen rural Rwandan coffee cooperatives and Peru’s rural primary health care centers. These papers offer refreshingly realistic and nuanced observations of appropriate technology solutions and business models and, in this writer’s opinion, highlight the important potential offered by handheld devices (cell phones in particular).



Moreover, this edited volume makes an important contribution to our understanding of urban public communication access by exploring how cyber cafes in Abuja, Nigeria both shape and are deeply embedded within existing social and business networks and relationships. These networks and relationships produce a diverse set of cyber cafes and related business/operational models, each conforming to the needs of their users.

In sum, the LMI Innovation Committee hopes that readers will enjoy and benefit from *Last Mile Initiative Innovations: Research Findings from the Georgia Institute of Technology*. These multi-faceted research papers provide significant new evidence that successful donor-funded ICT programs depend on a host of factors, such as regulatory institutions able and willing to liberalize, donor environments that foster strong and open partnerships and communications, sensitivity to appropriate, differentiated business models and technology solutions, and concern for the demands and capacities of the end-users themselves.

ABSTRACTS

SUMMARY: Information and Communication Needs of Rwandan Coffee Stakeholders

AUTHORS: Kelly E. Caine, Walter E. Hargrove
and Michael W. Sun

RWANDA IS ONE OF THE POOREST COUNTRIES IN AFRICA. DESPITE FEW NATURAL RESOURCES, NO OCEAN PORTS, AND SERIOUS social issues, Rwanda has the potential to flourish economically. High-end Arabica coffee beans, which command a steep price on the international market, are grown with great success in Rwanda. Our research examined the current communication network in the Rwandan coffee agribusiness and evaluated the system with an eye toward improvement. We also examined the coffee growers' familiarity with communication devices. Some of the key findings show that both high frequency domestic interaction and high cost international contact could benefit from the application of additional information and communication technologies (ICTs). We found that Rwandan farmers, despite having little experience using most ICTs, are eager to integrate ICTs into their everyday agricultural practices. In addition to these research findings, a new method of displaying interaction networks is presented.

INTRODUCTION AND MOTIVATION FOR PAPER

The purpose of this study was to perform a needs assessment for ICTs that would allow for implementation of an effective information exchange structure for all stakeholders in the Rwandan coffee business—from local to international players. Specifically, the study examined the farmers' current communication interactions and assessed how they could be improved. The study also explored technology familiarity and preferences among the farmers.

FINDINGS

Key findings regarding the current communication interactions among Rwandan coffee business stakeholders and desired enhancements are depicted in Figure 1. The most significant axis of interaction is between the coffee farmers and local coffee co-op staff. At the same time, both individual coffee farmers and expert farmers expressed a desire to have direct access to information from other stakeholders. Currently, the co-op staff is serving as a conduit relaying general agriculture, governmental, and business data to the farmers.

The study results indicate that ICTs could improve communication flows and efficiencies in the business process. Most participants were familiar with some ICTs and reported that they would like to use ICTs in the future. While most participants were familiar with letters, cell

phones, desktop and laptop computers, and faxes, none were familiar with personal digital assistants (PDAs) or beepers. In terms of usefulness for business, coffee farmers rated cell phones most useful, followed by desktop computers and face-to-face communication. When coffee farmers ranked ease of use, however, computers fell well below top-ranked face-to-face communications, letters, and cell phones as a useful communication method.

While participants did rank solutions such as face-to-face meetings as easier to use than ICTs, they also noted that face-to-face communication was not always without problems. For instance, many mentioned that in order for them to meet face to face with someone, they often had to walk for many hours. If all stakeholders had access to real-time ICTs, the “meeting” could instead take place via ICTs. If a face-to-face meeting was necessary and the person was not there at the appointed time, ICTs such as cell phones would make it easy to avoid questions such as “Are they coming?” or “Should I wait?” and to coordinate next steps.

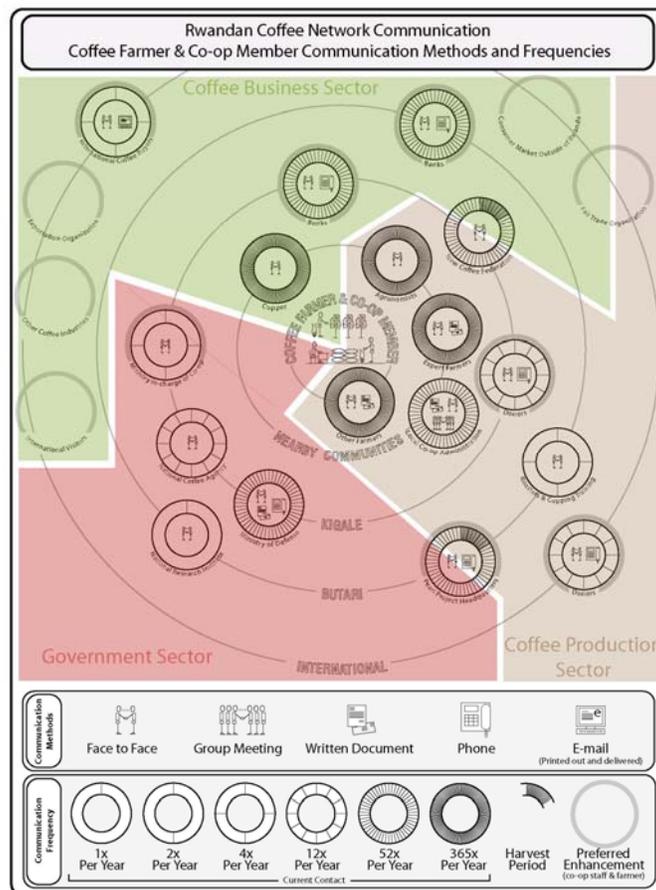


Figure 1. Rwandan Coffee Farmer Communication Methods and Frequencies

CONCLUSIONS

Most of the communication desired by coffee farmers is with stakeholders that are physically distant from them—banks, international aid organizations, the Ministry of Defense, and the new coffee federation. Reliable, easy to use ICTs could clearly help coffee farmers acquire these desired connections. Ease of use and language barriers may hinder farmers from using computers and the Internet for communication, particularly because software written in Kinyarwanda may not be available. In contrast, participants rated cell phones easy to use *and* useful in business, while also indicating a desire to use them in the future.

SUMMARY: Evaluating The Impact And Affordability Of ICTs In Rural Primary Health Care Centers Of Peru

AUTHOR: Sofia Espinoza

THIS PAPER PRESENTS THE RESULTS OF A STUDY PERFORMED IN RURAL PRIMARY HEALTH CARE CENTERS OF PERU. THE STUDY analyzes the potential impact of information and communication technologies (ICTs) on delivery of reproductive health care services, and evaluates whether the perceived impact supports the acquisition of ICT services from a local micro-telecommunications enterprise (micro-telco). This micro-telco will provide users with a basic service package that includes Internet access and voice communication services within the local network. The results show that although rural workers believe that the use of ICTs would allow them to have better access to health information and therefore, improve the quality of the health care provided, they fail to see how ICTs could satisfy more urgent needs such as the lack of qualified personnel and medical equipment. Furthermore, current health care practices (domiciliary visits to patients) and alternative and cheaper communication means (public phones) also make it difficult to capture these health centers as clients of the micro-telco.

Based on those results, the author suggests how ICTs could indeed be of use to the health facilities if they are incorporated into the health care practices and used as tools to satisfy the aforementioned needs.

INTRODUCTION AND MOTIVATION FOR PAPER

The paper assesses the potential impact of ICTs on delivery of reproductive health care at rural health care centers and evaluates the feasibility of acquiring such services. A USAID-funded ICT initiative recently developed in Peru to expand connectivity to rural areas is taken as a case study. The pilot project consists of creating a local micro-telco that will provide, in the initial phase, Internet access and voice communication services (within the local network) to a cluster of rural districts in Jauja Province. While the basic service package will cap the maximum Internet access time, voice communication within the network will be unlimited.

The study was conducted in December 2005, at which time only a small group of users had been connected to the local network, and only voice communication services were available.

FINDINGS

Results show that most of the participants (80%) are familiar with some type of ICT, with the cell phone being the most used device (by 92% of participants). In terms of computer experience, physicians tended to have more experience than non-physicians. About a third of all respondents had no experience with computers. Still, seventy-three percent of the respondents indicated that the Internet would be the most useful ICT to improve reproductive health care services. In fact, all of the participants with “10 or less years of experience” considered the Internet as more useful, while those with “more than 10 years of work experience” considered the Internet and fixed-line phones equally useful.

Participants’ perceptions about the impact of ICTs on improving their work were also very positive. Nearly all (93%) responded “Yes” when asked if they thought that using ICTs at work would help them make better medical decisions and improve the quality of health care. The same proportion responded positively when asked if they thought that having better access to medical information via ICTs would help reduce medical errors related to reproductive health. Eighty-six percent of respondent also thought that having real-time access to reproductive health information would make their jobs easier.

In general, there is a consensus regarding the usefulness of using Internet or email in improving the quality of the health care services provided. Yet, the study also revealed that while health workers saw specific benefits from ICTs, such as ease of coordinating meetings with the community, they failed to see how other, indirect benefits, such as increased patient retention from better quality health care, could make ICTs profitable or cost effective overall when compared to less expensive alternatives such as pay phones or personal visits.

CONCLUSIONS

Although ICTs cannot directly address urgent needs such as lack of qualified personnel or equipment, they can help to increase the time that health workers spend in the health posts (HPs), while also improving the qualifications of the current workers. Currently, attending training courses or searching for health information outside the workplace facility requires leaving the health centre. With ICTs, online distance education could help satisfy the need for staff training yet keep needed staff at the facility. The lack of communication and cooperation among health care providers outside the community can be improved by the “unlimited local calls” feature and thus encourage the sharing of cognitive and even physical resources. Although all the HPs belong to the same category of health facility, differences in quality and quantity of equipment, personnel, and health care services were found even in HPs not more than 2 miles apart.

The positive impact of ICTs on reproductive health care delivery is clear, but it is still too early to fully know how ICTs can support health care information needs. Regarding the financial feasibility of ICTs, the potential increase in the productivity of the health posts could help to cover the expenses of acquiring such ICT services. Further in-depth studies such as detailed cost-benefit analyses are required to confirm results from the present study. Even if the health facilities are unable to afford the micro-telco services by themselves, parallel health initiatives that will assist with acquisition of ICTs by the studied health facilities seem imminent. To take advantage of these ICT tools, health workers need training as soon as possible so that their current positive perception about ICTs does not diminish.

SUMMARY: Influences on the Partial Liberalization of Internet Service Provision in Ethiopia

AUTHORS: Lynn Hartley & Michael Murphree

ETHIOPIA'S INTERNET SERVICE PROVISION (ISP) INDUSTRY IS AT A CRITICAL JUNCTURE ON ITS PATH OF PARTIAL LIBERALIZATION between deepening competitive reforms and a continuation of monopoly control by the public sector. This paper will show how the introduction of peripheral competition will likely not change the nature or quality of Internet service provision in Ethiopia. The institutional framework of the ISP sector can be modeled as a continuum of willingness to accept competitive reforms among the various actors. While there is consensus for reform, views of further liberalization and the rate of expanding competitive provision of services vary along this continuum. We found that stakeholders with the most significant institutional powers advocated sector reforms with the most significant barriers to liberalization.

INTRODUCTION AND MOTIVATION FOR PAPER

The national government of Ethiopia plans to use information and communication technologies (ICTs) to fight poverty and modernize the economy. The government is moving slowly to encourage competition in this sector. An unsuccessful attempt at partial privatization of the national incumbent, the Ethiopian Telecommunications Corporation (ETC), has left many officials at high levels of government skeptical about extensive reform. This paper explores the potential for reform in the ISP sector in Ethiopia to add increased service and quality and why the Ethiopian government prefers certain types of reform to others.

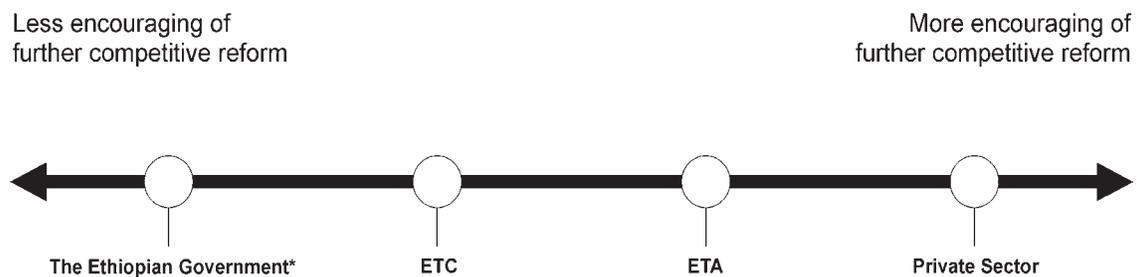
FINDINGS

The debate among stakeholders in Ethiopia is not a question of whether to reform but of how much reform, what type of reform, and when to implement it. Different groups recommend different strategies and timelines. We found that the stakeholders' level of influence was inversely related to their support of rapid and broad competitive reform in the Internet service provision sector (see Figure 1). Though the distances between points on the continuum cannot be exactly fixed, the order of the stakeholders along the continuum illustrates their stated positions relative to each other.

Two specific examples of current Ethiopian policies that create barriers to reform are:

- Limits on technology. Ethiopia's strict control over its international gateway limits the transformative power of the Internet. Currently, the ETC operates a satellite connection and does not allow other entities (aside from two international aid organizations) to operate their own international links. The power of the Internet to act as a globalizing influence on policy is limited when the entire national bandwidth is only twenty-four megabits and no alternative international gateways are available.
- Entry barriers to ISP entrepreneurship. To help realize its ambitious ICT goals, the national government approved a new directive, effective on August 16, 2005, to begin licensing of virtual Internet service providers (VISPs). These VISPs are not, apparently, facilities-based, but still may provide some semblance of competition within the sector. While allowing VISP licensing, the new directive requires certain levels of education and experience from potential licensees. Unfortunately, the stringent education and experience requirements are well beyond those of many interested providers (and well beyond those of successful small-business entrepreneurs in both developed and developing countries), severely limiting the pool of entrepreneurs able to participate. The current requirements will likely negate the chances of a successful introduction of competition.

Figure 1. Continuum of Perspectives on Competitive Reform in Internet Service Provision



*Those organizationally superior to the interviewed officials. Organizationally, this only includes the Council of Ministers and the Prime Minister.

CONCLUSIONS

Given the nature of the institutional framework in Ethiopia, immediate and full competition in the ISP sector is neither possible nor desirable. The regulatory capacity of the Ethiopian Telecommunications Agency (ETA) would be overwhelmed. Yet, reform should not be halted. In fact, continuing on the path of partial liberalization is the most likely way to effect successful reforms in the future.

However, a policy that would result in full, open competition should be applied in the ISP arena. Were the current reforms modified to lower the barriers to market entry, allow for more robust competitive participation from new entrants, and allow for broad access to the Internet, the benefits to Ethiopia would accrue far more quickly. These reforms would provide a foundation from which to test further liberalization. Four likely benefits from modifying the reform initiative are:

- Assurance that the private sector is capable of providing quality service.
- Increased service capacity in the private sector.
- Improvement in the efficiency and capabilities of the ETC as a network operator.
- Experience for ETA as a regulator and licensor of multiple operators.

SUMMARY: Whither or Wither: Sustainability of Regional Regulatory Bodies

AUTHOR: Kipp Jones

INFORMATION AND COMMUNICATION TECHNOLOGIES (ICTS) HAVE CONTINUED TO HELP FUEL THE DRIVE TO GLOBALIZATION AND international interactions. The global growth of ICTs does not come without effort and requires the coordinated work of governments, businesses, and regulators to ensure both internal and external interactions can be conducted in a supportive environment. This need has been addressed around the world through various organizations that span beyond traditional country or economic boundaries to ensure that scarce resources are optimized, that competition is fair, and that policies and legislation are coordinated across national boundaries. The operation and sustainability of these international organizations is not a well-understood process and warrants further study. In particular we explore organizations that address telecommunications regulations that span international boundaries and examine the sustainability of the West Africa Telecommunications Regulators Assembly (WATRA).

Sustainability is a far reaching topic that is impacted by many factors both internal and external to an organization that influence the ability of the organization to survive over a period of time. This research explores the needs, influences, and requirements for sustainability of regional regulatory bodies.

To illustrate the need for regional coordination, we examine the possible interactions of WATRA on the critical topic of Internet Exchange Points (IXP) as an example of the interaction, utility, and possible launch point for a sustainable model of operation.

INTRODUCTION AND MOTIVATION FOR PAPER

WATRA is composed of telecommunications regulatory authorities from member countries in the Economic Community of West African States (ECOWAS) sub-region (minus Togo and plus Mauritania). Because of economic, political, and capacity constraints within the West Africa region, the long-term sustainability of WATRA presents a number of unique challenges. This paper argues that WATRA can and should address these challenges to its ongoing sustainability. For example, the authors discuss regional IXPs in detail to show how WATRA can improve its prospects for sustainability and positively impact the region by coordinating connectivity via regional IXPs.

FINDINGS

Based on review of similar organizations around Africa and the world and assessment of current practices, the authors make several recommendations, summarized in Table 1, for improving operational capabilities and the overall sustainability of WATRA.

The authors identify sufficient Internet connectivity as critical to enabling growth in the use of ICTs. Current constraints have created a slow, expensive network for businesses and consumers, greatly limiting who has access to the network and what people can do with it. The authors argue that interconnectivity achieved via regional IXPs among WATRA countries will optimize.

Table 1. Summary of Recommendations

Category	Description	Improvement/Value
Membership	Streamline membership categories, enhance associate (private sector) membership value and increase number of participants	Increases community awareness, builds capacity, increases communication, leverages scale economies, improves operational revenue for WATRA.
Organization	Hire Managing Director and establish priority task forces	Increases WATRA's capacity and ability to execute on mission.
Operation	Act like a start-up, become entrepreneurial	Increases WATRA's capacity, stretches capabilities and attracts additional talent.
Projects	Leverage unique regional capabilities, act as a neutral convener standing in community.	Focuses on impact, provides valuable cohesive force across region, improves WATRA's

Internet traffic within the region and should reduce costs and improve service. They outline how WATRA could facilitate coordination and provide resources to realize regional IXPs, in turn demonstrating its value as an institution and increasing its sustainability. These measures include:

- Providing model policies to help harmonize regulations across WATRA countries.
- Offering workshops to educate stakeholders on the issues related to creating an IXP-friendly environment.
- Facilitating expertise for ISPs and helping establish regional ISP organizations.
- Developing RFPs, innovative incentive structures, and contract agreements for establishing IXPs.

CONCLUSIONS

Prospects for local, national and regional Internet connection points in the WATRA region are numerous. WATRA can take several immediate steps to help with implementation of improved Internet connectivity, while also improving the standing of the organization within the eyes of its constituents.

Recommendations the authors believe will move WATRA towards a longer-term sustainable position include taking lessons from start-up and early-stage companies, continuously monitoring and growing the human capacity within WATRA (especially at the top management positions), initiating an aggressive membership campaign, and formulating funded projects based on a model project plan. While the recommendations do not provide specifics with respect to a financial plan or implementation details, the authors believe the recommendations implemented along with the current activities underway within WATRA provide the best path to a sustainable future for WATRA.

SUMMARY: Lessons from the Macedonia Connects Aid Model

AUTHORS: Taehyun Jung & Keegan Wade

MACEDONIA CONNECTS, AN AID PROJECT FUNDED BY THE UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT (USAID), has recently finished its first phase by successfully providing Internet access to the primary and secondary schools of Macedonia. In this paper, we report an interim evaluation of this project. First, we assess the outcomes of the project through three evaluative criteria: efficiency, effectiveness, and sustainability. Then, we attempt to identify the institutional and managerial features that had contributed to the success of the project. We reconfirm that institutional support and environmental harmonization are key elements to aid project success. Additionally, we found that the utilization of local resources combined with smart contracts had multiple virtues in this aid context.

INTRODUCTION AND MOTIVATION FOR PAPER

Macedonia Connects is providing high-speed Internet access to more than 450 primary and secondary schools and to rural Macedonians. The Macedonia Connects project team contracted with a local Internet Service Provider (ISP), On.net, to create a network and provide Internet service to the schools. Connection fees are paid by the contract for two years, at which time the schools will need to pay for continued connection. The first phase of the project, completed in September 2005, connected schools via high-speed wireless Internet using the Motorola Canopy technology. The next phase aims to maintain stable service quality and to expand the school network to rural Macedonians. The purpose of this paper is to evaluate the interim accomplishment, as of December 2005, of the Macedonia Connects project and to draw useful lessons from this experience to be replicated in similar international aid projects.

FINDINGS

We identified four critical success factors for this project:

- *Use of local expertise.* USAID and Academy for Educational Development, the nongovernmental organization responsible for local implementation, used aid workers experienced with the local aid environment, including during the initial design of the project.
- *Project objectives met recipient's needs.* The objective of rural Internet diffusion was what Macedonia wanted. Local ISPs were willing to provide this service if they had the capital.

- *Partnerships and cooperation among the stakeholders.* Stakeholders operated more in a complementary capacity than in a competitive one.
- *Aid project design used market leverage.* By contracting a capable but incipient local ISP, a new network was implemented efficiently, injecting competition.

Several factors contributed to smooth partnerships in this project.

- *Project-based approach.* The entire Macedonia Connects staff is made up of temporary, individual contractors. Also, some of the key personnel are career aid workers whose customers are aid agencies. To all of them, the success of one aid project is important in getting their next job.
- *Fixed-price plus incentive fee structure with distributed payment.* The design of the contract between Macedonia Connects and On.net also contributed. First, the contract amount does not reimburse the cost of network implementation but instead subsidizes user service fees. Therefore, On.net had to invest its own money building the network infrastructure in order to receive the aid money. Second, the contract includes an award connection bonus for every three rural schools connected to the Internet. This incentive for On.net worked to connect higher cost rural regions that otherwise might have been avoided.

CONCLUSIONS

The Macedonia Connects project has brought Internet connectivity to all primary and secondary schools in Macedonia and will try to provide much of the rural population with affordable connectivity. To determine how well this project has worked to date, we analyzed its components (e.g. actors, socioeconomic attributes) through the lenses of efficiency, effectiveness, and sustainability. We find that it has met these criteria thus far.

The efficiency highlights include the meeting of all project goals to date, excellent resource management, and the use of efficient communication channels. The effectiveness highlights include the lowering of Internet access price levels, enhanced exposure to information and communication technologies in Macedonian schools, and pro-competitive shifts in the Internet market. The sustainability highlights include an optimistic outlook for market, socioeconomic, and technological sustainability.

The project had the benefit of a highly motivated local project team. Not only was this team aid-savvy, they were also knowledgeable about the local environment and communicated with stakeholders on a frequent basis to ensure project success.

Macedonia Connects achieved its successes in part by building on previous development initiatives such as e-Schools and computer donations from China, in conjunction with regulatory and government reform, and a strong desire on the part of the entire nation to meet eligibility criteria to join the European Union.

One major concern is how the schools will maintain their Internet connections over the long run. The issue, however, is stimulating community-based working groups focused on finding a solution.

SUMMARY: USAID Implementing Networks: A Macedonian e-Case Study

AUTHOR: David Sibal

THIS CASE STUDY ANALYZES HOW STAKEHOLDERS OF THREE DEVELOPMENT PROJECTS IN MACEDONIA INTERACT. THE PROJECTS include Macedonia Connects (MKCon), e-Schools, and e-Biz – all of which are United States Agency for International Development (USAID) efforts. They follow a traditional USAID model where contracts are dispersed in Washington, D.C. to a non-profit organization that does most of the groundwork. In implementation, these organizations oftentimes require the assistance of other stakeholders (i.e. local government, civil society, private enterprises, etc.). By studying the relational hierarchies along with communication and information transfer, each effort is portrayed within an institutional context to create clearer understanding of interaction between actors and their implications. We found that USAID in Macedonia capitalized on their unique position as primary funder and diplomatic liaison to ensure that its contracted projects were executed on their terms, under their guidance, while maintaining a cooperative atmosphere. While not all aspects of the interaction were positive, the formula followed by USAID in Macedonia was, on the whole, successful and worth inspection.

INTRODUCTION AND MOTIVATION FOR PAPER

This case study focuses on three USAID initiatives in Macedonia that integrate information and communication technologies (ICTs) into society: e-Schools, Macedonia Connects, and e-Biz. This study focuses mainly on contract performance and evaluation of in-progress and completed work. It employs an institutional framework for studying the driving forces and relationships in aid projects. This framework accounts for non-tangible factors that influence groups working within an organization or network and allows for study on how differences are overcome. The four factors that we focus on, which are especially problematic in the aid environment, are challenges of symbolic capital (how credibility is built up through characteristics like prestige, status, authority, reputation), isomorphism (pressure for one organization working under another to change as a result of exposure), fragmentation (situations where numerous participants interact with an organization and administrative operations are complex), and external forces.

FINDINGS

All three projects have been successful to date. Creative and focused staff on the ground contributed to the efficient management and

implementation of the project. Understanding how they overcame institutional challenges provides lessons for USAID aid systems. Our findings regarding four institutional challenges follow:

- **Symbolic Capital:** USAID-MK (USAID's Macedonia mission) has established a high degree of symbolic capital through its strong presence on the ground and direct involvement in implementation. This presence allowed them to maximize their pay-off (i.e., being effective and receiving credit).
- **Isomorphism:** Initially it can be hard to distinguish isomorphic tendencies when the partnering groups share similar goals, but changes did occur gradually. Positive U.S. influences were visible from exposure to a well-functioning, non-corrupt government administration and from guidance on business operations in a competitive market.
- **Fragmentation:** For the most part, strong coordination by USAID-MK and strong communication by all organizations allowed specialization to be an asset not a hindrance to the project.
- **External Forces:** Competition for contracts in Washington can create barriers on the ground, at the expense of results. Fortunately, this was not the case in Macedonia because USAID-MK was able to gain sufficient symbolic capital. Also, the removal of communication barriers between the Academy for Educational Development and Education Development Center, the nongovernmental organizations (NGOs) responsible for local implementation, contributed to the success of the e-Schools and MKCon projects.

CONCLUSIONS

This research analyzed the ways in which ground operations are executed in an institutional context. Foreign aid networks are often convoluted and complicated. Macedonia provided a unique case study because, contrary to much aid literature, stakeholders on the ground created synergy and executed profound projects (especially Macedonia Connects and e-Schools) that had a substantive impact on the people of Macedonia and a high payoff for USAID. Open channels of communication, high levels of information transfer, strong cooperation, well-organized stakeholders, and USAID-MK support were critical success factors.

The case of Macedonia shows that many positive benefits can result from using NGOs to implement aid initiatives, but that does not remove the need for USAID to have a strong presence on the ground. In working as a partner to the contracted NGOs, USAID was able to maximize their funds for both the Macedonian and American people. Macedonia benefited from the improved status of their education system and market structure, while America won the admiration and gratitude of a Balkan country that may soon find itself as a voting member of the European Union. However, one visible weakness was a lack of institutional learning transferred between the ground and USAID in Washington, DC. Given the success of these three Macedonian initiatives, lessons learned (and transferred) could greatly help projects, at minimum, in Eastern Europe, and possibly around the world.

SUMMARY: Connecting the Rwandan Coffee Cooperatives: Economic Analysis of Network Deployments for Rural Rwanda

AUTHOR: Michael Sun

UNDER THE USAID-LED PARTNERSHIP FOR ENHANCING AGRICULTURE IN RWANDA THROUGH LINKAGES (PEARL) PROJECT, A number of Rwandan coffee cooperatives now sell high-profit, specialty coffee to the international market. Essential to the project's success has been the “richness” in relationships developed between cooperatives and international buyers. As the project nears completion, management and operation responsibilities will be transferred from USAID directly to the local cooperatives. It is critical for the cooperatives to maintain and cultivate these vital business relationships. Currently however, none of the cooperatives have Internet connectivity and few have phone service. USAID wishes to deploy a low-cost, economically sustainable network to the cooperatives that will provide, at minimum, e-mail capabilities.

Ten cooperatives are to be connected with varying levels of Internet service. Some cooperatives seek high bandwidth solutions that will support cooperative-run cyber-café, bandwidth re-selling, and voice-over-IP, while others desire only connectivity adequate for e-mail. This work proposes several wireless network technologies and topologies capable of connecting the cooperatives. Economic models for deployments using WiFi (802.11), pre-WiMAX (proprietary OFDM), VSAT, GSM/GPRS, CDMA2000 1x, and CDMA2000 EVDO, and using varied network topologies, are constructed and analyzed. Resulting from the analysis are insights on proper technology choices—fixed-link wireless versus cellular-based wireless deployments—key cost factors, and the impacts that NGOs and other external funding agencies can have on local telecom tariffs.

INTRODUCTION AND MOTIVATION FOR PAPER

Through managerial and technical support, the PEARL project has helped local Rwandan coffee cooperatives grow, process, and distribute their high-quality coffee beans to buyers worldwide. As a result, cooperatives under the program have seen their revenues quadruple and exports increase tenfold. As the PEARL project comes to a close however, all managerial and business operations must be taken over by the cooperatives. Currently, none of the cooperatives have Internet access, and telephone service is sparse. The USAID Last-Mile Initiative (LMI) aims to provide, at minimum, e-mail capabilities to the cooperatives.

This paper looks in detail at a range of potential wireless networks. Economic models incorporating deployment costs and estimated revenue streams are then constructed for the proposed network solutions.

FINDINGS

Four cooperative types were identified based on their needs and characteristics:

- The “Sub-POP” (Point of Presence) cooperative is located in a substantial business district with enough demand to support a cooperative-owned cybercafé and the reselling of capacity to local schools, health centers, and government offices. This arrangement requires fairly high bandwidth (at least 384 Kbps) and presumably a wireless local-area network (WLAN) to share Internet connectivity with neighboring entities.
- The “Telecenter” cooperative operates a cybercafé, but does not resell bandwidth to local entities. A bandwidth of 256 Kbps via a wireless wide-area network (WWAN) is sufficient.
- The “Rich” cooperative desires high quality connectivity (at least 128 Kbps), but does not run a cybercafé or resell to local entities.
- The “Minimalist” cooperative resides in a relatively isolated locale and requires minimal connectivity for e-mail use (48 Kbps).

Even with the support of LMI, connecting all of the cooperatives and providing the needed bandwidth remains economically challenging. After determining that WiFi is the lowest cost technology for WLANs and Canopy 2.4 GHz currently the cheapest for point-to-point or point-to-multipoint fixed-wireless WWAN networks, we looked at the overall economic sustainability of deployments using these technologies in addition to VSAT, GSM/GPRS, CDMA2000 1x, and CDMA2000 EVDO. Table 1 shows the net present value of deployment over a 10-year period for each technology solution and cooperative type. The cheapest solution for each category is shaded.

Table 1- NPVs of various technology solutions

Technology	Net Present Value			
	Minimal Coop	Rich Coop	Telecenter Coop	Sub-POP Coop
Canopy 2.4 GHz	-\$8,072	-\$12,105	-\$15,814	-\$39,377
VSAT	-	-\$29,400	-	-
GSM/GPRS	-\$2,352		-	-
CDMA2000 EVDO	-\$8,309	-\$10,999	-\$16,729	-\$30,024
CDMA2000 1x	-\$4,814	-\$8,847	-\$17,804	-\$28,952

Overall, analysis of the economic models reveals two major insights:

1. Cellular-based WWAN deployments such as GPRS, CDMA2000 1x, and CDMA2000 EVDO are the preferred solutions if enough aggregate demand exists and a cell base station tower exists within the coverage area. Otherwise, fixed-link WWAN deployments using WiFi and WiMAX are more viable when specific locations must be reached and regional demand is uncertain.

2. Operating expenses such as human resources and bandwidth dominate the overall costs of these networks. Bandwidth tariffs generally rise exponentially as bandwidth requirements are increased, but the increase can display great variability across technologies. This is a result of the complex set of revenue and external funding streams telecoms receive that subsidize certain technology deployments in differing ways.

CONCLUSIONS

We have evaluated the costs for several technology deployments capable of connecting ten coffee cooperatives around rural Rwanda. Depending on the needs of individual cooperatives, various technologies offer the lowest cost solution. These choices are dictated less by actual technical capabilities and costs, but rather by bandwidth tariff structures offered by the telecoms that provide the backbone network and international connectivity. When a cooperative is not within range of an existing base station tower and latent demand in the area is uncertain, fixed-link WWAN technologies offer the most cost effective, risk averse solution.

SUMMARY: 3G in China: A Resource-Based Examination of Telecom Firms in China

AUTHOR: Yu Tao

MULTINATIONAL AND DOMESTIC TELECOMMUNICATIONS FIRMS (TELECOMS) IN CHINA ARE ACTIVELY WORKING ON THE RESEARCH and development (R&D) of 3G, or third generation mobile communication technology, before China licenses any standard for commercial use. This paper uses a resource-based perspective of a firm's sustained competitive advantage to examine and compare the long-term competitive advantage of multinational telecom firms and Chinese telecom firms in terms of 3G strategies. It concludes by going beyond the resource-based perspective and discussing what the current 3G R&D situation means to China.

INTRODUCTION AND MOTIVATION FOR PAPER

3G is the third generation mobile communication technology that allows mobile subscribers access to high-speed data services as well as voice. This broadband capacity can support services such as video, music, and data downloading for mobile subscribers. Three international 3G standards have been approved by the International Telecommunication Union (ITU): WCDMA, widely accepted and used in Europe; CDMA2000, primarily used in the United States; and TD-SCDMA, China's homegrown standard developed by the telecom company Datang.

This paper compares the sustained competitive advantage of multinational telecom companies versus domestic Chinese telecom companies in their R&D of 3G systems, and discusses the domestic telecom firms' position as 3G enters the Chinese market. The paper examines multinational and Chinese telecom firms' physical and human capital resources and compares their long-term competitiveness in the 3G market. Both groups have been active players in the second generation (2G) voice arena, and currently are active in the R&D of 3G standards. The companies in this study are equipment and network technology providers rather than network operators.

FINDINGS

The resource-based view argues that whether a firm has a sustained competitive advantage depends on whether it is implementing a unique value-creating strategy that current or potential competitors are unable to duplicate. Based on this framework, the authors find that both the domestic Chinese and multinational groups of firms are implementing a value-creating strategy. Given that the government has not licensed any

particular standard(s), most firms are working on more than one. The strategies that both multinational and Chinese telecom firms are implementing are quite similar, as summarized in Table 1.

In terms of location, both multinational and Chinese telecom firms have been expanding their R&D activities in various cities, taking advantage of local capital resources and policies of the cities where they set up 3G R&D centers. In terms of experience with 3G operations and training, multinational telecom firms have more experience in European and American markets, though most of these 3G markets have yet to earn a profit. This greater experience in 3G R&D can be applied to training their R&D staff in China. Chinese telecom firms also currently have the capability to train their staff based on their R&D experience in China, while experience they gain from overseas market expansion will likely further enhance these abilities.

Table 1. Comparison of multinational telecom firms and Chinese telecom firms working on 3G in China

Group	Location	Experience in 3G operations and 3G training	R&D Personnel
Multinational Telecom Firms	Traditionally well developed major cities (East Coast, Changjiang River Delta, Zhujiang River Delta); the Western Region (Chengdu)	Experienced in overseas market; training in overseas centers	New graduates, most of whom are not experienced, and experienced R&D workers. This will still be true when they expand recruitment in the near future.
Chinese Telecom Firms	Similar to above locations	Some experience in the overseas market; training primarily in China	Similar to above personnel

Multinational telecom firms do not enjoy an absolute long-term competitive advantage in terms of physical and human capital resources. However, multinational telecom firms do have certain advantages. R&D personnel in multinational firms can more readily travel to Europe and other places where the firms' headquarters and major R&D centers are located to gain first-hand experience with 3G technologies. This experience is not necessarily available to staff at all Chinese telecom firms. Another factor is market share in the 2G market. Currently, one multinational, Nokia, holds about one third of the market share for 2G, while all the multinationals combined have a majority of the market. If network operators decide to upgrade their 2G networks to 3G networks in the near future, multinational telecom firms will benefit much more than domestic telecom firms.

But these factors do not mean Chinese firms cannot catch up. Those Chinese firms working on WCDMA and CDMA 2000 are gaining experiences from European and other markets. In addition, the Chinese government may offer incentives for TD-SCDMA to keep it in the mix of 3G standards, offering a small advantage to domestic firms with this R&D experience.

CONCLUSIONS

Multinational telecom firms do not enjoy a sustained competitive advantage in terms of physical and human capital resources. Chinese firms have made first steps and are showing progress.

But the current disadvantages of Chinese telecom firms are easily recognized. Those working on 3G are fewer in number and smaller in scale in general than multinational telecom firms. They also have fewer patents than their international competitors. The multinational telecom firms have embraced not only the standards they started to work on earlier, but also the Chinese standard.

SUMMARY: Relating Regulatory Independence to Telecommunications Sector Performance: A Study of the ECOWAS Region

AUTHOR: Nsikan Udoyen

A SURVEY OF NATIONAL TELECOMMUNICATIONS REGULATORY AGENCIES IN WEST AFRICA WAS CONDUCTED TO BETTER understand regulatory environments within the region and determine whether the independence of regulatory regimes could be used to explain variations in teledensity and telecommunications sector performance. The survey characterized the regulatory agencies' independence by studying their relationships with the government, the industry, and the general public. In studying responses from six respondents, no significant variation was found in terms of the regulators' relationships with the industry and the general public. Differences in the regulators' relationships with the government could not be used to explain variations in teledensity.

INTRODUCTION AND MOTIVATION FOR PAPER

This study examines the functioning, roles, and capabilities of the current regulators in six West African countries using a framework developed by Irene Wu of the Federal Communications Commission (FCC) to assess regulator independence and openness of rule-making procedures. The authors hope this information will contribute to discussions on harmonization of telecommunications policies in the Economic Community of West African States (ECOWAS) region by identifying best practices for approaching recurrent common problems.

The study also attempts to determine specific ways that the Wu framework can be augmented to more accurately identify relevant traits of telecommunication regulators in order to examine the correlation between such traits, regulator independence, and telecommunications sector performance.

FINDINGS

Six countries participated in the study by answering surveys. Table I summarizes indicators that characterize the regulators' relationship with consumers, industry, and government. The results show little variation in the relationship between the general public and regulators or industry and regulators, though there is variation in indicators of sector performance, including teledensity, across the six countries participating in the study. Similarly, no significant relationship was found to exist between teledensity and indicators describing the relationship between the government

and the regulatory agencies. However, indicators of the regulators' relationships with the government returned the most varied results, prompting deeper analysis to better understand how these indicators relate to indicators of sector performance.

One possible explanation for these somewhat surprising findings is that most regulatory agencies in ECOWAS are relatively new, and thus it is too early to use the independence of the regulatory agency to explain variations in telecommunications sector performance across ECOWAS.

Table 10. Summary of indicators

Country	Independent Leader	License issued by regulator only	Independent Funding	Private Incumbent	Little movement of staff b/w regulator and industry	Consumer office	Universal service office
Cote d'Ivoire	Yes	Yes	No	No	Yes	No	No
Gambia	No	No	No	No	No	No	No
Ghana	Yes	No	Yes	No	Yes	No	No
Guinea	No	No	No	No	No	No	No
Mali	No	Yes	Yes	No	No	No	No
Nigeria	Yes	Yes	Yes	No	No	Yes	No

CONCLUSIONS

Telecommunications regulators in six ECOWAS countries were studied based on their responses to a survey. The survey instrument attempted to characterize regulator independence by examining their relationships with the government, industry, and the general public. The responses showed that the relationships between the regulators and the general public and industry varied little across the six countries. However, variation was found in the relationship of the regulator to government across the sample countries. While this variation is present, our analysis demonstrates that it does not adequately explain differences in sector performance, for instance as indicated by teledensity, between the participating countries. It was concluded that it is too early to relate variations in sector performance across ECOWAS to regulatory independence. Furthermore, it may be necessary to develop new indicators to describe in greater detail the relationship between the regulator and other sector stakeholders if we are going to be able to fully reveal how regulatory independence and sector performance is (or is not) related.

SUMMARY: Portal, Pedagogue, Worksite: Cybercafés as Second and Third Place

AUTHOR: Arvind Venkataramani

TELECENTERS ARE FAST BECOMING A WIDESPREAD METHOD FOR PROVIDING PUBLIC ACCESS TO INFORMATION AND communications technologies (ICTs) within underserved communities. One particular version — the cybercafé — is particularly interesting because it is sufficiently mutable and adaptable to a variety of contexts. Unfortunately, however, cybercafés' status as independent stand-alone business ventures, which usually are not funded by development agencies, means that studies of such institutions tend to focus either on their function as enablers of specific communication needs, or as sites for measurement of ICT use. But cybercafés are as much an urban social phenomenon molded by the peculiarities of their context as a deliberate means of providing access to ICTs. Are there other aspects of access that need to be considered?

This paper attempts to present a more holistic picture of access through a case study of cybercafés in Abuja, Nigeria. We discuss the frames that Nigerians use for cybercafés - portal to the outside world, a pedagogue for computer skills, and an informal worksite - in light of the kinds of relationships between operator and user, the physical location, and the infrastructural, technological, and financial hurdles overcome as part of normal operation of these cafes. We then demonstrate how these interconnections explain the practices surrounding ICT usage and access patterns at the cafés, and the implications for supporting public access to the Internet.

INTRODUCTION AND MOTIVATION FOR PAPER

This paper describes the value that cybercafés provide to users in Abuja, Nigeria by examining a) technological infrastructure, b) services offered, and c) practices surrounding usage in order to distill strategies for success in the future.

FINDINGS

The paper identifies three distinct forms of cybercafés, each offering different combinations of services: the “business center”, the “neighborhood café”, and the “cool café”. Differentiation occurs in location, services, technological infrastructure, and, to some extent, price.

The business center is the most common form of cybercafé in Abuja. It typically consists of not more than 10 or 12 computers for browsing and is distinguished by its close proximity to commercial establishments, basic interior, simplicity of technological infrastructure and an emphasis on document services. This emphasis on document services includes staff dedicated to assisting clients with creating letters, resumes, project reports, and other text documents. The only clear difference between a business center and a printing shop/document services center is the greater availability of computers set aside for Internet browsing.

The neighborhood café usually has 10 to 12 computers, and, while present in a wide variety of locations, they are, in contrast to the business center, usually near a residential area. The neighborhood café may have newer hardware than the business center and devotes more attention to comfort and privacy. While they also generally have printers and other hardware related to the provision of document services, they do not have staff dedicated to that purpose. Many of the cafés of this type were very new — most were open less than 6 to 8 months at the time this research was carried out.

The cool café is an establishment that explicitly differentiates itself by framing itself as a place for entertainment and relaxation. The cool cafés are located away from the other cafés, higher priced, and generally more luxurious. Staff spend less time assisting users because the customers are generally regular surfers comfortable using computers and the Internet. These establishments, though equipped with printers and scanners, do not emphasize these services or devote dedicated staff to supporting them. The cool café attempts to sustain itself using computer and Internet usage as the primary source of revenue. It is by far the rarest kind of cybercafé.

For most people, the cybercafé with its fixed times of operation and shared usage model is the *only* means of Internet access. They tend to use cybercafés in three distinct ways:

- A portal to the world outside Nigeria. A cybercafé has value as a place to 1) connect with people outside Nigeria and establish relationships with them and 2) find valuable information about the outside world, as well as information from the outside world about things relevant to oneself.
- A place to learn computer skills. While computers themselves are not new to Nigeria, only a small fraction of interviewed users had used a computer before they started to access the Internet. Most users did not distinguish between using a computer and going online and saw acquisition of computer skills as an economic advantage. This view was held not only by students, but also by working professionals.
- A worksite. A cybercafé serves as a worksite, either as an extension of the office, or, for users without their own offices, as an office itself. The primary use for most business people is email. However, some users rely on the operators to create, print, and manage documents—both when they are on site and when they are not. In some cases, trust between the operator and the users is strong enough that the operator takes on a quasi-secretarial role for the user, performing tasks such as checking and sending email or getting documents printed and sent.

CONCLUSIONS

Cybercafés in Abuja serve several functions simultaneously: as a place to work, learn, or relax and socialize. Operators play a critical role regarding services and access: as host, as provider of technical assistance, and as trusted provider of computing services. Operators also target their businesses geographically with those emphasizing business activities locating in commercial areas, while those emphasizing recreation tend to locate near more privileged or residential communities. Thus, we see significant specialization and differentiation among cybercafés.