# Unbounded Possibilities: Observations on sustaining rural information and communication technology (ICT) in Africa

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# Table of Contents



# 1 About the Author

Ian Howard is an expert in sustainable, open and clean technologies for developing markets. He has worked for the past five years in the information and communication technology for development (ICT4D) sector, and for over eleven years in technology. He co-authored the Wireless Networking in the Developing World (WNDW) book series and is a frequent speaker at ICT4D events.

From 2003 to 2004, Ian was the country director of Geekcorps in Mali, where he led a significant United States Agency for International Development (USAID) funded program to bring ICTs to rural areas. He also completed numerous consulting assignments for a number of non-governmental organisations (NGOs) throughout Africa and in other developing areas.

He has an undergraduate degree in Environmental Studies from the University of Waterloo and recently completed an international graduate degree in Business Administration (MBA) from the Schulich School of Business at York University in Toronto.

Ian now works in the renewable energy sector, dividing his time between developing a green energy fund and carbon program for the Mennonite Economic Development Associates (MEDA), a Canadian NGO, and working with Menova Energy, a solar concentrator manufacturer, where he leads new market development with particular emphasis on Africa and the Middle East.

This report documents some of the observations Ian made while working on developing sustainable rural connectivity programs, in the pursuit of furthering the discourse on the subject of sustainable ICTs.

# 2 Acknowledgements

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# 3 Intellectual Property



# 4 Background

This study was prepared to support the WNDW book series, to further document the economic and operating models, or paradigms, of small-scale rural ICT initiatives that utilise wireless technologies.[1] Members of the wireless for development (W4D) community involved in initiatives in Africa, whose end-users or clients include businesses, radio stations, schools, individuals, local and international NGOs, government agencies, and telecentres, are the intended audience for this work.

Evaluating assumptions about wireless technologies for rural ICT development and noting differences between markets throughout West and East Africa, this work documents the business models used by two case study sites in Tanzania: 1) the Family Alliance for Development and Cooperation (FADECO) in Karagwe, Bukabo District; and 2) the Sengerema telecentre inMwanza, Tanzania. It attempts to derive a few "good ideas"[2] that can be promulgated amongst the W4D community.

# 5 Preface: What is Sustainable ICT?

In the late 1990s, the use of ICTs in international development work expanded greatly. Reasons behind this expansion include the commoditisation of ICT equipment, the simplification of use and support of equipment, improved access to electricity, more affordable internet connections through telephones and very small aperture terminals (VSATs),[3] and the growing use of ICTs by donors and NGOs themselves. Also, a number of studies by the World Bank and other organisations had affirmed the importance of information for improved health and social wellbeing and the role of communications in economic development. By 2004 almost all donors and NGOs were involved in some sort of ICT4D initiative.

1 802.11 and other standards-based technologies
2 The term "good idea" is used instead of "best practice" as this second, more prevalent term seems to suggest that there is one, "best" way to do something while the author believes that it is more fitting to highlight good ideas that should be considered and adapted to sites as appropriate.
3 A two-way satellite ground station with a small dish antenna

Unfortunately, this interest has since subsided. In part this lapse is due to the many ill-executed or misguided projects that failed due to limited local buy-in, flawed economic models, inadequate training, and/or the use of inappropriate equipment. From the perspective of donors, the most obvious failure of ICT4D initiatives was that few were able to persist without their continued intervention and financial support, leading to an impression that ICT4D projects are largely unsustainable.

In the field of ICT4D, the term "sustainable" refers to initiatives that are able to transition to models that can be supported by local and domestic resources. This is a departure from the popular contemporary use of this term to mean an initiative which has an environmental impact that can be accommodated in perpetuity.

Ironically this understanding of sustainability reflects what has made so many ICT4D projects inherently unsustainable; sponsors generally want to limit their involvement to short-term support in order to incubate it, then have its continued operations handed over to others. This practise, called "parachuting," is ill suited to ICTs as few communities are able to continue to fund and support this equipment. Consequently, when ICT4D projects reach the end of their funding period and are cast off with hopes that the local communities will take over support for them, most list on the water and soon slip under the surface. Internet connections are soon dropped, computers infected by viruses and hardware fails, technical staff move to bigger communities and the projects often disappear as quickly as they arrived.

While many rural ICT4D initiatives have failed, mobile phone towers stand above shinning brightly on the horizon. Particularly in Africa these towers are now found in many places where economic theory had previously predicted they never could. In 2006, the fastest growing mobile phone network in the world was in the Democratic Republic of the Congo, a country still fighting a civil war with virtually no infrastructure or legitimate economy. Mobile phone networks have re-written these economic rules and have provided unparallelled economic and social benefit, calling into question whether there is still a need for other ICTs?

Support for this notion has grown, promulgated by *The Economist* and no doubt many mobile phone company lobbyists. Donors too have succumbed to this utopian remedy and have retreated en-masse from rural ICT projects. This has left the development of ICTs in the hands of large, highly centralised telecoms. While the decision to focus on mobile phones can easily be supported by the performance of past ICT projects, this decision is naive. The failures of rural ICT4D projects were, as noted above, not because they lacked utility to their beneficiaries. Rather, they failed because they were poorly designed and implemented.

While there is truth in the notion that mobile phones will have the greatest impact on rural people in least developed countries (LDCs)[4] in the near future, there is still a great need for grassroots ICT development to fill the void that large mobile phone companies cannot see and/or respond to quickly, adequately, or economically. There is also a great need to find new ways to use and promote these new mobile-phone infrastructures. And a great need for local solutions, not those imposed by business models designed on distant continents.

These incumbent mobile phone companies have built high walls, using high licensing fees to protect them from new technologies and using reserved frequency allotments to keep new

4 LDC is a term used by the United Nations to describe nations with: 1) per capita incomes lower than USD 750; 2) weak human resources due to poor nutrition, health, education and/or adult literacy; and 3) severe economic vulnerability. http://www.un.org/special-rep/ohrlls/ldc/ldc%20criteria.htm

entrants at bay. These barriers are oft cited by those who have been thwarted while attempting to build ICT networks to serve local needs and although prices for voice and short message service (SMS) services are largely competitive and somewhat affordable, the great breadth of services and unbounded possibilities offered by ICTs are hampered within the highly centralised, closed and hierarchical mobile phone infrastructure. As such they are unable to serve small market segments, non-mainstream interests, or services beyond those suited to the mass-market. Consequently unless the entrepreneur can convince one of these large companies to look down from its deck, these niches, or smaller markets, like most rural areas will always be forgotten.

The great possibilities that the internet has allowed in developed markets has come from bottom-up solutions that serve smaller and niche markets then grow and supplant previously dominant services, products and, in some cases, infrastructures. The mobile phone infrastructure today does not allow for this to happen, even though it was at one point a niche technology that was largely supplanting fixed phone networks throughout the developing world.

The myriad of issues posed by the bottom of the pyramid requires a myriad of people with a myriad of ideas to address. Because of the dominance of mobile carriers, who hold a disproportionate amount of power, there is a great need for multilateral and bilateral agencies, and NGOs, to intervene to help extend and democratise ICTs so that people at the base of the pyramid markets have the opportunity to create and invent what we could never imagine.

To reiterate, there is a great need for continued intervention in ICT4D to ensure the development of social good that human ingenuity can create, when unbounded. But the question remains: Can rural ICTs be sustainable? This document will seek to explore this question in the African context.

# 6 Rationale: Is There Still a Need for wireless?

One advent that is poised to make great changes, but also serves to substantiate the thesis that there is still much need for donors and implementers in ICT4D, is data over mobile phone networks, herein referred to as general packet radio service (GPRS).[5] In 2007, GPRS services seemed to have finally begun to take hold in many of the more competitive markets in Africa, including Kenya and Tanzania. The beginnings of this more widespread GPRS use was observed during the author's visit to Tanzania.

Generally, mobile operators have been slow to provide GPRS services, or have kept them very pricey, out of fear of deriding margins for voice calls. Their principal fear is that users will opt for an instant message, Skype call, or voice over internet protocol (VoIP) call rather than a voice call through their network, which is their principle source of revenue. They are particularly concerned about the impact of GPRS on their lucrative international phone services. Consequently, mobile phone providers have limited the use of their networks for data services even though they could easily provide such services over the IP-based networks. Nonetheless, where services are now being offered, there is great potential for internet use in a majority of the inhabited areas in most nations.

In many ways, wireless networks were hoped to be the disruptive innovation that would unseat incumbents. This has not happened to the degree that was hoped, but in countries

5 A packet-oriented mobile data service available to users of Global Sysem for Mobile Communications (GSM) and IS0136 mobile phones

where wireless, worldwide interoperability for microwave access (WiMAX)[6] and other lightly or unregulated bands are permitted, they have driven demand and have persuaded incumbents to respond. GPRS has great potential to provide internet access across many countries, though again, like the mobile phone itself, these are top-down, large scale efforts that are not likely to address local needs.

As more and more internet-capable phones become mainstream, demand and need for phone-based internet access will increase, along with an increase in the number of devices such as web-pads and other internet appliances, and Amazon's e-Book.[7] This will be slow to develop in these smaller markets, particularly where incumbents have little incentive to provide these less lucrative services. Thus, the development of autonomous infrastructure is still required in order to meet the needs of rural communities. Moreover, there must also be the development of networks that tie together data and information that is local, regional and national. This will ensure greater, cheaper and easier access to information and data that is most important to people in these areas. For this data and information to exist, however, it must be generated - hence the importance of telecentres.

The role of NGOs and donors, from a free-market perspective, is to intervene where there are market failures.[8] As the development of this more local information and data is likely to be largely non-commercial, it will require support in order to avoid falling victim to market failures.

# 7 Methodology

A case study methodology, focused on the economic and operational aspects of two networks, was employed for this work, with data collected through primary qualitative research including content analysis, personal and group interviews, and informal conversation. Where quantitative data (such as financial reports) was readily available, it was analysed and included; where it was not, it was constructed using interpolative methods. Little macroeconomic analysis was used, except to help explain differences between markets. Instead, secondary data sources from organisations such as the World Bank and the International Finance Corporation were used and cross-referenced against the information contained in interviews.

Based on a wide survey and feedback from the wireless community, a number of sites were considered,[9] using the following selection criteria:

- Operating revenues of less than USD 200,000 per annum (adjusted for purchasing power parity)
- Rural: in a community that does not have affordable access to other technologies such as digital subscriber line (DSL)
- Located in a LDC
- Operational for at least one year with no more than 50% subsidisation
- Intent on persisting for at least another two to five years
- A replicable model
- Accessible and available financial information

Two sites in rural Tanzania were selected as case studies as they conformed to the selection

6 Provides for the wireless transmission of data in a variety of ways
7 Which has a GPRS internet connection to Amazon.com
8 That is, there are things that should happen, that will benefit the community, but due to an inability to monetise or commercialise such activities, these things do not happen.
9 Including: "Wireless Ghana"; "Nepal Wireless"; projects in the Soloman Islands; and sites implemented by Inveneo in Uganda, Geekcorps in Mali, and the International Development Research Centre (IDRC) in Morocco.

criteria (while few others did), were not affiliated with the author, were in a market not included in previous case studies by the author, and were both accessible within the time available to the author.

The driving questions asked in the analysis were:
1. Is the model sustainable?
2. What are the key success factors?
3. How does it generate revenue?
4. What non-economic factors have been crucial to success?
5. What characteristics are particular to this market, and which are not? Can these elements be applied elsewhere?

This study is by no means rigorous or scientific and certainly lacks elements of quality research such as control groups, a sufficient number of sample sites, and thorough sampling (data collection). A more thorough and wider study would provide more substantive results. Nevertheless, these two sites do serve to contrast findings from other markets and are implemented by other parties than those that were familiar to the author, so they provide the basis for objective reasoning in the author's findings. The study serves to contrast experience that has been accrued through the author's more than five years of rural ICT work throughout Africa, evaluating assumptions, proposing good ideas, and providing examples of networks from an operational and economic perspective to the W4D community.

# 8 Case Study #1: Grassroots ICT Development in Tanzania – FADECO

## *8.1 Background*

FADECO is located in the small town of Karagwe in northwestern Tanzania near the Burundi and Ugandan borders. The town, marked by a police outpost, a few schools and a concentration of mud and some cinder block buildings, rests on a table-top plateau that overlooks lush valleys where bananas, coffee, and staple foods are grown. The road from Bukoba, the regional capital, is unpaved - like most roads in the large east African country. The drive takes several hours, weaving past farmers carrying their goods on their heads, bicycles, scooters and the occasional car, all cloaked inred clouds of dust along the winding and bumpy road.

Registered not-for-profit NGO founded in 1996 by a group led by current director Mr. Sekiku Joseph Mtabazi, FADECO is a small and very modest association. In addition to the director, its principal staff consists of Mr. Itegereize Titus Tobias (chair), Mrs. Elieth Kikaka, (office manager) and Mr. John Kibuuka (information technology manager). The organisation works to provide information resources that help families to improve their living standards. It serves as a vehicle for promoting new agricultural methods and other activities to heighten community and economic development.

Where possible these efforts have been commercialised as separate ventures. For example, Sekiku began a very small seasonal fruit drying business, FADECO Trading Co. Ltd., based on techniques that he promoted via FADECO. As well acting as chair, Mr. Titus sells agribusiness products that support the farming techniques taught by FADECO, such as solar drying and composting. FADECO largely serves as a brand name for initiatives promoted by the group, as it has few resources.

The group has maintained an apolitical nature, partly to avoid any confrontation. As noted by Sekiku, the organisation allows the group to participate in not-for-profit initiatives where there is funding and no commercial interest. The association is best described as a manifestation of Sekiku's interests and a body that legitimises his endeavours.

In 1997, Sekiku, a self-taught technologist, began work on a small telecentre for the community under the FADECO umbrella. This centre was based on his property in the building next to his home that was previously used for the aforementioned fruit-drying business. Sekiku purchased used computers for a few hundred dollars each in the nearest big city and nation's captial, Kampala, to equip the telecentre. They were then connected to the internet via modems on a fixed-line telephone network. To pay for some of this equipment, Sekiku received small grants and donations from the Dutch NGO the Humanist Institute for Development Cooperation (Hivos), the British Council and others.

In 2004, after a few years of operation, he was able to buy a VSAT (a weighty purchase at more than USD 3,500)[10] with the financial support of an NGO called the Regional Agricultural Information Network (RAIN). He purchased the VSAT so that he could avoid the onerous charges for internet access. To access the internet, his telecentre previously had to dial out to Dar Es Salaam, 1,500 kilometres away, with fees for these long-distance calls calculated based on distance. Most users of dial-up in Tanzania from distant outposts like Karagwe report that most often the best attainable speed is of approximately five kilobytes per second (kBps). So, the upgrade to a VSAT was not only cheaper, but also provided much better speed, possibly even ten times faster, according to Sekiku.[11] Although the acquisition of VSAT helped to reduce costs, the telecentre was nevertheless operating at a loss.

In late 2006, after hearing about the use of wireless at other telecentres and being directed to the WNDW books, Sekiku began to build a wireless network. His intent was to share the internet costs with other groups in Karagwe. He started his network with a few off-the-shelf wireless access points[12] and at each site used directional antennas to point back to his base station at FADECO.[13] In August of 2007, his network connected three clients: 1) a private secondary school; 2) the local office for the electric company (Tanesco); and 3) a local agricultural development NGO.

## *8.2 Observations*

Sekiku explained the long process of discovery and frustration that he experienced while connecting these customer sites to his network. He toiled slowly, learning piece by piece how to install equipment and debug problems with help from colleagues via email and online chat, and using online references such as the WNDW books and internet forums. Eventually, however, he did persevere.

Connecting his first site, the school, required particular effort. The school is located at the trough of a valley below FADECO. The walls of the valley block some of the signal from the access point at his main office, seven kilometres away.[14] The relatively low powered

10 He purchased a Ku band VSAT from a local supplier Satcom
11 A VSAT normally is not a cheaper option than dial-up, but in some cases where there are onerous tolls this can be the case particularly when a connection is used often. Moreover, a VSAT is a cost that is normally quite difficult to amortise, thus can normally only be used when donated.
12 He used Linksys 54 series access points and Senao 2511 series 802.11b access points which were sent to him from the Netherlands (not available locally)
13 These are point-to-point connections using 24 isotropic decibel (dBi)grill antenna on both ends
14 The ridge between FADECO and the client site blocked much of the signal's fresnel zone. As a wireless signal

equipment that he employed, even with highly directional antennas required that there were no obstructions in the path between the client site and the access point. To achieve this he had to continue a process of trial-and-error where he kept raising his antennas until the path between them was sufficiently unobstructed (a process of finding new materials to raise the mast, testing adjusting and then repeating this process again). Sekiku was not familiar with fresnel zone calculations beforehand, which might have indicated to him that this connection would be difficult and that he would need to build tall masts on either side.

He also had significant challenges in connecting the electric company office to the network. To accomplish that connection he had to overcome some very tall trees. He did this by borrowing an idea from Nepal that he had learned about through exchanges and open information in the WNDW community. Instead of beating nature, he used it to his advantage. He used the tallest tree surrounding the site as his antenna mast, cut a limb from the tree and mounted the client antenna to its trunk facing back to his access point. Although prior training and better equipment may have saved him some considerable trouble, Sekiku may not have learnt how to support his network as well had he not undergone this process. He now understands how his network was built and he can continue to add new clients to it at will. This autonomy is crucial for a network located in such a frontier location.

### 8.2.1 The process of learning by doing without active assistance led to a deeper understanding and self-sufficiency

This case study demonstrates that learning is critical to allow such networks to be installed and supported. Sekiku was not taught, but learned how to build the network by searching for information and through trial-and-error. This learning process did require access to good learning materials, some counsel and reasonable access to equipment, but for the most part it was accomplished through sweat and passion.

This process also required that he be a very capable self-learner, a characteristic that tends to be quite rare in countries that do not encourage creative learning. As noted by Dr. Romain Tomani, a young technologist and doctor from Bamako, too few young Africans are encouraged to become self-learners in their hierarchical society, making it much harder to develop technologists. The process of taking ICT graduates from local universities and developing them into technologists can take considerable time. This process can also be counter-cultural for many, where the norm for young employees is for them to rarely be asked to make decisions on their own. This resistance to self-learning must be broken.[15]

Opportunities for self-learning are further hindered because few of these capable minds have the opportunity to tinker with computers or other gadgets, or break them as do many techies from richer markets. Learning the troubleshooting process is central to becoming technologically minded. This analytical process can take considerable effort but can be done. The many ad-hoc roadside bicycle, car and television repair shops across developing nations are a testament that this ability exists everywhere but that it is not well cultivated by most developing nation schools. Thus, because it is rare to find those who are, or have the

travels its width broadens and a majority of that signal needs to be captured on the other end for the connection to work.

15 This observation was made by the author on numerous projects, in particular an internship programme that was offered by Geekcorps in Mali, where young technologist interns learnedhow to support and install wireless networks and use other technologies. Learning troubleshooting processes were difficult for these interns who were used to more instructive and rote processes, where troubleshooting required more synthesis and an unguided approach. Eventually these interns would become accustomed to this process and would quickly begin to learn. This was what was called "breaking down" the rote education system that was often ingrained into the young interns. This is just a personal observation and is not meant to be taken as a generalised comment.

capacity to become, techies in Africa, when one is found that individual should be given the opportunity to further develop these skills.

In most ways the development of this network defies conventional best-practices, which recommend that ICT projects are planned, people trained, and equipment selected based on design and evaluation before commencing work. Sekiku's approach missed each of these steps, working in a piecemeal fashion with few resources and no formal training. As such it could be considered emblematic of worst-practices and, yet, the network was built and still persists. Thus, it has succeeded in becoming sustainable.

The slow process that Sekiku undertook allowed him to build the needed skills at the same pace as the network's growth – not by design but due to access to equipment and funds. This slow development is contrary to standard practice. Generally, telecentres are built rapidly so that they can be operational as soon as possible. Building quickly is perhaps necessary where rent and salaries are high, and technical competence and equipment abundant. In this case growing slowly was not a problem and is the norm. By building slowly the staff can learn how to support the network as it grows in complexity. This contrasts many other sites that the author has visited, where local staff members have not appropriated the skills required to support the systems or services provided by the site, resulting in their degradation.

### 8.2.2 ICT sites that do have readily available technical support should adopt new systems only at a pace at which their staff (or their support network) can competently learn how to use and support them.

In 2004, the author visited the University of Bamako at the behest of USAID, which had sponsored a project to install a wireless network there. Although the system was reasonably well installed by local and foreign contractors, it fell into disrepair within a few months. Funding for continued technical support had ended[16] and local staff had limited knowledge of how to support the system. Thus, many of the sites were completely offline, while the network at large was so overwhelmed by viruses that it was virtually unusable. Staff had been provided training, but most had little prior technical experience and very little experience with networking.

Some believe that a techie can be made by sending someone to a five-week training program. The author has found, however, that the attributes required of techies (such as the ability to persist, self-learn and troubleshoot and profound curiosity about how things work) must already exist as they cannot easily be taught, but generally only fostered. This site reinforced this notion. Even after many weeks of comprehensive training by the implementers, these former administrators were evidently not transformed into technicians.

When the author's team arrived at the university, his team set about a slow process of teaching a few of the staff how to repair these problems themselves. They identified those staff members who possessed techie attributes and gave them responsibilities. Eventually, with a lot of guidance and on-the-job training, they were able to repair the network themselves. A little more than a year later, the university's staff independently and successfully moved several nodes and installed some new sites.

There are several lessons that can be drawn from this experience, but the primary one is that, as ICTs are fickle, the capacity to maintain them must be ensured. It is best to build a network slowly at a pace that matches the abilities the people who will be left to maintain it. Implicitly, the types of systems installed should be within the grasp of those who will

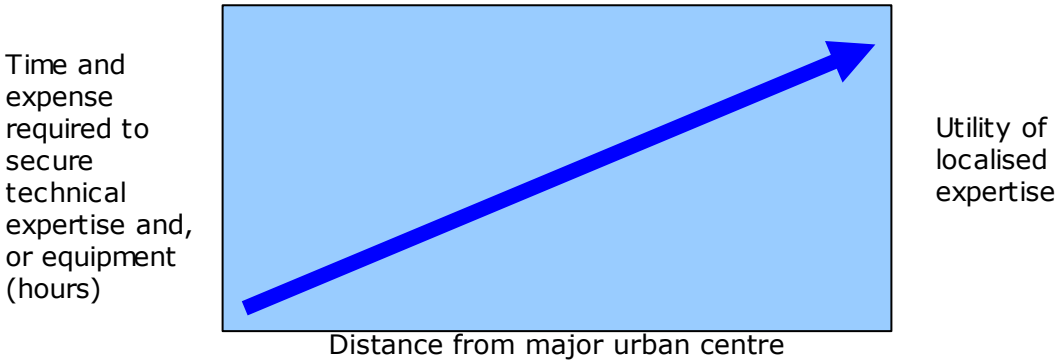
16 The author's team volunteered their time.

support them.

Often, techies consider what is technologically superior to be best, rather than what is most appropriate. Instead, the best technology is the most appropriate one, which can be learned by those who will be supporting it. As wireless networks are particularly finicky and require a wide range of skills and knowledge in order to effectively support them, it is often best to install wired networks, which are simpler.

### 8.2.3 The need to localise expertise and provision for local repairs and within local means becomes more necessary with increasing distance from major urban areas.

The ability of local staff to support their network increases in importance as locations become more remote. In isolated places like Karagwe there are great costs to bring in expertise or equipment from commercial centres such as Dar Es Salaam, Nairobi, or Kampala.[17] This fact has also been found to be important at many other sites. A network in Gao, in eastern Mali, requires an expert to travel twelve hours from Bamako every time that the network fails as there are no local specialists there to repair the network. This means that the network is occasionally offline for several weeks, or even months, at a time. This can cause financial strain both in terms of lost revenue and the price of repairing the network. This would be much less severe if the network was closer to the capital, or if there was somewhat locally who was competent to support the network.




Having competent local staff capable of supporting an ICT system is a prerequisite for its installation. If a system cannot be supported locally, it must be simplified or a more simple system must be used so that someone on site can learn to support it. As mentioned, this largely precludes the use of wireless networks in many sites, unless considerable effort is made to implant local expertise and to simplify the systems and make them robust. Although the process of imparting network support knowledge is sometimes more important than the network itself, as was the case with the University of Bamako and other Geekcorps projects, few initiatives define it as the objective, nor provide adequate resources to make it happen.

### 8.2.4 Commercial grade wireless systems are often cheaper once training and long-term support is factored into total costs because of the inaccessibility and lack of local resources in rural developing communities.

There is also a paradox in the use of low-cost wireless/ICT systems in the developing world. The factors that make this equipment relatively cheap in the developed world are less

17 The closest major city and is still a full-day's journey across some very rough terrain and a border.

relevant in rural developing communities, where affordable equipment is generally of poorer quality and very basic. Low-cost wireless routers are designed to sit in the corner of a climate controlled office and connect a couple of laptops nearby. When these low-cost routers are subjected to the heat, humidity, and/or dust of many developing countries, they quickly fail. Such devices are simply not designed to endure African climate; they may not have proper cooling, fast enough processors or quality power supplies, may use less resilient materials, and also tend to have interfaces that are much less elegant than commercial grade systems. As a result, they tend to fail more often, be more difficult to install and adapt, and require more technological training on the part of local people. When there is a lack of competent technical staff in rural developing communities, installing poorer grade equipment can raise support and training costs and increase risks of failure. This is often overlooked by western project proponents who see low-cost tools as a way to overcome limited resources and do not consider the costs of supporting such systems – costs which are largely absent in developed world cities. Also, in the developed world people can readily tinker with cheap equipment, such as a wireless router, which is easy to replace if it breaks. Such equipment is considerably more expensive in developing countries, both in nominal and relative terms.

Another fallacy that contributes to this misguided use of low-cost equipment lies in the assumption that support is cheap in developing economies. While labour is cheap for unskilled work, it can be very expensive to get quality support for technical work. The WNDW books provides useful guidance on how to adapt regular low-cost, off-the-shelf equipment, but it requires considerable hacking and skills that are in short supply in rural developing communities. Thus, if local expertise is not available, commercial grade, robust and well-designed equipment, which is usually expensive and often proprietary, can be the most suitable for rural wireless installations. The total cost of installing more expensive systems may in fact be less than the low-cost systems once the cost of adequate training and equipment adaptation is considered. Moreover, the long-term total costs of ownership may be less too, if trips from capital cities can be avoided. Low-cost equipment outside of the developed world is a misnomer.[18]

## *8.3 Financial Analysis[19]*

Money flows through in small amounts and seasonally nourishes this business, not unlike the farms and other enterprises that surround it. Appendix one shows the FADECO telecentre's income statement for a typical month in 2007. As the bottom line of this table indicates, this business loses money, but it continues to persist because it is sustained by its operator, Sekiku.

The business model that has emerged for this site is one that generates revenue by providing a variety of ICT services including training, internet use, and wireless internet access to the three customer sites. There is not a formal business plan, nor a business per say, so this assertion is based on facts gathered on-site. The telecentre has also begun a FM radio station which supports itself through announcements, advertising and sponsored programs. Though not an internet service, the radio is an inexpensive way for Sekiku to

18 One important caveat should be noted: Although the commercial grade systems may in many situations be more appropriate and have a lower total cost, they will not yield the training benefits of low-cost systems (i.e. more emphasis is put on imparting knowledge, rather than spending money on expensive equipment).

19 While visiting rudimentary financial figures were collected, partly due to time constraints, but also because the business does not have great nor accessible records. A more thorough analysis of financial performance of such a site over a period of time would be useful, though even without this data some analysis can be derived from this basic data, and much can be inferred.

extend the internet out to the poor, those who cannot read, and/or are not computer literate by reading what they find on the internet over the air.

Typically the telecentre earns about USD 370 per month. Costs can be broken down into operating and staffing costs. Operating costs are paid to service providers and amount to an average of USD 400 per month. Staffing costs amount to almost USD 340 per month. However, this figure indicates only what is paid in ideal circumstances, and staff members are typically only paid when there is sufficient money. Most often, they only take home only a fraction of this amount. Staff members are quasi-volunteers, with no formal status. They could best be described as "casual wage workers,"[20] meaning that their wage is not defined strictly, but they are paid according to the resources available to the telecentre.

While this arrangement allows FADECO to continue operating despite little revenue, it means that staff members treat their work as a hobby that they attend to after taking care of family and other personal interests. It limits the professionalism of the business and, from a developed world perspective, and in the laws of Tanzania (which are largely borrowed from the West), is likely to be deemed illegitimate. At the same time, however, this type of arrangement is quite common and is seen to create the most social and economic value for an impoverished community. If this arrangement was not used, there might only be one staff member, if any, and the other casual wage workers would have to be completely unpaid volunteers. This flexibility in staffing is perhaps why FADECO and many, if not most, businesses can survive in such rural economies with wild variability in incomes due to seasonality and commodity price fluctuation.

Costs are also scaled in other areas, as with telephone use. Because neither the telecentre nor Sekiku have immediate access to credit, expenses are naturally scaled back when there is no cash to buy phone credit. These scalable costs allow the centre to adjust to fluctuations, though they make it quite difficult to plan or keep consistent service levels.

Beyond the telecentre, Sekiku is able to do ICT consulting work based on the expertise he developed through the telecentre. Mostly derived through conferences, consulting is his greatest source of revenue and nearly pure profit. In 2007, he earned about USD 6,000, up from USD 4,000 in 2006. Through these revenues Sekiku subsidises the telecentre, contributing approximately USD 200 per month to pay its staff, buy equipment to expand its services, and repay the three-year loan for the building. This, while the telecentre is a loss-making venture, it does provide Sekiku the opportunity to learn and gain income through consulting work.

Appendix two shows a value creation perspective of FADECO's estimated monthly income. Its figures are more realistic, whereas the first appendix provides a more idealistic perspective. By including Sekiku's consulting and by reducing costs to what they are more likely to be, we can see that this project does create almost USD 400 for Sekiku monthly, while it provides some pay to staff and covers the centre's costs.

Appendix three shows the capital costs for equipment purchased to run the telecentre (excluding radio equipment). These assets are not amortised in the costs of operation, but if they were they would amount to an amortisation charge of approximately USD 150 per month and the loan could be subtracted from this, to give a nominal amount of USD 100 per month. This is the amount that the equipment costs per month if its purchase price was spread out throughout its lifespan and is a reflection of the actual cost to use that

20 This term is taken from the work of Martha Alter Chen, in her paper, "Rethinking the informal economy", United Nations Department of Economic and Social Affairs, published July 2007 and available here: http://secint24.un.org/esa/desa/papers/2007/wp46_2007.pdf.

equipment to run the business. Because some of this equipment is donated and replacement equipment will likely also be donated, this amortisation can be further reduced to about 25% of that amount, or USD 25 per month. This also assumes that the property and building would have been there anyway.

## *8.4 Conclusion*

As the telecentre educates and supplies information that improves the work, health, and productivity of people in this community, it provides significant gain. This model serves as an example of how a low-cost, sole proprietor telecentre can be built in a small rural community in poor agrarian areas. In this network, the obvious key ingredient is a leader like Sekiku. It is his charisma and entrepreneurism that has sustained this network.

That this site is successful despite defying best practices is particularly interesting. Moreover, that few resources were needed and the effort was spurn locally means that it is both more scalable and naturally within the resources available to many rural communities, in most places. This slow and modest model stands as a great contrast to the following case study, which, while planned and fully funded, required considerable capital, effort and involvement by many parties to install a sustainable rural telecentre and wireless network.

# 9 Case Study #2: A Donor-led Sustainable Rural ICT Project in Tanzania - Sengerema

## *9.1 Background*

Sengerema has become an important town because it lies at the intersection of two roads that connect northeastern Tanzania and the western shores of Lake Victoria to the southern part of the country. It is believed that there are almost 300,000 people in the area and the town itself is an agglomeration of several nearby communities that have slowly moved toward this significant intersection over the past twenty years.

This area of Tanzania is largely inaccessible as there are no proper roads in any direction, so the trucks that trundle along these roads are large, slow and robust, taking days to traverse the country. Reaching this inland town from the ferry terminal takes approximately two hours and requires a 4x4 vehicle. Because of its inaccessible and remote location, and because the town serves a poor agrarian hinterland, Sengerema is very underdeveloped. However, it does serve a sizable population and is an important administrative centre. Thus, the placement of a telecentre here is quite apt.

Sengerema's telecentre is the result of several initiatives that occurred throughout its now four-year history. In general terms the centre is sustainable; it has been able to sustain its activities over a number of years, though it certainly is not financially autonomous and has relied on continual funding and assistance. Estimates show that the centre needs an average of USD 1,100 per month to subsidise its operations.[21]

This telecentre, although only 200 kilometres away from FADECO, could not be more different. Sengerema is housed in a purpose-built building at the town's main intersection. It boasts a large conference room, an air conditioned server room, an e-training lab with six computers and a projector, a cybercafe with five computers, several offices for staff, and a learning room (which acts as a workshop for testing refurbished computers and a studio for

21 Please see appendix four.

its FM radio station). Equally impressive is its bureaucratic composure. The centre has a staff accountant, radio manager, customer service manager and IT manager who report to the general manager. Financial reports are produced monthly and compiled annually.

To offset some of the centre's operating costs, a Motorola Canopy wireless system was installed. This allows the centre to share its internet connection with three other sites: 1) the government funded secondary school; 2) the local government education offices; and 3) the town's council offices. This system is based at a Celtel's mobile tower, on a high-spot, one kilometre north of the telecentre, atop a hill. There are the two Motorola base stations, one facing south and the other facing west. On the opposite side of the tower are two FM diapoles that make the antenna for the FM station and another that acts as the receiver antenna for the FM relay from the telecentre's studio. The radio uses a coaxial cable to ascend the tower to its antenna. The Motorola equipment is powered over Ethernet.

Revenues for the centre are derived through internet use, photocopying, binding, lamination, faxing, instruction, advertising and announcements on the radio and, until recently, direct funding. Many of the operating costs for the centre are paid for by third-parties, through the Commission for Science and Technology (COSTECH), a government agency which has overseen the project.

## *9.2 Observations*

Perhaps this model does not serve as an example of how to construct an entrepreneurial ICT-based rural enterprise, but it does serve as a model for building a centre that is embraced by all stakeholders. What this model has yielded is a hybrid between a parastatal enterprise and a not-for-profit NGO. Like many such organisations, it is not streamlined to reduce costs and maximise revenues, but rather it is focused on serving the development goals of its constituents. Thus, it comes as little surprise that it is not financially autonomous and needs continuous funding under its current design. That said, stakeholders continue to fund the centre and it has proved to be able to persist, which is the main measure of sustainability as defined in this report.

As this report is published, some of the funding that has supported this site will end and the danger inherent in such a model will start to materialise. Such models require continual subsidisation, making it very difficult to transition to a self-sustaining (commercial) model. Such transitions require severe changes to the model and normally result in a medial solution, one that compromises both the social mission and financial viability of the site.

### 9.2.1 A telecentre may not be financially self-sufficient but may be sustained by its stakeholder groups because of its social benefits

Typically, such compromised models fail. Its supporters become disenfranchised, its costs too heavy, and its ability to generate revenues too encumbered by the site's pre-existing obligations. Normally it is more effective to close the doors and to let a new structure be developed by local entrepreneurs. This may then yield a financially self-sustaining model, as entrepreneurs aim to choose those services that are profitable and avoid those that aren't. Unfortunately, the services that are avoided are normally those that have great social value but little economic value, such as literacy programmes or malaria information.

For the Sengerema telecentre there does seem to be some hope that the domestic government may intervene, with local government and federal government offices (such as the Ministry of Education, for example) taking ownership of this endeavour. Having local

partners take ownership of such a multilateral initiative, largely funded by foreign governments, would be a remarkable feat. If this happens, then the Sengerema telecentre may very well find the funding it needs to persist. It will likely need to adjust to more meagre funding as is within the means of the domestic government, but the heavy expense of institutionalising and educating the community and the staff has already been done.

This is an interesting view on what a sustainable rural ICT enterprise is. Most who seek to make a project sustainable are seeking a self-funding model. Donors wish to plant something that can thereafter seed itself, not requiring continual attention. International implementers too, wish to intervene and then extricate themselves. Local parties often also wish to carry-out their contract, then seek more funding for other work. So normally the incentives are to execute a project within a limited period of time and not to support continual operating costs. The ideal solution for these parties is to charge the local participants to take ownership of the activity. Rarely does the local party so oblige.

In this case the local party, COSTECH, was the principle implementer from the outset. It was already an owner, so there wasn't a need to transition to local ownership. Rather, this model simply co-opted a local body to initiate this endeavour and it now maintains its ownership and is likely to continue to try to ensure that the centre persists.

### 9.2.2 Strong local leadership and the inclusion of local stakeholder groups can successfully lead to ownership and responsibility by local stakeholders

In a departure from the author's experience elsewhere, in this example local government took some responsibility and ownership of the endeavour and was an asset. The government proved capable of managing this and other community initiatives. Involvement by several levels of government also legitimised the effort and brought it under public scrutiny. This also afforded the centre insulation from graft or harassment. This stands in contrast to the author's experience in Mali where local government was ineffective or obstructive and other government agencies often sought rents from projects. Thus perhaps LDC local governments are characterised too easily and often of not being capable or reliable enough to intervene in such projects. Although this is only one case and there is considerable rent-seeking involved, generally there is a sense of cooperation and mission that is driving collaboration between the centre, local government and other government departments.

### 9.2.3 Telecentres can become knowledge service centres that add tremendous value to local economies, act as catalysts for the creation of a micro-knowledge sector, and provide higher value work for educated workers who can be retained in the rural community.

Wireless internet services provide about a quarter of conventional revenues (non irregular revenues) for the centre. Though only a quarter, these services provides tremendous value to a local community by lowering transaction costs to do business through email, VoIP and chat. This increases the information that flows in and out from a community through media, creates connections with other centres for education, informal learning, research and commerce, and provides a variety of other benefits. One no longer needs to wait several weeks to hear about legislative changes, or to learn of changes to school curriculum. Tourists or NGOs may visit based on reading a web site about the community or based on email correspondence with people in the community. This access to information and the ability to communicate allows some professional work to be done in such rural towns; these professionals can keep abreast of changes to their profession, learn of opportunities and draw on outside intellectual resources. Workers can also become further specialised as they

have access to more resources and information, and can perform some tasks more quickly.

#### 9.2.4 Because information-based services are intangible, their benefits are significantly discounted in developing economies, where there is a strong preference for physical goods, whilst the cost to provide these services are substantially higher than in developed communities. By providing access to these services, gradually demand will increase as users begin to appreciate their value and become more willing to pay full costs.

As the value of information-based services is indirect and difficult to ascertain, local users in lesser developed communities are often reluctant to pay their full cost. As they grow more familiar with the use of the services at a telecentre and begin to more fully integrate them into their business or work, they begin to realise their value. This is often called the bridging period and the market education period. Once the market is educated about the products or services it is easier to charge full rates. A typical marketing scheme to overcome this is to offer the first few months of a service at a discount and then to provide a no fee cancellation policy.

In the case of Sengerema, this has only partly occurred. As shown in appendix four, the centre is estimated to lose a significant amount of money each month, putting it in a difficult position were some of its funding to recede. Considering the political control of, and stakeholder involvement in, the centre, significant changes to reduce costs through raising prices, downsizing staff, cutting wages, and curtailing money losing services are not likely. Instead, the centre is likely to be subsidised, though not sufficiently to maintain the current model.

## *9.3 Financial Analysis*

The business model for Sengerema is very similar to that of FADECO, but at a much larger scale (ten times perhaps). This is in part due to the nature of the two locations; Sengerema is about twenty times the size of the Karagwe area. Moreover, much more capital was invested in Sengerema compared to FADECO. Based on some financial data, it is estimated that more than USD 100,000 was spent to install the Sengerema facility, not including oversight and the management of funds, which double that figure. In addition, the centre requires at least USD 12,000 per year in subsidisation and much of the equipment upgrades are provided through grants. Thus, the centre likely costs approximately USD 24,000 to operate each year. By the time this report is issued, approximately USD 120,000 will have been spent on operations and USD 200,000 on the total project set-up costs, making the total cost for donors about USD 320,000.

As mentioned, the centre provides a variety of services and sells those at arbitrary rates to its clients.[22] The income statement found in appendix four can be used only as a rough estimate, because the figures given in reports are not presented in accrual format[23] and have a number of errors and inconsistencies. Thus it is difficult to do a thorough financial analysis (although such analysis is perhaps not required considering that this site cannot

22 The rates for these services seem to be roughly based on rates for these services elsewhere. Thus they do not reflect the cost to deliver these services. Some changes have been made, but due to political pressure and not economics (stakeholders complained that services were too expensive). Proper price setting, through the use of supply and demand analysis has not been performed.

23 Detailed accrual accounting, where expenses are matched to revenues in the same month allows analysis on profitability and gives a better picture of the financial performance of an operation. This site is using single entry cash flow accounting. Moreover, because there are numerous examples of inaccuracies in reports it is presumed that these reports do not provide very accurate data, thus analysis would be flawed.

serve as a model for building a sustainable financial model).

Suffice it to say that the cost of this facility is well beyond the means of local actors and its operating costs must be reduced significantly for it to be sustained by local resources. There are numerous examples of equipment purchases or other capital costs that cannot be justified with return-on-investment criteria as they fail to earn sufficient revenues to pay back the costs of the equipment. Thus, these purchases can only be afforded by donors who wish to provide a means to create income for the centre (thus they must be zero capital cost to the centre).

The Sengerema financials provide some interesting information, such as the fact that the centre earns substantial revenue for secretarial, consulting, and training services. These are high value creating services as they require few capital resources and can be offered at low operating costs. They also provide good employment for knowledge workers and help to develop a service industry. As mentioned, this centre earns approximately a quarter of its revenues on such high value creating knowledge work.

## *9.4 Conclusion*

The centre is a good model for establishing a telecentre that provides great services to a community and that has active engagement of stakeholders and longer term commitments. While the centre's future is presently in doubt, it does serve as a model for community engagement.

Regrettably, although much of the centre's design is formidable, it was designed in such a way that it is too expensive and thus has limited future financial sustainability. It also does not serve as a model that other communities can themselves create. It will continue to provide very meaningful services only so long as it is funded, which is not only the responsibility of the local government but also of those funders who created the centre.[24]

This centre is providing great hope to young people and those who aspire to participate in an information society. Young people clamour to the radio station and spend their days talking about news and other issues and are slowly starting to head off to other cities to new careers. Professionals have come, or have returned to this community providing a great brain gain. The centre has become a social hub and showpiece for a community that otherwise might only be a crossing of two important, but unpaved and bumpy roads. Those who built this centre have a great responsibility to ensure that this prized and important facility can continue to provide its services. It is a beacon for opportunities and hope for many people in the community and should not be left to falter.

# 10 Final Notes

Renowned development economist William Easterly suggests that there is not one solution or plan that will fit all situations.[25] This is illustrated by these two case studies, which show that two different approaches to sustainable ICTs can both provide great value to their communities. As an entrepreneurial endeavour that, with some directed assistance, over time, has created a replicable and sustainable model, FADECO is a project that fits well with

24 But not before the centre's finances are restructured. Costs must be curtailed and better accounting and regular auditing should be performed. The present financial reports are commendable, but, given the amount of money invested, they should be much better. Better reports would provide better oversight and cost control and would also allow for better analysis.

25 Easterly, William, *The White Man's Burden*, Penguin, New York, 2007.

Easterly's ideas. Easterly is a proponent of the bubbling up of enterprise, where, given the right environment, business can take hold. He advocates that big projects and big spending will not allow sustainable solutions to emerge. Sengerema is a model that contravenes Easterly's notions and conforms much more to the approach championed by Jefferey Sachs. He is another celebrated development economist who argues that poor communities are stuck and need a "big-push" to get out of their rut.[26] In Sachs' view, projects need to be big and provide wholesale changes, rather than be small, iterative and adaptive.

Although these scholars disagree, these case studies demonstrate that there is merit to both approaches. These centres are more effective than the majority of telecentres visited by the author, providing great value to their proponents and communities. Yet, while they are good examples, both should be improved and made to be more efficient and effective. FADECO could be better designed and expanded to serve as a model for entrepreneurs. Meanwhile, Sengerema needs to be made more cost efficient, its finances should be better accounted, and it costs should be significantly curtailed.

There has yet been little emphasis on the economic design of entrepreneurial and community telecentres that truly promulgate economic development in rural communities. The development of entrepreneurial telecentres requires much more emphasis on creating knowledge and information-based opportunities for entrepreneurs in rural communities, while the development of community telecentres needs to be supported through enterprise development methods that few ICT4D donors understand or have experience in developing.

The telecentre has lost favour because of so many botched efforts. Short-term development design and inexperienced donors and NGOs have haphazardly tried to implement complex models that take time and infrastructure to build. One of the ingredients that has made these two sites notable is the patient longer-term support that they have received. In contrast, many telecentre projects are "complete" within one year's time.

There is considerable need for telecentres in rural communities like Sengerema and Karagwe, and the expansion of mobile phone networks represents a great opportunity to further increase the use of ICTs as cheaper and local internet services can be provided through them. The telecentres can also leave the business of providing networks and focus on services that increase the value of these networks to local communities. While such networks are geographically limited and incumbent operators continuously fail to provide affordable internet access, telecentres still have a great role to play in extending internet access to their communities. Indeed, they may always be the provider to smaller communities which are not seen as viable customers to big mobile phone networks.

While this report suggests that both models are valuable, the FADECO entrepreneurial approach has the potential to be vastly more scalable and thus important. The development of institutions to support the development of such enterprises could lead to much better rural ICT development using some of the humble but adapted approaches championed by Joseph Sekiku.

26 Sachs, Jeffery, *The End of Poverty*, New York, 2006

# Appendix One: FADECO's Monthly Income (Classic accounting view)

**FADECO Monthly Income Estimate**

| | | |
|---|---|---|
| **Income** | | |
| Wireless Network | | |
| School | $70.00 | |
| NGO | $50.00 | |
| Electricity Company | $10.00 | |
| | | $130.00 |
| Telecentre | | |
| Web browsing | $90.00 | |
| Training | $100.00 | |
| | | $190.00 |
| Radio announcements | $50.00 | $50.00 |
| **Total Income** | | **$370.00** |
| **Operating Expenses** | | |
| Internet | $150.00 | |
| Electricity | $50.00 | |
| Mobile Phone | $50.00 | |
| Fixed Phone | $100.00 | |
| Loan payment | $50.00 | |
| **Total Operating Expenses** | | **$400.00** |
| **Staff Expenses** | | |
| Telecentre staff | $60.00 | |
| Computer trainer | $60.00 | |
| Bookkeeper | $60.00 | |
| Radio staff | | |
| Radio manager | $100.00 | |
| Djs | $60.00 | |
| **Total Staff Expenses** | | **$340.00** |
| **Net Monthly Income (EBITDA)** | | **-$370.00** |
| Amortization | | $100.00 |
| Taxes (estimated) | | $50.00 |
| Net Monthly Income (fully factored) | | -$520.00 |

# Appendix Two: FADECO's Monthly Income (Actual Scenario – Value Creation View)

**FADECO Monthly Income Estimate**

| | | | |
|---|---|---|---|
| **Income** | | | |
| Wireless Network | | | |
| School | $70.00 | | |
| NGO | $50.00 | | |
| Electricity Company | $10.00 | | |
| | | $130.00 | |
| Telecentre | | | |
| Web browsing | $90.00 | | |
| Training | $100.00 | | |
| | | $190.00 | |
| Radio announcements | $50.00 | $50.00 | |
| | **Total Income** | **$370.00** | |
| **Operating Expenses** | | | |
| Internet | $150.00 | | |
| Electricity | $50.00 | | |
| Mobile Phone | $60.00 | | |
| Fixed Phone | $60.00 | | |
| Loan payment | $50.00 | | |
| | **Total Operating Expenses** | **$370.00** | |
| **Staff Expenses** | | | |
| Telecentre staff | $30.00 | | |
| Computer trainer | $40.00 | | |
| Bookkeeper | $30.00 | | |
| Radio staff | | | |
| Radio manager | $50.00 | | |
| Djs | $40.00 | | |
| | **Total Staff Expenses** | **$190.00** | |
| **Telecentre Net Monthly Income (EBITDA)** | | **-$190.00** | |
| Sekiku Consulting Income | | $500.00 | |
| Amortization | | $25.00 | Most gear is donated |
| Taxes (estimated) | | $50.00 | |
| Net Monthly Income (fully factored) | | $385.00 | |

# Appendix Three: FADECO's Capital Assets

| Item | Date purchased | Lifespan (years) | Ownership (own, lent, rent) | Value at purchase | Estimated market value | Monthly Amortization Charge |
|---|---|---|---|---|---|---|
| VSAT | 2004 | 10 | own | $3,500 | $2,100 | $29 |
| Server | 2004 | 5 | own | $300 | $60 | $5 |
| Networking Equip. | 2004 | 5 | own | $300 | $60 | $5 |
| Wireless Equip. | 2005 | 5 | own | $500 | $200 | $8 |
| Building | 2004 | 30 | own/loan | $36,000 | $38,400 | $100 |
| Property | 1997 | 30 | own | $850 | $1,610 | $2 |
| | | | Totals | $41,450 | $42,430 | $150 |

# Appendix Four: Sengeremarama's Income Statement (Reconstructed)

*Source: Telecentre monthly reports April – July 2007 and 2006 Annual Report and interviews*

**Segerama Telecentre Income Statement – Reconstructed**
USD
* note: there are tremendous iregularities with this data and it has not been audited

| | 2006 Average | April | May | June | July | Average |
|---|---|---|---|---|---|---|
| **Income** | | | | | | |
| Secratarial | $155 | $145 | $292 | $175 | $270 | $207 |
| Internet | $205 | $204 | $243 | $243 | $484 | $276 |
| Internet – wireless | $0 | $336 | $336 | $664 | $664 | $400 |
| Radio | $227 | $255 | $208 | $269 | $309 | $254 |
| Photocopying | $173 | $179 | $0 | $133 | $221 | $141 |
| Computer use | $455 | $455 | $582 | $259 | $223 | $395 |
| Subcontracts | $0 | $0 | $0 | $0 | $2,369 | $474 |
| Other | $1,145 | $11,730 | $699 | $794 | $113 | $2,896 |
| Total | $2,360 | $13,305 | $2,360 | $2,536 | $4,654 | $5,043 |
| | | | | | | |
| **Expenses** | | | | | | |
| Wages | | $1,282 | $214 | $394 | $1,282 | $793 |
| Meetings | | $264 | $0 | $0 | $364 | $157 |
| Assets & Equip | | $862 | $200 | $0 | $0 | $265 |
| Overhead | | $575 | $1,008 | $712 | $431 | $682 |
| Equipment maintenance | | $6,519 | $14 | $353 | $0 | $1,722 |
| Subcontracts | | $3,595 | $4,974 | $1,231 | $637 | $2,609 |
| Total | | $13,097 | $6,409 | $2,690 | $2,714 | $6,227 |
| | | | | | | |
| **Net Income** | | $208 | -$4,049 | -$154 | $1,940 | -$1,184 |